Appendix A.2 - Site-specific pluvial modelling produced by Herrington Consulting Ltd

Technical Note: Flood Modelling Manston Road Ramsgate

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Checked by: N. West BSc MCIWEM

Project: 1077 – Manston Road, Ramsgate

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Revision: 1st ISSUE

1. Background Information

1.1. Herrington Consulting has been commissioned to undertake numerical flood modelling for the site at Flambeau, Manston Road, Ramsgate. The purpose of the modelling is to support a Flood Risk Assessment (FRA) and planning application for the proposed development consisting of residential dwellings, roads and landscaping. The location of the site is shown in Figure 1.

1.2. This technical note details the setup of the model representing the existing conditions and the proposed scheme, by removing the footprint of the existing building, including the footprints of the proposed buildings and incorporating any proposed landscaping features.

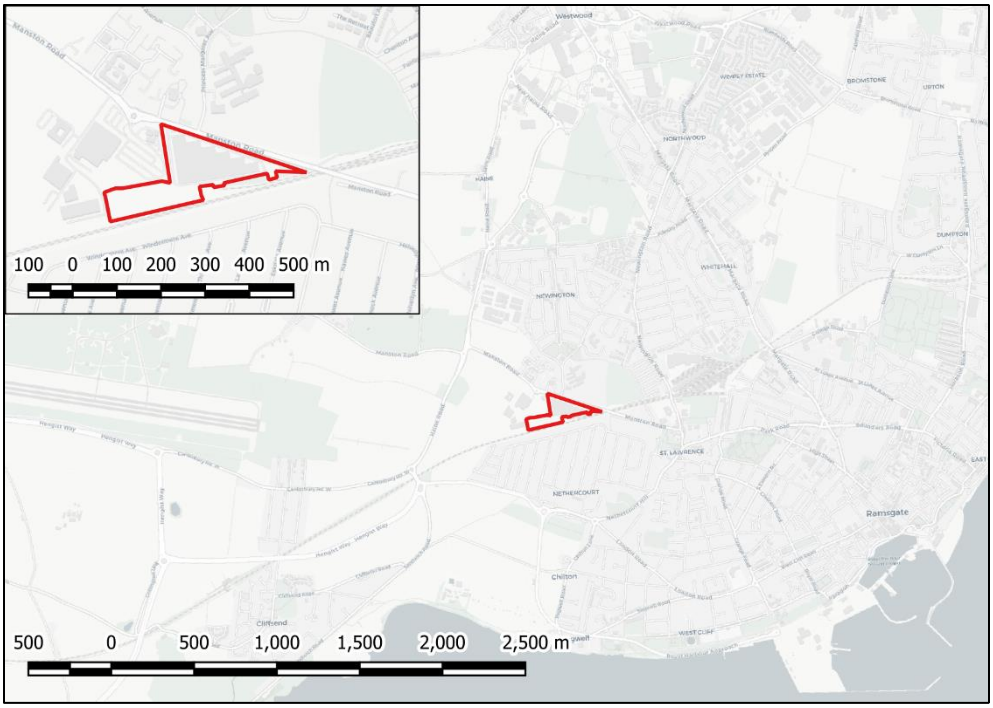


Figure 1 – Site location. Site boundary outlined in red.

1.3. The site is situated to the west of Ramsgate on the southwest coast of England. There are no watercourses located close to the site. However, a Victorian sewer runs deep underground beneath Manston Road, along the north of the site, and discharges into Ramsgate Harbour at distance of approximately 1.8 km from the site.

1.4. A site visit was undertaken on 29th September 2023. The on-site drainage system was inpected and photographed as far as possible while the area surrounding the site was examined to accurately identify potential flow paths.

1.5. The site sits in the lowest area within the catchment, as shown in Figure 2. Consequently, rainfall runoff from the wider catchment area naturally flows towards the site and could pond in the low elevated eastern end of the site.

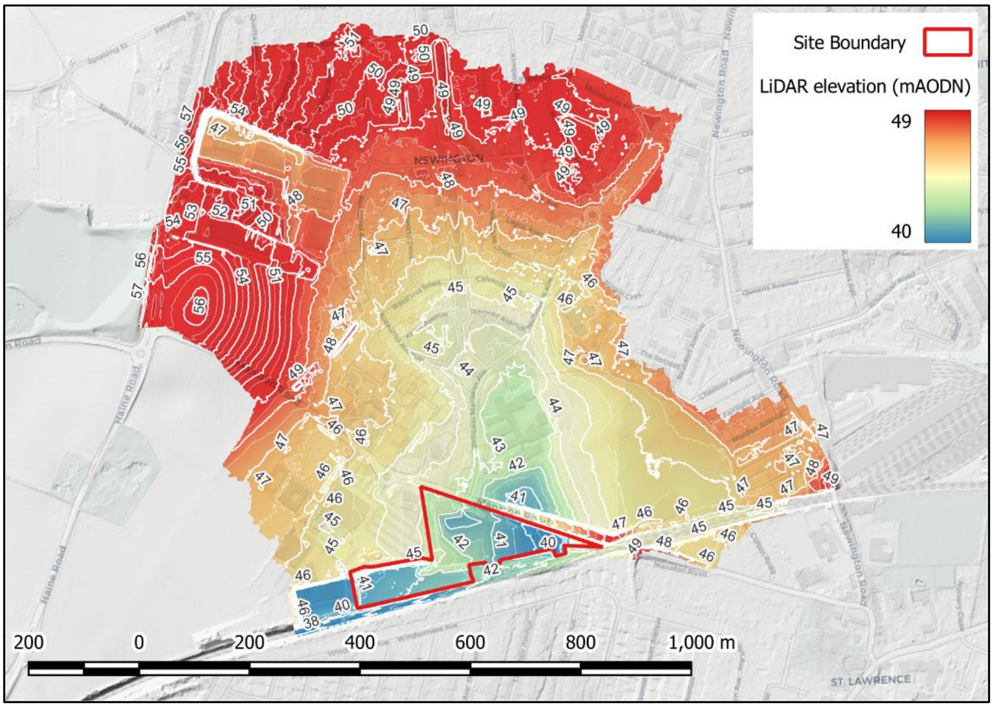


Figure 2 – Topography of the catchment area.

1.6. Two topographic surveys of the site have previously been undertaken. One in late 2014 and one in late 2023 and have been made available to inform this modelling study. Copies of the topographic survey drawings have been enclosed with this technical note.

2. Numerical Flood Model – Conceptual Approach

2.1. The embankments of Manston Road, upstream, and the railway line, downstream, limit the flows in and out of the site area and create a potential flood compartment. The lower elevated section of the railway line to the southwest of the site provides a logical downstream end to the model such that water flowing towards the railway line is able to leave the modelling domain.

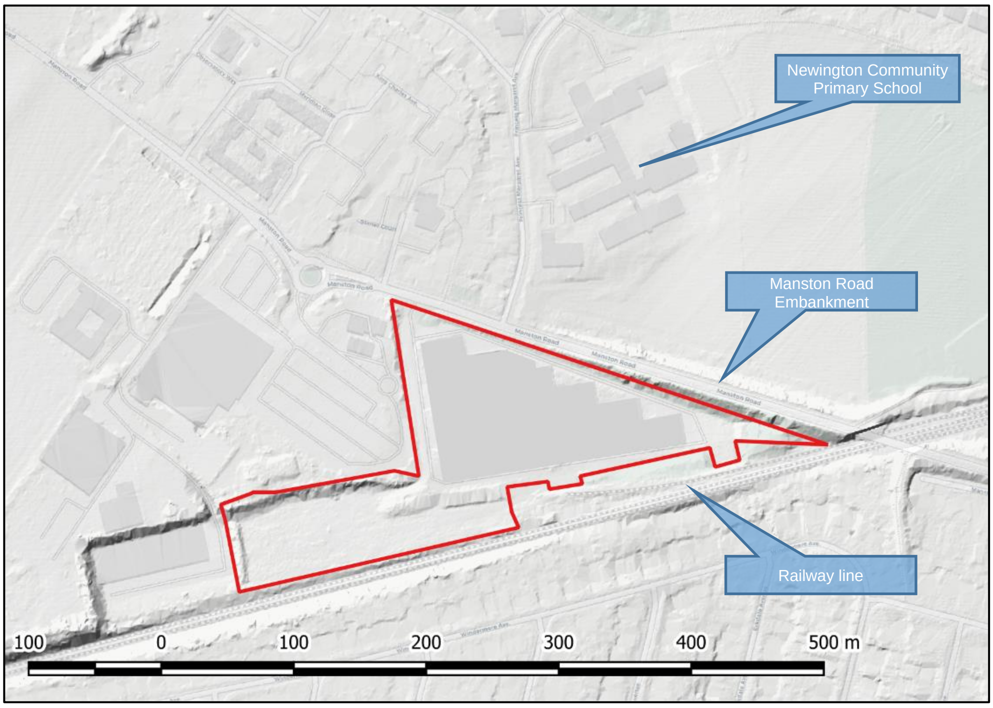


Figure 3 – Features of the area around the site.

2.2. The Newington Community Primary School to the north of the site contains sports fields and carparking areas with its own standalone drainage system. However, the details of this drainage system are unavailable and therefore an estimation for its capacity has been included in the model, as explained in further detail in Section 3.

2.3. The Manston Road embankment prevents any potential runoff from flowing directly from the sports field onto the site area, forming a flood containment area that could potentially retain water on the sports fields.

2.4. Based on the above observations the extent of the 2D model domain is shown in Figure 4. The western downstream outflow boundary is located to the southwest of the site at the railway cutting. The eastern downstream outflow boundary is also situated on the railway line. This eastern downstream boundary exists to prevent any glass walling as explained in Section 3. A downstream boundary to the 1D sewage network and a section of the Victorian sewer channel is also shown in Figure 4.

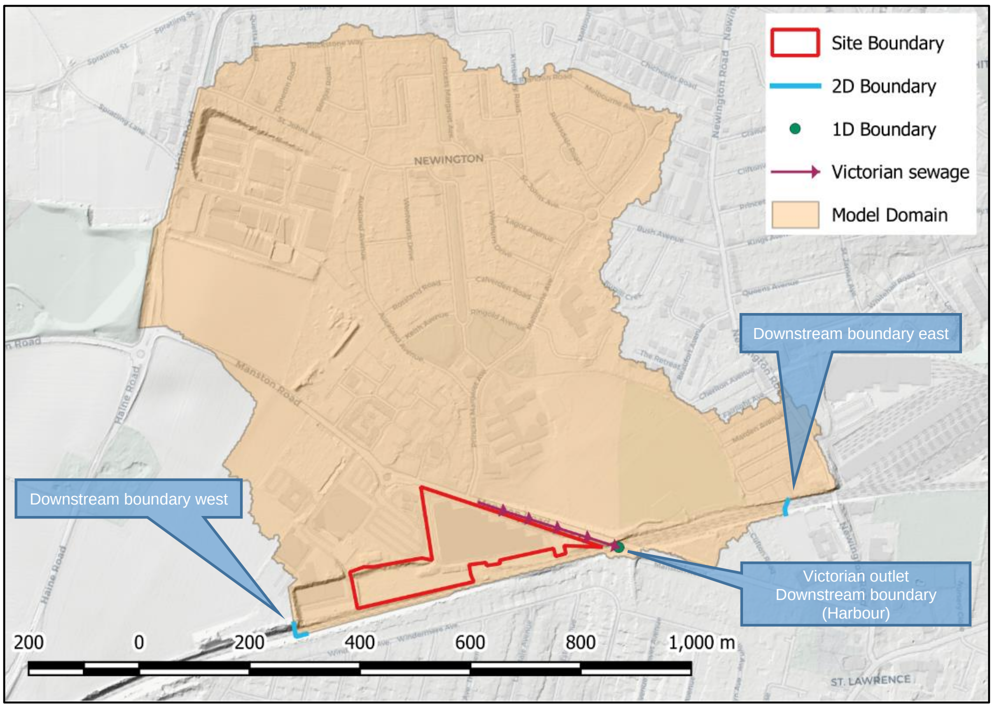


Figure 4 – Model domain.

3. Drainage system

3.1. The Victorian sewer channel runs deep beneath Manston Road and has various drainage systems interconnect with it just north of the site, Figure 5. . Based on the CCTV survey by OmegaGeo (November 2023), the drainage system found on site also connects to the Victorian age sewage channel at the same manhole.

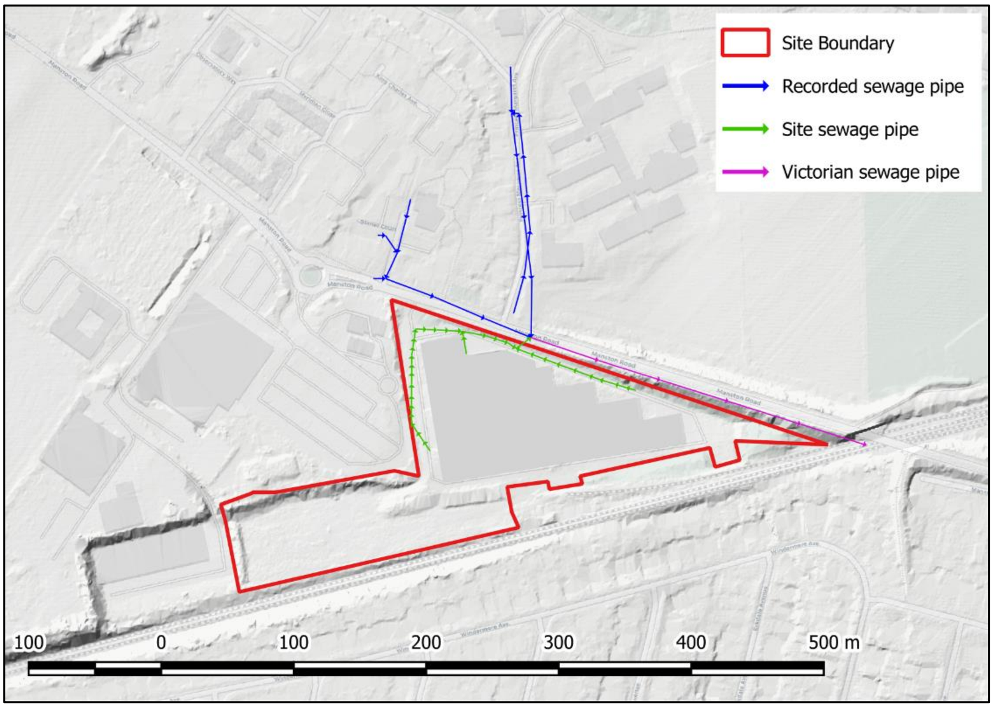


Figure 5 – Sewage pipe network on and around the site.

4. Proposed Development

4.1. The proposed development comprises housing and roads. To mitigate flooding on site two flood retention areas have been proposed as is shown in Figure 6. A platform has been added to the model in the eastern end of the site in order to smooth out levels.

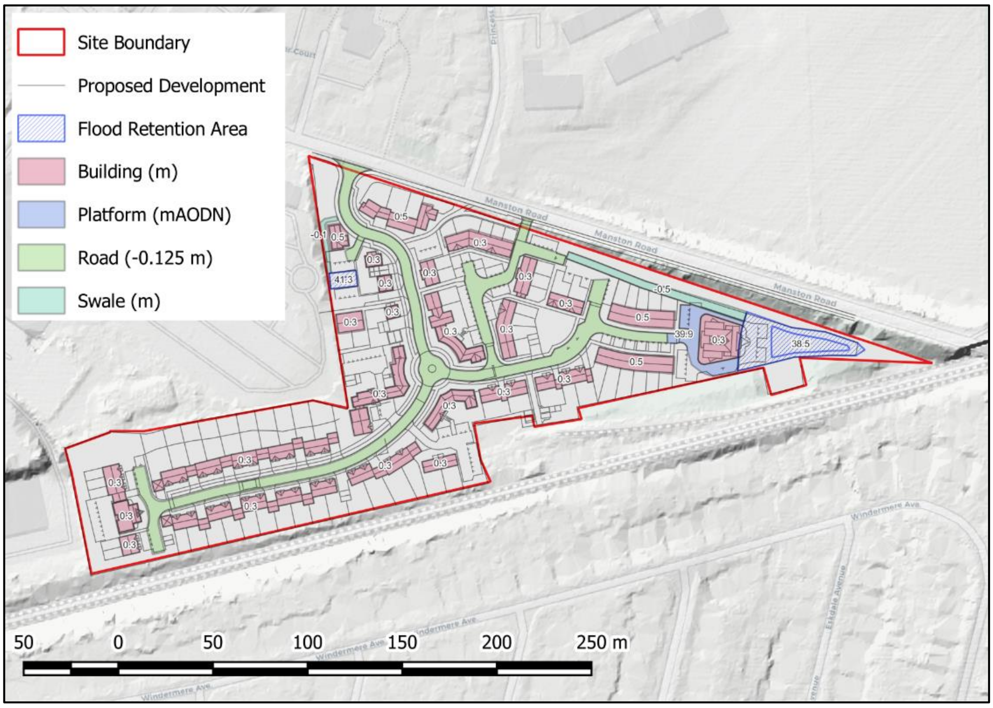


Figure 6 – Proposed development scheme including levels.

5. Numerical Flood Model - Technical Methodology

5.1. The model has been constructed using the TUFLOW 2-dimensional (2D) numerical flood modelling system, version TUFLOW 2023-03-AA_w64. The model has 1-dimensional (1D) structures placed into the 2D domain, to represent the important sections of the sewer system ; these have been constructed in ESTRY (TUFLOW's 1D channel and pipe flow model). The most recent version of TUFLOW has been used to take advantage of TUFLOW's Highly Parallelised Computation (HPC) using Graphical Processing Unit (GPU). This approach uses the latest advances in the TUFLOW software to ensure the detail is captured and capitalises on improved model run times to allow the entire catchment to be modelled.

5.2. The 2D Digital Elevation Model (DEM) of the catchment uses a grid resolution of 4 m to represent areas of particular interest, 2 m to represent the main flow routes through the catchment, and 1 m to represent the site area and the sewer network connections. The grid resolution slackens to 8 m in wider catchment areas away from the main flow routes. The ground elevations of the DEM are based upon the EA's 1 m LiDAR Digital Terrain Model (DTM) originating from the National LiDAR Programme 2022, which is shown in Figure 4.

5.3. The catchment area has been delineated using the published method of Kwast and Menke (2019), the results of which are shown in Figure 4. The delineated catchment defines the 2D model domain through which water could flow over a 'bare-earth' with no influence from the sub-surface drainage network. The delineation method is based on the EA/Defra LiDAR aerial height data and requires some manual intervention to ensure that flow routes are not blocked by any misrepresentation of bridges, tunnels, or other similar features. The catchment defined by the TUFLOW software might differ slightly from the delineated catchment and to be certain that the complete catchment is represented within the model domain, the domain is set slightly larger than the delineated catchment on some locations. To then prevent water from unrealistically ponding at the edge of the domain (glass-walling), a 2D boundary is drawn such that this water is free to flow out of the model. An example of this is the eastern downstream boundary as shown in Figure 4.

5.4. The LiDAR levels have been verified with the site-specific topographic survey levels from the surveys by SDS and Assoc. Ltd. (September 2014) and OmegaGeo (November 2023). A comparison of the LiDAR and topographic survey levels has been made and has been applied to update the LiDAR levels at the site.

5.5. The 2D downstream limit of the model, also shown in Figure 4, is a stage-discharge (HQ) type with a specified water level surface gradient of 0.01 congruent with the gradient of the land levels in this area. The 1D downstream limit of the model, is situated at the downstream end of the Victorian age underground sewage channel which discharges into Ramsgate Harbour at approximately 1.8 km from the site. This 1D downstream boundary is a stage-water level (HT) type with a specified water level of 3 m AODN at the harbour.

5.6. Roads throughout the modelled catchment have been lowered by 0.125 m to represent typical UK kerb heights and enhance their flood water routing effect This method follows the Defra guidance for modelling surface water.

5.7. Building thresholds throughout the modelled catchment have been raised by 0.3 m as per stubby building approach.

5.8. A section of the surface water sewer network to the north of the site has been modelled based on Southern Water's asset database and the surface water network available on the site has been modelled based on OmegaGeo's CCTV survey (November 2023). The extent of both networks is shown in Figure 5. The locations of the gullies that provide the inflow points to the network have only been provided by the CCTV survey and not by the asset data. Therefore, the locations of the gullies for the area north of the site have been identified as best possible using Google Streetview. All gully locations linked to the known sewer assets are shown in Figure 7.

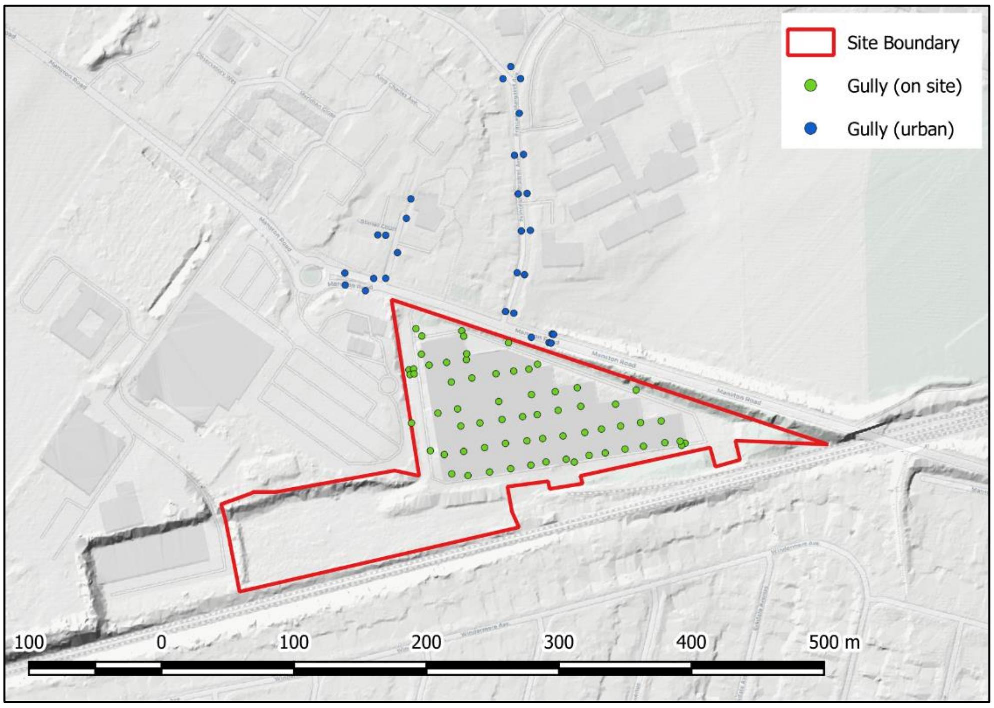


Figure 7 – Gully locations digitised on and close to the site.

5.9. In order to represent the unknown part of the urban drainage system within the model domain, an initial infiltration loss of 12 mm/hr is applied on roads and building footprints. This is the same approach as used in the national scale surface water modelling methodology undertaken for the EA.

5.10. The model applies spatially varying Manning's *n* roughness values to represent the various land surfaces found within the model domain. The values applied to the different land use types are summarised in Table 1.

Feature code	n	Description
10021	0.1	Buildings
10119	0.03	Roads Tracks and Paths
10167	0.05	Railway lines
10111	0.08	Woodland or scrub

Table 1 – Manning's n roughness values and land use types.

5.11. Five extreme flow events have been simulated within the model, including:

- 1 in 30 year return period event (3.33%AEP, Annual Exceedance Probability), with and without climate change allowance of 40%;
- 1 in 100 year return period event (1%AEP), with and without climate change allowance of 45%; and
- 1 in 1,000 year return period event (0.1%AEP).

5.12. A review of the Flood Estimation Handbook (FEH) online revealed a chalk catchment with a BFIHOST value of 0.788. Rainfall hyetographs have been generated for the above events using the catchment's rainfall data derived by FEH in combination with the industry standard Revitalised Flood Hydrograph method (ReFH 2.3).

5.13. The soils and geology of the catchment are chalk as per British Geological Survey (BGS) mapping, which means that infiltration rates are in the order of 80 mm/hr. Section 6 explains the infiltration rate sensitivity testing in more detail. However, a superficial deposit consisting of clay and silt covers part of the catchment area including the site. Infiltration rates at this superficial deposit area are much lower and in the order of 4.57 mm/hr (Ground Investigation Report – EPS, 10th August 2023).

5.14. Table 2 lists the models run for the TUFLOW baseline conditions and initial testing. All simulations use the TUFLOW control file *1077_Flambeau_~s1~_~e1~_~s2~.tcf*. All baseline simulations are designated *A7,* and all proposed simulations are designated *B2*.

Scenario	s1	e1	s2	Comment
Existing conditions	A7	P30		3.3%AEP
		P30cc40	000	3.3%AEP + 40% climate change (higher central)
		P100		1.0%AEP
		P100cc45		1%AEP + 45% climate change (higher central)
		P1000		0.1%AEP
			000	Infiltration rate testing
			nUP	Manning's n roughness +20%
			nDN	Manning's n roughness -20%
Proposed conditions (post-development)	B2	P30	000	3.3%AEP
		P30cc40		3.3%AEP + 40% climate change (higher central)
		P100		1.0%AEP
		P100cc45		1%AEP + 45% climate change (higher central)
		P1000		0.1%AEP

Table 2 – List of model simulations with corresponding events

5.15. Table 3 lists and describes the files used in the TUFLOW model setup, including geometry files, boundary files for both 2D and 1D.

File name	Description
2d_code_1077_Active_Area_A_R.SHP	2D active area of the model
2d_loc_1077_Grid_A_L.SHP	2D origin and orientation of the grid
2d_qnl_1077_Grid_Res_A_R.SHP	2D grid resolution control within the active area
1d_pit_1077_Sewage_Network_C_P.SHP; 1d_nwk_1077_Sewage_Network_B_L.SHP; 1d_nwk_1077_Sewage_Network_B_P.SHP; 1d_pit_1077_Sewage_Network_Prop_P.SHP; 1d_nwk_1077_Sewage_Network_Prop_L.SHP; & 1d_nwk_1077_Sewage_Network_Prop_P.SHP	1D representation of the gully network for the baseline & proposed situation

1d_bc_1077_Sewage_Connection_Outlet_B_P.SHP	1D representation of the Victorian age sewage outfall in Ramsgate harbour
2d_zsh_1077_Offsite_Buildings_n_Roads_A_R.SHP	2D representation of buildings and roads within the catchment outside the site area
2d_zsh_1077_Onsite_Building_Existing_A_R.shp & 2d_zsh_1077_Onsite_Building_Existing_A_P.shp	2D representation of the existing building on site
2d_zsh_1077_Onsite_building_removed_Prop_R.SHP	Existing on site building removed from the 2D domain
2d_zsh_1077_Onsite_Buildings_n_Roads_Prop_B_R.SHP	2D representation of the proposed buildings and roads
2d_zsh_1077_Prop_Mitigation_B_R.SHP & 2d_zsh_1077_Prop_Mitigation_B_P.SHP	2D representation of the proposed flood mitigation
2d_soil_1077_soil_areas_B_R.SHP	On site infiltration rate representation in the 2D domain
2d_soil_1077_drained_areas_C_R.SHP & 2d_soil_1077_drained_areas_Prop_R.SHP	Initial infiltration loss on buildings and roads for baseline & proposed
2d_mat_1077_Materials_R.shp	2D representation of Manning's *n* roughness for various surfaces within the modelling domain
2d_bc_1077_Downstream_A_L.SHP	2D specification of the downstream boundaries
2d_rf_1077_Rainfall_16_R.SHP & 2d_rf_1077_Rainfall_16_Proposed_B_R.SHP	Rainfall catchment area for baseline & proposed

Table 3 – TUFLOW model files

6. Sensitivity Testing

6.1. Several sensitivity tests have been undertaken to ensure a full understanding of model behaviour. These have included:

- Infiltration rate testing for chalk areas; and
- Manning's n roughness value ±20%.

6.2. **Infiltration rate testing for chalk areas –** from publicly available soil data provided by the British Geological Survey (BGS), it becomes apparent that two mayor soil types are present in the catchment area. A clayey soil type is present on site and has been investigated by means of on-site infiltration testing. A chalk soil type is present in the wider catchment and has not been infiltration tested. Therefore, an infiltration rate for this area has been calibrated by using the 1 in 5 year event.

6.2.1. The results of this test showed that an infiltration rate of 80 mm/hr results in the most realistic flooding for the 1 in 5 year event where floodwater has not travelled from the field over the road into the site area. Therefore, an infiltration rate of 80 mm/hr has been applied on the areas within the catchment consisting of chalk bedrock.

6.3. **Manning's n values ±20% –** the surface roughness in the model represents typical conditions with respect to seasonal vegetative growth. However, vegetation can change significantly between summer and winter, and therefore greatly affect the speed at which flood water may transit through an area.

6.3.1. A roughness value of 0.05 has been applied globally to the model; this is a value that is typically used to represent grasslands, roadside verges, or sparse scrub. To represent the seasonal variation, the Manning's n value has been varied by ±20% in two separate simulations.

6.3.2. The results show that the variance of Manning's n by +20% and -20% results in flood levels varying in the river adjacent to the-site by 0.000 m and -0.013 m respectively. On this basis, the seasonal growth and variation in vegetation is not considered to be significant and therefore, no further adjustment has been made or investigated.

7. Simulation Messages

7.1. No warning messages have been reported prior to or during the model simulation.

8. Results

8.1. The graphical model results are appended to this technical report and are listed in Table 4.

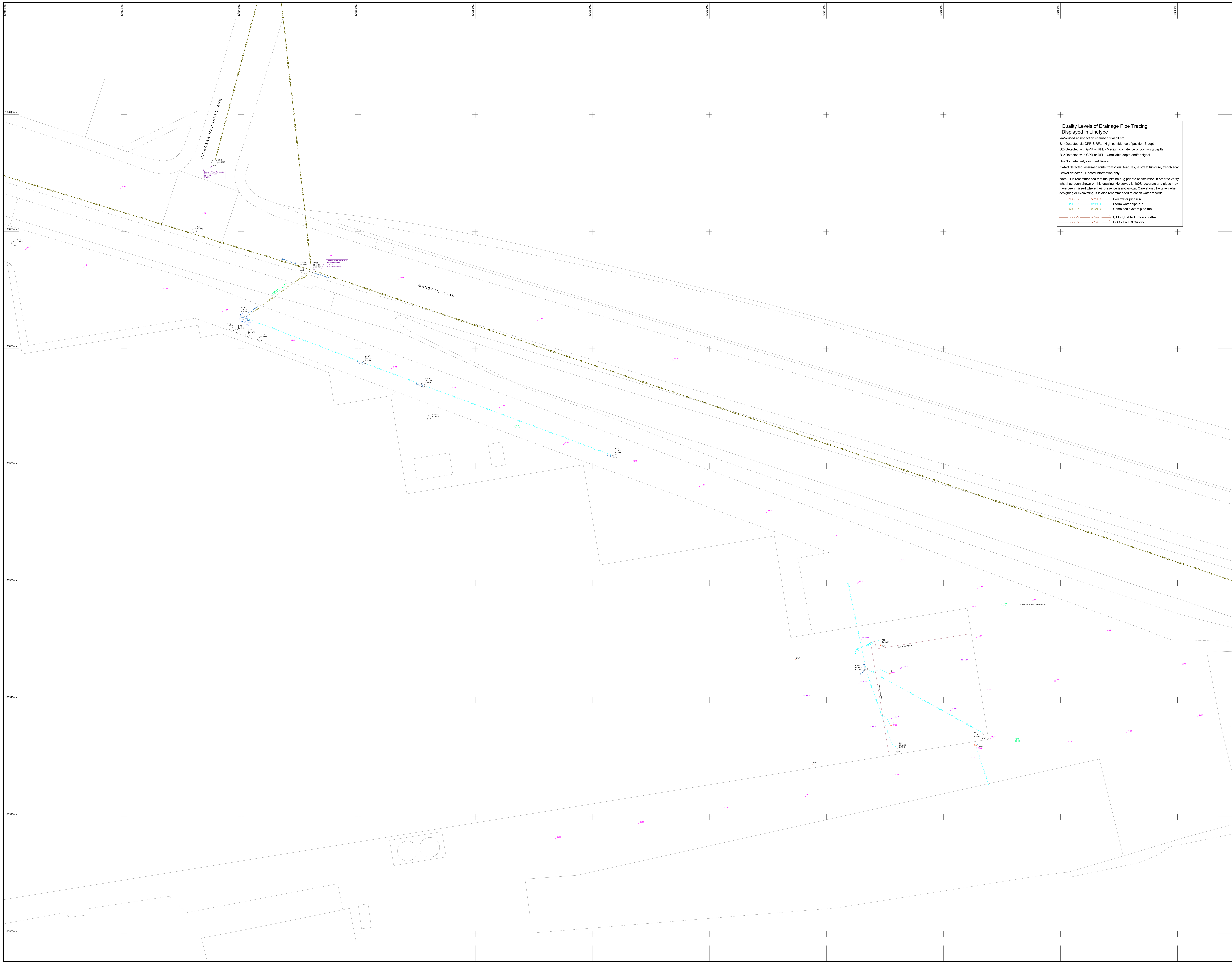
Model result no.	Scenario	Event	Scenario	Output	Figure No.
1	Existing & Proposed	1:30 year, present day	Event representing the functional floodplain	Max depth & difference in max level	A.1
		1:30 year + 40% climate change		Max depth & difference in max level	A.2
2		1:100		Max depth & difference in max level	A.3
3		1:100 + 45% climate change	Design event	Max depth & difference in max level	A.4
4		1:1,000 year, present day	Exceedance event	Max depth & difference in max level	A.5

Table 4 - List of appended figures

9. Enclosed Documents

9.1. The following documents have been enclosed with this technical note:

- Topographic survey;
- Drainage asset information; and
- Modelling results.



Quality Levels of Drainage Pipe Tracing Displayed in Linetype

A=Verified at inspection chamber, trial pit etc

B1=Detected via GPR & RFL - High confidence of position & depth

B2=Detected with GPR or RFL - Medium confidence of position & depth

B3=Detected with GPR or RFL - Unreliable depth and/or signal

B4=Not detected, assumed Route

C=Not detected, assumed route from visual features, ie street furniture, trench scar

D=Not detected - Record information only

Note - it is recommended that trial pits be dug prior to construction in order to verify what has been shown on this drawing. No survey is 100% accurate and pipes may have been missed where their presence is not known. Care should be taken when designing or excavating. It is also recommended to check water records.

FW (B4) -> FW (B4) -> Foul water pipe run

SW (B4) -> SW (B4) -> Storm water pipe run

CO (B4) -> CO (B4) -> Combined system pipe run

FW (B4) -> FW (B4) -> UTT - Unable To Trace further

FW (B4) -> FW (B4) -> EOS - End Of Survey

Project Datum

All levels and coordinates are related to the Ordnance Survey national grid by means of GPS.
One survey control point has been fixed using GPS and then the survey orientated to additional GPS points.
No scale factor has been applied therefore only the fixed GPS point is a true Ordnance Survey position.

Topographical Survey Legend

BEB	Belisha Beacon	FH	Fire Hydrant	RL	Ridge Level
BH	Borehole	FL	Flood Light	RS	Road Sign
BL	Base Level	FP	Flag Pole	RTW	Retaining Wall
BO	Bollard	G	Gully	RWP	Rain Water Pipe
BP	Brick Pillar	GB	Grit Box	SEG	Side Entry Gully
BPav	Brick Paving	GIC	Gas Inspection Cover	SI	Sign
BRW	Brick Wall	GM	Gas Meter	SSL	Structural Slab Level
BS	Bus Stop	GP	Gas Pipe	STN	Survey Station
BW	Block Wall	GV	Gas Valve	STW	Stone Wall
CBF	Close Board Fence	Ht	Height (in meters)	SU	Step Up
CL	Cover Level	IC	Inspection Cover	SV	Stop Valve(W)Water(G)Gas
CLF	Chain Link Fence	IC(C)	(C)Combined(F)Foul(S)Storm	SVP	Soil Vent Pipe
Conc	Concrete	IL	Invert Level	TAC	Tactile Paving
CPF	Chestnut Paling Fence	JB	Junction Box	TCB	Telephone Call Box
CPO	Concrete Post	LP	Lamp Post	TEP	Telegraph & Electric Pole
CPS	Concrete Paving Slabs	MB	Multi Boled Tree	THL	Threshold Level
CRW	Concrete Retaining Wall	MK	Service Marker	TIC	Telecom Inspection Cover
CW	Concrete Wall	MRF	Metal Railing Fence	TM	Ticket Machine
DC	Drainage Channel	NP	Name Plate	TL	Traffic Light
DIL	Dilapidated	OBF	Open Board Fence	TLCB	Traffic Light Control Box
DP	Down Pipe	PB	Post Box	TP	Telegraph Pole
DPC	Damp Proof Course	PCF	Post & Chain Fence	TWL	Top Of Wall Level
EIC	Electric Inspection Cover	PM	Parking Meter	UTL	Unable To Lift
EL	Eaves Level	PNF	Panel Fence	WIC	Water Inspection Cover
EP	Electric Pole	PRF	Post & Rail Fence	WM	Water Meter
ER	Earth Rod	PRL	Parapet Wall Level	WMF	Wire Mesh Fence
FB	Flower Bed	PWF	Post & Wire Fence	WTL	Water Level
FFL	Finished Floor Level	RE	Rodding Eye	VP	Vent Pipe

Tree Species

AC	Acer	FR	Fruit	LN	London Plane	SC	Sweet Chestnut
AL	Alder	HA	Hawthorn	LO	Locust	SP	Spruce
AS	Ash	HB	Hornbeam	MA	Maple	ST	Stump
BE	Beech	HC	Horse Chestnut	MG	Magnolia	SY	Sycamore
CE	Cedar	HY	Holly	OA	Oak	U	Unidentified
CH	Cherry	HZ	Hazel	PI	Pine	WA	Walnut
CY	Cypress	LA	Larch	PO	Poplar	WB	Whitebeam
DE	Dead	LB	Laburnum	RO	Rowan	WI	Willow
EL	Elm	LI	Lime	SB	Silver Birch	YE	Yew

Line Types

Steps / Ramps	Fence
Top / Bottom of Banking	Building Face
Bushes / Vegetation	Drop Kerb
Change of Surface	Kerb
Detail	Wall / Structure
Overhead Structure	Single Gate
T Telecom Overhead	Double Gate
T & E Telecom & Power Overhead	Banking
E Power Overhead	Survey Station

All levels and dimensions are quoted in metres. Tree girths and canopy spreads are surveyed as a mean size and shown to scale. Tree heights are quoted based on an estimation taken from the ground and have not been accurately confirmed.
Whilst every effort is made to identify tree species and sizes, no responsibility can be taken for the accuracy of this information and an Arborologist should be consulted for confirmation.
Eave levels are taken at the bottom of the lowest roof tile.
It is recommended that all invert levels and pipe sizes be checked prior to construction.
Drawing correct at time of survey and to scale.
Any setting out works should be undertaken using Omega Geomatics Ltd survey control only.

Measured Building Survey Legend

ACL	Arch Center Level / Height above floor
ASL	Arch Spring Level / Height above floor
C-H	Window Cill to Window Head Dimension
CLG	Ceiling Level / Height above floor
DH	Door Head Height above floor
DHL	Door Head Level
F-C	Floor to Window Cill Dimension
FL	Floor Level
RU	Ramp Up
SCLG	Suspended / False Ceiling Level / Height above floor
SL	Slab Level
SU	Step(s) Up
TH	Threshold Height above floor
THL	Threshold Level
TWL	Top of Wall Level
US	Underside Level / Height above floor
USB	Underside of Beam level / Height to underside above floor
USJ	Underside of Joist level / Height to underside above floor
WACL	Window Arch Center Level
WASL	Window Arch Spring Level
WCL	Window Cill Level
WHL	Window Head Level

Sloping Roof
Sloped Ceiling (Points up)
Arched / Vaulted Ceiling

Building Line / Wall Line
Detail
Steps
Overhead Detail
Partitions
Glazing

All building measurements are taken to existing finishes or faces which are constant and represent an average face or wall line. All levels and dimensions are quoted in metres.
All window head and window cill levels are internal measurements.
Ceiling height measurements are taken to a point which best represents the general room height.

An Ordnance Survey map is shown in the background in grey. Omega Geomatics Ltd takes no responsibility for the accuracy of this information. Its purpose on this drawing is as a guide only and should not be relied upon.

N

Drawing Revisions

Rev No.	Date	Details
B		
A		
Original	See below	Original survey carried out

OmegaGeo

Unit 5 Hoath Business Centre
Hoath Lane
Gillingham
Kent ME8 0BF

+44 (0)1634 751 002
www.OmegaGeo.co.uk
survey@OmegaGeo.co.uk

Client	Flambeau Europlast Ltd
Project	Flambeau Europlast Ltd Manston Road, Ramsgate, Kent, CT12 6HW
Original Survey Date	November 2023
Job Ref	2314673
Presentation Scale	1:200 @ A0
Drawing Number	1 of 1

(c) Crown copyright and database rights 2023 Ordnance Survey 100031673	Date: 10/08/23	Scale: 1:1250	Map Centre: 636389,165493	Data updated: 05/05/23	Our Ref: 1246861 - 1

Wastewater Plan A1

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2023 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Foul Outfall
Surface Water Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

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1077/LS

WATER for LIFE from Southern Water.

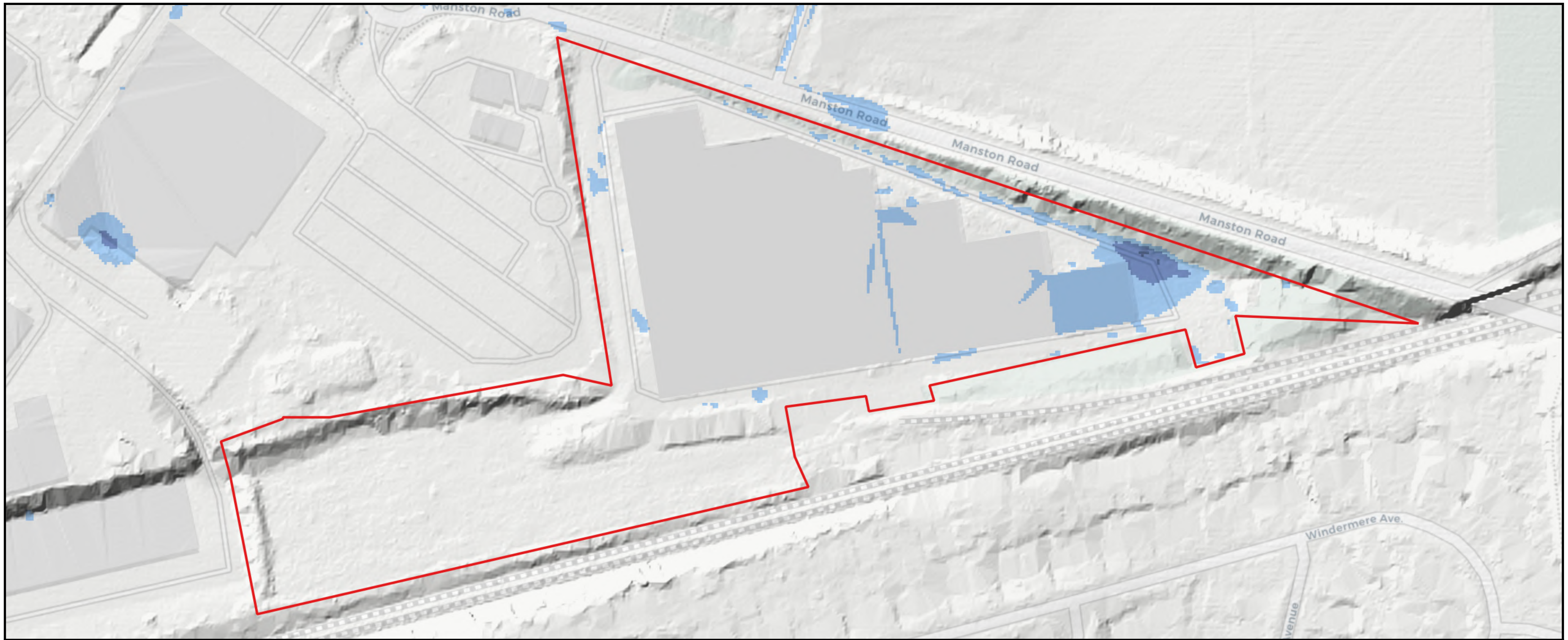
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0201	C	42.57	38.28	
0202	C	39.43	35.79	
0203	C	40.86	36.42	
0301	C	44.55	43.16	
0302	C	44.20	41.44	
1101	C	39.64	35.87	
1201	C	43.48	39.70	
1202	C	43.67	41.06	
1301	C	45.15	42.36	
1302	C	45.11	43.43	
1303	C	44.93	42.80	
2201	C	42.94	39.69	
2301	C	44.76	42.96	
2302	C	44.39	42.31	
2303	C	44.70	41.76	
2601	C	44.23	42.78	
2602	C	44.15	42.35	
2603	C	43.98	42.30	
2604	C	43.78	0.00	
2701	C	44.76	43.92	
2702	C	44.41	43.66	
2703	C	44.25	43.45	
3101	C	38.54	34.74	
3201	C	41.32	37.77	
3301	C	43.85	42.15	
3302	C	43.41	0.00	
3303	C	43.54	0.00	
3601	C	42.64	40.79	
3602	C	42.88	40.28	
3603	C	42.08	0.00	
3701	C	43.26	39.46	
4101	C	36.17	33.08	
4201	C	40.96	37.27	
4202	C	37.59	33.73	
4301	C	40.62	37.68	
4401	C	38.11	36.28	
4402	C	39.94	38.30	
4403	C	41.83	39.34	
5101	C	33.24	30.83	
5201	C	34.23	31.94	
5202	C	34.27	0.00	
5203	C	34.17	31.72	
5301	C	36.74	34.51	
5302	C	37.27	35.10	
5401	C	38.52	35.93	
5402	C	39.32	35.65	
6201	C	34.46	30.74	
6301	C	43.80	42.13	
6302	C	39.53	37.83	
6303	C	41.45	39.08	
6401	C	42.84	0.00	
6402	C	46.09	46.09	
6501	C	45.76	0.00	
7101	C	43.56	40.76	
7102	C	40.49	0.00	
7201	C	43.32	41.77	
7301	C	44.27	42.46	
7302	C	44.69	43.13	
7401	C	45.84	44.52	
7402	C	45.80	44.02	
7403	C	45.77	43.70	
7404	C	45.77	43.55	
7501	C	45.56	43.90	
7701	C	47.76	41.66	
7801	C	47.80	41.45	
8201	C	39.19	36.76	
8201	C	45.23	42.39	
8202	C	44.63	41.57	
8301	C	45.13	43.38	
8302	C	44.96	43.25	
8401	C	45.76	21.84	
8402	C	45.68	42.95	
8404	C	0.00	0.00	
8601	C	46.83	0.00	
8602	C	46.90	44.22	
8603	C	46.97	0.00	
8604	C	46.74	44.85	
8701	C	47.34	0.00	
8702	C	47.23	43.41	
8804	C	47.38	0.00	
9101	C	37.98	0.00	
9103	C	0.00	0.00	
9201	C	40.29	37.76	
9202	C	39.46	36.22	
9203	C	39.99	0.00	
9204	C	37.59	0.00	
9301	C	41.86	0.00	
0204	F	0.00	0.00	
0205	F	0.00	0.00	
0501	F	46.02	45.36	
0601	F	46.25	45.65	
0602	F	46.25	45.18	
0603	F	46.15	44.71	
0604	F	46.20	44.02	
0605	F	46.24	45.70	
1601	F	45.05	41.10	
1602	F	45.50	41.50	
1603	F	45.90	42.74	
1604	F	46.20	42.47	
1701	F	45.65	42.08	
2605	F	43.92	40.50	
2704	F	0.00	0.00	
2805	F	0.00	0.00	
3202	F	0.00	0.00	
3203	F	0.00	0.00	
3204	F	0.00	0.00	
3205	F	0.00	0.00	
3206	F	0.00	0.00	
3304	F	0.00	0.00	
3305	F	0.00	0.00	
3306	F	0.00	0.00	
3702	F	0.00	0.00	
3703	F	0.00	0.00	
4203	F	0.00	0.00	
4204	F	0.00	0.65	
4205	F	0.00	0.70	
4206	F	0.00	0.70	
4207	F	0.00	0.70	
4303	F	0.00	0.00	
4304	F	0.00	0.00	
4305	F	0.00	0.00	
5204	F	0.00	0.00	
8101	F	45.23	41.94	
8204	F	45.06	42.63	
8205	F	45.03	42.59	
8303	F	0.00	0.00	
9203	F	45.13	42.75	

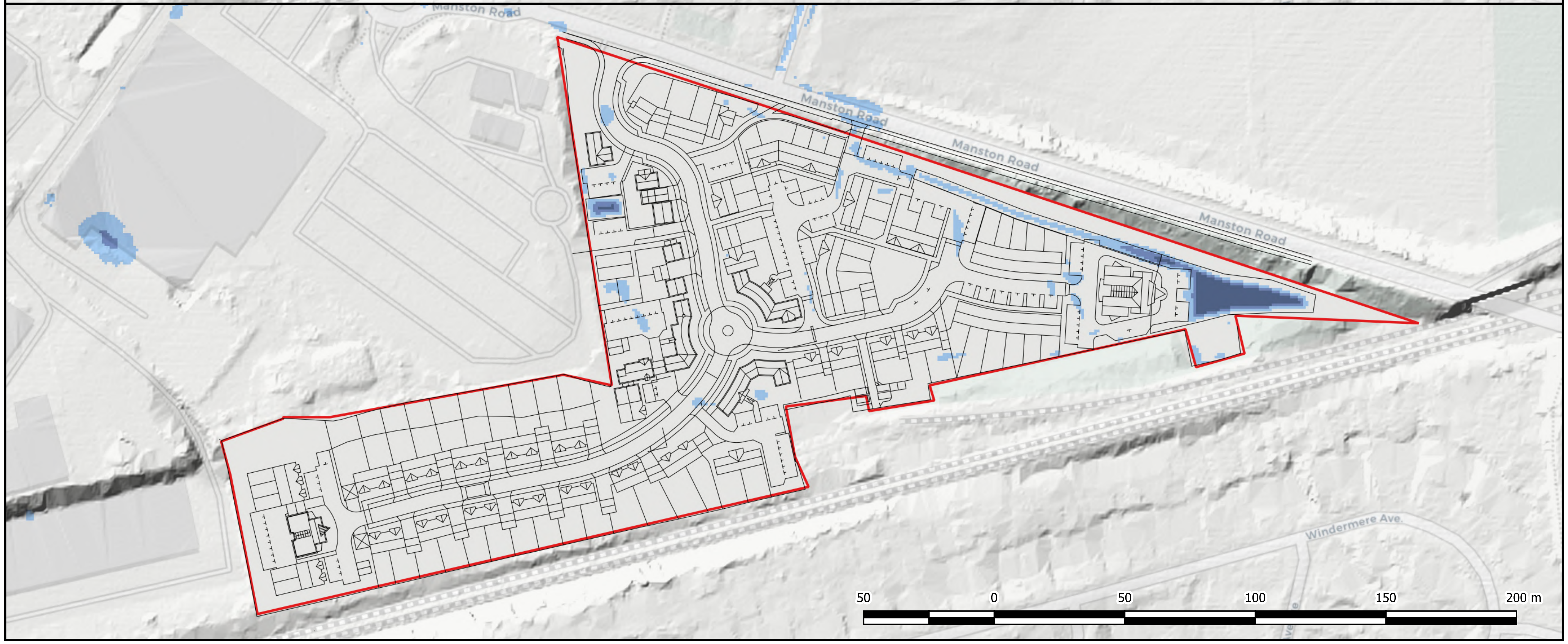
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert





TITLE

MAXIMUM DEPTH OF FLOODING 3.33%AEP EVENT PRESENT DAY

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary
- Proposed Flood Retention Zone

DETAILS

The model results presented are the maximum depth of flooding.
The scenario represents an extreme flood depth during a 1 in 30 year return period event for the present day.

Buildings and roads have been represented within the model by:
-Raising the footprint of each building by 300 mm to represent the threshold (i.e. typical depth before floodwater ingress), road footprints have been lowered by 125mm;
-Using additional surface roughness to represent the resistance to floodwater ingress provided by the structure and materials of the building (e.g. brick/stone walls) or road.

Existing

Proposed

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London: Unit 52.11, Woolyard, 52 Bermondsey Street, London. SE1 3UD

REV	DESCRIPTION	DATE
1	1st issue	30-11-2023
2	2nd issue	14-02-2024

CLIENT: FLAMBEAU EUROPLAST LTD.

PROJECT: MANSTON ROAD, RAMSGATE

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:1700 @ A3	1077	DW	NW

DRAWING No. **A.1**

TITLE

MAXIMUM DEPTH OF FLOODING 3.33%AEP EVENT + 40% CLIMATE CHANGE ALLOWANCE

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary
- Proposed Flood Retention Zone

DETAILS

The model results presented are the maximum depth of flooding.
The scenario represents an extreme flood depth during a 1 in 30 year return period event including a 40% allowance for climate change.

Buildings and roads have been represented within the model by:
-Raising the footprint of each building by 300 mm to represent the threshold (i.e. typical depth before floodwater ingress), road footprints have been lowered by 125mm;
-Using additional surface roughness to represent the resistance to floodwater ingress provided by the structure and materials of the building (e.g. brick/stone walls) or road.

Existing

Proposed

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REV	DESCRIPTION	DATE
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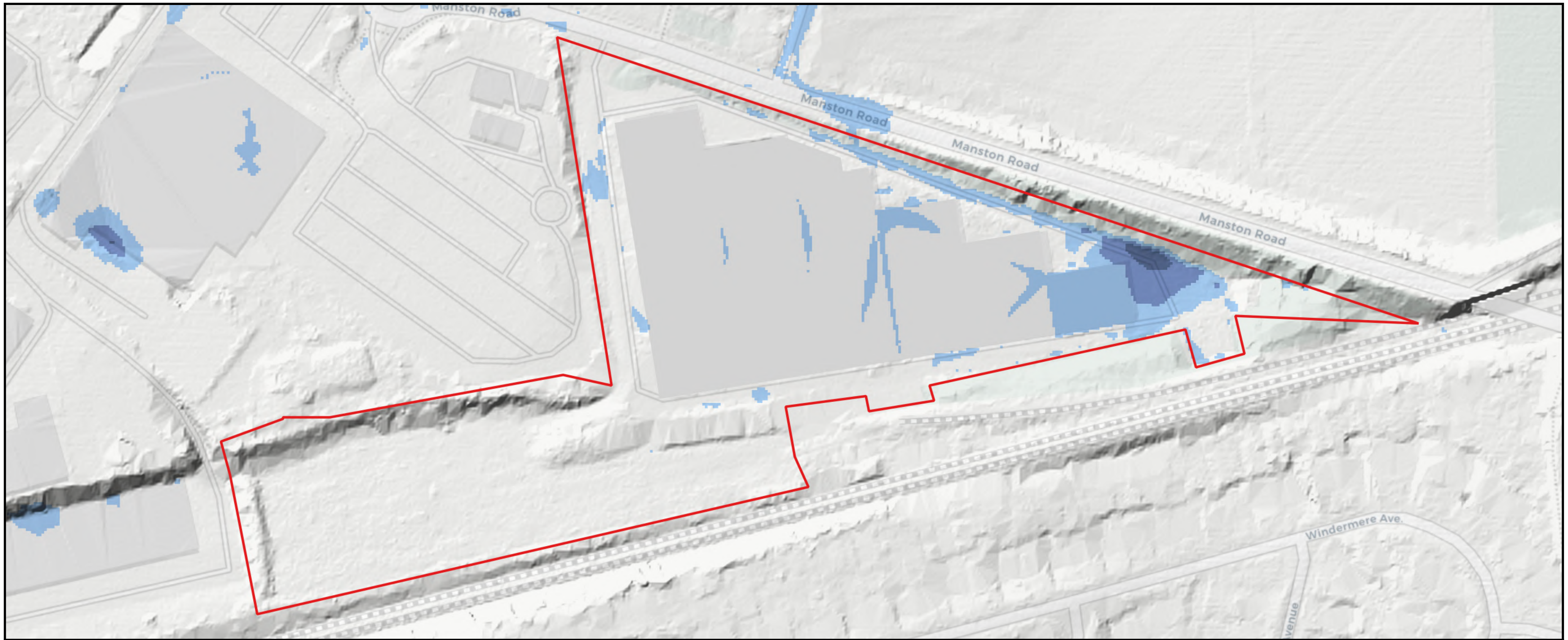
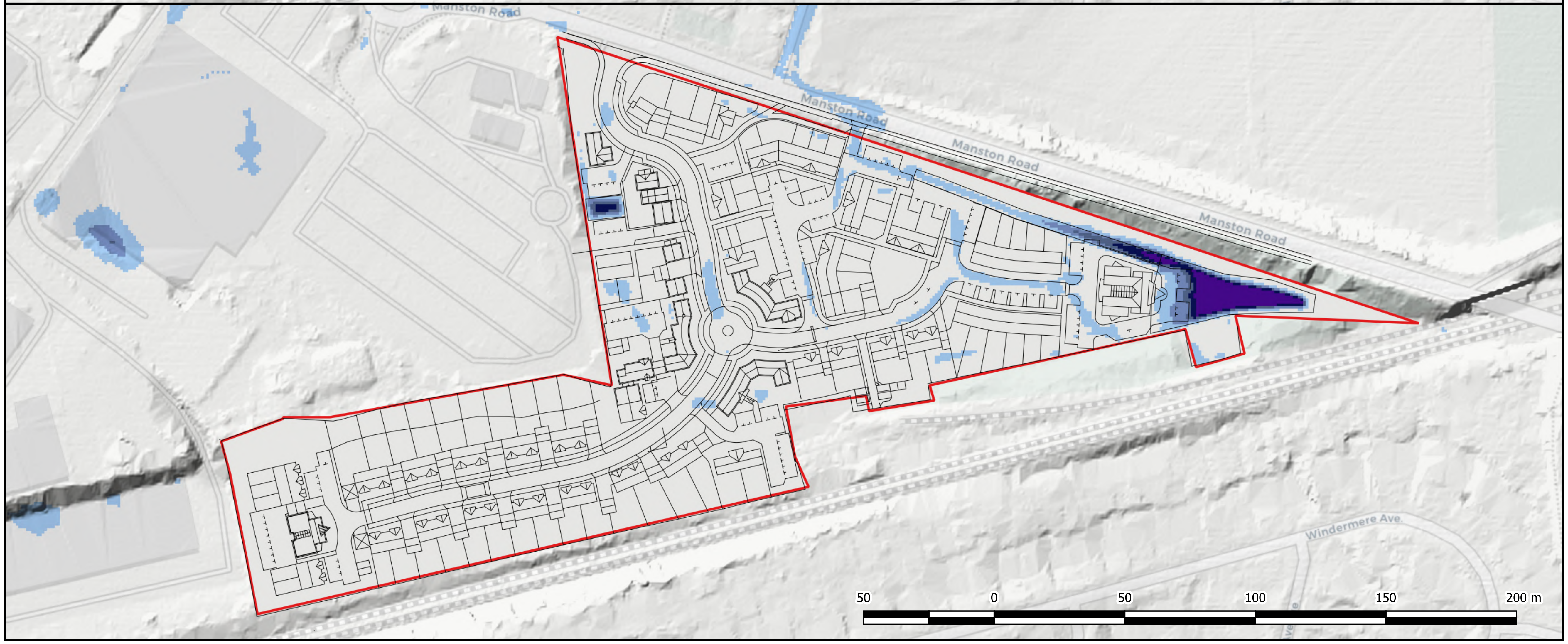
CLIENT: FLAMBEAU EUROPLAST LTD.

PROJECT: MANSTON ROAD, RAMSGATE

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:1700 @ A3	1077	DW	NW

DRAWING No. **A.2**





TITLE

MAXIMUM DEPTH OF FLOODING
1.0%AEP EVENT PRESENT DAY

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary
- Proposed Flood Retention Zone

DETAILS

The model results presented are the maximum depth of flooding.
The scenario represents an extreme flood depth during a 1 in 100 year return period event for the present day.

Buildings and roads have been represented within the model by:
-Raising the footprint of each building by 300 mm to represent the threshold (i.e. typical depth before floodwater ingress), road footprints have been lowered by 125mm;
-Using additional surface roughness to represent the resistance to floodwater ingress provided by the structure and materials of the building (e.g. brick/stone walls) or road.

Existing

Proposed

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1	1st issue	30-11-2023
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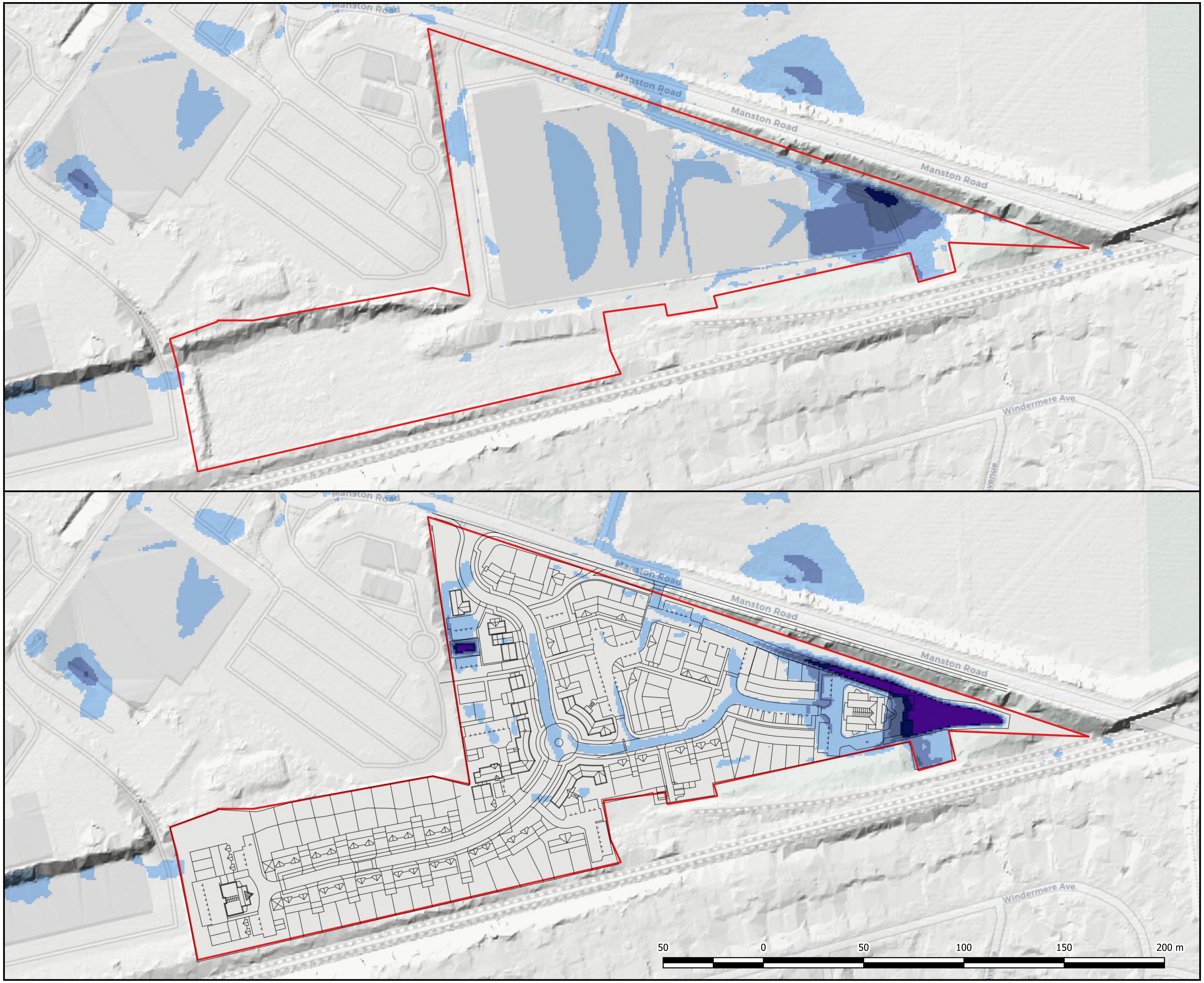
CLIENT FLAMBEAU EUROPLAST LTD.

PROJECT MANSTON ROAD, RAMSGATE

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:1700 @ A3	1077	DW	NW

DRAWING No. **A.3**



TITLE

MAXIMUM DEPTH OF FLOODING 1.0%AEP EVENT + 45% CLIMATE CHANGE ALLOWANCE

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary
- Proposed Flood Retention Zone

DETAILS

The model results presented are the maximum depth of flooding.
The scenario represents an extreme flood depth during a 1 in 100 year return period event including a 45% allowance for climate change.

Buildings and roads have been represented within the model by:
-Raising the footprint of each building by 300 mm to represent the threshold (i.e. typical depth before floodwater ingress), road footprints have been lowered by 125mm;
-Using additional surface roughness to represent the resistance to floodwater ingress provided by the structure and materials of the building (e.g. brick/stone walls) or road.

Existing

Proposed

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REV	DESCRIPTION	DATE
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CLIENT: FLAMBEAU EUROPLAST LTD.

PROJECT: MANSTON ROAD, RAMSGATE

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:1700 @ A3	1077	DW	NW

DRAWING No. **A.4**

TITLE

IMPACT PROPOSED SCHEME ON FLOOD LEVELS ON AND AROUND THE SITE
1.0%AEP EVENT + 45% CLIMATE CHANGE ALLOWANCE

LEGEND

Flood level difference (m)
Proposed level minus Existing level

- Now dry
- < -1.00
- -1.00 - -0.10
- -0.10 - -0.05
- -0.05 - -0.03
- -0.03 - -0.01
- -0.01 - 0.01
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.10
- 0.10 - 1.00
- > 1.00
- Now wet
- Site Boundary

DETAILS

The model results presented are the maximum difference in flood levels between proposed and existing.
The scenarios represent an extreme flood level during a 1 in 100 year return period event including a 45% allowance for climate change.

Buildings and roads have been represented within the model by:
-Raising the footprint of each building by 300 mm to represent the threshold (i.e. typical depth before floodwater ingress), road footprints have been lowered by 125mm;
-Using additional surface roughness to represent the resistance to floodwater ingress provided by the structure and materials of the building (e.g. brick/stone walls) or road.

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REV	DESCRIPTION	DATE
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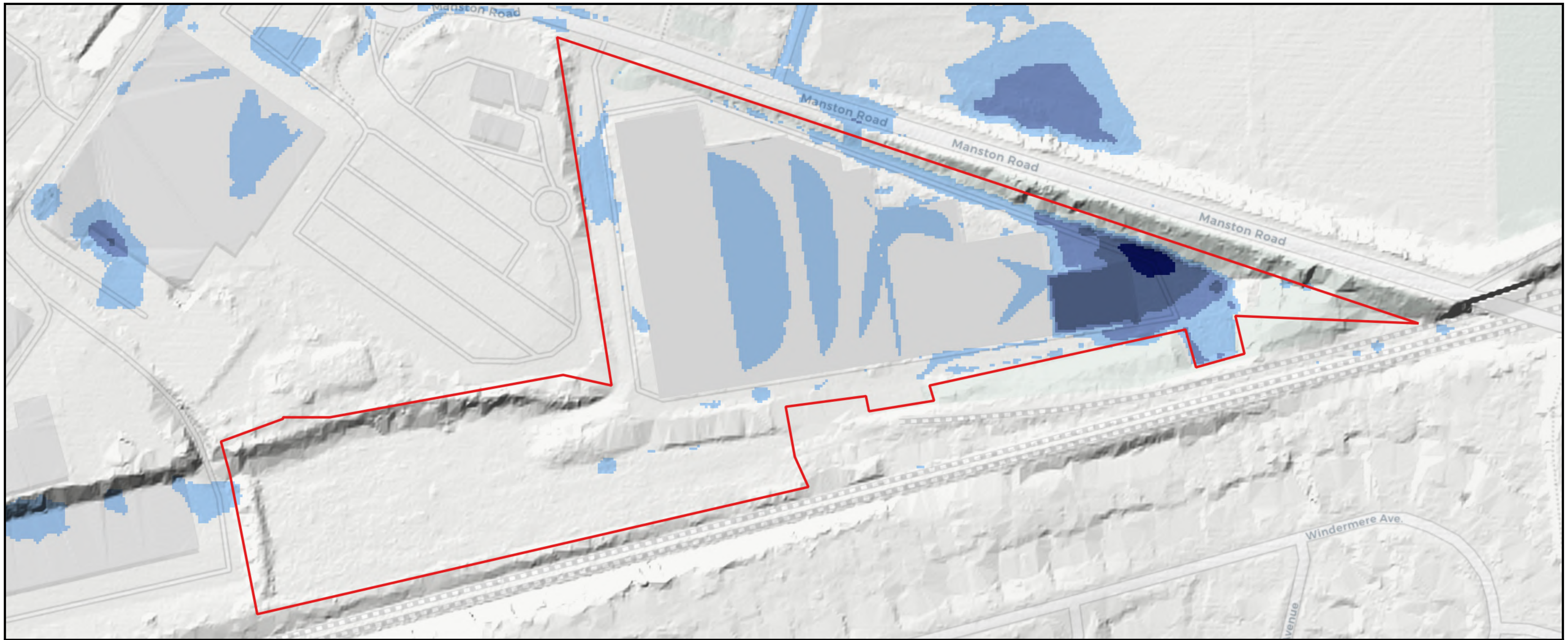
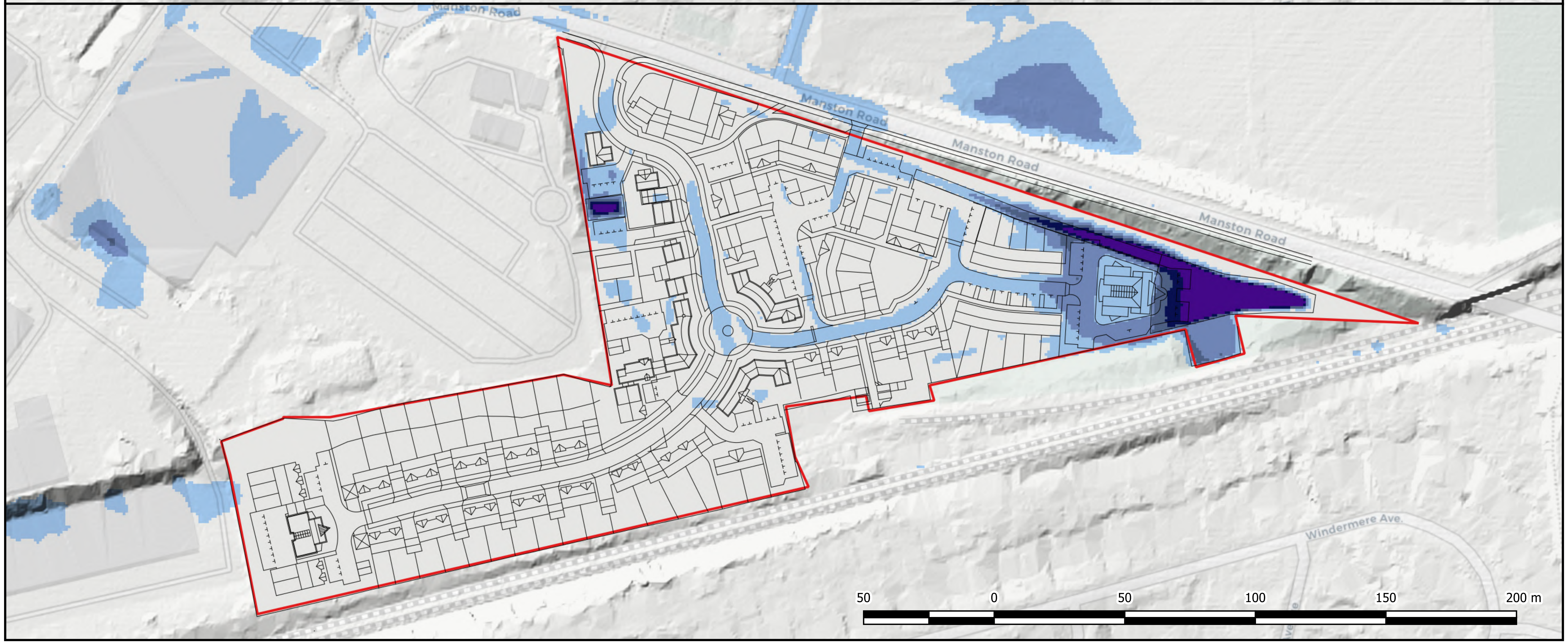
CLIENT
FLAMBEAU EUROPLAST LTD.

PROJECT
MANSTON ROAD, RAMSGATE

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:1700 @ A3	1077	DW	NW

DRAWING No.
A.5





TITLE

MAXIMUM DEPTH OF FLOODING 0.1%AEP EVENT PRESENT DAY

LEGEND

Maximum Depth (m)

- 0.00 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- > 1.00
- Site Boundary
- Proposed Flood Retention Zone

DETAILS

The model results presented are the maximum depth of flooding.
The scenario represents an extreme flood depth during a 1 in 1000 year return period event for the present day.

Buildings and roads have been represented within the model by:
-Raising the footprint of each building by 300 mm to represent the threshold (i.e. typical depth before floodwater ingress), road footprints have been lowered by 125mm;
-Using additional surface roughness to represent the resistance to floodwater ingress provided by the structure and materials of the building (e.g. brick/stone walls) or road.

Existing

Proposed

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CLIENT
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PROJECT
MANSTON ROAD, RAMSGATE

SCALE	PROJECT No.	INITIALS	CHECKED BY
1:1700 @ A3	1077	DW	NW

DRAWING No.
A.6