S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

TECHNICAL MEMORANDUM

To:	Vince Molinaro Molinaro Group	**From:**	Alexandra Porco John Oreskovic
		Date:	March 23, 2021
Project:	Queen Elizabeth & Fairview Burlington, ON	**Pages:**	12 + Appendix A
		Job #:	20071
Re:	Floodplain Analysis for Area Along Proposed Development (Updated for Existing Condition Floodplains)		

Introduction

S. Llewellyn and Associates was retained by Molinaro Group to review and update the floodplain hydraulic analysis prepared for the Burlington Go Mobility Hub study (ref. 1) in support the development of a two phased, 654 and 408-unit residential buildings. The 1.56ha site is located on Plains Road East, north of Fairview Street, south of the CN Railway tracks and east of Queen Elizabeth Way, in the City of Burlington. Upper Hager Creek (a tributary of Indian Creek) and the associated floodplain is located east of the proposed development. Refer to **Figure 1** for the location plan.

The purpose of this memo is to document the methodology and results from the floodplain analysis and demonstrate how the proposed site grading design can meet the criteria of the Halton Region Conservation Authority (HRCA).

Background

The following information was used in the preparation of this memo:

Ref. 1: Burlington Go Mobility Hub and Downtown Study HEC-RAS hydraulic model (Conservation Halton).

Ref. 2: Various topographic surveys from A.T. McLaren Limited.

Methodology

The floodplain analysis assessment included the following tasks:

- Review of the HR Freeman Pond river reach within the Burlington Go Mobility Hub and Downtown Study hydraulic (HEC-RAS) model provided by the HRCA.
- Revise the existing model cross-sections based on current topographic survey information taken across the site.
- Revise the existing model channel invert and bank elevations shot.

- Verify, and revise as necessary, the existing culvert information at the CN Rail and Plains Road.

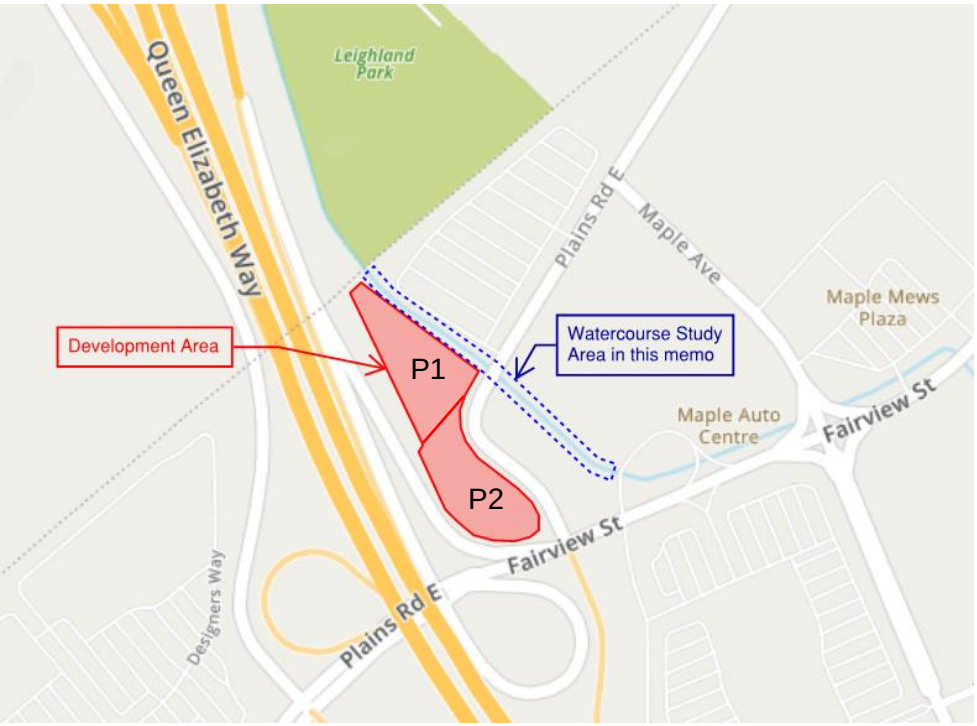


Figure 1 – Location Plan

Hydraulic Modeling Information

The HRCA provided the updated Burlington Go Mobility Hub and Downtown Study HEC-RAS model for use in the floodplain analysis. The subject site is located within the *HRFreemanPond* river tributary and the *WestHager* river reach. The site's boundary conditions are cross-section 789.1301 upstream and cross-section 508.5913 downstream. The steady flow data within the model was not changed and is summarized for the required cross-sections in **Table 1** below.

Table 1 – Steady Flow Rates

River (Reach)	River Station	Flow Rate (L/s)			
		With SWM Controls		Without SWM Controls	
		24Hr SCS	Regional	24Hr SCS	Regional
HRFreemanPond (WestHager)	1018.932	34.34	63.71	101.91	81.04
	765.4565	37.21	65.45	105	83.94

Existing Model

The existing model was reviewed and it was noted that the left and right banks of the existing channel within cross-sections 780.9492 and 776.5764 did not line up physically with the stream channel. To correct this, all station values in cross-section 780.9492 were increased by 25.5m and all station values in cross-section 776.5764 were increased by 19.25m. **Table 2** compares the original model flood elevations with the flood elevations from the corrected model (herein referred to as the existing model).

Table 2 – Flood Elevations (Original vs. Corrected)

River Reach	River Station	Flood Elevations (m)							
		With SWM Controls				Without SWM Controls			
		24 Hour SCS		Regional		24 Hour SCS		Regional	
		Orig.	Corr.	Orig.	Corr.	Orig.	Corr.	Orig.	Corr.
	789.1301	97.90	97.90	98.99	98.98	99.03	99.00	99.01	99.01
	780.9492	97.86	97.86	98.95	98.96	98.91	98.92	98.95	98.97
	776.5764	97.59	97.59	98.94	98.95	98.75	98.85	98.93	98.95
	765.4565	96.91	96.91	97.80	97.80	98.71	98.71	98.93	98.93
	695.1021	97.03	97.03	97.77	97.77	98.43	98.43	97.55	97.55
	674.8755	97.07	97.07	97.84	97.84	98.38	98.38	97.63	97.63
	652.9897	97.15	97.15	97.99	97.99	97.46	97.46	97.95	97.95
	621.3574	96.51	96.51	97.92	97.92	98.09	98.09	98.01	98.01
	595.1021	96.01	96.01	97.66	97.66	98.15	98.15	98.04	98.04
	550.8193	96.22	96.22	97.72	97.72	98.15	98.15	98.04	98.04
	508.5913	96.01	96.01	97.73	97.73	98.16	98.16	98.05	98.05
	490.8526	95.57	95.57	97.73	97.73	98.16	98.16	98.05	98.05
	485.7959	95.47	95.47	97.73	97.73	98.16	98.16	98.05	98.05

The existing model was further updated to include the current topographic information that was collected by A.T. McLaren Limited in April 2018, December 2020 and January 2021. The cross-sections that were updated include 789.1301 through 508.5913. Additionally, culverts at the CN Railway crossing and Plains Road crossing were revised based on the topographic information collected. **Tables 3 and 4** summarize the revised culvert data. **Table 5** compares the existing and revised flood elevations for the cross-sections within the site area for all storm events (the 100-year and Regional storms both with and without SWM controls considered).

Table 3 – Characteristics of Culvert at CN Railway

Culvert	Diameter (m)	Length (m)	Invert (m)		Centerline Station (m)	
			Upstream	Downstream	Upstream	Downstream
#1 – middle	2.1	29	93.70	93.26	557.95	277.93
# 2 – left	2.1	29	93.90	93.69	554.91	274.50
#3 – right	2.1	29	93.90	93.66	560.91	281.86

Table 4 – Characteristics of Culvert at Plains Road East

Culvert	Span (m)	Rise (m)	Length (m)	Invert (m)		Centerline Station (m)	
				Upstream	Downstream	Upstream	Downstream
#1 – left	2.6	2.6	26	93.31	93.22	86.56	109.42
# 2 – right	2.6	2.6	26	93.31	93.22	89.66	112.19

Table 5 – Flood Elevations (Existing vs. Revised)

River Reach	River Station	Flood Elevations (m)							
		With SWM Controls				Without SWM Controls			
		24 Hour SCS		Regional		24 Hour SCS		Regional	
		Ex.	Rev.	Ex.	Rev.	Ex.	Rev.	Ex.	Rev.
	805.3582	Culvert (CN Railway)							
	789.1301	97.90	97.55	98.98	98.22	99.00	98.95	99.01	98.53
	780.9492	97.86	97.50	98.96	98.09	98.92	98.97	98.97	98.38
	776.5764	97.59	97.41	98.95	97.83	98.85	97.98	98.95	97.94
	765.4565	96.91	97.39	97.80	97.82	98.71	97.91	98.93	97.90
	695.1021	97.03	97.38	97.77	97.82	98.43	97.96	97.55	97.90
	674.8755	97.07	97.37	97.84	97.81	98.38	98.18	97.63	97.89
	652.9897	97.15	97.36	97.99	97.73	97.46	98.24	97.95	97.69
	633.4816	Culvert (Plains Road East)							
	621.3574	96.51	96.88	97.92	97.52	98.09	98.09	98.01	97.84
	595.1021	96.01	96.01	97.66	97.67	98.15	98.15	98.04	98.04
	550.8193	96.22	96.22	97.72	97.72	98.15	98.15	98.04	98.04
	508.5913	96.01	96.01	97.73	97.73	98.16	98.16	98.05	98.05

Analysis Results

The original, existing and revised results for the 24-Hour SCS (100-year) and Regional storm events (with and without SWM controls) are summarized in the HEC-RAS outputs, **Tables 6A, 6B and 6C**. The floodplains for all storm events have been plotted on **Figure 2** (attached) and cross-section outputs from HEC-RAS are provided in Appendix A.

The analysis results indicated:

- When considering the upstream stormwater management controls, the Regional storm event governs with a maximum elevation of 97.83m through phase one development and a maximum elevation of 97.73m through phase two development.
- When not considering the upstream SWM controls, the 100-year 24-hour SCS storm event governs with a maximum elevation of 97.98m through phase one development and a maximum elevation of 98.16m through phase two development.
- Only the 100-year 24-hour SCS storm is contained within the channel through all cross-sections.
- For the 24-hour SCS storm event with SWM controls, the revised flood elevations are -0.36m to +0.48m lower/higher than the existing conditions model. For the Regional storm event with SWM controls, the revised flood elevations are -0.76m to +0.05m lower/higher than the existing conditions model.
- For the 24-hour SCS storm event without SWM controls, the revised flood elevations are -0.86m to +0.78m lower/higher than the existing conditions model. For the Regional storm event without SWM controls, the revised flood elevations are -1.03m to +0.35m lower/higher than the existing conditions model.

Fairview Street Spill

The HEC-RAS model as set up assumes any spill upstream of Fairview Street will be directed to the downstream cross-sections located on the Upper Hagar Creek, east of Maple Avenue. Based upon a site visit to the area, it appears the flows conveyed through the West Hagar Creek reach (area of interest for the subject lands) may spill over Fairview Street (elevation approximately 96.0m) into the ditch system located between the west edge of Mapleview Mall parking lot and the QEW off-ramp. These flows would be conveyed south where they would rejoin the main Hagar Creek south of the mall, prior to crossing the QEW. A modelled spill over Fairview Street near Plains Road could have a significant impact in reducing the calculated floodline elevations upstream of Fairview Street.

Conclusions and Recommendations

Based on the information provided herein, it is concluded that the phase one building will be above the 24-hour SCS and Regional floodplain (with and without consideration of upstream SWM controls) with all door sills above an elevation of 98.40m. In order for the phase two building to be above the 24-hour SCS and Regional floodplain, all door sill elevations will need to be raised to

a minimum elevation of 97.90m (including upstream SWM controls) or 98.30m (not including upstream SWM controls) to have a minimum of 0.15m of freeboard.

It is recommended that the potential spilling over Fairview Street be reviewed further with Conservation Halton to determine what modelling modifications should be undertaken that might better characterize the flooding conditions of the area.

We trust the information enclosed is satisfactory. Should you have any questions please do not hesitate to contact our office.

S. Llewellyn & Associates Limited.

D R A F T

Alexandra Porco, B. Eng.

John Oreskovic, P.Eng.

Table 6A - Original Conditions Water Surface Elevations

HEC-RAS Plan: sc1_nov2018 River: HRFreemanPond Reach: WestHager

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)	
WestHager	1321.378	24 Hour SCS_SWM	17.39	97.32	99.63		99.71	0.000223	1.22	14.27	8.12	0.29
WestHager	1321.378	REG_SWM	71.02	97.32	100.61	99.90	101.05	0.000847	3.01	31.89	57.04	0.61
WestHager	1321.378	24 Hour SCS_NS	77.19	97.32	100.86	100.02	101.22	0.000637	2.78	47.34	64.46	0.53
WestHager	1321.378	REG_NS	70.99	97.32	100.73	99.90	101.10	0.000678	2.78	39.29	60.80	0.55
WestHager	1254.522	24 Hour SCS_SWM	17.39	97.39	99.55	98.99	99.67	0.002927	1.54	11.29	10.49	0.47
WestHager	1254.522	REG_SWM	71.02	97.39	100.60	100.20	100.91	0.003771	2.63	38.75	65.10	0.60
WestHager	1254.522	24 Hour SCS_NS	77.19	97.39	100.94	100.30	101.09	0.001727	1.98	61.66	67.83	0.41
WestHager	1254.522	REG_NS	70.99	97.39	100.78	100.19	100.97	0.002210	2.14	51.18	66.83	0.46
WestHager	1193.02	24 Hour SCS_SWM	17.39	97.28	99.44		99.52	0.001677	1.28	13.57	10.51	0.36
WestHager	1193.02	REG_SWM	71.02	97.28	100.73		100.76	0.000466	1.04	121.59	217.72	0.21
WestHager	1193.02	24 Hour SCS_NS	77.19	97.28	101.01		101.02	0.000177	0.69	194.00	294.22	0.13
WestHager	1193.02	REG_NS	70.99	97.28	100.87		100.88	0.000269	0.82	153.91	256.82	0.16
WestHager	1193		Lat Struct									
WestHager	1076.52	24 Hour SCS_SWM	17.39	96.83	99.40	98.45	99.46	0.000213	1.13	15.49	12.29	0.31
WestHager	1076.52	REG_SWM	71.02	96.83	100.74	99.64	100.75	0.000012	0.42	389.99	378.62	0.08
WestHager	1076.52	24 Hour SCS_NS	77.19	96.83	101.02	99.73	101.02	0.000007	0.34	493.05	379.63	0.06
WestHager	1076.52	REG_NS	70.99	96.83	100.87	99.64	100.88	0.000008	0.36	439.48	379.11	0.07
WestHager	1018.932	24 Hour SCS_SWM	34.34	96.56	99.18	98.67	99.40	0.003827	2.08	16.71	14.23	0.57
WestHager	1018.932	REG_SWM	63.71	96.56	100.74	99.25	100.75	0.000011	0.19	395.98	279.68	0.04
WestHager	1018.932	24 Hour SCS_NS	101.91	96.56	101.01	99.51	101.02	0.000017	0.24	471.64	280.44	0.04
WestHager	1018.932	REG_NS	81.04	96.56	100.87	99.51	100.88	0.000014	0.21	432.31	280.04	0.04
WestHager	895.4784	24 Hour SCS_SWM	34.34	96.01	98.96	98.07	99.09	0.001524	1.60	23.95	22.91	0.38
WestHager	895.4784	REG_SWM	63.71	96.01	100.74	98.65	100.74	0.000009	0.20	604.70	335.89	0.03
WestHager	895.4784	24 Hour SCS_NS	101.91	96.01	101.01	99.29	101.01	0.000015	0.27	695.42	336.49	0.04
WestHager	895.4784	REG_NS	81.04	96.01	100.87	98.96	100.87	0.000012	0.23	648.27	336.18	0.04
WestHager	847.417	24 Hour SCS_SWM	34.34	94.95	99.01	97.38	99.05	0.000073	0.95	85.92	260.92	0.19
WestHager	847.417	REG_SWM	63.71	94.95	100.74	98.04	100.74	0.000001	0.17	788.27	404.26	0.03
WestHager	847.417	24 Hour SCS_NS	101.91	94.95	101.01	99.11	101.01	0.000002	0.23	897.47	404.94	0.03
WestHager	847.417	REG_NS	81.04	94.95	100.87	98.34	100.87	0.000002	0.20	840.72	404.59	0.03
WestHager	835.2853	24 Hour SCS_SWM	34.34	94.22	99.00	96.74	99.05	0.000077	1.00	82.33	268.13	0.19
WestHager	835.2853	REG_SWM	63.71	94.22	100.74	97.42	100.74	0.000004	0.30	778.53	376.21	0.04
WestHager	835.2853	24 Hour SCS_NS	101.91	94.22	101.01	98.27	101.01	0.000006	0.41	879.89	376.77	0.06
WestHager	835.2853	REG_NS	81.04	94.22	100.87	97.75	100.87	0.000005	0.35	827.22	376.48	0.05
WestHager	826.5759	24 Hour SCS_SWM	34.34	93.70	99.01	95.32	99.04	0.000019	0.72	47.55	410.06	0.11
WestHager	826.5759	REG_SWM	63.71	93.70	100.74	95.87	100.74	0.000000	0.12	1088.65	449.76	0.02
WestHager	826.5759	24 Hour SCS_NS	101.91	93.70	101.01	96.48	101.01	0.000001	0.17	1210.01	450.55	0.02
WestHager	826.5759	REG_NS	81.04	93.70	100.87	96.16	100.87	0.000001	0.15	1146.95	450.14	0.02
WestHager	805.3582		Culvert									
WestHager	789.1301	24 Hour SCS_SWM	34.34	93.73	97.90	95.01	97.93	0.000035	0.73	47.30	13.05	0.12
WestHager	789.1301	REG_SWM	63.71	93.73	98.99	95.57	99.01	0.000028	0.75	201.64	324.18	0.11
WestHager	789.1301	24 Hour SCS_NS	101.91	93.73	99.03	96.18	99.07	0.000065	1.14	214.08	324.64	0.17
WestHager	789.1301	REG_NS	81.04	93.73	99.01	95.86	99.05	0.000042	0.92	210.41	324.51	0.14
WestHager	780.9492	24 Hour SCS_SWM	34.34	93.74	97.86	95.22	97.92	0.000104	1.11	30.96	8.62	0.19
WestHager	780.9492	REG_SWM	63.71	93.74	98.95	95.89	99.00	0.000084	1.11	102.77	117.12	0.18
WestHager	780.9492	24 Hour SCS_NS	101.91	93.74	98.91	96.60	99.05	0.000233	1.83	98.33	116.90	0.30
WestHager	780.9492	REG_NS	81.04	93.74	98.95	96.23	99.03	0.000136	1.41	103.02	117.13	0.23
WestHager	776.5764	24 Hour SCS_SWM	34.34	93.79	97.59	96.29	97.86	0.000736	2.28	15.06	5.95	0.46
WestHager	776.5764	REG_SWM	63.71	93.79	98.94	97.27	99.00	0.000171	1.34	90.83	114.79	0.24
WestHager	776.5764	24 Hour SCS_NS	101.91	93.79	98.75	98.70	99.01	0.000762	2.74	68.79	114.11	0.51
WestHager	776.5764	REG_NS	81.04	93.79	98.93	97.76	99.03	0.000282	1.72	90.00	114.76	0.31
WestHager	765.4565	24 Hour SCS_SWM	37.21	93.67	96.91	96.91	97.78	0.003501	4.13	9.01	5.16	1.00
WestHager	765.4565	REG_SWM	65.45	93.67	97.80	97.80	98.89	0.003282	4.63	14.15	6.47	1.00
WestHager	765.4565	24 Hour SCS_NS	105.00	93.67	98.71	98.71	98.99	0.000921	2.99	73.01	119.80	0.56
WestHager	765.4565	REG_NS	83.94	93.67	98.93	98.58	99.02	0.000300	1.79	100.00	120.30	0.32
WestHager	695.1021	24 Hour SCS_SWM	37.21	93.55	97.03	96.10	97.42	0.001149	2.76	13.47	5.72	0.57
WestHager	695.1021	REG_SWM	65.45	93.55	97.77	97.05	98.43	0.001858	3.60	18.25	11.00	0.76
WestHager	695.1021	24 Hour SCS_NS	105.00	93.55	98.43	98.43	98.71	0.000838	2.87	82.17	147.01	0.54
WestHager	695.1021	REG_NS	83.94	93.55	97.55	97.55	98.85	0.003392	5.04	16.64	6.41	1.00
WestHager	674.8755	24 Hour SCS_SWM	37.21	93.47	97.07	95.75	97.37	0.000865	2.45	15.19	5.84	0.49
WestHager	674.8755	REG_SWM	65.45	93.47	97.84	96.75	98.36	0.001354	3.20	22.29	48.94	0.64
WestHager	674.8755	24 Hour SCS_NS	105.00	93.47	98.38	98.38	98.66	0.000828	2.85	81.30	159.08	0.52
WestHager	674.8755	REG_NS	83.94	93.47	97.63	97.26	98.65	0.002806	4.48	18.72	7.57	0.91
WestHager	652.9897	24 Hour SCS_SWM	37.21	93.45	97.15	95.03	97.28	0.000111	1.63	22.84	6.61	0.27
WestHager	652.9897	REG_SWM	65.45	93.45	97.99	95.73	98.17	0.000395	2.01	61.52	131.29	0.34
WestHager	652.9897	24 Hour SCS_NS	105.00	93.45	97.46	96.56	98.38	0.000671	4.23	24.81	6.64	0.68
WestHager	652.9897	REG_NS	83.94	93.45	97.95	96.13	98.28	0.000695	2.65	56.60	122.87	0.44

HEC-RAS Plan: sc1_nov2018 River: HRFreemanPond Reach: WestHager (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)	
WestHager	633.4816		Culvert									
WestHager	621.3574	24 Hour SCS_SWM	37.21	93.33	96.51	95.81	97.05	0.001801	3.25	11.45	4.53	0.65
WestHager	621.3574	REG_SWM	65.45	93.33	97.92	97.92	98.12	0.000697	2.38	58.56	157.49	0.40
WestHager	621.3574	24 Hour SCS_NS	105.00	93.33	98.09	98.09	98.31	0.000899	2.79	86.11	158.36	0.46
WestHager	621.3574	REG_NS	83.94	93.33	98.01	98.01	98.22	0.000787	2.57	73.34	158.12	0.43
WestHager	595.1021	24 Hour SCS_SWM	37.21	93.26	96.01	96.01	96.89	0.003345	4.15	8.97	5.11	1.00
WestHager	595.1021	REG_SWM	65.45	93.26	97.66	96.90	97.81	0.000531	2.14	71.56	186.27	0.43
WestHager	595.1021	24 Hour SCS_NS	105.00	93.26	98.15	97.80	98.18	0.000164	1.34	189.31	269.89	0.25
WestHager	595.1021	REG_NS	83.94	93.26	98.04	97.72	98.07	0.000162	1.30	159.45	269.58	0.24
WestHager	550.8193	24 Hour SCS_SWM	37.21	93.19	96.22	95.25	96.54	0.000842	2.50	14.88	6.27	0.52
WestHager	550.8193	REG_SWM	65.45	93.19	97.72	96.06	97.74	0.000081	0.97	158.53	157.15	0.18
WestHager	550.8193	24 Hour SCS_NS	105.00	93.19	98.15	97.23	98.17	0.000079	1.04	229.52	166.52	0.18
WestHager	550.8193	REG_NS	83.94	93.19	98.04	97.13	98.06	0.000063	0.91	211.65	166.52	0.16
WestHager	508.5913	24 Hour SCS_SWM	37.21	93.02	96.01	95.43	96.48	0.001421	3.01	12.37	6.20	0.68
WestHager	508.5913	REG_SWM	65.45	93.02	97.73	96.90	97.73	0.000022	0.53	272.46	264.70	0.10
WestHager	508.5913	24 Hour SCS_NS	105.00	93.02	98.16	97.08	98.16	0.000020	0.54	386.81	264.70	0.09
WestHager	508.5913	REG_NS	83.94	93.02	98.05	97.01	98.05	0.000016	0.48	357.73	264.70	0.08
WestHager	490.8526	24 Hour SCS_SWM	37.21	92.79	95.57	95.57	96.40	0.003120	4.05	9.19	5.48	1.00
WestHager	490.8526	REG_SWM	65.45	92.79	97.73	96.60	97.73	0.000013	0.42	336.19	248.23	0.07
WestHager	490.8526	24 Hour SCS_NS	105.00	92.79	98.16	96.80	98.16	0.000014	0.47	443.29	248.23	0.08
WestHager	490.8526	REG_NS	83.94	92.79	98.05	96.74	98.05	0.000011	0.41	416.01	248.23	0.07
WestHager	485.7959	24 Hour SCS_SWM	37.21	92.76	95.47	95.24	96.20	0.002573	3.79	9.81	4.87	0.85
WestHager	485.7959	REG_SWM	65.45	92.76	97.73	96.15	97.73	0.000014	0.42	393.08	312.81	0.07
WestHager	485.7959	24 Hour SCS_NS	105.00	92.76	98.16	97.08	98.16	0.000014	0.45	528.11	312.81	0.07
WestHager	485.7959	REG_NS	83.94	92.76	98.05	96.62	98.05	0.000011	0.39	493.69	312.81	0.06
WestHager	249.2144		Culvert									
WestHager	26.09473	24 Hour SCS_SWM	37.21	89.80	92.27	91.41	92.58	0.000503	2.45	15.17	8.29	0.51
WestHager	26.09473	REG_SWM	65.45	89.80	93.25	92.10	93.59	0.000619	2.59	25.59	10.63	0.48
WestHager	26.09473	24 Hour SCS_NS	105.00	89.80	94.26	92.88	94.73	0.000638	3.05	37.16	12.21	0.49
WestHager	26.09473	REG_NS	83.94	89.80	93.93	92.50	94.29	0.000535	2.68	33.19	11.65	0.45

Table 6B - Existing Conditions Water Surface Elevations

*updated bank locations for XS 780.9492 (+25.5m) and XS 776.5764 (+19.25m) to align the channel properly

HEC-RAS Plan: sc1_nov2018 River: HRFreemanPond Reach: WestHager

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)	
WestHager	1321.378	24 Hour SCS_SWM	17.39	97.32	99.63		99.71	0.000223	1.22	14.27	8.12	0.29
WestHager	1321.378	REG_SWM	71.02	97.32	100.61	99.90	101.05	0.000847	3.01	31.89	57.04	0.61
WestHager	1321.378	24 Hour SCS_NS	77.19	97.32	100.86	100.02	101.22	0.000637	2.78	47.35	64.46	0.53
WestHager	1321.378	REG_NS	70.99	97.32	100.73	99.90	101.10	0.000675	2.77	39.45	60.88	0.55
WestHager	1254.522	24 Hour SCS_SWM	17.39	97.39	99.55	98.99	99.67	0.002927	1.54	11.29	10.49	0.47
WestHager	1254.522	REG_SWM	71.02	97.39	100.60	100.20	100.91	0.003769	2.63	38.76	65.11	0.60
WestHager	1254.522	24 Hour SCS_NS	77.19	97.39	100.94	100.30	101.09	0.001726	1.98	61.66	67.83	0.41
WestHager	1254.522	REG_NS	70.99	97.39	100.79	100.19	100.97	0.002191	2.13	51.38	66.85	0.46
WestHager	1193.02	24 Hour SCS_SWM	17.39	97.28	99.44		99.52	0.001677	1.28	13.57	10.51	0.36
WestHager	1193.02	REG_SWM	71.02	97.28	100.73		100.76	0.000466	1.04	121.62	217.75	0.21
WestHager	1193.02	24 Hour SCS_NS	77.19	97.28	101.01		101.02	0.000177	0.69	194.01	294.23	0.13
WestHager	1193.02	REG_NS	70.99	97.28	100.87		100.89	0.000267	0.82	154.55	257.96	0.16
WestHager	1193		Lat Struct									
WestHager	1076.52	24 Hour SCS_SWM	17.39	96.83	99.40	98.45	99.46	0.000213	1.13	15.49	12.29	0.31
WestHager	1076.52	REG_SWM	71.02	96.83	100.74	99.64	100.75	0.000012	0.42	390.04	378.62	0.08
WestHager	1076.52	24 Hour SCS_NS	77.19	96.83	101.02	99.73	101.02	0.000007	0.34	493.07	379.63	0.06
WestHager	1076.52	REG_NS	70.99	96.83	100.88	99.64	100.88	0.000008	0.36	440.35	379.12	0.07
WestHager	1018.932	24 Hour SCS_SWM	34.34	96.56	99.18	98.67	99.40	0.003827	2.08	16.71	14.23	0.57
WestHager	1018.932	REG_SWM	63.71	96.56	100.74	99.25	100.75	0.000011	0.19	396.02	279.68	0.04
WestHager	1018.932	24 Hour SCS_NS	101.91	96.56	101.01	99.51	101.02	0.000017	0.24	471.66	280.44	0.04
WestHager	1018.932	REG_NS	81.04	96.56	100.88	99.51	100.88	0.000014	0.21	432.95	280.05	0.04
WestHager	895.4784	24 Hour SCS_SWM	34.34	96.01	98.96	98.07	99.09	0.001524	1.60	23.95	22.91	0.38
WestHager	895.4784	REG_SWM	63.71	96.01	100.74	98.65	100.74	0.000009	0.20	604.75	335.89	0.03
WestHager	895.4784	24 Hour SCS_NS	101.91	96.01	101.01	99.29	101.01	0.000015	0.27	695.44	336.49	0.04
WestHager	895.4784	REG_NS	81.04	96.01	100.88	98.96	100.88	0.000012	0.23	649.04	336.19	0.04
WestHager	847.417	24 Hour SCS_SWM	34.34	94.95	99.01	97.38	99.05	0.000073	0.95	85.92	260.92	0.19
WestHager	847.417	REG_SWM	63.71	94.95	100.74	98.04	100.74	0.000001	0.17	788.33	404.26	0.03
WestHager	847.417	24 Hour SCS_NS	101.91	94.95	101.01	99.11	101.01	0.000002	0.23	897.50	404.94	0.03
WestHager	847.417	REG_NS	81.04	94.95	100.88	98.34	100.88	0.000002	0.20	841.65	404.60	0.03
WestHager	835.2853	24 Hour SCS_SWM	34.34	94.22	99.00	96.74	99.05	0.000077	1.00	82.33	268.13	0.19
WestHager	835.2853	REG_SWM	63.71	94.22	100.74	97.42	100.74	0.000004	0.30	778.58	376.21	0.04
WestHager	835.2853	24 Hour SCS_NS	101.91	94.22	101.01	98.27	101.01	0.000006	0.41	879.91	376.77	0.06
WestHager	835.2853	REG_NS	81.04	94.22	100.87	97.75	100.88	0.000005	0.35	828.09	376.49	0.05
WestHager	826.5759	24 Hour SCS_SWM	34.34	93.70	99.01	95.32	99.04	0.000019	0.72	47.55	410.06	0.11
WestHager	826.5759	REG_SWM	63.71	93.70	100.74	95.87	100.74	0.000000	0.12	1088.72	449.76	0.02
WestHager	826.5759	24 Hour SCS_NS	101.91	93.70	101.01	96.48	101.01	0.000001	0.17	1210.04	450.55	0.02
WestHager	826.5759	REG_NS	81.04	93.70	100.88	96.16	100.88	0.000001	0.15	1147.98	450.14	0.02
WestHager	805.3582		Culvert									
WestHager	789.1301	24 Hour SCS_SWM	34.34	93.73	97.90	95.01	97.93	0.000035	0.73	47.30	13.05	0.12
WestHager	789.1301	REG_SWM	63.71	93.73	98.98	95.57	99.01	0.000028	0.75	200.70	324.14	0.11
WestHager	789.1301	24 Hour SCS_NS	101.91	93.73	99.00	96.18	99.05	0.000070	1.18	204.39	324.28	0.18
WestHager	789.1301	REG_NS	81.04	93.73	99.01	95.86	99.04	0.000043	0.93	208.52	324.43	0.14
WestHager	780.9492	24 Hour SCS_SWM	34.34	93.74	97.86	95.22	97.92	0.000104	1.11	30.96	8.62	0.19
WestHager	780.9492	REG_SWM	63.71	93.74	98.96	95.89	99.00	0.000074	1.04	117.79	145.66	0.17
WestHager	780.9492	24 Hour SCS_NS	101.91	93.74	98.92	96.61	99.03	0.000209	1.73	111.33	145.41	0.28
WestHager	780.9492	REG_NS	81.04	93.74	98.97	96.23	99.03	0.000117	1.31	118.88	145.69	0.21
WestHager	776.5764	24 Hour SCS_SWM	34.34	93.79	97.59	96.30	97.86	0.000736	2.28	15.06	5.95	0.46
WestHager	776.5764	REG_SWM	63.71	93.79	98.95	97.27	99.00	0.000148	1.25	101.32	134.08	0.23
WestHager	776.5764	24 Hour SCS_NS	101.91	93.79	98.85	98.70	99.01	0.000525	2.30	87.25	133.70	0.43
WestHager	776.5764	REG_NS	81.04	93.79	98.95	97.77	99.03	0.000239	1.58	101.51	134.08	0.29
WestHager	765.4565	24 Hour SCS_SWM	37.21	93.67	96.91	96.91	97.78	0.003501	4.13	9.01	5.16	1.00
WestHager	765.4565	REG_SWM	65.45	93.67	97.80	97.80	98.89	0.003282	4.63	14.15	6.47	1.00
WestHager	765.4565	24 Hour SCS_NS	105.00	93.67	98.71	98.71	98.99	0.000921	2.99	73.01	119.80	0.56
WestHager	765.4565	REG_NS	83.94	93.67	98.93	98.58	99.02	0.000300	1.79	100.00	120.30	0.32
WestHager	695.1021	24 Hour SCS_SWM	37.21	93.55	97.03	96.10	97.42	0.001149	2.76	13.47	5.72	0.57
WestHager	695.1021	REG_SWM	65.45	93.55	97.77	97.05	98.43	0.001858	3.60	18.25	11.00	0.76
WestHager	695.1021	24 Hour SCS_NS	105.00	93.55	98.43	98.43	98.71	0.000838	2.87	82.17	147.01	0.54
WestHager	695.1021	REG_NS	83.94	93.55	97.55	97.55	98.85	0.003392	5.04	16.64	6.41	1.00
WestHager	674.8755	24 Hour SCS_SWM	37.21	93.47	97.07	95.75	97.37	0.000865	2.45	15.19	5.84	0.49
WestHager	674.8755	REG_SWM	65.45	93.47	97.84	96.75	98.36	0.001354	3.20	22.29	48.94	0.64
WestHager	674.8755	24 Hour SCS_NS	105.00	93.47	98.38	98.38	98.66	0.000828	2.85	81.30	159.08	0.52
WestHager	674.8755	REG_NS	83.94	93.47	97.63	97.26	98.65	0.002806	4.48	18.72	7.57	0.91
WestHager	652.9897	24 Hour SCS_SWM	37.21	93.45	97.15	95.03	97.28	0.000111	1.63	22.84	6.61	0.27
WestHager	652.9897	REG_SWM	65.45	93.45	97.99	95.73	98.17	0.000395	2.01	61.52	131.29	0.34
WestHager	652.9897	24 Hour SCS_NS	105.00	93.45	97.46	96.56	98.38	0.000671	4.23	24.81	6.64	0.68
WestHager	652.9897	REG_NS	83.94	93.45	97.95	96.13	98.28	0.000695	2.65	56.60	122.87	0.44

HEC-RAS Plan: sc1_nov2018 River: HRFreemanPond Reach: WestHager (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)	
WestHager	633.4816		Culvert									
WestHager	621.3574	24 Hour SCS_SWM	37.21	93.33	96.51	95.81	97.05	0.001801	3.25	11.45	4.53	0.65
WestHager	621.3574	REG_SWM	65.45	93.33	97.92	97.92	98.12	0.000697	2.38	58.56	157.49	0.40
WestHager	621.3574	24 Hour SCS_NS	105.00	93.33	98.09	98.09	98.31	0.000899	2.79	86.11	158.36	0.46
WestHager	621.3574	REG_NS	83.94	93.33	98.01	98.01	98.22	0.000787	2.57	73.34	158.12	0.43
WestHager	595.1021	24 Hour SCS_SWM	37.21	93.26	96.01	96.01	96.89	0.003345	4.15	8.97	5.11	1.00
WestHager	595.1021	REG_SWM	65.45	93.26	97.66	96.90	97.81	0.000531	2.14	71.56	186.27	0.43
WestHager	595.1021	24 Hour SCS_NS	105.00	93.26	98.15	97.80	98.18	0.000164	1.34	189.31	269.89	0.25
WestHager	595.1021	REG_NS	83.94	93.26	98.04	97.72	98.07	0.000162	1.30	159.45	269.58	0.24
WestHager	550.8193	24 Hour SCS_SWM	37.21	93.19	96.22	95.25	96.54	0.000842	2.50	14.88	6.27	0.52
WestHager	550.8193	REG_SWM	65.45	93.19	97.72	96.06	97.74	0.000081	0.97	158.53	157.15	0.18
WestHager	550.8193	24 Hour SCS_NS	105.00	93.19	98.15	97.23	98.17	0.000079	1.04	229.52	166.52	0.18
WestHager	550.8193	REG_NS	83.94	93.19	98.04	97.13	98.06	0.000063	0.91	211.65	166.52	0.16
WestHager	508.5913	24 Hour SCS_SWM	37.21	93.02	96.01	95.43	96.48	0.001421	3.01	12.37	6.20	0.68
WestHager	508.5913	REG_SWM	65.45	93.02	97.73	96.90	97.73	0.000022	0.53	272.46	264.70	0.10
WestHager	508.5913	24 Hour SCS_NS	105.00	93.02	98.16	97.08	98.16	0.000020	0.54	386.81	264.70	0.09
WestHager	508.5913	REG_NS	83.94	93.02	98.05	97.01	98.05	0.000016	0.48	357.73	264.70	0.08
WestHager	490.8526	24 Hour SCS_SWM	37.21	92.79	95.57	95.57	96.40	0.003120	4.05	9.19	5.48	1.00
WestHager	490.8526	REG_SWM	65.45	92.79	97.73	96.60	97.73	0.000013	0.42	336.19	248.23	0.07
WestHager	490.8526	24 Hour SCS_NS	105.00	92.79	98.16	96.80	98.16	0.000014	0.47	443.29	248.23	0.08
WestHager	490.8526	REG_NS	83.94	92.79	98.05	96.74	98.05	0.000011	0.41	416.01	248.23	0.07
WestHager	485.7959	24 Hour SCS_SWM	37.21	92.76	95.47	95.24	96.20	0.002573	3.79	9.81	4.87	0.85
WestHager	485.7959	REG_SWM	65.45	92.76	97.73	96.15	97.73	0.000014	0.42	393.08	312.81	0.07
WestHager	485.7959	24 Hour SCS_NS	105.00	92.76	98.16	97.08	98.16	0.000014	0.45	528.11	312.81	0.07
WestHager	485.7959	REG_NS	83.94	92.76	98.05	96.62	98.05	0.000011	0.39	493.69	312.81	0.06
WestHager	249.2144		Culvert									
WestHager	26.09473	24 Hour SCS_SWM	37.21	89.80	92.27	91.41	92.58	0.000503	2.45	15.17	8.29	0.51
WestHager	26.09473	REG_SWM	65.45	89.80	93.25	92.10	93.59	0.000619	2.59	25.59	10.63	0.48
WestHager	26.09473	24 Hour SCS_NS	105.00	89.80	94.26	92.88	94.73	0.000638	3.05	37.16	12.21	0.49
WestHager	26.09473	REG_NS	83.94	89.80	93.93	92.50	94.29	0.000535	2.68	33.19	11.65	0.45

Table 6C - Revised Conditions Water Surface Elevations

*updated to reflect new topographic information

HEC-RAS Plan: Plan 02 River: HRFreemanPond Reach: WestHager

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)	
WestHager	1321.378	24 Hour SCS_SWM	17.39	97.32	99.61		99.69	0.000230	1.23	14.12	8.07	0.30
WestHager	1321.378	REG_SWM	71.02	97.32	100.61	99.90	101.06	0.000836	2.99	32.33	57.30	0.60
WestHager	1321.378	24 Hour SCS_NS	77.19	97.32	100.82	100.02	101.20	0.000684	2.85	44.81	63.34	0.55
WestHager	1321.378	REG_NS	70.99	97.32	100.66	99.90	101.07	0.000775	2.91	34.81	58.61	0.58
WestHager	1254.522	24 Hour SCS_SWM	17.39	97.39	99.52	98.99	99.65	0.003116	1.58	11.03	10.37	0.49
WestHager	1254.522	REG_SWM	71.02	97.39	100.34	100.20	100.92	0.007497	3.38	22.26	18.04	0.82
WestHager	1254.522	24 Hour SCS_NS	77.19	97.39	100.90	100.30	101.06	0.001916	2.06	58.95	67.70	0.44
WestHager	1254.522	REG_NS	70.99	97.39	100.69	100.19	100.93	0.002909	2.38	44.66	65.97	0.53
WestHager	1193.02	24 Hour SCS_SWM	17.39	97.28	99.41		99.49	0.001792	1.31	13.23	10.35	0.37
WestHager	1193.02	REG_SWM	71.02	97.28	100.58		100.64	0.000926	1.41	90.80	191.53	0.30
WestHager	1193.02	24 Hour SCS_NS	77.19	97.28	100.98		100.99	0.000203	0.74	184.20	287.30	0.14
WestHager	1193.02	REG_NS	70.99	97.28	100.79		100.81	0.000361	0.93	135.50	232.89	0.19
WestHager	1193		Lat Struct									
WestHager	1076.52	24 Hour SCS_SWM	17.39	96.83	99.36	98.45	99.43	0.000234	1.16	15.03	12.04	0.32
WestHager	1076.52	REG_SWM	71.02	96.83	100.61	99.64	100.62	0.000018	0.50	339.73	378.13	0.10
WestHager	1076.52	24 Hour SCS_NS	77.19	96.83	100.98	99.73	100.99	0.000007	0.35	480.53	379.51	0.07
WestHager	1076.52	REG_NS	70.99	96.83	100.80	99.64	100.81	0.000010	0.39	412.11	378.84	0.08
WestHager	1018.932	24 Hour SCS_SWM	34.34	96.56	99.11	98.67	99.36	0.004504	2.18	15.82	13.49	0.61
WestHager	1018.932	REG_SWM	63.71	96.56	100.61	99.25	100.61	0.000016	0.21	358.95	279.31	0.04
WestHager	1018.932	24 Hour SCS_NS	101.91	96.56	100.98	99.51	100.98	0.000018	0.25	462.39	280.34	0.04
WestHager	1018.932	REG_NS	81.04	96.56	100.80	99.51	100.80	0.000016	0.23	412.09	279.84	0.04
WestHager	895.4784	24 Hour SCS_SWM	34.34	96.01	98.27	98.07	98.63	0.007719	2.64	13.02	11.86	0.78
WestHager	895.4784	REG_SWM	63.71	96.01	100.61	98.65	100.61	0.000012	0.22	560.13	335.59	0.04
WestHager	895.4784	24 Hour SCS_NS	101.91	96.01	100.98	99.29	100.98	0.000016	0.27	684.29	336.42	0.04
WestHager	895.4784	REG_NS	81.04	96.01	100.80	98.96	100.80	0.000014	0.24	623.94	336.02	0.04
WestHager	847.417	24 Hour SCS_SWM	34.34	94.95	98.38	97.38	98.52	0.000339	1.69	21.16	15.99	0.40
WestHager	847.417	REG_SWM	63.71	94.95	100.61	98.04	100.61	0.000001	0.19	734.63	403.93	0.03
WestHager	847.417	24 Hour SCS_NS	101.91	94.95	100.98	99.11	100.98	0.000002	0.24	884.08	404.86	0.04
WestHager	847.417	REG_NS	81.04	94.95	100.80	98.34	100.80	0.000002	0.21	811.44	404.41	0.03
WestHager	835.2853	24 Hour SCS_SWM	34.34	94.22	98.40	96.74	98.50	0.000205	1.39	26.87	19.85	0.29
WestHager	835.2853	REG_SWM	63.71	94.22	100.61	97.42	100.61	0.000004	0.32	728.53	375.93	0.05
WestHager	835.2853	24 Hour SCS_NS	101.91	94.22	100.98	98.27	100.98	0.000007	0.42	867.40	376.70	0.06
WestHager	835.2853	REG_NS	81.04	94.22	100.80	97.75	100.80	0.000005	0.37	799.93	376.33	0.05
WestHager	826.5759	24 Hour SCS_SWM	34.34	93.70	98.43	95.32	98.47	0.000028	0.91	37.80	321.49	0.14
WestHager	826.5759	REG_SWM	63.71	93.70	100.61	95.91	100.61	0.000001	0.13	1028.94	449.37	0.02
WestHager	826.5759	24 Hour SCS_NS	101.91	93.70	100.98	96.55	100.98	0.000001	0.17	1195.09	450.45	0.02
WestHager	826.5759	REG_NS	81.04	93.70	100.80	96.21	100.80	0.000001	0.15	1114.35	449.92	0.02
WestHager	805.3582		Culvert									
WestHager	789.1301	24 Hour SCS_SWM	34.34	93.25	97.55	94.75	97.58	0.000028	0.76	45.37	13.15	0.13
WestHager	789.1301	REG_SWM	63.71	93.25	98.22	95.30	98.29	0.000054	1.18	53.95	50.15	0.18
WestHager	789.1301	24 Hour SCS_NS	101.91	93.25	98.95	95.85	99.08	0.000082	1.61	63.32	314.02	0.23
WestHager	789.1301	REG_NS	81.04	93.25	98.53	95.57	98.63	0.000069	1.40	57.96	55.63	0.21
WestHager	780.9492	24 Hour SCS_SWM	34.34	93.23	97.50	95.19	97.57	0.000114	1.16	29.49	8.68	0.20
WestHager	780.9492	REG_SWM	63.71	93.23	98.09	95.82	98.26	0.000240	1.83	37.29	21.63	0.29
WestHager	780.9492	24 Hour SCS_NS	101.91	93.23	98.97	96.49	99.06	0.000145	1.63	134.49	140.29	0.24
WestHager	780.9492	REG_NS	81.04	93.23	98.38	96.14	98.60	0.000287	2.09	52.87	90.17	0.32
WestHager	776.5764	24 Hour SCS_SWM	34.34	93.22	97.41	95.49	97.55	0.000283	1.63	21.05	6.35	0.29
WestHager	776.5764	REG_SWM	63.71	93.22	97.83	96.24	98.20	0.000710	2.68	23.97	11.32	0.44
WestHager	776.5764	24 Hour SCS_NS	101.91	93.22	97.98	97.06	98.84	0.001577	4.10	26.18	19.13	0.67
WestHager	776.5764	REG_NS	81.04	93.22	97.94	96.63	98.49	0.001041	3.31	25.38	16.66	0.54
WestHager	765.4565	24 Hour SCS_SWM	37.21	93.22	97.39	95.53	97.54	0.000314	1.73	21.47	6.50	0.30
WestHager	765.4565	REG_SWM	65.45	93.22	97.82	96.24	98.19	0.000693	2.69	24.63	12.05	0.45
WestHager	765.4565	24 Hour SCS_NS	105.00	93.22	97.91	97.07	98.81	0.001649	4.21	25.79	14.85	0.69
WestHager	765.4565	REG_NS	83.94	93.22	97.90	96.64	98.48	0.001065	3.38	25.63	14.52	0.55
WestHager	695.1021	24 Hour SCS_SWM	37.21	93.00	97.38	95.33	97.51	0.000272	1.64	22.72	6.47	0.28
WestHager	695.1021	REG_SWM	65.45	93.00	97.82	96.03	98.13	0.000563	2.52	31.77	41.42	0.41
WestHager	695.1021	24 Hour SCS_NS	105.00	93.00	97.96	96.84	98.65	0.001206	3.78	42.17	105.01	0.60
WestHager	695.1021	REG_NS	83.94	93.00	97.90	96.43	98.38	0.000833	3.11	37.22	80.21	0.49
WestHager	674.8755	24 Hour SCS_SWM	37.21	92.98	97.37	95.33	97.51	0.000280	1.65	22.50	7.15	0.28
WestHager	674.8755	REG_SWM	65.45	92.98	97.81	96.04	98.12	0.000573	2.52	33.19	53.70	0.41
WestHager	674.8755	24 Hour SCS_NS	105.00	92.98	98.18	96.87	98.53	0.000684	2.93	87.11	175.15	0.46
WestHager	674.8755	REG_NS	83.94	92.98	97.89	96.44	98.36	0.000841	3.10	39.56	94.37	0.50
WestHager	652.9897	24 Hour SCS_SWM	37.21	92.98	97.36	95.07	97.50	0.000288	1.66	22.36	7.07	0.27
WestHager	652.9897	REG_SWM	65.45	92.98	97.73	95.82	98.10	0.000659	2.67	24.68	114.91	0.41
WestHager	652.9897	24 Hour SCS_NS	105.00	92.98	98.24	96.71	98.44	0.000479	2.45	124.57	149.73	0.36
WestHager	652.9897	REG_NS	83.94	92.98	97.69	96.26	98.30	0.001120	3.46	24.42	112.52	0.54

HEC-RAS Plan: Plan 02 River: HRFreemanPond Reach: WestHager (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)	
WestHager	633.4816		Culvert									
WestHager	621.3574	24 Hour SCS_SWM	37.21	93.01	96.88	95.22	97.10	0.000244	2.06	18.04	5.52	0.36
WestHager	621.3574	REG_SWM	65.45	93.01	97.52	96.00	97.98	0.000976	2.99	23.54	28.70	0.48
WestHager	621.3574	24 Hour SCS_NS	105.00	93.01	98.09	98.09	98.44	0.000845	3.05	96.91	152.95	0.46
WestHager	621.3574	REG_NS	83.94	93.01	97.84	96.45	98.29	0.000983	3.16	58.16	152.29	0.49
WestHager	595.1021	24 Hour SCS_SWM	37.21	93.26	96.01	96.01	96.89	0.003345	4.15	8.97	5.11	1.00
WestHager	595.1021	REG_SWM	65.45	93.26	97.67	96.90	97.80	0.000459	2.00	84.26	207.23	0.40
WestHager	595.1021	24 Hour SCS_NS	105.00	93.26	98.15	97.77	98.18	0.000154	1.30	210.82	270.06	0.24
WestHager	595.1021	REG_NS	83.94	93.26	98.04	97.70	98.07	0.000148	1.24	181.07	269.78	0.23
WestHager	550.8193	24 Hour SCS_SWM	37.21	93.19	96.22	95.25	96.54	0.000842	2.50	14.88	6.27	0.52
WestHager	550.8193	REG_SWM	65.45	93.19	97.72	96.06	97.74	0.000071	0.91	189.24	213.27	0.17
WestHager	550.8193	24 Hour SCS_NS	105.00	93.19	98.15	97.22	98.17	0.000065	0.95	281.82	214.59	0.17
WestHager	550.8193	REG_NS	83.94	93.19	98.04	97.13	98.06	0.000053	0.83	258.60	214.26	0.15
WestHager	508.5913	24 Hour SCS_SWM	37.21	93.02	96.01	95.43	96.48	0.001421	3.01	12.37	6.20	0.68
WestHager	508.5913	REG_SWM	65.45	93.02	97.73	96.84	97.73	0.000017	0.47	306.89	294.18	0.09
WestHager	508.5913	24 Hour SCS_NS	105.00	93.02	98.16	97.03	98.16	0.000015	0.48	433.96	294.18	0.08
WestHager	508.5913	REG_NS	83.94	93.02	98.05	96.92	98.05	0.000012	0.42	401.59	294.18	0.07
WestHager	490.8526	24 Hour SCS_SWM	37.21	92.79	95.57	95.57	96.40	0.003120	4.05	9.19	5.48	1.00
WestHager	490.8526	REG_SWM	65.45	92.79	97.73	96.60	97.73	0.000013	0.42	336.19	248.23	0.07
WestHager	490.8526	24 Hour SCS_NS	105.00	92.79	98.16	96.80	98.16	0.000014	0.47	443.29	248.23	0.08
WestHager	490.8526	REG_NS	83.94	92.79	98.05	96.74	98.05	0.000011	0.41	416.01	248.23	0.07
WestHager	485.7959	24 Hour SCS_SWM	37.21	92.76	95.47	95.24	96.20	0.002573	3.79	9.81	4.87	0.85
WestHager	485.7959	REG_SWM	65.45	92.76	97.73	96.15	97.73	0.000014	0.42	393.08	312.81	0.07
WestHager	485.7959	24 Hour SCS_NS	105.00	92.76	98.16	97.08	98.16	0.000014	0.45	528.11	312.81	0.07
WestHager	485.7959	REG_NS	83.94	92.76	98.05	96.62	98.05	0.000011	0.39	493.69	312.81	0.06
WestHager	249.2144		Culvert									
WestHager	26.09473	24 Hour SCS_SWM	37.21	89.80	92.27	91.41	92.58	0.000503	2.45	15.17	8.29	0.51
WestHager	26.09473	REG_SWM	65.45	89.80	93.25	92.10	93.59	0.000619	2.59	25.59	10.63	0.48
WestHager	26.09473	24 Hour SCS_NS	105.00	89.80	94.26	92.88	94.73	0.000638	3.05	37.16	12.21	0.49
WestHager	26.09473	REG_NS	83.94	89.80	93.93	92.50	94.29	0.000535	2.68	33.19	11.65	0.45

S:\20071\Working\Current\20071 - Floodplain Mapping.dwg



LEGEND

- +209.00 — EXISTING GROUND ELEVATION
- 100YR, 24HR SCS FLOODPLAIN (NO SWM CONTROLS)
- REGIONAL FLOODPLAIN (NO SWM CONTROLS)
- 100YR, 24HR SCS FLOODPLAIN (WITH SWM CONTROLS)
- REGIONAL FLOODPLAIN (WITH SWM CONTROLS)
- PHASE ONE DEVELOPMENT AREA
- PHASE TWO DEVELOPMENT AREA

FLOOD ELEVATIONS (m)				
RIVER STATION	WITH SWM		WITHOUT SWM	
	24HR SCS	REG.	24HR SCS	REG.
789.1301	97.550	98.22	98.95	98.53
780.9492	97.50	98.09	98.97	98.38
776.5764	97.41	97.83	97.98	97.94
765.4565	97.39	97.82	97.91	97.90
695.1021	97.38	97.82	97.96	97.90
674.8755	97.37	97.81	98.18	97.89
652.9897	97.36	97.73	98.24	97.69
621.3574	96.88	97.52	98.09	97.84
595.1021	96.01	97.67	98.15	98.04
550.8193	96.22	97.72	98.15	98.04
508.5913	96.01	97.73	98.16	98.05

FIGURE 2

FLOODPLAIN MAPPING

SCALE: 1:1000

PROJECT: QUEEN ELIZABETH & FAIRVIEW, BURL., ON
PROJECT No.: 20071

S. LLEWELLYN & ASSOCIATES LIMITED
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3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

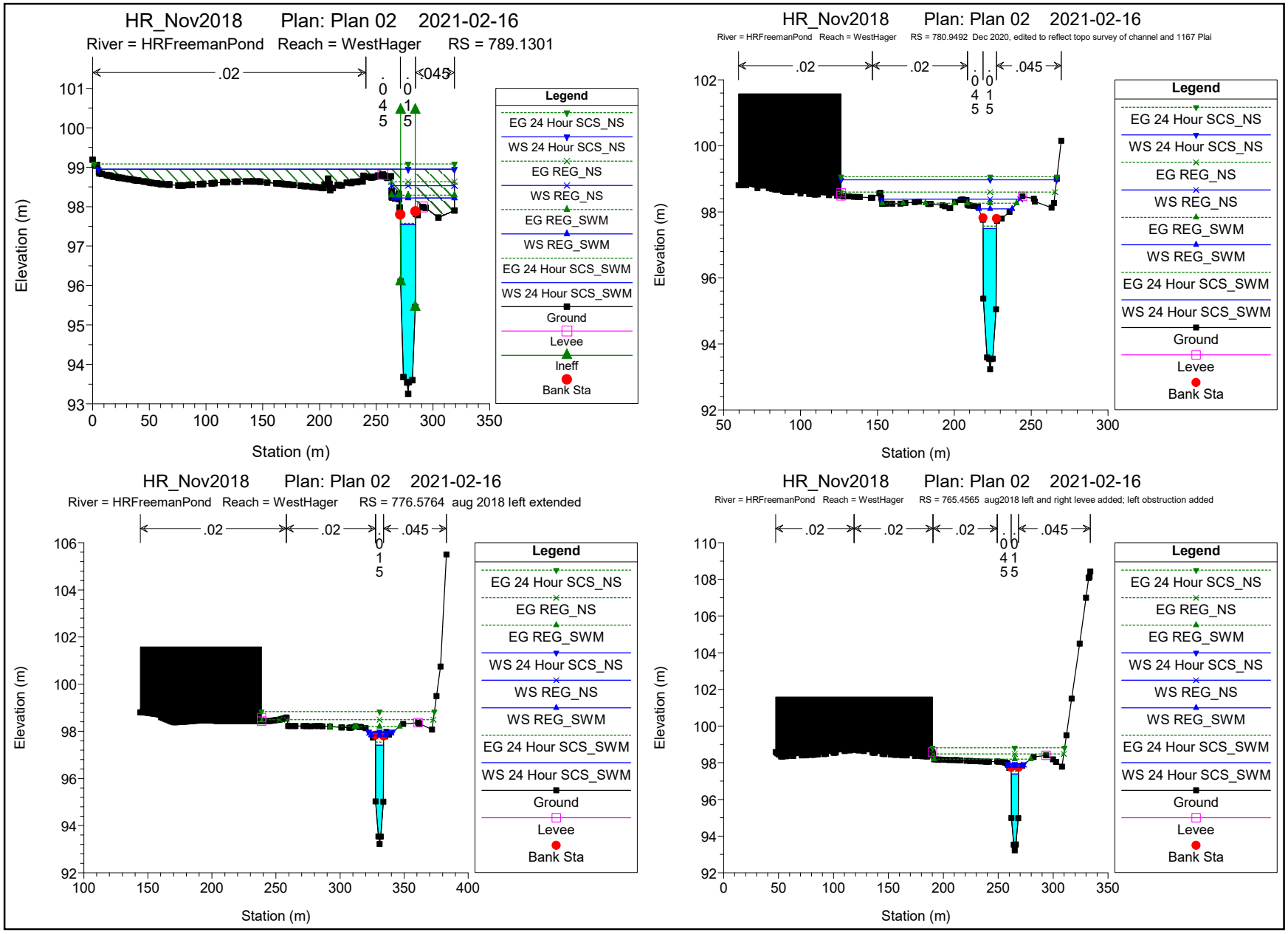
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APPENDIX A

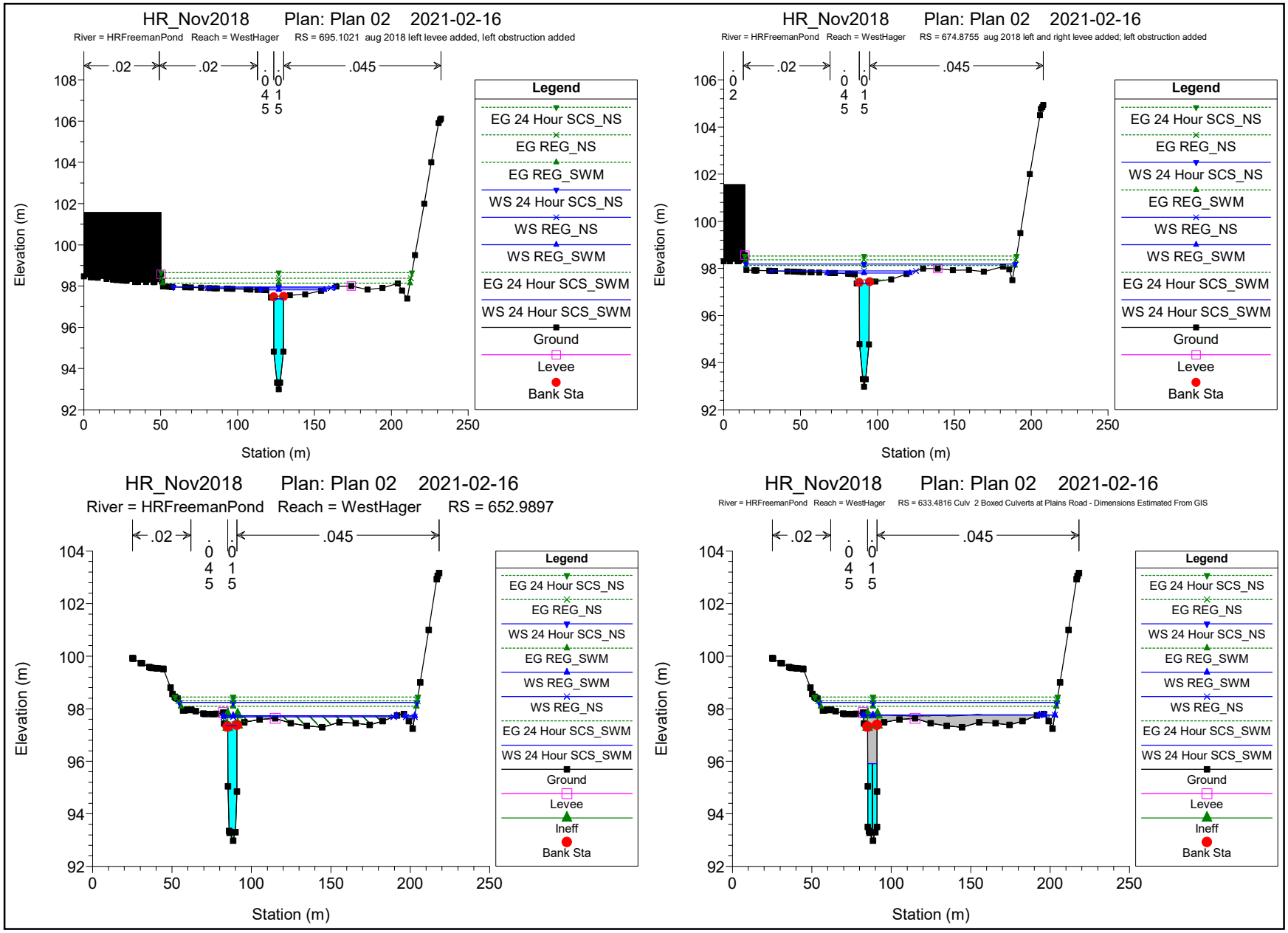
HEC-RAS MODEL OUTPUT

3228 South Service Road, Suite 105, East Wing Burlington, Ontario L7N 3H8
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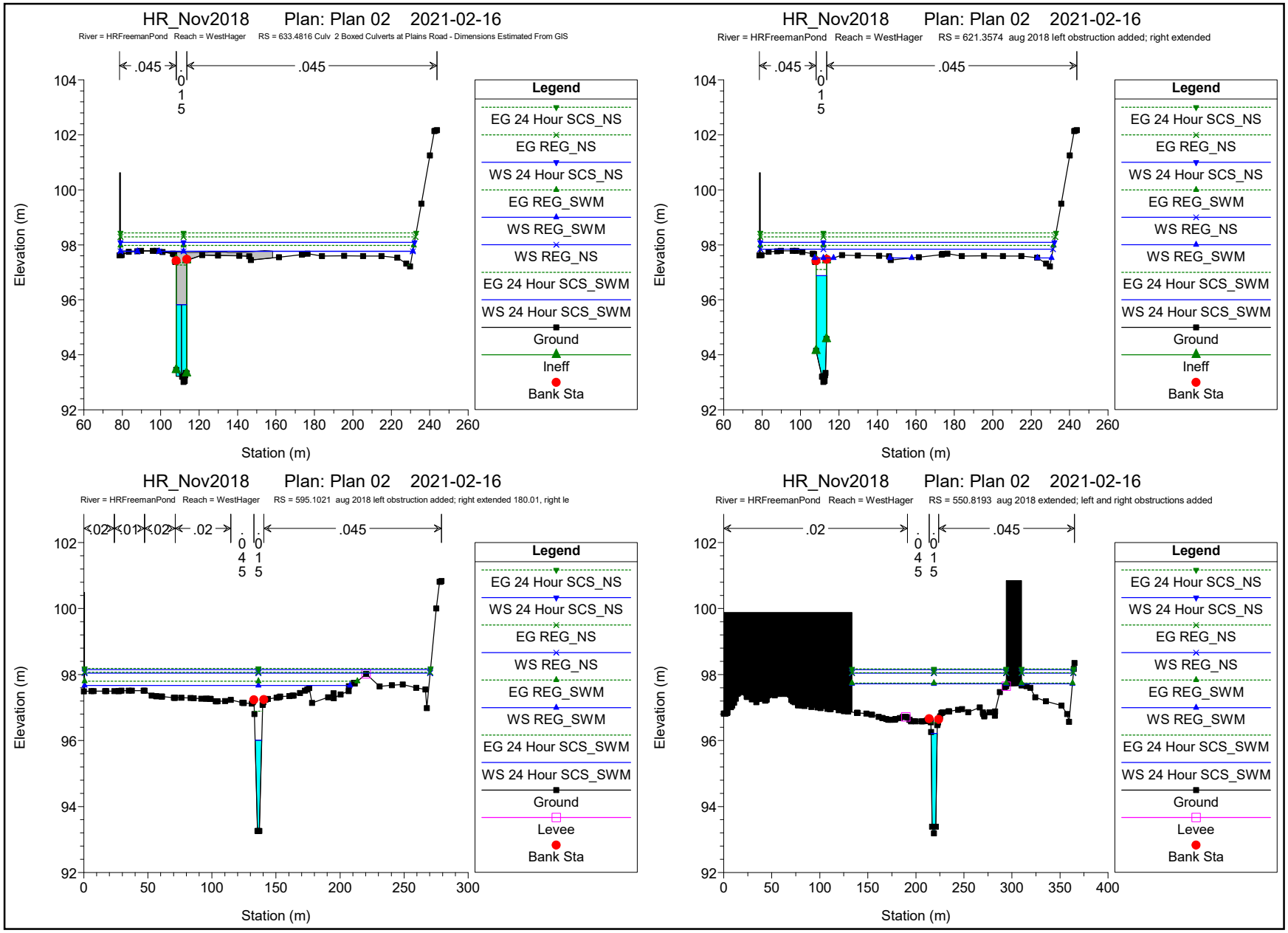
EXISTING CROSS-SECTIONS



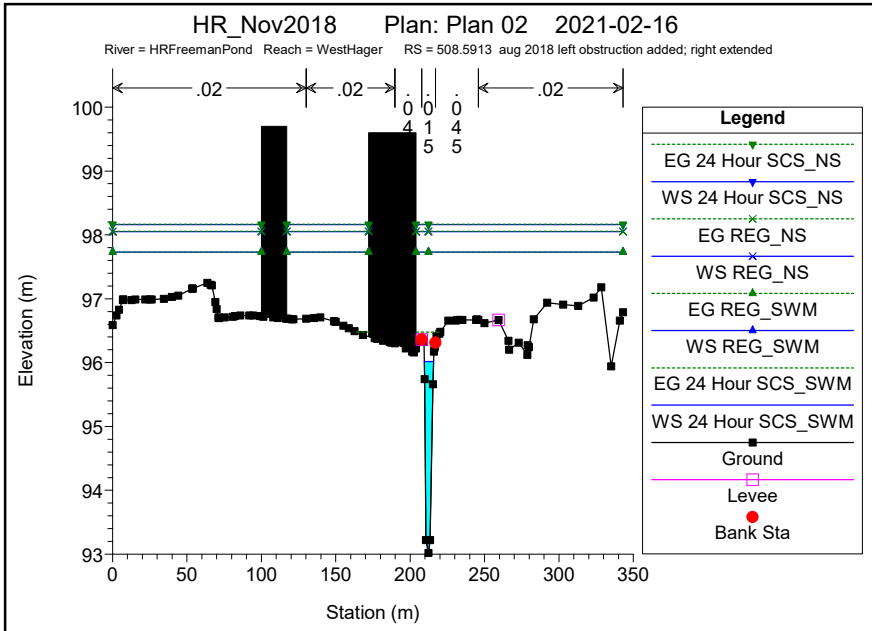
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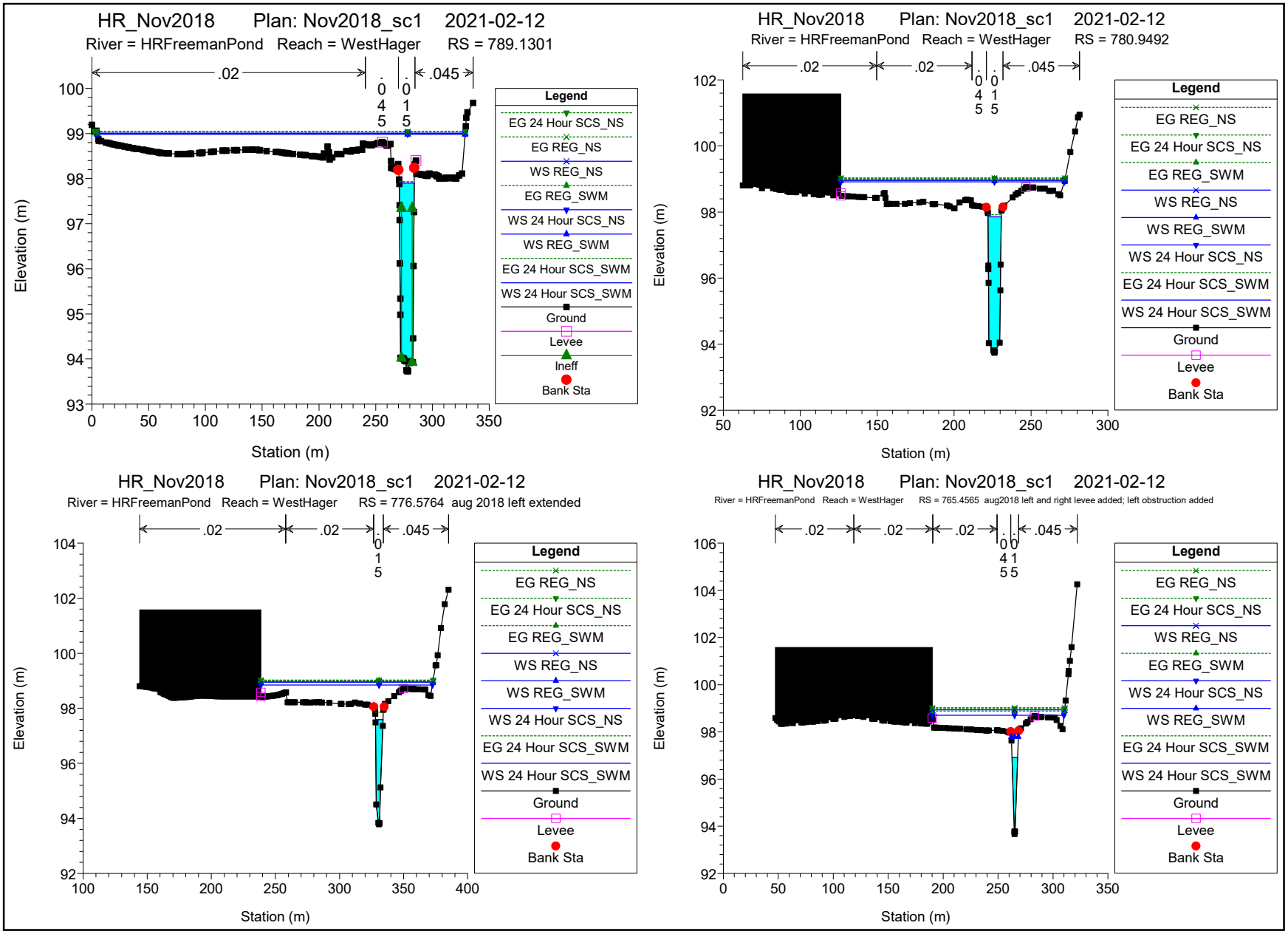
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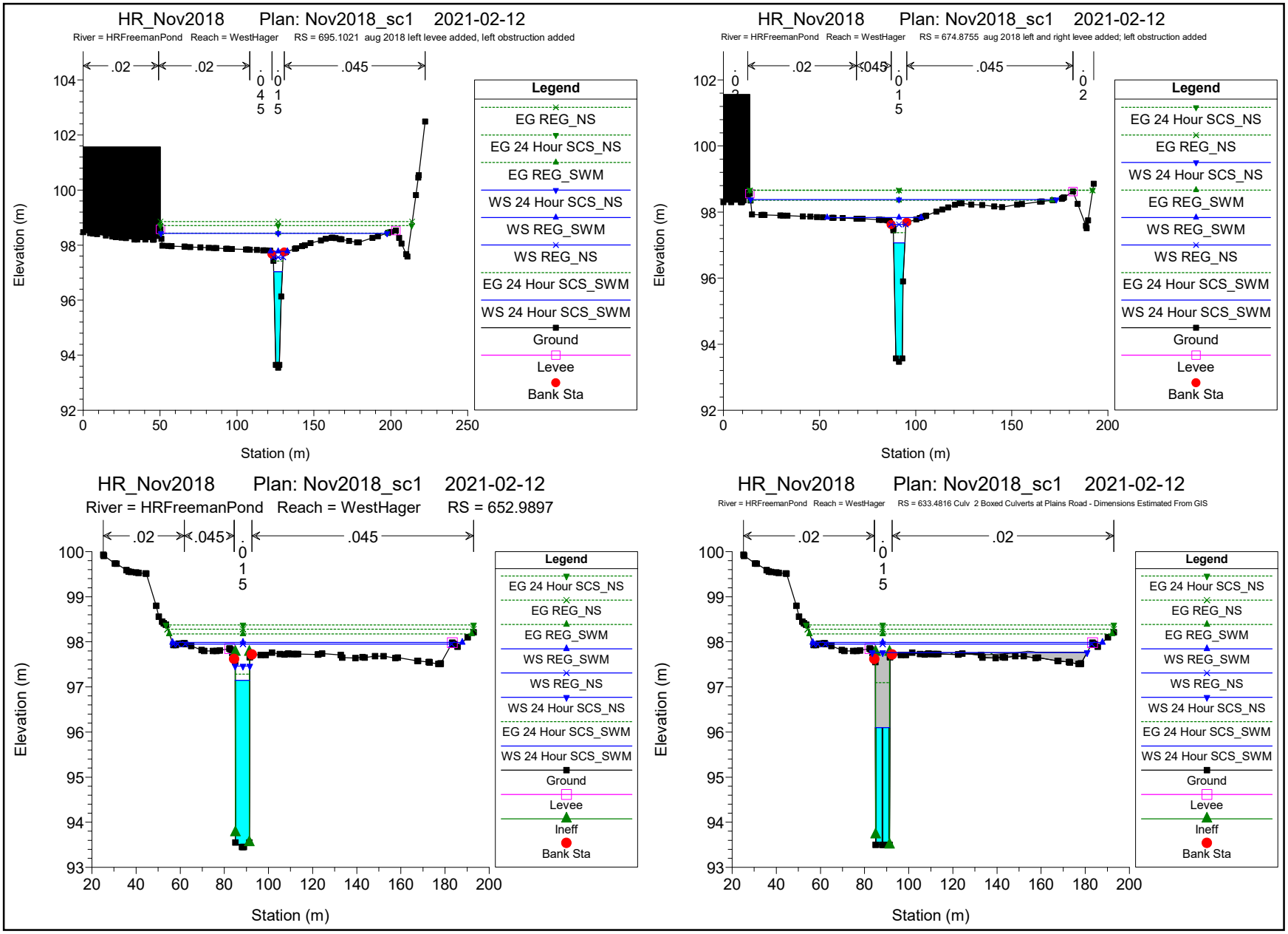
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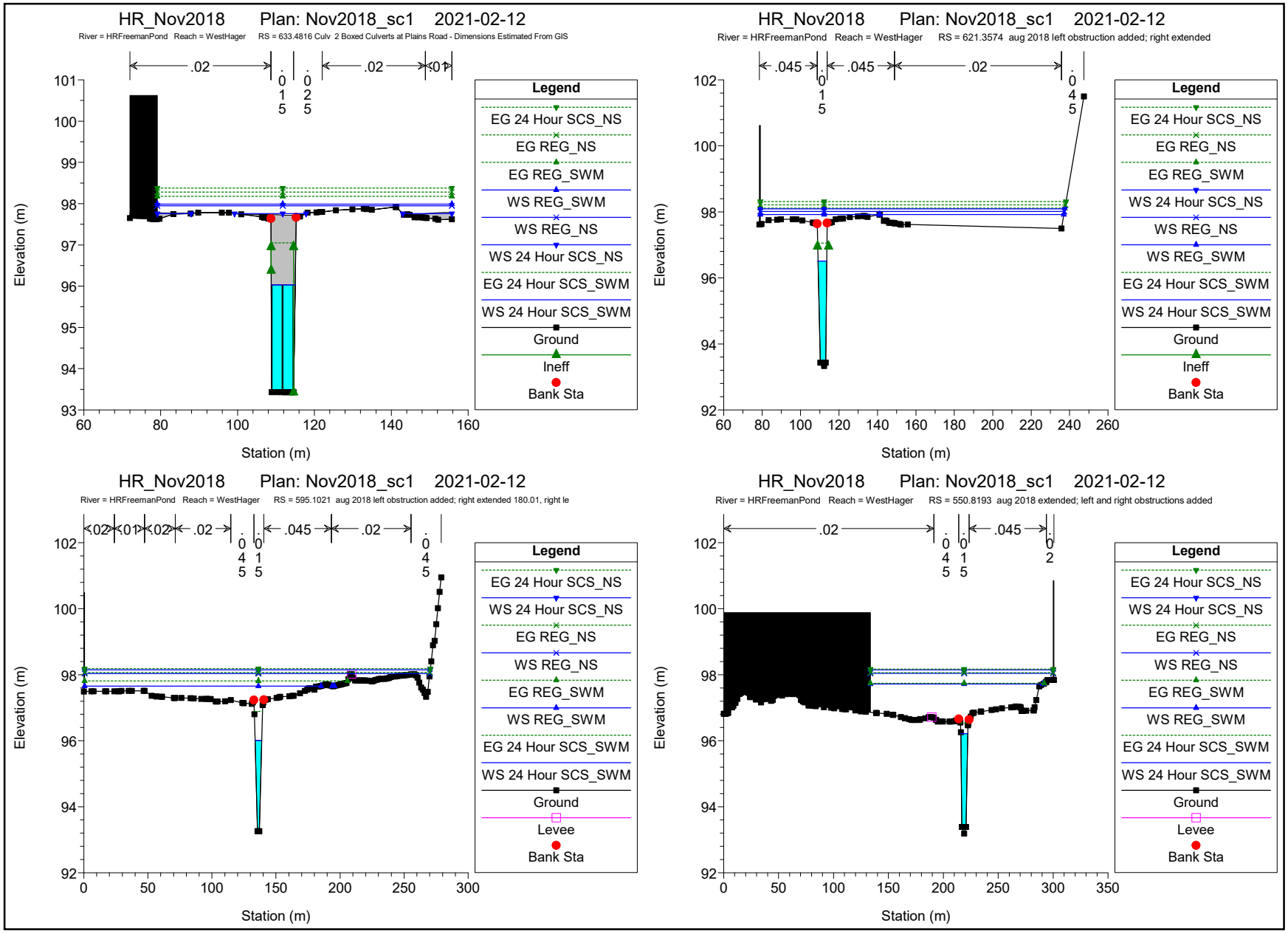
REVISED CROSS-SECTIONS



REVISED CROSS-SECTIONS



REVISED CROSS-SECTIONS



REVISED CROSS-SECTIONS

