C 12
Item # 5
Report # 9

COUNCIL – March 19, 2013

HUMPHRIES PLANNING GROUP INC.

HPGI File: 09203
March 14, 2013

RECEIVED
MAR 14 2013
CLERK'S DEPT.

City of Vaughan
Development Planning Department
2141 Major Mackenzie Drive
Maple, ON L6A 1T1

Attn: Jeffrey Abrams, Clerk

Re: Proposed Modifications to the Woodbridge Centre Secondary Plan
Trimax on Islington Avenue
8013 Islington Avenue, Vaughan (the "Site")

Humphries Planning Group Inc. act as planning consultants for Trimax on Islington Avenue with respect to the Site. Trimax on Islington Avenue submitted planning applications (OP.12.009 and Z.12.023) on June 13, 2012 for Official Plan Amendment and Zoning By-Law Amendment to permit a 3-storey 6 unit townhouse development on the Site and has also filed an appeal of the VOP 2010 to the OMB and is a party to the OMB process. The scope of the appeal includes the entirety of Volume 2 Chapter 4, being the Woodbridge Centre Secondary Plan.

Staff Report – Item 5 of the Committee of the Whole February 5, 2013 meeting made reference to a comprehensive SPA review and flood risk assessment that was undertaken to determine the boundaries of the SPA area. The flood risk assessment has been reviewed and determines the average depth of flooding for the Site is 2.6m and makes no reference to having considered site specific information as submitted on behalf of Trimax on Islington Avenue.

An Engineering Study, stamped and certified by a Professional Engineer, dated May 2012, has been completed by Masongsong Associates Engineers Limited (find enclosed) in support of the applications and in response to the SPA policies for the area. We have received no comments back from the City or TRCA on this engineering study, while the applications were submitted in June of last year. The study determined that the existing ground elevations of the Site, which range from 143.26m to 144.35m in the developable area, are above the 100 year flood level, which varies between 141.74m to 141.97m on the Site. The Study also determines that the Regional Storm Event levels occur between 145.13 and 145.88, which create flooding conditions of approximately 1.5m to 1.9m above ground level. Therefore, with the implementation of appropriate building design inclusive of: providing the minimum finished floor elevation at least 0.3m above the Regional flood line (166.2m), no basement walk outs and appropriate flood proofing

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measures provided for the basement/garage, flood risk is eliminated thereby ensuring the proposed development is appropriate for the Site.

In addition to the above analysis, overbank velocities during Regional storm conditions were also determined and found to be approximately 0.53m/s. The engineering consultant has indicated that this velocity will not create erosion of the ground surrounding the development during Regional storm conditions and therefore not an issue.

In consideration of the above, the comprehensive SPA review and flood risk assessment did review the information that was provided for 8013 Islington Avenue. The SPA boundary as currently shown and supported by staff is not reflective of accurate information and will unnecessarily negatively affect land use planning opportunities for the subject site. Prior to establishing a City position on the SPA, which will be forwarded to the Province for consideration, it is imperative that all the detailed information included in the background work be considered in Staff's determination of the SPA area limits. In this case the subject site should be found to be acceptable for development purposes in accordance with the conclusions of the Masongsong Associates Engineers Limited Engineering Study, as dated May 2012 and submitted to the Committee of the Whole.

We respectfully request the following motion/resolution be adopted by Vaughan Council: **"that Council direct staff to consider the information provided on behalf of the applicant of the 8013 Islington Avenue lands in light of having the technical basis for not including the subject site within the SPA area and prepare a revised report back to Council for consideration."**

Should you require anything further please contact the undersigned at ext 244.

Yours truly,
HUMPHRIES PLANNING GROUP INC.

Rosemarie Humphries BA, MCIP, RPP
President

cc: Mayor and Members of Council
Trimax on Islington Avenue
Brattys LLP Barristers and Solicitors

SPA STUDY

Proposed 6 Units Residential Townhouses
8013 Islington Avenue
City of Vaughan

For

Trimax (Islington Avenue)

MAEL Project No: 11-534

MASONGSONG ASSOCIATES ENGINEERING LIMITED

Markham
1151 Denison Street, Unit 15
Markham, Ontario, L3R 3Y4
T: (905) 944-0162 / F: (905) 944-0165

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1.0 INTRODUCTION

Trimax on Islington Avenue submitted an OPA and Zoning By-Law Amendment to the City of Vaughan proposing a townhouse development on 8013 Islington Avenue. Figure 1, in Appendix A, is a Google Earth aerial view of the site. The development proposal is to construct 6 condo type townhomes as per the Figure 2, in appendix A. This subject site is located within the TRCA regulated flood zone and as such, Section 6C.b.vii of OPA 240 requires an SPA Study to address the following statement:

> *No development or redevelopment within the "Special Policy Area" which required a By-Law Amendment and/or Official Plan Amendment application shall be permitted until such time as an engineering study detailing such matters as flood frequency, the velocity and depth of storm flows, proposed flood damage reduction measures, and storm water management has been reviewed and approved by the Metropolitan Toronto and Region Conservation Authority and the Town of Vaughan, unless it is determined by these agencies that a study is not required.*

The site is tributary to the Humber River and under the jurisdiction of the Toronto and Region Conservation Authority (TRCA).

2.0 METHODOLOGY

1. Update the HEC-RAS model provided by TRCA and translate the regional flood line into the detailed topographic survey of the property. In order to better assess the impact, an additional cross section will have to be added crossing the proposed site. This new section will be evaluated for both existing and proposed conditions. The relevant sections are between River Stations 27+57 to 27+58 including the Islington Avenue bridge section. The Regional HWL at the subject land is approximately 145.88

2. Review and update floodplain mapping if necessary.

3. Report the findings and conclusion.

3.0 FLOODPLAIN HYDRAULICS

A more rigorous computation of the hydraulic impact was undertaken using HEC-RAS. The current Humber River HEC model and mapping were obtained from TRCA and was modified to include the proposed development grading and structure (River Station 27+577).

Figure 3 is the Humber River HEC Mapping with the location of the cross-sections shown. Detailed model output and cross-sectional plots are attached in Appendix B and discussed in the proceeding section.

3.1 Updates to the Existing HEC-RAS model

The HEC RAS model was updated as follows:

- Updated topographical information from TRCA mapping and new site topography data was used to create an existing ground surface digital terrain model (DTM) using Civil 3D. Sections 27+571 to 27+58 were updated in HEC-RAS using this latest DTM. The model was run using a newly created geometry named "Main Humber River Geometry-Modified 2012". Refer to CD enclosed for modeling details.

- An additional HEC section "27+577" was created and coded to the HEC model. A new geometry file was named "Main Humber River Geometry-EX-NEW-X".

- The elevations used in the model for the ineffective flow areas for the sections US and DS of the CN culvert remained the same as in the original model. The horizontal ineffective flow area locations were adjusted due to a small shift in the updated sections.

- The bridge/roadway geometry data in the Bridge/Culvert Data Editor was updated; the elevations of the road are the same as in the original model, stations were slightly shifted for both US and DS sections and the pier locations were adjusted accordingly.

3.2 HEC-RAS modeling: Updated Existing Condition - Analysis of results

The newly created geometries were used to run the model. Using the approach described above, results for the Regional Flood line are presented in Table 1.0 below.

Table 1.0 Regulatory Water Surface Elevations – Updated Existing Condition

HEC-RAS Station	Regional Water Elevations (m)		
	Existing TRCA HEC	Existing Updated HEC	Existing Updated HEC w/ New Section
27+58	145.87	145.86	145.86
27+577			145.88
27+572	145.87	145.86	145.86
27+571	145.17	145.21	145.21
BRIDGE			
27+57	145.13	145.13	145.13

The modeling results for the updated existing condition indicate that the Regional water surface elevations upstream of the bridge decreased by approximately 0.01m at section 27+58, and remained unchanged downstream of the bridge. The additional section 27+577 shows a small hydraulic jump of 0.02m, again this is for the existing condition. From the results it appears that the flood line is influenced by the elevation of the existing Islington Avenue road structure as the flood level overtops this road.

The new/updated sections used in the hydraulic model are included in Appendix B – Existing Condition.

3.3 HEC-RAS modeling: Proposed Condition

The proposed site was added to section 27+577 as an obstruction in the HEC model. This new section was created using the latest DTM and the detailed topographical survey of the subject land undertaken by Krcmar within the past year.

The results of the analysis are presented in Table 2.0 below:

Table 2.0 Regulatory Water Surface Elevations - Proposed Condition

HEC-RAS Station	Regional Water Elevations (m)
	Proposed Condition
27+58	145.86
27+577	145.88
27+572	145.86
27+571	145.21
BRIDGE	
27+57	145.13

The analysis indicates there is no change in water surface elevations both upstream and downstream of the proposed development.

The HEC-RAS model output files and sections used in the hydraulic model are included in Appendix B – Proposed Condition.

It can be summarized that there is virtually no impact to the Regional water surface profile with the introduction of the proposed development, as the proposed regional level remains unchanged.

3.4 HEC-RAS modeling: 100-yr Storm Frequency Event

The 100-year condition was also analyzed to ensure that under this storm frequency event, the site is not impacted. Table 3 below is the results of the analysis for the existing and proposed conditions.

Table 3.0 100-yr Water Surface Elevations – Existing Proposed Conditions

HEC-RAS Station	100-yr Water Elevations (m)	100-yr Water Elevations (m)
	Proposed Condition	Existing Condition
27+58	141.97	141.97
27+577	141.95	141.95
27+572	141.91	141.91
27+571	141.77	141.77
BRIDGE		
27+57	141.74	141.74

It is evident from the results of the analysis that the 100-yr flood level is well below the existing ground elevations within the subject land, and in fact it is confined in the flood zone west of Islington Avenue. This storm event does not overtop Islington Avenue and therefore has no direct impact to this development proposal, nor does this development have any impact during the 100-yr storm event.

The HEC-RAS model output files and sections used in the hydraulic model are included in Appendix B.

4.0 DEVELOPMENT IMPACT

4.1 Volumetric Balance

A simplistic approach to volumetric balance over the subject reach was to compute the displacement resulting from the proposed 6 townhouse dwelling units and minor re-grading within the driveway front and rear yard areas. If the results of the analysis shows considerable displacement, further recommendation to remediate this maybe considered.

As documented in Tables 1 and 2, the proposed structure and minor re-grading (fill) within the flood fringe did not have any impact on the flood levels up to and including the Regional storm flood therefore no impact to the storage volume. There will be no mitigation required.

4.2 Overbank Velocities

The velocities were computed for both Regional and 100-yr event and since the 100-yr event does not impact the subject land, only the Regional is evaluated. From the detailed hydraulic computation for River Station 27+577 (See Velocities Table in Appendix C), the dynamic impact to the proposed townhouse dwellings is minimal, as the **right overbank** velocities are approximately 0.53 m/s, velocity calculated for the proposed development conditions. This is well below the erosive capacity of grass which is between 1.2 to 1.5 m/s.

Furthermore, this velocity will not create erosion of the ground surrounding the dwelling as it is well below the erosion velocities for grass (0.6 m/s) and hard surfaces (1.0 m/s). There will be no mitigation required.

4.3 Hydrostatic Pressure

From the analysis and proposed grading of the subject development, the 100-yr storm event will not impact the property however the Regional storm condition will create hydrostatic pressure to the dwelling units based on water levels ranging from approximately 1.5m to 1.9m above the ground level. Mitigation will be required.

5.0 MITIGATION

The most important requirement in the OPA 240 SPA Engineering Study is to identify all the *"proposed flood damage reduction measures"* and the following is the complete list of requirements and conditions to be considered in the SPA approval:

5.1 Floodplain

As the resultant flood line is not impacted, there will be no recommended mitigations in terms of loss of volume. Furthermore the resulting dynamic velocities will not have any significant impact on the building design as well as the erosion of the ground surface surrounding the building structure.

5.2 Building Design Considerations

1. For **the habitable living space** it is recommend that the minimum floor elevation be set to at least 0.3m above the Regional flood line; the minimum first floor elevation should be 146.20 and there shall be no building openings below this elevation.

2. The structural considerations will primarily be for waterproofing and hydrostatic pressure, rather than dynamic impacts. The architect and structural engineer will have to include in the permit application, under

3. The subject site is subjected to flooding during major storm events in excess of the 100 year storm. Although only the non-occupied living spaces are impacted (driveways and garages) notice to the homeowners is further recommended. **Indemnification on Title** shall be required to indemnify the City of Vaughan, TRCA and the Region of York from damage claims in the event of flooding.

6.0 STORMWATER MANAGEMENT REPORT

A Stormwater Management Report entitled "Functional Servicing and Stormwater Management Brief" dated September 2011 was prepared by Masongsong Associates Engineering Limited. Appendix D is the copy of report which will also be submitted under separate cover to the City of Vaughan as part of the complete application.

7.0 CONCLUSIONS

The following conclusions can be drawn from the analysis:

1. No impact in the water elevations of the Humber River is expected due to the proposed development.

2. There are no impacts on water levels downstream of the proposed bridge.

3. No updates to the floodplain mapping are warranted due to the proposed development.

4. Building Design Considerations are identified in this report for inclusion as condition of the SPA approval for the OPA and Zoning By-Law Amendment applications for the subject land.

Respectfully Submitted,

Masongsong Associates Engineering Limited

REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

Ken Lo, C.E.T.
Sr. Design Technologist

Tony Masongsong, P.Eng.
Principal

APPENDIX A
Figures

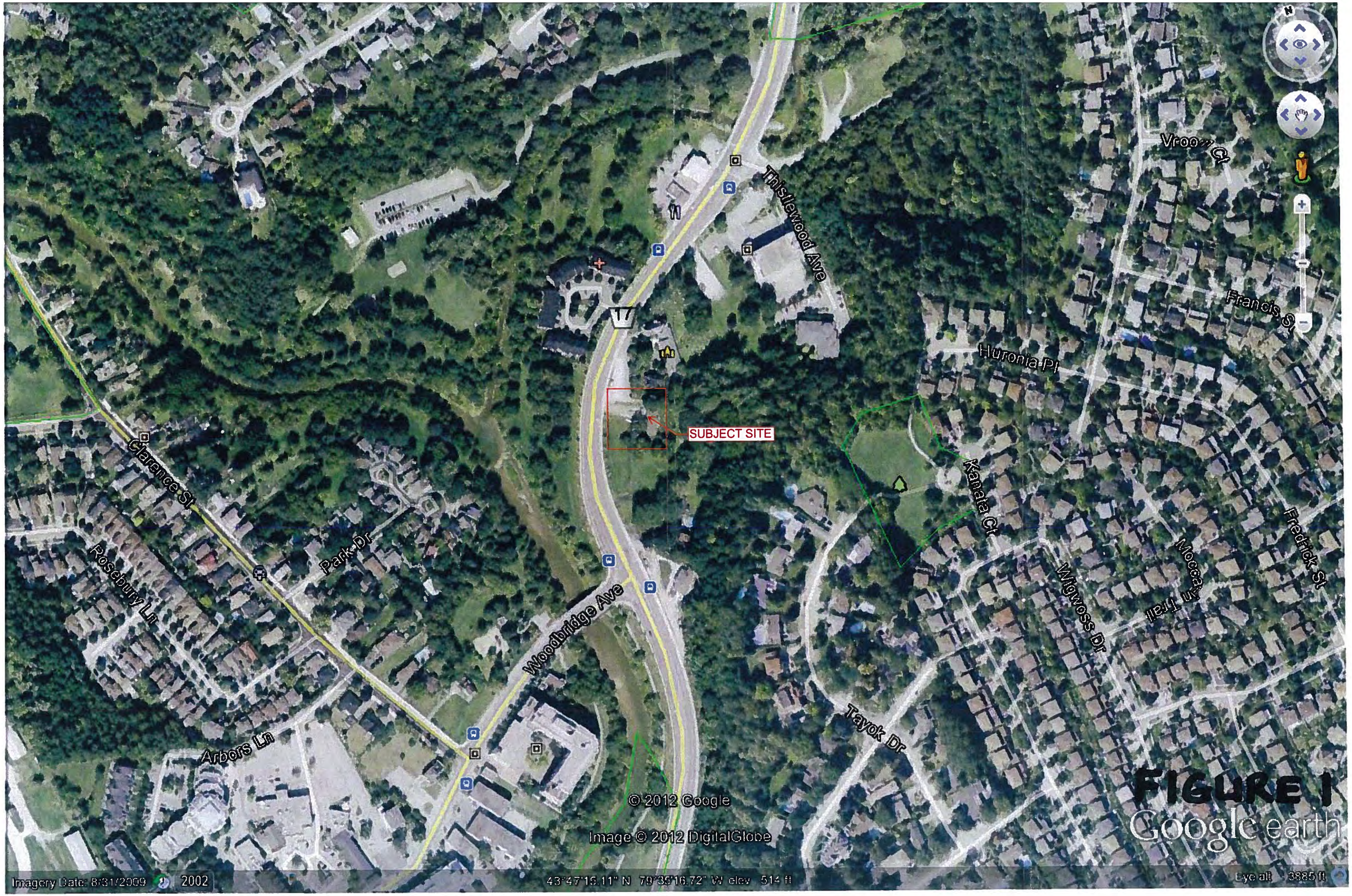
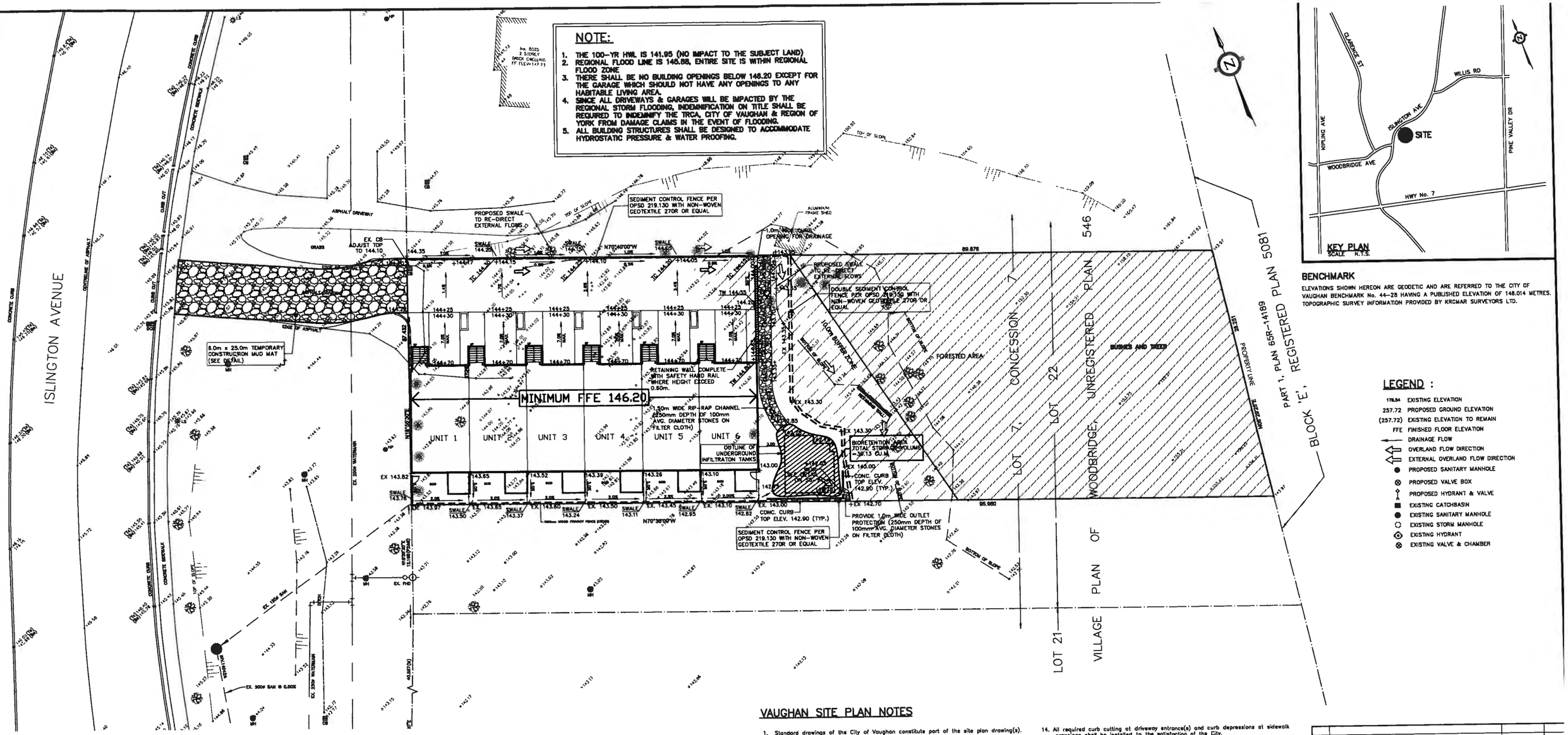

SUBJECT SITE
Thistlewood Ave
Vroom St
Francis St
Huronia Pl
Kanata Ct
Wigwoss Dr
Mocca Pl
Fredrick St
Clarence St
Rosebury Ln
Park Dr
Woodbridge Ave
Arbors Ln
Tayok Dr
© 2012 Google
Image © 2012 DigitalGlobe
Imagery Date: 8/31/2009 2002
43°47'15.11" N 79°35'16.72" W elev 514 ft
Eye alt 3885 ft
Google earth

FIGURE 1

NOTE:

1. THE 100-YR HWL IS 141.95 (NO IMPACT TO THE SUBJECT LAND)
2. REGIONAL FLOOD LINE IS 145.88, ENTIRE SITE IS WITHIN REGIONAL FLOOD ZONE
3. THERE SHALL BE NO BUILDING OPENINGS BELOW 146.20 EXCEPT FOR THE GARAGE WHICH SHOULD NOT HAVE ANY OPENINGS TO ANY HABITABLE LIVING AREA.
4. SINCE ALL DRIVEWAYS & GARAGES WILL BE IMPACTED BY THE REGIONAL STORM FLOODING, INDEMNIFICATION ON TITLE SHALL BE REQUIRED TO INDEMNIFY THE TRCA, CITY OF VAUGHAN & REGION OF YORK FROM DAMAGE CLAIMS IN THE EVENT OF FLOODING.
5. ALL BUILDING STRUCTURES SHALL BE DESIGNED TO ACCOMMODATE HYDROSTATIC PRESSURE & WATER PROOFING.

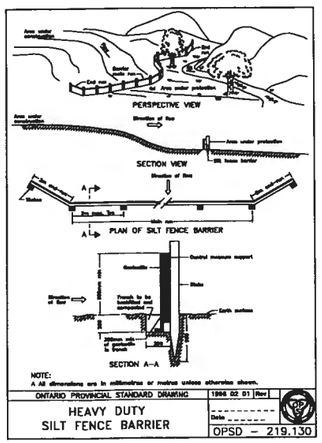


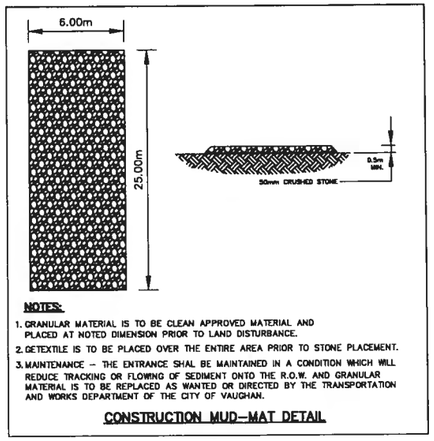
BENCHMARK

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE CITY OF VAUGHAN BENCHMARK No. 44-28 HAVING A PUBLISHED ELEVATION OF 148.014 METRES. TOPOGRAPHIC SURVEY INFORMATION PROVIDED BY KRCMAR SURVEYORS LTD.

LEGEND :

178.84	EXISTING ELEVATION
257.72	PROPOSED GROUND ELEVATION
(257.72)	EXISTING ELEVATION TO REMAIN
FFE	FINISHED FLOOR ELEVATION
	DRAINAGE FLOW
	OVERLAND FLOW DIRECTION
	EXTERNAL OVERLAND FLOW DIRECTION
	PROPOSED SANITARY MANHOLE
	PROPOSED VALVE BOX
	PROPOSED HYDRANT & VALVE
	EXISTING CATCHBASIN
	EXISTING SANITARY MANHOLE
	EXISTING STORM MANHOLE
	EXISTING HYDRANT
	EXISTING VALVE & CHAMBER





NOTES:

1. GRANULAR MATERIAL IS TO BE CLEAN APPROVED MATERIAL AND PLACED AT NOTED DIMENSION PRIOR TO LAND DISTURBANCE.
2. GETEXTILE IS TO BE PLACED OVER THE ENTIRE AREA PRIOR TO STONE PLACEMENT.
3. MAINTENANCE - THE ENTRANCE SHAL BE MAINTAINED IN A CONDITION WHICH WILL REDUCE TRACKING OR FLOWING OF SEDIMENT ONTO THE R.O.W. AND GRANULAR MATERIAL IS TO BE REPLACED AS WANTED OR DIRECTED BY THE TRANSPORTATION AND WORKS DEPARTMENT OF THE CITY OF VAUGHAN.

CONSTRUCTION MUD-MAT DETAIL

EROSION AND SEDIMENT CONTROL

1. SEDIMENT CONTROL FENCE AND TEMPORARY CONSTRUCTION ACCESS MUD MAT TO BE INSTALLED PRIOR TO THE BEGINNING OF CONSTRUCTION.
2. ALL SEDIMENT CONTROL DEVICES TO BE ROUTINELY INSPECTED AND MAINTAINED IN PROPER WORKING ORDER UNTIL AREA IS STABILIZED.
3. IF NECESSARY, TRUCKS WILL BE WASHED DOWN BEFORE LEAVING THE SITE.
4. THE SITE WILL BE WET DOWN IF NECESSARY TO CONTROL DUST.
5. ALL CONSTRUCTION EQUIPMENT MUST BE PARKED ON-SITE.
6. SEDIMENT CONTROL FENCE TO BE OF NON-WOVEN SYNTHETIC GEOTEXTILE, 270R OR EQUAL.
7. ALL CONSTRUCTION VEHICLES TO ENTER AND EXIST SITE FROM TEMPORARY CONSTRUCTION ACCESS.
8. ALL TOPSOIL STOCKPILES TO BE SURROUNDED WITH SEDIMENT FENCING.

VAUGHAN SITE PLAN NOTES

1. Standard drawings of the City of Vaughan constitute part of the site plan drawing(s).
2. All construction work to be carried out in accordance with the requirements of the Occupational Health and Safety Act and Regulations for construction projects.
3. The Owner and/or his representative shall rectify all disturbed areas to original condition or better and to the satisfaction of the City.
4. The location of such utilities and structures is approximate only, and where shown on the drawing(s) the accuracy of the location of such utilities is not guaranteed. The owner and/or his representative shall determine the location of all such utilities and structures by consulting the appropriate authorities or utility companies concerned. The owner shall prove the location of all such utilities and structures and shall assume all liability for damage or restoration to same.
5. Any conflicts with existing services shall be rectified at the Owner's expense.
6. Sanitary and storm control manholes shall be in accordance with City Standard Drawings M-1. Frame and cover shall be McCoy HM331 or approved equal. The manholes shall be benched to the obvert of pipes.
7. All sanitary manhole covers in the ponding areas to be water tight sealed covers.
8. All catchbasins shall be installed in accordance with City Standard Drawing K-4. All catchbasin frames and covers shall be McCoy HM311 or approved equal.
9. All industrial/commercial/condominium watermain connections shall be constructed in accordance with City Standard Drawings I-2 and I-3.
10. Watermain shall have a minimum vertical separation of 0.5 m and horizontal separation of 2.5 m between any sewer or manhole.
11. Hydrants to be installed as per City Standard H-4.
12. Driveway entrance shall be constructed with heavy duty asphalt from the back of the municipal curb or edge of pavement to the property line (area highlighted on drawing(s)) in accordance with the following specifications:
    (a) 50 mm compacted depth of HL3 asphalt - top course
    (b) 75 mm compacted depth of HL8 asphalt - binder course
    (c) 150 mm compacted depth of 20 mm crusher run limestone - granular base
    (d) 300 mm compacted depth of 50 mm crusher run limestone - granular sub-base
13. All concrete curb from existing road curb to street line shall be barrier curb per OPSD 600.110. All concrete curb heights shall be 150 mm unless otherwise noted. Driveway curb to be discontinuous at sidewalk and tapered back 600 mm minimum.
14. All required curb cutting at driveway entrance(s) and curb depressions at sidewalk crossings shall be installed to the satisfaction of the City.
15. Sidewalk to be 200 mm thick through driveway entrance per City Standard E-1.
16. Frost collars are to be provided on curb stops and valve boxes when located within the limits of the driveway.
17. Driveways shall be setback a minimum clearance of 1.0 m from all aboveground services or other obstructions.
18. Appropriate constructions details should be provided for retaining walls higher than 1.0m. Details shall be designed and certified by a professional engineer upon approval. Handrail/guard is required when height exceeds 0.60 m (as per City Standard Drawing N-6 or approved equal).
19. Landscaping shall not encroach on boulevard nor shall boulevard grades be altered.
20. Slopes in landscaped areas and on berms shall not exceed 3 horizontal to 1 vertical.
21. Pavement grades (min. 0.5%, max. 5%).
22. Drainage swales with grades (min. 2%, max 5%).
23. Outside lighting shall be directed downward and inward and designed to maintain zero cut-off light level distribution at the property line.
24. Sanitary, storm and water service connections which are not in place on the municipal road allowance to the property line shall be arranged for installation of the service connection(s), the owner shall file an application with the Construction Services Division of the Engineering Department which includes a copy(s) of the approved site plan drawing(s).
25. Silt fence(s) to be installed and maintained to prevent silt flowing onto adjacent lands.
26. Construction access shall be constructed with a minimum depth of 450 mm crushed stone base from the municipal curb or edge of pavement to the property line, to the satisfaction of the City.
27. The surface of all loading spaces and related driveways, parking spaces, and manoeuvring areas within the site shall be paved with a hard surface. The recommended minimum depth requirements are as follows:
    (a) 40 mm compacted depth HL3 asphalt - top course
    (b) 50 mm compacted depth HL8 asphalt - binder course
    (c) 150 mm compacted depth 20 mm crusher run limestone - granular base
    (d) 200 mm compacted depth 50 mm crusher run limestone - granular sub-base

REVISIONS	DATE	BY

CITY OF VAUGHAN
REGIONAL MUNICIPALITY OF YORK
PART OF LOT 7, CONCESSION 7
(ALSO KNOWN AS PART OF LOT 22 VILLAGE PLAN OF WOODBRIDGE, UNREGISTERED PLAN 548)

PROPOSED 6 UNITS RESIDENTIAL TOWNHOUSES
8013 ISLINGTON AVENUE, CITY OF VAUGHAN

REGISTERED PROFESSIONAL ENGINEER
A. MASONGSONG
SEPT 27/11
PROVINCE OF ONTARIO

Drawing Title:
SITE GRADING AND SEDIMENT & EROSION CONTROL PLAN

MASONGSONG ASSOCIATES ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers
1151 Denison Street • Unit 15 • Markham, Ontario • L3R 3Y4
Tel:(905) 944-0182 • Fax:(905) 944-0185 • E-mail:msong@msong.ca

DESIGN BY: K.L.	CHECKED BY: T.M.	PROJECT No.	DRAWING No.
DRAWN BY: K.L.	CHECKED BY: K.L.	11534	SGR-1
SCALE: 1:200	DATE: SEPT. 2011		

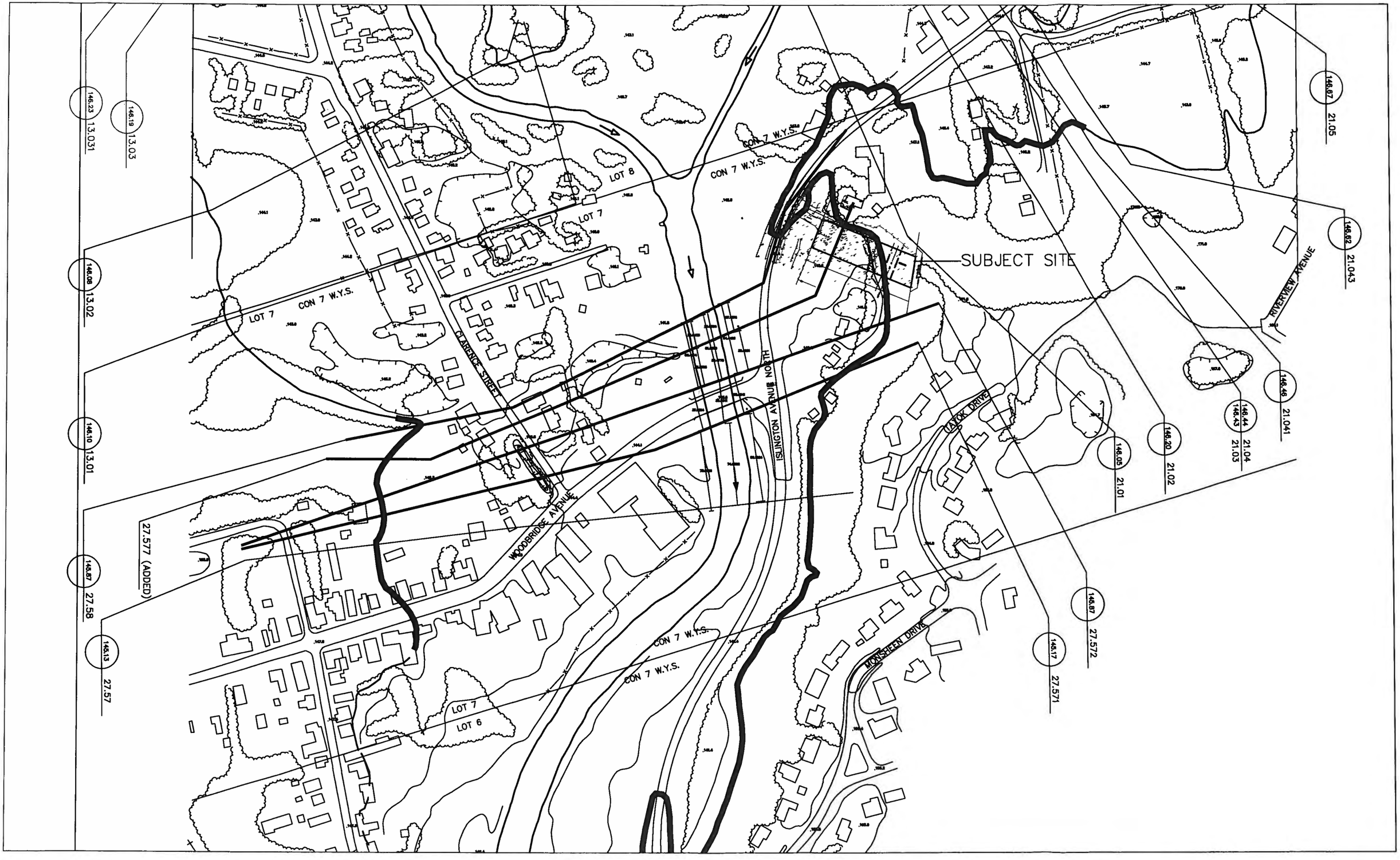


FIGURE 2: HUMBER RIVER HEC MODEL MAPPING – CROSS SECTION

APPENDIX B
HEC-RAS Model Results and Cross-sections

Existing Condition

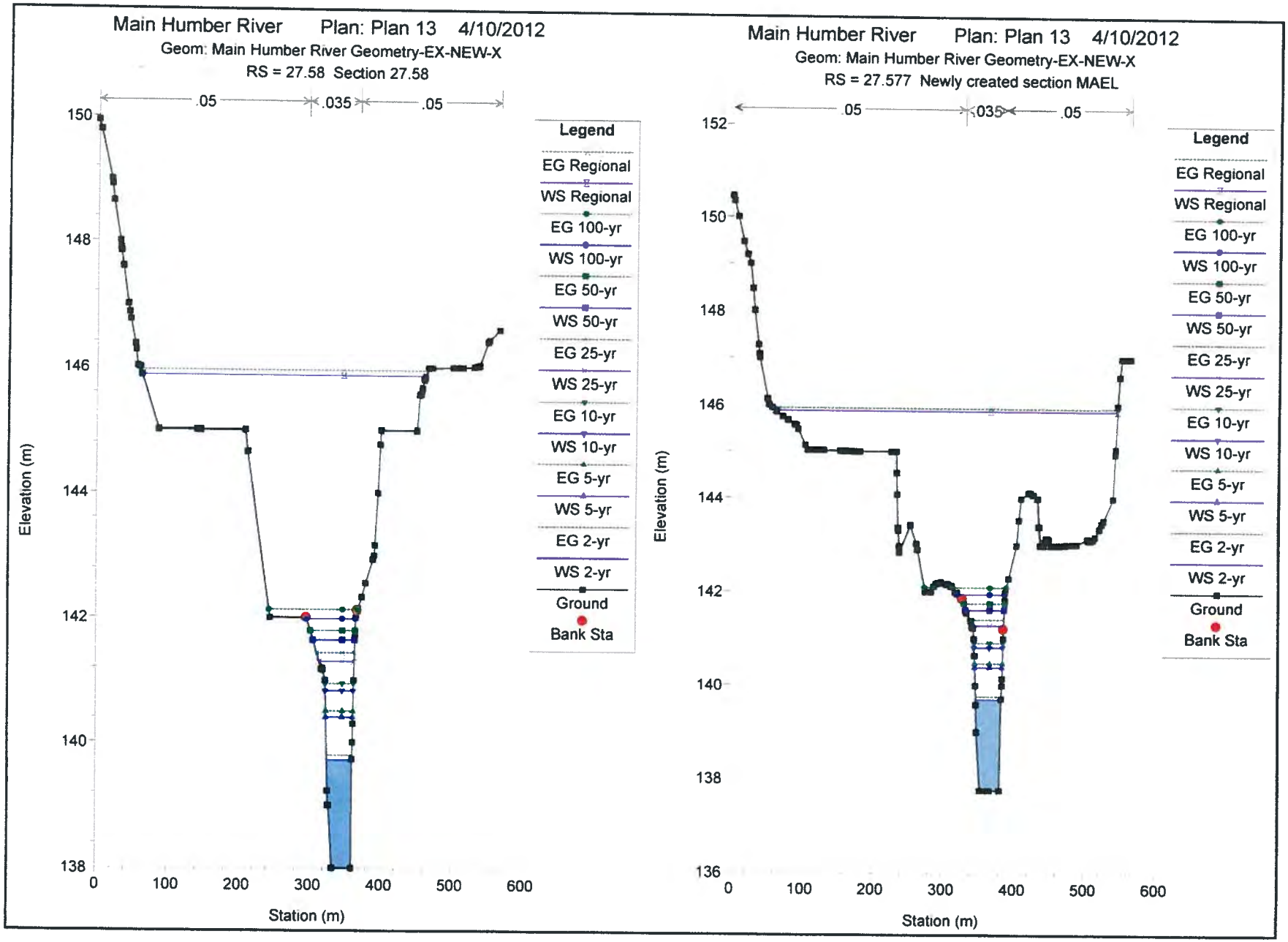
EXISTING
UP-DATED

HEC-RAS Plan: Plan 07 River: RIVER-1 Reach: Reach-1

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)	
Reach-1	27.58	2-yr	68.10	138.00	139.71		139.79	0.001143	1.25	54.41	35.41	0.32
Reach-1	27.58	5-yr	112.40	138.00	140.40		140.50	0.000971	1.41	79.63	38.07	0.31
Reach-1	27.58	10-yr	146.10	138.00	140.82		140.94	0.000926	1.52	96.12	39.54	0.31
Reach-1	27.58	25-yr	193.20	138.00	141.29		141.43	0.001140	1.66	116.22	49.16	0.35
Reach-1	27.58	50-yr	229.90	138.00	141.64		141.79	0.001245	1.71	134.81	58.97	0.36
Reach-1	27.58	100-yr	268.10	138.00	141.97		142.12	0.001259	1.72	156.30	68.65	0.36
Reach-1	27.58	Regional	920.30	138.00	145.86		145.96	0.000274	1.54	974.82	398.84	0.20
Reach-1	27.577	2-yr	68.10	137.75	139.70		139.76	0.000724	1.10	62.14	35.45	0.26
Reach-1	27.577	5-yr	112.40	137.75	140.39		140.47	0.000708	1.28	87.59	38.57	0.27
Reach-1	27.577	10-yr	146.10	137.75	140.81		140.91	0.000710	1.40	104.38	40.33	0.28
Reach-1	27.577	25-yr	193.20	137.75	141.28		141.40	0.000807	1.56	123.89	44.99	0.30
Reach-1	27.577	50-yr	229.90	137.75	141.62		141.75	0.000952	1.64	140.52	54.71	0.32
Reach-1	27.577	100-yr	268.10	137.75	141.95		142.09	0.000943	1.68	160.09	66.39	0.32
Reach-1	27.577	Regional	920.30	137.75	145.88		145.94	0.000193	1.38	1239.60	483.25	0.17
Reach-1	27.572	2-yr	68.10	137.50	139.68	138.38	139.74	0.000573	1.01	67.16	34.76	0.23
Reach-1	27.572	5-yr	112.40	137.50	140.37	138.71	140.45	0.000614	1.23	91.61	37.17	0.25
Reach-1	27.572	10-yr	146.10	137.50	140.79	138.93	140.89	0.000648	1.35	107.83	39.26	0.26
Reach-1	27.572	25-yr	193.20	137.50	141.26	139.20	141.38	0.000713	1.53	126.54	41.33	0.28
Reach-1	27.572	50-yr	229.90	137.50	141.59	139.38	141.72	0.000745	1.64	140.39	42.62	0.29
Reach-1	27.572	100-yr	268.10	137.50	141.91	139.57	142.06	0.000755	1.74	154.22	43.75	0.29
Reach-1	27.572	Regional	920.30	137.50	145.86	141.92	145.93	0.000238	1.51	1143.64	487.54	0.18
Reach-1	27.5715		Bridge									
Reach-1	27.571	2-yr	68.10	137.50	139.62	138.39	139.69	0.000676	1.20	61.56	34.39	0.26
Reach-1	27.571	5-yr	112.40	137.50	140.29	138.74	140.40	0.000710	1.47	85.77	38.07	0.28
Reach-1	27.571	10-yr	146.10	137.50	140.70	138.98	140.83	0.000738	1.64	101.93	40.34	0.29
Reach-1	27.571	25-yr	193.20	137.50	141.15	139.29	141.32	0.000814	1.88	120.36	42.78	0.31
Reach-1	27.571	50-yr	229.90	137.50	141.46	139.50	141.66	0.000857	2.04	134.10	44.51	0.33
Reach-1	27.571	100-yr	268.10	137.50	141.77	139.71	141.99	0.000887	2.18	147.97	51.63	0.34
Reach-1	27.571	Regional	920.30	137.50	145.21	142.35	145.39	0.000521	2.48	897.12	390.46	0.29
Reach-1	27.57	2-yr	68.10	137.50	139.57		139.64	0.000869	1.17	58.06	34.54	0.29
Reach-1	27.57	5-yr	112.40	137.50	140.24		140.33	0.000871	1.35	83.07	39.91	0.30
Reach-1	27.57	10-yr	146.10	137.50	140.66		140.76	0.000872	1.46	100.37	43.24	0.30
Reach-1	27.57	25-yr	193.20	137.50	141.10		141.23	0.000902	1.60	120.60	48.86	0.32

HEC-RAS Plan: Plan 07 River: RIVER-1 Reach: Reach-1 (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)	
Reach-1	27.57	50-yr	229.90	137.50	141.42		141.57	0.000866	1.70	137.71	57.84	0.32
Reach-1	27.57	100-yr	268.10	137.50	141.74		141.90	0.000830	1.78	157.30	66.66	0.31
Reach-1	27.57	Regional	920.30	137.50	145.13		145.34	0.000531	2.29	644.73	290.20	0.28


Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
RS = 27.58 Section 27.58
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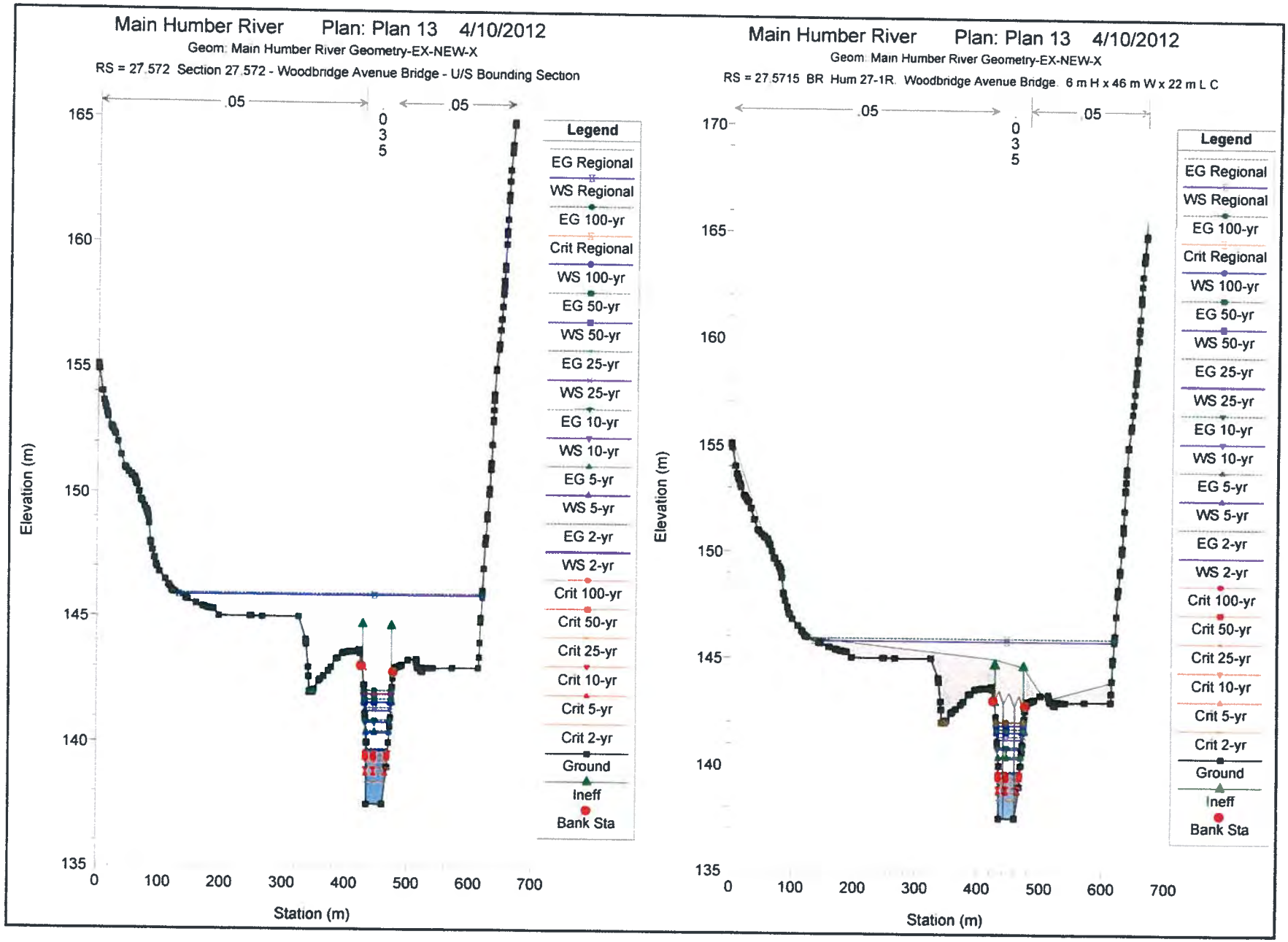
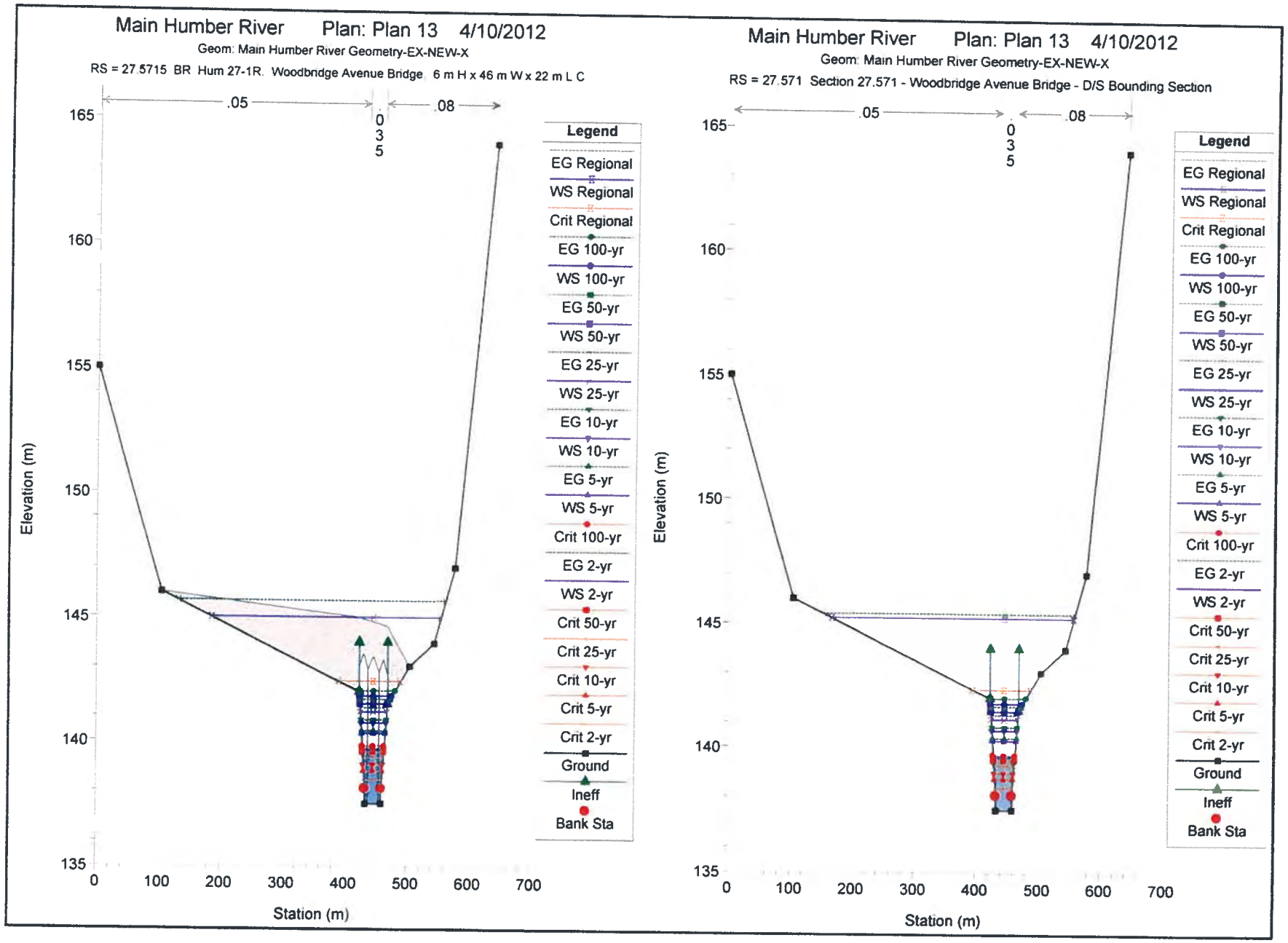
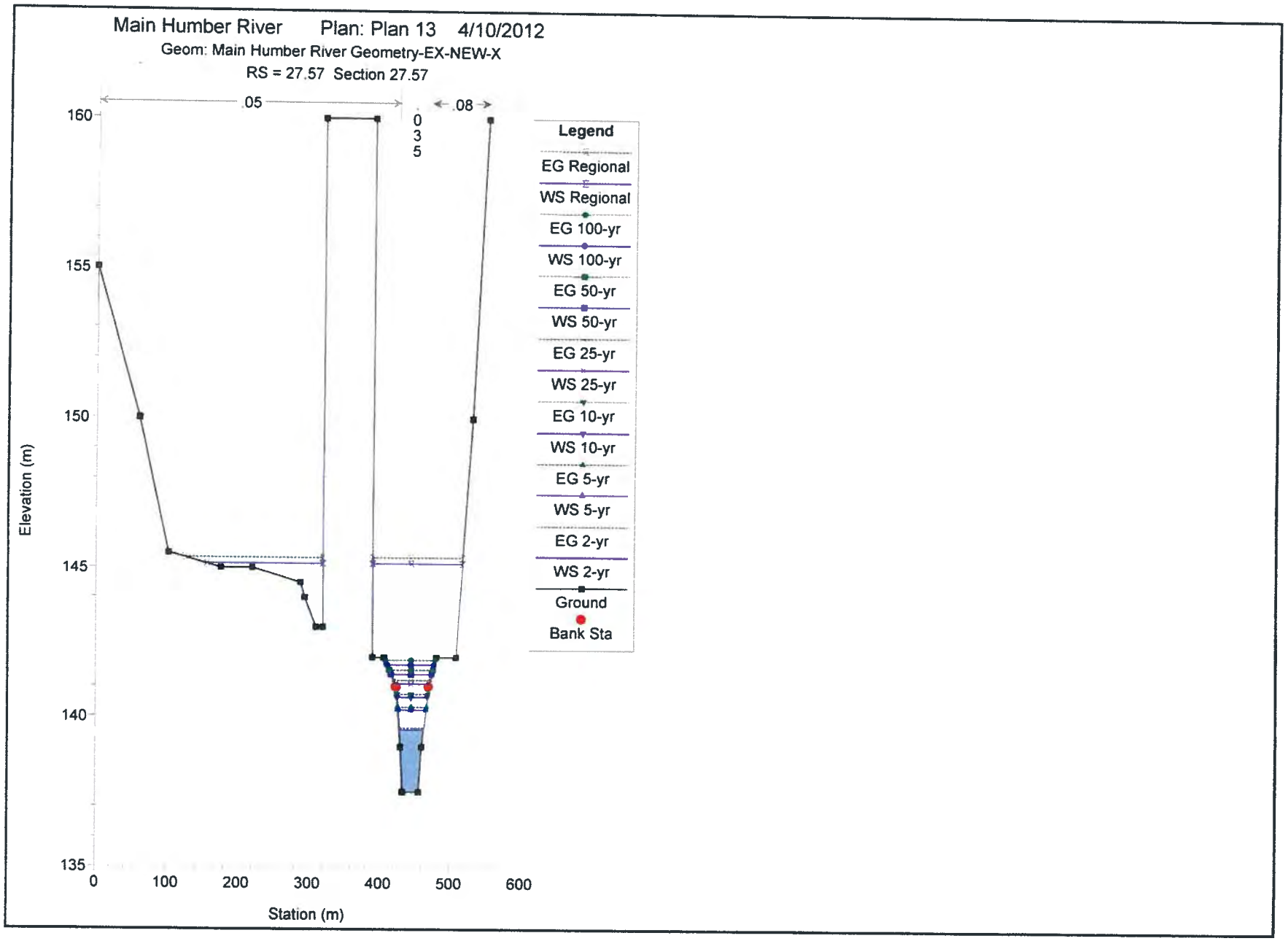
.035
.05
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
RS = 27.577 Newly created section MAEL
.05
.035
.05
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta


Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
RS = 27.572 Section 27.572 - Woodbridge Avenue Bridge - U/S Bounding Section
.05
.05
0
3
5
Legend
EG Regional
WS Regional
EG 100-yr
Crit Regional
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Crit 100-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
RS = 27.5715 BR Hum 27-1R Woodbridge Avenue Bridge 6 m H x 46 m W x 22 m L C
.05
.05
0
3
5
Legend
EG Regional
WS Regional
EG 100-yr
Crit Regional
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Crit 100-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)


Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
RS = 27.5715 BR Hum 27-1R. Woodbridge Avenue Bridge 6 m H x 46 m W x 22 m L C
.05
.035
.08
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
Crit Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
Crit 100-yr
EG 2-yr
WS 2-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
RS = 27.571 Section 27.571 - Woodbridge Avenue Bridge - D/S Bounding Section
.05
.035
.08
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
Crit Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
Crit 100-yr
EG 2-yr
WS 2-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta


Main Humber River Plan: Plan 13 4/10/2012
Geom: Main Humber River Geometry-EX-NEW-X
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.05
.08
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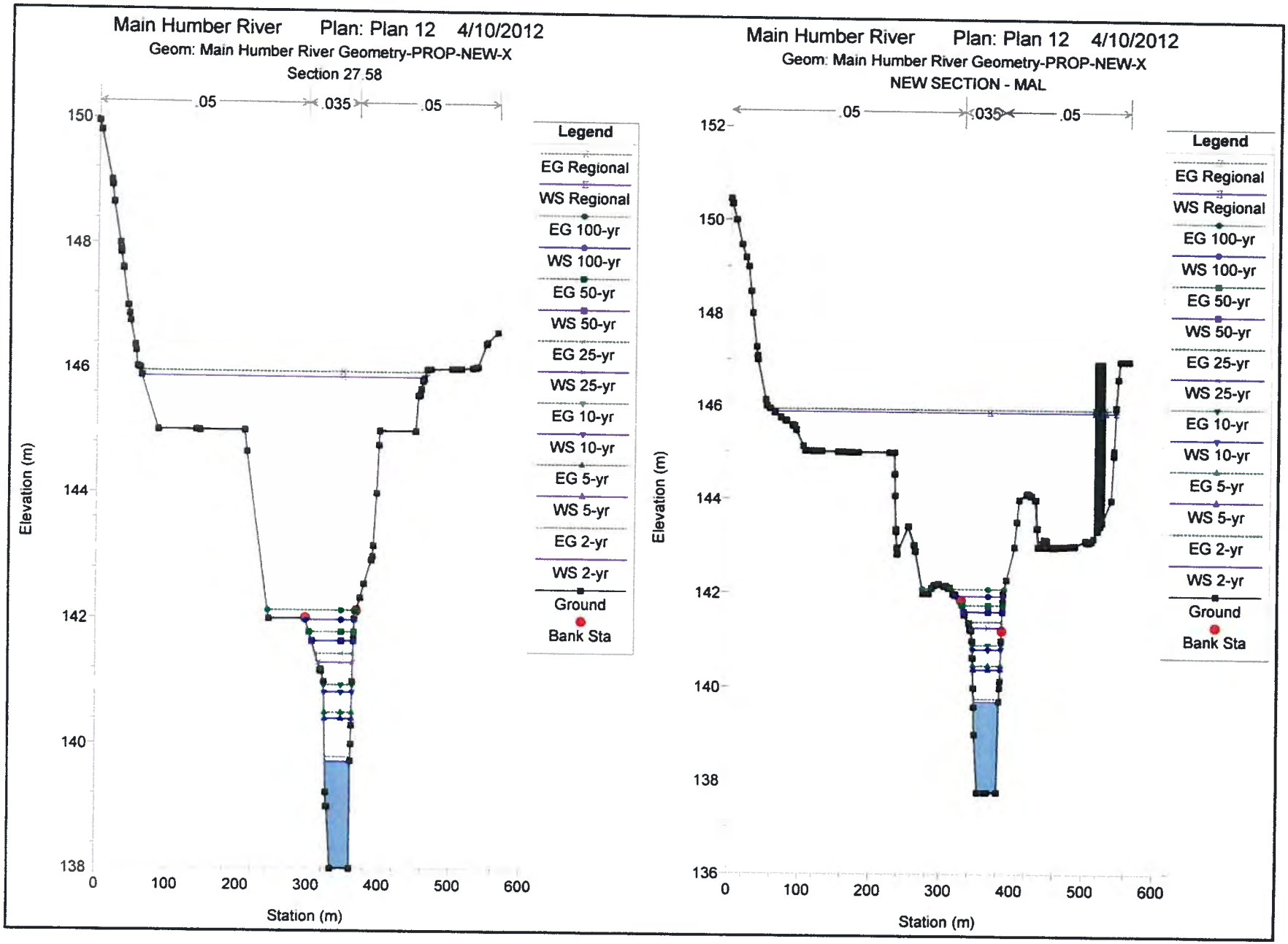
3
5
160
155
150
145
140
135
Elevation (m)
0
100
200
300
400
500
600
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta

Proposed Condition

HEC-RAS Plan: Plan 07 River: RIVER-1 Reach: Reach-1

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)	
Reach-1	27.58	2-yr	68.10	138.00	139.71		139.79	0.001143	1.25	54.41	35.41	0.32
Reach-1	27.58	5-yr	112.40	138.00	140.40		140.50	0.000971	1.41	79.63	38.07	0.31
Reach-1	27.58	10-yr	146.10	138.00	140.82		140.94	0.000926	1.52	96.12	39.54	0.31
Reach-1	27.58	25-yr	193.20	138.00	141.29		141.43	0.001140	1.66	116.22	49.16	0.35
Reach-1	27.58	50-yr	229.90	138.00	141.64		141.79	0.001245	1.71	134.81	58.97	0.36
Reach-1	27.58	100-yr	268.10	138.00	141.97		142.12	0.001259	1.72	156.30	68.65	0.36
Reach-1	27.58	Regional	920.30	138.00	145.86		145.95	0.000275	1.54	974.32	398.77	0.20
Reach-1	27.577	2-yr	68.10	137.75	139.70		139.76	0.000724	1.10	62.14	35.45	0.26
Reach-1	27.577	5-yr	112.40	137.75	140.39		140.47	0.000708	1.28	87.59	38.57	0.27
Reach-1	27.577	10-yr	146.10	137.75	140.81		140.91	0.000710	1.40	104.38	40.33	0.28
Reach-1	27.577	25-yr	193.20	137.75	141.28		141.40	0.000807	1.56	123.89	44.99	0.30
Reach-1	27.577	50-yr	229.90	137.75	141.62		141.75	0.000952	1.64	140.52	54.71	0.32
Reach-1	27.577	100-yr	268.10	137.75	141.95		142.09	0.000943	1.68	160.09	66.39	0.32
Reach-1	27.577	Regional	920.30	137.75	145.88		145.94	0.000202	1.41	1202.90	468.79	0.17
Reach-1	27.572	2-yr	68.10	137.50	139.68	138.38	139.74	0.000573	1.01	67.16	34.76	0.23
Reach-1	27.572	5-yr	112.40	137.50	140.37	138.71	140.45	0.000614	1.23	91.61	37.17	0.25
Reach-1	27.572	10-yr	146.10	137.50	140.79	138.93	140.89	0.000648	1.35	107.83	39.26	0.26
Reach-1	27.572	25-yr	193.20	137.50	141.26	139.20	141.38	0.000713	1.53	126.54	41.33	0.28
Reach-1	27.572	50-yr	229.90	137.50	141.59	139.38	141.72	0.000745	1.64	140.39	42.62	0.29
Reach-1	27.572	100-yr	268.10	137.50	141.91	139.57	142.06	0.000755	1.74	154.22	43.75	0.29
Reach-1	27.572	Regional	920.30	137.50	145.86	141.92	145.93	0.000238	1.51	1143.64	487.54	0.18
Reach-1	27.5715		Bridge									
Reach-1	27.571	2-yr	68.10	137.50	139.62	138.39	139.69	0.000676	1.20	61.56	34.39	0.26
Reach-1	27.571	5-yr	112.40	137.50	140.29	138.74	140.40	0.000710	1.47	85.77	38.07	0.28
Reach-1	27.571	10-yr	146.10	137.50	140.70	138.98	140.83	0.000738	1.64	101.93	40.34	0.29
Reach-1	27.571	25-yr	193.20	137.50	141.15	139.29	141.32	0.000814	1.88	120.36	42.78	0.31
Reach-1	27.571	50-yr	229.90	137.50	141.46	139.50	141.66	0.000857	2.04	134.10	44.51	0.33
Reach-1	27.571	100-yr	268.10	137.50	141.77	139.71	141.99	0.000887	2.18	147.97	51.63	0.34
Reach-1	27.571	Regional	920.30	137.50	145.21	142.35	145.39	0.000521	2.48	897.12	390.46	0.29
Reach-1	27.57	2-yr	68.10	137.50	139.57		139.64	0.000869	1.17	58.06	34.54	0.29
Reach-1	27.57	5-yr	112.40	137.50	140.24		140.33	0.000871	1.35	83.07	39.91	0.30
Reach-1	27.57	10-yr	146.10	137.50	140.66		140.76	0.000872	1.46	100.37	43.24	0.30
Reach-1	27.57	25-yr	193.20	137.50	141.10		141.23	0.000902	1.60	120.60	48.86	0.32
Reach-1	27.57	50-yr	229.90	137.50	141.42		141.57	0.000866	1.70	137.71	57.84	0.32
Reach-1	27.57	100-yr	268.10	137.50	141.74		141.90	0.000830	1.78	157.30	66.66	0.31
Reach-1	27.57	Regional	920.30	137.50	145.13		145.34	0.000531	2.29	644.73	290.20	0.28


Main Humber River Plan: Plan 12 4/10/2012
Geom: Main Humber River Geometry-PROP-NEW-X
Section 27.58
.05
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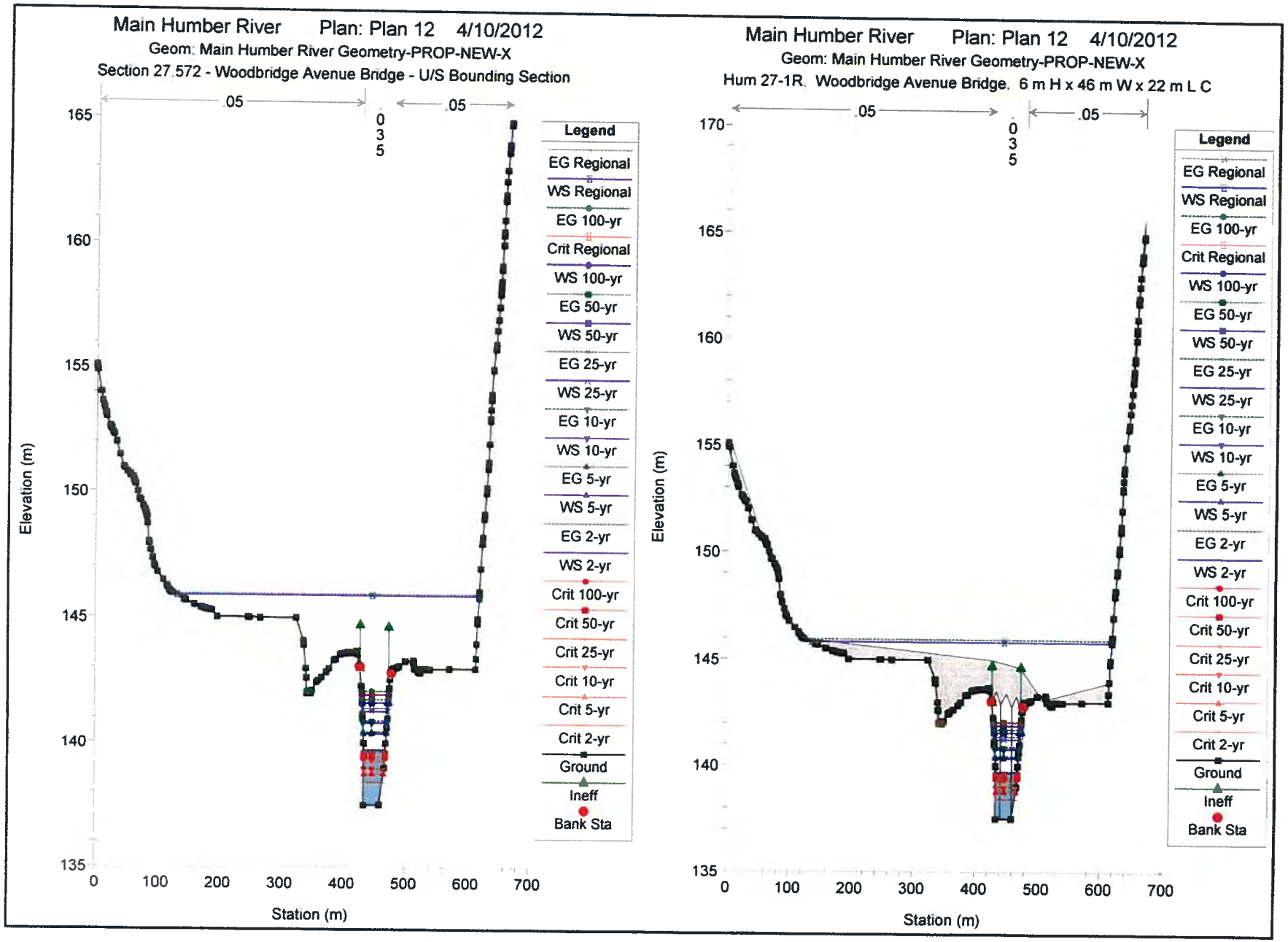
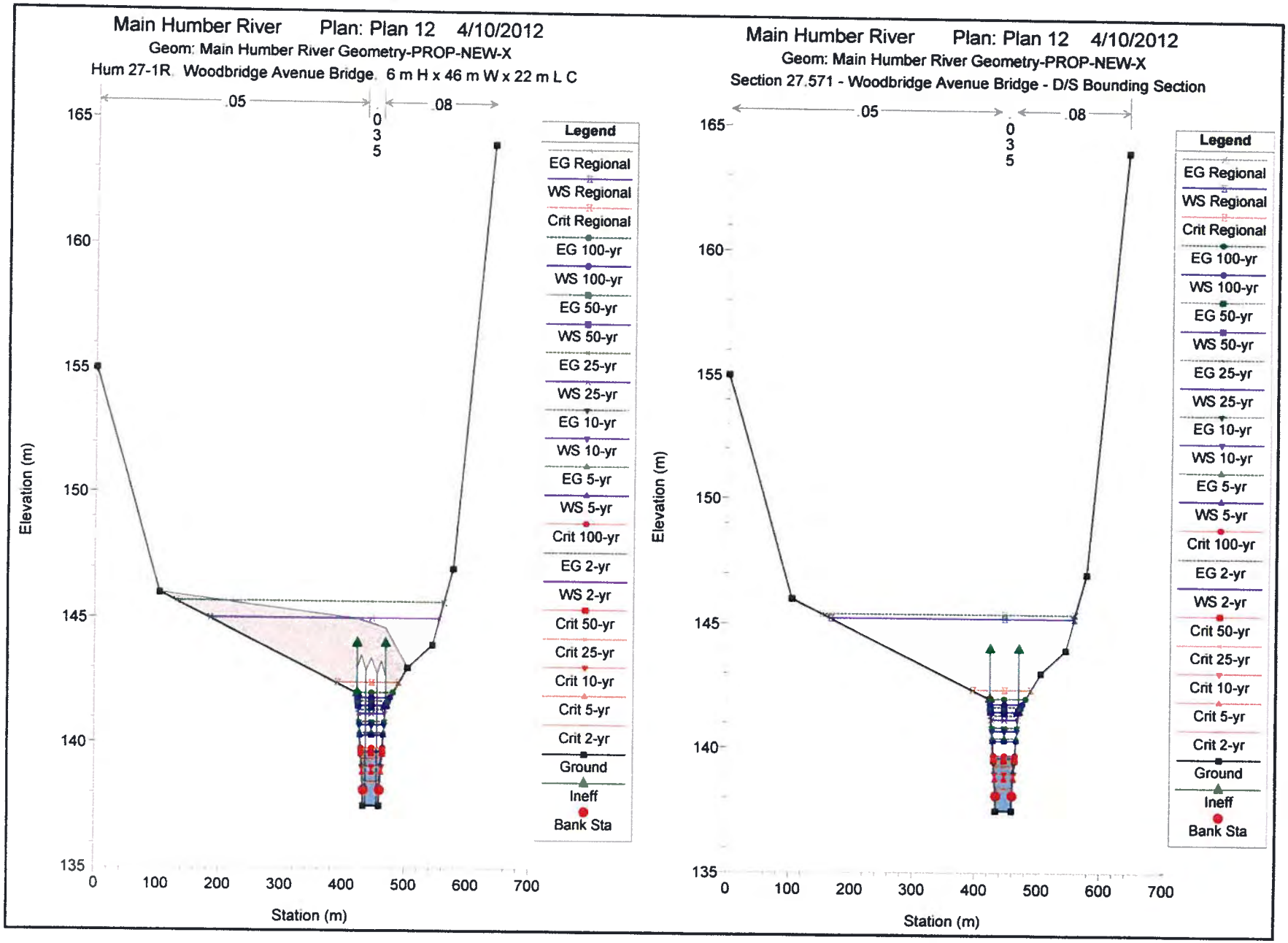
.05
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Main Humber River Plan: Plan 12 4/10/2012
Geom: Main Humber River Geometry-PROP-NEW-X
NEW SECTION - MAL
.05
.035
.05
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta


Main Humber River Plan: Plan 12 4/10/2012
Geom: Main Humber River Geometry-PROP-NEW-X
Section 27.572 - Woodbridge Avenue Bridge - U/S Bounding Section
.05
.05
0
3
5
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
Crit Regional
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Crit 100-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Main Humber River Plan: Plan 12 4/10/2012
Geom: Main Humber River Geometry-PROP-NEW-X
Hum 27-1R, Woodbridge Avenue Bridge, 6 m H x 46 m W x 22 m L C
.05
.05
0
3
5
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
EG 100-yr
Crit Regional
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
EG 2-yr
WS 2-yr
Crit 100-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta


Main Humber River Plan: Plan 12 4/10/2012
Geom: Main Humber River Geometry-PROP-NEW-X
Hum 27-1R Woodbridge Avenue Bridge 6 m H x 46 m W x 22 m L C
.05
.08
0
3
5
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
Crit Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
Crit 100-yr
EG 2-yr
WS 2-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Main Humber River Plan: Plan 12 4/10/2012
Geom: Main Humber River Geometry-PROP-NEW-X
Section 27.571 - Woodbridge Avenue Bridge - D/S Bounding Section
.05
.08
0
3
5
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
Crit Regional
EG 100-yr
WS 100-yr
EG 50-yr
WS 50-yr
EG 25-yr
WS 25-yr
EG 10-yr
WS 10-yr
EG 5-yr
WS 5-yr
Crit 100-yr
EG 2-yr
WS 2-yr
Crit 50-yr
Crit 25-yr
Crit 10-yr
Crit 5-yr
Crit 2-yr
Ground
Ineff
Bank Sta

APPENDIX C
Flows and Velocities Table

Velocities - Existing Condition

HEC-RAS Plan: Plan 07 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total (m3/s)	Vel Total (m/s)	Vel Right (m/s)	Vel Left (m/s)
Reach-1	27.58	100-yr	268.10	1.72		
Reach-1	27.58	Regional	920.30	0.94	0.43	0.47
Reach-1	27.577	100-yr	268.10	1.67	0.30	0.08
Reach-1	27.577	Regional	920.30	0.74	0.52	0.39
Reach-1	27.572	100-yr	268.10	1.74		
Reach-1	27.572	Regional	920.30	0.80	0.60	0.38
Reach-1	27.5715		Bridge			
Reach-1	27.571	100-yr	268.10	1.81	0.56	0.85
Reach-1	27.571	Regional	920.30	1.03	0.51	0.66
Reach-1	27.57	100-yr	268.10	1.70	0.18	0.30
Reach-1	27.57	Regional	920.30	1.43	0.59	0.69
Reach-1	27.56	100-yr	268.10	1.45	0.62	0.80
Reach-1	27.56	Regional	920.30	1.21	0.97	0.66
Reach-1	27.55	100-yr	268.10	1.04	0.45	0.29
Reach-1	27.55	Regional	920.30	0.88	0.68	0.53
Reach-1	27.54	100-yr	268.10	1.80	0.92	0.46
Reach-1	27.54	Regional	920.30	1.52	1.10	0.74
Reach-1	27.532	100-yr	268.10	2.45	1.17	0.75
Reach-1	27.532	Regional	920.30	1.93	1.17	0.75
Reach-1	27.5315		Bridge			
Reach-1	27.531	100-yr	268.10	3.03	1.41	0.87
Reach-1	27.531	Regional	920.30	4.35	2.61	1.89
Reach-1	27.52	100-yr	268.10	1.53	0.71	0.77
Reach-1	27.52	Regional	920.30	0.79	0.78	0.48
Reach-1	27.51	100-yr	268.10	0.70	0.38	0.49
Reach-1	27.51	Regional	920.30	0.48	0.42	0.34
Reach-1	27.5	100-yr	268.10	0.61	0.32	0.47
Reach-1	27.5	Regional	920.30	0.60	0.52	0.54
Reach-1	27.49	100-yr	268.10	1.01	0.39	0.39
Reach-1	27.49	Regional	920.30	0.74	0.49	0.54
Reach-1	27.48	100-yr	268.10	0.56	0.48	0.41
Reach-1	27.48	Regional	920.30	0.60	0.53	0.50
Reach-1	27.47	100-yr	268.10	0.76	0.51	0.60
Reach-1	27.47	Regional	920.30	0.72	0.73	0.48

Subject Section

Velocities - Evaluated with the Proposed Development

HEC-RAS Plan: Plan 07 River: RIVER-1 Reach: Reach-1

Reach	River Sta	Profile	Q Total (m3/s)	Vel Chnl (m/s)	Vel Left (m/s)	Vel Right (m/s)	Vel Total (m/s)
Reach-1	27.58	100-yr	268.10	1.72			1.72
Reach-1	27.58	Regional	920.30	1.54	0.48	0.43	0.94
Reach-1	27.577	100-yr	268.10	1.68	0.08	0.30	1.67
Reach-1	27.577	Regional	920.30	1.41	0.40	0.53	0.77
Reach-1	27.572	100-yr	268.10	1.74			1.74
Reach-1	27.572	Regional	920.30	1.51	0.38	0.60	0.80
Reach-1	27.5715		Bridge				
Reach-1	27.571	100-yr	268.10	2.18	0.85	0.56	1.81
Reach-1	27.571	Regional	920.30	2.48	0.66	0.51	1.03
Reach-1	27.57	100-yr	268.10	1.78	0.30	0.18	1.70
Reach-1	27.57	Regional	920.30	2.29	0.69	0.59	1.43
Reach-1	27.56	100-yr	268.10	2.01	0.80	0.62	1.45
Reach-1	27.56	Regional	920.30	2.24	0.66	0.97	1.21
Reach-1	27.55	100-yr	268.10	1.77	0.29	0.45	1.04
Reach-1	27.55	Regional	920.30	1.85	0.53	0.68	0.88
Reach-1	27.54	100-yr	268.10	2.52	0.46	0.92	1.80
Reach-1	27.54	Regional	920.30	2.97	0.74	1.10	1.52
Reach-1	27.532	100-yr	268.10	3.31	0.75	1.17	2.45
Reach-1	27.532	Regional	920.30	4.31	0.75	1.17	1.93
Reach-1	27.5315		Bridge				
Reach-1	27.531	100-yr	268.10	3.90	0.87	1.41	3.03
Reach-1	27.531	Regional	920.30	6.55	1.89	2.61	4.35
Reach-1	27.52	100-yr	268.10	3.65	0.77	0.71	1.53
Reach-1	27.52	Regional	920.30	1.87	0.48	0.78	0.79
Reach-1	27.51	100-yr	268.10	2.13	0.49	0.38	0.70
Reach-1	27.51	Regional	920.30	1.28	0.34	0.42	0.48
Reach-1	27.5	100-yr	268.10	1.63	0.47	0.32	0.61
Reach-1	27.5	Regional	920.30	1.50	0.54	0.52	0.60
Reach-1	27.49	100-yr	268.10	1.80	0.39	0.39	1.01
Reach-1	27.49	Regional	920.30	1.72	0.54	0.49	0.74
Reach-1	27.48	100-yr	268.10	1.39	0.41	0.48	0.56
Reach-1	27.48	Regional	920.30	1.70	0.50	0.53	0.60
Reach-1	27.47	100-yr	268.10	1.89	0.60	0.51	0.76
Reach-1	27.47	Regional	920.30	2.10	0.48	0.73	0.72

Subject section