8. Photos of left and right hand side flood plain in the vicinity of cross sections 1.022 to 0.502. Photos taken on 12th February 2020.

9. Photo of culvert beneath field access, standing downstream and looking upstream from right hand side bank. Photos taken on 12th February 2020.

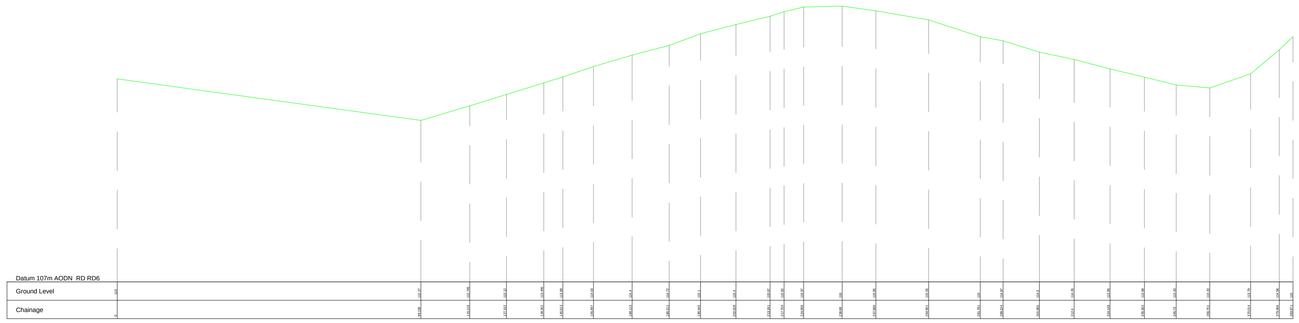
10. Watercourse and floodplain on the left and right hand side bank in the vicinity of cross sections 0.467 to 0.300. Photos taken on 12th February 2020.

11. Watercourse and flood plain on left and right hand side of watercourse in the vicinity of cross sections 0.300 to 0.05. Photos taken on 12th February 2020.

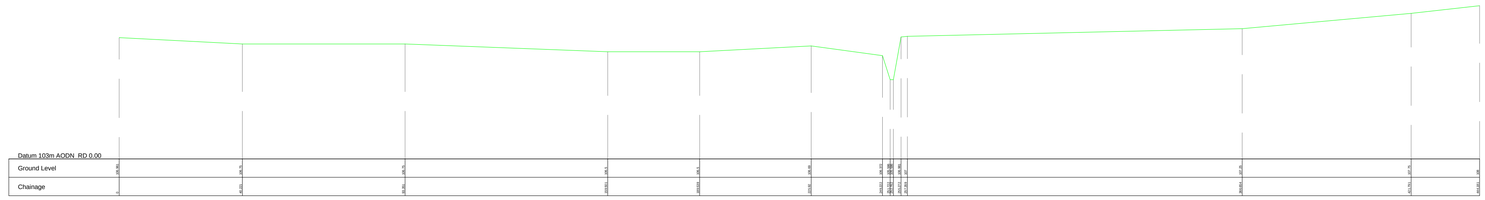
12.Photo of watercourse at most downstream point of model. Photo taken on 12th February 2020.

APPENDIX 5

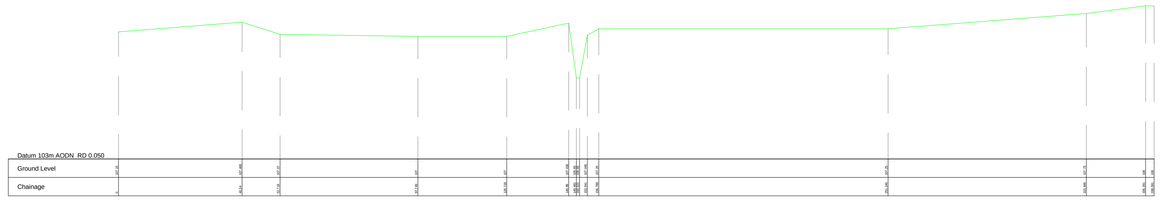
HYDRAULIC MODEL CROSS SECTIONS



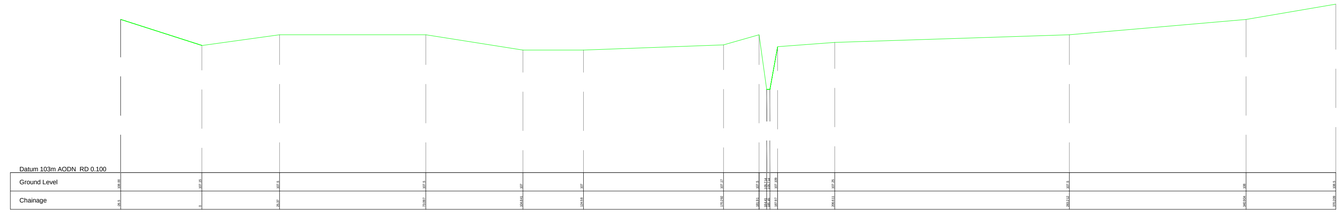
BODDINGTON ROAD



CHAINAGE 00



CHAINAGE 0.050



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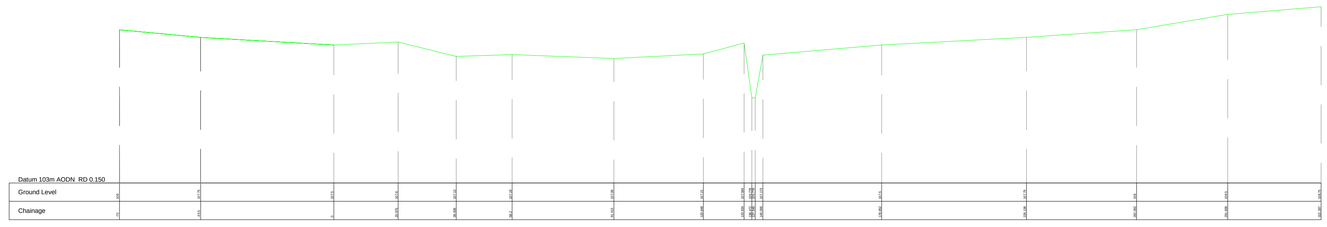

CHAINAGE 0.150

REV	DATE	DESCRIPTION/REASON FOR ISSUE	
B	15.06.2020	REVISED ALIGNMENT OF SECTIONS	SEC
A	10.03.2020	REVISED TO SUIT LIDAR	SEC

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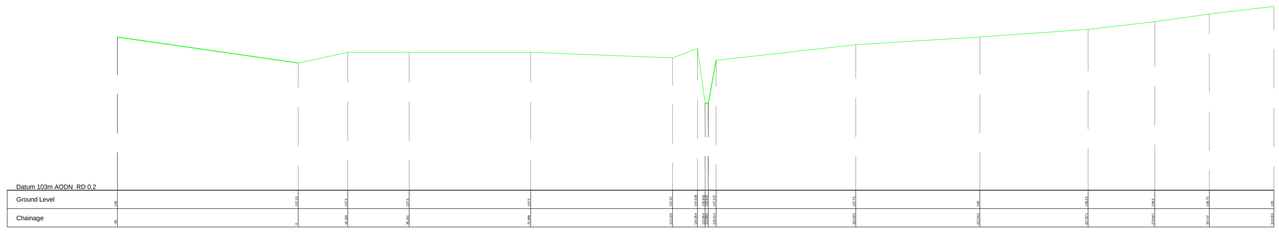
TITLE

NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 1 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE V: 1:100 H: 1:1000
APPR	DRAWING NO 2420-05 REV B



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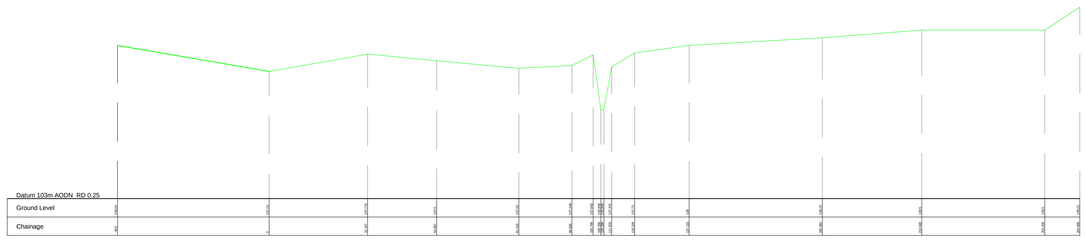

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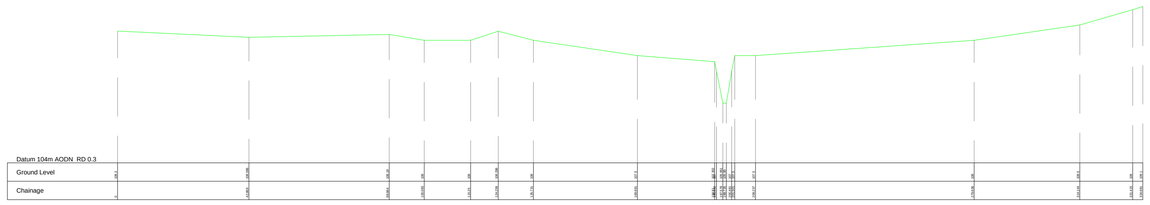
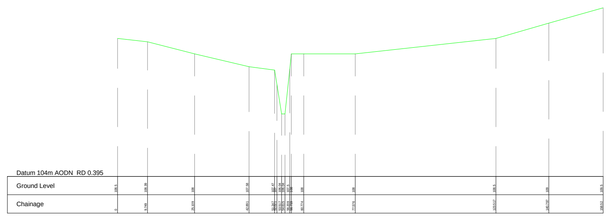


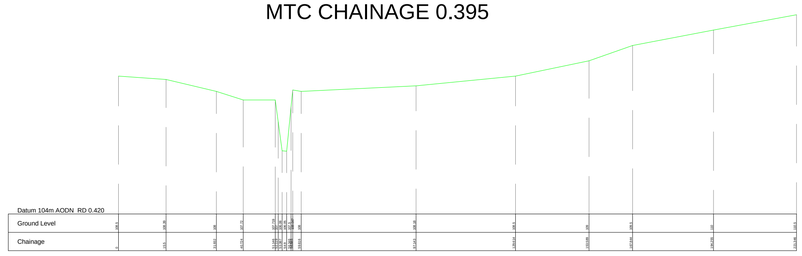
Chainage 1228.785m (446799.3E 250767.1N)

MTC CHAINAGE 0.300



Chainage 1135.241m (446750.3E 250846.8N)

MTC CHAINAGE 0.395



Chainage 1108.784m (446749.8E 250873.2N)

MTC CHAINAGE 0.420

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
B	15.06.2020	REVISED CROSS SECTION ALIGNMENT	SEC
A	10.03.2020	REVISED TO SUIT LIDAR	SEC

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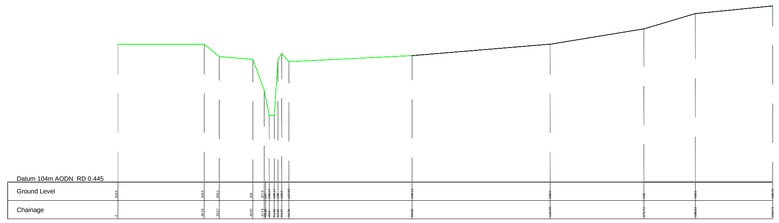
TITLE

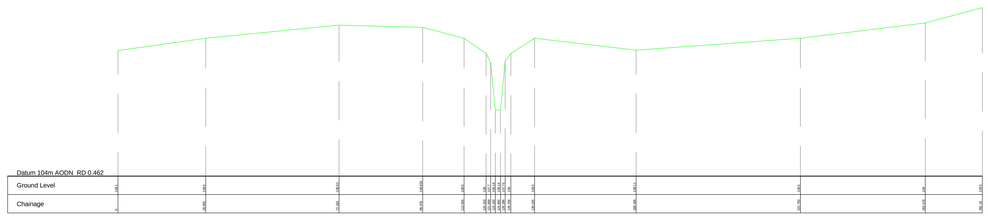
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 2 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE V: 1:100 H:1:1000
APPR	DRAWING NO 2420-06 REV B



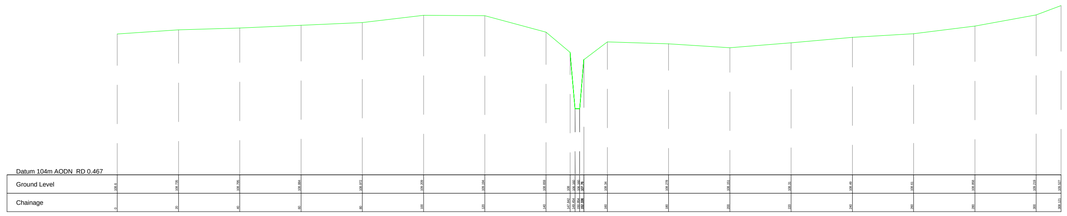
Chainage 1084.929m (446763.9E 250892.5N)

MTC CHAINAGE 0.445



Chainage 1067.347m (446774.3E 250906.6N)

MTC CHAINAGE 0.462



Chainage 1063.615m (446774.9E 250910.3N)

MTC CHAINAGE 0.467

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
B	15.06.2020	REVISED CROSS SECTION ALIGNMENT	SEC
A	10.03.2020	REVISED TO SUIT LIDAR	SEC

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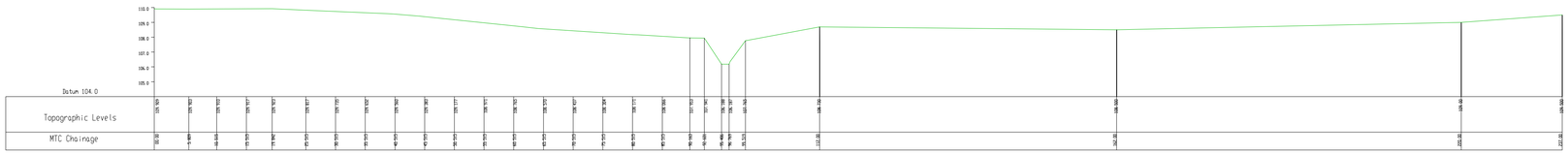
TITLE

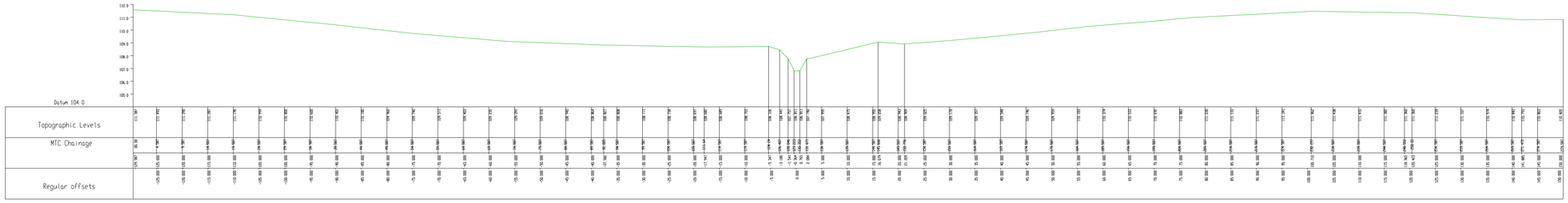
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 3 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE V: 1:100 H:1: 1000
APPR	DRAWING NO 2420-07 REV B



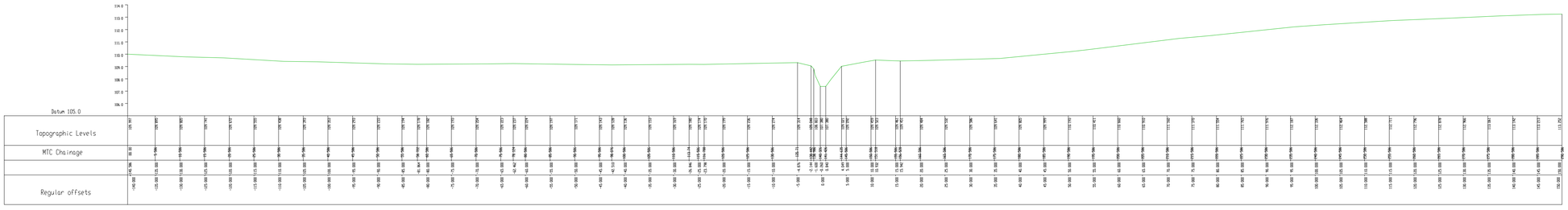
Chainage 1030.452m (446751.5E 250933.8N)

MTC CHAINAGE 0.502



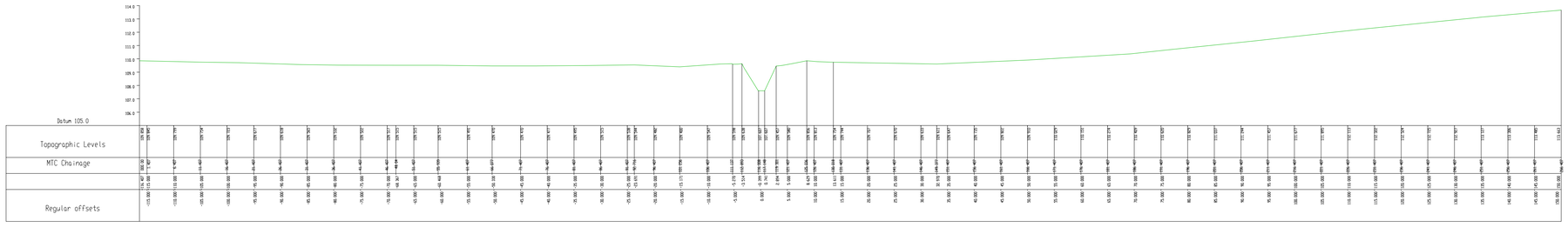
Chainage 861.996m (446613.1E 251029.9N)

MTC CHAINAGE 0.672



Chainage 731.699m (446496.5E 251088.0N)

MTC CHAINAGE 0.802



Chainage 612.244m (446390.1E 251142.4N)

MTC CHAINAGE 0.992

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
B	15.06.2020	REVISED CROSS SECTION ALIGNMENT	SEC
A	A	REVISED SECTIONS SHOWN	SEC

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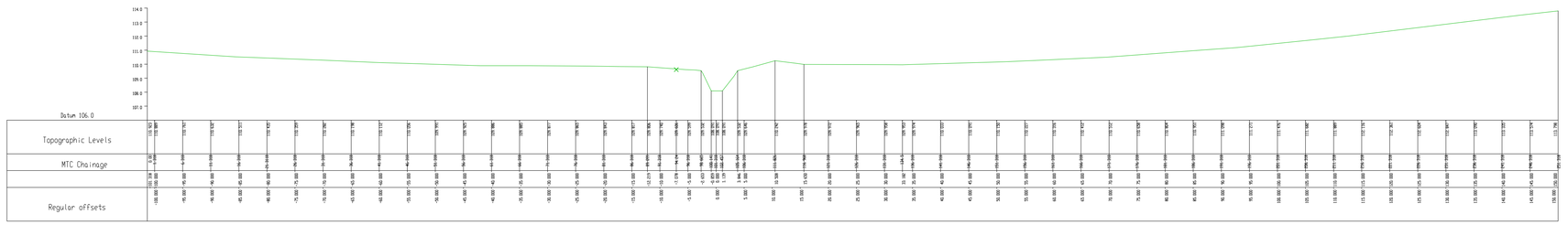
TITLE

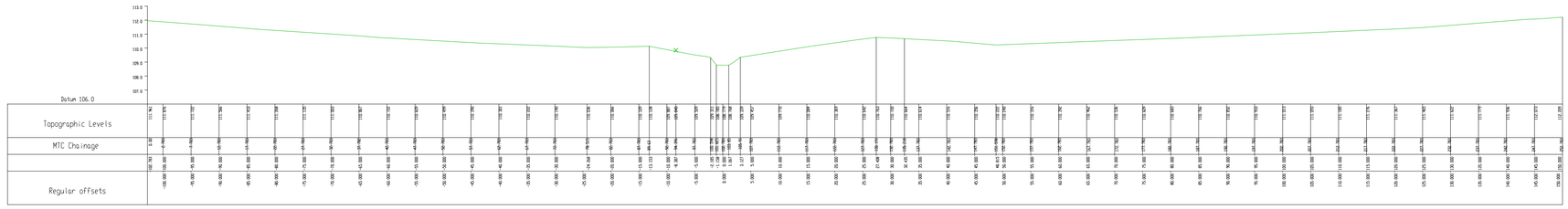
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 4 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE V: 1: 200 H: 1:500
APPR	DRAWING NO 2420-08 REV B



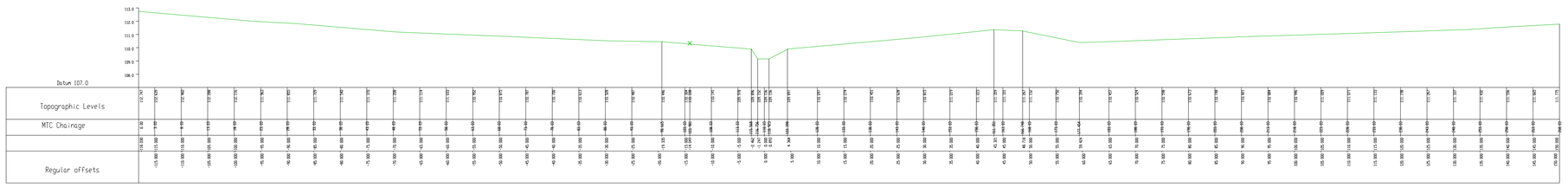
Chainage 511.218m (446301.5E 251190.9N)

MTC CHAINAGE 1.022



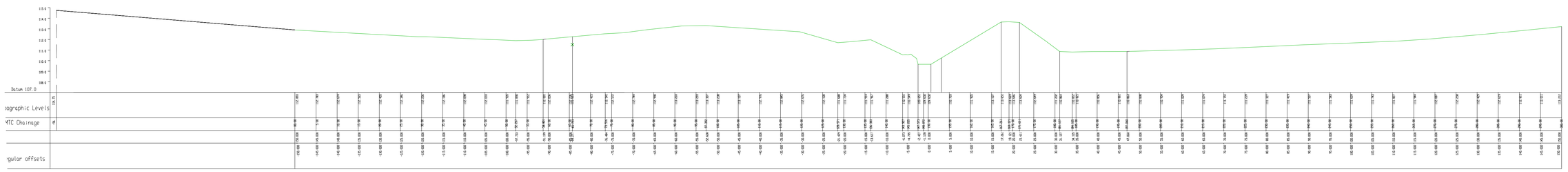
Chainage 422.838m (446230.0E 251242.9N)

MTC CHAINAGE 1.112



Chainage 342.527m (446162.9E 251287.0N)

MTC CHAINAGE 1.192



Chainage 237.386m (446057.9E 251291.8N)

MTC CHAINAGE 1.304

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
B	15.06.2020	REVISED CROSS SECTION ALIGNMENT	SEC
A	10.03.2020	REVISED SECTIONS SHOWN	SEC

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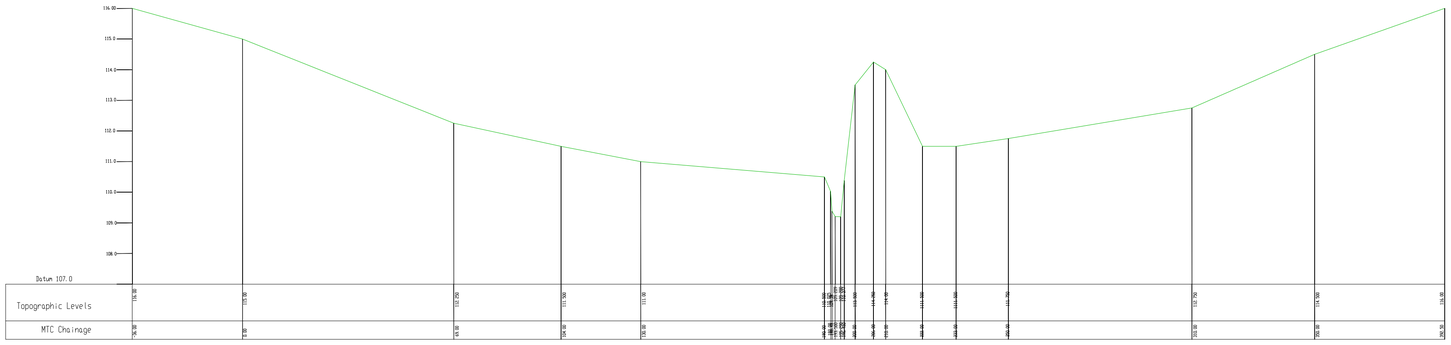
TITLE

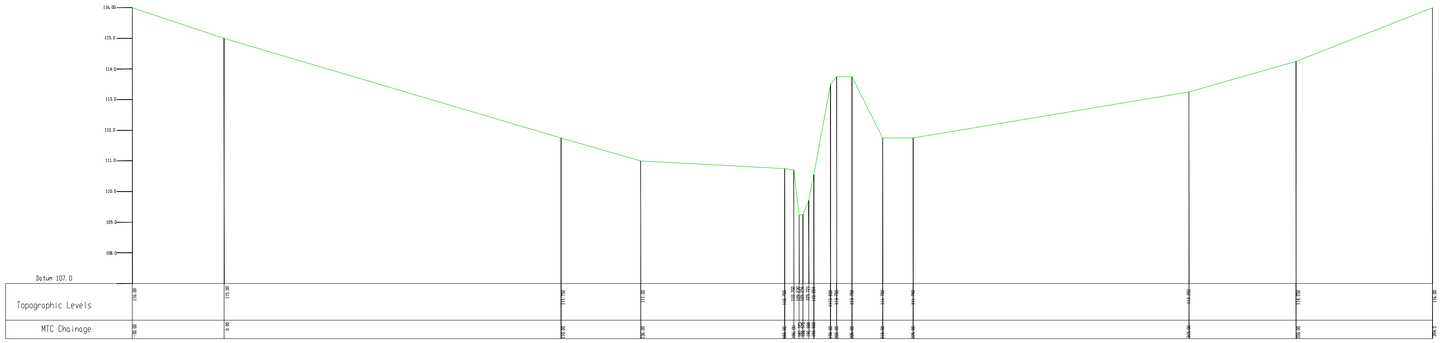
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 5 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE V: 1: 200 H:1:500
APPR	DRAWING NO 2420-09 REV B



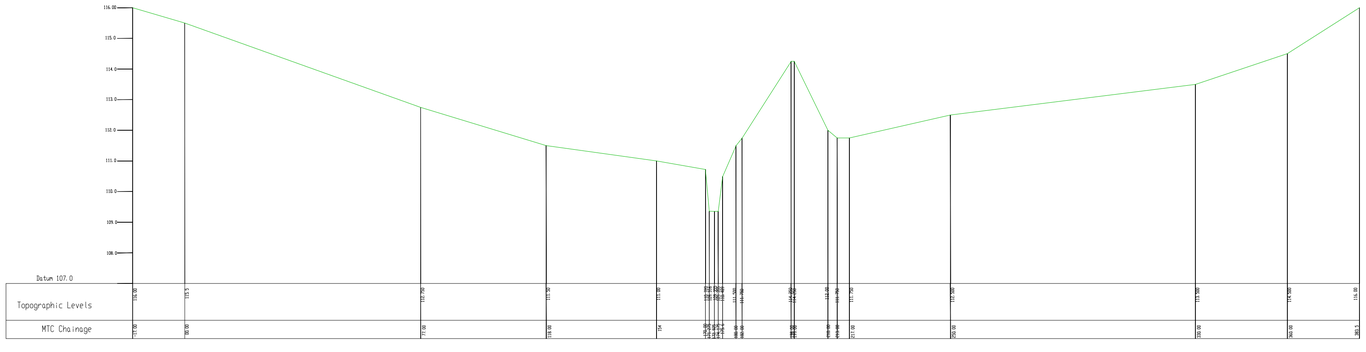
Chainage 199.942m (446021.0E 251298.0N)

MTC CHAINAGE 1.342



Chainage 168.2m (445990.2E 251305.7N)

MTC CHAINAGE 1.372



Chainage 135.01m (445963.3E 251325.2N)

MTC CHAINAGE 1.402

REV	DATE	DESCRIPTION/REASON FOR ISSUE	
B	15.06.2020	REVISED CROSS SECTION ALIGNMENT	SE
A	10.03.2020	REVISED TO SUIT LIDAR	SE

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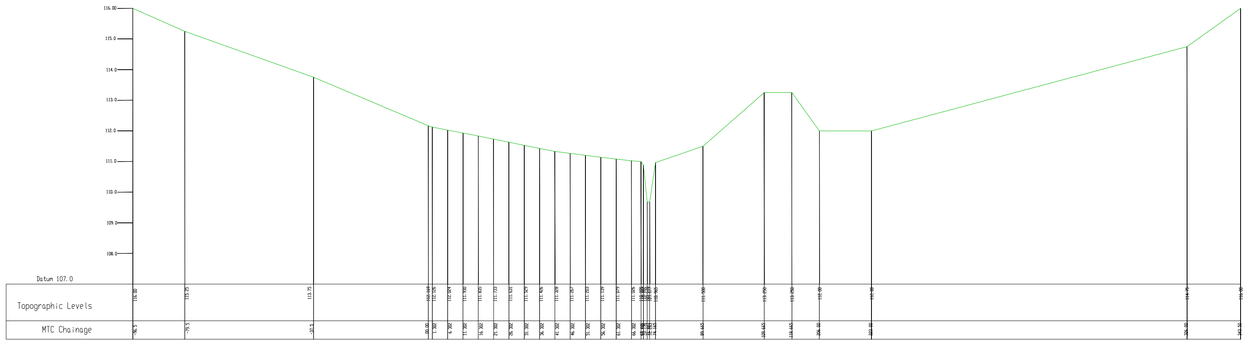
TITLE

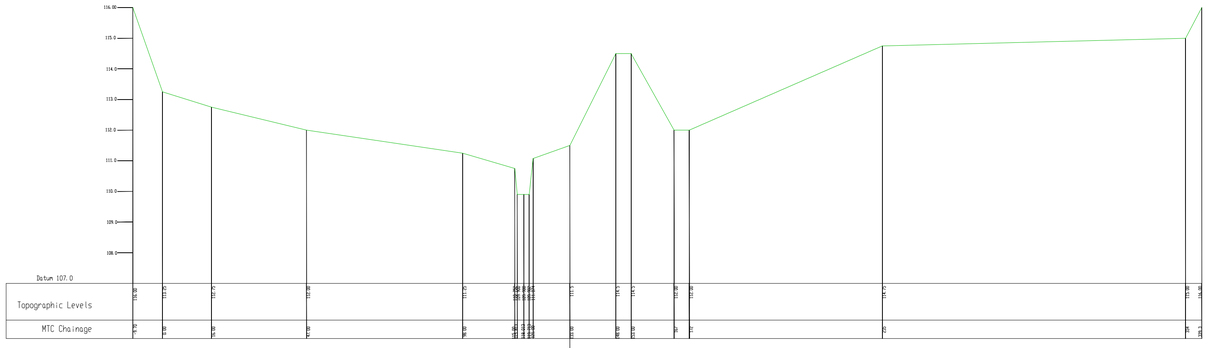
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 6 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE V: 1:100 H: 1:1000
APPR	DRAWING NO 2420-10 REV B



Chainage 53.453m (445886.7E 251353.2N)

MTC CHAINAGE 1.492



Chainage 0.0m (445833.3E 251354.9N)

MTC CHAINAGE 1.547

REVISED CROSS SECTIONS ALIGNMENT

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
A	10.03.2020	REVISED TO SUIT LIDAR	SEC

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TITLE

NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY CROSS SECTIONS 7 OF 7

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE ~~V: 1:100 H: 1:1000~~
APPR	DRAWING NO 2420-11 REV B

APPENDIX 6

ReFH2 FLOW HYDROGRAPHS

UK Design Flood Estimation

Generated on Tuesday, October 01, 2019 2:03:12 PM by Michael
Printed from the ReFH Flood Modelling software package, version 2.2.6589.25305

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 0B97-E98D

Site name: FEH_Catchment_Descriptors_446850_250750

Easting: 446850

Northing: 250750

Country: England, Wales or Northern Ireland

Catchment Area (km²): 17.8

Using plot scale calculations: No

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	83.37	Total runoff (ML):	868.74
Total Rainfall (mm):	54.69	Total flow (ML):	1331.72
Peak Rainfall (mm):	3.89	Peak flow (m³/s):	24.77

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	09:15:00 [09:00:00]	Yes
Timestep (hh:mm:ss)	00:15:00 [01:00:00]	Yes
SCF (Seasonal correction factor)	0.69	No
ARF (Areal reduction factor)	0.95	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	171.61	No
Cmax (mm)	222.51	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	5.69	No
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	1.22	No
BL (hr)	32.36	No
BR	0.54	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0.27	No
Urbext 2000	0.01	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.295	0.000	0.227	0.000	1.223	1.223
00:15:00	0.344	0.000	0.266	0.003	1.213	1.216
00:30:00	0.401	0.000	0.311	0.012	1.204	1.216
00:45:00	0.467	0.000	0.363	0.029	1.195	1.224
01:00:00	0.545	0.000	0.424	0.055	1.186	1.240
01:15:00	0.635	0.000	0.496	0.090	1.177	1.267
01:30:00	0.739	0.000	0.580	0.138	1.168	1.306
01:45:00	0.860	0.000	0.678	0.199	1.160	1.359
02:00:00	1.001	0.000	0.793	0.277	1.152	1.429
02:15:00	1.164	0.000	0.928	0.374	1.144	1.518
02:30:00	1.352	0.000	1.085	0.493	1.137	1.630
02:45:00	1.569	0.000	1.270	0.638	1.131	1.769
03:00:00	1.819	0.000	1.486	0.814	1.125	1.939
03:15:00	2.105	0.000	1.738	1.024	1.120	2.144
03:30:00	2.433	0.000	2.033	1.276	1.116	2.392
03:45:00	2.804	0.000	2.376	1.576	1.113	2.689
04:00:00	3.216	0.000	2.769	1.932	1.111	3.043
04:15:00	3.651	0.000	3.200	2.353	1.111	3.464
04:30:00	3.891	0.000	3.476	2.850	1.113	3.963
04:45:00	3.651	0.000	3.323	3.433	1.117	4.549
05:00:00	3.216	0.000	2.976	4.101	1.123	5.224
05:15:00	2.804	0.000	2.632	4.849	1.132	5.981
05:30:00	2.433	0.000	2.313	5.667	1.144	6.811
05:45:00	2.105	0.000	2.023	6.546	1.160	7.706
06:00:00	1.819	0.000	1.763	7.473	1.179	8.651
06:15:00	1.569	0.000	1.533	8.434	1.201	9.635
06:30:00	1.352	0.000	1.330	9.423	1.227	10.651
06:45:00	1.164	0.000	1.151	10.431	1.258	11.688
07:00:00	1.001	0.000	0.995	11.450	1.292	12.741
07:15:00	0.860	0.000	0.859	12.471	1.330	13.801
07:30:00	0.739	0.000	0.738	13.488	1.371	14.860
07:45:00	0.635	0.000	0.634	14.493	1.417	15.910
08:00:00	0.545	0.000	0.544	15.480	1.466	16.946
08:15:00	0.467	0.000	0.467	16.440	1.519	17.960
08:30:00	0.401	0.000	0.400	17.369	1.576	18.945

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.344	0.000	0.343	18.257	1.636	19.893
09:00:00	0.295	0.000	0.294	19.095	1.699	20.794
09:15:00	0.000	0.000	0.000	19.874	1.765	21.639
09:30:00	0.000	0.000	0.000	20.579	1.834	22.413
09:45:00	0.000	0.000	0.000	21.193	1.905	23.099
10:00:00	0.000	0.000	0.000	21.704	1.978	23.682
10:15:00	0.000	0.000	0.000	22.094	2.052	24.147
10:30:00	0.000	0.000	0.000	22.354	2.128	24.481
10:45:00	0.000	0.000	0.000	22.483	2.203	24.686
11:00:00	0.000	0.000	0.000	22.493	2.279	24.772
11:15:00	0.000	0.000	0.000	22.398	2.353	24.751
11:30:00	0.000	0.000	0.000	22.210	2.427	24.637
11:45:00	0.000	0.000	0.000	21.943	2.499	24.442
12:00:00	0.000	0.000	0.000	21.607	2.570	24.176
12:15:00	0.000	0.000	0.000	21.212	2.638	23.850
12:30:00	0.000	0.000	0.000	20.767	2.704	23.471
12:45:00	0.000	0.000	0.000	20.280	2.768	23.048
13:00:00	0.000	0.000	0.000	19.757	2.830	22.587
13:15:00	0.000	0.000	0.000	19.205	2.888	22.094
13:30:00	0.000	0.000	0.000	18.630	2.944	21.574
13:45:00	0.000	0.000	0.000	18.036	2.998	21.033
14:00:00	0.000	0.000	0.000	17.428	3.048	20.476
14:15:00	0.000	0.000	0.000	16.811	3.096	19.906
14:30:00	0.000	0.000	0.000	16.189	3.140	19.329
14:45:00	0.000	0.000	0.000	15.566	3.182	18.747
15:00:00	0.000	0.000	0.000	14.946	3.221	18.167
15:15:00	0.000	0.000	0.000	14.340	3.257	17.597
15:30:00	0.000	0.000	0.000	13.754	3.290	17.044
15:45:00	0.000	0.000	0.000	13.192	3.321	16.512
16:00:00	0.000	0.000	0.000	12.655	3.349	16.004
16:15:00	0.000	0.000	0.000	12.146	3.375	15.520
16:30:00	0.000	0.000	0.000	11.664	3.398	15.062
16:45:00	0.000	0.000	0.000	11.206	3.420	14.626
17:00:00	0.000	0.000	0.000	10.770	3.439	14.209
17:15:00	0.000	0.000	0.000	10.353	3.457	13.810
17:30:00	0.000	0.000	0.000	9.953	3.472	13.425

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.000	0.000	0.000	9.567	3.486	13.053
18:00:00	0.000	0.000	0.000	9.194	3.498	12.692
18:15:00	0.000	0.000	0.000	8.831	3.509	12.340
18:30:00	0.000	0.000	0.000	8.478	3.518	11.996
18:45:00	0.000	0.000	0.000	8.134	3.526	11.659
19:00:00	0.000	0.000	0.000	7.796	3.532	11.327
19:15:00	0.000	0.000	0.000	7.464	3.536	11.000
19:30:00	0.000	0.000	0.000	7.138	3.539	10.677
19:45:00	0.000	0.000	0.000	6.816	3.541	10.357
20:00:00	0.000	0.000	0.000	6.497	3.542	10.039
20:15:00	0.000	0.000	0.000	6.182	3.541	9.723
20:30:00	0.000	0.000	0.000	5.870	3.539	9.409
20:45:00	0.000	0.000	0.000	5.561	3.535	9.096
21:00:00	0.000	0.000	0.000	5.253	3.531	8.784
21:15:00	0.000	0.000	0.000	4.948	3.525	8.473
21:30:00	0.000	0.000	0.000	4.644	3.518	8.162
21:45:00	0.000	0.000	0.000	4.344	3.509	7.853
22:00:00	0.000	0.000	0.000	4.046	3.500	7.545
22:15:00	0.000	0.000	0.000	3.751	3.489	7.240
22:30:00	0.000	0.000	0.000	3.461	3.477	6.938
22:45:00	0.000	0.000	0.000	3.175	3.464	6.640
23:00:00	0.000	0.000	0.000	2.895	3.450	6.346
23:15:00	0.000	0.000	0.000	2.622	3.435	6.057
23:30:00	0.000	0.000	0.000	2.356	3.419	5.775
23:45:00	0.000	0.000	0.000	2.099	3.402	5.501
24:00:00	0.000	0.000	0.000	1.852	3.384	5.236
24:15:00	0.000	0.000	0.000	1.617	3.365	4.983
24:30:00	0.000	0.000	0.000	1.397	3.346	4.743
24:45:00	0.000	0.000	0.000	1.193	3.325	4.518
25:00:00	0.000	0.000	0.000	1.008	3.304	4.313
25:15:00	0.000	0.000	0.000	0.845	3.283	4.128
25:30:00	0.000	0.000	0.000	0.703	3.261	3.964
25:45:00	0.000	0.000	0.000	0.581	3.238	3.819
26:00:00	0.000	0.000	0.000	0.476	3.216	3.692
26:15:00	0.000	0.000	0.000	0.387	3.193	3.580
26:30:00	0.000	0.000	0.000	0.312	3.169	3.482

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.000	0.000	0.000	0.249	3.146	3.395
27:00:00	0.000	0.000	0.000	0.195	3.123	3.318
27:15:00	0.000	0.000	0.000	0.151	3.100	3.251
27:30:00	0.000	0.000	0.000	0.115	3.076	3.191
27:45:00	0.000	0.000	0.000	0.085	3.053	3.138
28:00:00	0.000	0.000	0.000	0.061	3.030	3.091
28:15:00	0.000	0.000	0.000	0.042	3.007	3.049
28:30:00	0.000	0.000	0.000	0.027	2.984	3.011
28:45:00	0.000	0.000	0.000	0.016	2.961	2.977
29:00:00	0.000	0.000	0.000	0.009	2.938	2.947
29:15:00	0.000	0.000	0.000	0.004	2.916	2.919
29:30:00	0.000	0.000	0.000	0.001	2.893	2.894
29:45:00	0.000	0.000	0.000	0.000	2.871	2.871
30:00:00	0.000	0.000	0.000	0.000	2.849	2.849
30:15:00	0.000	0.000	0.000	0.000	2.827	2.827
30:30:00	0.000	0.000	0.000	0.000	2.805	2.805
30:45:00	0.000	0.000	0.000	0.000	2.784	2.784
31:00:00	0.000	0.000	0.000	0.000	2.762	2.762
31:15:00	0.000	0.000	0.000	0.000	2.741	2.741
31:30:00	0.000	0.000	0.000	0.000	2.720	2.720
31:45:00	0.000	0.000	0.000	0.000	2.699	2.699
32:00:00	0.000	0.000	0.000	0.000	2.678	2.678
32:15:00	0.000	0.000	0.000	0.000	2.657	2.657
32:30:00	0.000	0.000	0.000	0.000	2.637	2.637
32:45:00	0.000	0.000	0.000	0.000	2.617	2.617
33:00:00	0.000	0.000	0.000	0.000	2.597	2.597
33:15:00	0.000	0.000	0.000	0.000	2.577	2.577
33:30:00	0.000	0.000	0.000	0.000	2.557	2.557
33:45:00	0.000	0.000	0.000	0.000	2.537	2.537
34:00:00	0.000	0.000	0.000	0.000	2.518	2.518
34:15:00	0.000	0.000	0.000	0.000	2.498	2.498
34:30:00	0.000	0.000	0.000	0.000	2.479	2.479
34:45:00	0.000	0.000	0.000	0.000	2.460	2.460
35:00:00	0.000	0.000	0.000	0.000	2.441	2.441
35:15:00	0.000	0.000	0.000	0.000	2.422	2.422
35:30:00	0.000	0.000	0.000	0.000	2.404	2.404

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.000	0.000	0.000	0.000	2.385	2.385
36:00:00	0.000	0.000	0.000	0.000	2.367	2.367
36:15:00	0.000	0.000	0.000	0.000	2.348	2.348
36:30:00	0.000	0.000	0.000	0.000	2.330	2.330
36:45:00	0.000	0.000	0.000	0.000	2.312	2.312
37:00:00	0.000	0.000	0.000	0.000	2.295	2.295
37:15:00	0.000	0.000	0.000	0.000	2.277	2.277
37:30:00	0.000	0.000	0.000	0.000	2.259	2.259
37:45:00	0.000	0.000	0.000	0.000	2.242	2.242
38:00:00	0.000	0.000	0.000	0.000	2.225	2.225
38:15:00	0.000	0.000	0.000	0.000	2.208	2.208
38:30:00	0.000	0.000	0.000	0.000	2.191	2.191
38:45:00	0.000	0.000	0.000	0.000	2.174	2.174
39:00:00	0.000	0.000	0.000	0.000	2.157	2.157
39:15:00	0.000	0.000	0.000	0.000	2.141	2.141
39:30:00	0.000	0.000	0.000	0.000	2.124	2.124
39:45:00	0.000	0.000	0.000	0.000	2.108	2.108
40:00:00	0.000	0.000	0.000	0.000	2.091	2.091
40:15:00	0.000	0.000	0.000	0.000	2.075	2.075
40:30:00	0.000	0.000	0.000	0.000	2.059	2.059
40:45:00	0.000	0.000	0.000	0.000	2.044	2.044
41:00:00	0.000	0.000	0.000	0.000	2.028	2.028
41:15:00	0.000	0.000	0.000	0.000	2.012	2.012
41:30:00	0.000	0.000	0.000	0.000	1.997	1.997
41:45:00	0.000	0.000	0.000	0.000	1.981	1.981
42:00:00	0.000	0.000	0.000	0.000	1.966	1.966
42:15:00	0.000	0.000	0.000	0.000	1.951	1.951
42:30:00	0.000	0.000	0.000	0.000	1.936	1.936
42:45:00	0.000	0.000	0.000	0.000	1.921	1.921
43:00:00	0.000	0.000	0.000	0.000	1.906	1.906
43:15:00	0.000	0.000	0.000	0.000	1.892	1.892
43:30:00	0.000	0.000	0.000	0.000	1.877	1.877
43:45:00	0.000	0.000	0.000	0.000	1.863	1.863
44:00:00	0.000	0.000	0.000	0.000	1.848	1.848
44:15:00	0.000	0.000	0.000	0.000	1.834	1.834
44:30:00	0.000	0.000	0.000	0.000	1.820	1.820

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
44:45:00	0.000	0.000	0.000	0.000	1.806	1.806
45:00:00	0.000	0.000	0.000	0.000	1.792	1.792
45:15:00	0.000	0.000	0.000	0.000	1.778	1.778
45:30:00	0.000	0.000	0.000	0.000	1.765	1.765
45:45:00	0.000	0.000	0.000	0.000	1.751	1.751
46:00:00	0.000	0.000	0.000	0.000	1.738	1.738
46:15:00	0.000	0.000	0.000	0.000	1.724	1.724
46:30:00	0.000	0.000	0.000	0.000	1.711	1.711
46:45:00	0.000	0.000	0.000	0.000	1.698	1.698
47:00:00	0.000	0.000	0.000	0.000	1.685	1.685
47:15:00	0.000	0.000	0.000	0.000	1.672	1.672
47:30:00	0.000	0.000	0.000	0.000	1.659	1.659
47:45:00	0.000	0.000	0.000	0.000	1.646	1.646
48:00:00	0.000	0.000	0.000	0.000	1.633	1.633
48:15:00	0.000	0.000	0.000	0.000	1.621	1.621
48:30:00	0.000	0.000	0.000	0.000	1.608	1.608
48:45:00	0.000	0.000	0.000	0.000	1.596	1.596
49:00:00	0.000	0.000	0.000	0.000	1.584	1.584
49:15:00	0.000	0.000	0.000	0.000	1.571	1.571
49:30:00	0.000	0.000	0.000	0.000	1.559	1.559
49:45:00	0.000	0.000	0.000	0.000	1.547	1.547
50:00:00	0.000	0.000	0.000	0.000	1.535	1.535
50:15:00	0.000	0.000	0.000	0.000	1.524	1.524
50:30:00	0.000	0.000	0.000	0.000	1.512	1.512
50:45:00	0.000	0.000	0.000	0.000	1.500	1.500
51:00:00	0.000	0.000	0.000	0.000	1.489	1.489
51:15:00	0.000	0.000	0.000	0.000	1.477	1.477
51:30:00	0.000	0.000	0.000	0.000	1.466	1.466
51:45:00	0.000	0.000	0.000	0.000	1.455	1.455
52:00:00	0.000	0.000	0.000	0.000	1.443	1.443
52:15:00	0.000	0.000	0.000	0.000	1.432	1.432
52:30:00	0.000	0.000	0.000	0.000	1.421	1.421
52:45:00	0.000	0.000	0.000	0.000	1.410	1.410
53:00:00	0.000	0.000	0.000	0.000	1.400	1.400
53:15:00	0.000	0.000	0.000	0.000	1.389	1.389
53:30:00	0.000	0.000	0.000	0.000	1.378	1.378

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
53:45:00	0.000	0.000	0.000	0.000	1.367	1.367
54:00:00	0.000	0.000	0.000	0.000	1.357	1.357
54:15:00	0.000	0.000	0.000	0.000	1.347	1.347
54:30:00	0.000	0.000	0.000	0.000	1.336	1.336
54:45:00	0.000	0.000	0.000	0.000	1.326	1.326
55:00:00	0.000	0.000	0.000	0.000	1.316	1.316
55:15:00	0.000	0.000	0.000	0.000	1.306	1.306
55:30:00	0.000	0.000	0.000	0.000	1.295	1.295
55:45:00	0.000	0.000	0.000	0.000	1.286	1.286
56:00:00	0.000	0.000	0.000	0.000	1.276	1.276
56:15:00	0.000	0.000	0.000	0.000	1.266	1.266
56:30:00	0.000	0.000	0.000	0.000	1.256	1.256
56:45:00	0.000	0.000	0.000	0.000	1.246	1.246
57:00:00	0.000	0.000	0.000	0.000	1.237	1.237

Appendix

Catchment descriptors

Name	Value	User-defined value used?
Area (km²)	17.8	No
ALTBAR	134	No
ASPBAR	142	No
ASPVAR	0.32	No
BFIHOST	0.26	No
DPLBAR (km)	4.31	No
DPSBAR (mkm-¹)	33.9	No
FARL	0.98	No
LDP	7.2	No
PROPWET (mm)	0.3	No
RMED1H	11.3	No
RMED1D	33.7	No
RMED2D	42.3	No
SAAR (mm)	655	No
SAAR4170 (mm)	696	No
SPRHOST	52.8	No
Urbext2000	0.01	No
Urbext1990	0.01	No
URBCONC	0.78	No
URBLOC	1.22	No
Urban Area (km²)	0.27	No
DDF parameter C	-0.03	No
DDF parameter D1	0.35	No
DDF parameter D2	0.37	No
DDF parameter D3	0.23	No
DDF parameter E	0.29	No
DDF parameter F	2.51	No
DDF parameter C (1km grid value)	-0.03	No
DDF parameter D1 (1km grid value)	0.35	No
DDF parameter D2 (1km grid value)	0.37	No
DDF parameter D3 (1km grid value)	0.23	No
DDF parameter E (1km grid value)	0.29	No
DDF parameter F (1km grid value)	2.51	No

APPENDIX 7

CATCHMENT DESCRIPTIONS METHOD CALCULATED FLOWS

Institute of Hydrology - Flood Peaks Database
Printed : 3 December 2019
Station : 999200 (gb 446850 250750 (sp 46850 50750))

Fittings for FFC

Standardised by median

Return periods

	L	GL	G	GEV	LN3	P3	E	GP
2	4.172	4.172	4.172	4.172	4.172	4.172	4.172	4.172
5	5.958	6.225	6.497	6.453	6.450	6.491	7.085	6.936
10	7.003	7.624	8.036	7.899	7.880	7.920	9.288	8.320
25	8.266	9.543	9.981	9.653	9.618	9.617	12.201	9.540
50	9.186	11.116	11.423	10.906	10.872	10.809	14.405	10.151
100	10.092	12.827	12.856	12.109	12.098	11.949	16.608	10.580
200	10.991	14.701	14.283	13.269	13.308	13.047	18.812	10.882
500	12.175	17.465	16.165	14.742	14.895	14.451	21.725	11.148

APPENDIX 8

1 IN 100 YEAR RESULTS

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	24.77	109.90	113.28		113.28	0.000010	0.13	206.03	141.97	0.02
Upper	1.5287*	Max WS	24.77	109.83	113.28		113.28	0.000012	0.14	198.83	136.58	0.02
Upper	1.5103*	Max WS	24.77	109.75	113.27		113.28	0.000012	0.13	200.66	132.98	0.02
Upper	1.492	Max WS	24.77	109.68	113.28		113.28	0.000008	0.11	328.19	302.35	0.02
Upper	1.4740*	Max WS	24.77	109.60	113.27		113.28	0.000008	0.11	314.05	293.36	0.02
Upper	1.4560*	Max WS	24.77	109.53	113.27		113.27	0.000010	0.13	201.84	132.59	0.02
Upper	1.4380*	Max WS	24.77	109.46	113.27		113.27	0.000010	0.13	200.91	130.99	0.02
Upper	1.4200*	Max WS	24.77	109.39	113.27		113.27	0.000009	0.13	201.50	130.03	0.02
Upper	1.402	Max WS	24.77	109.32	113.27		113.27	0.000009	0.13	203.48	129.41	0.02
Upper	1.3870*	Max WS	24.77	109.27	113.27		113.27	0.000006	0.10	298.86	251.53	0.02
Upper	1.372	Max WS	24.77	109.23	113.27		113.27	0.000005	0.10	239.08	139.15	0.02
Upper	1.342	Max WS	4.59	109.20	113.24	110.19	113.24	0.000035	0.30	28.74	155.57	0.05
Upper	1.341		Bridge									
Upper	1.312	Max WS	24.77	109.20	111.35		111.37	0.001626	1.11	50.12	85.55	0.26
Upper	1.304	Max WS	24.77	109.04	111.27		111.38	0.003130	1.48	18.88	17.27	0.37
Upper	1.2853*	Max WS	24.77	109.06	111.20		111.32	0.003691	1.58	18.15	17.92	0.40
Upper	1.2667*	Max WS	24.77	109.08	111.11		111.24	0.004454	1.69	17.45	18.84	0.44
Upper	1.2480*	Max WS	24.77	109.10	111.00		111.16	0.005483	1.83	17.00	26.07	0.48
Upper	1.2293*	Max WS	24.77	109.12	110.88		111.05	0.006815	1.96	17.49	28.60	0.54
Upper	1.2107*	Max WS	24.77	109.13	110.76		110.92	0.007348	1.98	19.20	34.46	0.55
Upper	1.192	Max WS	24.77	109.15	110.71		110.79	0.004730	1.59	30.35	67.57	0.45
Upper	1.1720*	Max WS	24.77	109.06	110.62		110.69	0.004686	1.59	29.45	65.57	0.45
Upper	1.1520*	Max WS	24.77	108.97	110.52		110.60	0.005142	1.67	28.24	63.43	0.47
Upper	1.1320*	Max WS	24.76	108.87	110.45		110.51	0.003780	1.46	28.97	64.71	0.40
Upper	1.112	Max WS	24.76	108.78	110.40		110.45	0.002329	1.19	31.56	66.24	0.32
Upper	1.0940*	Max WS	24.76	108.64	110.36		110.41	0.002394	1.21	31.28	69.92	0.32
Upper	1.0760*	Max WS	24.76	108.50	110.33		110.37	0.002314	1.19	31.68	75.10	0.31
Upper	1.0580*	Max WS	24.75	108.37	110.29		110.34	0.002131	1.16	34.98	112.84	0.30
Upper	1.0400*	Max WS	24.75	108.23	110.27		110.30	0.001335	0.93	39.66	118.45	0.24
Upper	1.022	Max WS	24.75	108.09	110.26		110.28	0.000914	0.79	46.21	125.49	0.19
Upper	1.0020*	Max WS	24.75	107.99	110.18		110.20	0.000961	0.79	46.26	130.82	0.20
Upper	0.9820*	Max WS	24.74	107.90	110.10		110.12	0.001022	0.80	46.16	136.55	0.20
Upper	0.9620*	Max WS	24.74	107.80	110.02		110.04	0.001123	0.81	45.50	142.42	0.21
Upper	0.9420*	Max WS	24.74	107.70	109.92		109.94	0.001561	0.92	38.03	109.10	0.24
Upper	0.922	Max WS	24.74	107.61	109.74		109.79	0.003451	1.26	29.33	109.56	0.35

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.90200*	Max WS	24.74	107.57	109.69		109.73	0.003312	1.24	29.66	108.47	0.34
Upper	0.88200*	Max WS	24.74	107.53	109.64		109.68	0.003224	1.23	30.03	109.71	0.34
Upper	0.86200*	Max WS	24.74	107.49	109.59		109.63	0.003139	1.21	30.48	111.74	0.34
Upper	0.84200*	Max WS	24.74	107.46	109.53		109.58	0.003048	1.20	30.99	114.12	0.33
Upper	0.82200*	Max WS	24.74	107.42	109.48		109.53	0.002933	1.18	31.63	116.77	0.33
Upper	0.802	Max WS	24.74	107.38	109.44		109.48	0.002788	1.16	32.43	119.49	0.32
Upper	0.78343*	Max WS	24.74	107.30	109.37		109.43	0.003902	1.42	27.27	106.58	0.38
Upper	0.76486*	Max WS	24.74	107.22	109.30		109.37	0.004539	1.57	24.17	89.61	0.41
Upper	0.74629*	Max WS	24.74	107.14	109.22		109.30	0.004504	1.61	22.93	77.49	0.41
Upper	0.72771*	Max WS	24.73	107.05	109.15		109.23	0.004045	1.57	23.01	72.66	0.40
Upper	0.70914*	Max WS	24.73	106.97	109.10		109.17	0.003214	1.45	24.29	70.97	0.36
Upper	0.69057*	Max WS	24.73	106.89	109.06		109.12	0.002379	1.29	26.42	67.52	0.31
Upper	0.672	Max WS	24.73	106.81	109.03		109.07	0.001719	1.14	29.06	66.49	0.26
Upper	0.65311*	Max WS	24.73	106.74	109.00		109.04	0.001610	1.11	29.66	64.16	0.26
Upper	0.63422*	Max WS	24.73	106.67	108.97		109.01	0.001464	1.06	30.64	62.54	0.25
Upper	0.61533*	Max WS	24.73	106.60	108.95		108.98	0.001308	1.01	31.79	61.07	0.23
Upper	0.59644*	Max WS	24.73	106.53	108.93		108.96	0.001341	1.03	33.65	71.84	0.24
Upper	0.57756*	Max WS	24.73	106.46	108.91		108.94	0.001196	0.98	35.00	72.88	0.23
Upper	0.55867*	Max WS	24.73	106.40	108.89		108.92	0.001073	0.93	36.50	75.91	0.21
Upper	0.53978*	Max WS	24.73	106.33	108.87		108.90	0.000956	0.88	38.69	85.93	0.20
Upper	0.52089*	Max WS	24.73	106.26	108.86		108.88	0.000749	0.79	45.11	115.78	0.18
Upper	0.502	Max WS	24.73	106.19	108.86		108.87	0.000443	0.61	59.40	145.44	0.14
Upper	0.467	Max WS	24.73	106.16	108.85		108.86	0.000261	0.44	73.93	146.72	0.10
Upper	0.462	Max WS	24.73	106.16	108.85	108.56	108.86	0.000424	0.31	65.08	151.54	0.11
Upper	0.461		Bridge									
Upper	0.452	Max WS	22.03	106.16	108.16	108.15	108.53	0.022463	2.70	8.42	12.91	0.86
Upper	0.445	Max WS	24.73	106.17	108.33		108.38	0.003341	1.10	28.85	90.09	0.34
Upper	0.43250*	Max WS	24.73	106.11	108.27		108.34	0.004031	1.35	24.59	78.68	0.38
Upper	0.42	Max WS	24.73	106.05	108.23		108.30	0.003787	1.40	24.17	79.79	0.36
Upper	0.40750*	Max WS	24.72	106.05	108.17		108.25	0.004316	1.46	22.32	73.12	0.39
Upper	0.395	Max WS	24.72	106.04	108.10		108.19	0.004669	1.50	20.97	66.23	0.40
Upper	0.38143*	Max WS	24.71	106.03	108.06		108.13	0.003914	1.37	23.89	77.82	0.37
Upper	0.36786*	Max WS	24.71	106.01	108.03		108.08	0.003604	1.31	26.10	89.34	0.36
Upper	0.35429*	Max WS	24.69	106.00	107.99		108.04	0.002953	1.19	27.35	85.29	0.33
Upper	0.34071*	Max WS	24.68	105.99	107.96		108.00	0.002574	1.12	29.77	93.25	0.31

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.32714*	Max WS	24.63	105.98	107.94		107.97	0.002181	1.03	32.71	102.60	0.29
Upper	0.31357*	Max WS	24.59	105.96	107.91		107.94	0.001758	0.94	36.35	112.05	0.26
Upper	0.30	Max WS	24.55	105.95	107.90		107.92	0.001370	0.84	40.81	122.59	0.23
Upper	0.28333*	Max WS	24.47	105.94	107.87		107.90	0.001884	0.89	34.84	106.85	0.27
Upper	0.26667*	Max WS	24.35	105.92	107.86		107.87	0.001189	0.63	49.90	177.64	0.21
Upper	0.25	Max WS	24.24	105.91	107.85		107.86	0.000406	0.32	68.49	167.38	0.12
Upper	0.23333*	Max WS	24.12	105.89	107.85		107.85	0.000338	0.34	74.69	189.61	0.11
Upper	0.21667*	Max WS	24.01	105.86	107.84		107.85	0.000278	0.35	82.65	215.89	0.10
Upper	0.20	Max WS	23.83	105.84	107.84		107.84	0.000223	0.33	92.22	244.10	0.09
Upper	0.18333*	Max WS	23.66	105.82	107.84		107.84	0.000173	0.29	101.35	259.55	0.08
Upper	0.16667*	Max WS	23.45	105.80	107.83		107.84	0.000131	0.26	111.94	276.00	0.07
Upper	0.15	Max WS	23.15	105.78	107.83		107.83	0.000097	0.22	123.94	289.86	0.06
Upper	0.13333*	Max WS	22.83	105.76	107.83		107.83	0.000073	0.20	138.24	312.78	0.05
Upper	0.11667*	Max WS	22.48	105.74	107.83		107.83	0.000053	0.17	154.31	328.71	0.04
Upper	0.1	Max WS	22.13	105.71	107.83		107.83	0.000038	0.14	171.64	342.13	0.04
Upper	0.08333*	Max WS	21.84	105.69	107.83		107.83	0.000032	0.13	179.98	347.77	0.04
Upper	0.06667*	Max WS	21.44	105.67	107.83		107.83	0.000027	0.12	188.93	353.09	0.03
Upper	0.05	Max WS	50.46	105.65	107.41	107.44	107.69	0.033941	2.94	24.20	124.70	1.06
Upper	0.03333*	Max WS	50.26	105.63	107.11	107.14	107.26	0.020385	2.12	29.67	132.19	0.81
Upper	0.01667*	Max WS	49.26	105.61	106.99		107.07	0.008941	1.58	41.17	205.19	0.55
Upper	0.00	Max WS	49.24	105.59	106.96	106.79	106.98	0.001572	0.72	81.31	255.24	0.24

APPENDIX 9

SENSITIVITY TEST: MANNING'S NUMBERS INCREASED 20%

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	24.74	109.90	113.26		113.26	0.000015	0.13	204.25	141.86	0.02
Upper	1.5287*	Max WS	24.74	109.83	113.26		113.26	0.000017	0.14	197.09	136.06	0.02
Upper	1.5103*	Max WS	24.74	109.75	113.26		113.26	0.000017	0.13	199.00	132.53	0.02
Upper	1.492	Max WS	24.74	109.68	113.26		113.26	0.000012	0.11	324.33	301.61	0.02
Upper	1.4740*	Max WS	24.74	109.60	113.26		113.26	0.000012	0.11	310.31	291.96	0.02
Upper	1.4560*	Max WS	24.74	109.53	113.26		113.26	0.000015	0.13	200.14	132.08	0.02
Upper	1.4380*	Max WS	24.74	109.46	113.26		113.26	0.000015	0.13	199.20	130.55	0.02
Upper	1.4200*	Max WS	24.74	109.39	113.26		113.26	0.000014	0.13	199.80	129.58	0.02
Upper	1.402	Max WS	24.74	109.32	113.26		113.26	0.000013	0.13	201.79	128.96	0.02
Upper	1.3870*	Max WS	24.74	109.27	113.26		113.26	0.000008	0.10	295.49	250.46	0.02
Upper	1.372	Max WS	24.73	109.23	113.26		113.26	0.000008	0.10	237.22	138.67	0.02
Upper	1.342	Max WS	24.73	109.20	113.22	113.08	113.29	0.001623	1.70	27.59	154.94	0.27
Upper	1.341		Bridge									
Upper	1.312	Max WS	24.74	109.20	111.45		111.47	0.001530	0.93	59.52	91.20	0.21
Upper	1.304	Max WS	24.73	109.04	111.38		111.47	0.003488	1.36	20.90	18.35	0.33
Upper	1.2853*	Max WS	24.73	109.06	111.31		111.40	0.004116	1.45	20.14	19.07	0.36
Upper	1.2667*	Max WS	24.74	109.08	111.21		111.32	0.004966	1.56	19.41	20.41	0.39
Upper	1.2480*	Max WS	24.73	109.10	111.09		111.22	0.006272	1.70	19.53	28.62	0.44
Upper	1.2293*	Max WS	24.73	109.12	110.98		111.11	0.007104	1.75	20.42	31.48	0.46
Upper	1.2107*	Max WS	24.73	109.13	110.85		110.97	0.007851	1.77	22.19	38.32	0.48
Upper	1.192	Max WS	24.73	109.15	110.77		110.83	0.005029	1.41	34.94	73.07	0.39
Upper	1.1720*	Max WS	24.73	109.06	110.68		110.74	0.005206	1.44	33.56	74.01	0.39
Upper	1.1520*	Max WS	24.73	108.97	110.59		110.64	0.004794	1.39	32.92	71.19	0.38
Upper	1.1320*	Max WS	24.73	108.87	110.52		110.56	0.003808	1.26	33.46	69.56	0.34
Upper	1.112	Max WS	24.73	108.78	110.47		110.50	0.002396	1.03	35.72	70.04	0.27
Upper	1.0940*	Max WS	24.73	108.64	110.42		110.46	0.002345	1.02	35.71	74.25	0.27
Upper	1.0760*	Max WS	24.72	108.50	110.39		110.42	0.002143	0.99	36.78	80.75	0.25
Upper	1.0580*	Max WS	24.72	108.37	110.36		110.39	0.001809	0.92	42.75	120.91	0.23
Upper	1.0400*	Max WS	24.72	108.23	110.34		110.36	0.001292	0.79	47.89	125.77	0.19
Upper	1.022	Max WS	24.72	108.09	110.32		110.34	0.000845	0.65	54.73	133.28	0.16
Upper	1.0020*	Max WS	24.71	107.99	110.25		110.26	0.000883	0.65	54.84	138.61	0.16
Upper	0.9820*	Max WS	24.71	107.90	110.16		110.18	0.000942	0.65	54.58	144.10	0.16
Upper	0.9620*	Max WS	24.70	107.80	110.07		110.08	0.001047	0.67	53.50	149.22	0.17
Upper	0.9420*	Max WS	24.70	107.70	109.96		109.98	0.001315	0.72	50.35	154.58	0.18
Upper	0.922	Max WS	24.70	107.61	109.78		109.81	0.003477	1.07	33.69	115.16	0.29

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.90200*	Max WS	24.70	107.57	109.73		109.76	0.003360	1.06	33.83	112.62	0.29
Upper	0.88200*	Max WS	24.70	107.53	109.67		109.71	0.003281	1.05	34.10	112.70	0.29
Upper	0.86200*	Max WS	24.70	107.49	109.62		109.65	0.003207	1.04	34.50	114.25	0.28
Upper	0.84200*	Max WS	24.70	107.46	109.57		109.60	0.003128	1.03	34.99	116.33	0.28
Upper	0.82200*	Max WS	24.70	107.42	109.52		109.55	0.003012	1.01	35.69	118.87	0.28
Upper	0.802	Max WS	24.70	107.38	109.47		109.50	0.002852	0.99	36.62	121.59	0.27
Upper	0.78343*	Max WS	24.70	107.30	109.41		109.45	0.003847	1.19	31.73	112.76	0.32
Upper	0.76486*	Max WS	24.70	107.22	109.34		109.40	0.004364	1.31	28.74	100.46	0.34
Upper	0.74629*	Max WS	24.40	107.14	109.27		109.33	0.004170	1.32	27.40	87.46	0.33
Upper	0.72771*	Max WS	24.38	107.05	109.21		109.26	0.003753	1.29	27.32	77.09	0.32
Upper	0.70914*	Max WS	24.34	106.97	109.15		109.20	0.003164	1.22	28.34	80.34	0.30
Upper	0.69057*	Max WS	24.16	106.89	109.10		109.15	0.002525	1.13	29.51	71.34	0.27
Upper	0.672	Max WS	24.28	106.81	109.06		109.10	0.002324	1.12	32.15	79.18	0.26
Upper	0.65311*	Max WS	24.03	106.74	109.02		109.06	0.001907	1.02	31.38	65.94	0.23
Upper	0.63422*	Max WS	24.14	106.67	108.99		109.02	0.002112	1.07	32.47	74.11	0.25
Upper	0.61533*	Max WS	23.86	106.60	108.96		108.99	0.001916	1.02	33.10	72.76	0.24
Upper	0.59644*	Max WS	23.94	106.53	108.93		108.96	0.001803	0.99	33.70	71.91	0.23
Upper	0.57756*	Max WS	23.56	106.46	108.90		108.93	0.001616	0.94	34.52	72.15	0.22
Upper	0.55867*	Max WS	23.39	106.40	108.87		108.90	0.001486	0.91	35.36	73.86	0.21
Upper	0.53978*	Max WS	23.08	106.33	108.85		108.87	0.001357	0.87	36.53	80.96	0.20
Upper	0.52089*	Max WS	22.98	106.26	108.82		108.85	0.001180	0.81	40.55	111.00	0.19
Upper	0.502	Max WS	22.01	106.19	108.81		108.82	0.000675	0.62	52.60	138.73	0.14
Upper	0.467	Max WS	22.72	106.16	108.79		108.80	0.000451	0.47	65.12	139.46	0.10
Upper	0.462	Max WS	24.19	106.16	108.78	108.55	108.79	0.000972	0.37	54.62	143.04	0.14
Upper	0.461		Bridge									
Upper	0.452	Max WS	30.46	106.16	108.34	108.43	108.76	0.031474	2.96	11.12	18.11	0.87
Upper	0.445	Max WS	28.62	106.17	108.42		108.45	0.003347	0.96	36.99	101.28	0.29
Upper	0.43250*	Max WS	28.46	106.11	108.36		108.41	0.004190	1.20	32.47	95.50	0.33
Upper	0.42	Max WS	28.32	106.05	108.30		108.36	0.004228	1.27	30.64	90.69	0.32
Upper	0.40750*	Max WS	28.18	106.05	108.25		108.31	0.004553	1.30	28.99	84.80	0.34
Upper	0.395	Max WS	28.00	106.04	108.19		108.26	0.004972	1.34	27.03	77.32	0.35
Upper	0.38143*	Max WS	27.87	106.03	108.14		108.19	0.004210	1.23	30.43	90.67	0.33
Upper	0.36786*	Max WS	27.75	106.01	108.09		108.14	0.003931	1.18	32.35	99.96	0.32
Upper	0.35429*	Max WS	27.66	106.00	108.05		108.09	0.003975	1.18	33.54	110.18	0.32
Upper	0.34071*	Max WS	27.57	105.99	108.00		108.04	0.003370	1.09	33.89	100.00	0.30

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.32714*	Max WS	27.51	105.98	107.97		108.00	0.003101	1.04	35.92	107.64	0.29
Upper	0.31357*	Max WS	27.47	105.96	107.93		107.96	0.002846	1.00	37.94	114.86	0.28
Upper	0.30	Max WS	27.44	105.95	107.90		107.92	0.002497	0.94	40.59	122.20	0.26
Upper	0.28333*	Max WS	27.36	105.94	107.83		107.87	0.004655	1.14	30.67	98.78	0.35
Upper	0.26667*	Max WS	27.26	105.92	107.78		107.81	0.004094	0.92	36.63	150.88	0.32
Upper	0.25	Max WS	27.18	105.91	107.75		107.76	0.001713	0.50	52.26	154.34	0.20
Upper	0.23333*	Max WS	27.08	105.89	107.73		107.74	0.001702	0.59	53.18	172.17	0.20
Upper	0.21667*	Max WS	26.88	105.86	107.70		107.72	0.001728	0.67	54.27	192.36	0.21
Upper	0.20	Max WS	26.59	105.84	107.68		107.69	0.001701	0.70	56.25	212.56	0.21
Upper	0.18333*	Max WS	26.38	105.82	107.66		107.67	0.001424	0.64	59.62	216.80	0.19
Upper	0.16667*	Max WS	26.23	105.80	107.64		107.65	0.001118	0.57	64.60	223.05	0.17
Upper	0.15	Max WS	26.16	105.78	107.63		107.64	0.000779	0.48	72.18	227.12	0.14
Upper	0.13333*	Max WS	26.14	105.76	107.62		107.63	0.000740	0.47	78.27	268.62	0.14
Upper	0.11667*	Max WS	26.11	105.74	107.62		107.62	0.000549	0.41	88.67	294.31	0.12
Upper	0.1	Max WS	26.10	105.71	107.61		107.62	0.000380	0.34	101.60	310.69	0.10
Upper	0.08333*	Max WS	26.09	105.69	107.61		107.61	0.000317	0.31	107.87	313.96	0.09
Upper	0.06667*	Max WS	26.09	105.67	107.61		107.61	0.000263	0.27	114.88	317.29	0.08
Upper	0.05	Max WS	26.08	105.65	107.29	107.41	107.85	0.084925	3.52	10.14	108.95	1.37
Upper	0.03333*	Max WS	26.08	105.63	107.04	107.06	107.13	0.018588	1.78	21.44	119.93	0.65
Upper	0.01667*	Max WS	26.08	105.61	106.93		106.97	0.008405	1.24	30.29	153.46	0.44
Upper	0.00	Max WS	26.08	105.59	106.89	106.71	106.89	0.001458	0.55	61.71	240.69	0.19

APPENDIX 10

SENSITIVITY TEST: MANNING'S NUMBERS DECREASED 20%

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	24.77	109.90	113.59		113.59	0.000004	0.10	250.44	144.61	0.02
Upper	1.5287*	Max WS	24.77	109.83	113.59		113.59	0.000004	0.11	243.08	148.31	0.02
Upper	1.5103*	Max WS	24.76	109.75	113.59		113.59	0.000004	0.11	243.82	145.24	0.02
Upper	1.492	Max WS	24.77	109.68	113.59		113.59	0.000003	0.08	424.78	320.20	0.01
Upper	1.4740*	Max WS	24.77	109.60	113.59		113.59	0.000003	0.08	408.11	311.81	0.01
Upper	1.4560*	Max WS	24.76	109.53	113.59		113.59	0.000003	0.09	392.89	303.47	0.01
Upper	1.4380*	Max WS	24.77	109.46	113.58		113.59	0.000004	0.10	243.27	141.68	0.02
Upper	1.4200*	Max WS	24.76	109.39	113.58		113.59	0.000004	0.10	243.57	140.60	0.02
Upper	1.402	Max WS	24.76	109.32	113.58		113.59	0.000003	0.10	245.38	140.11	0.02
Upper	1.3870*	Max WS	24.77	109.27	113.58		113.59	0.000002	0.08	380.92	276.36	0.01
Upper	1.372	Max WS	24.76	109.23	113.58		113.59	0.000002	0.08	284.09	150.77	0.01
Upper	1.342	Max WS	5.60	109.20	113.57	110.33	113.58	0.000015	0.26	48.32	164.83	0.04
Upper	1.341		Bridge									
Upper	1.312	Max WS	24.77	109.20	111.23		111.27	0.001759	1.38	40.21	79.16	0.33
Upper	1.304	Max WS	24.77	109.04	111.14		111.27	0.002704	1.62	16.77	16.07	0.42
Upper	1.2853*	Max WS	24.77	109.06	111.07		111.22	0.003220	1.74	16.01	16.59	0.46
Upper	1.2667*	Max WS	24.77	109.08	110.99		111.16	0.003874	1.87	15.35	17.41	0.51
Upper	1.2480*	Max WS	24.77	109.10	110.89		111.08	0.004886	2.04	14.62	18.58	0.56
Upper	1.2293*	Max WS	24.77	109.12	110.78		111.00	0.006274	2.23	14.64	26.30	0.64
Upper	1.2107*	Max WS	24.77	109.13	110.64	110.58	110.88	0.007717	2.37	15.13	30.17	0.70
Upper	1.192	Max WS	24.77	109.15	110.61		110.73	0.004871	1.92	24.11	59.23	0.56
Upper	1.1720*	Max WS	24.77	109.06	110.52		110.64	0.004934	1.94	23.31	57.32	0.56
Upper	1.1520*	Max WS	24.77	108.97	110.43		110.55	0.004649	1.90	23.07	56.49	0.55
Upper	1.1320*	Max WS	24.77	108.87	110.36		110.46	0.003801	1.75	23.83	57.26	0.50
Upper	1.112	Max WS	24.77	108.78	110.33		110.39	0.002324	1.43	26.62	60.69	0.39
Upper	1.0940*	Max WS	24.77	108.64	110.29		110.35	0.002318	1.43	26.31	64.63	0.39
Upper	1.0760*	Max WS	24.76	108.50	110.25		110.31	0.002301	1.43	25.97	68.57	0.39
Upper	1.0580*	Max WS	24.76	108.37	110.22		110.28	0.001976	1.35	27.29	75.91	0.36
Upper	1.0400*	Max WS	24.76	108.23	110.20		110.25	0.001554	1.22	31.54	109.65	0.31
Upper	1.022	Max WS	24.76	108.09	110.19		110.23	0.001186	1.09	31.07	74.51	0.27
Upper	1.0020*	Max WS	24.75	107.99	110.12		110.15	0.001235	1.09	31.54	80.74	0.28
Upper	0.9820*	Max WS	24.75	107.90	110.04		110.08	0.001288	1.09	32.15	88.41	0.28
Upper	0.9620*	Max WS	24.75	107.80	109.96		109.99	0.001340	1.08	32.81	96.04	0.28
Upper	0.9420*	Max WS	24.75	107.70	109.87		109.90	0.001440	1.08	33.11	103.92	0.29
Upper	0.922	Max WS	24.75	107.61	109.70		109.77	0.003265	1.50	25.05	103.84	0.42

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.90200*	Max WS	24.75	107.57	109.65		109.72	0.003130	1.47	25.50	104.81	0.41
Upper	0.88200*	Max WS	24.75	107.53	109.60		109.66	0.003030	1.46	25.94	106.83	0.41
Upper	0.86200*	Max WS	24.75	107.49	109.55		109.61	0.002908	1.43	26.50	109.27	0.40
Upper	0.84200*	Max WS	24.75	107.46	109.50		109.56	0.002795	1.41	27.06	111.71	0.40
Upper	0.82200*	Max WS	24.75	107.42	109.45		109.51	0.002634	1.38	27.79	113.59	0.39
Upper	0.802	Max WS	24.75	107.38	109.41		109.46	0.002358	1.31	29.12	116.00	0.37
Upper	0.78343*	Max WS	23.97	107.30	109.34		109.42	0.002908	1.51	24.60	99.21	0.41
Upper	0.76486*	Max WS	24.75	107.22	109.27		109.37	0.003642	1.74	21.78	84.69	0.46
Upper	0.74629*	Max WS	24.75	107.14	109.15	109.18	109.30	0.004864	2.03	17.97	69.72	0.53
Upper	0.72771*	Max WS	24.75	107.05	109.05	109.09	109.22	0.005248	2.14	16.37	61.64	0.56
Upper	0.70914*	Max WS	24.74	106.97	108.97	108.99	109.14	0.004917	2.12	15.97	56.54	0.54
Upper	0.69057*	Max WS	24.74	106.89	108.90	108.72	109.05	0.003999	1.97	16.78	53.98	0.49
Upper	0.672	Max WS	24.74	106.81	108.88		108.98	0.002464	1.62	20.22	55.42	0.39
Upper	0.65311*	Max WS	24.74	106.74	108.84		108.94	0.002337	1.58	20.73	53.77	0.38
Upper	0.63422*	Max WS	24.74	106.67	108.81		108.90	0.002162	1.52	21.45	52.49	0.37
Upper	0.61533*	Max WS	24.74	106.60	108.78		108.86	0.001975	1.46	22.28	51.46	0.36
Upper	0.59644*	Max WS	24.74	106.53	108.75		108.82	0.001800	1.40	23.12	50.45	0.34
Upper	0.57756*	Max WS	24.74	106.46	108.72		108.79	0.001634	1.33	23.98	49.54	0.32
Upper	0.55867*	Max WS	24.74	106.40	108.70		108.76	0.001450	1.26	25.06	48.86	0.31
Upper	0.53978*	Max WS	24.74	106.33	108.68		108.73	0.001276	1.19	26.22	48.29	0.29
Upper	0.52089*	Max WS	24.74	106.26	108.66		108.70	0.001127	1.12	27.36	47.68	0.27
Upper	0.502	Max WS	24.74	106.19	108.64		108.68	0.000988	1.06	28.60	47.15	0.25
Upper	0.467	Max WS	24.74	106.16	108.64		108.65	0.000661	0.81	44.90	121.76	0.19
Upper	0.462	Max WS	24.74	106.16	108.62	108.56	108.65	0.001875	0.64	33.68	124.30	0.28
Upper	0.461		Bridge									
Upper	0.452	Max WS	16.73	106.16	108.07		108.34	0.011638	2.28	7.39	10.25	0.76
Upper	0.445	Max WS	24.74	106.17	108.28		108.34	0.003378	1.33	24.16	82.95	0.42
Upper	0.43250*	Max WS	24.74	106.11	108.19	108.17	108.31	0.004875	1.78	18.54	68.29	0.52
Upper	0.42	Max WS	24.74	106.05	108.15		108.27	0.004159	1.77	18.39	65.30	0.47
Upper	0.40750*	Max WS	24.70	106.05	108.09	108.01	108.22	0.004545	1.81	17.30	62.06	0.50
Upper	0.395	Max WS	24.69	106.04	108.03	107.94	108.16	0.004865	1.84	16.31	56.23	0.51
Upper	0.38143*	Max WS	24.70	106.03	108.00		108.10	0.004094	1.69	18.97	68.10	0.47
Upper	0.36786*	Max WS	24.68	106.01	107.94		108.04	0.003902	1.64	19.25	72.54	0.47
Upper	0.35429*	Max WS	24.67	106.00	107.91		108.00	0.003565	1.57	20.67	72.52	0.45
Upper	0.34071*	Max WS	24.65	105.99	107.87		107.95	0.003224	1.49	22.32	79.20	0.43

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.32714*	Max WS	24.63	105.98	107.85		107.91	0.002776	1.39	24.35	85.85	0.40
Upper	0.31357*	Max WS	24.60	105.96	107.82		107.88	0.002308	1.28	26.86	93.50	0.37
Upper	0.30	Max WS	24.51	105.95	107.81		107.85	0.001806	1.14	30.23	102.82	0.33
Upper	0.28333*	Max WS	24.45	105.94	107.74		107.81	0.003267	1.35	22.94	79.16	0.43
Upper	0.26667*	Max WS	24.51	105.92	107.70		107.75	0.003055	1.12	26.98	110.73	0.40
Upper	0.25	Max WS	24.17	105.91	107.70		107.71	0.001011	0.56	43.85	146.89	0.22
Upper	0.23333*	Max WS	23.83	105.89	107.68		107.69	0.000957	0.64	45.20	165.60	0.23
Upper	0.21667*	Max WS	23.36	105.86	107.67		107.68	0.000873	0.69	47.18	186.02	0.22
Upper	0.20	Max WS	22.56	105.84	107.65		107.67	0.000734	0.68	50.80	208.46	0.20
Upper	0.18333*	Max WS	21.98	105.82	107.65		107.65	0.000510	0.57	56.67	214.13	0.17
Upper	0.16667*	Max WS	21.44	105.80	107.64		107.65	0.000343	0.47	63.85	222.05	0.14
Upper	0.15	Max WS	20.50	105.78	107.64		107.64	0.000206	0.37	73.02	228.45	0.11
Upper	0.13333*	Max WS	19.52	105.76	107.63		107.64	0.000168	0.34	80.57	270.97	0.10
Upper	0.11667*	Max WS	18.57	105.74	107.63		107.63	0.000109	0.27	92.45	296.42	0.08
Upper	0.1	Max WS	18.54	105.71	107.63		107.63	0.000074	0.23	106.16	312.83	0.07
Upper	0.08333*	Max WS	18.64	105.69	107.62		107.62	0.000063	0.21	112.48	316.23	0.06
Upper	0.06667*	Max WS	18.96	105.67	107.62		107.62	0.000054	0.18	119.83	319.87	0.06
Upper	0.05	Max WS	24.29	105.65	107.61		107.61	0.000078	0.20	125.21	321.59	0.07
Upper	0.03333*	Max WS	80.39	105.63	107.19	107.25	107.39	0.012454	2.03	41.43	169.06	0.79
Upper	0.01667*	Max WS	78.28	105.61	106.96	107.05	107.22	0.019793	2.91	36.45	177.09	1.02
Upper	0.00	Max WS	70.36	105.59	107.00	106.84	107.03	0.001545	0.79	89.18	256.82	0.29

APPENDIX 11

SENSITIVITY TEST: FLOW INCREASED 20%

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	29.72	109.90	113.29		113.29	0.000015	0.15	208.10	142.09	0.03
Upper	1.5287*	Max WS	29.72	109.83	113.29		113.29	0.000016	0.16	200.84	137.18	0.03
Upper	1.5103*	Max WS	29.72	109.75	113.29		113.29	0.000016	0.16	202.61	133.54	0.03
Upper	1.492	Max WS	29.72	109.68	113.29		113.29	0.000011	0.13	332.62	303.19	0.02
Upper	1.4740*	Max WS	29.72	109.60	113.29		113.29	0.000011	0.13	318.36	294.74	0.02
Upper	1.4560*	Max WS	29.72	109.53	113.29		113.29	0.000015	0.15	203.78	133.16	0.03
Upper	1.4380*	Max WS	29.72	109.46	113.29		113.29	0.000014	0.15	202.79	131.47	0.03
Upper	1.4200*	Max WS	29.72	109.39	113.29		113.29	0.000013	0.15	203.37	130.51	0.03
Upper	1.402	Max WS	29.72	109.32	113.29		113.29	0.000012	0.15	205.30	129.90	0.02
Upper	1.3870*	Max WS	29.72	109.27	113.29		113.29	0.000008	0.12	302.47	252.68	0.02
Upper	1.372	Max WS	29.72	109.23	113.29		113.29	0.000007	0.12	241.04	139.65	0.02
Upper	1.342	Max WS	4.59	109.20	113.24	110.19	113.24	0.000035	0.30	28.74	155.57	0.05
Upper	1.341		Bridge									
Upper	1.312	Max WS	29.72	109.20	111.48		111.51	0.001374	1.07	62.22	92.76	0.24
Upper	1.304	Max WS	29.70	109.04	111.40		111.52	0.003414	1.62	21.10	18.45	0.39
Upper	1.2853*	Max WS	29.69	109.06	111.31		111.45	0.004053	1.73	20.28	19.14	0.43
Upper	1.2667*	Max WS	29.69	109.08	111.21		111.37	0.004949	1.86	19.45	20.56	0.47
Upper	1.2480*	Max WS	29.68	109.10	111.09		111.28	0.006385	2.05	19.35	28.51	0.53
Upper	1.2293*	Max WS	29.68	109.12	110.97		111.16	0.007342	2.12	20.11	31.24	0.56
Upper	1.2107*	Max WS	29.67	109.13	110.83		111.01	0.008304	2.17	21.57	37.43	0.59
Upper	1.192	Max WS	29.66	109.15	110.78		110.86	0.004901	1.68	35.34	73.53	0.46
Upper	1.1720*	Max WS	29.66	109.06	110.69		110.77	0.004989	1.70	34.22	74.96	0.46
Upper	1.1520*	Max WS	29.64	108.97	110.59		110.68	0.005418	1.78	32.77	71.06	0.49
Upper	1.1320*	Max WS	29.64	108.87	110.51		110.58	0.003831	1.52	33.36	69.47	0.41
Upper	1.112	Max WS	29.59	108.78	110.47		110.51	0.002349	1.23	35.91	70.21	0.32
Upper	1.0940*	Max WS	29.60	108.64	110.43		110.47	0.002406	1.24	35.76	74.29	0.33
Upper	1.0760*	Max WS	29.56	108.50	110.39		110.44	0.002257	1.21	36.81	80.78	0.31
Upper	1.0580*	Max WS	29.57	108.37	110.36		110.40	0.002022	1.16	42.34	120.54	0.29
Upper	1.0400*	Max WS	29.48	108.23	110.34		110.36	0.001163	0.90	47.92	125.80	0.22
Upper	1.022	Max WS	29.54	108.09	110.33		110.34	0.000828	0.77	54.97	133.49	0.18
Upper	1.0020*	Max WS	29.41	107.99	110.25		110.27	0.000853	0.77	55.22	138.95	0.19
Upper	0.9820*	Max WS	29.52	107.90	110.17		110.18	0.000920	0.78	54.89	144.37	0.19
Upper	0.9620*	Max WS	29.37	107.80	110.08		110.09	0.001000	0.78	54.05	149.68	0.20
Upper	0.9420*	Max WS	29.49	107.70	109.97		109.99	0.001251	0.84	51.10	155.22	0.22
Upper	0.922	Max WS	29.36	107.61	109.78		109.83	0.003319	1.26	34.04	115.54	0.34

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.90200*	Max WS	29.48	107.57	109.73		109.77	0.003264	1.25	34.07	112.93	0.34
Upper	0.88200*	Max WS	29.34	107.53	109.68		109.72	0.003138	1.23	34.41	112.92	0.34
Upper	0.86200*	Max WS	29.43	107.49	109.62		109.67	0.003084	1.23	34.82	114.44	0.33
Upper	0.84200*	Max WS	29.34	107.46	109.57		109.62	0.002955	1.20	35.45	116.58	0.33
Upper	0.82200*	Max WS	29.37	107.42	109.52		109.57	0.002810	1.18	36.34	119.22	0.32
Upper	0.802	Max WS	29.34	107.38	109.48		109.52	0.002568	1.13	37.73	122.11	0.31
Upper	0.78343*	Max WS	29.25	107.30	109.42		109.48	0.003459	1.37	32.84	116.11	0.36
Upper	0.76486*	Max WS	29.29	107.22	109.35		109.42	0.004127	1.54	29.62	103.89	0.40
Upper	0.74629*	Max WS	29.12	107.14	109.29		109.36	0.003745	1.51	28.57	91.23	0.38
Upper	0.72771*	Max WS	29.14	107.05	109.22		109.29	0.003344	1.47	28.55	78.52	0.36
Upper	0.70914*	Max WS	28.77	106.97	109.18		109.24	0.002937	1.43	30.37	84.06	0.34
Upper	0.69057*	Max WS	29.12	106.89	109.13		109.18	0.002538	1.37	31.80	82.45	0.32
Upper	0.672	Max WS	28.75	106.81	109.09		109.13	0.001934	1.24	34.29	81.82	0.28
Upper	0.65311*	Max WS	28.72	106.74	109.05		109.10	0.001842	1.21	34.51	79.17	0.28
Upper	0.63422*	Max WS	28.25	106.67	109.03		109.07	0.001619	1.14	35.46	77.80	0.26
Upper	0.61533*	Max WS	27.08	106.60	109.01		109.04	0.001341	1.04	36.62	77.30	0.24
Upper	0.59644*	Max WS	27.22	106.53	108.98		109.01	0.001233	1.01	37.72	77.24	0.23
Upper	0.57756*	Max WS	25.82	106.46	108.97		108.99	0.000976	0.90	39.53	79.27	0.21
Upper	0.55867*	Max WS	25.72	106.40	108.94		108.97	0.000893	0.87	40.86	82.90	0.20
Upper	0.53978*	Max WS	24.03	106.33	108.93		108.95	0.000681	0.76	43.97	96.41	0.17
Upper	0.52089*	Max WS	20.75	106.26	108.92		108.93	0.000375	0.57	52.33	123.39	0.13
Upper	0.502	Max WS	17.12	106.19	108.93		108.93	0.000144	0.36	69.51	154.89	0.08
Upper	0.467	Max WS	20.10	106.16	108.91		108.91	0.000128	0.31	82.08	151.94	0.07
Upper	0.462	Max WS	26.62	106.16	108.87	108.55	108.88	0.000426	0.32	68.72	160.01	0.11
Upper	0.461		Bridge									
Upper	0.452	Max WS	19.38	106.16	108.33		108.50	0.009074	1.90	11.00	17.92	0.56
Upper	0.445	Max WS	45.26	106.17	108.50		108.55	0.003419	1.22	45.09	111.31	0.35
Upper	0.43250*	Max WS	42.05	106.11	108.42		108.49	0.004321	1.51	38.41	107.25	0.40
Upper	0.42	Max WS	42.22	106.05	108.37		108.45	0.004210	1.57	36.92	100.15	0.39
Upper	0.40750*	Max WS	41.64	106.05	108.31		108.40	0.004721	1.63	34.13	92.81	0.41
Upper	0.395	Max WS	40.95	106.04	108.23		108.34	0.005837	1.77	29.97	82.16	0.46
Upper	0.38143*	Max WS	40.20	106.03	108.18		108.27	0.004612	1.57	34.33	97.54	0.41
Upper	0.36786*	Max WS	39.86	106.01	108.14		108.21	0.004223	1.50	36.84	109.31	0.40
Upper	0.35429*	Max WS	38.03	106.00	108.09		108.15	0.003769	1.41	38.14	116.86	0.38
Upper	0.34071*	Max WS	37.82	105.99	108.05		108.10	0.003267	1.31	38.24	106.65	0.35

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.32714*	Max WS	37.64	105.98	108.01		108.06	0.002820	1.22	41.36	115.70	0.33
Upper	0.31357*	Max WS	37.49	105.96	107.99		108.03	0.002366	1.13	45.30	133.66	0.30
Upper	0.30	Max WS	37.49	105.95	107.97		108.00	0.001954	1.03	49.71	137.04	0.28
Upper	0.28333*	Max WS	37.31	105.94	107.91		107.96	0.003122	1.18	39.90	115.89	0.35
Upper	0.26667*	Max WS	37.16	105.92	107.90		107.92	0.001889	0.81	57.02	187.15	0.26
Upper	0.25	Max WS	36.94	105.91	107.89		107.90	0.000736	0.44	74.28	171.80	0.16
Upper	0.23333*	Max WS	36.74	105.89	107.88		107.89	0.000627	0.48	80.62	195.43	0.15
Upper	0.21667*	Max WS	36.76	105.86	107.87		107.88	0.000532	0.49	88.56	220.48	0.14
Upper	0.20	Max WS	36.82	105.84	107.86		107.87	0.000446	0.47	98.16	249.67	0.13
Upper	0.18333*	Max WS	36.83	105.82	107.86		107.86	0.000358	0.43	107.03	264.95	0.12
Upper	0.16667*	Max WS	36.50	105.80	107.85		107.86	0.000277	0.38	117.45	280.60	0.10
Upper	0.15	Max WS	36.05	105.78	107.85		107.85	0.000210	0.33	129.19	294.35	0.09
Upper	0.13333*	Max WS	28.57	105.76	107.85		107.85	0.000102	0.23	143.51	315.98	0.06
Upper	0.11667*	Max WS	28.04	105.74	107.84		107.85	0.000074	0.20	159.54	330.74	0.05
Upper	0.1	Max WS	27.39	105.71	107.84		107.84	0.000053	0.17	176.66	344.27	0.05
Upper	0.08333*	Max WS	25.99	105.69	107.84		107.84	0.000042	0.15	184.76	349.90	0.04
Upper	0.06667*	Max WS	24.36	105.67	107.84		107.84	0.000033	0.13	193.25	354.73	0.04
Upper	0.05	Max WS	76.35	105.65	107.44		107.50	0.005368	1.20	73.64	286.63	0.43
Upper	0.03333*	Max WS	75.50	105.63	107.17	107.23	107.37	0.020530	2.06	38.88	147.32	0.81
Upper	0.01667*	Max WS	73.63	105.61	107.08		107.15	0.007892	1.32	61.01	223.71	0.51
Upper	0.00	Max WS	72.05	105.59	107.06	106.84	107.09	0.001378	0.61	107.97	285.62	0.22

APPENDIX 12

SENSITIVITY TEST: FLOW DECREASED 20%

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	19.82	109.90	113.26		113.26	0.000007	0.10	204.30	141.86	0.02
Upper	1.5287*	Max WS	19.82	109.83	113.26		113.26	0.000008	0.11	197.17	136.09	0.02
Upper	1.5103*	Max WS	19.81	109.75	113.26		113.26	0.000008	0.11	199.08	132.55	0.02
Upper	1.492	Max WS	19.82	109.68	113.26		113.26	0.000005	0.09	324.51	301.65	0.02
Upper	1.4740*	Max WS	19.82	109.60	113.26		113.26	0.000005	0.09	310.57	292.06	0.02
Upper	1.4560*	Max WS	19.82	109.53	113.26		113.26	0.000007	0.10	200.31	132.13	0.02
Upper	1.4380*	Max WS	19.82	109.46	113.26		113.26	0.000007	0.10	199.36	130.59	0.02
Upper	1.4200*	Max WS	19.81	109.39	113.26		113.26	0.000006	0.10	200.00	129.63	0.02
Upper	1.402	Max WS	19.82	109.32	113.26		113.26	0.000006	0.10	201.99	129.02	0.02
Upper	1.3870*	Max WS	19.81	109.27	113.26		113.26	0.000004	0.08	295.87	250.59	0.01
Upper	1.372	Max WS	19.82	109.23	113.26		113.26	0.000003	0.08	237.47	138.74	0.01
Upper	1.342	Max WS	4.59	109.20	113.24	110.19	113.24	0.000035	0.30	28.74	155.57	0.05
Upper	1.341		Bridge									
Upper	1.312	Max WS	19.82	109.20	111.19		111.23	0.002101	1.19	37.23	77.13	0.29
Upper	1.304	Max WS	19.82	109.04	111.13		111.21	0.002811	1.32	16.51	15.92	0.35
Upper	1.2853*	Max WS	19.82	109.06	111.06		111.16	0.003320	1.41	15.81	16.46	0.37
Upper	1.2667*	Max WS	19.82	109.08	110.99		111.09	0.003952	1.51	15.22	17.32	0.41
Upper	1.2480*	Max WS	19.82	109.10	110.89		111.02	0.004855	1.63	14.66	18.61	0.45
Upper	1.2293*	Max WS	19.82	109.12	110.79		110.93	0.006013	1.76	14.95	26.56	0.50
Upper	1.2107*	Max WS	19.81	109.13	110.68		110.81	0.006521	1.78	16.42	31.54	0.52
Upper	1.192	Max WS	19.81	109.15	110.62		110.70	0.004579	1.50	24.86	60.31	0.43
Upper	1.1720*	Max WS	19.81	109.06	110.54		110.61	0.004487	1.49	24.39	58.85	0.43
Upper	1.1520*	Max WS	19.81	108.97	110.45		110.52	0.004731	1.54	23.83	57.56	0.45
Upper	1.1320*	Max WS	19.81	108.87	110.38		110.43	0.003527	1.36	24.61	58.35	0.39
Upper	1.112	Max WS	19.81	108.78	110.33		110.37	0.002215	1.12	27.13	61.30	0.31
Upper	1.0940*	Max WS	19.81	108.64	110.30		110.34	0.002270	1.14	26.88	65.35	0.31
Upper	1.0760*	Max WS	19.80	108.50	110.26		110.30	0.002283	1.15	26.64	69.37	0.31
Upper	1.0580*	Max WS	19.80	108.37	110.23		110.27	0.002058	1.11	27.59	76.32	0.29
Upper	1.0400*	Max WS	19.80	108.23	110.20		110.23	0.001442	0.94	31.91	110.12	0.24
Upper	1.022	Max WS	19.80	108.09	110.19		110.21	0.001183	0.87	31.09	74.53	0.22
Upper	1.0020*	Max WS	19.80	107.99	110.12		110.14	0.001240	0.88	31.49	80.69	0.22
Upper	0.9820*	Max WS	19.79	107.90	110.04		110.06	0.001301	0.88	32.02	88.27	0.22
Upper	0.9620*	Max WS	19.79	107.80	109.96		109.98	0.001374	0.87	32.49	95.74	0.23
Upper	0.9420*	Max WS	19.79	107.70	109.86		109.89	0.001518	0.88	32.44	103.28	0.24
Upper	0.922	Max WS	19.79	107.61	109.70		109.74	0.003283	1.20	24.99	103.76	0.34

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.90200*	Max WS	19.79	107.57	109.65		109.69	0.003138	1.18	25.47	104.79	0.33
Upper	0.88200*	Max WS	19.79	107.53	109.60		109.64	0.003018	1.16	25.97	106.85	0.33
Upper	0.86200*	Max WS	19.79	107.49	109.55		109.59	0.002906	1.15	26.50	109.27	0.32
Upper	0.84200*	Max WS	19.79	107.46	109.50		109.54	0.002793	1.13	27.06	111.71	0.32
Upper	0.82200*	Max WS	19.79	107.42	109.45		109.49	0.002674	1.11	27.62	113.40	0.31
Upper	0.802	Max WS	19.79	107.38	109.40		109.43	0.002587	1.09	28.07	114.86	0.31
Upper	0.78343*	Max WS	19.79	107.30	109.33		109.39	0.003587	1.33	23.10	97.47	0.36
Upper	0.76486*	Max WS	19.79	107.22	109.25		109.32	0.004266	1.49	20.14	80.78	0.40
Upper	0.74629*	Max WS	19.79	107.14	109.16		109.25	0.004479	1.56	18.73	71.19	0.41
Upper	0.72771*	Max WS	19.79	107.05	109.07		109.17	0.004525	1.61	17.67	63.97	0.42
Upper	0.70914*	Max WS	19.79	106.97	109.01		109.09	0.003624	1.49	18.68	60.98	0.37
Upper	0.69057*	Max WS	19.79	106.89	108.97		109.04	0.002512	1.29	21.10	60.43	0.31
Upper	0.672	Max WS	19.79	106.81	108.95		108.99	0.001686	1.10	24.11	60.52	0.26
Upper	0.65311*	Max WS	19.79	106.74	108.92		108.96	0.001514	1.05	25.17	59.14	0.25
Upper	0.63422*	Max WS	19.79	106.67	108.90		108.93	0.001342	0.99	26.37	58.09	0.24
Upper	0.61533*	Max WS	19.79	106.60	108.88		108.91	0.001181	0.94	27.66	57.14	0.22
Upper	0.59644*	Max WS	19.79	106.53	108.86		108.89	0.001027	0.88	29.11	56.41	0.21
Upper	0.57756*	Max WS	19.79	106.46	108.85		108.87	0.000892	0.83	30.58	55.73	0.19
Upper	0.55867*	Max WS	19.79	106.40	108.83		108.85	0.000779	0.78	32.04	55.12	0.18
Upper	0.53978*	Max WS	19.79	106.33	108.82		108.84	0.000793	0.79	34.23	74.86	0.18
Upper	0.52089*	Max WS	19.79	106.26	108.81		108.83	0.000665	0.73	38.87	109.22	0.17
Upper	0.502	Max WS	19.79	106.19	108.80		108.81	0.000397	0.57	51.59	137.71	0.13
Upper	0.467	Max WS	19.78	106.16	108.80		108.80	0.000226	0.40	66.27	140.43	0.09
Upper	0.462	Max WS	19.79	106.16	108.80	108.52	108.80	0.000394	0.28	57.21	145.20	0.11
Upper	0.461		Bridge									
Upper	0.452	Max WS	19.78	106.16	108.15	108.02	108.45	0.019085	2.46	8.25	12.50	0.79
Upper	0.445	Max WS	19.79	106.17	108.27		108.31	0.003807	1.12	23.03	81.14	0.36
Upper	0.43250*	Max WS	19.79	106.11	108.19		108.27	0.004722	1.40	18.81	68.79	0.41
Upper	0.42	Max WS	19.78	106.05	108.15		108.23	0.004196	1.42	18.29	64.92	0.38
Upper	0.40750*	Max WS	19.78	106.05	108.10		108.18	0.004403	1.43	17.62	63.00	0.39
Upper	0.395	Max WS	19.77	106.04	108.05		108.12	0.004397	1.41	17.25	58.39	0.39
Upper	0.38143*	Max WS	19.76	106.03	108.01		108.07	0.003805	1.31	19.66	69.57	0.37
Upper	0.36786*	Max WS	19.72	106.01	107.96		108.02	0.003787	1.30	20.83	78.76	0.37
Upper	0.35429*	Max WS	19.68	106.00	107.93		107.98	0.003038	1.17	22.16	75.55	0.33
Upper	0.34071*	Max WS	19.63	105.99	107.90		107.94	0.002678	1.10	24.15	83.18	0.31

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.32714*	Max WS	19.58	105.98	107.87		107.91	0.002244	1.01	26.58	90.67	0.29
Upper	0.31357*	Max WS	19.53	105.96	107.85		107.88	0.001801	0.92	29.68	99.38	0.26
Upper	0.30	Max WS	19.52	105.95	107.84		107.86	0.001394	0.82	33.56	109.43	0.23
Upper	0.28333*	Max WS	19.45	105.94	107.81		107.83	0.001929	0.87	28.61	94.09	0.27
Upper	0.26667*	Max WS	19.44	105.92	107.79		107.81	0.001254	0.62	39.02	161.84	0.21
Upper	0.25	Max WS	19.44	105.91	107.79		107.79	0.000433	0.31	58.19	159.22	0.12
Upper	0.23333*	Max WS	19.43	105.89	107.78		107.79	0.000363	0.34	63.11	180.02	0.11
Upper	0.21667*	Max WS	19.42	105.86	107.78		107.78	0.000304	0.35	69.42	205.26	0.11
Upper	0.20	Max WS	19.43	105.84	107.78		107.78	0.000246	0.34	77.49	229.72	0.09
Upper	0.18333*	Max WS	19.42	105.82	107.77		107.78	0.000188	0.30	85.77	244.11	0.08
Upper	0.16667*	Max WS	19.42	105.80	107.77		107.77	0.000141	0.26	95.45	259.40	0.07
Upper	0.15	Max WS	19.42	105.78	107.77		107.77	0.000105	0.23	106.65	274.58	0.06
Upper	0.13333*	Max WS	19.42	105.76	107.77		107.77	0.000082	0.20	119.44	301.08	0.06
Upper	0.11667*	Max WS	19.42	105.74	107.77		107.77	0.000059	0.17	134.66	319.00	0.05
Upper	0.1	Max WS	19.42	105.71	107.77		107.77	0.000043	0.15	151.26	333.28	0.04
Upper	0.08333*	Max WS	19.42	105.69	107.77		107.77	0.000037	0.14	159.38	338.45	0.04
Upper	0.06667*	Max WS	19.42	105.67	107.77		107.77	0.000032	0.12	168.09	344.06	0.03
Upper	0.05	Max WS	12.81	105.65	107.31	107.04	107.40	0.009209	1.42	13.14	112.50	0.54
Upper	0.03333*	Max WS	19.41	105.63	106.98	107.03	107.12	0.018627	2.12	14.49	105.57	0.77
Upper	0.01667*	Max WS	19.41	105.61	106.85	106.88	106.93	0.012363	1.72	18.55	137.80	0.64
Upper	0.00	Max WS	19.41	105.59	106.80	106.67	106.81	0.001904	0.72	41.05	223.55	0.26

APPENDIX 13

PRE-DEVELOPMENT 1 IN 100 YEAR PLUS 35% CLIMATE CHANG E RESULTS & CROSS SECTIONS

HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS

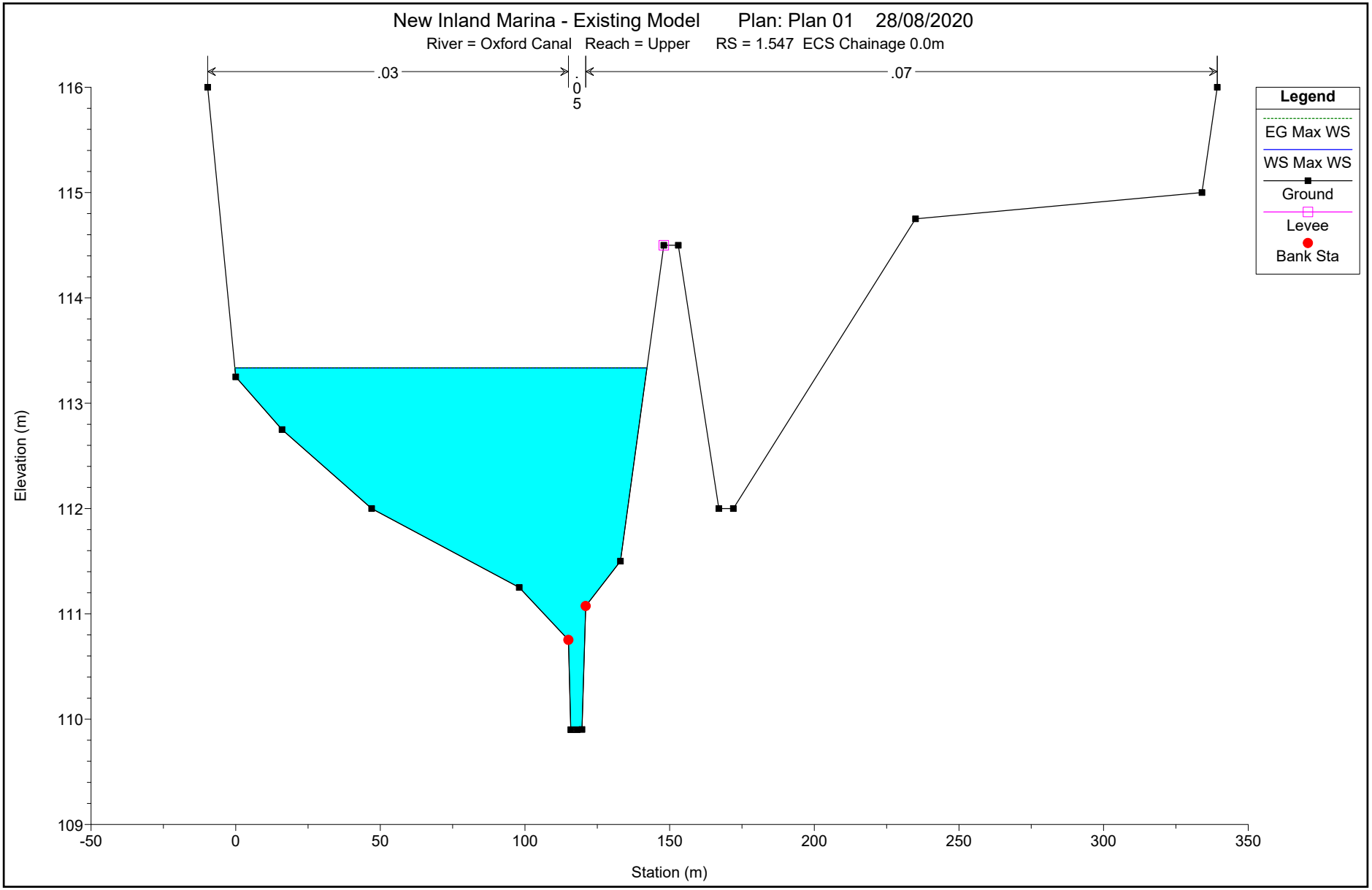
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	33.41	109.90	113.34		113.34	0.000017	0.16	214.61	142.48	0.03
Upper	1.5287*	Max WS	33.41	109.83	113.34		113.34	0.000019	0.17	207.11	139.03	0.03
Upper	1.5103*	Max WS	33.41	109.75	113.33		113.34	0.000019	0.17	208.72	135.27	0.03
Upper	1.492	Max WS	33.41	109.68	113.34		113.34	0.000013	0.14	346.55	305.82	0.02
Upper	1.4740*	Max WS	33.41	109.60	113.34		113.34	0.000013	0.14	331.90	297.38	0.03
Upper	1.4560*	Max WS	33.41	109.53	113.33		113.34	0.000013	0.14	318.50	288.95	0.03
Upper	1.4380*	Max WS	33.41	109.46	113.33		113.34	0.000016	0.17	208.80	133.00	0.03
Upper	1.4200*	Max WS	33.41	109.39	113.33		113.33	0.000015	0.16	209.33	132.06	0.03
Upper	1.402	Max WS	33.41	109.32	113.33		113.33	0.000015	0.16	211.24	131.46	0.03
Upper	1.3870*	Max WS	33.41	109.27	113.33		113.33	0.000009	0.13	314.03	256.31	0.02
Upper	1.372	Max WS	33.41	109.23	113.33		113.33	0.000009	0.13	247.42	141.27	0.02
Upper	1.342	Max WS	33.41	109.20	113.28	113.16	113.38	0.001539	2.00	30.73	156.67	0.32
Upper	1.341		Bridge									
Upper	1.312	Max WS	33.41	109.20	111.57		111.59	0.001253	1.05	70.73	97.14	0.23
Upper	1.304	Max WS	33.40	109.04	111.48		111.62	0.003638	1.72	22.62	19.21	0.41
Upper	1.2853*	Max WS	33.40	109.06	111.39		111.55	0.004315	1.84	21.78	19.96	0.44
Upper	1.2667*	Max WS	33.40	109.08	111.27		111.46	0.005359	1.99	20.94	25.69	0.49
Upper	1.2480*	Max WS	33.40	109.10	111.15		111.36	0.006701	2.16	21.21	29.71	0.54
Upper	1.2293*	Max WS	33.40	109.12	111.03		111.23	0.007631	2.23	22.07	32.70	0.58
Upper	1.2107*	Max WS	33.40	109.13	110.88		111.08	0.009081	2.32	23.36	41.13	0.62
Upper	1.192	Max WS	33.40	109.15	110.83		110.92	0.005100	1.75	39.24	81.57	0.47
Upper	1.1720*	Max WS	33.40	109.06	110.73		110.82	0.005024	1.75	37.78	77.71	0.47
Upper	1.1520*	Max WS	33.40	108.97	110.63		110.72	0.005586	1.84	35.83	73.53	0.50
Upper	1.1320*	Max WS	33.40	108.87	110.55		110.62	0.003974	1.57	36.09	71.74	0.42
Upper	1.112	Max WS	33.40	108.78	110.50		110.55	0.002509	1.29	38.32	72.31	0.34
Upper	1.0940*	Max WS	33.40	108.64	110.46		110.51	0.002486	1.29	38.69	77.00	0.33
Upper	1.0760*	Max WS	33.40	108.50	110.43		110.48	0.002370	1.26	39.78	84.24	0.32
Upper	1.0580*	Max WS	33.40	108.37	110.39		110.44	0.002078	1.19	46.52	124.13	0.30
Upper	1.0400*	Max WS	33.40	108.23	110.37		110.40	0.001192	0.92	52.20	129.44	0.22
Upper	1.022	Max WS	33.40	108.09	110.36		110.38	0.000858	0.79	59.52	137.38	0.19
Upper	1.0020*	Max WS	33.40	107.99	110.28		110.30	0.000913	0.80	59.21	142.41	0.19
Upper	0.9820*	Max WS	33.39	107.90	110.19		110.21	0.000978	0.81	58.81	147.71	0.20
Upper	0.9620*	Max WS	33.39	107.80	110.10		110.12	0.001065	0.82	58.06	153.02	0.20
Upper	0.9420*	Max WS	33.39	107.70	110.00		110.02	0.001260	0.85	55.84	159.09	0.22
Upper	0.922	Max WS	33.38	107.61	109.81		109.86	0.003367	1.28	37.29	118.96	0.35

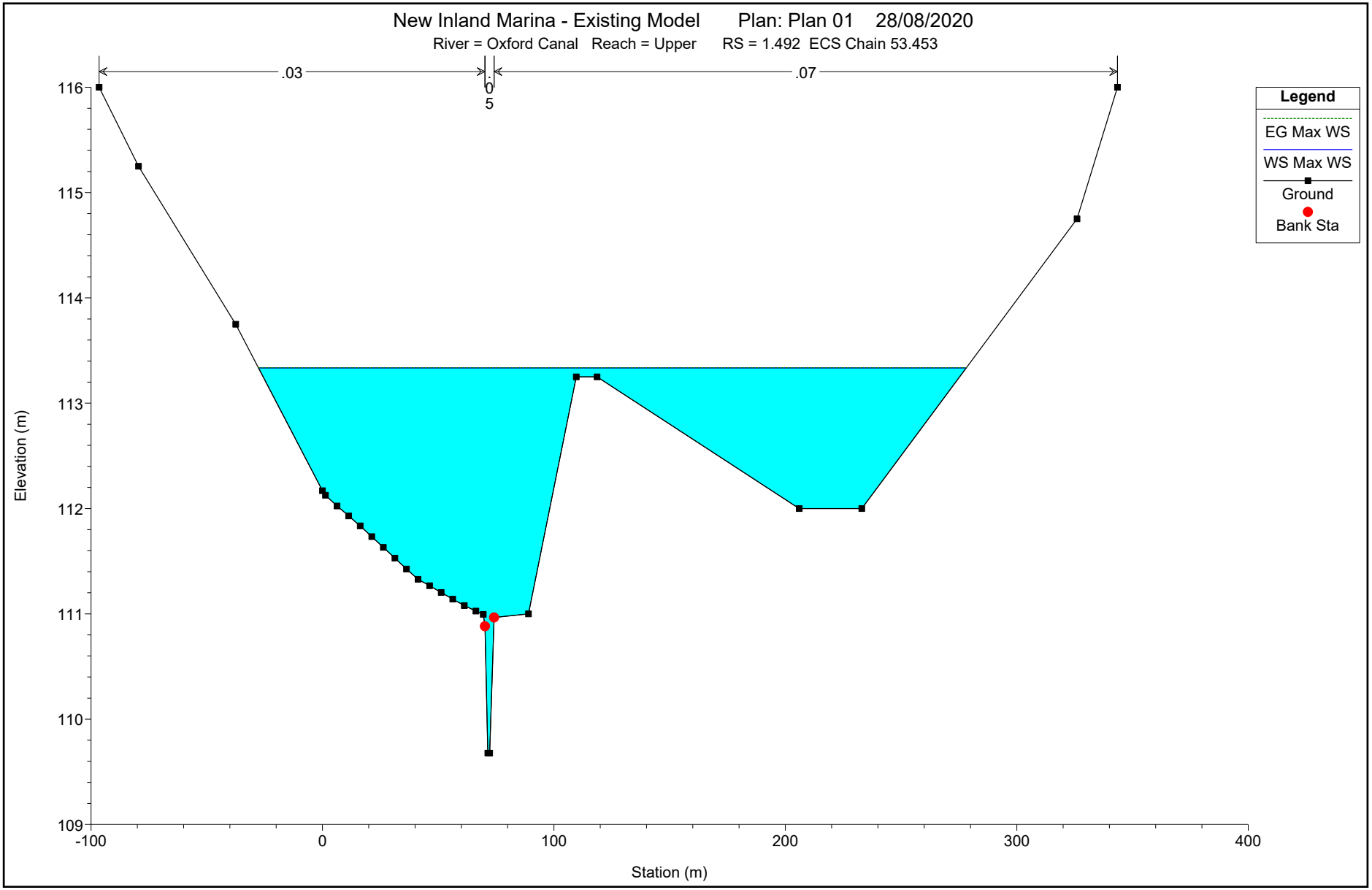
HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

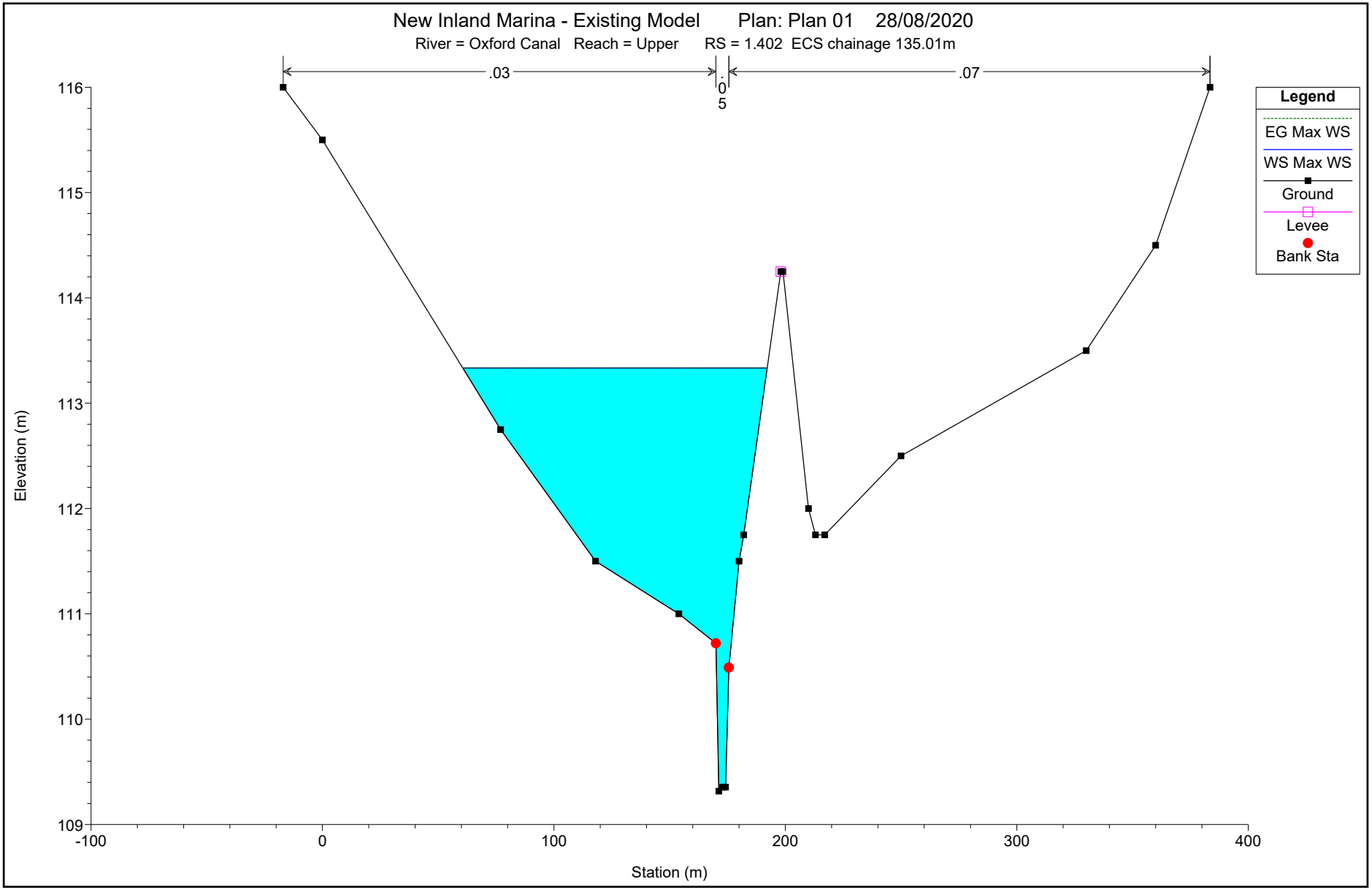
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.90200*	Max WS	33.38	107.57	109.75		109.80	0.003324	1.28	37.23	116.95	0.35
Upper	0.88200*	Max WS	33.38	107.53	109.70		109.75	0.003224	1.27	37.40	115.06	0.34
Upper	0.86200*	Max WS	33.38	107.49	109.65		109.70	0.003143	1.25	37.84	116.38	0.34
Upper	0.84200*	Max WS	33.38	107.46	109.60		109.64	0.003028	1.23	38.54	118.57	0.33
Upper	0.82200*	Max WS	33.38	107.42	109.55		109.59	0.002830	1.20	39.67	121.04	0.32
Upper	0.802	Max WS	33.38	107.38	109.51		109.55	0.002544	1.14	41.40	123.83	0.31
Upper	0.78343*	Max WS	33.38	107.30	109.45		109.51	0.003393	1.37	36.61	120.86	0.36
Upper	0.76486*	Max WS	33.38	107.22	109.39		109.46	0.003989	1.53	33.31	108.30	0.39
Upper	0.74629*	Max WS	32.01	107.14	109.32		109.39	0.003774	1.54	31.64	96.32	0.38
Upper	0.72771*	Max WS	32.12	107.05	109.25		109.32	0.003625	1.55	31.26	89.48	0.38
Upper	0.70914*	Max WS	31.81	106.97	109.20		109.26	0.003078	1.47	32.29	86.15	0.35
Upper	0.69057*	Max WS	32.32	106.89	109.15		109.20	0.002720	1.43	33.58	84.07	0.33
Upper	0.672	Max WS	32.07	106.81	109.11		109.16	0.002087	1.29	36.23	83.51	0.29
Upper	0.65311*	Max WS	31.64	106.74	109.08		109.12	0.001959	1.26	36.45	81.82	0.29
Upper	0.63422*	Max WS	31.14	106.67	109.05		109.09	0.001767	1.20	37.09	80.03	0.27
Upper	0.61533*	Max WS	30.62	106.60	109.02		109.06	0.001579	1.14	37.86	78.74	0.26
Upper	0.59644*	Max WS	29.84	106.53	109.00		109.03	0.001385	1.07	38.77	78.51	0.24
Upper	0.57756*	Max WS	28.08	106.46	108.97		109.00	0.001124	0.97	39.96	79.83	0.22
Upper	0.55867*	Max WS	27.93	106.40	108.95		108.98	0.001021	0.93	41.39	83.70	0.21
Upper	0.53978*	Max WS	25.89	106.33	108.94		108.96	0.000776	0.81	44.38	97.34	0.18
Upper	0.52089*	Max WS	22.14	106.26	108.93		108.94	0.000421	0.60	52.63	123.70	0.14
Upper	0.502	Max WS	18.11	106.19	108.93		108.93	0.000159	0.38	69.80	155.15	0.08
Upper	0.467	Max WS	20.26	106.16	108.91		108.91	0.000129	0.31	82.27	152.05	0.07
Upper	0.462	Max WS	26.62	106.16	108.87	108.55	108.88	0.000423	0.32	68.87	160.42	0.11
Upper	0.461		Bridge									
Upper	0.452	Max WS	19.40	106.16	108.33		108.50	0.009097	1.90	11.00	17.92	0.56
Upper	0.445	Max WS	46.06	106.17	108.50		108.55	0.003436	1.22	45.60	111.91	0.35
Upper	0.43250*	Max WS	42.81	106.11	108.43		108.50	0.004321	1.51	39.00	108.36	0.40
Upper	0.42	Max WS	42.79	106.05	108.38		108.46	0.004157	1.56	37.54	101.02	0.39
Upper	0.40750*	Max WS	42.22	106.05	108.32		108.41	0.004668	1.63	34.70	93.66	0.41
Upper	0.395	Max WS	41.69	106.04	108.23		108.35	0.005878	1.78	30.35	82.76	0.46
Upper	0.38143*	Max WS	40.80	106.03	108.19		108.27	0.004607	1.57	34.78	98.30	0.41
Upper	0.36786*	Max WS	40.24	106.01	108.14		108.21	0.004132	1.49	37.51	110.64	0.39
Upper	0.35429*	Max WS	39.61	106.00	108.09		108.16	0.003965	1.45	38.61	117.51	0.39
Upper	0.34071*	Max WS	38.80	105.99	108.05		108.11	0.003416	1.34	38.33	106.80	0.36

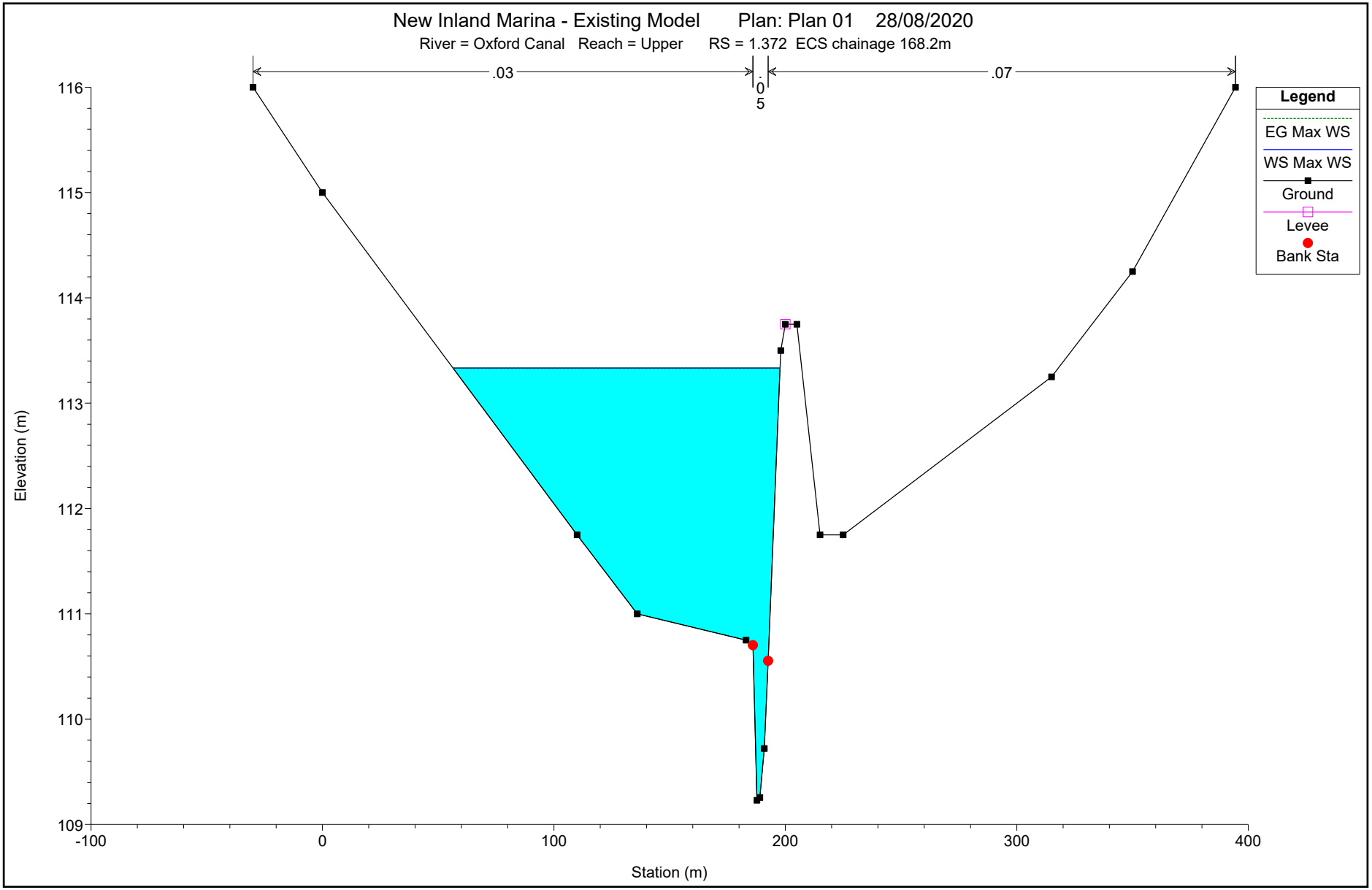
HEC-RAS Plan: 1 IN 100 YEAR River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

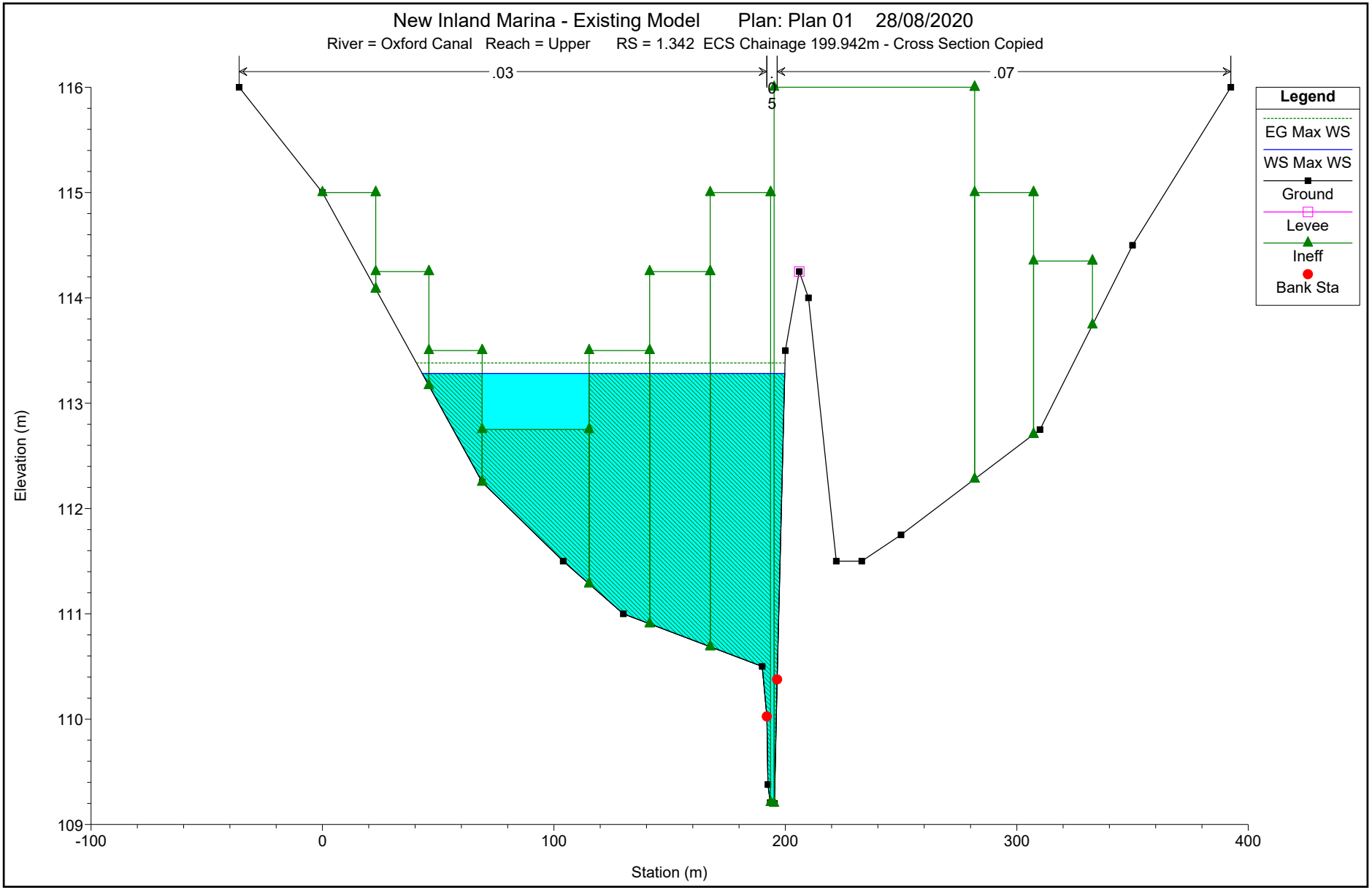
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.32714*	Max WS	38.65	105.98	108.01		108.07	0.003000	1.26	41.22	115.50	0.34
Upper	0.31357*	Max WS	38.44	105.96	107.99		108.03	0.002542	1.17	44.90	130.09	0.32
Upper	0.30	Max WS	38.43	105.95	107.96		108.00	0.002124	1.07	49.05	136.01	0.29
Upper	0.28333*	Max WS	34.77	105.94	107.91		107.96	0.002742	1.10	39.72	115.59	0.33
Upper	0.26667*	Max WS	34.66	105.92	107.90		107.92	0.001639	0.76	57.07	187.23	0.25
Upper	0.25	Max WS	34.31	105.91	107.89		107.90	0.000632	0.41	74.39	171.88	0.15
Upper	0.23333*	Max WS	34.10	105.89	107.88		107.89	0.000539	0.44	80.68	195.48	0.14
Upper	0.21667*	Max WS	33.47	105.86	107.87		107.88	0.000438	0.44	88.77	220.69	0.13
Upper	0.20	Max WS	32.94	105.84	107.86		107.87	0.000353	0.42	98.47	249.96	0.11
Upper	0.18333*	Max WS	32.26	105.82	107.86		107.86	0.000272	0.37	107.35	265.26	0.10
Upper	0.16667*	Max WS	31.62	105.80	107.85		107.86	0.000206	0.33	117.88	280.96	0.09
Upper	0.15	Max WS	31.16	105.78	107.85		107.85	0.000155	0.29	129.73	294.81	0.08
Upper	0.13333*	Max WS	30.01	105.76	107.85		107.85	0.000112	0.24	143.89	316.22	0.07
Upper	0.11667*	Max WS	28.27	105.74	107.85		107.85	0.000075	0.20	159.84	330.86	0.05
Upper	0.1	Max WS	27.47	105.71	107.84		107.84	0.000053	0.17	176.98	344.41	0.05
Upper	0.08333*	Max WS	26.22	105.69	107.84		107.84	0.000043	0.15	184.97	349.99	0.04
Upper	0.06667*	Max WS	24.74	105.67	107.84		107.84	0.000034	0.13	193.46	354.81	0.04
Upper	0.05	Max WS	77.87	105.65	107.44		107.50	0.005511	1.22	73.99	287.05	0.43
Upper	0.03333*	Max WS	77.14	105.63	107.17	107.23	107.38	0.021804	2.12	38.65	145.28	0.83
Upper	0.01667*	Max WS	72.39	105.61	107.08		107.15	0.007764	1.32	60.67	223.66	0.51
Upper	0.00	Max WS	71.40	105.59	107.06	106.84	107.08	0.001387	0.61	107.11	284.29	0.22

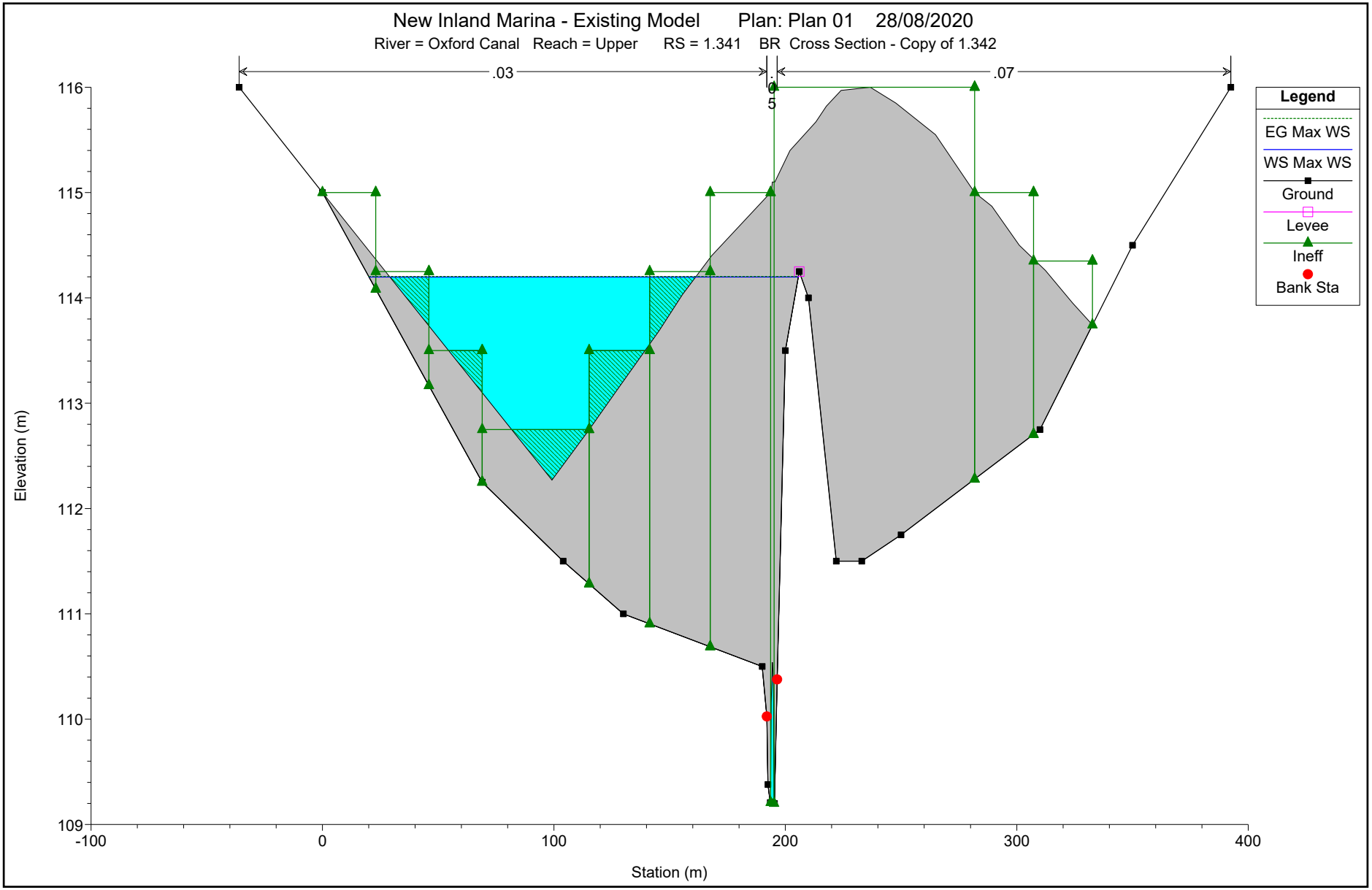

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.547 ECS Chainage 0.0m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-50
0
50
100
150
200
250
300
350

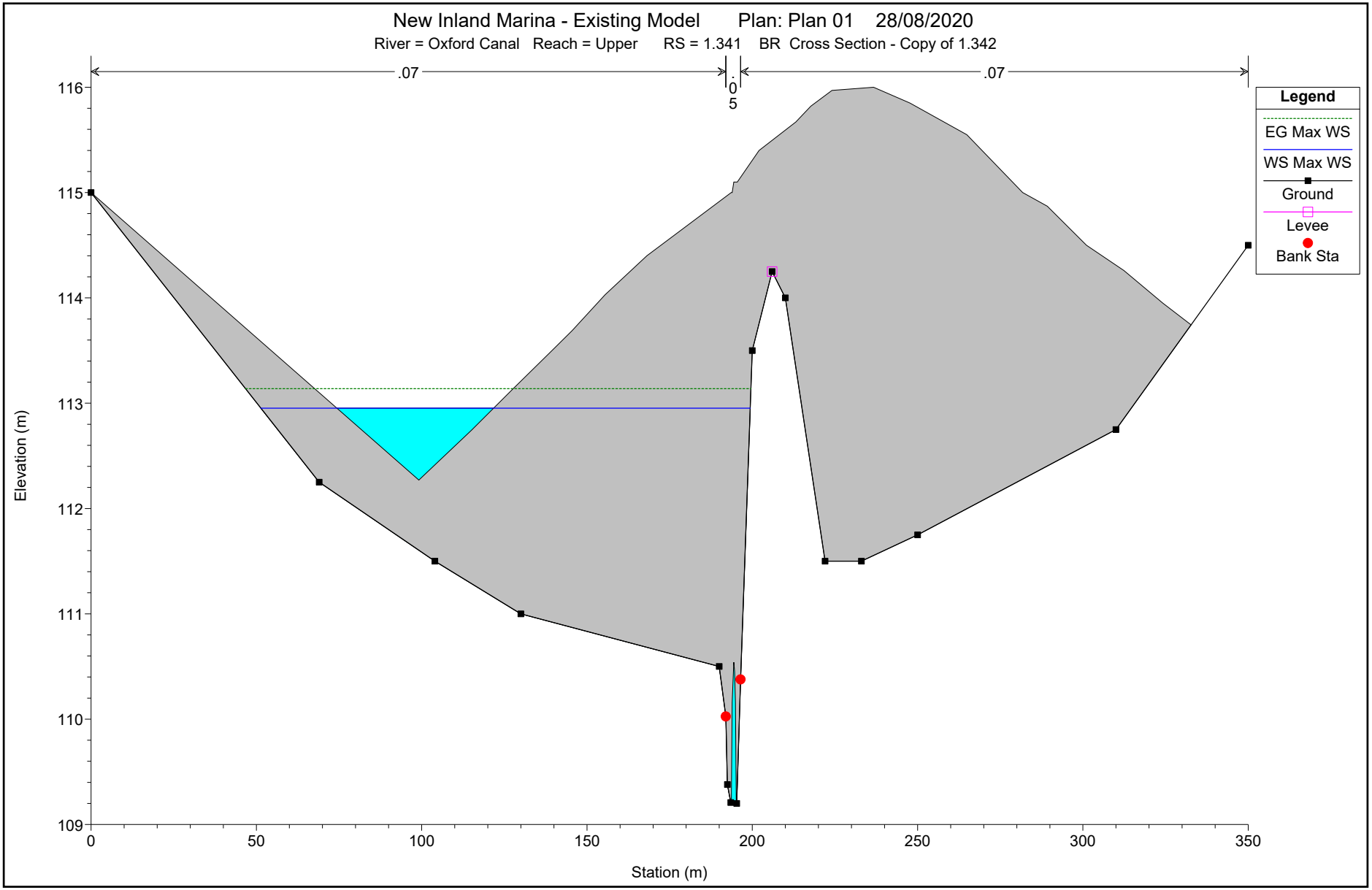

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.492 ECS Chain 53.453
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

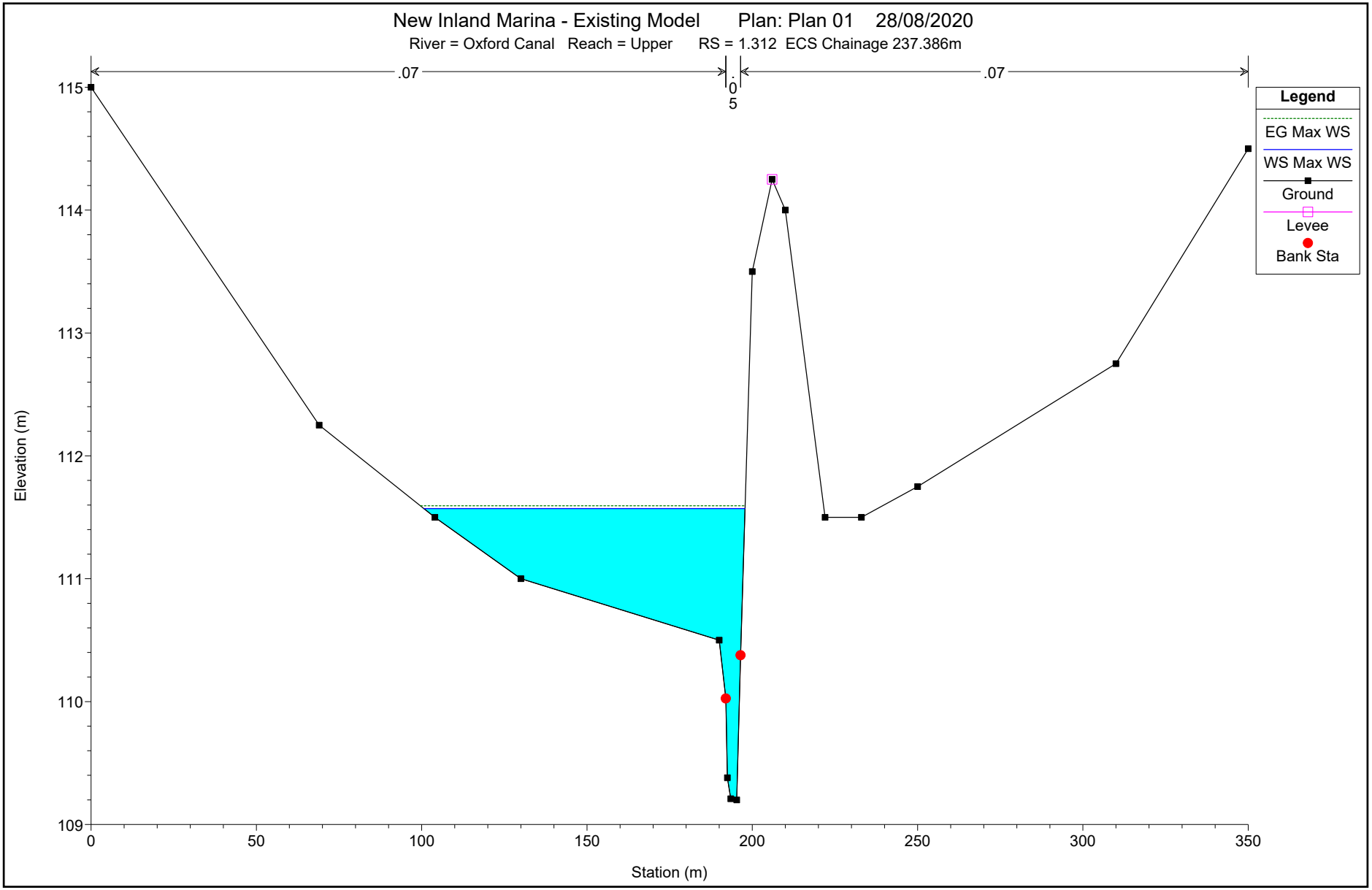

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.402 ECS chainage 135.01m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400
Station (m)

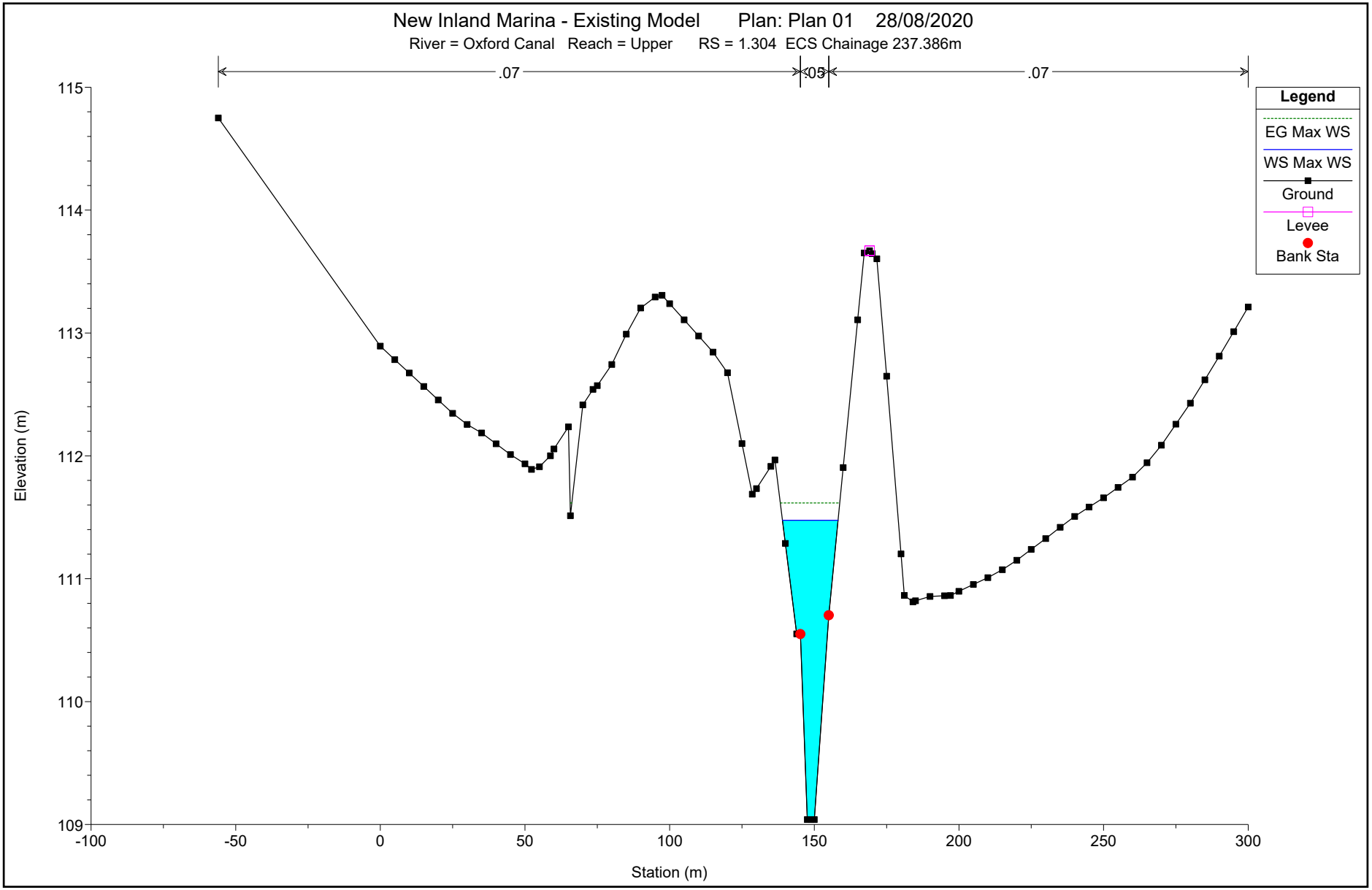

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.372 ECS chainage 168.2m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

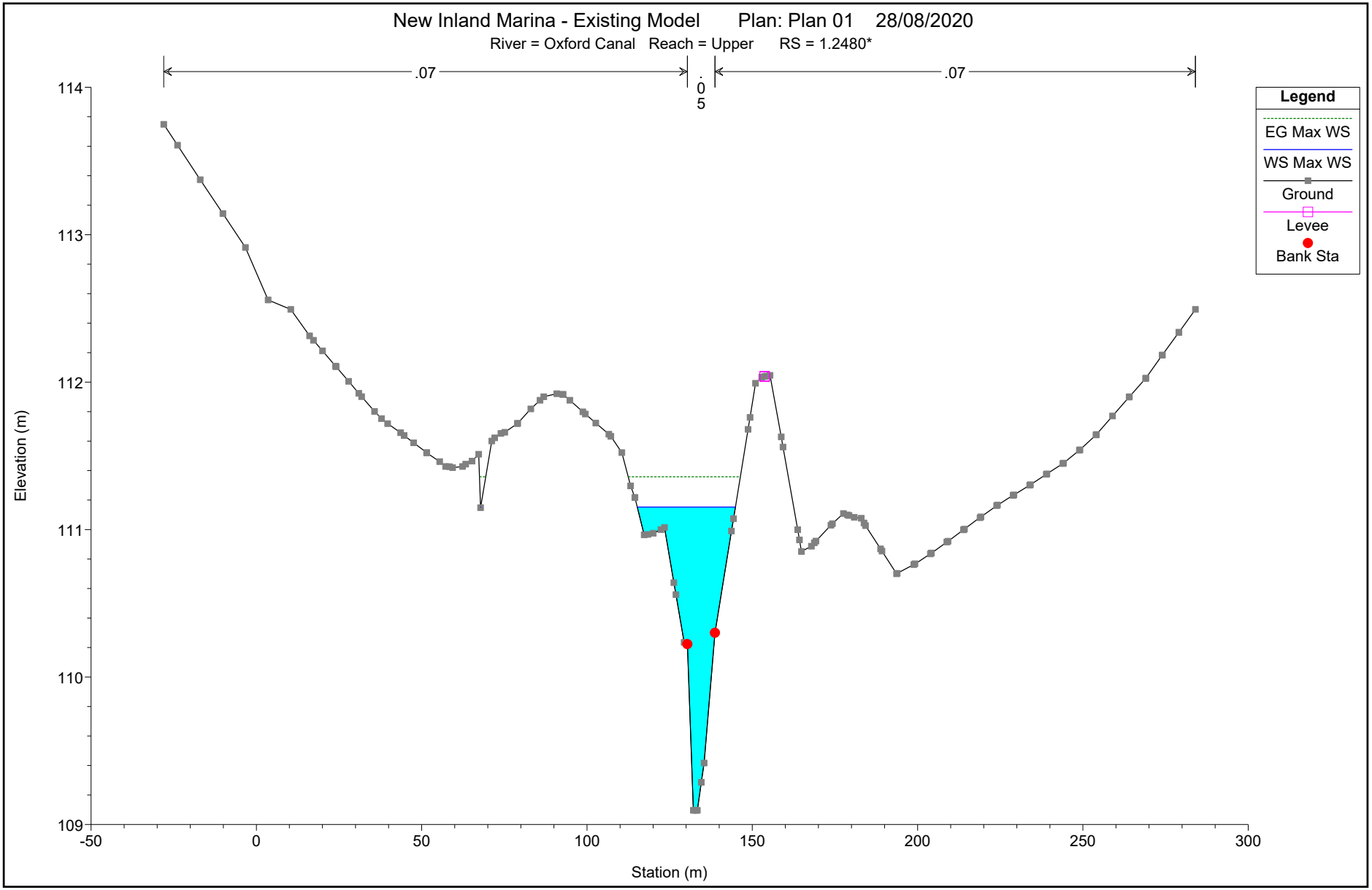

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.342 ECS Chainage 199.942m - Cross Section Copied
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

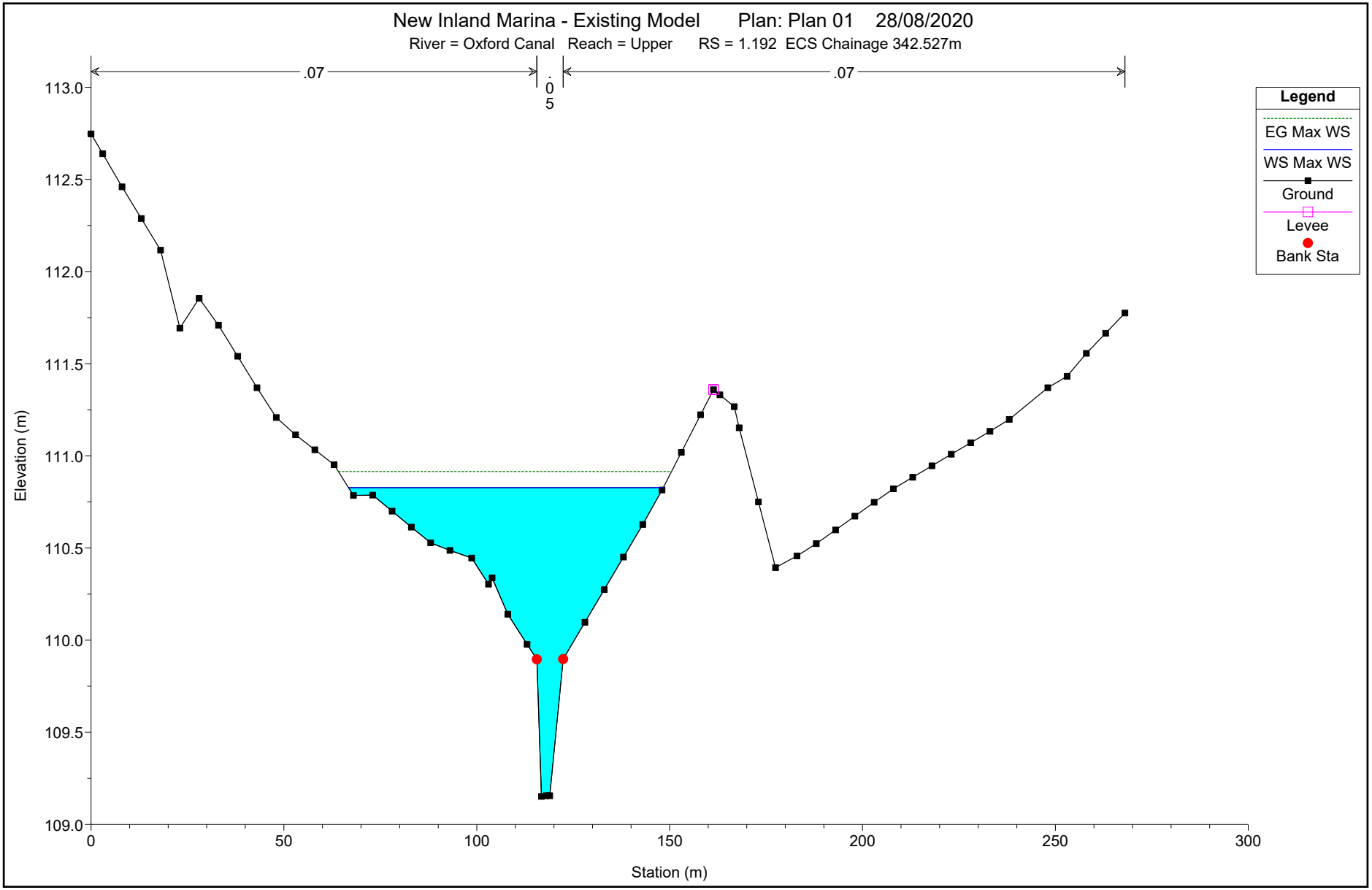

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.341 BR Cross Section - Copy of 1.342
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

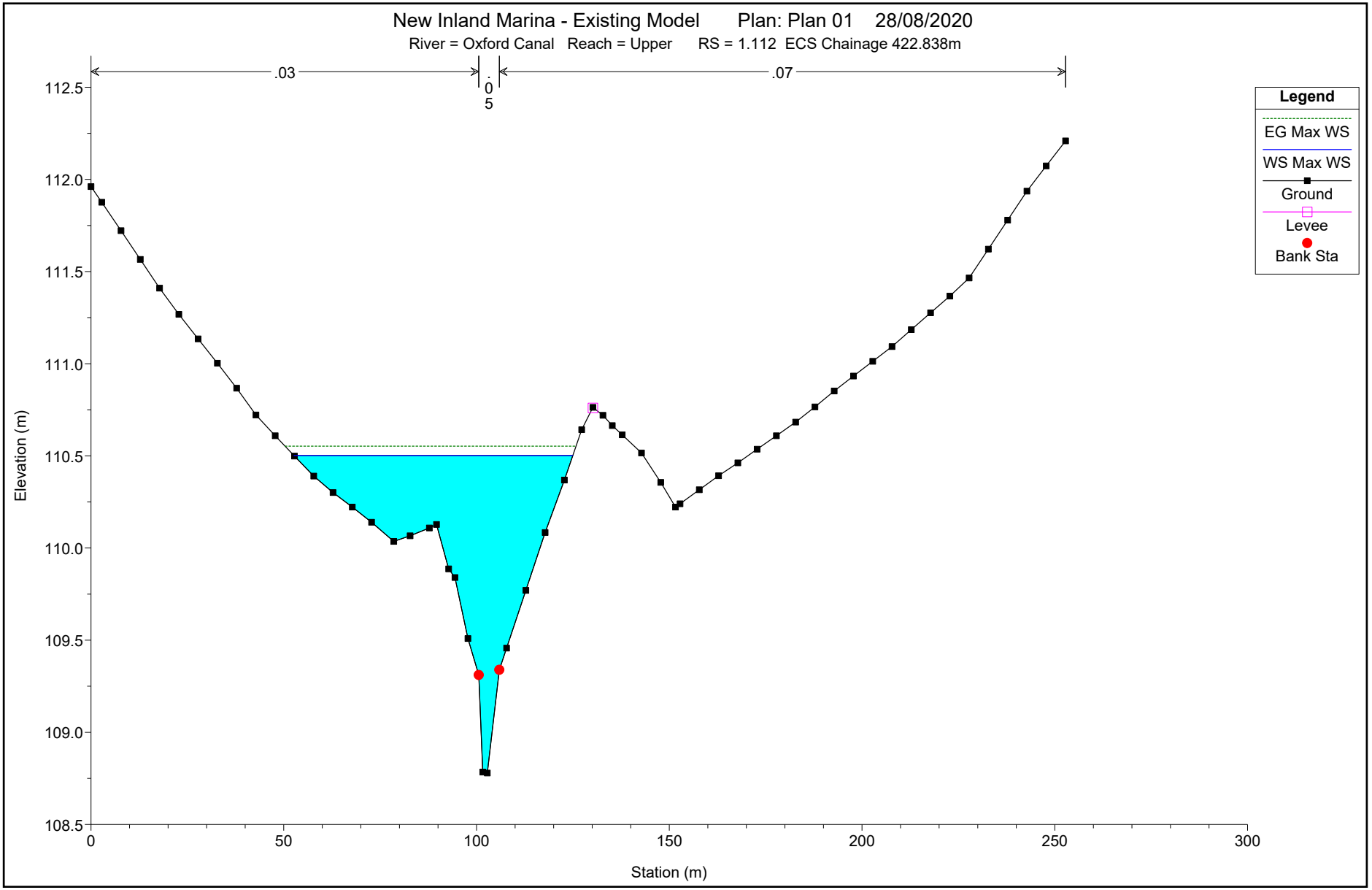

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.341 BR Cross Section - Copy of 1.342
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
0
50
100
150
200
250
300
350

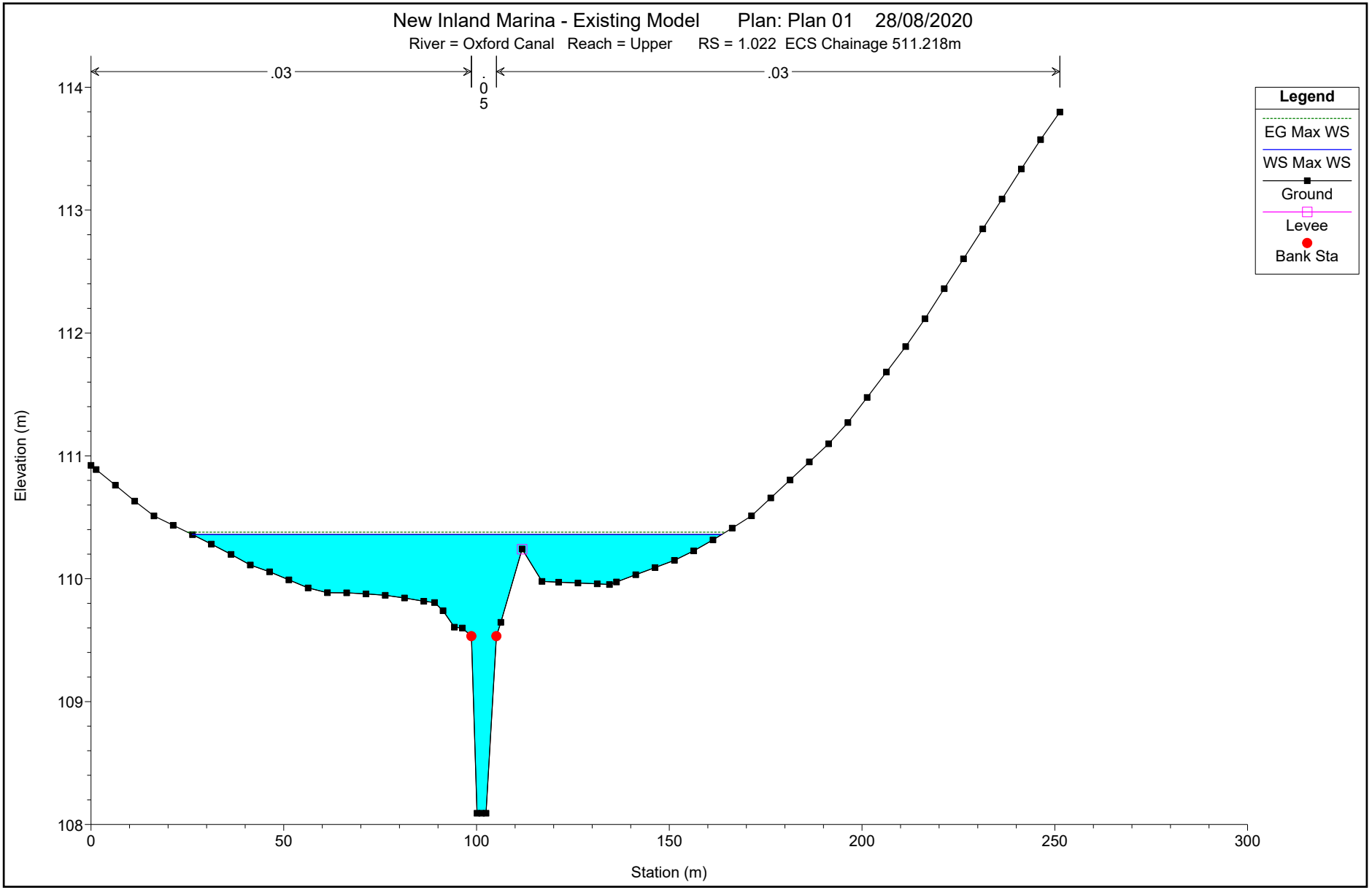

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.312 ECS Chainage 237.386m
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
115
114
113
112
111
110
109
0
50
100
150
200
250
300
350

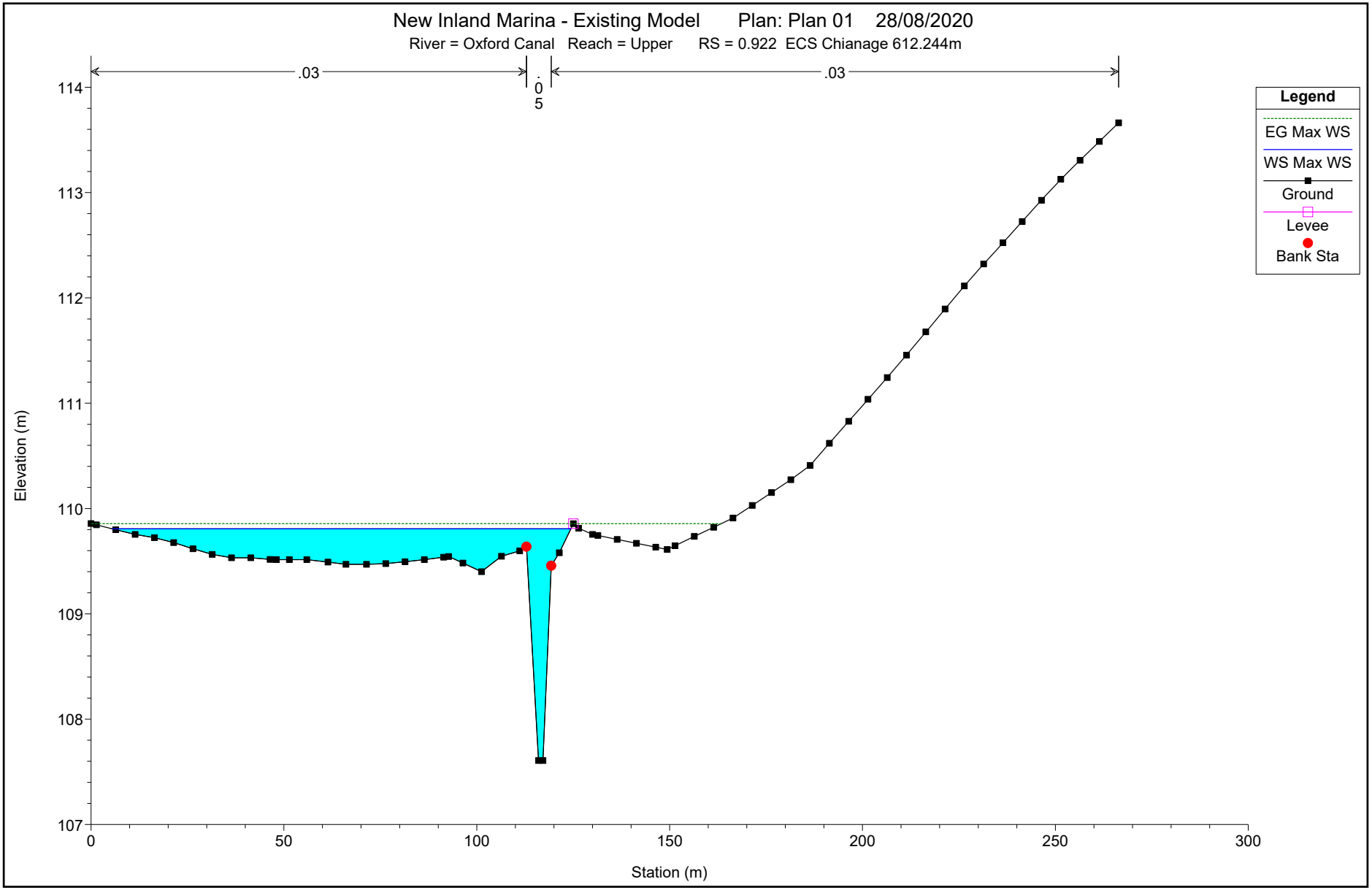

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.304 ECS Chainage 237.386m
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
115
114
113
112
111
110
109
-100
-50
0
50
100
150
200
250
300
Station (m)

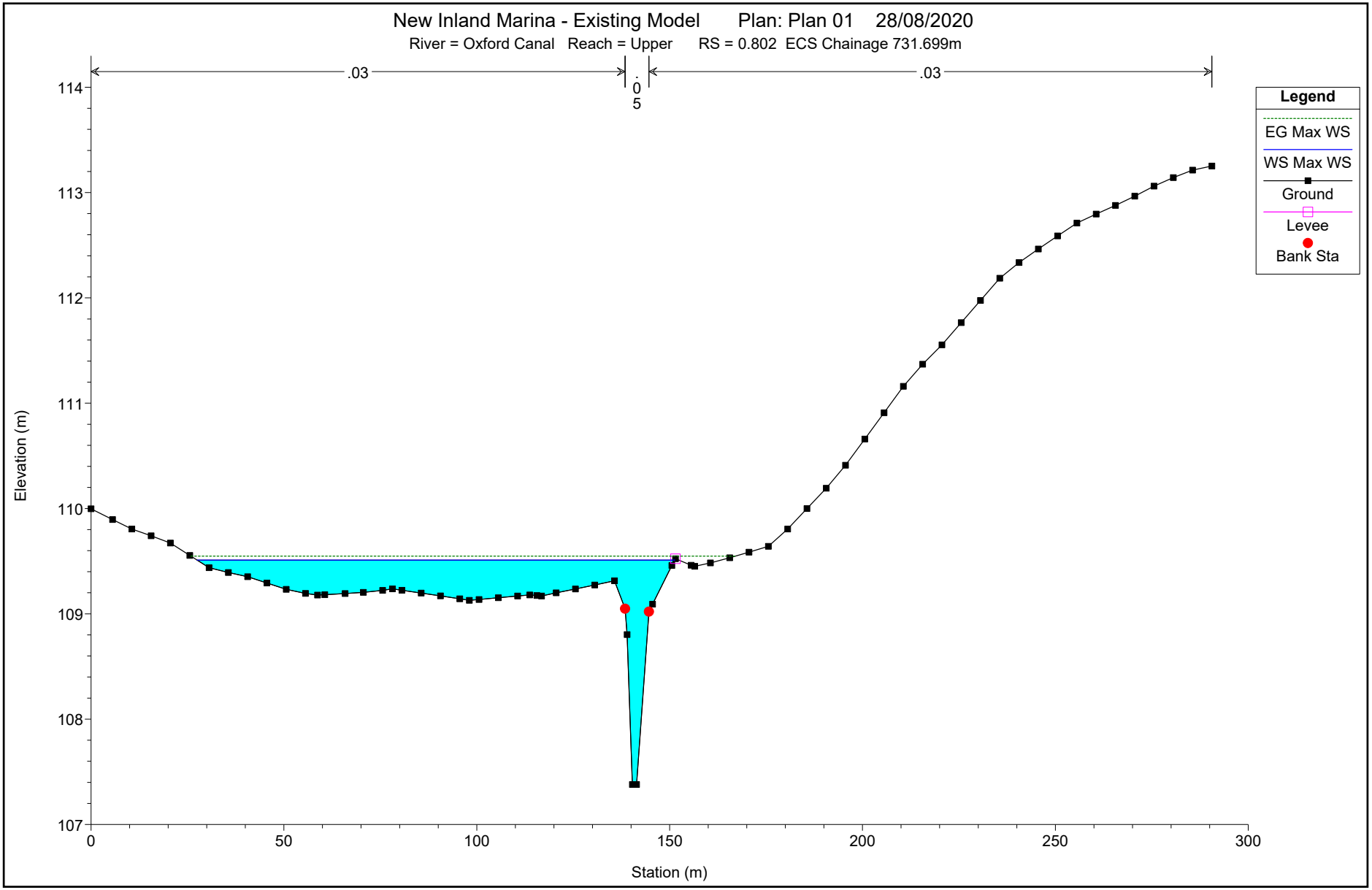

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.2480*
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
114
113
112
111
110
109
-50
0
50
100
150
200
250
300
Station (m)

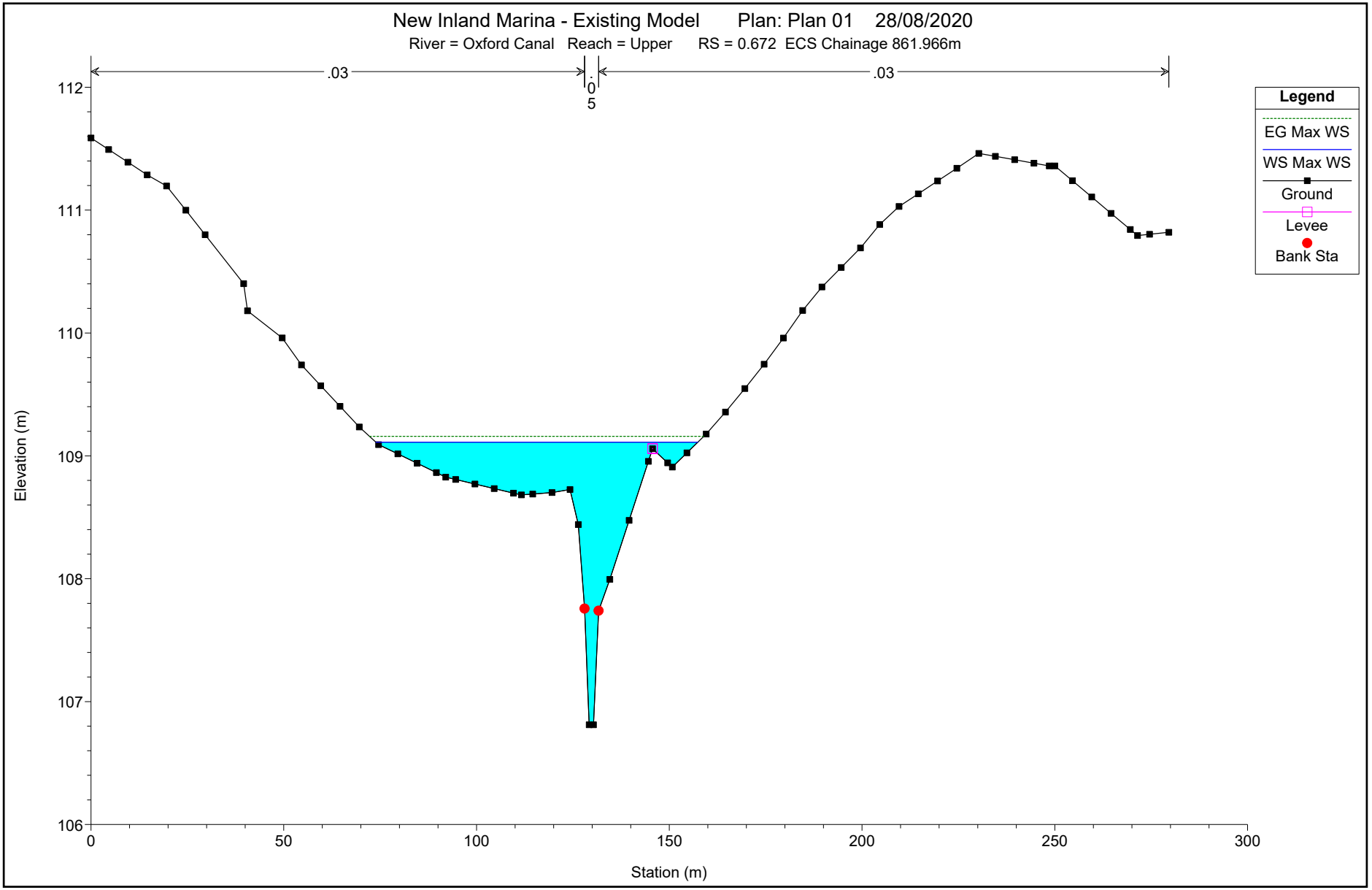

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.192 ECS Chainage 342.527m
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
113.0
112.5
112.0
111.5
111.0
110.5
110.0
109.5
109.0
0
50
100
150
200
250
300
Station (m)

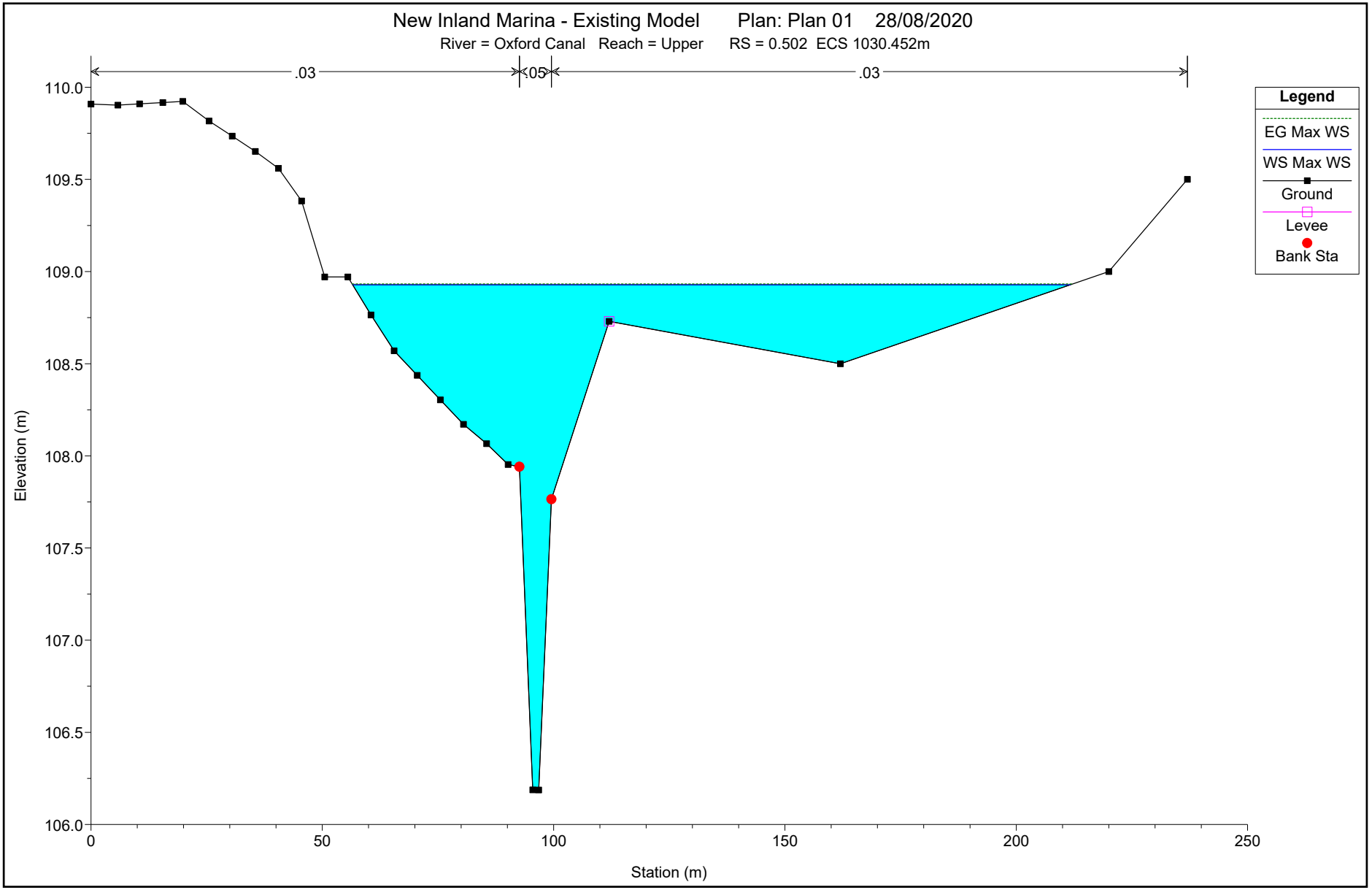

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.112 ECS Chainage 422.838m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
112.5
112.0
111.5
111.0
110.5
110.0
109.5
109.0
108.5
0
50
100
150
200
250
300

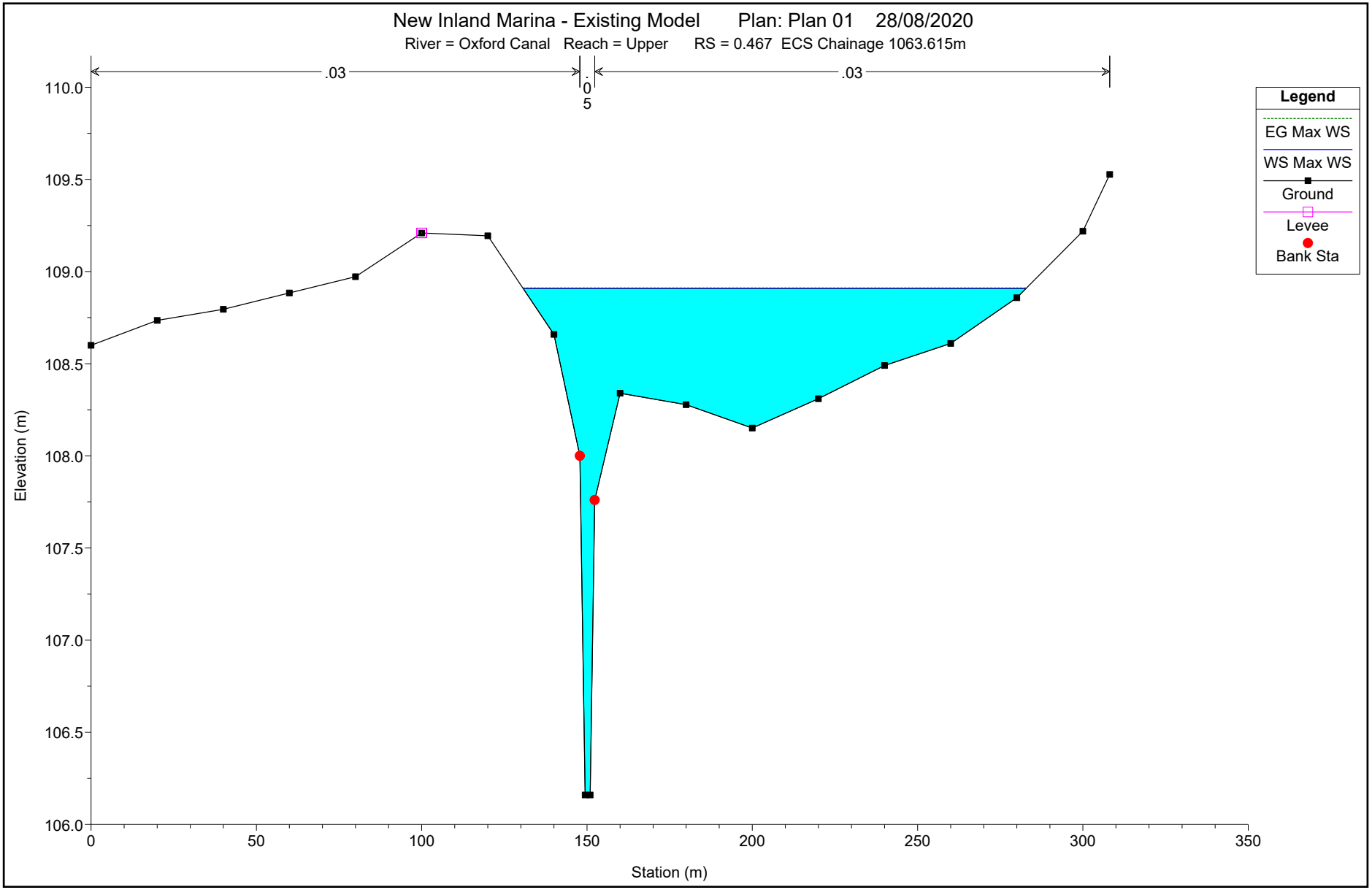

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 1.022 ECS Chainage 511.218m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
114
113
112
111
110
109
108
0
50
100
150
200
250
300
Station (m)

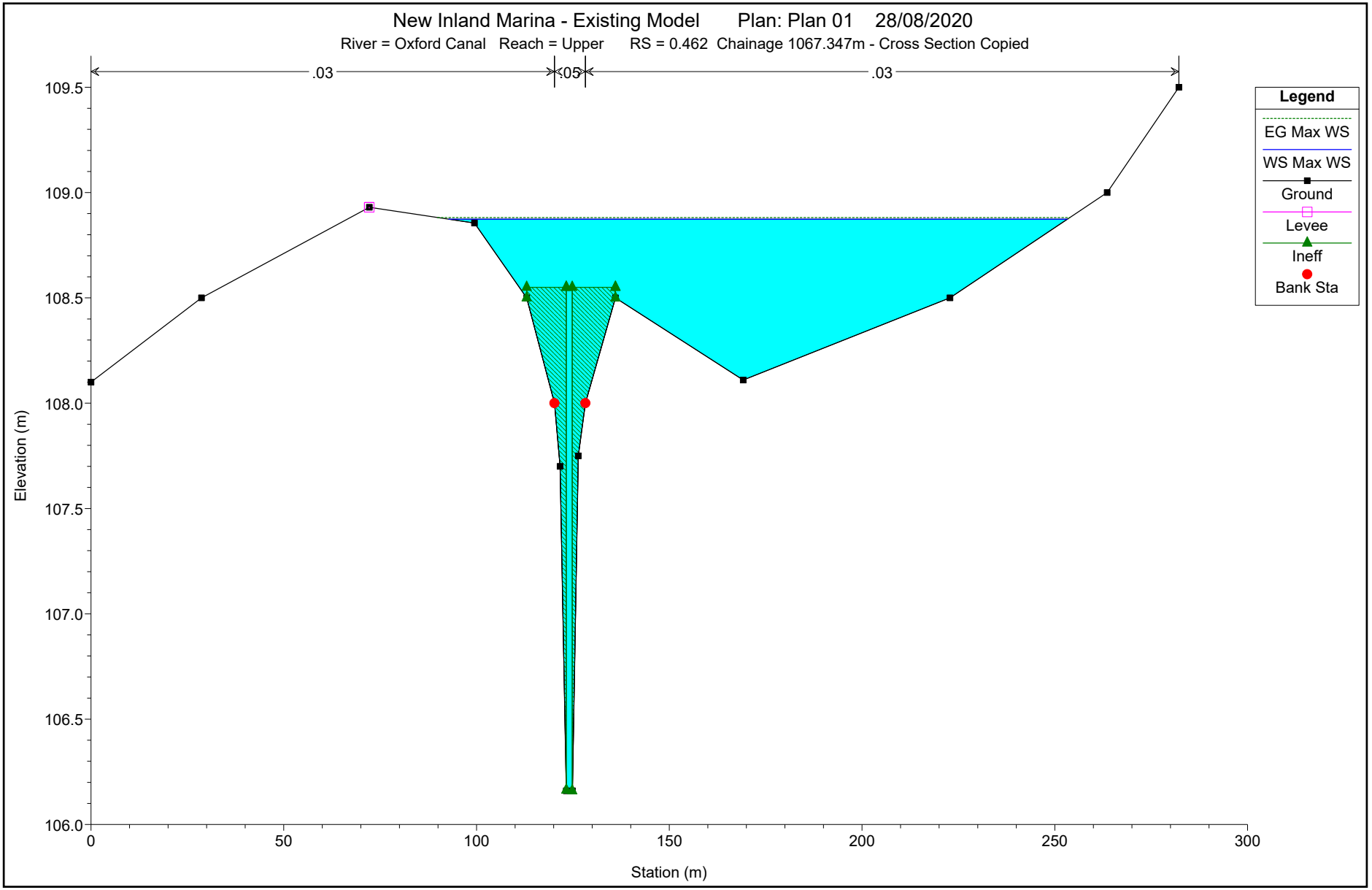

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.922 ECS Chianage 612.244m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
114
113
112
111
110
109
108
107
0
50
100
150
200
250
300
Station (m)

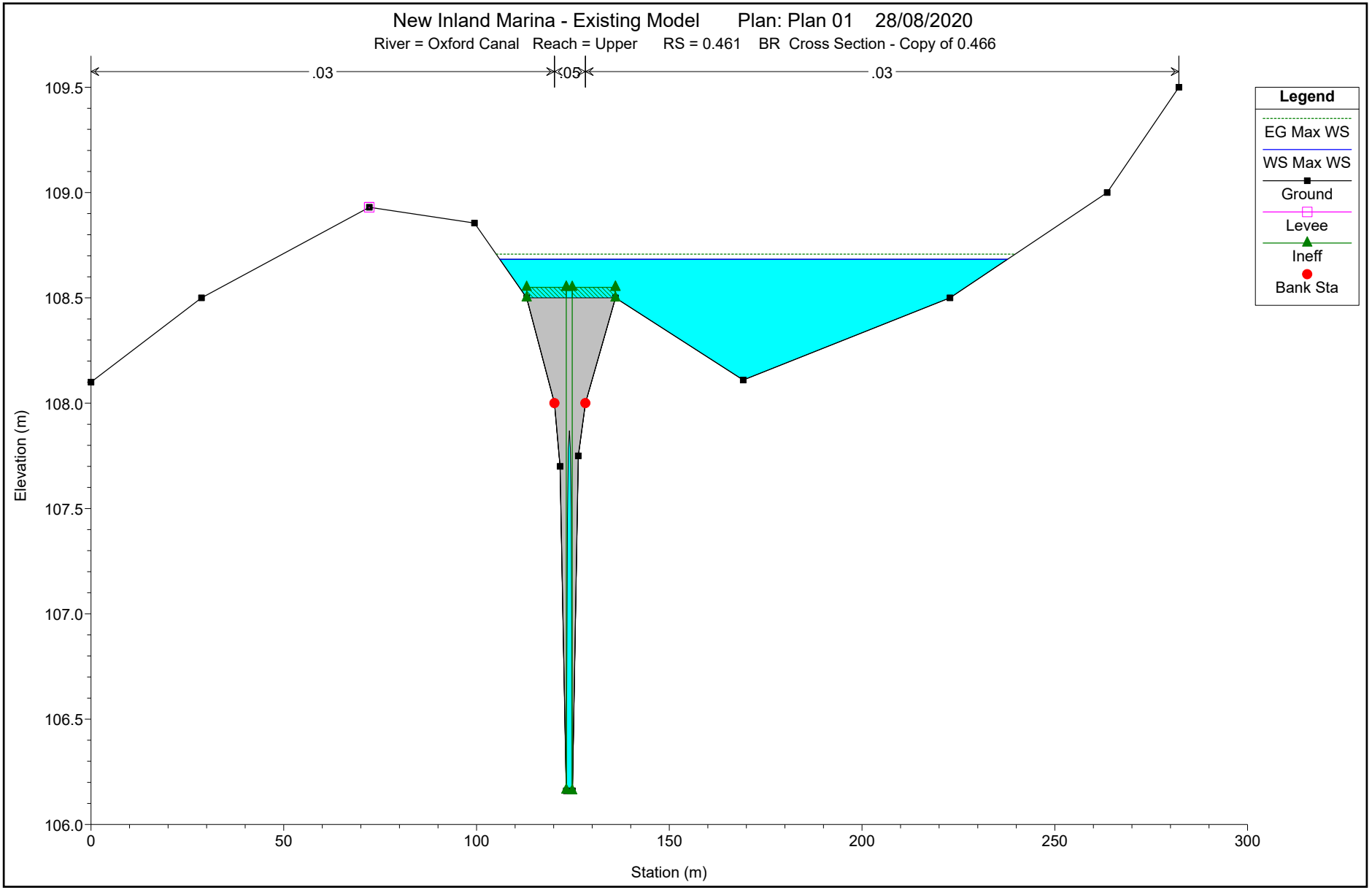

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.802 ECS Chainage 731.699m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
114
113
112
111
110
109
108
107
0
50
100
150
200
250
300
Station (m)

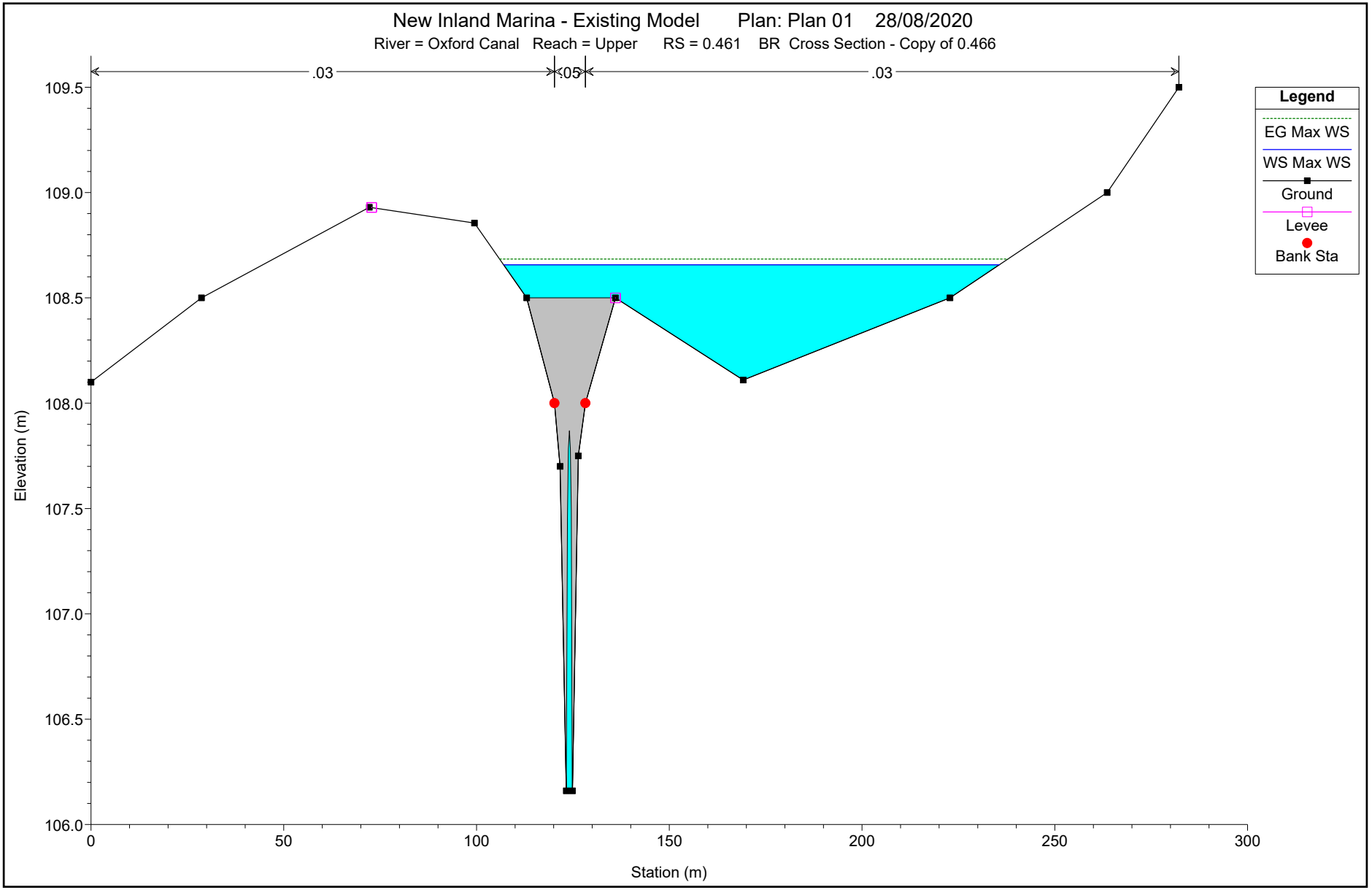

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.672 ECS Chainage 861.966m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
112
111
110
109
108
107
106
0
50
100
150
200
250
300
Station (m)

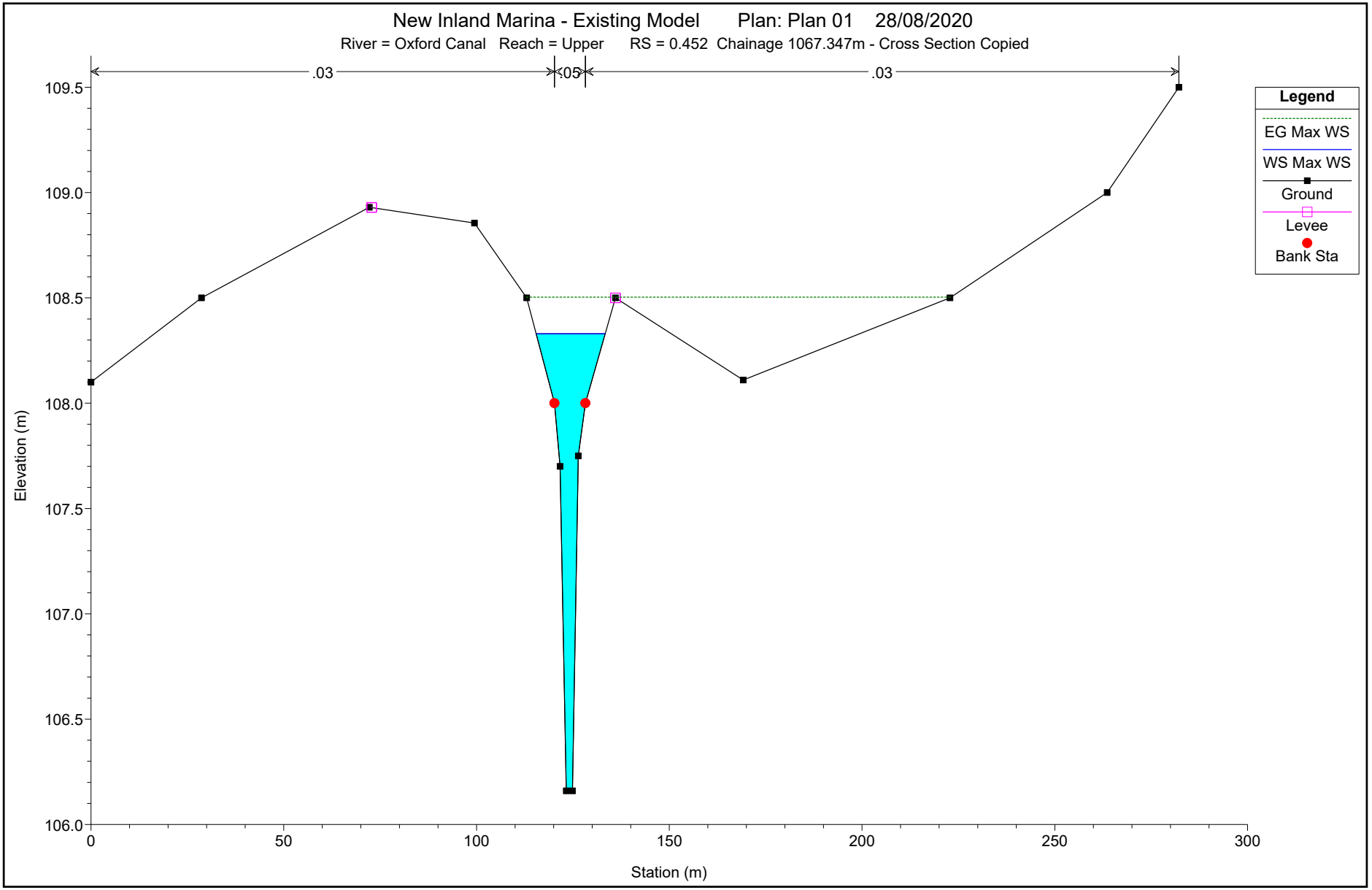

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.502 ECS 1030.452m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
110.0
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)

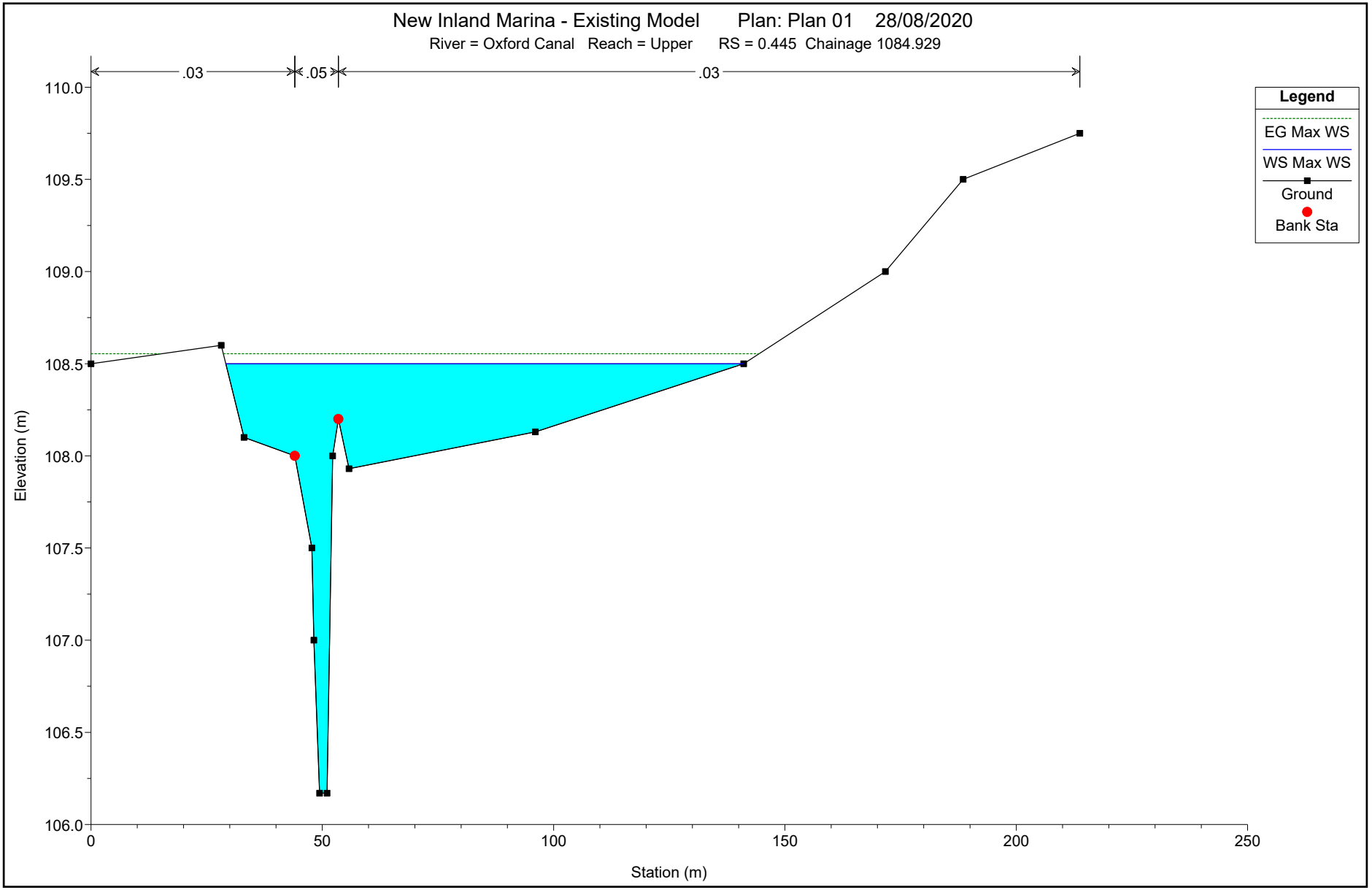

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.467 ECS Chainage 1063.615m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
110.0
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
300
350
Station (m)

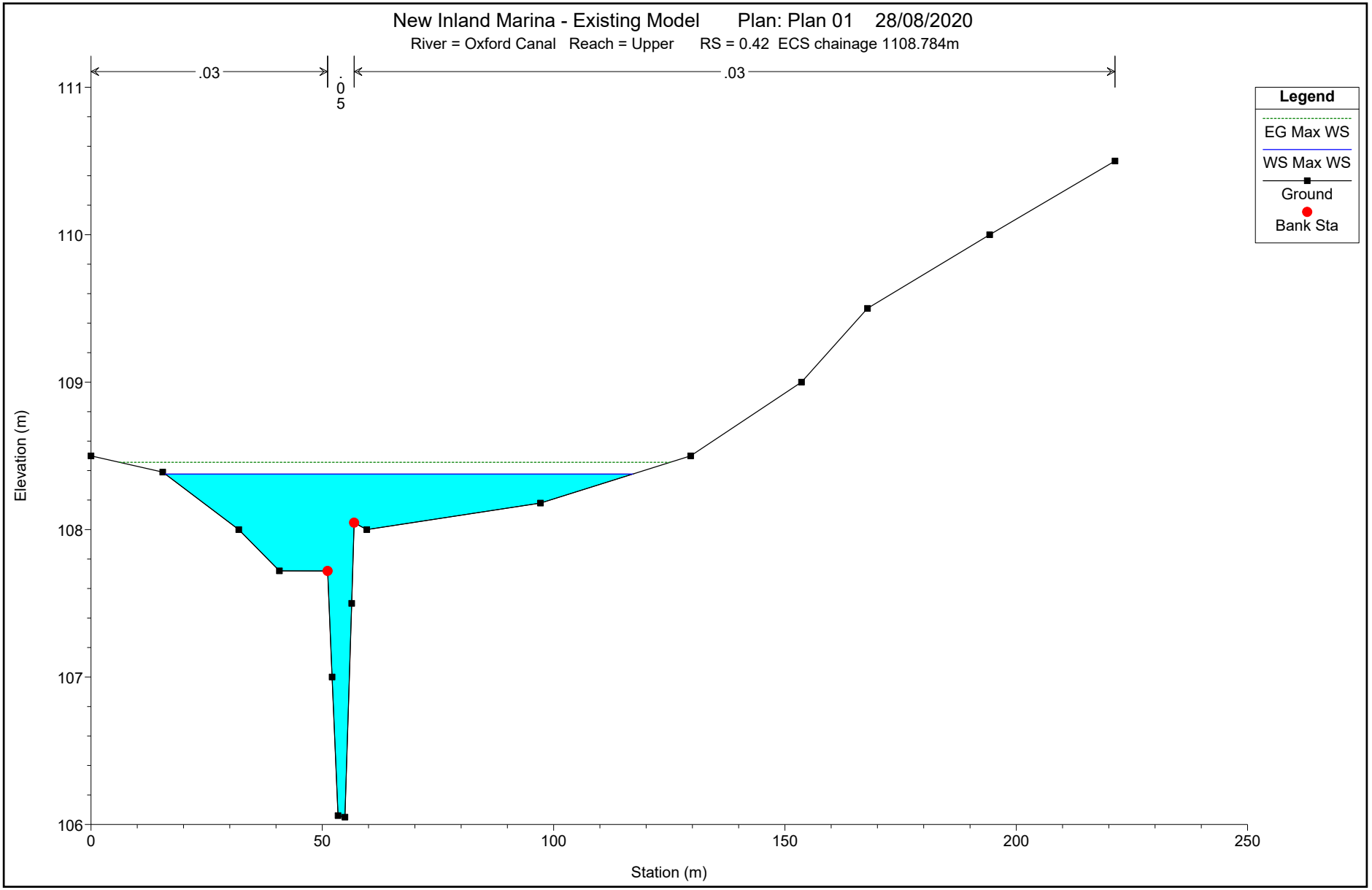

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.462 Chainage 1067.347m - Cross Section Copied
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
300
Station (m)

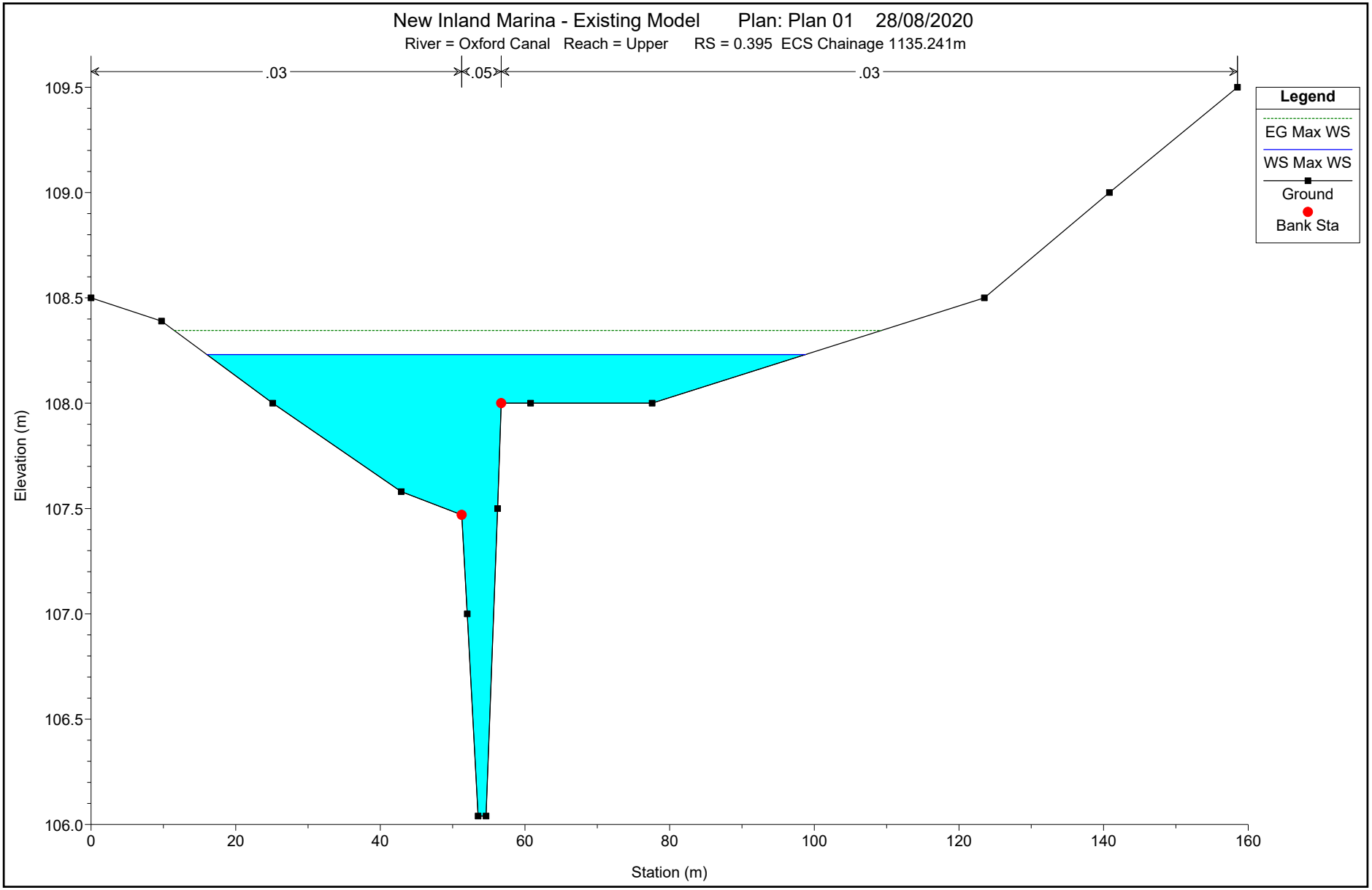

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.461 BR Cross Section - Copy of 0.466
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
300
Station (m)

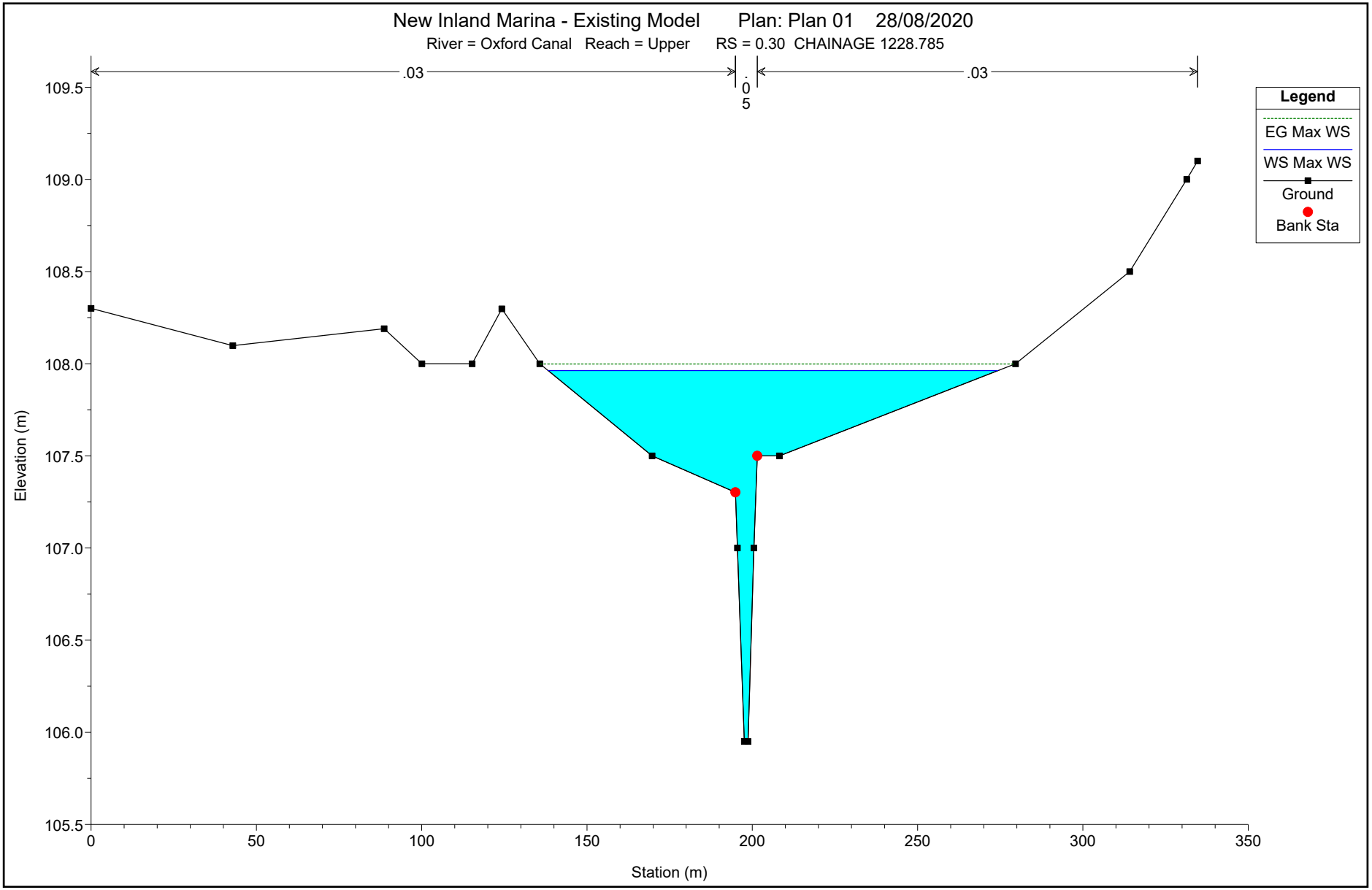

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.461 BR Cross Section - Copy of 0.466
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
300
Station (m)

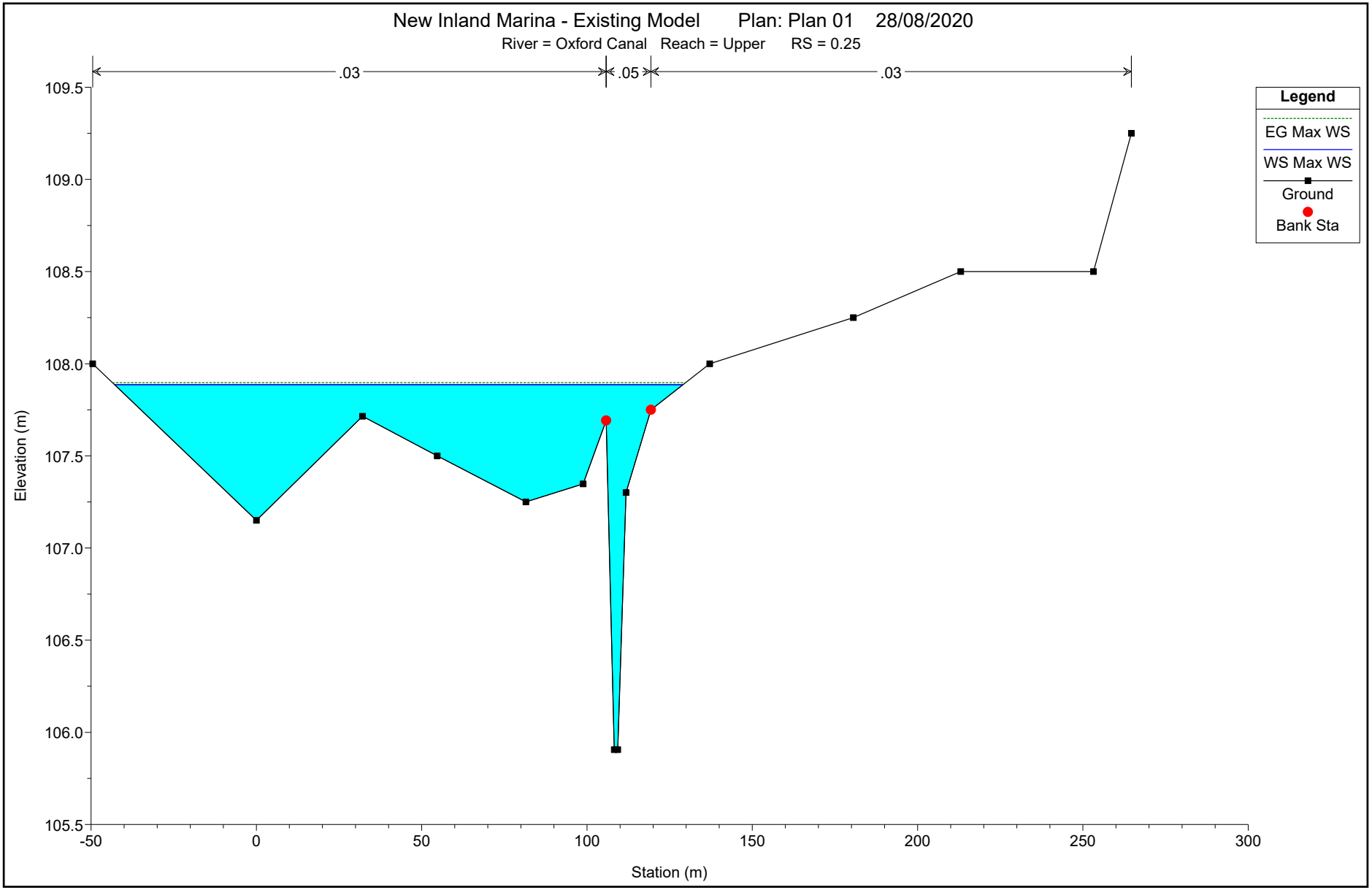

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.452 Chainage 1067.347m - Cross Section Copied
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
300
Station (m)

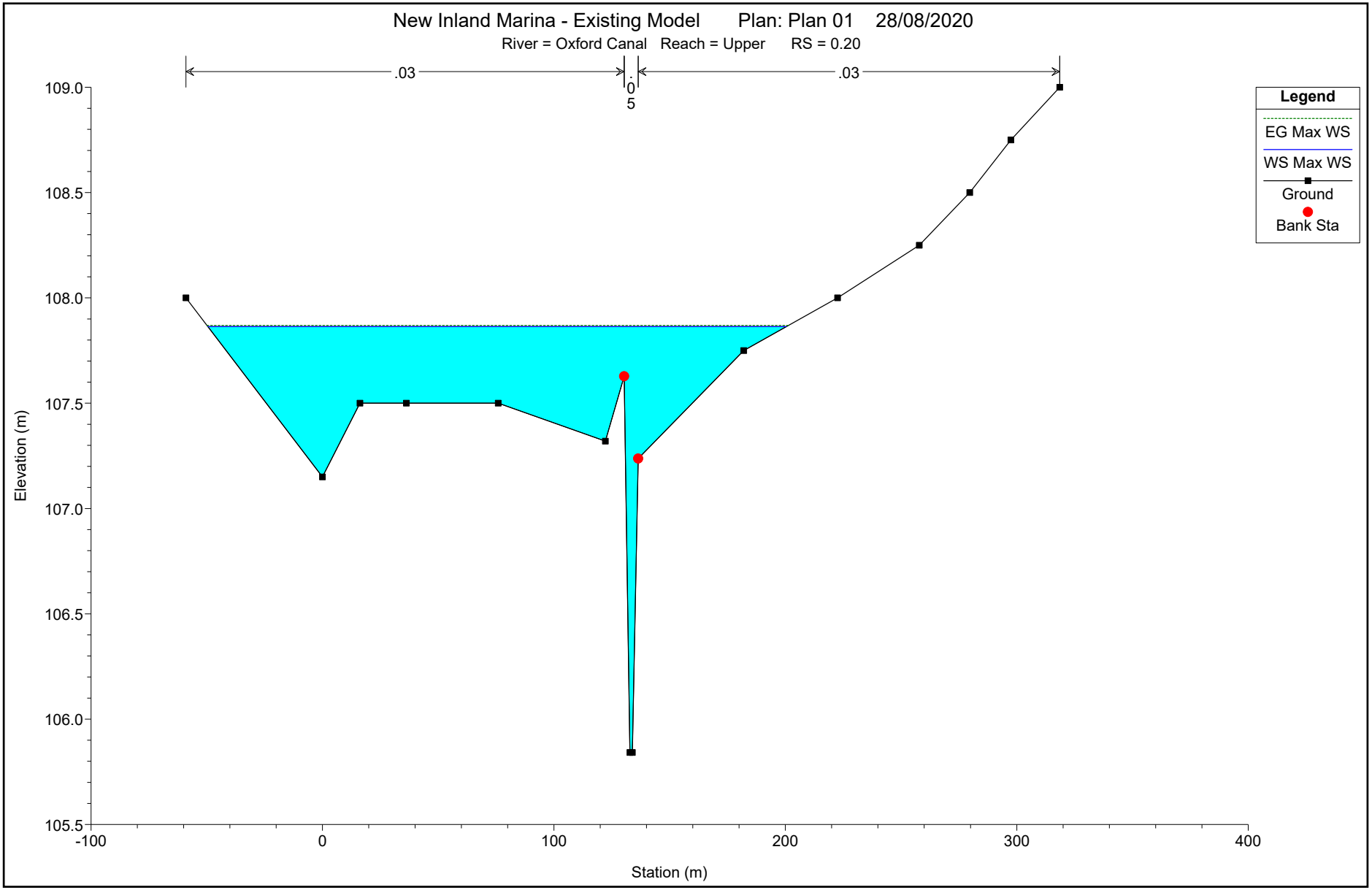

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.445 Chainage 1084.929
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
110.0
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)

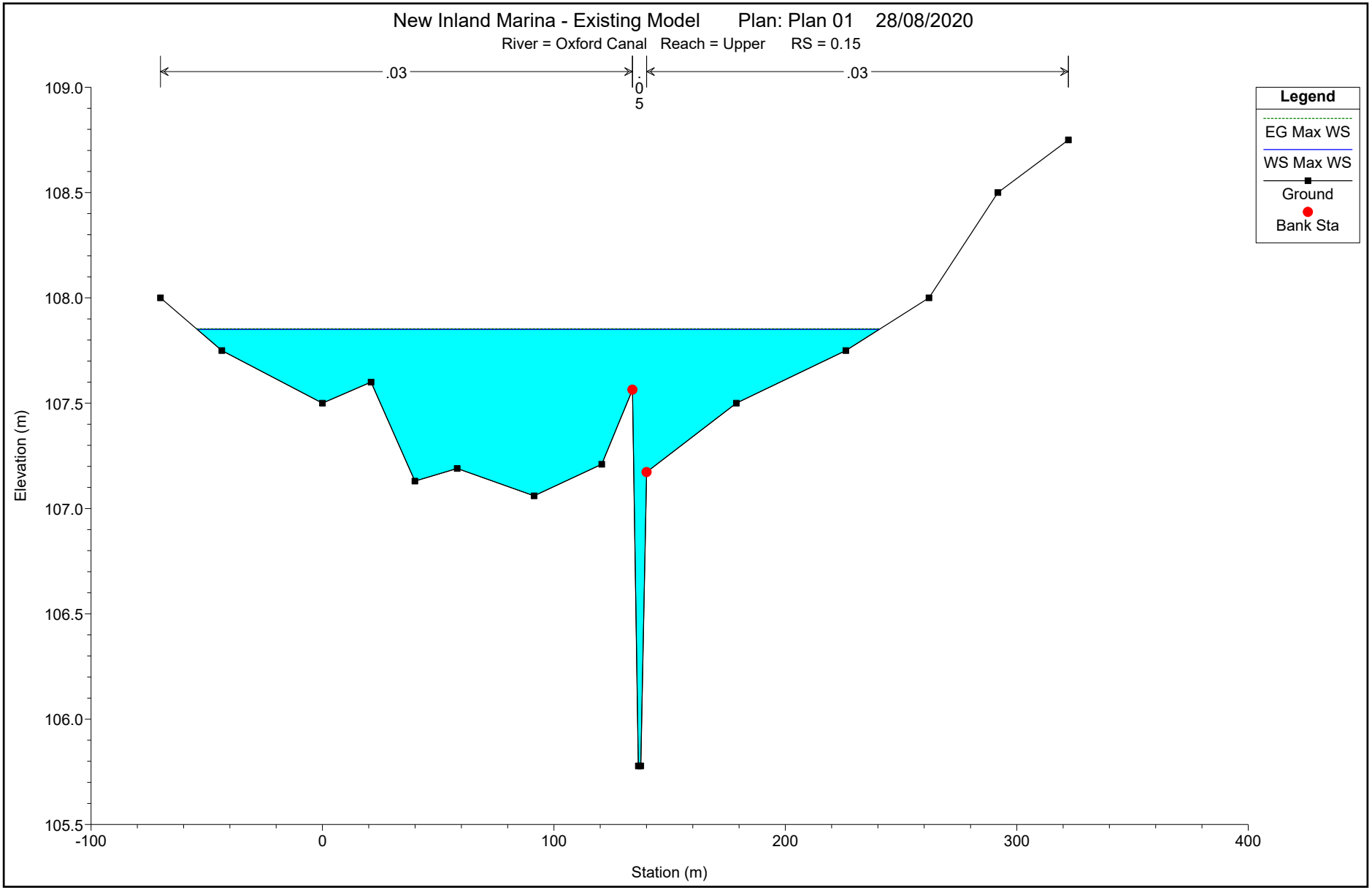

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.42 ECS chainage 1108.784m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
111
110
109
108
107
106
0
50
100
150
200
250
Station (m)

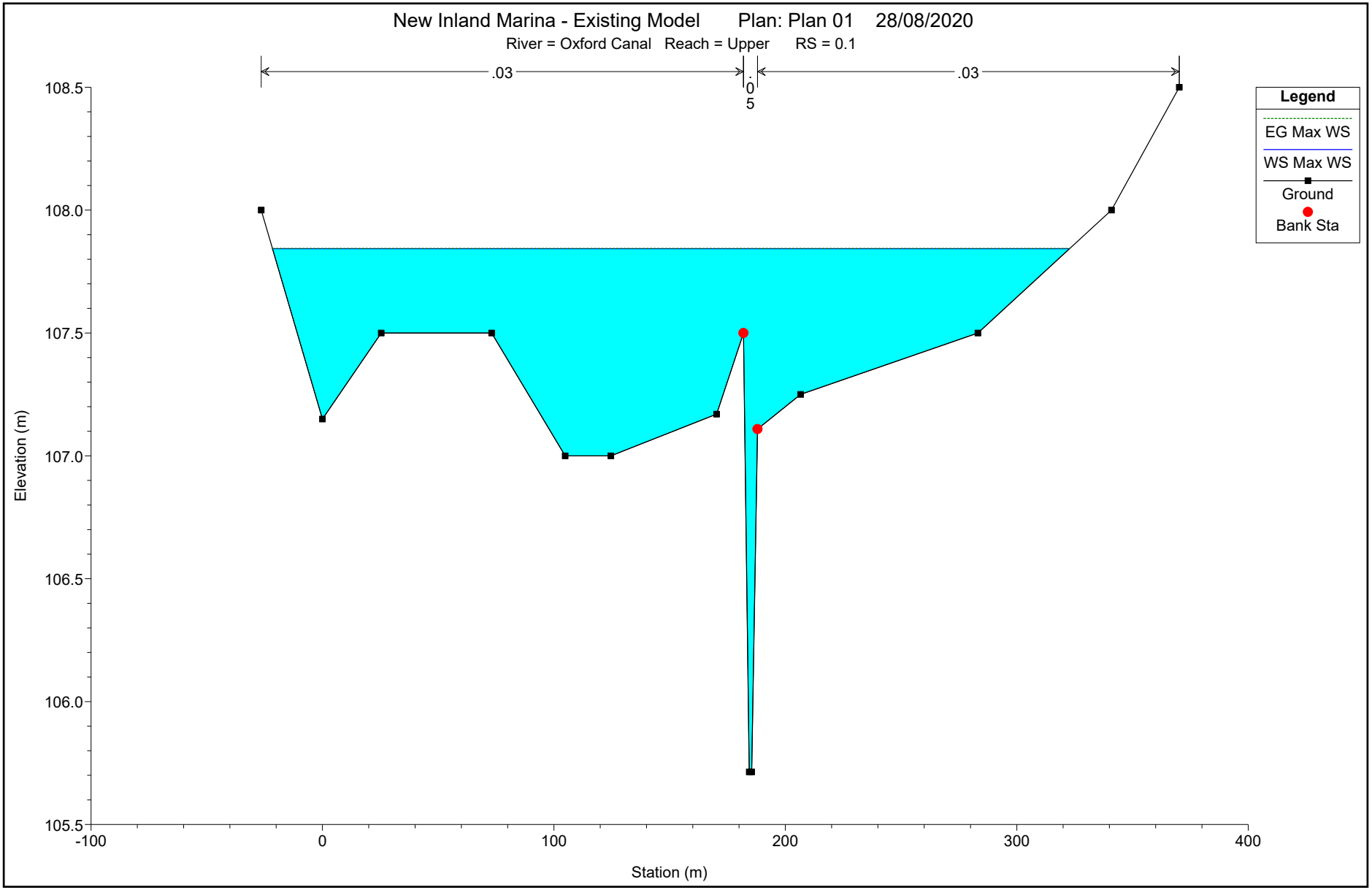

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.395 ECS Chainage 1135.241m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
20
40
60
80
100
120
140
160
Station (m)

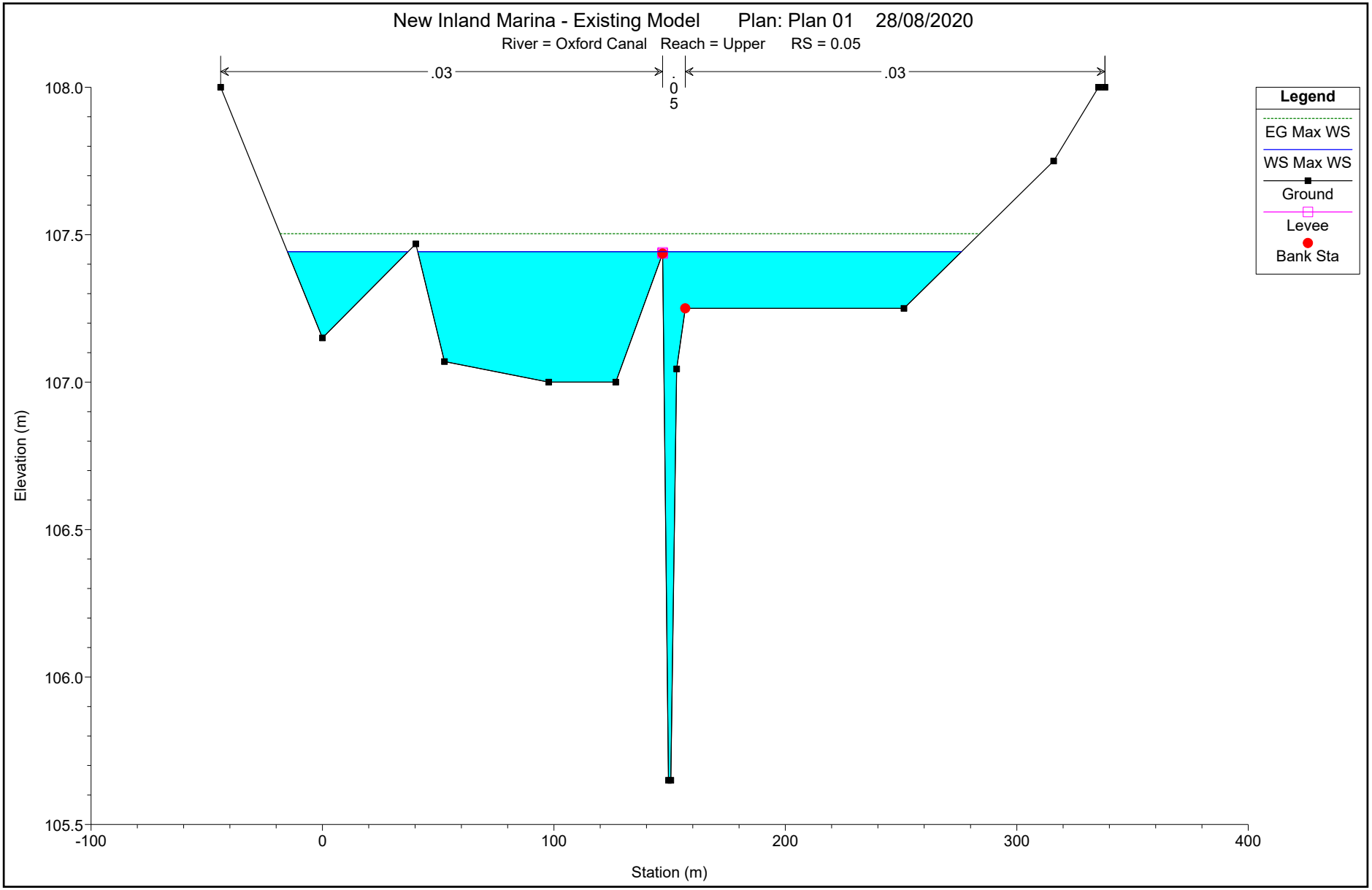

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.30 CHAINAGE 1228.785
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
0
50
100
150
200
250
300
350
Station (m)

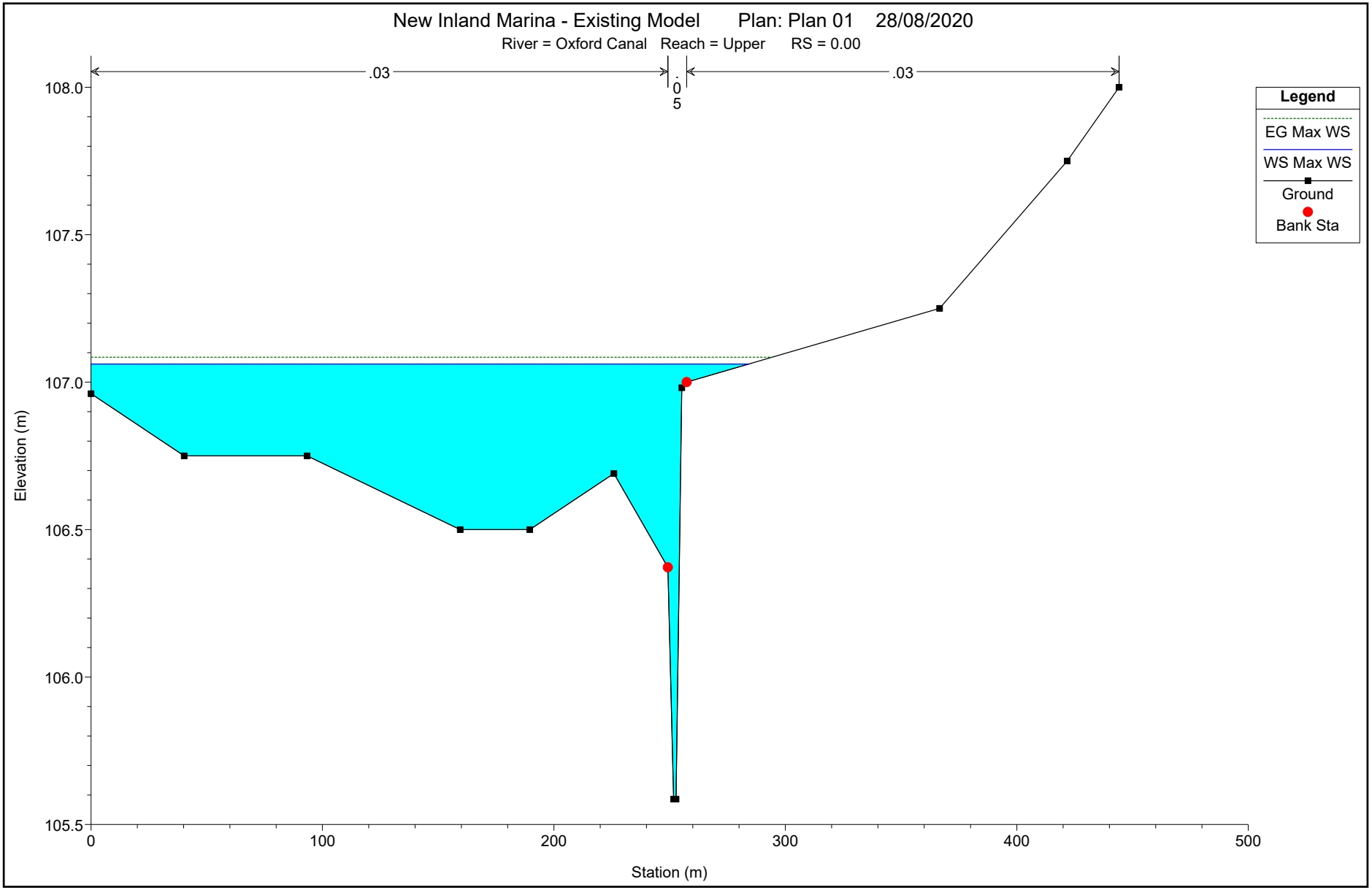

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.25
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-50
0
50
100
150
200
250
300
Station (m)


New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.20
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)


New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.15
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)

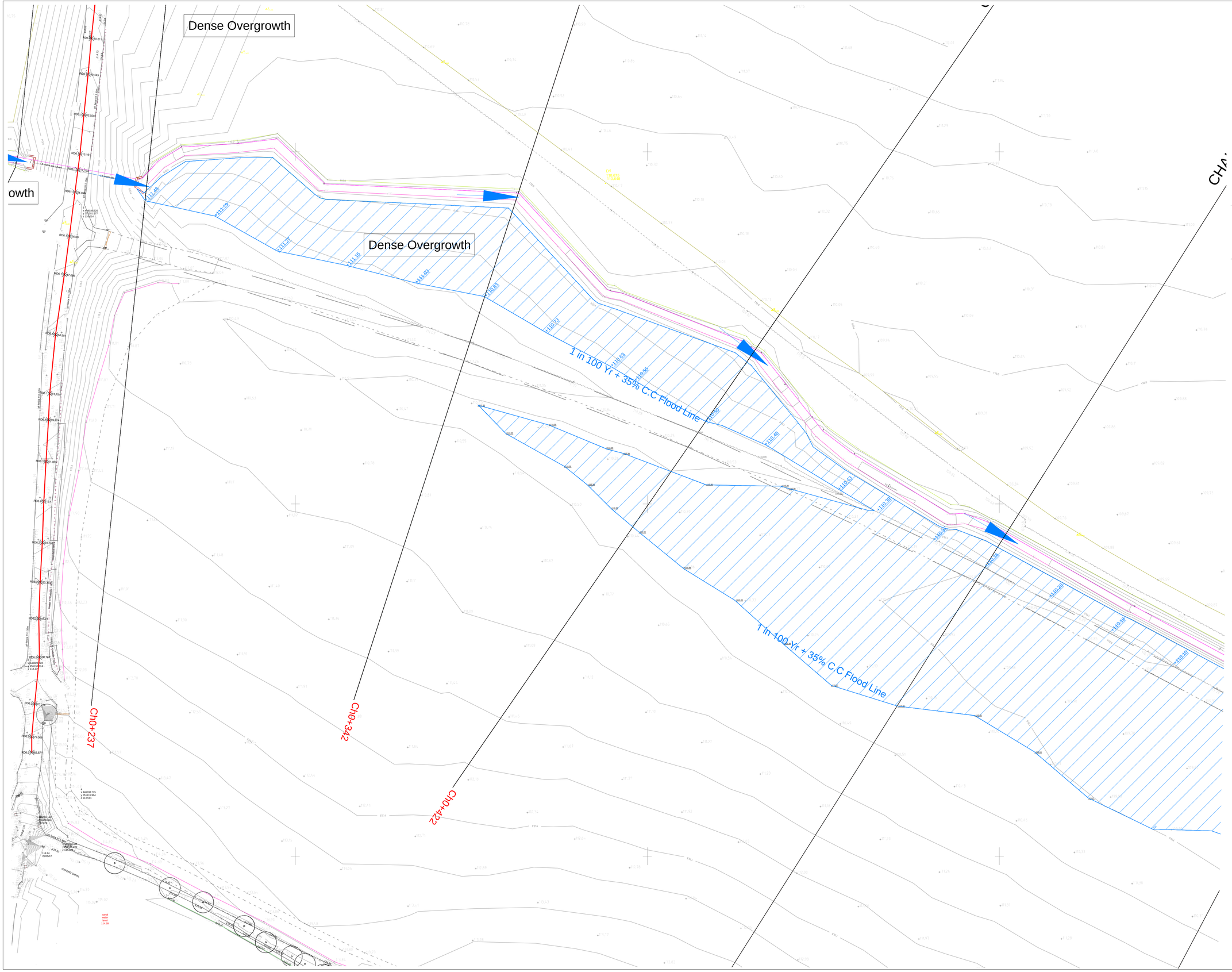

New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.1
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)


New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.05
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)


New Inland Marina - Existing Model Plan: Plan 01 28/08/2020
River = Oxford Canal Reach = Upper RS = 0.00
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
108.0
107.5
107.0
106.5
106.0
105.5
0
100
200
300
400
500
Station (m)

APPENDIX 14

PRE-DEVELOPMENT 1 IN 100 YEAR PLUS 35% CLIMATE CHANGE FLOOD EXTENT



REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
C	29.08.20	UPDATED TO SUIT MODEL	SEC
B	19.06.2020	Revised Flood Extent	SEC
A	11.03.2020	Revised extent to unsteady flow	SEC

MTC
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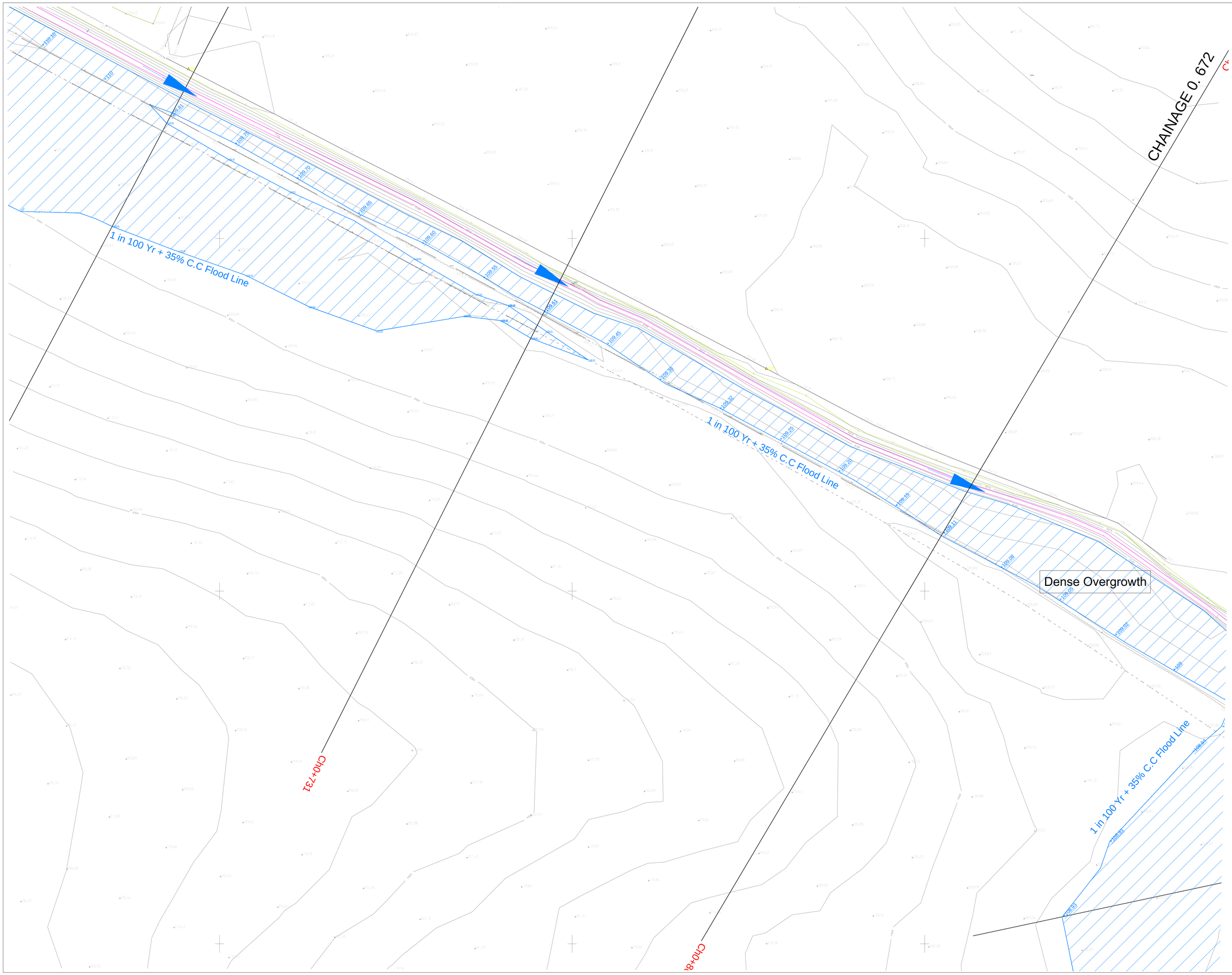
Ground Floor, 24 High Street
Whittlesford, Cambridgeshire, CB22 4LT
Tel (01223) 837270, fax (01223) 835648
E-mail office@mtcengineering.co.uk

TITLE
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY
1 in 100 Yr + 35% C.C FLOOD EXTENT
1 OF 3

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE 1:500@A1
APPR	DRAWING NO 2420-12 REV C



N
W E
S

1 in 100 Year Plus 35% Climate Change Flood Line

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
C	29.08.20	UPDATED TO SUIT MODEL	SEC
B	19.06.2020	Revised flood extent	SEC
A	11.03.2020	Revised to unsteady flow	SEC

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TITLE
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY
1 in 100 Yr + 35% C.C FLOOD EXTENT
2 OF 3

ORIG	DATE
S.E.C	29.11.2019
CHKD	SCALE 1:500@A1
APPR	DRAWING NO 2420-13 REV C

Dense Overgrowth

1 in 100 Yr + 35% C.C Flood Line

CHAINAGE 0.467

CHAINAGE 0. 462

CHAINAGE 0.445

CHAINAGE 0.420

CHAINAGE 0.395

Ch1+084

Ch1+108

Ch1+135

Ch1+067

108.500

108.000

107.750

107.500

1 in 100 Yr + 35% C.C Flood Line

N

W E

S

1 in 100 Year Plus 35% Climate Change Flood Line

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
C	29.08.20	UPDATED TO SUIT MODEL	SEC
B	19.06.2020	Revised flood extent	SEC
A	11.03.2020	Revised to suit unsteady flow	SEC

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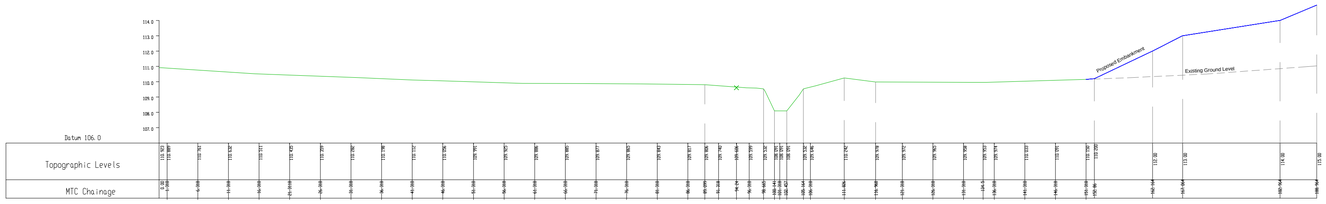
TITLE NEW INLAND MARINA,
ON LAND AT GLEBE FARM
CLAYDON, BANBURY
1 in 100 Yr + 35% C.C
FLOOD EXTENT
3 OF 3

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE 1:500@A1
APPR	DRAWING NO 2420-14 REV C

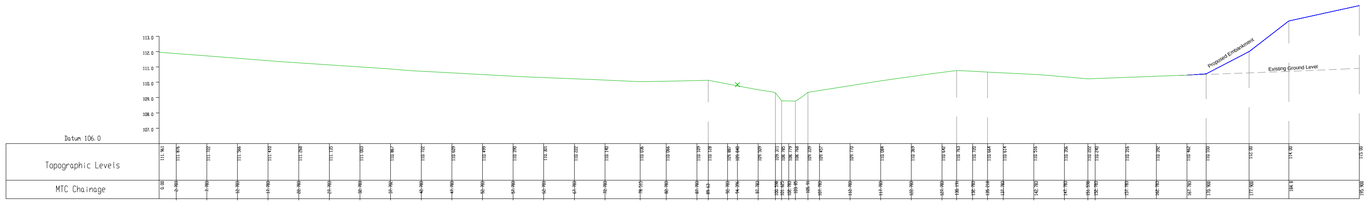
APPENDIX 15

POST DEVELOPMENT MODEL CROSS SECTIONS



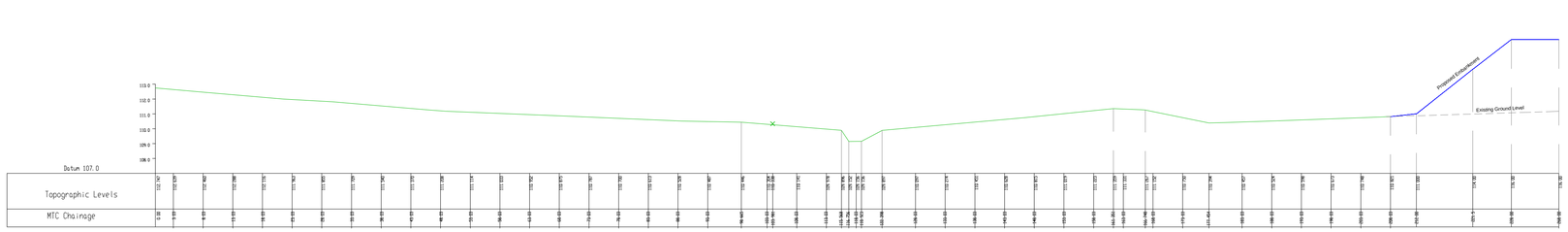
Chainage 511.218m (446301.5E 251190.9N)

MTC CHAINAGE 1.022



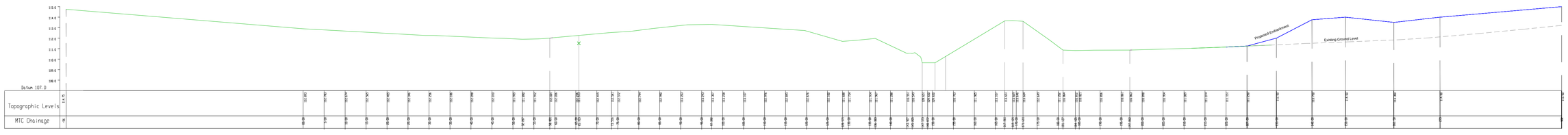
Chainage 422.838m (446230.0E 251242.9N)

MTC CHAINAGE 1.112



Chainage 342.527m (446162.9E 251287.0N)

MTC CHAINAGE 1.192



Chainage 237.386m (446057.9E 251291.8N)

MTC CHAINAGE 1.304

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR

MTC
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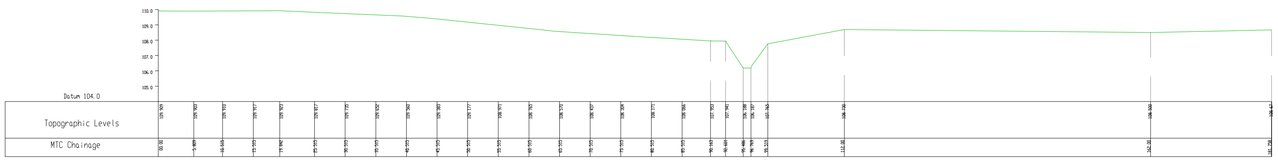
TITLE

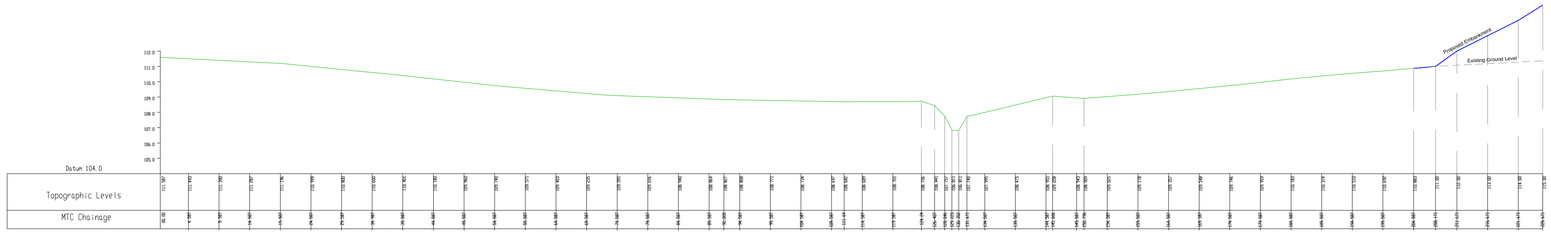
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY POST DEVELOPMENT CROSS SECTION 4 OF 4

ORIG	DATE
S.E.C	29.11.2019
CHKD	SCALE H 1:500 V1:200 @A1
APPR	DRAWING NO 2420-21 REV



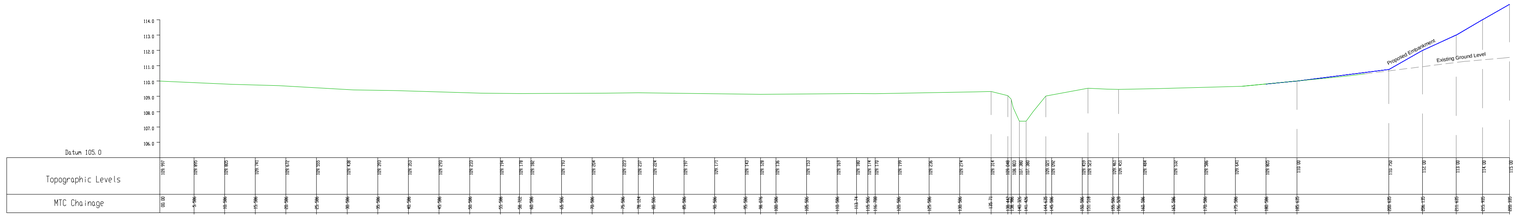
Chainage 1030.452m (446751.5E 250933.8N)

MTC CHAINAGE 0.502



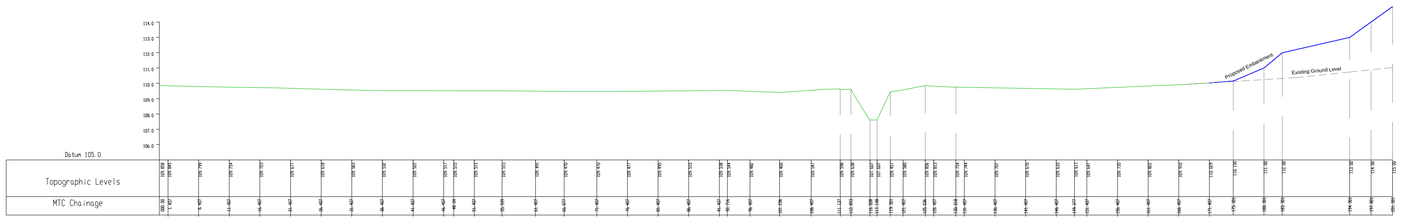
Chainage 861.996m (446613.1E 251029.9N)

MTC CHAINAGE 0.672



Chainage 731.699m (446496.5E 251088.0N)

MTC CHAINAGE 0.802



Chainage 612.244m (446390.1E 251142.4N)

MTC CHAINAGE 0.992

REV	DATE	DESCRIPTION/REASON FOR ISSUE	
A	28.08.20	LAKE REMOVED	SEC

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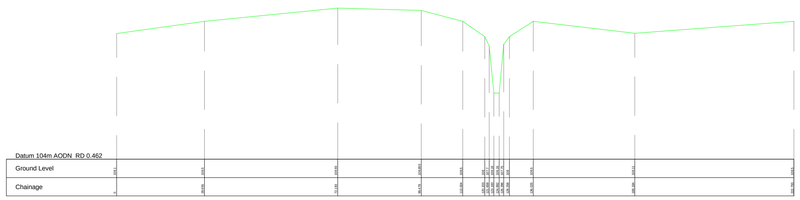
TITLE

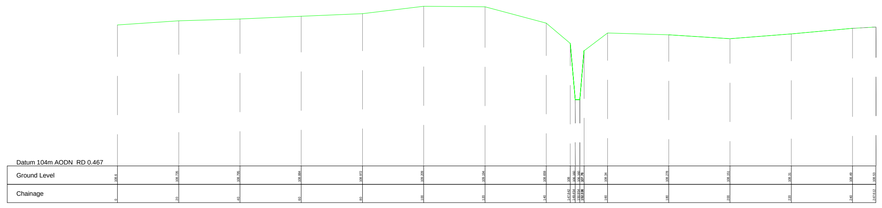
NEW INLAND MARINA,
ON LAND AT GLEBE FARM
CLAYDON, BANBURY
POST DEVELOPMENT CROSS SECTION
3 OF 4

ORIG	DATE
S.E.C	29.11.2019
CHKD	SCALE H 1:500 V1:200 @A1
APPR	DRAWING NO 2420-20 REV A



Chainage 1067.347m (446774.3E 250906.6N)

MTC CHAINAGE 0.462



Chainage 1063.615m (446774.9E 250910.3N)

MTC CHAINAGE 0.467

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
A	28.08.20	REMOVED LAKE	SEC

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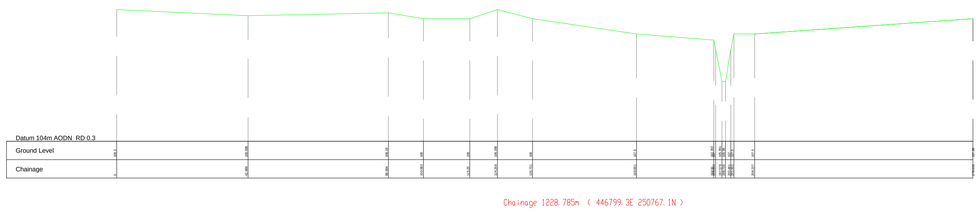
TITLE

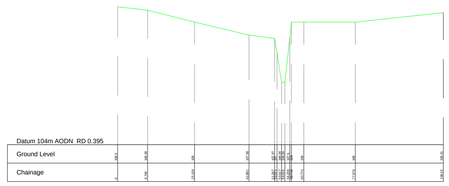
NEW INLAND MARINA,
ON LAND AT GLEBE FARM
CLAYDON, BANBURY
POST DEVELOPMENT CROSS SECTION
2 OF 4

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE H 1:100 V1:100 @A1
APPR	DRAWING NO 2420-19 REV A



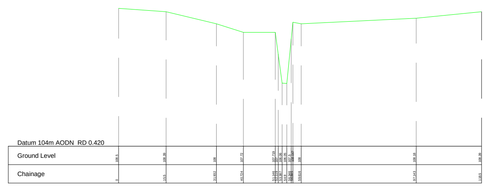
Chainage 1228.785m (446799.3E 250767.1N)

MTC CHAINAGE 0.300



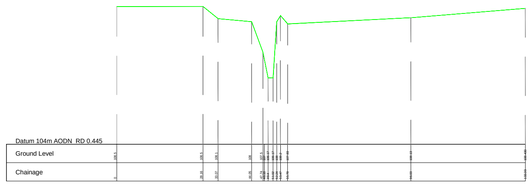
Chainage 1135.241m (446750.3E 250846.8N)

MTC CHAINAGE 0.395



Chainage 1108.784m (446749.8E 250873.2N)

MTC CHAINAGE 0.420



Chainage 1084.929m (446763.9E 250892.5N)

MTC CHAINAGE 0.445

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
A	28.08.20	REMOVED LAKE	SEC

ENGINEERING
MTC Engineering (Cambridge) Ltd.
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Tel (01223) 837270, fax (01223) 835648
E-mail office@mtcengineering.co.uk

TITLE
NEW INLAND MARINA,
ON LAND AT GLEBE FARM
CLAYDON, BANBURY
POST DEVELOPMENT CROSS SECTION
1 OF 4

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE H 1:100 V1:100 @A1
APPR	DRAWING NO 2420-18 REV A

APPENDIX 16

POST-DEVELOPMENT 1 IN 100 YEAR PLUS 35% CLIMATE CHANGE RESULTS & CROSS SECTIONS

HEC-RAS Plan: 01 River: Oxford Canal Reach: Upper Profile: Max WS

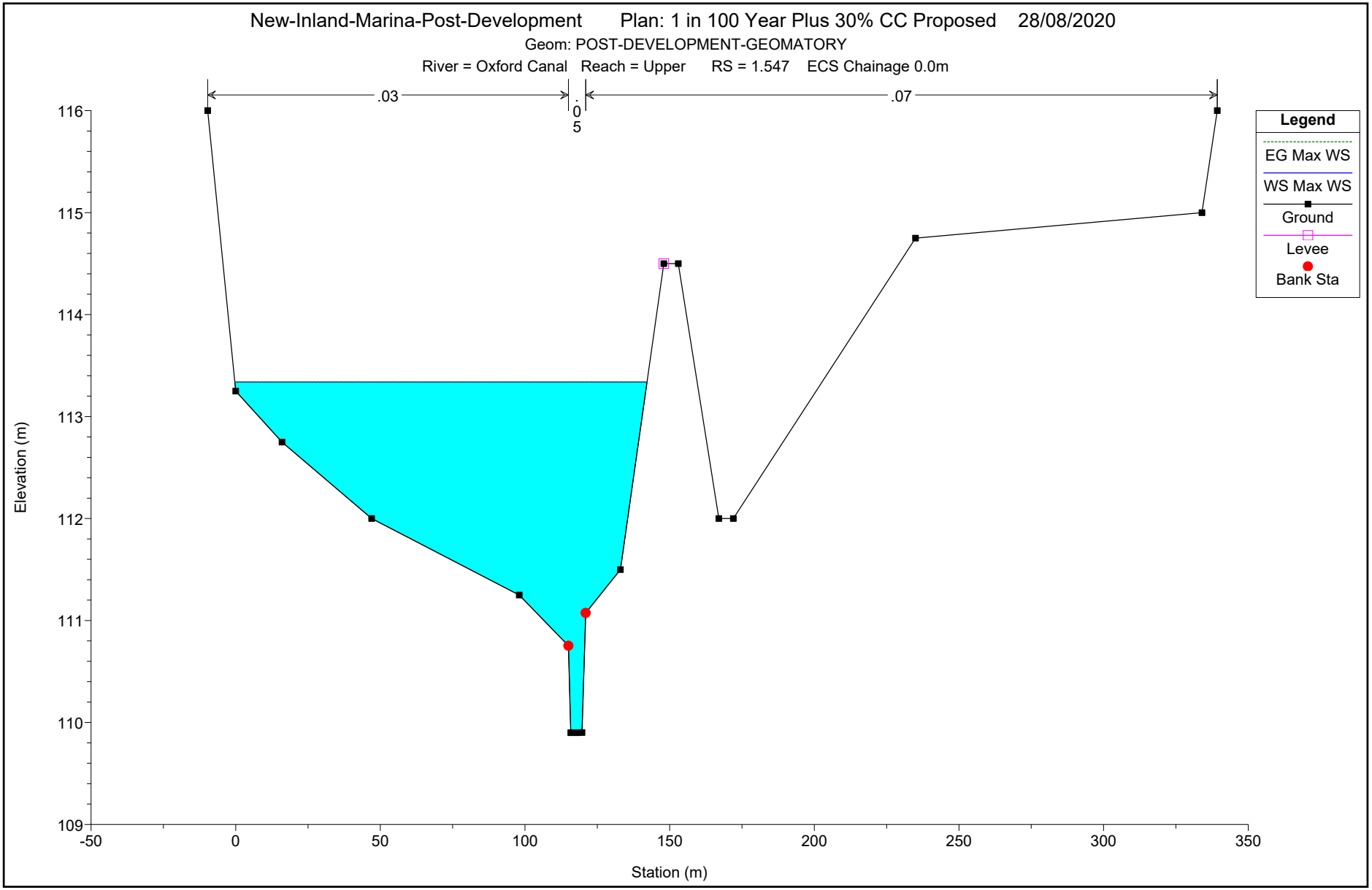
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	1.547	Max WS	33.42	109.90	113.34		113.34	0.000017	0.16	214.91	142.50	0.03
Upper	1.5287*	Max WS	33.42	109.83	113.34		113.34	0.000019	0.17	207.45	139.13	0.03
Upper	1.5103*	Max WS	33.42	109.75	113.34		113.34	0.000019	0.17	209.05	135.37	0.03
Upper	1.492	Max WS	33.41	109.68	113.34		113.34	0.000013	0.13	347.20	305.94	0.02
Upper	1.4740*	Max WS	33.41	109.60	113.34		113.34	0.000013	0.14	332.53	297.50	0.02
Upper	1.4560*	Max WS	33.42	109.53	113.34		113.34	0.000013	0.14	319.38	289.13	0.03
Upper	1.4380*	Max WS	33.42	109.46	113.34		113.34	0.000016	0.17	209.08	133.08	0.03
Upper	1.4200*	Max WS	33.41	109.39	113.34		113.34	0.000015	0.16	209.65	132.14	0.03
Upper	1.402	Max WS	33.42	109.32	113.34		113.34	0.000014	0.16	211.56	131.54	0.03
Upper	1.3870*	Max WS	33.41	109.27	113.34		113.34	0.000009	0.13	314.57	256.48	0.02
Upper	1.372	Max WS	33.41	109.23	113.34		113.34	0.000009	0.13	247.76	141.36	0.02
Upper	1.342	Max WS	33.41	109.20	113.29	113.16	113.38	0.001520	1.99	30.88	156.75	0.31
Upper	1.341		Bridge									
Upper	1.312	Max WS	33.41	109.20	111.57		111.59	0.001254	1.05	70.73	97.14	0.23
Upper	1.304	Max WS	33.41	109.04	111.48		111.62	0.003640	1.72	22.62	19.21	0.41
Upper	1.2853*	Max WS	33.41	109.06	111.39		111.55	0.004317	1.84	21.78	19.96	0.44
Upper	1.2667*	Max WS	33.41	109.08	111.27		111.46	0.005374	1.99	20.75	20.88	0.49
Upper	1.2480*	Max WS	33.41	109.10	111.15		111.36	0.006732	2.16	21.16	29.64	0.55
Upper	1.2293*	Max WS	33.41	109.12	111.03		111.23	0.007725	2.24	21.93	32.55	0.58
Upper	1.2107*	Max WS	33.41	109.13	110.87		111.08	0.009359	2.35	22.96	40.18	0.63
Upper	1.192	Max WS	33.41	109.15	110.81		110.91	0.005435	1.80	38.17	80.86	0.48
Upper	1.1760*	Max WS	33.41	109.08	110.74		110.83	0.005355	1.79	37.26	78.18	0.48
Upper	1.1600*	Max WS	33.41	109.00	110.66		110.74	0.005113	1.75	36.50	75.68	0.47
Upper	1.1440*	Max WS	33.41	108.93	110.59		110.67	0.004588	1.67	36.16	73.55	0.45
Upper	1.1280*	Max WS	33.41	108.85	110.54		110.60	0.003707	1.53	36.58	72.20	0.41
Upper	1.112	Max WS	33.41	108.78	110.50		110.55	0.002570	1.30	37.99	72.03	0.34
Upper	1.0940*	Max WS	33.41	108.64	110.46		110.51	0.002501	1.29	38.04	76.25	0.33
Upper	1.0760*	Max WS	33.41	108.50	110.42		110.47	0.002304	1.24	39.12	83.13	0.32
Upper	1.0580*	Max WS	33.41	108.37	110.39		110.43	0.001850	1.13	45.91	115.43	0.28
Upper	1.0400*	Max WS	33.41	108.23	110.37		110.40	0.001312	0.96	51.26	120.14	0.24
Upper	1.022	Max WS	33.41	108.09	110.36		110.38	0.000856	0.79	58.28	127.32	0.19
Upper	1.0020*	Max WS	33.41	107.99	110.28		110.30	0.000908	0.80	58.39	134.51	0.19
Upper	0.9820*	Max WS	33.40	107.90	110.19		110.21	0.000971	0.81	58.34	142.03	0.20
Upper	0.9620*	Max WS	33.40	107.80	110.10		110.12	0.001058	0.82	57.86	149.49	0.20
Upper	0.9420*	Max WS	33.40	107.70	110.00		110.02	0.001257	0.85	55.82	157.89	0.22

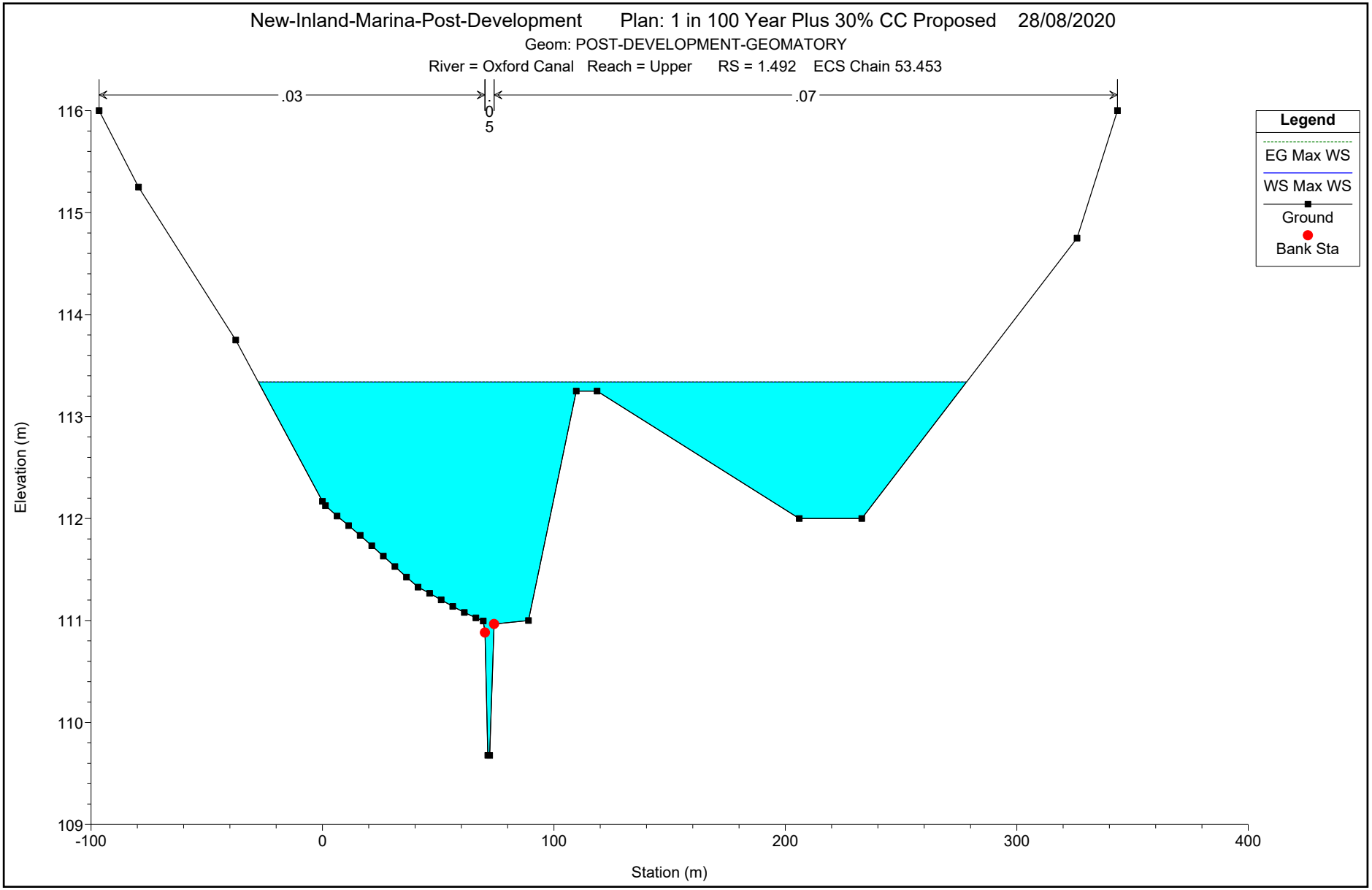
HEC-RAS Plan: 01 River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

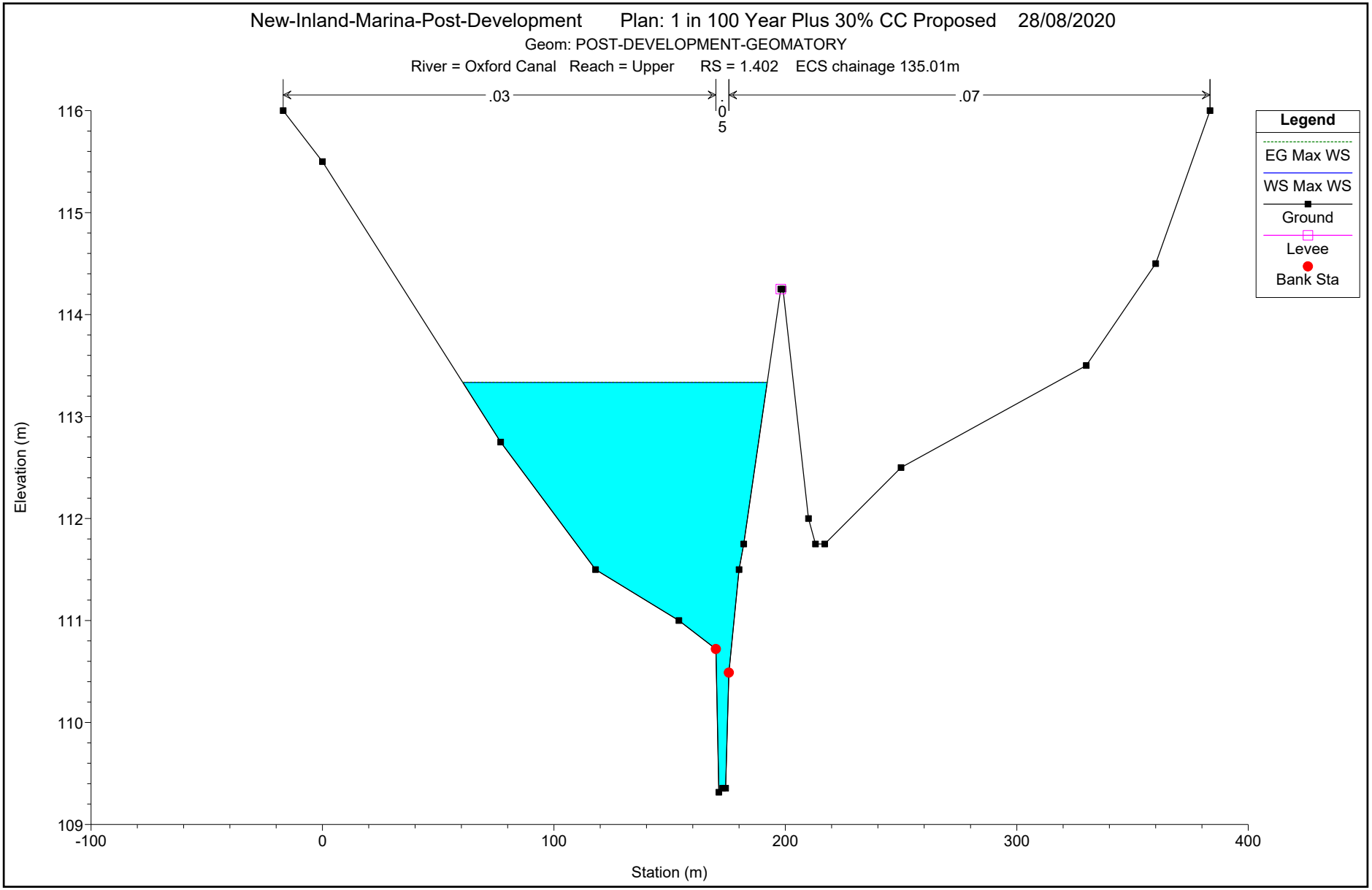
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.922	Max WS	33.40	107.61	109.81		109.86	0.003378	1.28	37.26	118.92	0.35
Upper	0.90200*	Max WS	33.40	107.57	109.75		109.80	0.003326	1.28	37.23	116.95	0.35
Upper	0.88200*	Max WS	33.40	107.53	109.70		109.75	0.003227	1.27	37.39	115.05	0.34
Upper	0.86200*	Max WS	33.40	107.49	109.65		109.70	0.003144	1.25	37.88	116.91	0.34
Upper	0.84200*	Max WS	33.40	107.46	109.60		109.64	0.003016	1.23	38.62	118.84	0.33
Upper	0.82200*	Max WS	33.40	107.42	109.55		109.60	0.002803	1.19	39.83	121.25	0.32
Upper	0.802	Max WS	33.39	107.38	109.51		109.55	0.002506	1.14	41.63	123.93	0.30
Upper	0.78343*	Max WS	33.39	107.30	109.46		109.51	0.003348	1.36	36.73	120.18	0.36
Upper	0.76486*	Max WS	33.39	107.22	109.39		109.46	0.003944	1.53	33.36	107.48	0.39
Upper	0.74629*	Max WS	33.39	107.14	109.32		109.40	0.004113	1.61	31.52	95.42	0.40
Upper	0.72771*	Max WS	33.39	107.05	109.25		109.33	0.003950	1.62	31.08	88.62	0.40
Upper	0.70914*	Max WS	33.39	106.97	109.19		109.27	0.003574	1.58	31.56	84.89	0.38
Upper	0.69057*	Max WS	33.39	106.89	109.14		109.20	0.003074	1.51	32.81	83.12	0.35
Upper	0.672	Max WS	33.39	106.81	109.10		109.15	0.002459	1.40	35.09	82.58	0.32
Upper	0.65311*	Max WS	33.39	106.74	109.06		109.11	0.002456	1.40	34.68	79.27	0.32
Upper	0.63422*	Max WS	33.39	106.67	109.02		109.08	0.002376	1.38	34.70	76.57	0.32
Upper	0.61533*	Max WS	33.39	106.60	108.98		109.04	0.002300	1.36	34.77	74.45	0.31
Upper	0.59644*	Max WS	33.39	106.53	108.94		109.00	0.002243	1.34	34.77	72.72	0.31
Upper	0.57756*	Max WS	33.39	106.46	108.91		108.96	0.002189	1.32	34.79	71.56	0.31
Upper	0.55867*	Max WS	33.39	106.40	108.87		108.92	0.002162	1.31	34.73	71.26	0.30
Upper	0.53978*	Max WS	33.39	106.33	108.83		108.88	0.002169	1.31	34.65	73.76	0.30
Upper	0.52089*	Max WS	33.39	106.26	108.79		108.85	0.002199	1.32	36.00	105.71	0.31
Upper	0.502	Max WS	33.39	106.19	108.77		108.81	0.001384	1.05	46.32	121.35	0.24
Upper	0.501		Lat Struct									
Upper	0.467	Max WS	30.86	106.16	108.76		108.77	0.000665	0.68	57.55	111.33	0.15
Upper	0.466		Lat Struct									
Upper	0.462	Max WS	30.09	106.16	108.75	108.55	108.77	0.001244	0.48	48.11	119.31	0.19
Upper	0.461		Bridge									
Upper	0.452	Max WS	21.94	106.16	108.16	108.15	108.53	0.022212	2.68	8.43	12.94	0.86
Upper	0.451		Lat Struct									
Upper	0.445	Max WS	30.09	106.17	108.39		108.43	0.003225	1.11	34.02	97.95	0.33
Upper	0.444		Lat Struct									
Upper	0.43250*	Max WS	30.09	106.11	108.33		108.40	0.003991	1.39	29.68	90.21	0.38
Upper	0.42	Max WS	30.09	106.05	108.28		108.35	0.004002	1.47	28.21	86.78	0.38
Upper	0.419		Lat Struct									

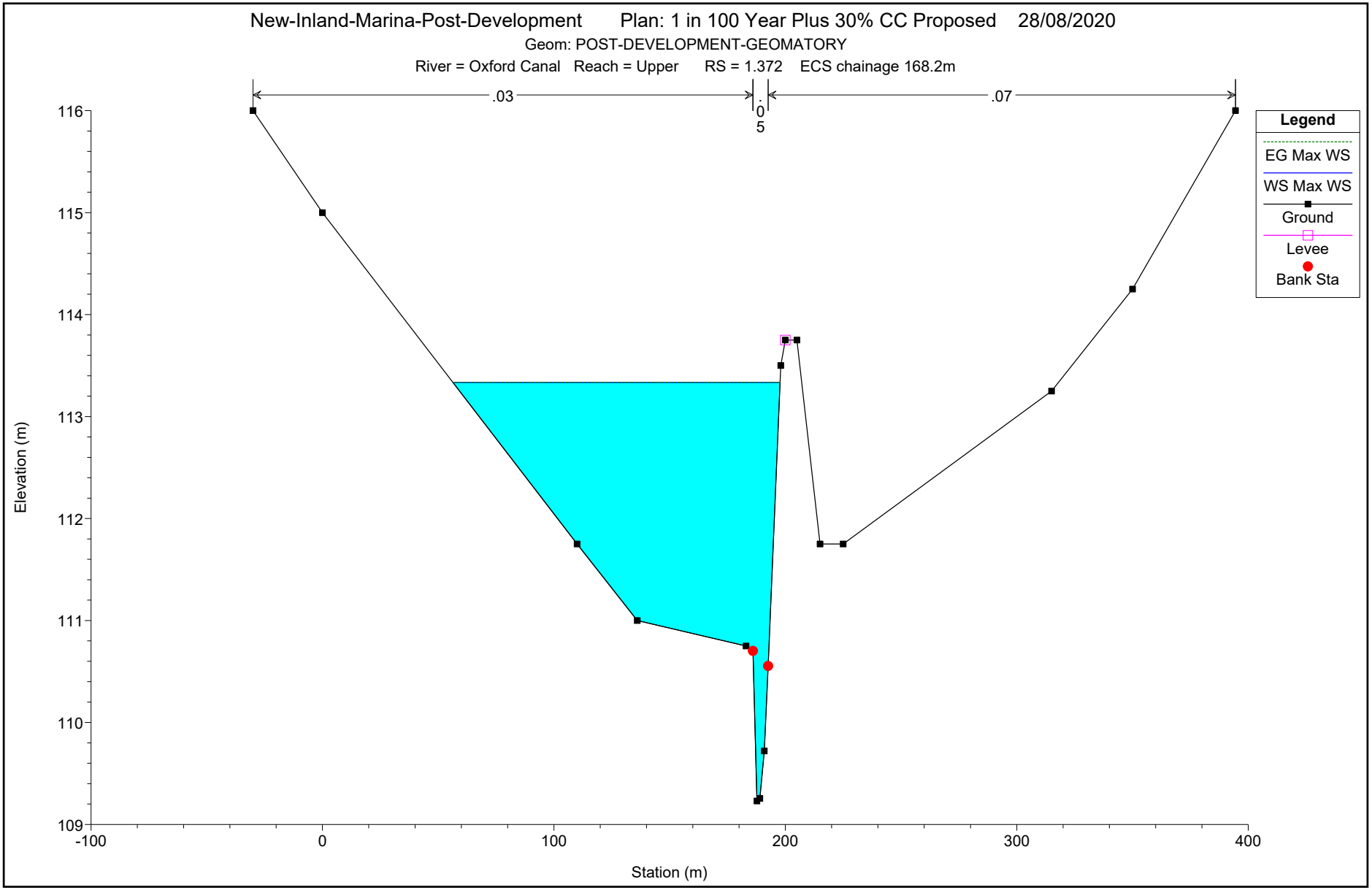
HEC-RAS Plan: 01 River: Oxford Canal Reach: Upper Profile: Max WS (Continued)

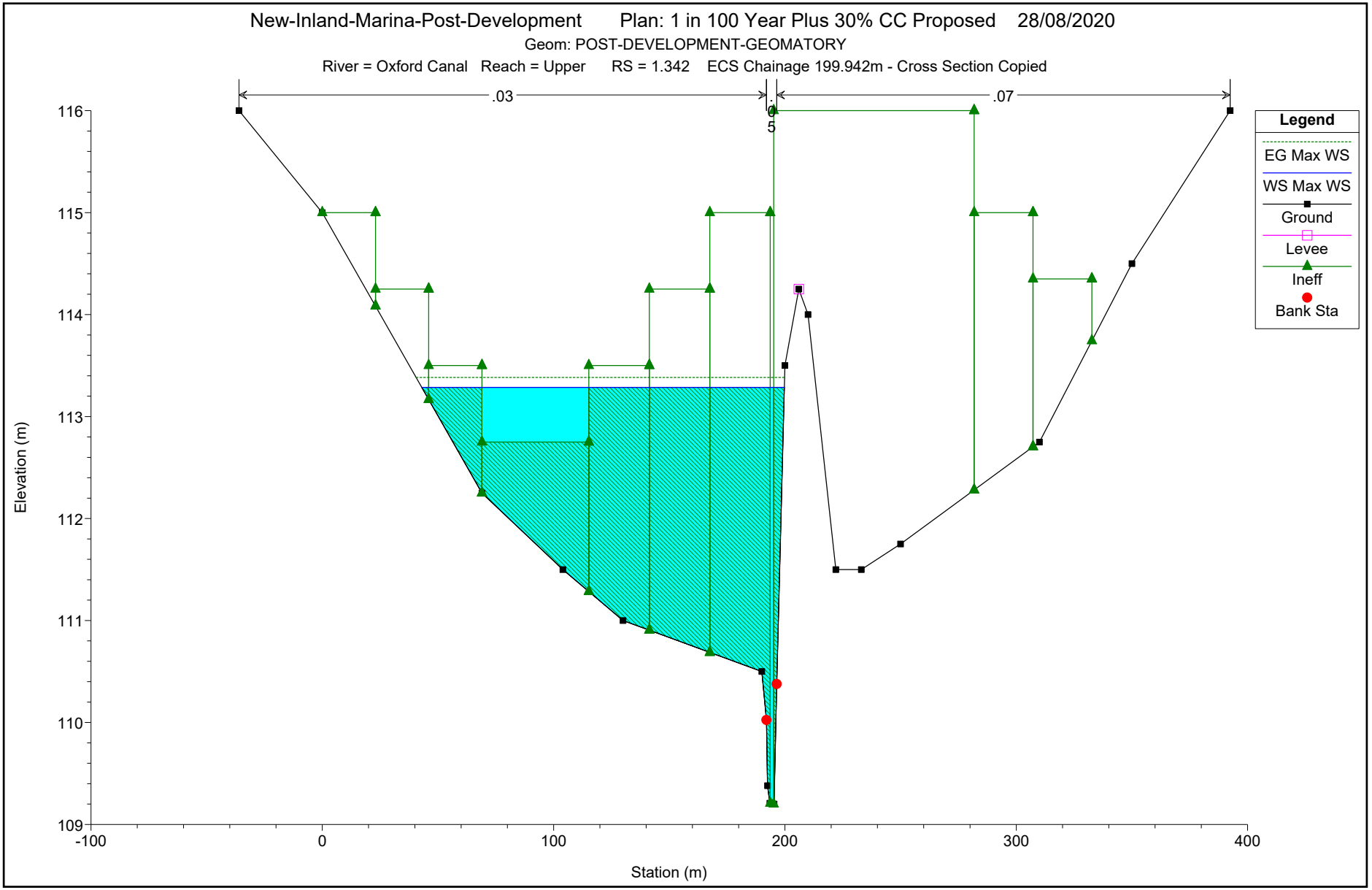
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Upper	0.40750*	Max WS	30.09	106.05	108.22		108.30	0.004335	1.51	26.70	80.86	0.39
Upper	0.395	Max WS	30.09	106.04	108.16		108.25	0.004698	1.54	25.13	74.13	0.41
Upper	0.394		Lat Struct									
Upper	0.38143*	Max WS	30.09	106.03	108.13		108.19	0.003843	1.40	28.81	87.52	0.37
Upper	0.36786*	Max WS	30.09	106.01	108.09		108.14	0.003432	1.32	31.27	97.16	0.36
Upper	0.35429*	Max WS	29.25	106.00	108.05		108.10	0.003108	1.26	33.24	108.25	0.34
Upper	0.34071*	Max WS	29.40	105.99	108.02		108.06	0.002488	1.13	34.47	98.48	0.31
Upper	0.32714*	Max WS	29.77	105.98	107.99		108.03	0.002190	1.06	37.47	106.25	0.29
Upper	0.31357*	Max WS	30.49	105.96	107.97		108.00	0.001982	1.02	40.57	114.31	0.28
Upper	0.30	Max WS	31.60	105.95	107.94		107.97	0.001816	0.98	43.67	120.64	0.27
Upper	0.28333*	Max WS	31.47	105.94	107.90		107.94	0.002557	1.05	37.49	109.70	0.31
Upper	0.26667*	Max WS	31.30	105.92	107.88		107.90	0.001546	0.73	54.19	183.58	0.24
Upper	0.25	Max WS	31.01	105.91	107.87		107.88	0.000570	0.38	72.04	170.10	0.14
Upper	0.23333*	Max WS	30.76	105.89	107.86		107.87	0.000479	0.41	78.25	193.12	0.13
Upper	0.21667*	Max WS	30.36	105.86	107.86		107.87	0.000392	0.42	86.22	218.67	0.12
Upper	0.20	Max WS	29.88	105.84	107.85		107.86	0.000315	0.39	95.81	247.49	0.11
Upper	0.18333*	Max WS	29.45	105.82	107.85		107.85	0.000244	0.35	104.70	262.75	0.10
Upper	0.16667*	Max WS	28.59	105.80	107.84		107.85	0.000180	0.30	115.07	278.61	0.08
Upper	0.15	Max WS	27.55	105.78	107.84		107.84	0.000129	0.26	126.86	292.37	0.07
Upper	0.13333*	Max WS	26.73	105.76	107.84		107.84	0.000094	0.22	141.01	314.47	0.06
Upper	0.11667*	Max WS	26.19	105.74	107.84		107.84	0.000068	0.19	157.02	329.76	0.05
Upper	0.1	Max WS	25.20	105.71	107.83		107.84	0.000047	0.16	174.15	343.20	0.04
Upper	0.08333*	Max WS	24.41	105.69	107.83		107.83	0.000039	0.14	182.21	348.76	0.04
Upper	0.06667*	Max WS	23.32	105.67	107.83		107.83	0.000031	0.12	190.87	353.83	0.03
Upper	0.05	Max WS	72.72	105.65	107.44	107.44	107.84	0.046920	3.54	28.10	128.72	1.26
Upper	0.03333*	Max WS	72.12	105.63	107.17	107.23	107.35	0.020847	2.06	37.54	136.92	0.82
Upper	0.01667*	Max WS	67.32	105.61	107.06		107.13	0.008168	1.39	56.99	223.06	0.52
Upper	0.00	Max WS	67.16	105.59	107.04	106.83	107.07	0.001434	0.61	101.90	276.16	0.22

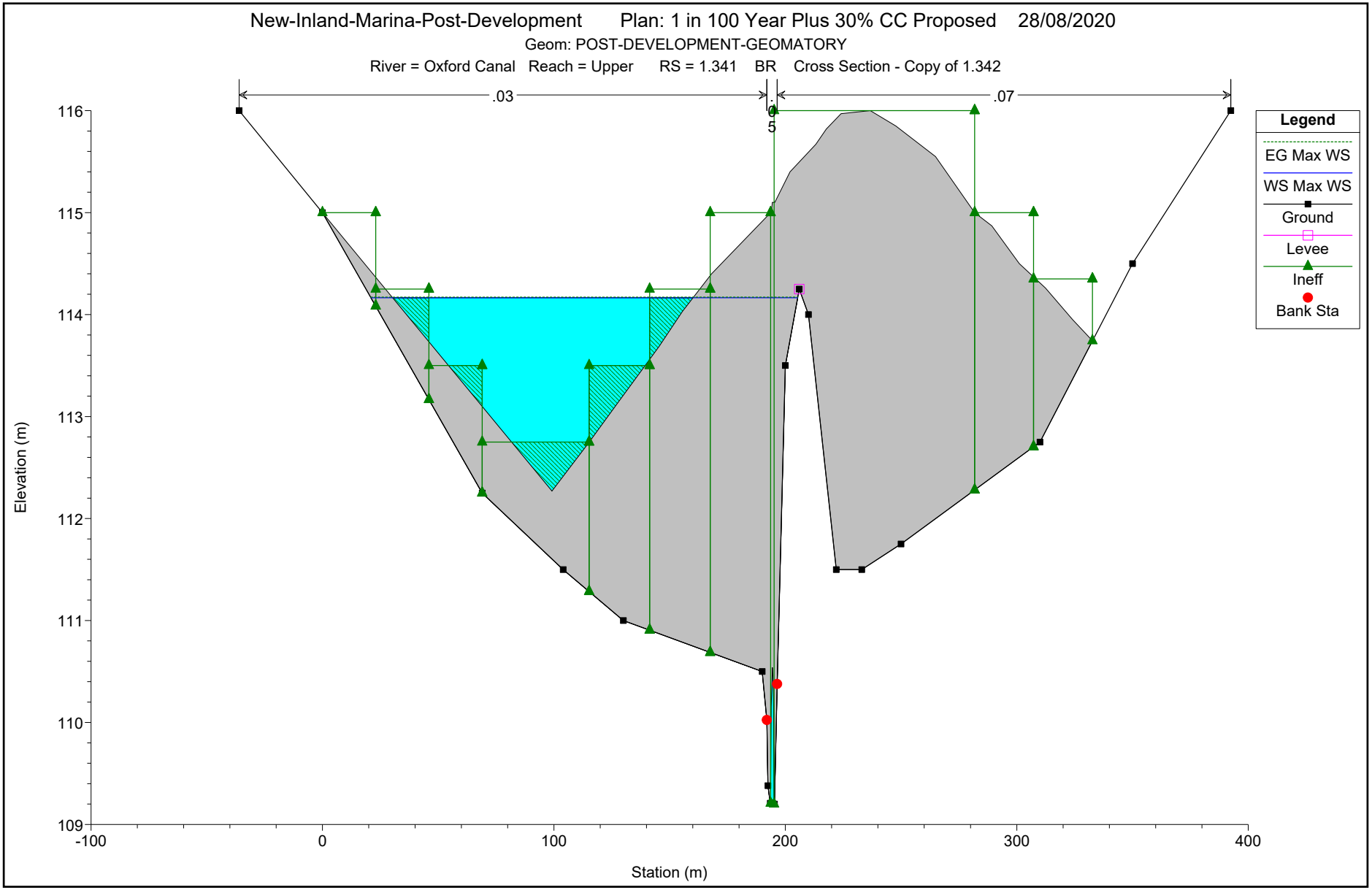

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.547 ECS Chainage 0.0m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-50
0
50
100
150
200
250
300
350

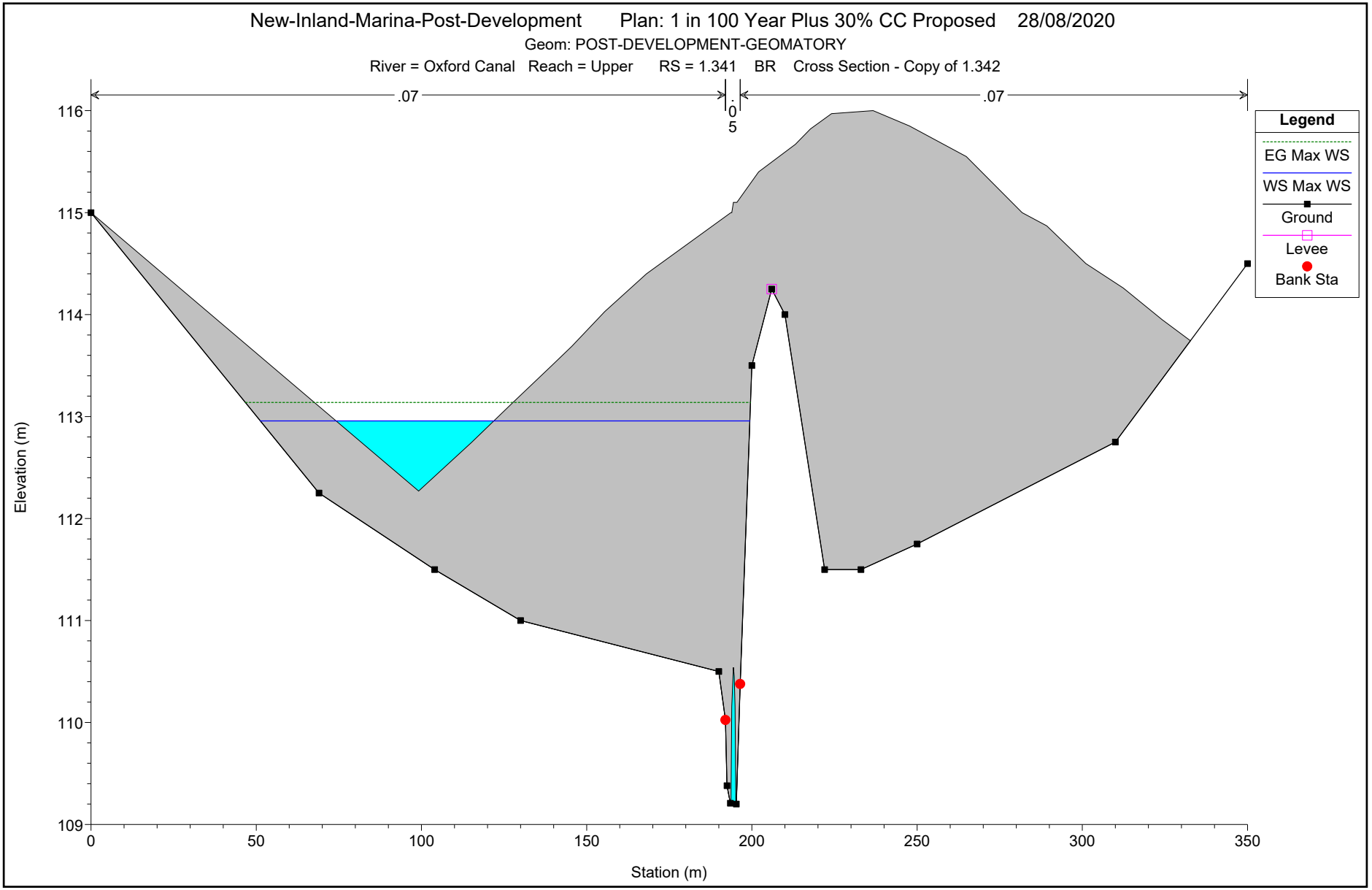

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.492 ECS Chain 53.453
.03
0
5
.07
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400
Station (m)

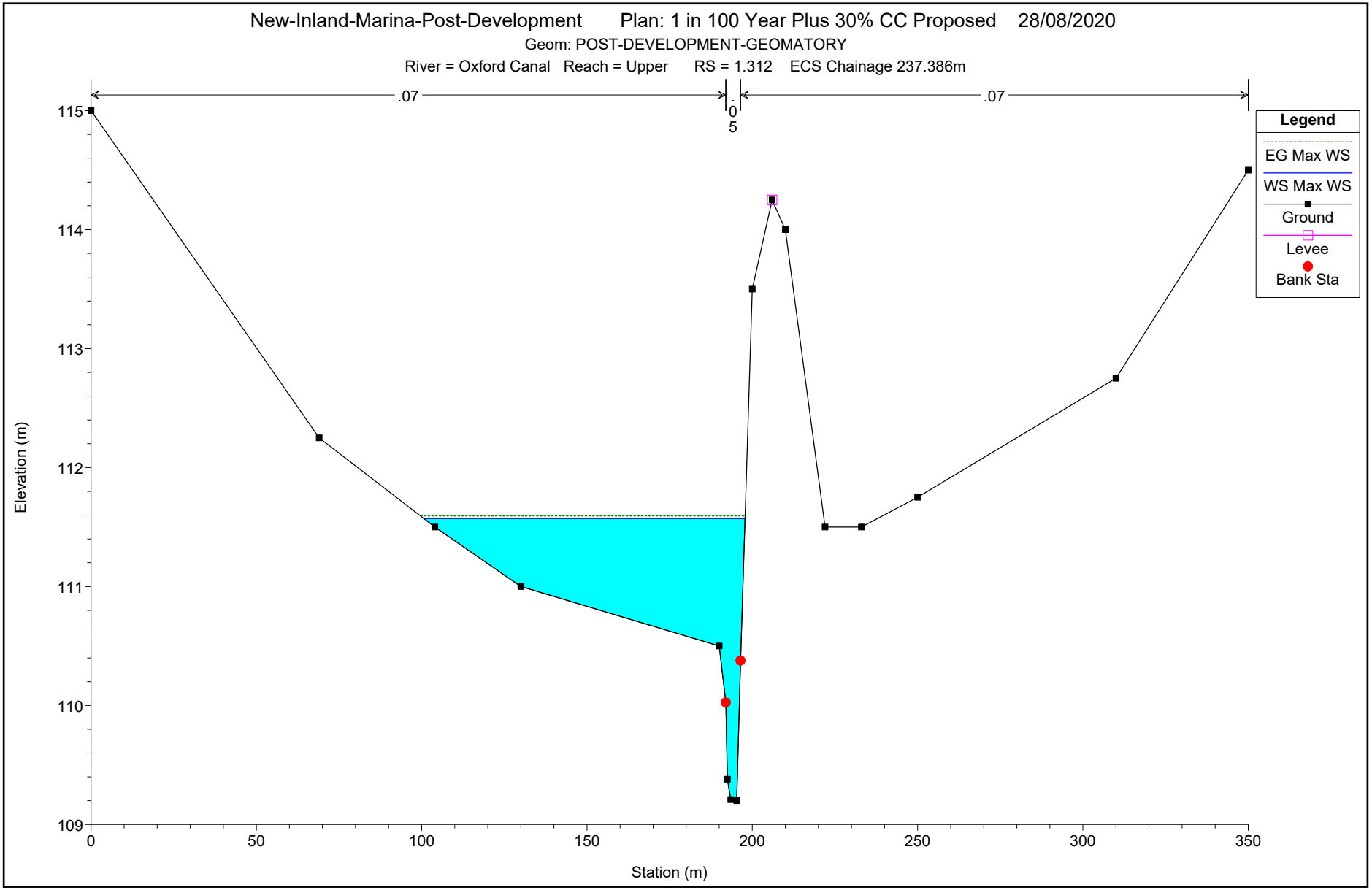

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.402 ECS chainage 135.01m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400
Station (m)

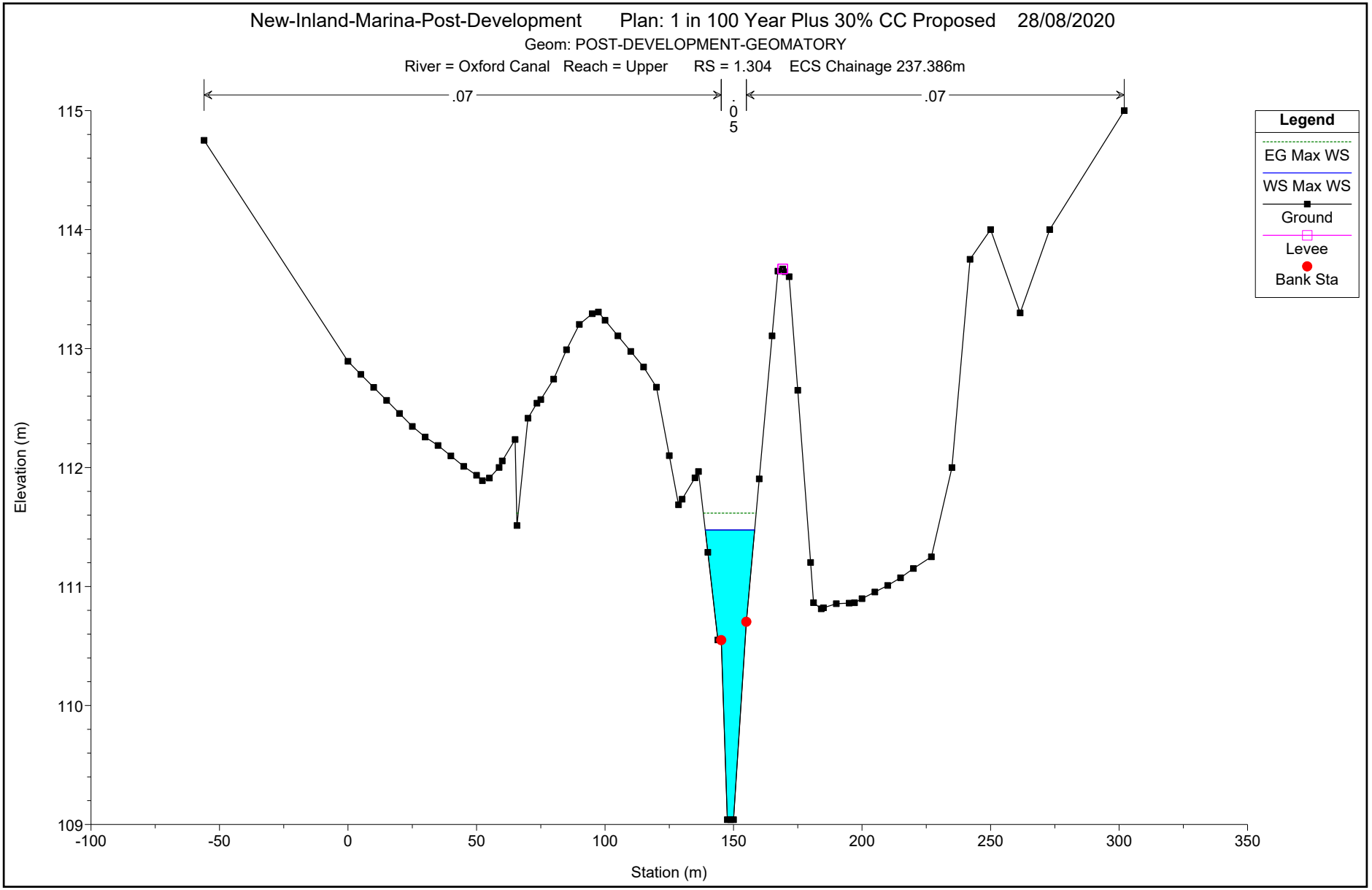

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.372 ECS chainage 168.2m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

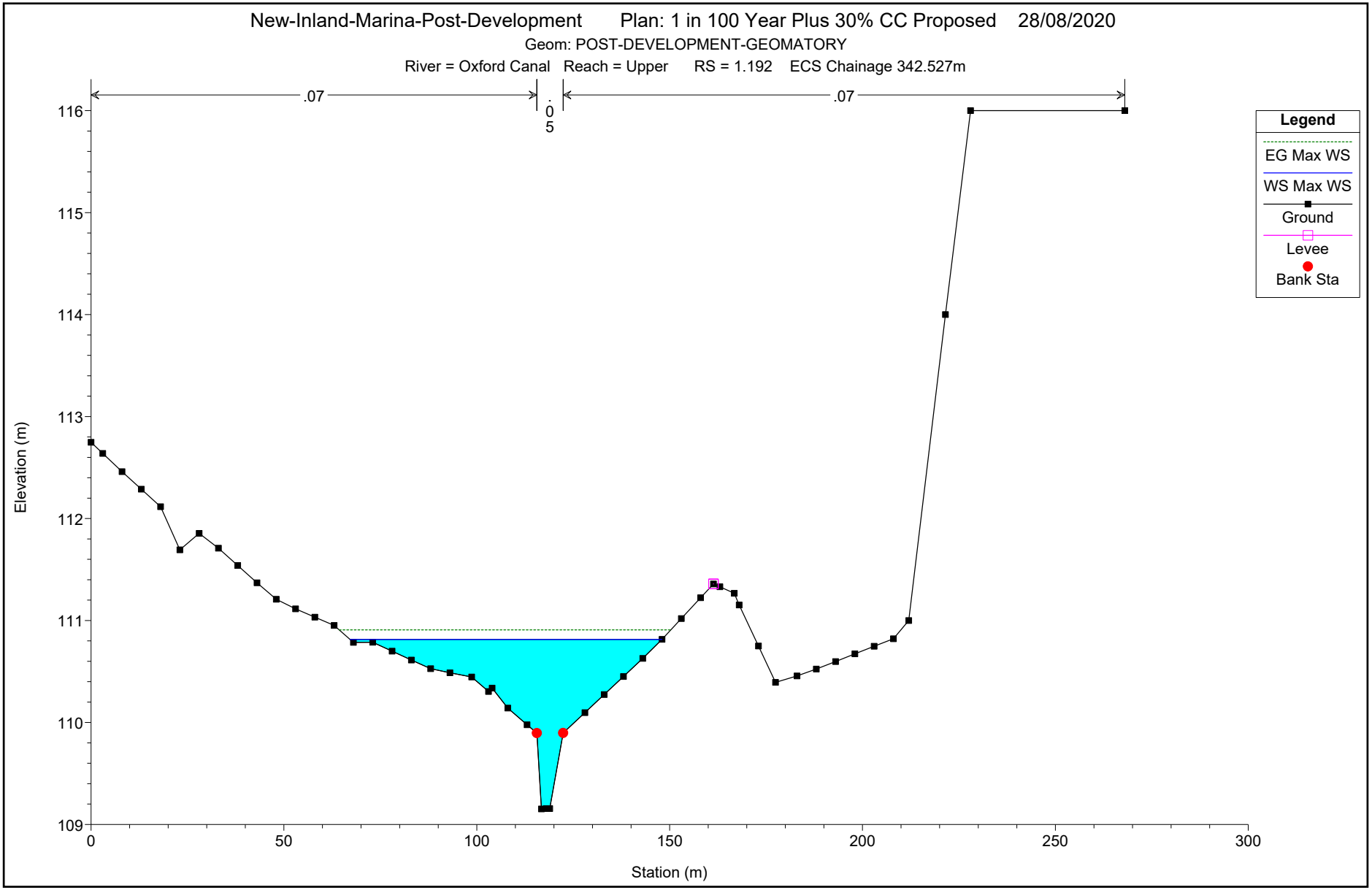

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.342 ECS Chainage 199.942m - Cross Section Copied
.03
.07
.0
5
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

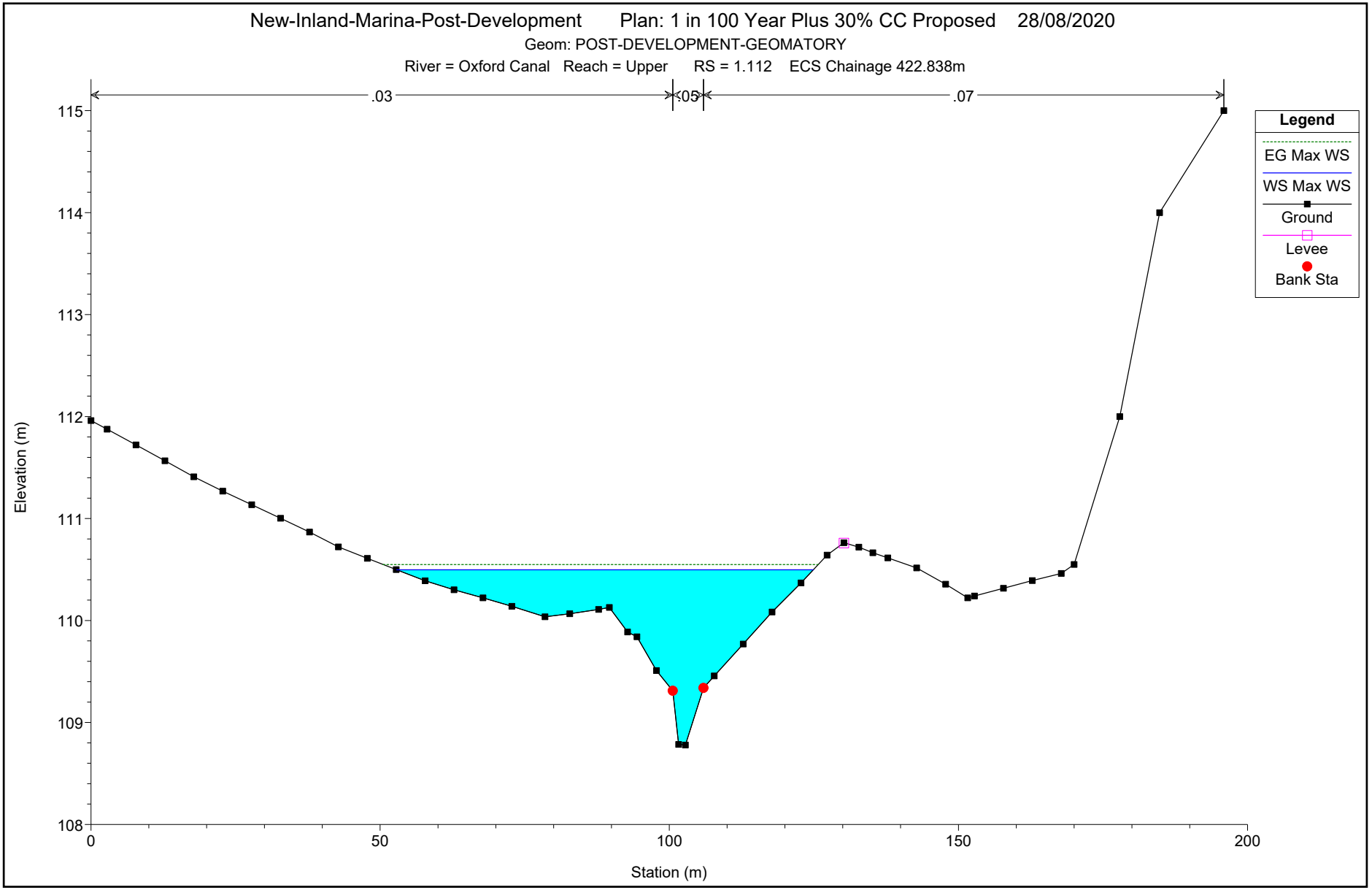

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.341 BR Cross Section - Copy of 1.342
.03
.07
.05
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
-100
0
100
200
300
400

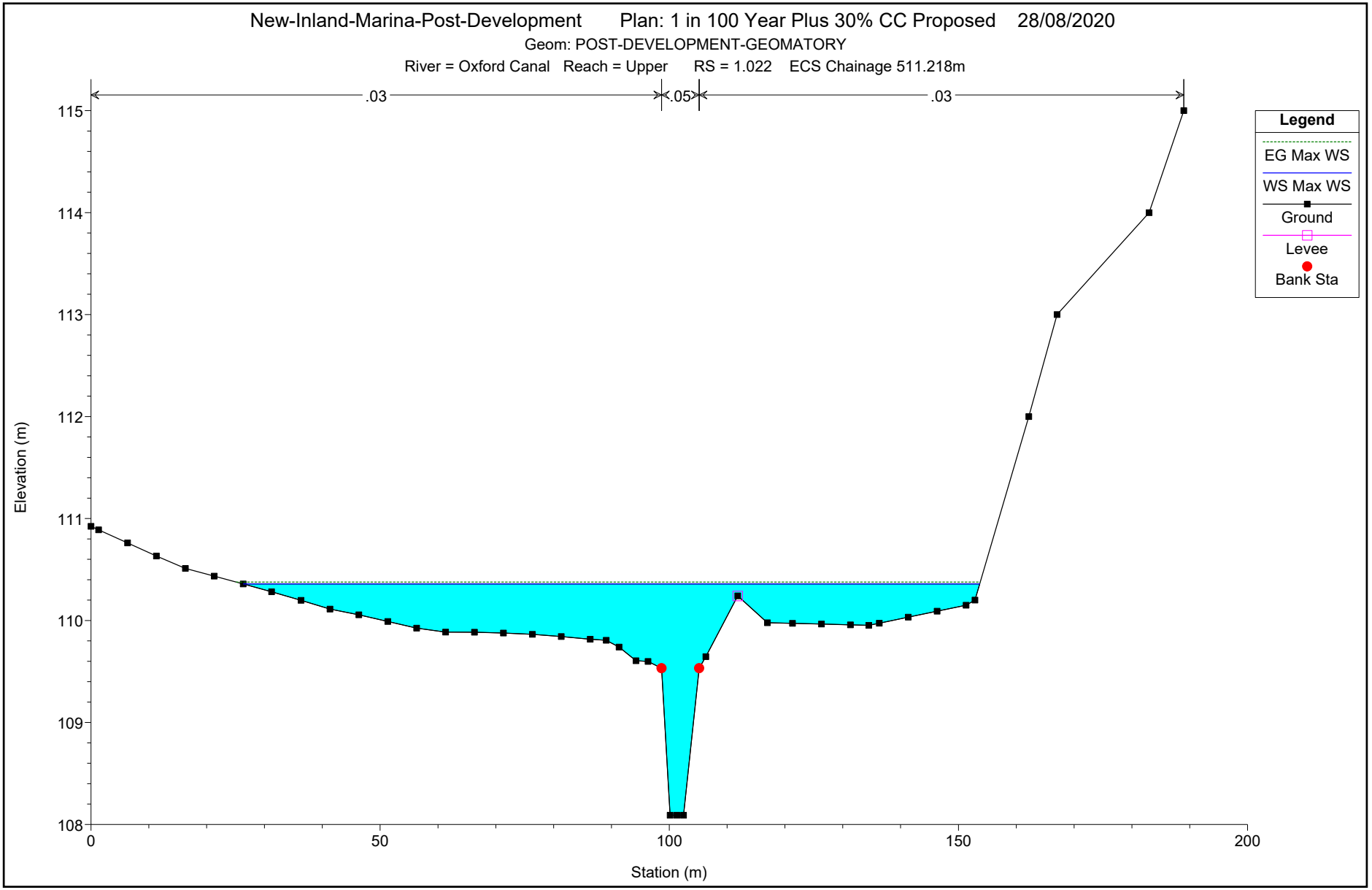

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.341 BR Cross Section - Copy of 1.342
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
0
50
100
150
200
250
300
350


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.312 ECS Chainage 237.386m
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
115
114
113
112
111
110
109
0
50
100
150
200
250
300
350


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.304 ECS Chainage 237.386m
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
115
114
113
112
111
110
109
-100
-50
0
50
100
150
200
250
300
350
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.192 ECS Chainage 342.527m
.07
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
116
115
114
113
112
111
110
109
0
50
100
150
200
250
300


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.112 ECS Chainage 422.838m
.03
.05
.07
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
115
114
113
112
111
110
109
108
0
50
100
150
200
Station (m)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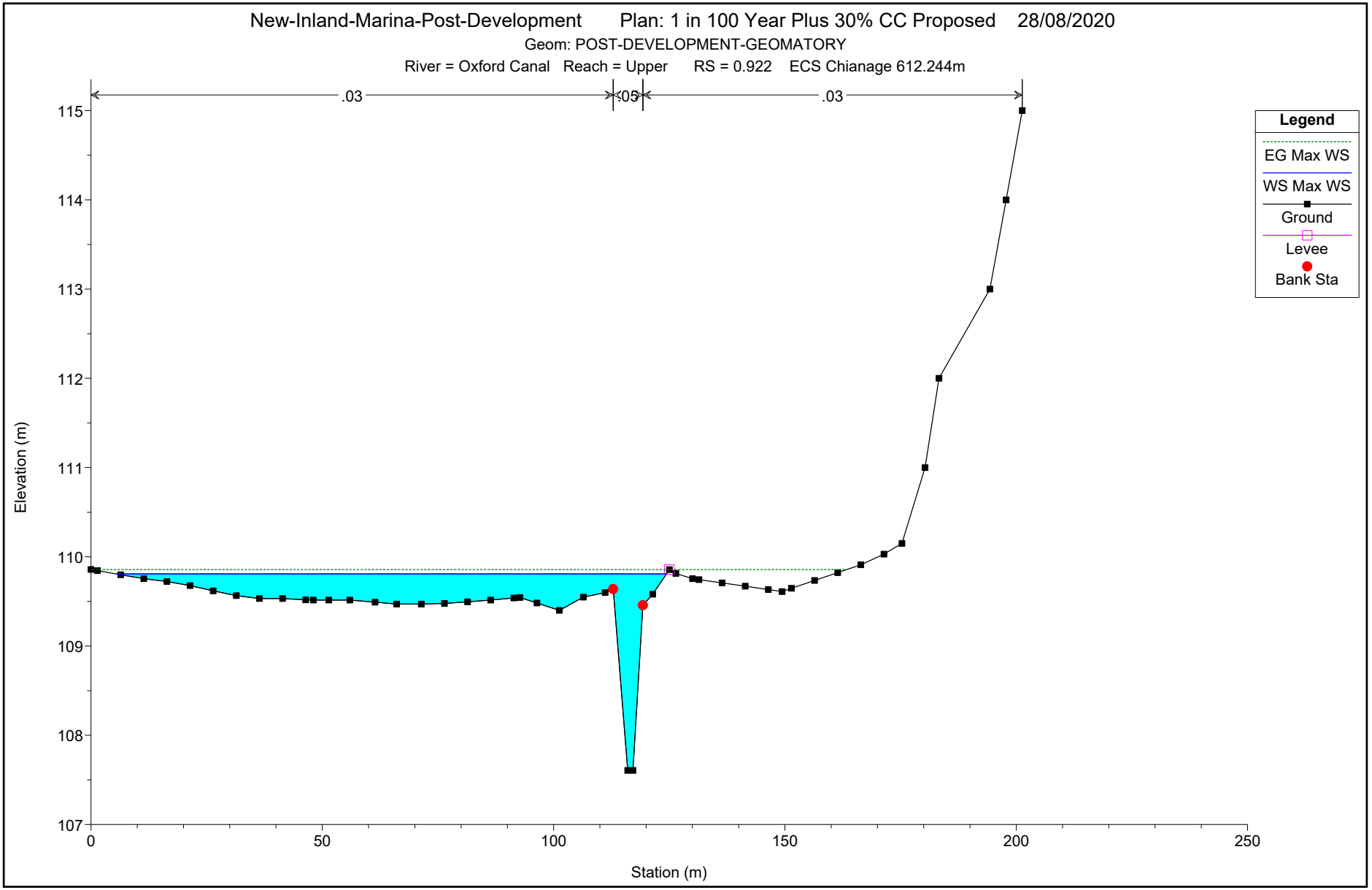
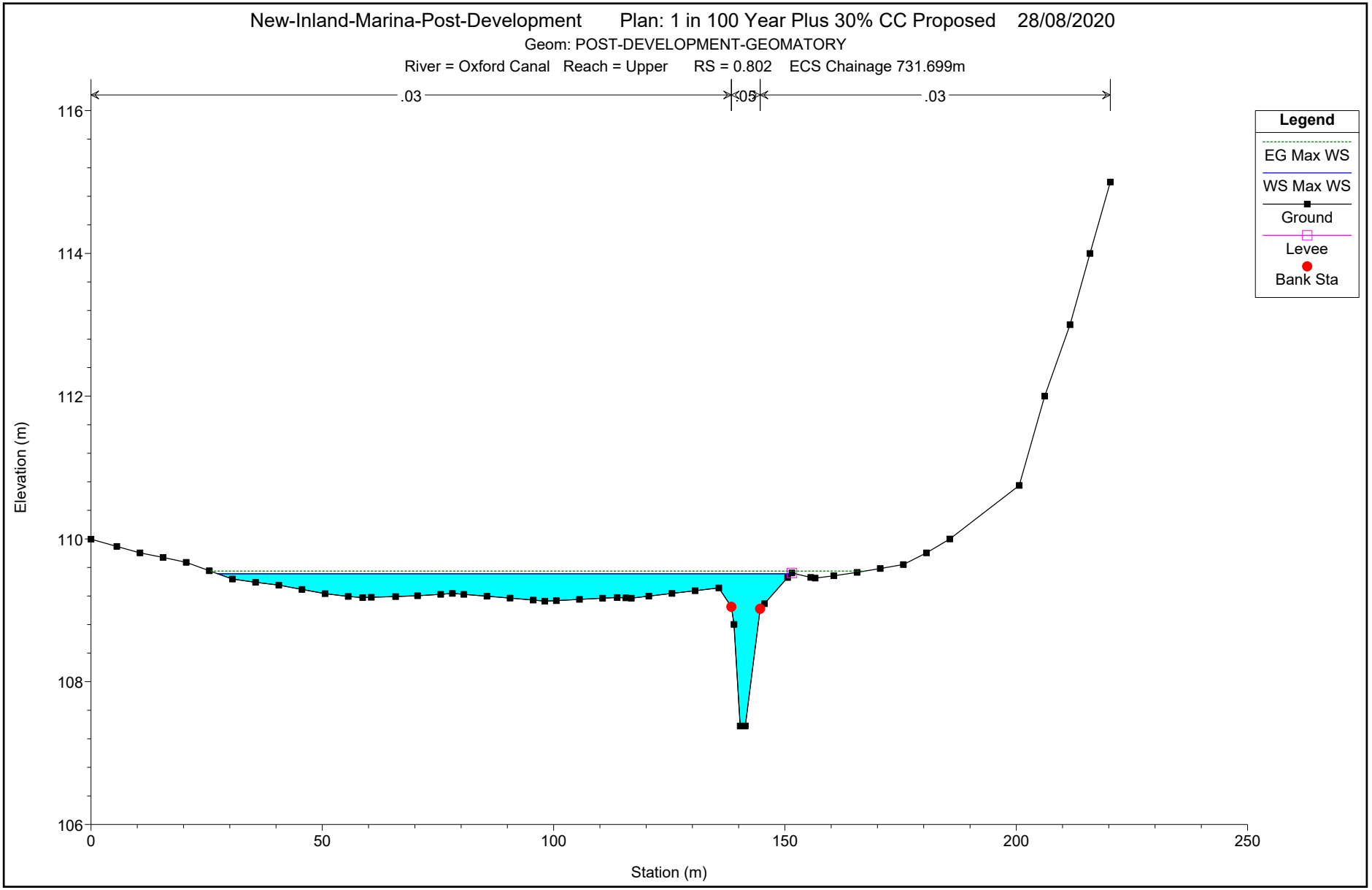
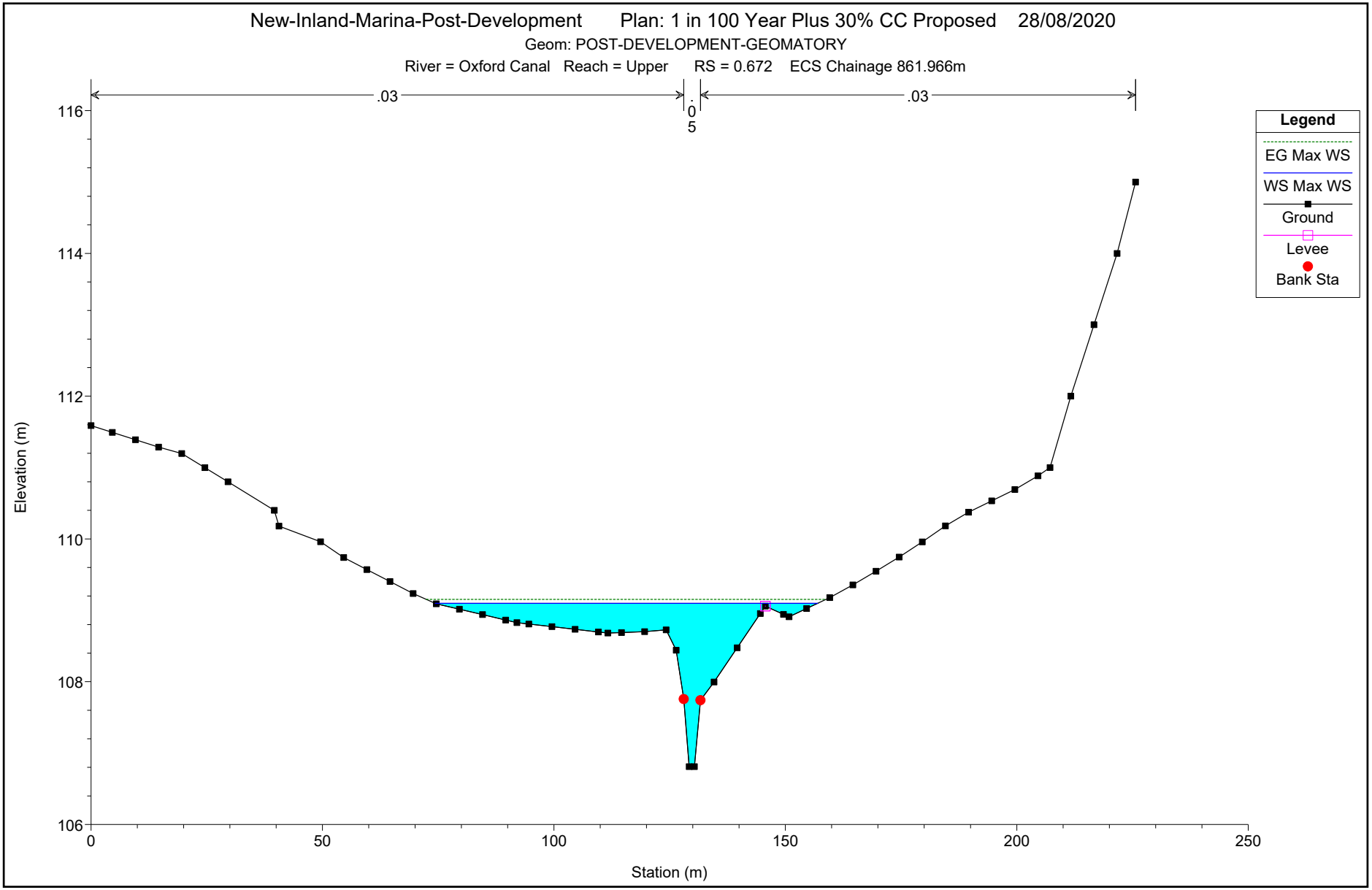
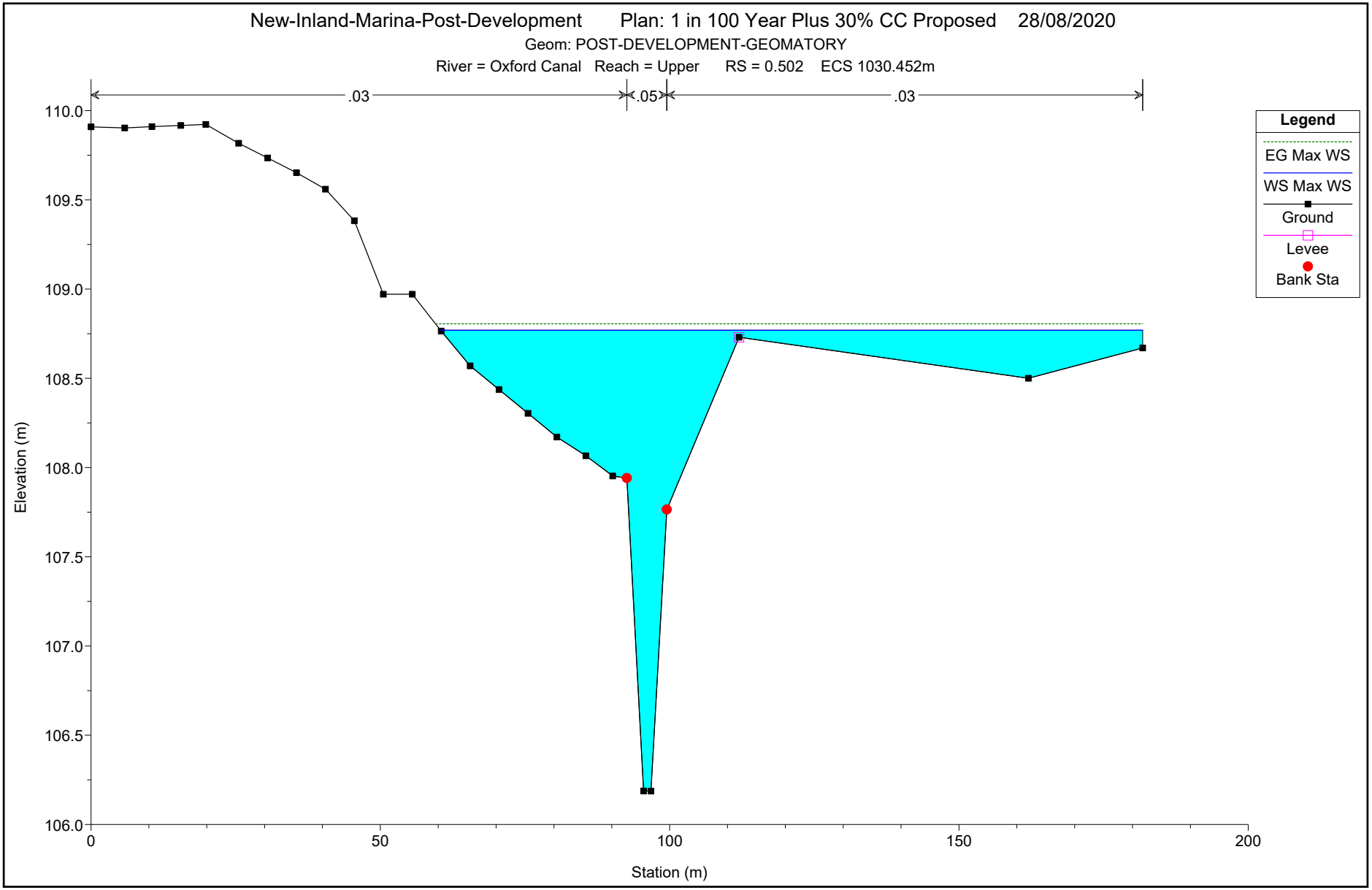
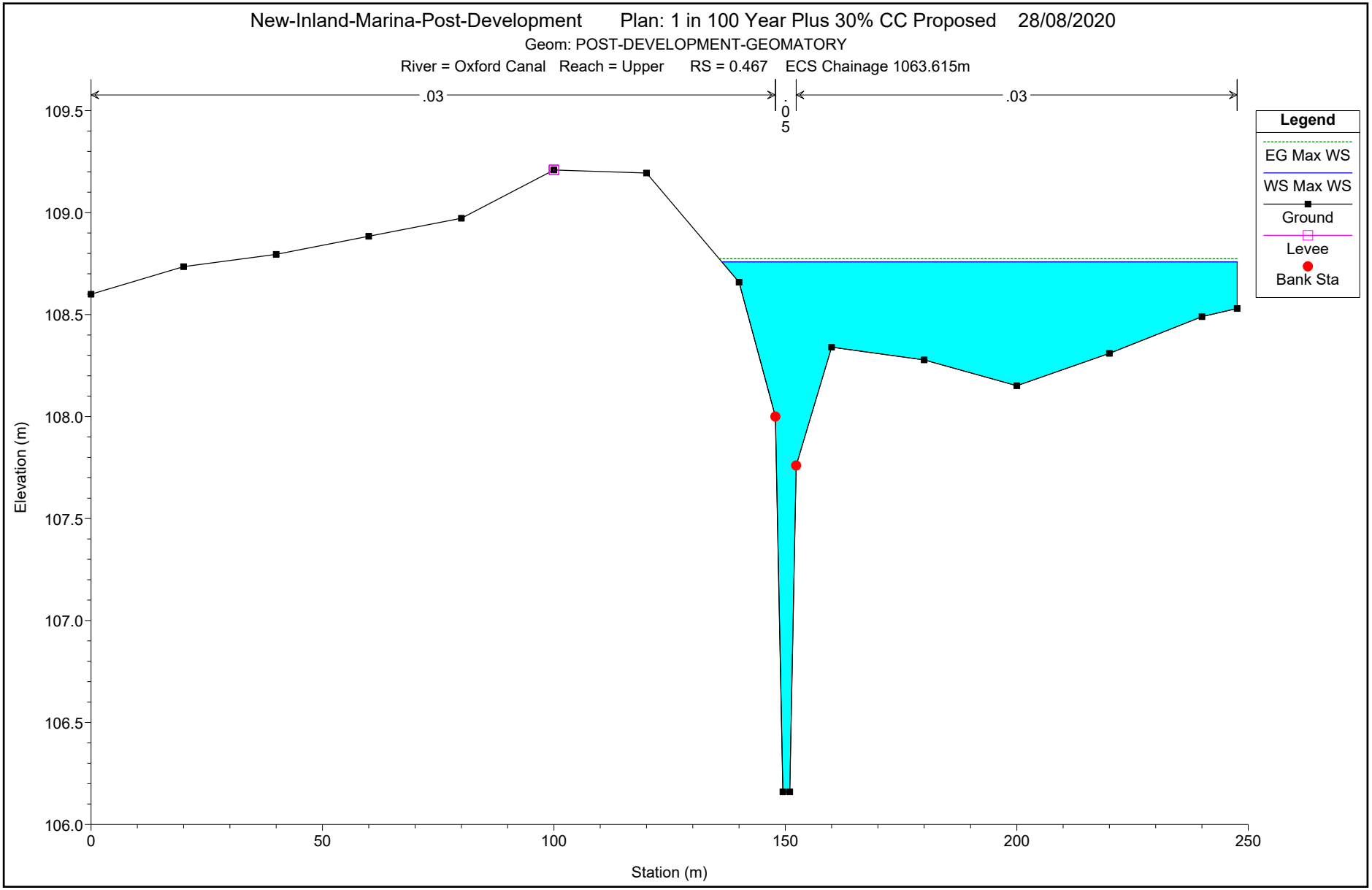
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 1.022 ECS Chainage 511.218m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
115
114
113
112
111
110
109
108
0
50
100
150
200
Station (m)

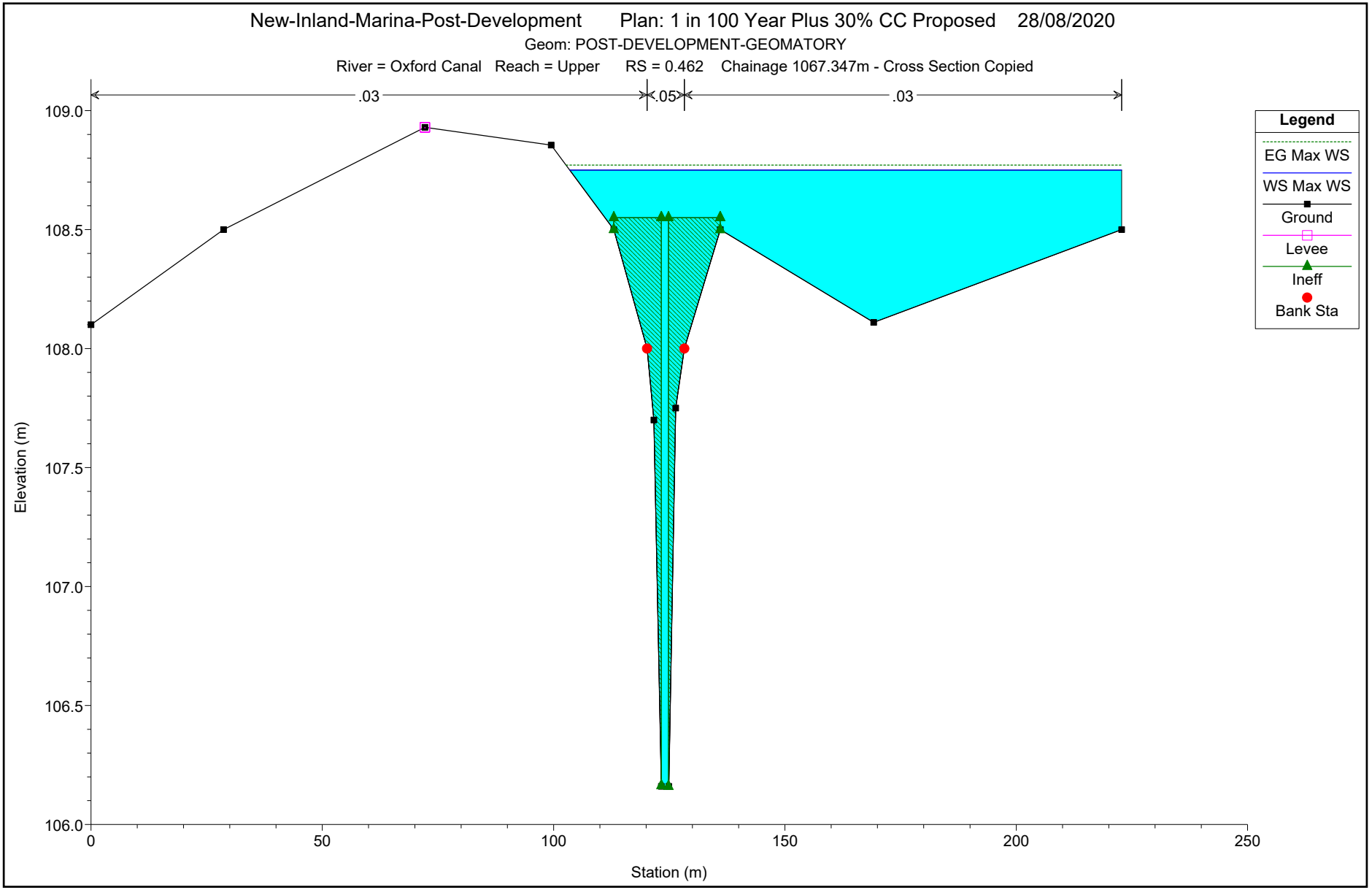

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.922 ECS Chianage 612.244m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
115
114
113
112
111
110
109
108
107
0
50
100
150
200
250
Station (m)

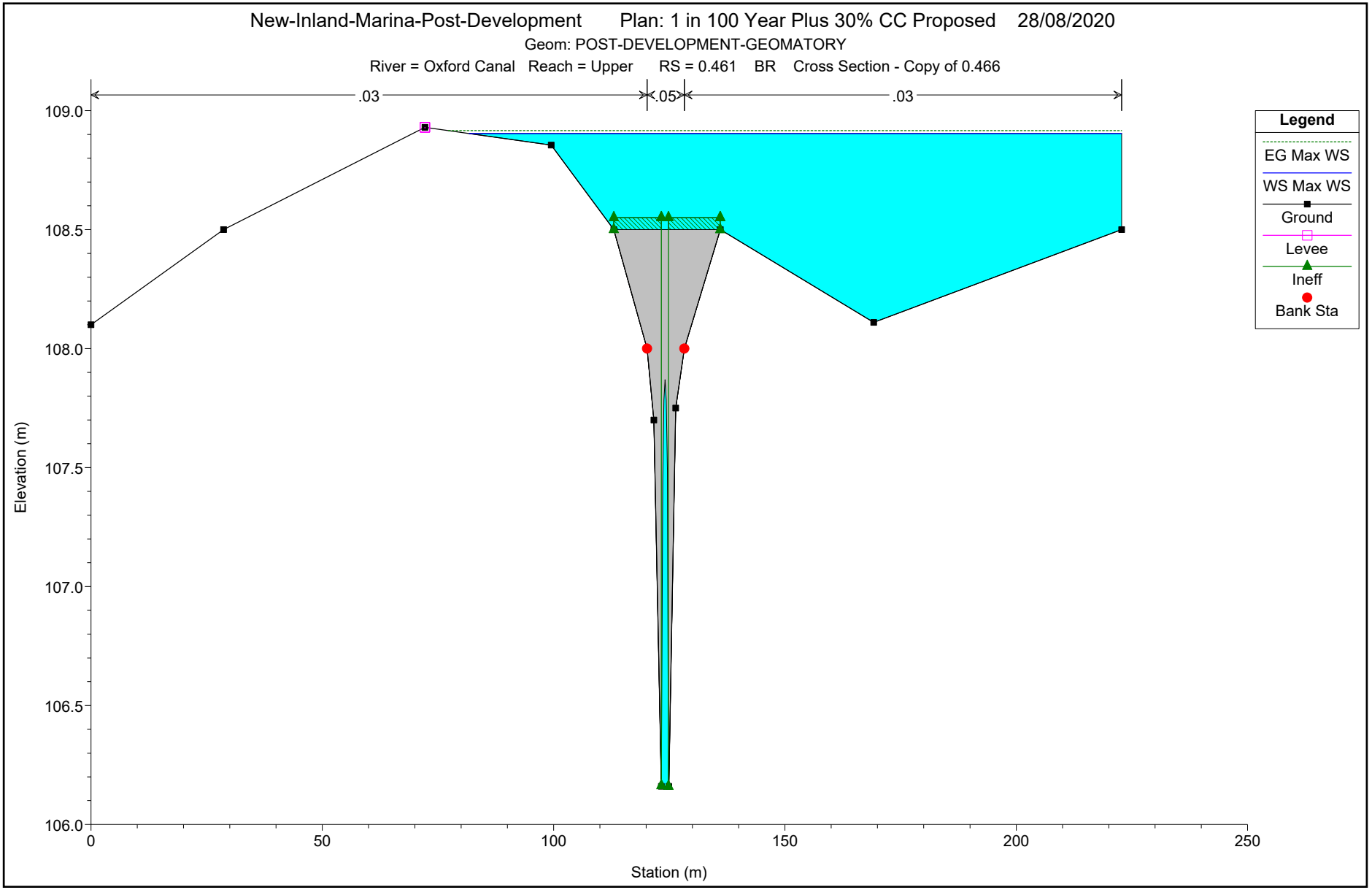

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.802 ECS Chainage 731.699m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
116
114
112
110
108
106
0
50
100
150
200
250
Station (m)

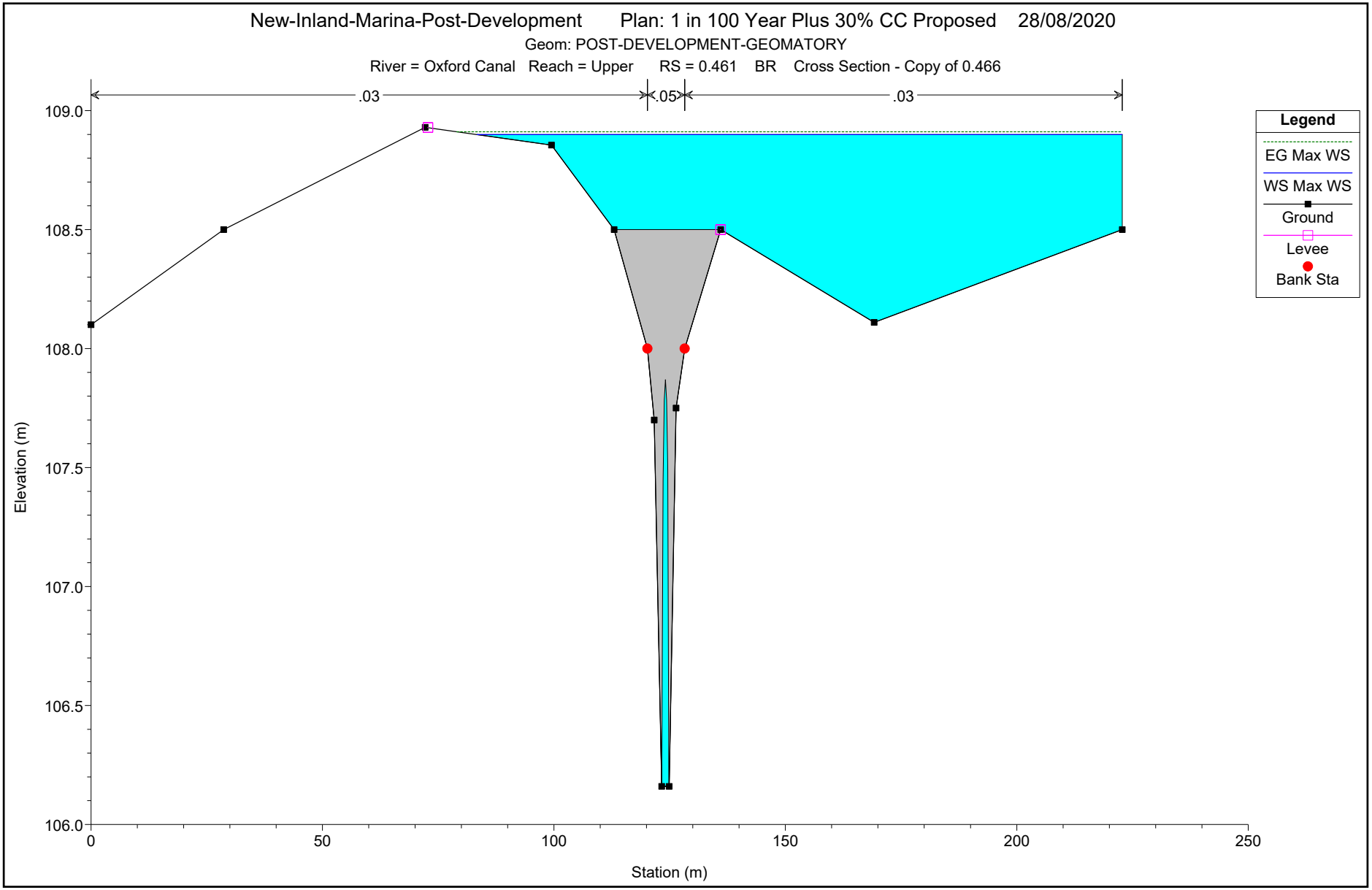

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.672 ECS Chainage 861.966m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
116
114
112
110
108
106
0
50
100
150
200
250
Station (m)

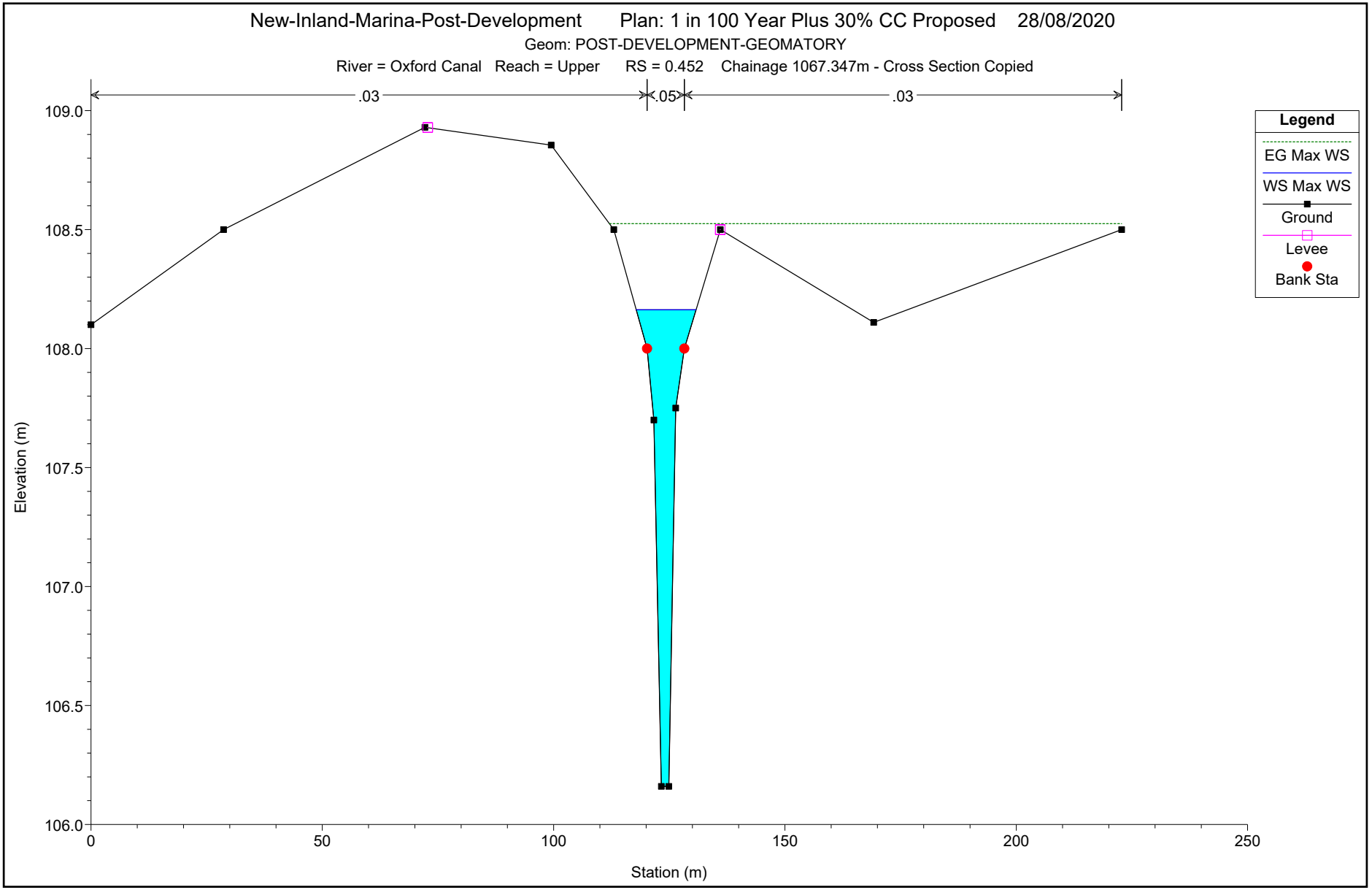

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.502 ECS 1030.452m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
110.0
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.467 ECS Chainage 1063.615m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.462 Chainage 1067.347m - Cross Section Copied
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.461 BR Cross Section - Copy of 0.466
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Ineff
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.461 BR Cross Section - Copy of 0.466
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)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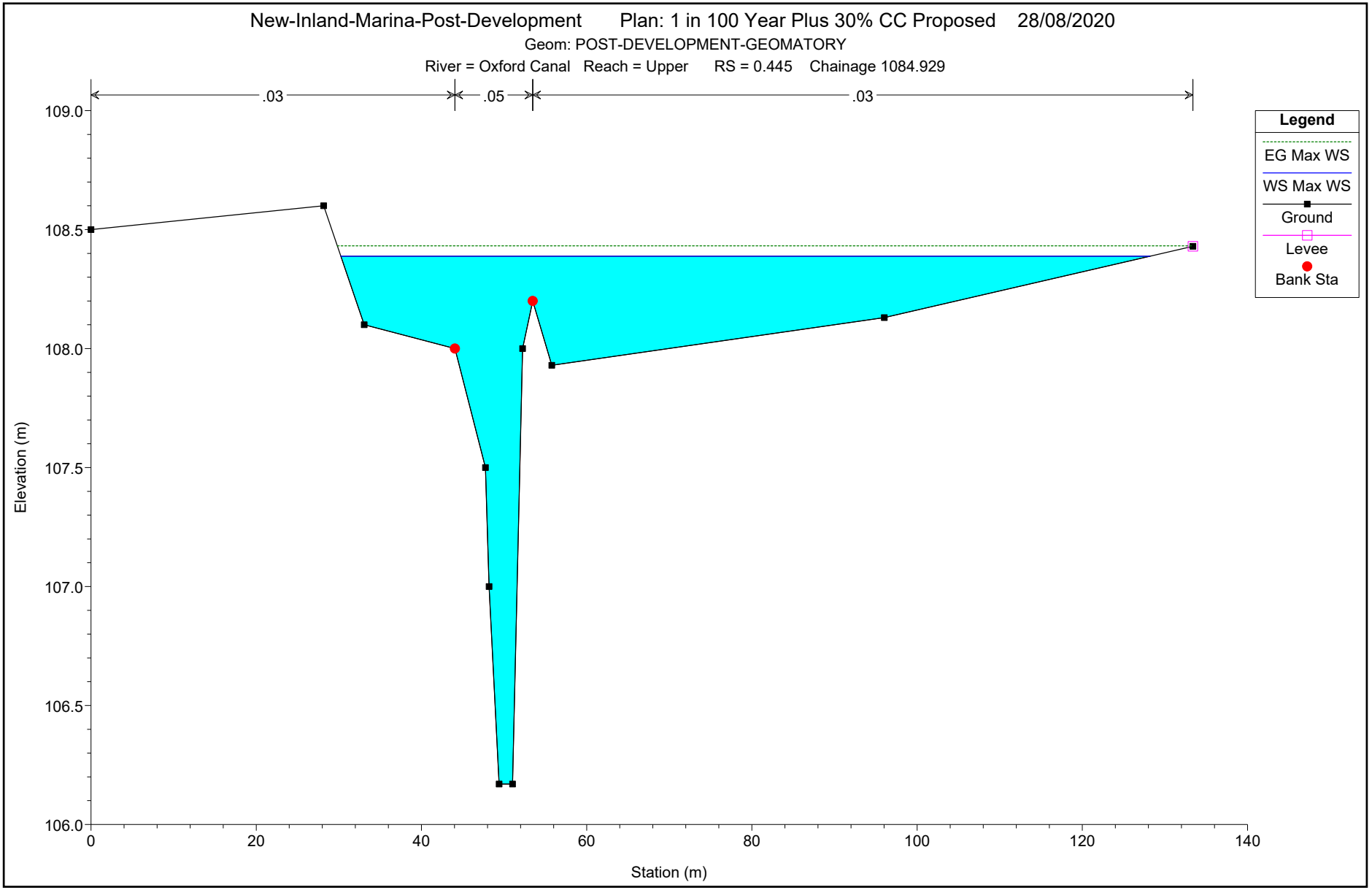
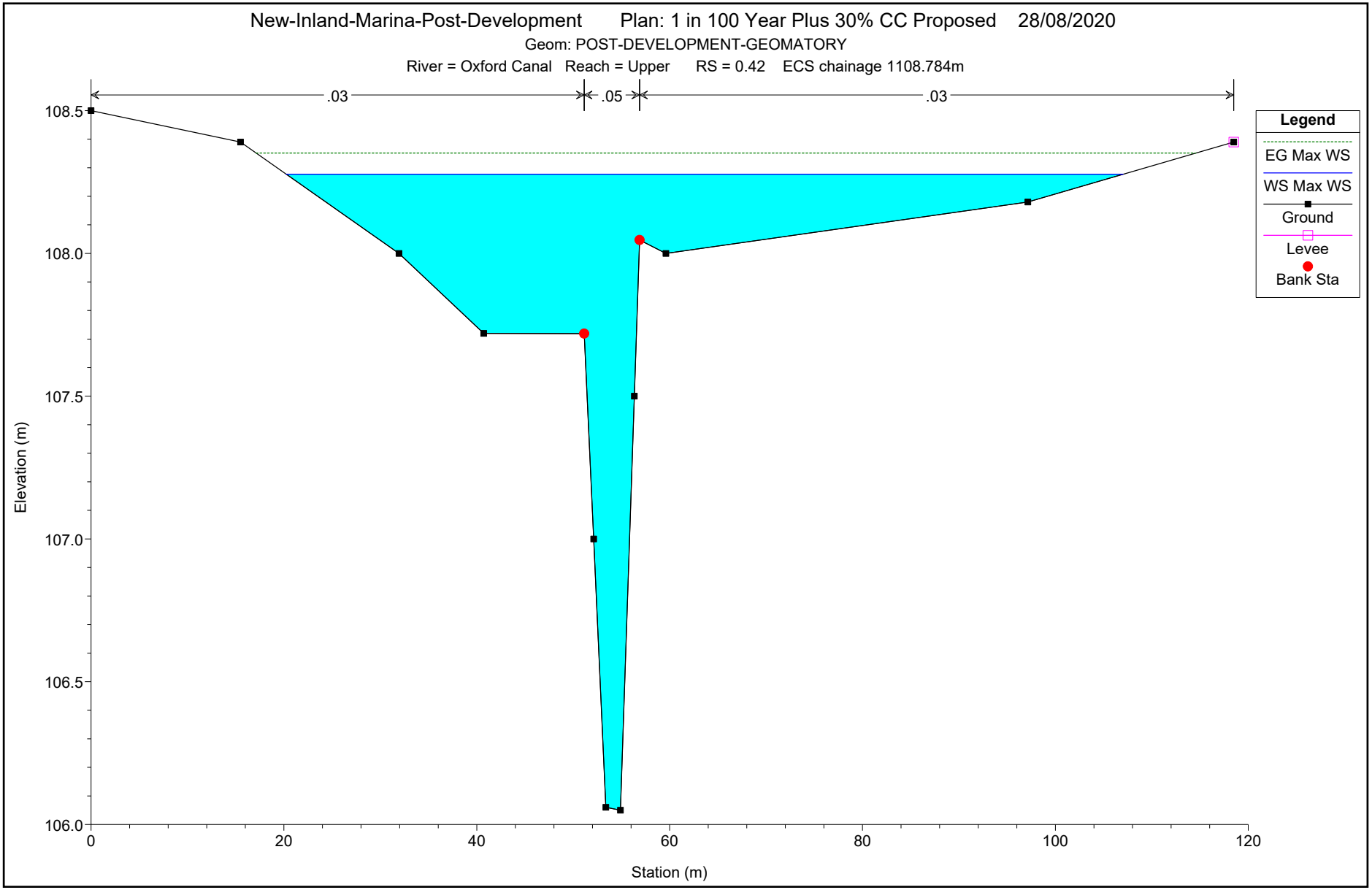
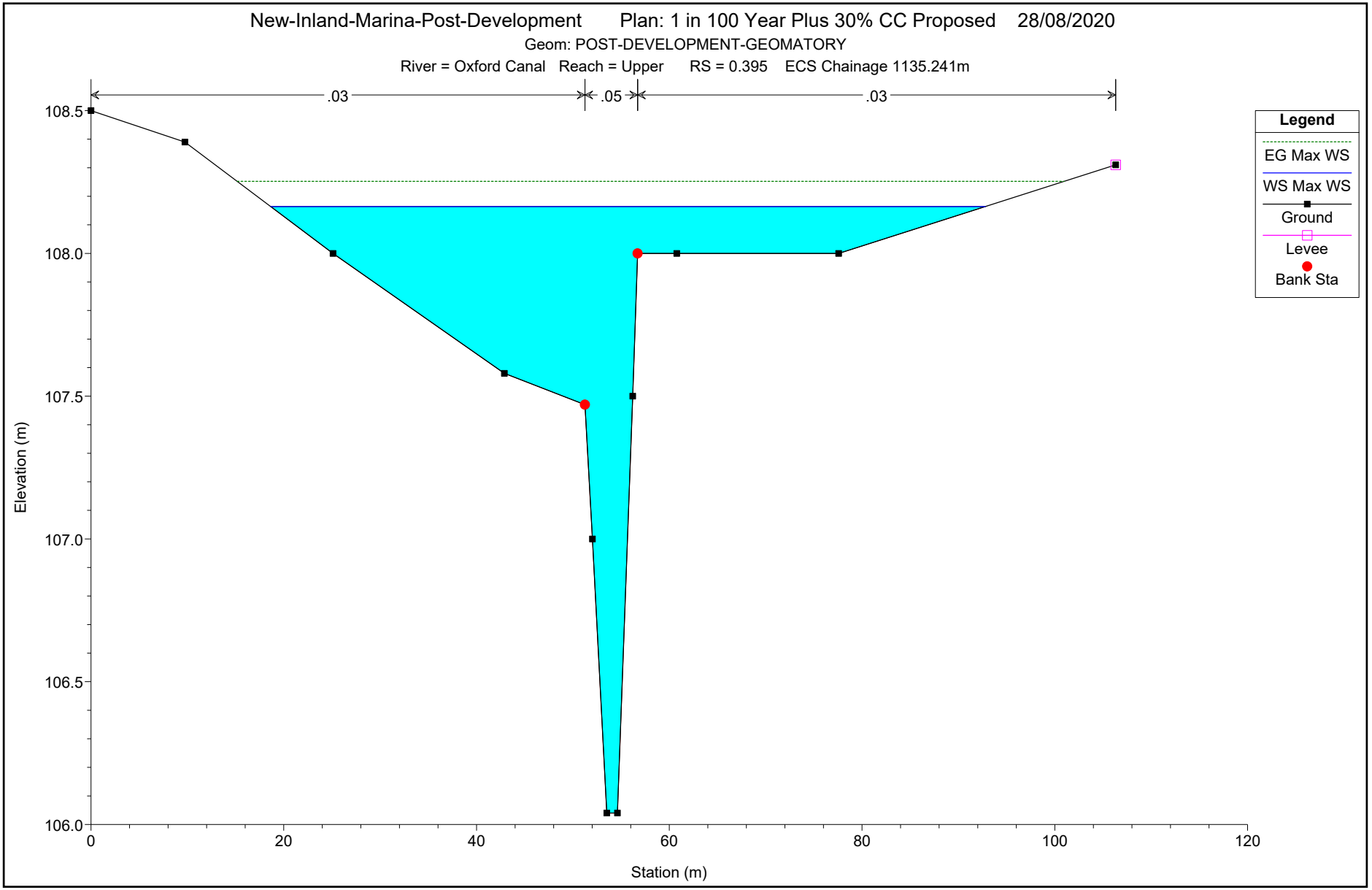
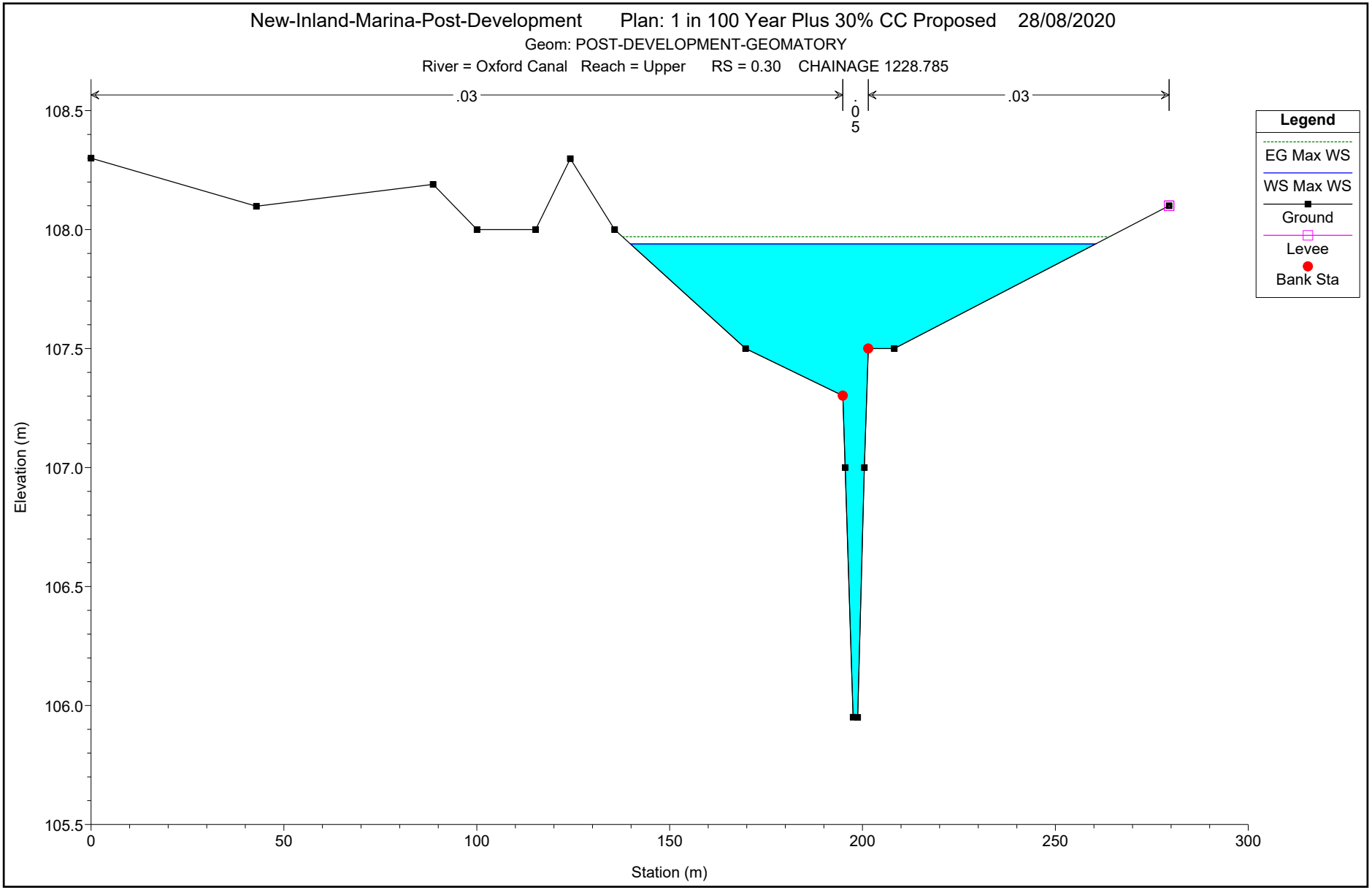
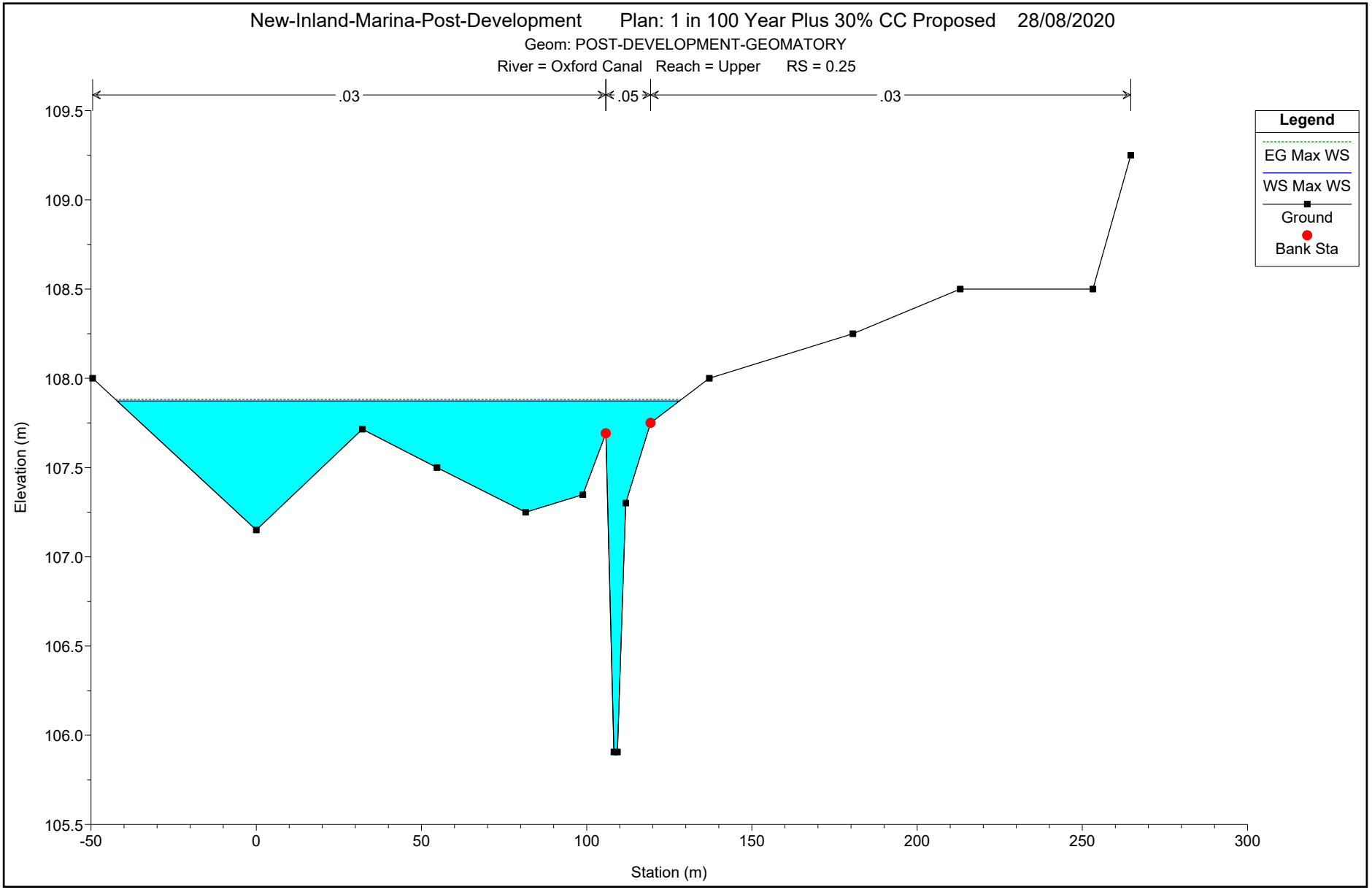
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.452 Chainage 1067.347m - Cross Section Copied
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
50
100
150
200
250
Station (m)

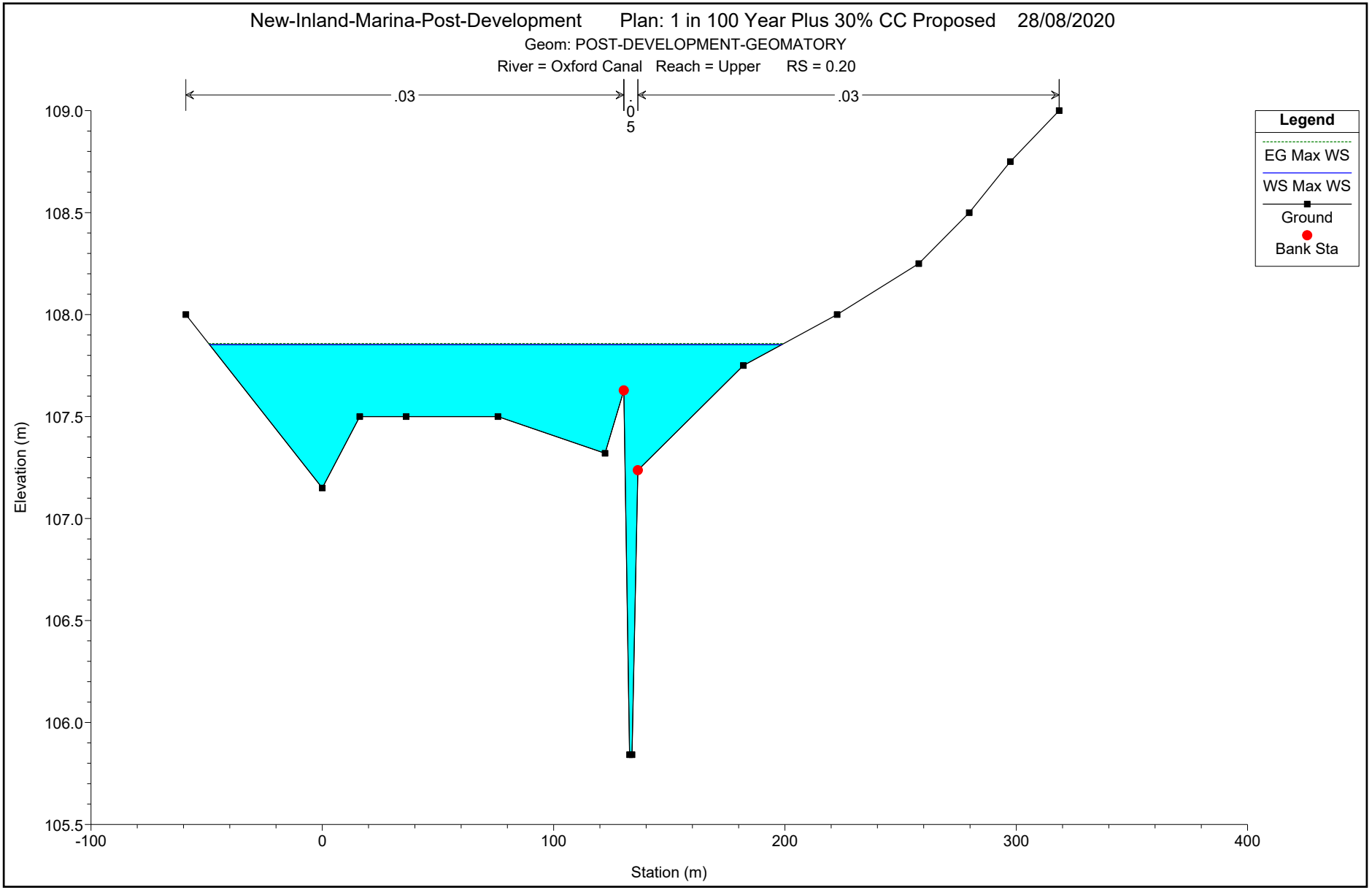

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.445 Chainage 1084.929
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
0
20
40
60
80
100
120
140
Station (m)

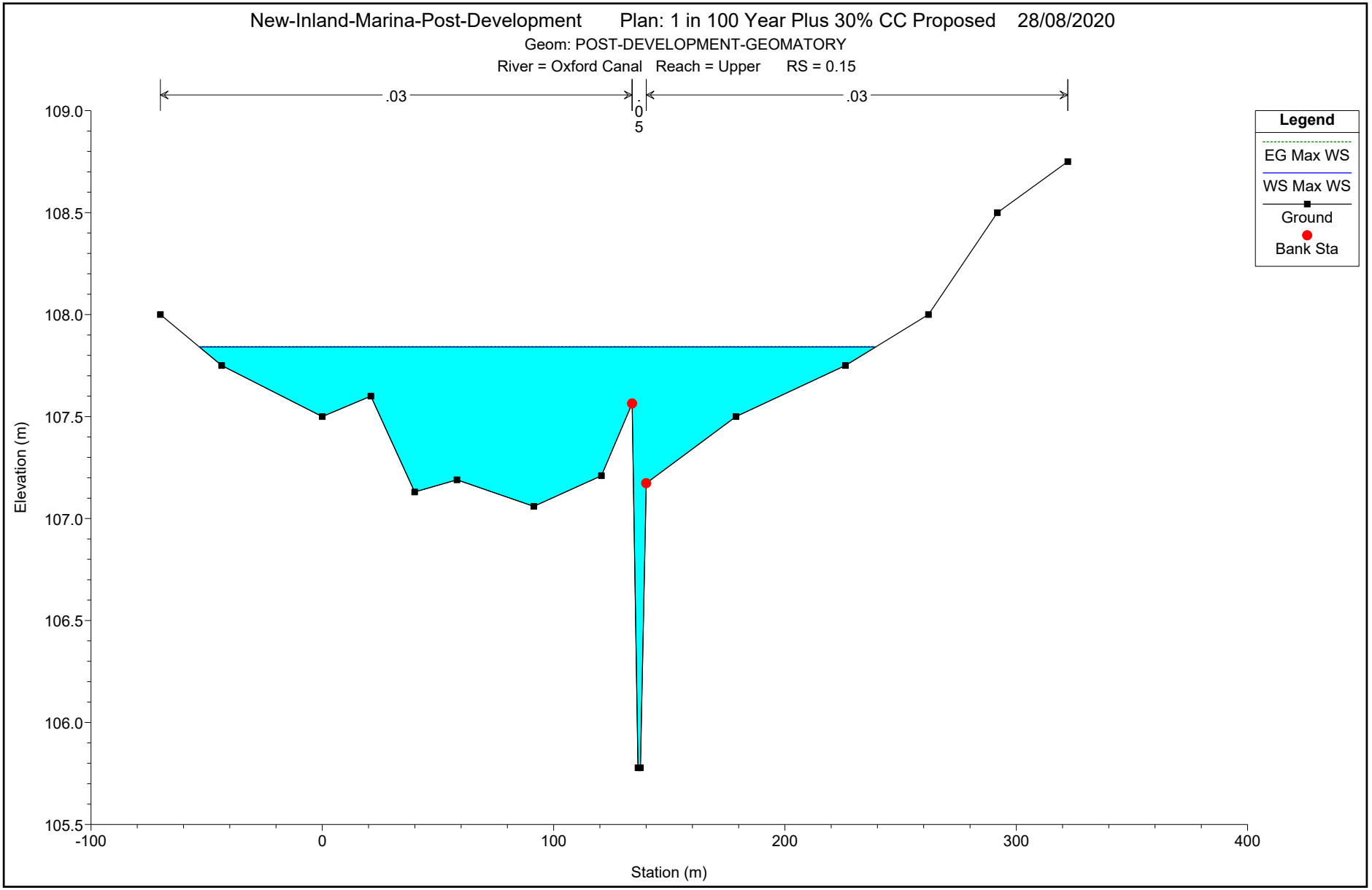

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.42 ECS chainage 1108.784m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
108.5
108.0
107.5
107.0
106.5
106.0
0
20
40
60
80
100
120
Station (m)

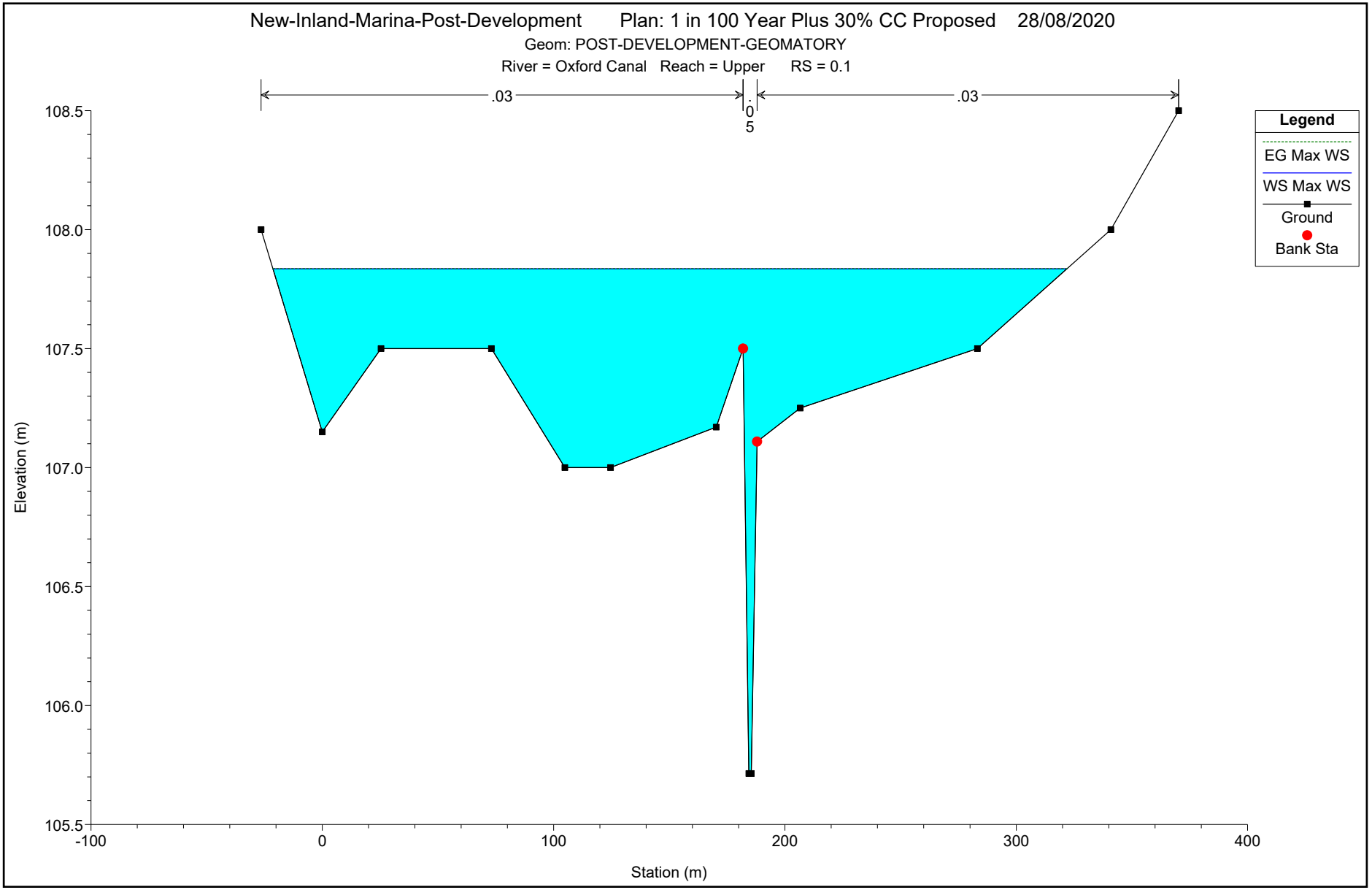

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.395 ECS Chainage 1135.241m
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
108.5
108.0
107.5
107.0
106.5
106.0
0
20
40
60
80
100
120
Station (m)

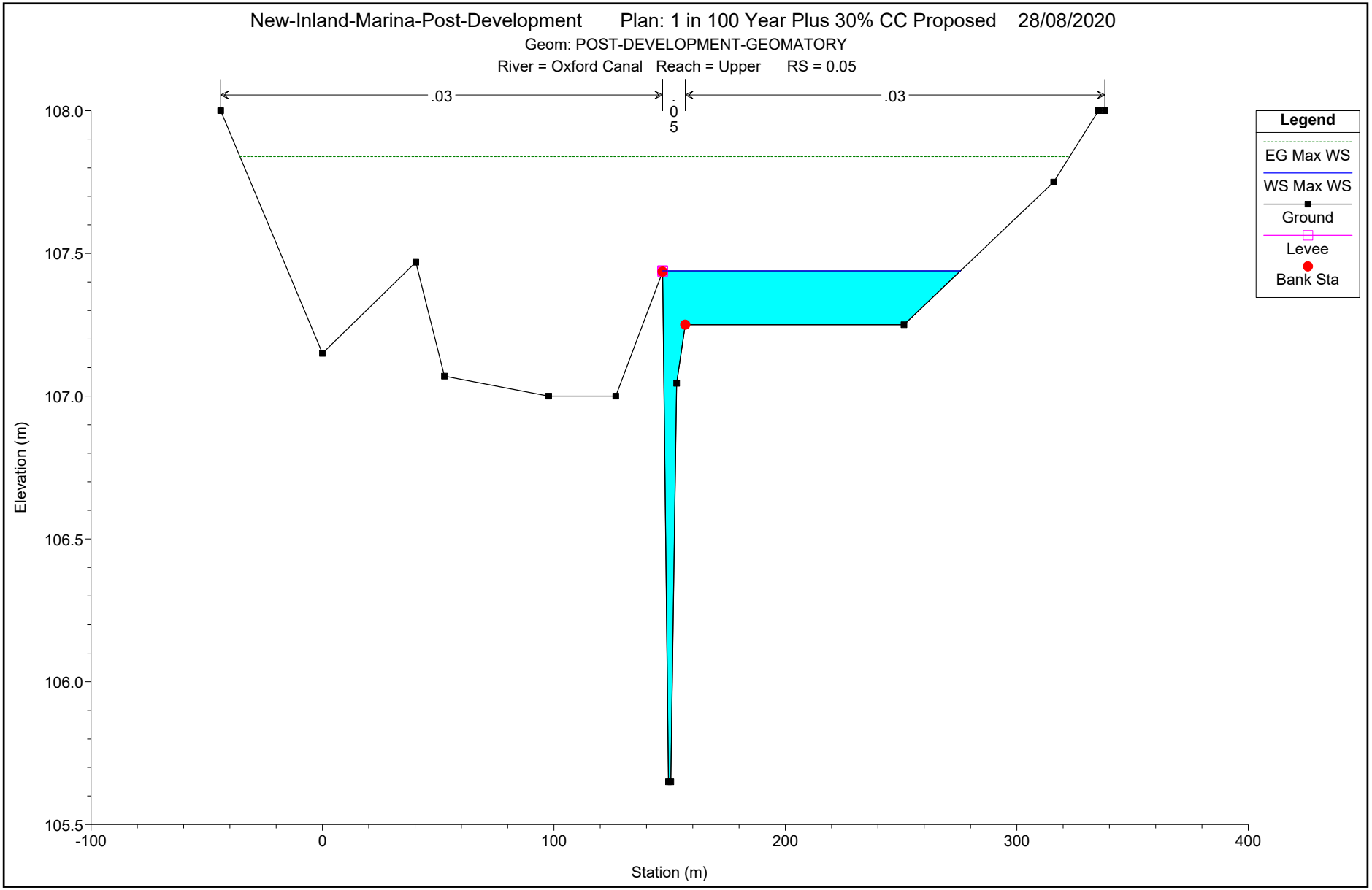

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.30 CHAINAGE 1228.785
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
108.5
108.0
107.5
107.0
106.5
106.0
105.5
0
50
100
150
200
250
300
Station (m)

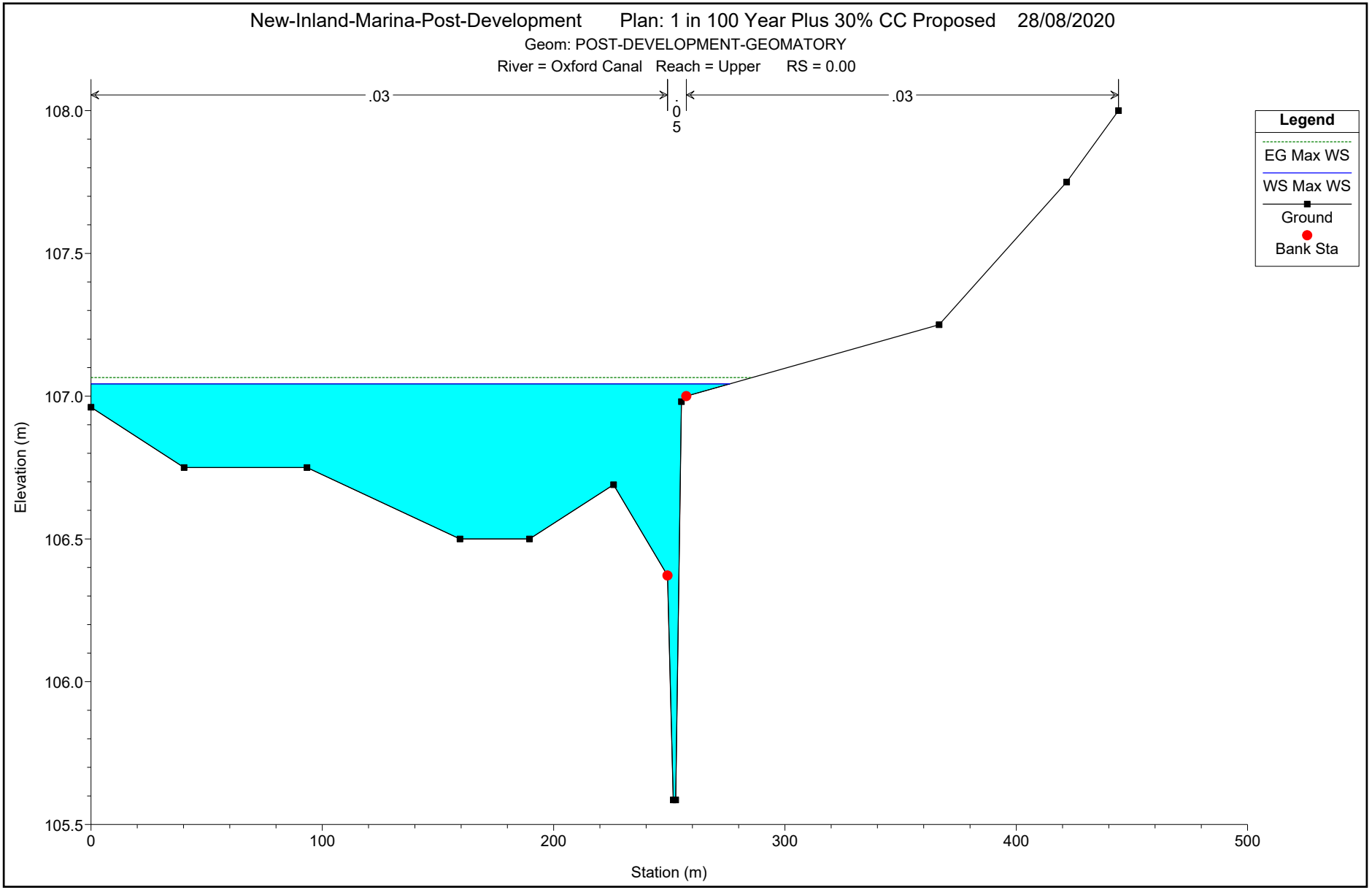

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.25
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.5
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-50
0
50
100
150
200
250
300
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.20
.03
0.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.15
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
109.0
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)

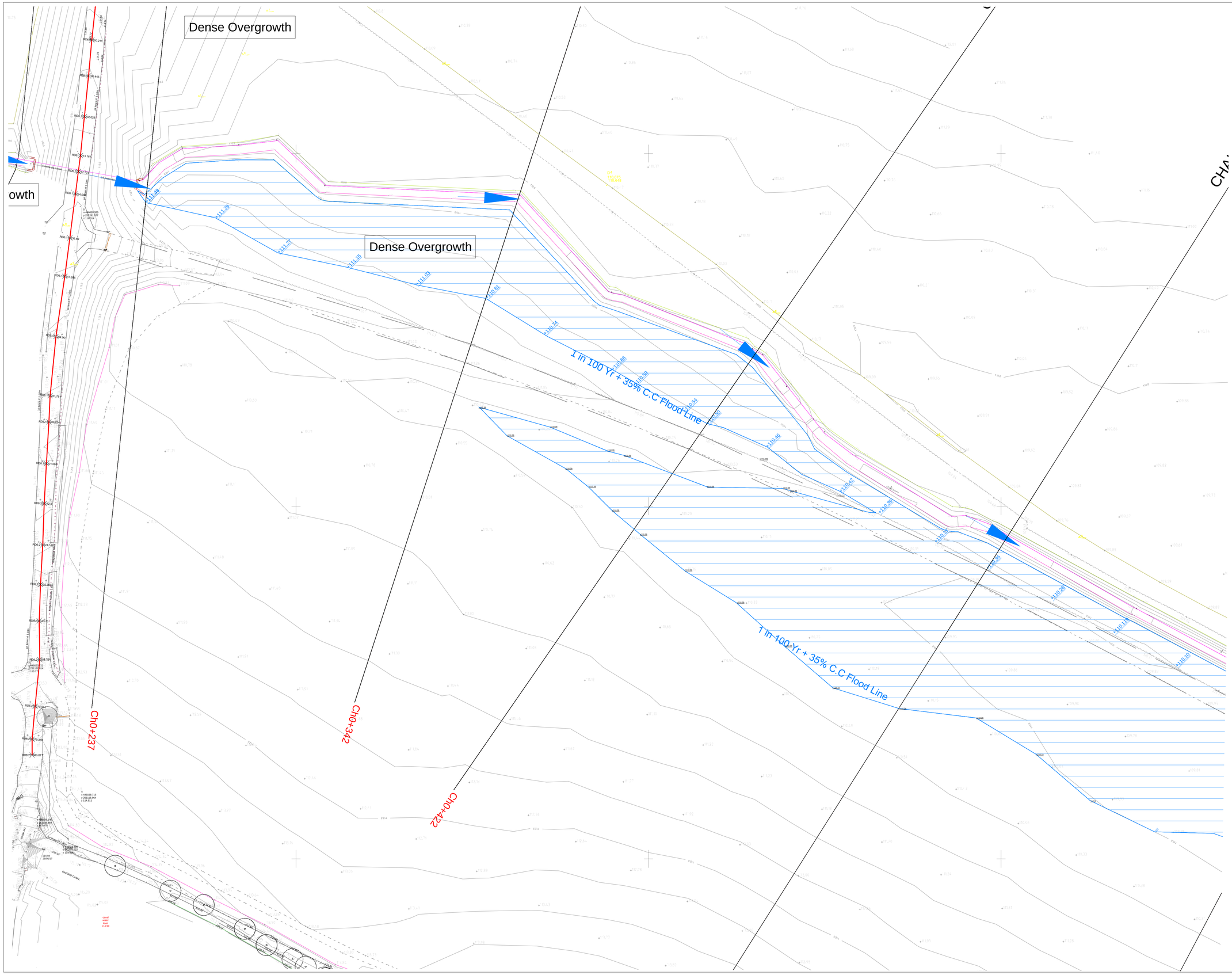

New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.1
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
108.5
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.05
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Levee
Bank Sta
Elevation (m)
108.0
107.5
107.0
106.5
106.0
105.5
-100
0
100
200
300
400
Station (m)


New-Inland-Marina-Post-Development Plan: 1 in 100 Year Plus 30% CC Proposed 28/08/2020
Geom: POST-DEVELOPMENT-GEOMATORY
River = Oxford Canal Reach = Upper RS = 0.00
.03
.05
.03
Legend
EG Max WS
WS Max WS
Ground
Bank Sta
Elevation (m)
108.0
107.5
107.0
106.5
106.0
105.5
0
100
200
300
400
500
Station (m)

APPENDIX 17

POST-DEVELOPMENT 1 IN 100 YEAR PLUS 35% CLIMATE CHANGE FLOOD EXTENT

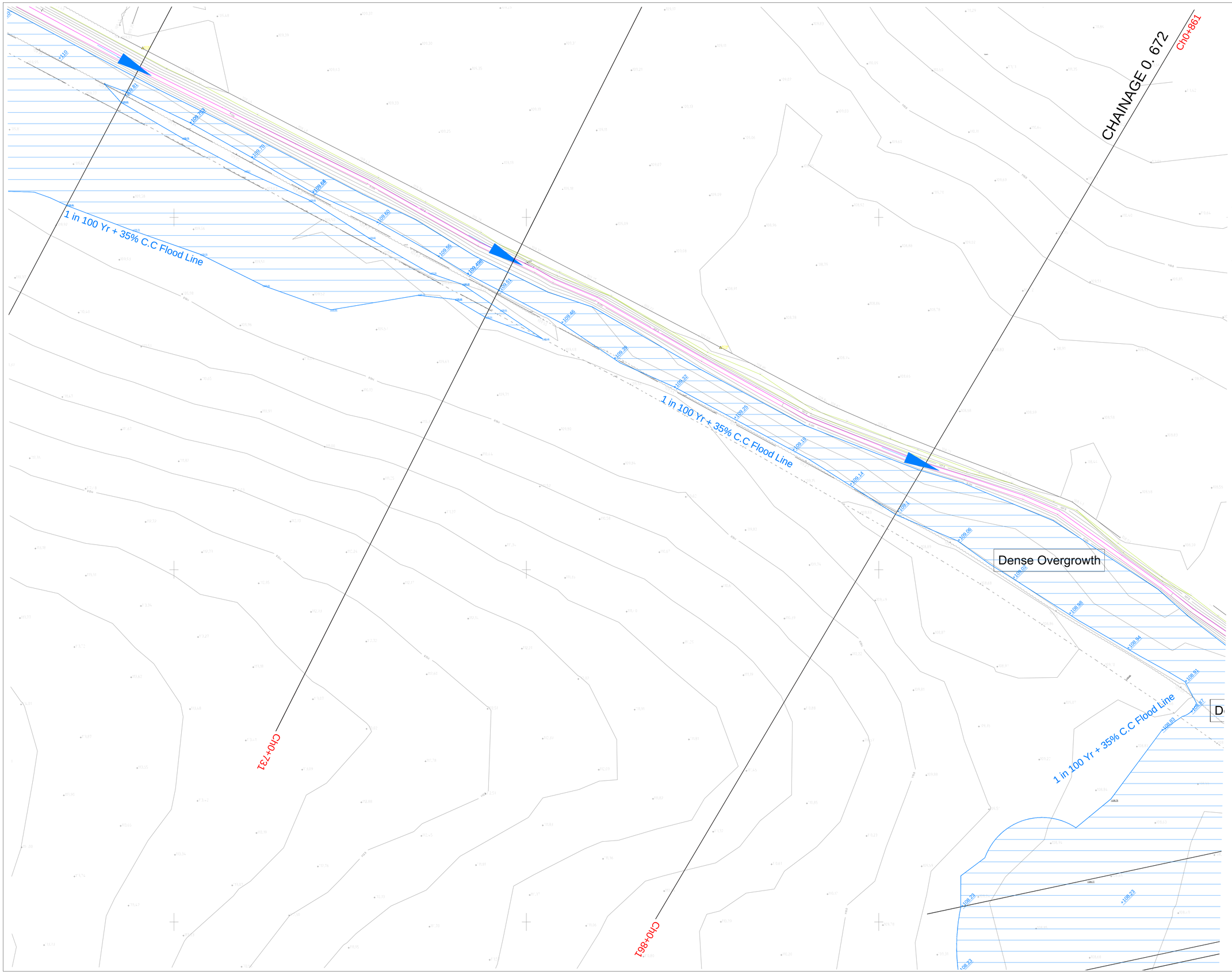


REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
C	28.08.20	UPDATED TO SUIT MODEL	SEC
B	19.06.2020	UPDATED FLOOD EXTENT	SEC
A	12.03.2020	Revised to unsteady flow	SEC

MTC ENGINEERING
MTC Engineering (Cambridge) Ltd.
Ground Floor, 24 High Street
Whittlesford, Cambridgeshire, CB22 4LT
Tel (01223) 837270, fax (01223) 835648
E-mail office@mtcengineering.co.uk

TITLE
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY 1 in 100 Yr + 35% C.C FLOOD EXTENT & LAYOUT 1 OF 3

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE 1:500@A1
APPR	DRAWING NO 2420-15 REV C



N
W E
S

1 in 100 Year Plus 35% Climate Change Flood Line

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
C	28.08.20	UPDATED TO SUIT MODEL	SEC
B	19.06.2020	UPDATED FLOOD EXTENT	SEC
A	11.03.2020	Revised to unsteady flow data	SEC

MTC ENGINEERING
MTC Engineering (Cambridge) Ltd.
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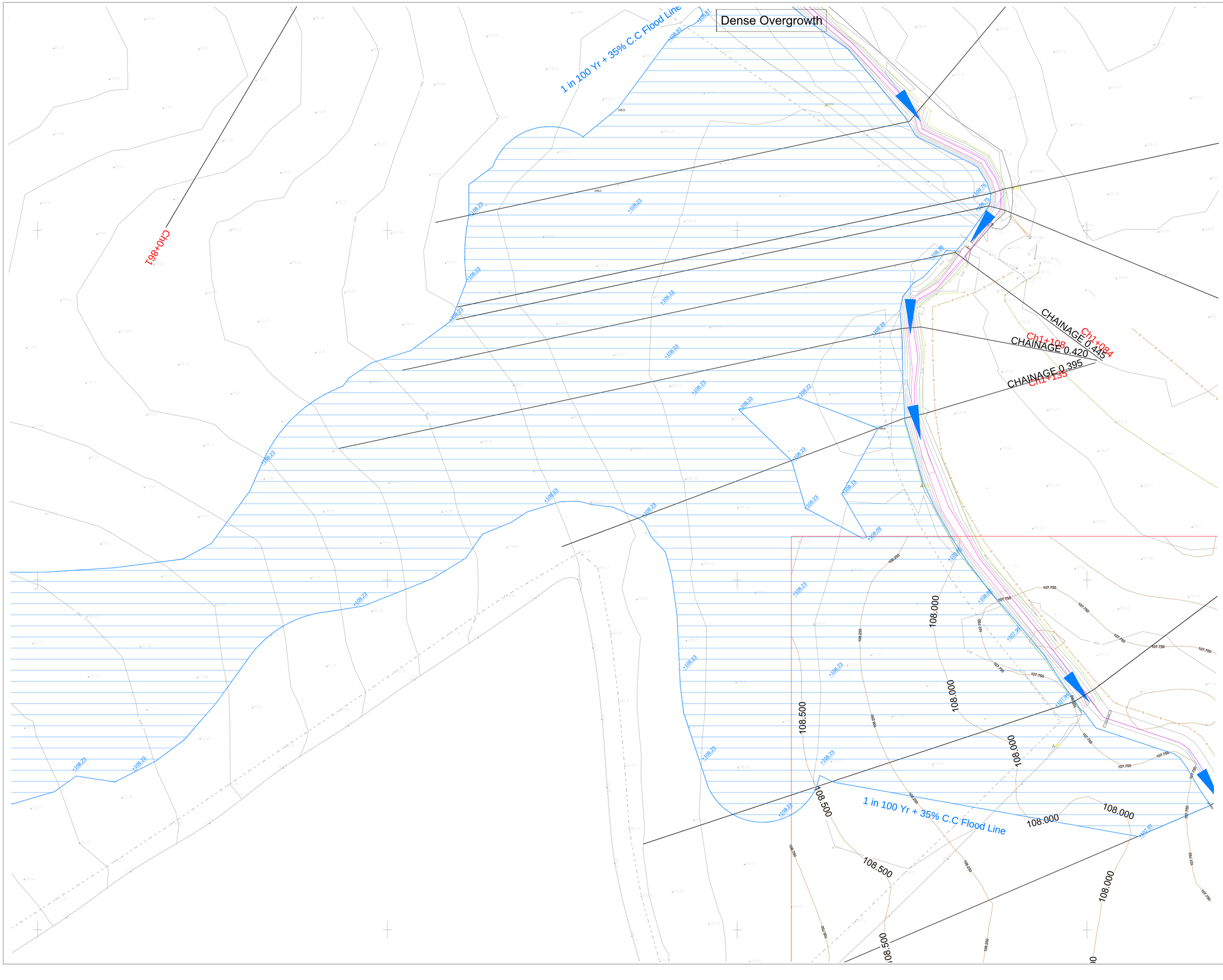
TITLE NEW INLAND MARINA,
ON LAND AT GLEBE FARM
CLAYDON, BANBURY
1 in 100 Yr + 35% C.C
FLOOD EXTENT & LAYOUT
2 OF 3

ORIG	DATE
S.E.C	29.11.2019
CHKD	SCALE 1:500@A1
APPR	DRAWING NO 2420-16 REV C



N
W E
S

1 in 100 Year Plus 35% Climate Change Flood Line

REV	DATE	DESCRIPTION/REASON FOR ISSUE	APPR
C	28.08.20	UPDATED TO SUIT MODEL	SEC
B	19.06.2020	UPDATED FLOOD EXTENT	SEC
A	11.03.2020	Updated to unsteady flow	SEC

MTC ENGINEERING
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TITLE
NEW INLAND MARINA, ON LAND AT GLEBE FARM CLAYDON, BANBURY
1 in 100 Yr + 35% C.C FLOOD EXTENT & LAYOUT
3 OF 3

ORIG S.E.C	DATE 29.11.2019
CHKD	SCALE 1:500@A1
APPR	DRAWING NO 2420-17 REV C

APPENDIX 18

ENVIRONMENT AGENCY HEC-RAS REVIEW

HYDRAULIC MODEL REVIEW

Project	Glebe Farm, Claydon	**Job Number**	

Model Type	1D	Software	HECRAS
Revision	1st review	**Date**	20/01/2020
	2nd review	**Date**	06/05/2020
	3rd review	**Date**	30/07/2020
Area Client	THM	**Reviewer**	Ines Martin

REVIEW SUMMARY/CONCLUSION

Is the model suitable for intended use?

30/07/2020: The model is not considered to be fit for purpose. Please review all coloured comments that have been raised in this review. For future submissions, there is no need for you to provide colouration to your responses.

06/05/2020: At present, the model is not suitable for its intended use. The model requires a number of improvements in order to bring it up to standard, and also an appropriate hydrology report should be supplied.

20/01/2020: The model is not considered to be fit for purpose. The proposed amendments and clarifications highlighted in this review would help to place more confidence in the current model. For future submissions, please consider to supply a hydrology report along with model report and model files, and make sure any update in the model is made in accordance with the latest EA guidance (Computational modelling to assess flood and coastal risk, Operational Instruction 379_05).

MODEL REVIEW PROCESS

Hydraulic Model reviews are an essential component of the Hydraulic Modelling Quality Assurance (QA) process that provides confidence in a model's suitability for its intended purpose. Evidence that the model has undergone QA may be requested by external parties and hence all reviews should be written with an expectation that they could be read externally.

Should any issue(s) be raised during the review process, which require attention, the reviewer should detail the action(s) required in sufficient detail to allow the modeller to complete the changes as appropriate. Completion of this Model Review document does not automatically constitute model approval. Once the suggested changes have been completed, the reviewer may require that the model be resubmitted for further review to establish whether the actions have been completed satisfactorily. Only once all the amendments have been completed satisfactorily, will the model be approved and the quality assured by the reviewer.

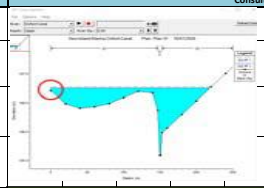
It is recommended that the reviewer makes good use of the fluvial design guide chapter 7
http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter_7_Background.aspx
and the user manual/help guides for the appropriate modelling software.

Depending on the work being reviewed some questions or entire sections may not be relevant, in which case they can be deleted. On completion of the review the reviewer may choose to use the following colour coding system to alert the modeller to the priority of the actions required (if any).

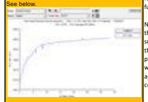
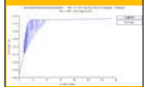
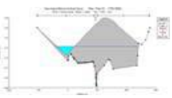
Colour coding used:

Green – Good practice – not strictly necessary in this case but good practice for future studies.
Amber – Useful – please follow recommendation if time allows.
Red – Must do.

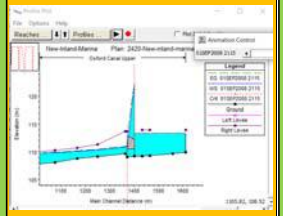
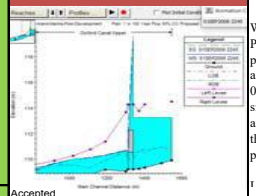
Item No.	Summary & Reporting								
	Item Checked		Comments	Suggested actions	Consultants response (April 2020)	EA Response (May 2020)	Consultants response (July 2020)	EA Response (July 2020)	Consultants response (Aug 2020)
1.1	Software used, including versions?		HEC-RAS v5.0.7						
1.2	Does the model run?		The model was re-run using version 5.0.7. A comparison with the supplied results within the report showed no difference for Q100+CC.						
1.3	AEPs provided		Only 100-years+35% climate change scenario (higher central) has been provided.	It is good practice to provide a set of return periods to check the model performance is reasonable.	The model was initially run using flows associated with a 1 in 100 year event as detailed within Section 4.5 of the revised Hydraulic Model Report. To ensure that the model was able to perform consistently, sensitivity analysis was carried out by increasing and decreasing the 1 in 100 year flow by 20% as per Section 6 of the revised Hydraulic Model Report. The results of the sensitivity analysis show the model to not be overly sensitive to changes in flow, thus indicating that the performance of the model is consistent. It is not considered that further checks involving varying return periods is required given that checks	No further action required.			
1.4	Scenarios provided		The model provided for review appears to be the pre-development scenario.	Please clarify in the report what is the scenario presented and why pre and post development scenarios have not been supplied and compared.	As detailed within Section 7 of the revised Hydraulic Model Report the pre-development scenario has been modelled within HEC-RAS to determine the flood extents at the watercourse during a 1 in 100 year plus 35% climate change event with the model results provided in Appendix 12 and the pre-development flood extents provided in Appendix 14 (drawings 2420-12, 2420-13 and 2420-14) of the Hydraulic Report. The pre-development flood extent modelled during the 1 in 100 year plus 35% climate change event was then overlain on the development layout in order to assess whether the proposed development would remain outside of the 1 in 100 year plus 35% climate change flood extent and thus not impact on flood storage. The comparison of the development layout and flood extent are shown on plans 2420-15, 2420-16 and 2420-17 provided in Appendix 15 of the Hydraulic Report and shows that the proposed development does not include any ground raising activities within the 1 in 100 year plus 35% flood extent thus would have no adverse impact upon storage volumes or off site water levels. Should the post-development scenario be modelled, the model would essentially show all cross sections to remain exactly the same as shown for the pre-development scenario, with all raised elements of the proposed development including embankment shown to be between 40m to 90m to the right of the watercourse and at least 11m outside of the flood extent. Therefore it is clear that if the post-development scenario was to be modelled the results would mimic that of the pre-development scenario along all of the length of the proposed development other than in the vicinity of the proposed lake, which would essentially fill and provide an additional flood storage volume of approximately 8,758m³ as detailed in Section 7 of the revised Hydraulic report, thus lowering water levels at the downstream end of the model. Therefore given that the post-development scenario would essentially mimic the pre-development scenario with the only alteration to the cross sections being located outside of the flood extent or lowering works at the lake, it is not considered necessary to also model the post-development scenario. The only part of the proposed development within the 1 in 100 year plus 35% climate change footprint is the proposed lake in the eastern part of the development. This however involves excavation only, and the proposed water level is lower than existing ground levels, thus there will be an increase in available storage in this location and no storage losses.	If the model is to demonstrate the impact of a development, pre and post development scenarios should be provided using specific site survey data to represent each scenario. The post development scenario should include the final ground levels for the lake and the embankments. This is also important to assess the effects of the development at neighbouring areas. Please provide both pre and post development plans with their associated pre and post development geometries for comparison.	Please refer to Section 7 of the revised Hydraulic report which now provides details of both the pre-development and post-development scenarios including results. As can be seen from the result, during the post development scenario the proposed lake would fill with flood water and provide an additional flood storage area, which in turn has resulted in water levels reducing by between 40mm to 90mm at the downstream end of the site.	Pre and post development scenarios have now been provided.	
1.5	Reports	Technical reporting	2420 - Hydraulic Modelling Report - New Inland Marina Glebe Farm Claydon Banbury.pdf						
1.6	Reporting	Objectives	The objectives of the study are set out in the modelling report.						
1.7		Approach Justification	Modelling approaches and assumptions are generally clearly stated.						
1.8		Assumptions, clarity, interpretation of results	Interpretation of the model results is generally acceptable.						
1.9	File organisation		Standard HEC-RAS structure.						
2.1	Survey / topographic data	Age Quality Suitability	A new 1D model has been built to estimate water levels at the site considering only one return period.						
2.2			Various plans showing the locations of the cross sections are included in the model report. The date of the survey used to inform cross sections is not stated.	Please include the date of the survey dataset in the model report.	Date of survey (8th November 2019) has been added to the revised Hydraulic Model Report - Sections 1.4 and 3.2.	This comment has been addressed.			
2.3			Survey data for the watercourse has been provided and they have been randomly selected and checked against model cross sections. Was cross section 1.2 duplicated or were interpolations used to adapt the right over bank area? Please explain the process to fill the missing data that led to obtain the manually amended cross sections. Please provide evidence that the assumptions made on cross sections are sensible i.e. compare the amended cross sections with LiDAR data if available, graphical views of the cross sections to show survey points and 'manually amended points'. Similarly, for the amendments made on the downstream end of the model.	It appears that the majority of the cross sections throughout the model have been manipulated. Please confirm the assumptions made on model geometry are sensible using another source i.e. LiDAR data if available. A comparison between the 'adjusted' cross sections and the channel gradient against LiDAR information would help to place more confidence on the model geometry used. Also for clarity, please add a note on the cross section's descriptions when it is a copy.	As survey works could not be undertaken for the full modelled area, LiDAR data has been obtained for the site and used to model Cross Sections where necessary. Comparison of levels shown on LiDAR data against levels provided on the topographical survey show that the LiDAR data is within an accuracy range of around +/-0.25m and is considered the most accurate data available to model Cross Sections in the absence of topographical survey information. The following cross sections are all fully based upon topographical site survey information: 1.2, 1.119, 1.028, 0.927, 0.807, 0.677, 0.506, 0.47, 0.466, 0.448, 0.423, 0.397. Cross Sections 1.315 and 0.303 are based almost entirely on topographical survey information, with LiDAR data only used to inform the bank profile where the Cross Sections were required to be extended past the topographical survey extents to avoid glass walling. The watercourse and left bank of Cross Sections 1.566, 1.510, 1.418, 1.385 and 1.353 are based almost entirely on topographical survey information, with LiDAR data only used to inform the bank profile where the Cross Sections were required to be extended past the topographical survey extents to avoid glass walling. The right hand bank of these Cross Sections was unable to be surveyed, therefore the profile of land is now based upon LIDAR information rather than OS contours previoulsy used. The left bank of Cross Sections 0.252, 0.201, 0.150, 0.1, 0.05 and 0.0 is based entirely on topographical survey information. The watercourse at these sections was unable to be surveyed, whilst LIDAR data does not provide intricate details of the bank profile in this area, as such in order to model the downstream section of watercourse that was unable to be surveyed, it was assumed that the longitudinal gradient and profile of the watercourse would continue to be similar to that surveyed immediately upstream. This is considered a reasonable assumption given that the longitudinal gradient of the watercourse surveyed is relatively linear and other available data does not indicate that there is likely to be any immediate change in gradient, whilst the site walkover conducted confirmed that the geometry of the downstream section of watercourse did not vary greatly from that upstream. The right hand bank of these cross sections has been modelled based upon LIDAR data. Topographical survey information has therefore been used to model either all or part of each Cross Sections on site, with LIDAR data only used where required in the absence of survey information, it is therefore considered that the model geometry used is sensible in this instance. Additionally a note has been added to all cross sections that have been copied as per Appendix 13 of the Revised Hydraulic Model Report.	Cross sections should not intersect each other as this causes overstatimation of volume. 	Please refer to Appendix 3 of the Revised Hydraulic Report, the following cross sections have been revised to ensure that they no longer intersect one another: 1.402, 1.372 1.342, 0.502, 0.467, 0.462, 0.445, 0.420 and 0.395.	The cross section location plan has been updated in Appendix 3 (modelling report Part 1), however, the previous cross sections set up is shown in the modelling report Part 2, this should be updated too.	It has however now been updated to show the latest set up of cross sections and match Appendix 3 and thus avoid any potential future confusion. I would note that this make absolutely no difference to the model itself or water levels.
2.4	Other	Any significant missing data							

Item No.	General modelling approach								
	Item Checked		Comments	Suggested actions	Consultants response (April 2020)	EA Response (May 2020)	Consultants response (July 2020)	EA Response (July2020)	Consultants response (Aug 2020)
3.1	Model extents	Domain boundaries	The HEC-RAS model uses 27 cross sections.						
3.2		Upstream boundaries	It appears that model coverage upstream of the site is adequate. An upstream flow boundary have been used for the single reach modelled.						
3.3		Downstream boundary	The location of the DS boundary is ~353m downstream of the site of interest.						
3.4		Glass walling	For the 1 in 100 year +35%CC event, there is a negligible glass walling on the left overbank of section 0.00. Please see screenshot.						
3.5	Modelling approach	1D / 2D / Linked	1D only model. There is a reference to the document "Requirements for completing river modelling for flood risk assessment - Guidance for developers, August 2009".	Please refer to the latest version of this document (version 7, 2011) in the model report.	Reference to Requirements for Completing Computer River Modelling for Flood Risk Assessments – Guidance for Developers- Version 7 has been made in Section 1.4, and 4.7 of the revised Hydraulic Model Report with guidance followed throughout the development of the model and model report.	Accepted.			
3.6		Is the model geo-referenced?	The model is not geo-referenced.	It is good practice to have the model geo-referenced.	Geo-referencing the model would not impact the watercourse characteristics or cause any variance in the model results, it is therefore considered that geo-referencing the model would not contribute to the model performance particularly as the model will not be used to inform flood map challenges within the area, thus is not considered necessary in this instance. Given the time it would take to geo reference the modell and the limited benefit doing so this has not been completed in this instance.	It is best practise to have the model geo-referenced.			
3.7	Inflows	Applied to 1D or 2D domain Lateral/point inflows	The inflow is applied directly to the upstream end of the watercourse.						
3.8		Consistency with reporting	A hydrology report should be submitted along with the model files and model report. Please consider the EA's flood estimation guidelines. It is good practise to provide a record of the calculations and decisions made during flood estimation, the information given should enable the work to be reproduced.	Information provided regarding hydrology is very limited. Please provide a detailed hydrology report.	Please refer to Section 4 of the revised Hydraulic Model Report which gives full details of the process involved in obtaining flow data. As detailed within the report two flow estimations have been made to determine the 1 in 100 year flow for the watercourse, using both ReFH Version 2 Software and the catchment descriptor method. The catchment descriptor method indicated peak flows to be around half that indicated by the Revitalised FSR/FEH method, therefore it was considered appropriate to use the flow data provided by the Revitalised FSR/FEH method as this would provide most conservative flow estimate.	This comment has not been adrresed. Section 4 and Appendix 6-7 are not a hydrology report. Please follow the EA's flood estimation guidance and complete the Flood estimation calculation record.	Please find attached the completed flood estimation calculation reecord document.	Received.	

1D Model Build - HECRAS

Item No.	Item Checked		Comments	Suggested actions	Consultants response (April 2020)	EA response (May 2020)	Consultants response (July 2020)	EA Response (July2020)	Consultants response (Aug 2020)
4.1	Model length	Accuracy of modelled channel	Model length is ~1566 m. Approximate measurements on an OS plan appear to differ slightly with cross section intervals in the model (~1612m).	Please amend according to survey data.	The model length has been calculated using the topographical site survey data provided in Appendix 3 of the Hydraulic Model Report. The topographical survey indicates that the length of watercourse subject to modelling is 1566m. As such the watercourse length of 1566m taken from the topographical survey has been used as the model length, and it is not considered that the model length should be updated to that calculated using the Ordnance Survey plan.	The model length (sum of all channel reach lengths) is 1612m, so there is a difference of 46m. (1612-1566=46m).	The reach lengths and model length has been adjusted to ensure this is no discprencies. The total model length is 1547 calculated by the below reach lengths: 55 + 90 + 30 + 30 + 30 + 8 + 112 + 80 + 90 + 100 + 120 + 130 + 170 + 35 + 5 + 10 + 7 + 25 + 25 +	Accepted.	
4.2	Schematisation	Flow paths	The model is created from 27 cross sections and no interpolates in-between. As the model is not georeferenced, I am unable to check whether cross sections are drawn perpendicular to the flow lines.	Please ensure that the cross sections are drawn perpendicular to the flow paths in both the channel and the overbank areas.	Please refer to plans 2420-02A, 2420-03A and 2420-04A provided within Appendix 3 of the Hydraulic Model Report. The plans show the location of the Cross Sections in relation to the watercourse, flood plain, and direction of flow through the watercourse. The plans clearly indicate that the Cross Sections have been drawn perpendicular to both the flow within the channel and flood plain.	The cross sections seem perpendicular to in-channel flow, but they are not perpendicular to the flow paths in the overbank areas, so as it is, this is not a good representation of the flowplains. Surveyed cross sections are not allow to intersect each other as you would be double counting volumes and results might be unreliable. Please see item 2.3. Please improve floodplain representation within the model e.g. using 1D cross sections that don't overlap each other and are perpendicular to flow paths or considering 2D modelling.	The cross sections have been updated to now run perpendicular in channel flow and perpendicular to out of bank flow,addiiontally as stated in response to 2.3, the cross sections have also been amended to ensure there they no longer intersect. A copy of the cross section locations is provided in Appendix 3 of the Revised Hydraulic Report.	This issue has been amended.	
4.3		Representation of storage	As the 100-year +35%CC flood extent incercepts with a water body (the proposed lake) this should be considered in the model. See item 5.7 below.						
4.4	Boundary conditions	Upstream boundary	Steady flow data have been applied at the most upstream cross section. Flow file is consistent with reporting.	Given that is not a narrow valley and the flows are not limited to in-channel, it is recommended to test the model using one-dimensional unsteady flow approach, and compare the results with the one-dimensional steady flow.	The model has now be run using the one-dimensional unsteady flow approach. The results have been compared to that produced using the one dimensional steady flow and show that the results do not vary greatly between approaches. The one dimensional unsteady flow approach has however now been used to inform the flood extents at the site during a 1 in 100 year plus 35% climate change event.	Accepted, unseady flow file provided (.u02).			
4.5		Downstream boundary	The DS boundary is 353m downstream of the site. Normal depth (slope = 0.00128) was specified at the downstream boundary.						
4.6	Cross sections	Roughness	A variable approach has been used throughout the model. The Manning's n value of 0.05 in-bank and out-of-bank (0.03-0.07) have been applied.	It is unusual to have lower Manning n values on the floodplain than in-channel. Please provide further evidence to support why these values were chosen, i.e. photographs.	Firstly in relation to the Manning's value for the channel, the Manning's value 0.05 relates to a clean channel with pools and shoals with some stones. The topographical survey undertaken for the watercourse shows multiple low spots along the channel bed, indicating pools to be present, whilst high spots along the bed indicate that shoals are also present, relevant extracts from the topographical survey are attached. This is further confirmed by the Ecological Report undertaken at the site, which highlights that riffle habitats with pebble/gravel substrate were noted throughout the brook. Photos of the brook bed are provided on the site walkover report attached. Therefore given that the watercourse is stony with pools and shoals/riffles it is considered appropriate to use the Manning's value of 0.05. Secondly, in relation to the Manning's value 0.07, which relates to medium to dense brush in winter. Please see attached the site walk over report, which shows the photos and annotation of watercourse and flood plain. The investigation confirms dense trees and shrubbery to be present on the right bank of the watercourse upstream of Boddington Road (Point 1), thus in the vicinity of cross sections 1.566 to 1.353. The dense trees and shrubbery then continues on either side of the watercourse to approximately the location of Cross Sections 1.2 and 1.19 (Points 3,5 and 6) before petering out to a thin width of shrubbery. It is clear from the photos provided that the flood plain in vicinity of these cross sections consists of medium to dense brush, and it is considered appropriate to use the Manning's value of 0.07. Finally, in relation to the Manning's value of 0.03, which relates to cultivated areas with no crop and pasture with short grass. As indicated by Points 7, 8, 10 and 11 of the attached site walk over report, from approximately the location of Cross section 1.119 and 1.028 to Cross Section 0.00 the floodplain on both the left and right hand side of the watercourse is formed of either cultivated uncropped field or pasture with short grass present.	Photos have been included in Appendix 4. Please note that the date on the first photo shown in that appendix is "26th July 2020".	The first photo was not taken during the site walk over conducted on the 12th February, this was instead taken on from the RSK Environment Limited Report which was conducted on the 26th July 2019 and has been included to demonstrate the nature of the bed of the watercourse. For clarityon the photos the date in which each was taken has now been added to all photo descriptions.	Ok.	
4.7		Cross section spacing	The cross section interval in the model is between 4-171m. Therefore, it is acceptable.						
4.8		Main channel bank stations	Based on the shapes of the cross sections in the model as viewed graphically in HEC-RAS, the locations of bank stations where Manning's n changes seem sensible.					Cross section rating curves are patchy and with oscillations throughout the model. Improvements should be made where possible. See below.  	I would note that similar that oscillations were present in the model submitted on the 16th March, however no concern was raised in the review dated 6th May. Had this concern been raised prior to the latest review then additional time could of spent increasing the model stability further. Nevertheless, following receipt of this comment we have spent time increasing the stability of the model and reducing the oscillation occurring in rating curves, and this is now significantly smoother than in the previous version, particularly along the stretch of watercourse adjacent to the site. Whilst some oscillations still occur at some sections in the model, these are predominantly at the upstream end of the model, thus will not have a significant impact upon water levels along the stretch of watercourse adjacent to the site. As such when taking into account the purpose of the model I would not expect this to constitute any reason not to consider the model fit for purpose
4.9		Downstream reach lengths	Left overbank, channel and right overbank reach lengths are similar throughout the model.						
5.1		Levees	Levees have been appropriately used throughout the model.						
5.2	Structures	Geometry	There are two structures within the modelled reach: Culvert US of the site and beneath Boddington Rd. (diameter:1.5m, length:30m) Culvert northeastern corner of the site. (diameter:1.5m; length:9.96m)	It is good practice to provide detailed information about structures i.e. photographs, drawings.	Please see attached the site walkover report which shows photos of the culvert beneath Boddington Road (Point 4) and culvert beneath the field access area (Point 9), both photos are taken from downstream and looking upstream. Details of both culverts are also provided on the topographical site survey provided within the site walk over report, and show details including culvert diameter, invert levels and culvert length and locations.	Accepted.		The culverts need to be represented using the culvert data editor in order to include length, diameter, entrance/exit losses coefficients, mannings, etc.	The culverts and bridge decks have been modelled in exactly the same way since the submission of the model dated 16th March 2020. As such if this was considered necessary it should have been raised in the review dated 6th May 2020, however absolutely no concern whatsoever in relation to the culvert modelling was expressed in that response, with the only comments regarding the culvert being "accepted". It is unreasonable to now request changes to the culvert at such a late stage in the modelling/consultation process when this could have easily been raised in the 6th May review. We have however had look at changing the way in which the culverts are modelled, although doing so started to give rise to significant instability in the model, whilst there is now insufficient time available to spend addressing this. Furthermore the main impact of any changes to how the culverts are modelled would be to water levels upstream of Boddington Road bridge, and there would be no signifcant impact upon water levels downstream of the bridge and in the vicinity of the site itself, which is the only area
5.3			Culvert US of the site and beneath Boddington Rd: 	How has the top of the deck level in the US culvert been informed?	The deck level for the culvert beneath Boddington Road represents the profile of Boddington Road itself where it runs over the watercourse and through the floodplain. The profile of the road/deck has been determined by drawing a long section along the centre line of Boddington Road, with the levels along Boddington Road then entered into HEC-RAS as a deck. A copy of the road long section is provided in Appendix 5 of the revised Hydraulic Model Report (drawing 2420-05). .	Accepted.			
5.4			Ineffective flow areas (no conveyance) have not been set in culverts. Normally these ineffective flow areas are applied until the water surface goes above the top of the culvert.	Please consider the use of ineffective flow areas at the US and DS cross sections for culverts. Ineffective areas could be used to represent the correct amount of active flow area US and DS of culverts due to contraction/expansion of flow.	Ineffective flow areas have been added to the model.	Ineffective flow areas have been added at the upstream section of the bridges only. Please consider the recommendations to model bridges and ineffective flow areas in the **Hydraulic reference manual v 5.0.**	Consideration has been given to the recommendations set out in the Hydraulic Reference Manual V 5.0, however as this comment is amber only thus given and only recommendations should be followed if time allows. In this instance given the time contstraints in providing a respons to the model comments, no action has been taken.	This item has not been resolved. A few amber comments on their own could lead to disapproval. Even green comments should be taken into consideration for future submissions.	Given the time constraints in providing a response to the model comments, no action has been taken in this instance. Whilst I appreciate the comment stating that a few amber comments could lead to disapproval, I would note that action has been taken for all other amber comments provided in this review. It is also worth noting that the main impact of any such areas would also be at the Boddington Road bridge and upstream of the site, with no significant impact upon water levels in the vicnity of the site itself. Therefore, this would not impact upon the fitness for purpose of the model.
5.5		Structure coefficients	The entrance loss coefficient of the culverts is 0.5 and the outlet loss coefficient is 1.						
5.6		Bypassing options	Bypassing of the culverts are modelled with broad-crested spill weirs and discharge coefficient of 1.4						
5.7	Floodplain representation	Suitability of approach	Surveyed river cross sections have been used for in-channel flows and also to represent the floodplain. The proposed lake is not represented in a post development scenario.	More detail is required regarding the lake. What is the initial water level for the lake? What is the extra storage capacity that the excavation works would provide? This extra storage could accommodate the 1 in 100 year +35%CC flood that falls into the lake? Please include the lake into the model to represent the post development scenario.	As detailed in response to Item Number 1.4, it is not considered necessary to model the post-development scenario in this instance, as this would essentially mimic the pre-development scenario. The water level proposed within the lake is 107.75m AOD, this is 100mm below the lowest existing ground level in the vicintiy of the lake. As detailed within Section 7.10 of the revised Hydraulic Model Report, approximately, 3,840m^2 of lake will be situated within the 1 in 100 year plus 35% climate change flood plain. Based upon the lowest ground level of 107.85m AOD, proposing a lake water level 100mm below this at 107.75m AOD the area of lake currently situated within the flood plain would be provide an additional flood storage volume of 384m^3. Approximately 17,090m^2 of the proposed lake is located outside the 1 in 100 year plus 35% climate change floodplain, and will also have a water level of 107.75m AOD. Based upon the lowest modelled flood level of 108.24m AOD in the vicinity of the lake, this area would provide an additional flood storage volume of 8,374m^3. Based upon the conservative calculations detailed above the proposed lake would provide a total additional storage volume of 8,758m^3, thus a signficant increase in flood storage currently provided at the site. Indicating the lake would therefore clearly reduce water levels rather than increase them, thus would have a beneficial rather than adverse impact thus it is not considered necessary to include a post development model.	This comment has not been addresed. The floodplain representation including the lake should be improved. As per items 2.3 and 4.2, the extending cross sections used to represent the site of interest and floodplain are overetimating volumes. To represent the lake in the model, please ensure that the storage area has the correct area/stage/volume relationship, and set appropriate initial water levels.	Please refer to Section 7 of the revised hydraulic model report which provides details of the post development scenario including results. Additionally please see attached the post development hydraulic model.	This comment has not been addressed. One of the limitations of using a 1D only model is that cannot simulate floodplain flow and provides a crude representation of floodplain storage capacity. That's why a 1D-2D approach has been recommended in previous reviews. However, if the preferred approach is 1D only, it is recommended to use a storage area to better represent the lake. Please provide a justification within the model report for the storage area data that will be used (area, min elevation, stage/volume, etc).	The revised proposed situation model has fully taken into account this comment and the lake has now been modelled using a storage area in order to better represent the lake as requested. Justification has been provided within the model report detailing the storage area data used and the lateral weirs allowing inflow into the storage area.
5.8	Initial conditions		N/A						
5.9	Run parameters and output data	Run parameters	No modifications to default simulation parameters were found as part of this review.						
6.1		Results generated	As only one return period was provided I am unable to check if the results generated by the model are consistent and water levels do increase with inflows.	It is good practice provide a set of runs including different return periods.	Whilst the model has only been run during one return period, it should be noted that sensitivity analysis on the inflow has been carried out, which involved increasing and decreasing the 1 in 100 year flow by 20% as detailed within Section 6 of the revised Hydraulic Model Report. The results show that when inflow is increased the water levels also increase, whilst when the inflow is decreased the water levels subsequently decrease, thus showing consistency. Such increase in water levels also occur when the flow is increased by 35% to allow for the inclusion of climate change as per Section 7 of the Hydraulic Report. The results generated by the model are therefore considered to be consistent.	It is good practice to provide a set of runs including different return periods.		It is good practice to provide a set of runs for different return periods.	
6.2			The results of the model are presented in the report (Appendix 12) and mapped as flood extents in Appendix 13. The cross sections presented in Appendix 12 do not have any identification.	Please add the River Station or any form of identification for cross sections in Appendix 12.	Please refer to the Cross Sections provided in Appendix 13 of the revised Hydraulic Model Report, which now detail the relevant River Station as a form of identification.	Accepted.			

Item No.	1D model runs			
	Item Checked		**Comments**	**Suggested actions**
7.1	Model simulations	Model runs	Only one geometry file has been supplied, which represents the pre-development configuration of the site.	
7.2		Baseline scenario	As above.	
7.3		Climate change	A 100-year event plus 35% increase in flow is used to represent climate change. In the Thames river basin district this percentage increase is equivalent to a 2080s "higher central" allowance.	
7.4		Sensitivity	Sensitivity testing was undertaken for +/-20% flows and for the Manning's n coefficient (+/-20%). When increasing Manning's n value by 20%, water levels increase up to around 0.12m, whereas when increasing flows by 20%, water levels increase up to 0.17m.	

Item No.	Stability, model sensitivity and calibration								
	Item Checked		Comments	Suggested actions	Consultants response (April 2020)	EA response (May 2020)	Consultants response (July 2020)	EA Response (July2020)	Consultants response (Aug 2020)
8.1			Inspection of the summary runtime diagnostic Errors, Warnings and Notes suggests that there are no runtime errors.						
8.2	Model stability	Model errors /warnings Mass balance Non-convergence Unrealistic oscillations	There are some Warnings, most of which are generated because the conveyance ratio is less than 0.7 or greater than 1.4; and the energy loss was greater than 0.3m.	The warnings suggest the need for additional cross sections. What steps were taken to amend/correct warnings?	In order to amend warnings the number of points within the Cross Section Table Properties was increased to 150, whilst incriements were increased to 0.25.	There are unrealistic fluctuations at the culvert beneath Boddington Rd. around 6:30hours and 2:15hours that need to be investigated. See screenshot below. 	This is amber comment only, thus it is only recommended should time allow. Due to time constraints this will not be looked into further, whilst as the fluctuation is located upstream of the site it should not have any impact upon water levels through the site itself.	This issue has not been resolved, and it is present at both pre and post development scenarios. Oscillations must be corrected prior model approval. Please provide a set of model runs to check if the same issue is occuring for different return periods. 	It is unclear why this comment has suddenly been changed to a "must do" red comment at the last minute when in the previous review this comment was amber as no explanation has been provided for this last minute change. As such we are continuing to treat this comment as amber. We have however investigated the oscillations. Playing through the storm event in the proposed scenario, peak water levels occur along the watercourse at about 1200 or so on 01 September (simulation time). There are no significant fluctuations or oscillations anywhere along the model in the vicinity of the peak water levels or in the build up to peak. Levels and flows then begin to subside, yet no
8.3	Sensitivity tests	Results and interpretation of sensitivity testing	The results for sensitivity testing including flow and roughness have been provided and discussed within the report.	Sensitivity test on culvert blockage is also recommended.	As per Section 4.3 of the Requirements for Completing Computer River Modelling for Flood Risk Assessments, Guidance for Developers - Version 7, Sensitivity Testing of features such as culverts are used to assess the possible circumstances that could cause flood levels to be significantly high than the modelled best estimates. The findings should then enable recommendations to be made on the design of any buildings on site to eliminate risk of flood	Please provide the unsteady flow data files used to test flow sensitivity, and the related model plans.	This can simply be provided by adjusting the multipler provided by for unsteady flow data, however please see attached flow data files for increase and decrease in flow	Accepted.	
8.4	Performance Calibration	Calibration	The model is not calibrated and the reasons are not stated in the model report.	Please add a commentary on calibration. If no calibration data is available, a reality check on the predicted levels and flows could be carried out from photographs and/or historic information.	There are no gauging stations in the vicinity of the site that could be used to provide calibration to the model, whilst there has been no historic record of this section of watercourse flooding. Photos of the watercourse provided in the site walk over investigation report where taken on the 12th February 2020 immediately after Storm Ciara and show that the water level within the watercourse remained significantly below bank levels, as such it is considered that out of bank flow would only occur during very extreme events. What's more the sensitivity analysis showed that water levels did not differ greatly with changes in flow therefore it is considered the model is calibrated as well as is possible in this instance.	Please add a commentary on calibration within the model report.	Commentary on the calibration of the model has been provided within the revised hydraulic report, please refer to Section 4.	Accepted.	