Prepared for:

The Credit Valley Conservation

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Applewood Creek Channel Restoration – St. James Avenue to Lakeshore Road East

Detailed Design Brief

A design brief submitted by:

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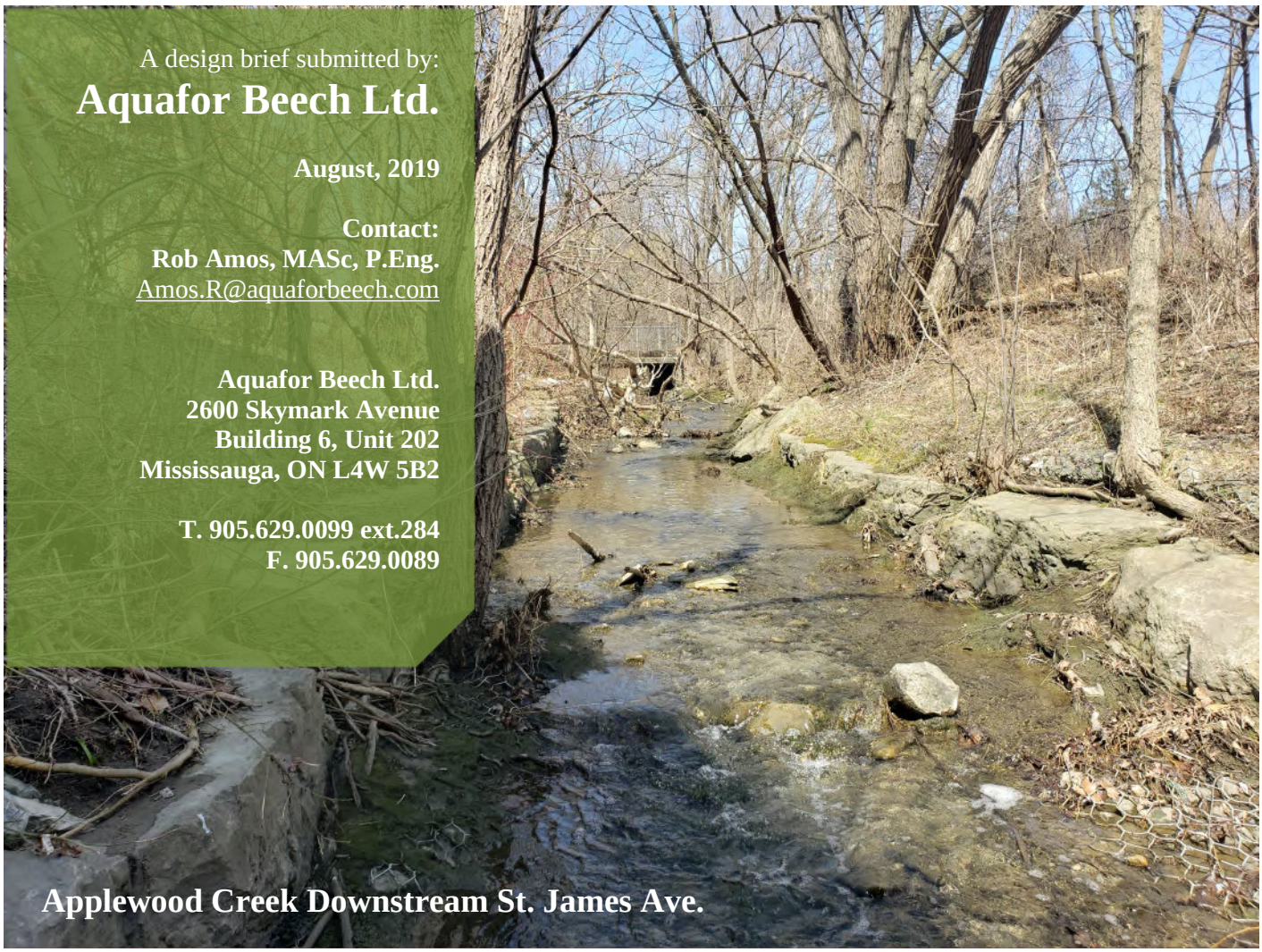

Applewood Creek Downstream St. James Ave.

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1 INTRODUCTION

Aquafor Beech Limited (Aquafor), in cooperation with Cole Engineering providing Water Resources and Toronto Inspection providing geotechnical expertise, were retained to address the recent issues with regards to the Applewood Creek channel, extending from St. James Avenue to Lakeshore Road East, as illustrated in Figure 1-1.

The project team proposes to undertake the restoration of the Applewood Creek channel, which will retain the regulatory flows below the top of slope and within the riparian corridor, in order to address the increased flood risks to the adjacent property to the east. The restoration will involve removal of gabion baskets, large angular stone, and invasive trees, and provide a stable channel morphology which offers Natural Channel Design application, with underlying engineering to ensure long term erosion hazard protection.

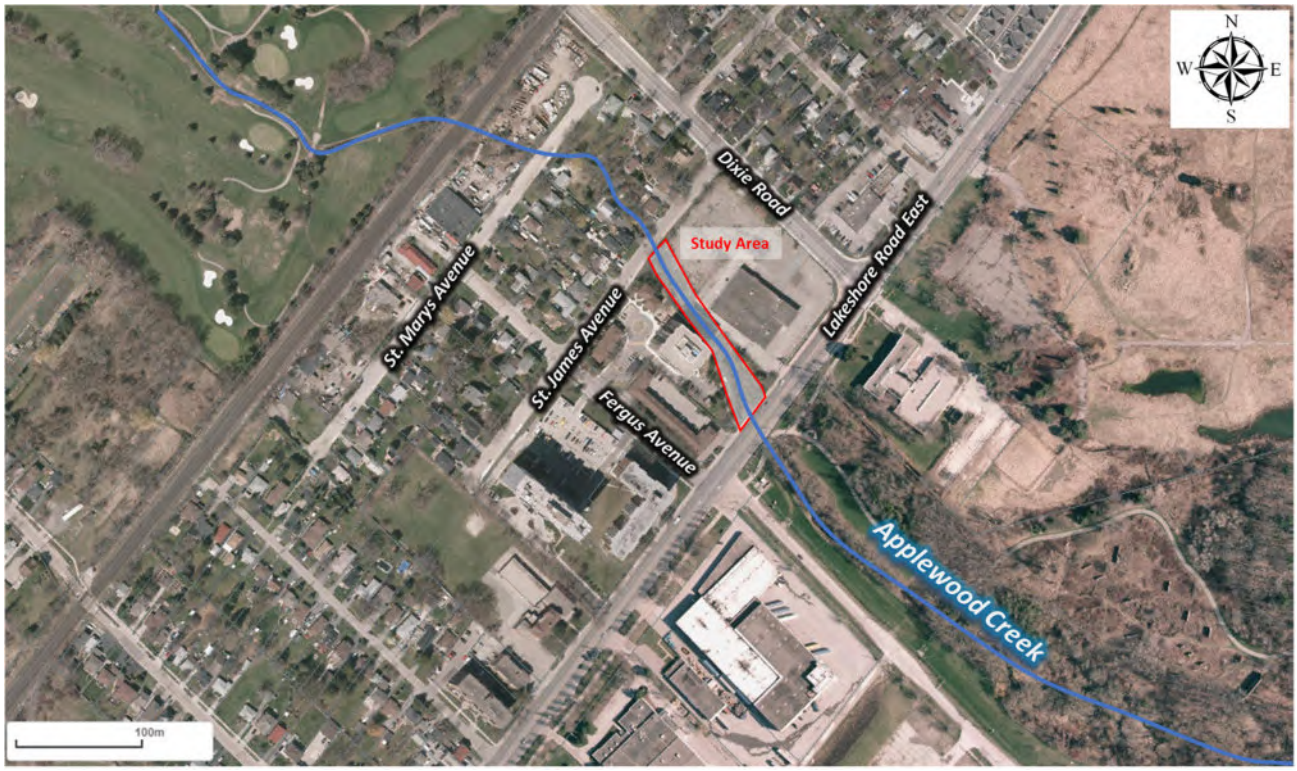


Figure 1-1. Applewood Creek Study Area – St. James Avenue to Lakeshore Road East

2 STUDY AREA EXISTING CONDITIONS

The property on the east of the study area is zoned as 'Mixed Use', currently includes a non-operational car dealership and is surrounded by commercial and residential land. Through a comprehensive understanding of the existing conditions, the detailed design will mitigate the revised floodplain constraints as defined by Cole and channel restoration efforts to address the identified risks within the study area.

The study area corridor consists of a narrow, wooded valley which contains Applewood Creek. Significant portions of the creek and valley walls consist of gabion baskets, and exotic species (i.e. Manitoba maple) dominate the woodland in the corridor.

The VanDyk Group proposes to develop the land parcel in the East as a residential condominium in one phase, consisting of 8-storey mixed-use residential commercial building facing Dixie Road and Lakeshore Road East, and a 12-storey high-rise residential building facing St. James Avenue and Dixie Road. The proposed development allows for a 10 m wide buffer strip along the western boundary of the property, which coincides with the edge of the woodland and the valley slope top-of-bank.

2.1 Geomorphic Assessment

A geomorphic investigation was completed to provide insight into the existing condition of Applewood Creek within the study area. An investigation into the historical changes in the creek corridor provides insight and understanding of the existing conditions. A series of historic aerial photographs from 1954 to 2016 were compared to provide perspective and context to the age of surrounding urbanization and channel adjustment. The aerial photographs were retrieved from the City of Mississauga's e-Maps, which is shown in Figure 2-1.

Figure 2-1. Historical Aerial Imagery of Applewood Creek from 1954 to 2016

The photo comparison shows urban development over that period, resulting in Applewood Creek being channelized and hardened. Figure 2-1 suggest that channel upstream Lakeshore Road East which extends to St. James Avenue was straightened prior to 1954. The large building completely encapsulated with a crossing in the middle of the creek on the eastern side of the creek. The large building was removed in 1989 and the property adjacent to the east contained a completely impervious land parcel with abandoned building. The crossing may have been removed as seen in the aerial photo from 1954. The gabion baskets were placed in the upper portion of the channel between 1989 and 2000. The building on the Applewood Creek's eastern adjacent property may have been replaced or renovated as the size of the building appears larger than the aerial photograph of 1989. The planform is being developed with vegetation on the gabion lining along the banks of the creek in 2016. On the downstream of the study area, additional armourstone is installed.

The City of Mississauga undertook the two culverts' rehabilitation project for the Applewood Creek and Lakeshore Road East crossing in 2018. A significant alteration and restoration of Applewood Creek was also undertaken upstream and downstream of Lakeshore Road East for the purposes of retaining all flows including regulatory flooding within the channel. Recent increases in CVC's regulatory hydrologic estimates, however, suggest that

flood reduction benefits from the City's project have been reduced so that the channel segment upstream to St James spills beyond the riparian corridor and into the impermeable overbank areas.

The rapid assessment tools include the rapid geomorphic assessment (RGA) and the rapid stream assessment technique (RSAT). Evidence of aggradation, degradation, channel widening, and planimetric form adjustment is recorded by completing a standard RGA form. Based on the RGA results, streams are classified as Stable, Moderately Stable, or Unstable. The RSAT evaluates channel reach on the basis of six factors: channel stability, channel scouring/sediment deposition, physical instream habitat, water quality, riparian habitat conditions, and biological indicators. Lake Ontario Integrated Shoreline Strategy (LOISS) study was undertaken by Aquafor Beech Ltd. with CVC in 2011. The study involved an assessment of existing fluvial geomorphic conditions, including Applewood Creek, on the 13 watercourses discharging to Lake Ontario. The geomorphic assessment was conducted to characterize the geomorphic state of the watercourse using field reconnaissance. The Reach 4 of Applewood Creek extends from Applewood Creek crossing at St. James Avenue to Lakeshore Road East. The study highlights that Reach 4 scored the RGA of 0.11 and RSAT of 23. Due to dominant aggradation process, the Applewood Creek (including our study area) was found to be "stable" and fair condition in terms of health. The key results from the RGA and RSAT are presented in Table 2-1. The report also indicates that the 150 m upstream of Applewood Creek from the mouth of Lake Ontario is sensitive to backwater effects. The backwater effects of the lake decrease the velocity in downstream reach of Applewood Creek, resulting in deposition of transported sediment. In Applewood Creek, low biological indicator score also indicates the low-velocity, depositional nature of the backwater conditions in the reach of the backwater. Urban debris was noted as an ongoing issue causing debris jams in the creek throughout the surveyed sections.

Table 2-1. Geomorphic Summary of Reach 4 from LOISS (2011)

Reach 4	Average
Bankfull Width	3.3 m
Bankfull Depth	0.4 m
Average Valley Width	10 m
Mean Slope	0.011
RGA Stability Index	0.11
RSAT Score	23

Applewood Creek conveys flows through the easterly edge of Mississauga, draining an area of approximately 600 hectares composed of residential, commercial, and industrial land use. The watercourse extends for nearly 3 kilometers, draining to Lake Ontario. Loose bed material composed of gabion stone and sediment accumulations. Figure 2-2 through Figure 2-7 provides a site inventory as a photographic illustration of the study area and downstream of the study area. The creek bed and the banks were hardened starting at the culvert crossing of Applewood Creek and St. James Avenue (Figure 2-2) to 72 meters downstream with a gabion basket structure (Figure 2-6). The established willow roots provide grade control in the banks (Figure 2-3). The channel is engineered with a combination of gabion baskets and armourstone lining the bed and banks (Figure 2-4). The meandering planform with engineered riffle-pool sequence follows the rest of the creek (Figure 2-7).

Figure 2-2. Looking downstream from the top of the culvert at Applewood Creek Crossing and St. James Avenue

Figure 2-3. Looking downstream. Established willow roots on the side of the creek bed.

Figure 2-4. Looking downstream. Combination of armourstone banks and gabion bed

Figure 2-5. Abandoned building parcel adjacent to the eastern side of the creek

Figure 2-6. Looking downstream from the end of proposed channel restoration

Figure 2-7. Downstream of the study area with a riffle-pool sequence

Figure 2-8. Looking upstream towards Applewood Creek and Lakeshore Road East. Aggraded sediment on the downstream of culvert openings

Figure 2-9. Downstream extent of Applewood Creek (south of Lakeshore Road East). Active bank slumping along the fence of Lakeview Wastewater Treatment Plant

2.2 Geotechnical Investigation

A detailed geotechnical investigation was undertaken by Toronto Inspection Limited on August 2019 to elaborate the existing site condition in order to define and characterize the subsurface soil and groundwater conditions within the study areas of erosion and creek bank stability related issues, with particular reference to the long-term slope delineation. The detailed investigation is completed in accordance with CVC and MNRF requirements. The results of the slope stability analyses indicated that the proposed slopes, following regrading, will have an adequate factor of safety against failures (F≥1.5). The complete slope stability study prepared by Toronto Inspection Limited is included in Appendix A.

2.3 Hydrologic & Hydraulic Assessment

2.3.1 *Hydrologic Conditions*

As previously mentioned, the Credit Valley Conservation Authority (CVC) has recently completed an update to the existing hydrology of Applewood Creek. The original hydrology data for Applewood Creek, created by Philips Engineering Ltd. in March 2001, was originally used within the existing Applewood Creek hydraulic model provided by CVC. An update to the hydrology of Applewood Creek was completed by CVC in 2019, and was applied in this hydraulic analysis.

In the previous set of hydrology data, flows from the 100-Year storm events were determined to be larger than the Regional storm events, and therefore the 100-Year storm was set as the Regulatory storm event for completing the hydraulic analysis. However, the Regional storm event was identified as the critical storm, and hence was applied in the current hydraulic analysis.

In comparing the previous 100-year flow values in the original to the update hydrology results, i.e., the Regional flows, it was noted that the updated hydrology resulted in a significantly greater flow than the original data from March 2001. As a result, the St. James Ave. will be overtopped and the floodline elevation will be increased significantly, which results the Regulatory floodplain now encompassing a portion of the table land to the east of the site that was intended to be developed in the future.

2.3.2 *Existing Hydraulic Conditions*

In order to determine the extent of the Regulatory floodplain under the existing conditions (i.e., with the new Regional storm flow), the updated Applewood HEC-RAS model, obtained from CVC on June 10th, 2019, was examined as the Existing Conditions/Baseline model. The Existing Conditions model within the vicinity of the

proposed restoration includes Cross Section 11015 through 11064 along Applewood River - Reach 2241, however additional cross sections upstream and downstream of the proposed restoration segment of the channel were also examined in completing the hydraulic analysis. The Existing Conditions model was run using the updated flows as per the new 2019 hydrology results, and the resultant water surface elevations (WSEL) at each cross section were used in generating the Regulatory floodplain in AutoCAD Civil 3D. The existing floodline, as illustrated in **Drawing FP-1,** is observed to overtop St James Ave. and the existing top of bank and spill from the riparian corridor into the table land for future development located to the east of the channel. Detailed HEC-RAS outputs for existing conditions have been provided in Appendix B.

2.4 Vegetation Communities and Flora

Information regarding vegetation communities and flora within and adjacent to the study area is detailed under the following subheadings. Confirmation of the vegetation community designation per the City of Mississauga's Natural Areas Survey (NAS) data, and a vascular plants inventory was completed on May 1st, 2018.

2.4.1 *Vegetation Communities*

The application of Ecological Land Classification (ELC) for Southern Ontario consists of describing, classifying and delineating ecological units under the guidance of a standardized protocol (Lee et al., 1998). As part of vegetation community classification field activities, site-specific information is collected on an array of bio-physical parameters – substrate type and depth, moisture regime, topography, floral composition, stand structure and disturbance, amongst others – to produce detailed accounts of individual vegetation communities. This approach allows for a comprehensive and consistent approach to ecosystem classification.

According to the City's NAS (2016), the creek corridor abutting the west side of the subject property is characterized by a Fresh-Moist Lowland Deciduous Forest Ecosite (FOD7). This forest community extends from St. James Avenue south to approximately 185 m south of Lakeshore Road East (see Figure 2-10).

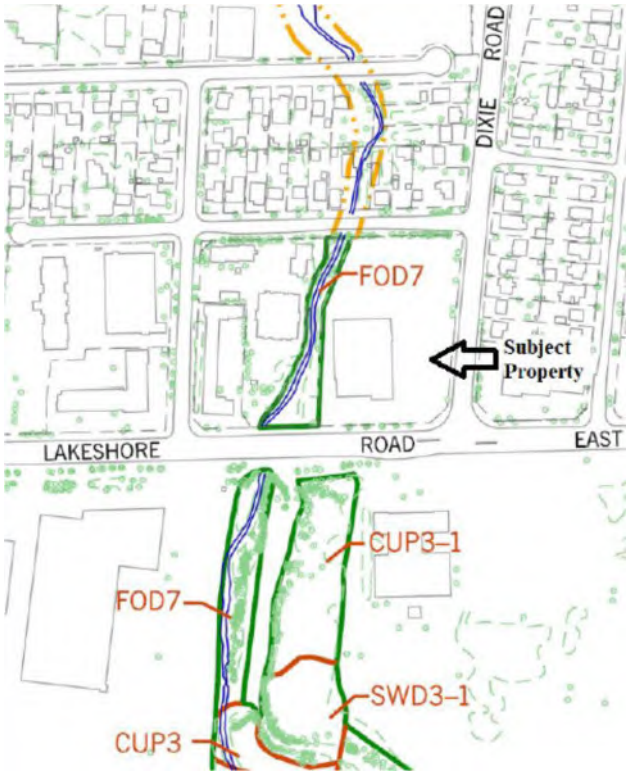


Figure 2-10. Vegetation Community Mapping (adapted from City of Mississauga, 2016)

In the opinion of Aquafor Beech Limited, the vegetation community within the creek corridor between St. James Ave. and Lakeshore Road E. would more accurately be described as a Cultural Woodland (CUW) dominated by

Manitoba maple (*Acer negundo*). Some of the dominant canopy species characteristic of Fresh-Moist Lowland Forest Ecosites (per Lee et al., 1998), such as willow (*Salix sp.*) and green ash (*Fraxinus pennsylvanica*), are present on occasion within the woodland, but are no means dominant. Tree cutting has thinned the canopy and, judging by the presence of spray-painted markings on many trees within the corridor, is likely to continue; further reducing canopy coverage. Furthermore, another deviation from the NAS description above is that within the creek corridor between St. James Avenue and Lakeshore Road East, the ground layer vegetation covers between approximately 25-60%. The relative lack of ground vegetation is likely due to the presence of unauthorized trails near St. James Avenue and the fact that most of the valley walls with the creek corridor consist of gabion baskets (see Figure 2-4). South of Lakeshore Road East, the ground layer vegetation coverage is as described in the NAS.

2.4.2 *Flora*

A botanical inventory was undertaken within the creek corridor between St. James Avenue and Lakeshore Road East on May 1, 2018 using an area search methodology. The area search method was also used to identify the potential for butternut (*Juglans cinerea*) within the aforementioned creek corridor and the subject property.

In total, thirty-five (35) species of vascular plants were identified to the species level, plus an additional two (2) identified to genus due to a lack of unidentifiable diagnostic features at the time of survey. Twelve (12) of the species are native (34%), and twenty-three (23) are introduced (66%). The majority of the species observed in the creek corridor are disturbance-tolerant exotic species. No species-at-risk (SAR) or other species of conservation concern were identified. An annotated list of the vascular plants identified within the study area is contained in Appendix C.

2.5 Tree Inventory

As part of the study for this project, a tree inventory assessment was conducted by Baker Turner Inc. (BTI) ISA Certified Arborist in May 2018. A tree inventory was undertaken within the study area where trees may be affected by proposed channel restoration works. A total of 73 trees (Figure 2-11) were inventoried in the study area along the creek and in any potentially suitable access and staging areas. A total 51 trees are recommended to be removed along the creek corridor with DBH ≥ 11cm (Tree ID 27 to 64 in Table 2-2).

During the surveys, tree location, species, crown diameter, tree health and physical condition were recorded. Each tree equal to or greater than 5 cm diameter at breast height (DBH) with the potential to be impacted was evaluated and given a preservation priority status of low, moderate, or high. Trees with poor health, poor structure, and is currently or potentially able to damage or interfere with existing structures were given low priority status. Trees with moderate previously mentioned qualities were given moderate priority status. Trees exhibiting good health, condition, large size, high quality species, and good growing conditions were given high priority status. Priority status designation was at the discretion of the arborist using the above-mentioned characteristics.

Table 2-2. Inventoried Trees along the study area

Tree No.	Species	dbh (cm)	Measure to Drip Line diameter (m)	Biological Health	Structural Condition	Recommended Action
1	Prunus sp.	10	2	H	H	R**
2	Prunus sp.	11	2	H	H	R**
3	Prunus sp.	11	2	H	H	R**
4	Prunus sp.	9	2	MH	H	R**
5	Prunus so.	5	2	MH	H	R**
6	Gleditsia triacanthos	37	7	MH	H	RC
7	Gleditsia triacanthos	34	7	MH	H	RC
8	Acer neaundo	79	4	H	MH	RC
9	Gleditsia triacanthos	44	11	MH	H	RC
10	Gleditsia triacanthos	24	5	MH	M	RC

11	Gleditsia triacanthos	33	7	MH	H	RC
12	Ulmus pumila	~40,~45	10	M	M	RC
13	Ulmus pumila	~20	6	ML	M	RC
14	Ulmus pumila	34	7	ML	M	R**
15	Ulmus pumila	16	5	ML	M	RC
16	Ulmus pumila	~20, ~30, ~33	12	ML	M	RC
17	Ulmus pumila	24, 19, 26, 30	12	ML	M	R**
18	Ulmus pumila	~35	6	ML	M	R**
19	Ulmus pumila	24	5	ML	ML	R**
20	Ulmus pumila	45	5	ML	L	R
21	Ulmus pumila	30	8	ML	M	R**
22	Ulmus oumila	29	7	M	MH	R**
23	Ulmus pumila	10	4	ML	M	R**
24	Ulmus pumila	13	4	ML	M	RC
25	Acer negundo	10, 14, 24, 19	10	ML	ML	R**
26	Ulmus oumila	10, 10, 10	5	M	M	RC
27	Acer Negundo	~10, ~10, ~10, ~10, ~10, ~10, ~20	8	ML	ML	R**
28	Ulmus pumila	27	8	ML	M	R**
29	Acer negundo	15, 15, 10, 10, 10	6	ML	M	R**
30	Acer negundo	18	7	M	M	P
31	Ulmus americana	26, 27, ~60	15	M	M	P
32	Ulmus pumila	21	6	ML	M	P
33	Populus sp.	12	4	M	M	P
34	Populus sp.	12	4	M	M	P
35	Ulmus pumila	23	7	ML	M	P
36	Ulmus pumila	21	4	L	ML	P
37	Acer negundo	19, 17, 23	8	ML	M	P
38	Ulmus pumila	15	4	L	L	P
39	Ulmus pumila	15, 15, 7	6	ML	M	P
40	Acer negundo	20	6	ML	M	P
41	Acer neaundo	14	5	M	M	P
42	Ulmus americana	30	12	M	ML	P
43	Acer negundo	11, 11	7	ML	ML	P
44	Ulmus americana	40, 43, 44, 55	16	ML	ML	P
45	Ulmus americana	15	5	M	ML	P
46	Acer negundo	15	6	ML	ML	P
47	Acer negundo	18	7	M	ML	P
48	Acer negundo	17	6	ML	M	P
49	Ulmus oumila	26, 28	8	ML	M	P
50	Ulmus pumila	15	4	M	M	P
51	Acer saccharinum	20, 8	7	M	M	P
52	Ulmus pumila	15	5	M	M	P
53	Acer saccharinum	15	6	M	M	P
54	Acer saccharinum	18	6	M	M	P
55	Acer negundo	18	7	M	M	P
56	Ulmus pumila	22	6	M	M	P
57	Acer saccharinum	17	7	M	M	P
58	Acer saccharinum	13	5	L	L	P
59	Acer saccharinum	15	7	L	M	P

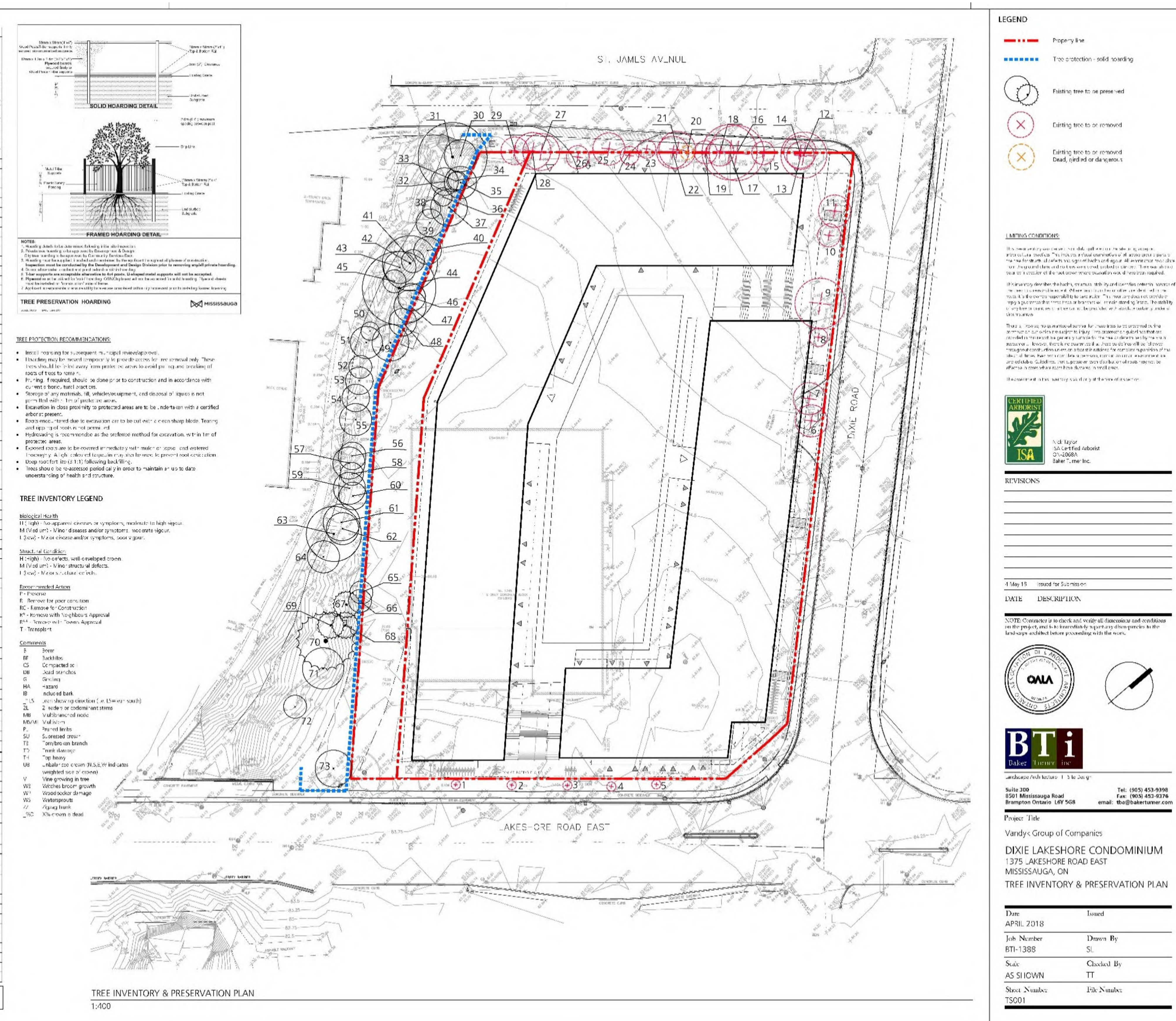
60	Acer saccharinum	19	6	M	M	P
61	Acer negundo	27	8	MH	M	P
62	Acer negundo	18	7	M	ML	P
63	Ulmus americana	24, 33, 25	12	M	M	P
64	Acer negundo	22	7	M	ML	P
65	Rhus typhina	18	5	ML	M	P
66	Rhus tvohina	16	5	ML	M	P
67	Picea glauca	24	6	ML	MH	P
68	Picea glauca	34	6	MH	MH	P
69	Picea glauca	32	6	MH	MH	P
70	Salix sp.	42	13	M	M	P
71	Salix sp.	29, 18	9	ML	ML	P
72	Acer negundo	18	5	M	M	P
73	Acer platanoides	37	8	MH	M	P

TREE INVENTORY LEGEND

Biological Health
H (High) - No apparent diseases or symptoms, moderate to high vigour.
M (Medium) - Minor diseases and/or symptoms, moderate vigour.
L (Low) - Major disease and/or symptoms, poor vigour.

Structural Condition
H (High) - No defects, well-developed crown.
M (Medium) - Minor structural defects.
L (Low) - Major structural defects.

Recommended Action
P - Preserve
R - Remove for poor condition
RC - Remove for Construction
R* - Remove with Neighbours Approval
R** - Remove with Town's Approval
T - Transplant



Tree No.	Species	dbh (cm)	Measure to Drip Line diameter (m)	Biogelogical Health	Structural Condition	Recommended Action	Comments	Location: Municipal Property	Location: Subject Property or Neighbouring Property owned by proponent	Location: Adjacent Property (5m to PL)
1	Prunus sp.	10	2	H	H	R**		X		
2	Prunus sp.	11	2	H	H	R**		X		
3	Prunus sp.	11	2	H	H	R**		X		
4	Prunus sp.	9	2	MH	H	R**		X		
5	Prunus sp.	5	2	MH	H	R**		X		
6	Gleditsia triacanthos	37	7	MH	H	RC	PL, DB(S), BB		X	
7	Gleditsia triacanthos	34	7	MH	H	RC	PL, DB(S), BB		X	
8	Acer negundo	7, 9	4	H	MH	RC	2L, Slight Lean		X	
9	Gleditsia triacanthos	44	11	MH	H	RC	PL, DB(S)		X	
10	Gleditsia triacanthos	24	5	MH	M	RC	DB(S)		X	
11	Gleditsia triacanthos	33	7	MH	H	RC	PL, DB(S)		X	
12	Ulmus pumila	~40, ~45	10	M	M	RC	2L, B, DB(M), BB		X	
13	Ulmus pumila	~20	6	ML	M	RC	DB(S), BB		X	
14	Ulmus pumila	34	7	ML	M	R**	DB(S), DB(S), BB, PL	X		
15	Ulmus pumila	16	5	ML	M	RC	Growing Through Fence, DB(M), BB		X	
16	Ulmus pumila	~20, ~30, ~33	12	ML	M	RC	3L, DB(M), BB, WS		X	
17	Ulmus pumila	24, 19, 26, 30	12	ML	M	R**	4L, DB(M), BB, WS	X		
18	Ulmus pumila	~35	6	ML	M	R**	BB(M), BB	X		
19	Ulmus pumila	24	5	ML	ML	R**	UB(S), 50%TD , 30%B, BB	X		
20	Ulmus pumila	45	5	ML	L	R	TOPPED@2M, WS	X		
21	Ulmus pumila	30	8	ML	M	R**	2L, DB(S), BB	X		
22	Ulmus pumila	29	7	M	MH	R**	DB(S)	X		
23	Ulmus pumila	10	4	ML	M	R**	Growing Through Fence, BB, DB(S)	X		
24	Ulmus pumila	13	4	ML	M	RC	DB(S), BB		X	
25	Acer negundo	10, 14, 24, 19	10	ML	ML	R**	4L, Growing Through Fence, PL, BB, DB(M)	X		
26	Ulmus pumila	10, 10, 10	5	M	M	RC	3L, DB(S)		X	
27	Acer Negundo	~10, ~10, ~10, ~10, ~10, ~10, 20	8	ML	ML	R**	7L, MB, Growing Through Fence, BB, Lean(all)	X		
28	Ulmus pumila	27	8	ML	M	R**	BB, DB(M)	X		
29	Acer negundo	15, 15, 10, 10, 10	6	ML	M	R**	SL, MB, Growing Through Fence, Lean(all)	X		
30	Acer negundo	18	7	M	M	P	Lean 45° NE, DB(S), WS	X		
31	Ulmus americana	26, 27, ~60	15	M	M	P	4L, DB(S)	X		
32	Ulmus pumila	21	6	ML	M	P	BB, DB(M)	X		
33	Populus sp.	12	4	M	M	P	DB(M)	X		
34	Populus sp.	12	4	M	M	P	DB(M)	X		
35	Ulmus pumila	23	7	ML	M	P	UB(E),DB(M),BB	X		
36	Ulmus pumila	21	4	L	ML	P	50%D, WS	X		
37	Acer negundo	19, 17, 23	8	ML	M	P	BB, DB(M), Lean(all), 50%TD	X		
38	Ulmus pumila	15	4	L	L	P	50%D, WS	X		
39	Ulmus pumila	15, 15, 7	6	ML	M	P	3L, DB(M), BB	X		
40	Acer negundo	20	6	ML	M	P	1L Cut, V, BB, UB(E),DB(M)	X		
41	Acer negundo	14	5	M	M	P		X		
42	Ulmus americana	30	12	M	ML	P	Girdled, Lean 30° NE, DB(S), BB	X		
43	Acer negundo	11, 11	7	ML	ML	P	Lean 45° W, 30%D, BB	X		
44	Ulmus americana	40, 43, 44, 55	16	ML	ML	P	4L, Fallen Limb, 1B, HA, BB, DB(M), Lean(all)	X		
45	Ulmus americana	15	5	M	ML	P	Lean 45° SW, BB, DB(M)	X		
46	Acer negundo	15	6	ML	ML	P	UB(E), BB, DB(M)	X		
47	Acer negundo	18	7	M	ML	P	Lean 30° SE, DB(S)	X		
48	Acer negundo	17	6	ML	M	P	Lean 30° SE, DB(S), BB	X		
49	Ulmus pumila	26, 28	8	ML	M	P	2L, DB(M), BB, 1B	X		
50	Ulmus pumila	15	4	M	M	P	WS	X		
51	Acer saccharinum	20, 8	7	M	M	P	2L, Lean 30° S, SU, DB(S)	X		
52	Ulmus pumila	15	5	M	M	P	DB (S), BB	X		
53	Acer saccharinum	15	6	M	M	P	2L, DB(S), BB	X		
54	Acer saccharinum	18	6	M	M	P	WS, DB(S)	X		
55	Acer negundo	18	7	M	M	P	Lean 30° E, V, BB	X		
56	Ulmus pumila	22	6	M	M	P	BB, DB(S)	X		
57	Acer saccharinum	17	7	M	M	P	Lean 30° E	X		
58	Acer saccharinum	13	5	L	L	P	DEAD	X		
59	Acer saccharinum	15	7	L	M	P	Lean 30° NE, DB(S), L	X		
60	Acer saccharinum	19	6	M	M	P	DB(S), BB	X		
61	Acer negundo	27	8	MH	M	P	2L, BB, WS	X		
62	Acer negundo	18	7	M	ML	P	Lean 45° E, BB, DB(S)	X		
63	Ulmus americana	24, 33, 25	12	M	M	P	3L, Lean(all), bb, DB(S)	X		
64	Acer negundo	22	7	M	ML	P	V(pulling down), BB, DB(s)	X		
65	Rhus typhina	18	5	ML	M	P	BB, DB(M), PL	X		
66	Rhus typhina	16	5	ML	M	P	SU, 30%TD, BB, DB(M)	X		
67	Picea glauca	24	6	ML	MH	P	DB(S), PL	X		
68	Picea glauca	34	6	MH	MH	P	DB(S), PL	X		
69	Picea glauca	32	6	MH	MH	P	DB(S), PL	X		
70	Salix sp.	42	13	M	M	P	2L, BB, DB(M)	X		
71	Salix sp.	29, 18	9	ML	ML	P	30%D, BB, WS	X		
72	Acer negundo	18	5	M	M	P	BB, DB(S)	X		
73	Acer platanoides	37	8	MH	M	P	MB	X		

Trees less than 15cmØ caliper, and large shrubs may exist on the site. It is the contractors responsibility to determine the extent of possible removals by field review prior to submission of quotations for removals work.

Figure 2-11. Map of Trees Inventoried within the Study Area

3 DESIGN FACTORS

During the process of creating a detailed design it is imperative that all conditions and constraints for the channel are identified at the onset of the design. This ensures that the conditions and constraints are considered while developing various elements of the design. While several of the constraints and conditions are common to any design project, several are unique to this study area. Constraints and considerations identified within the study area were as follows:

Flood Flows – Hydraulic modeling of the Applewood Creek study extents was performed using the U.S. Army Corps of Engineering HEC-RAS model (version 4.1.0). The model was provided by Credit Valley Conservation and modified by Cole for the purpose of this study. The flow profiles in CVC's baseline model are used for all modelling scenarios.

Shale Bed Materials – The watercourse within the study area is characterized by intermittent shale bedrock exposures and processes of wetting and drying accelerate shale bed degradation. The potential for undermining the proposed bank treatments must consider the long-term process of channel bed incision should the covering material and grade control structures fail. Also, material placed on the shale bed can be prone to movement or sliding downstream.

Disturbance to Terrestrial Vegetation – The creek corridor within the study area is well vegetated and contains many mature trees. Some vegetation may be harmed and/or removed during construction, however, wherever mature trees are required for removal to facilitate construction, new trees consistent with CVC planting guidelines will be replanted at a 3:1 ratio. As a number of potentially suitable maternity roosting trees for endangered bats are located within the study area, considerations will be given to minimize disturbance to those trees.

4 PROPOSED WORKS

The purpose of this study is to address the flooding issues and prepare the flood mitigation measures. The channel restoration work will limit spilling to the adjacent property of the Applewood Creek and proposed channel will convey all flows including the regulatory storm flow.

4.1 Detailed Design

The detailed design involves the following:

1. Excavation and modification of the main channel and easterly bank will be undertaken
    a. Removal of gabion baskets along the channel bed and the east bank. In-channel work bed structure will be rebuilt with deep riffle stone placement of 1 m on the main channel. For constructability, six (6) riffles and six (6) pools are designed (refer to Sheet 2 of design drawings).
    b. The banks and slope will be built as a stable channel morphology that provides underlying engineering to the Natural Channel Design to ensure long-term erosion protection. The slope will be constructed with vegetated buttresses consisting of roundstone layers with the void space filled with smaller roundstone and native soil. The surface of the buttress will be amended with topsoil, planted with 1 L potted shrubs planted at 0.5 m spacing (refer to Table 1, Sheet 3 of design drawings).
2. Removal of trees and riparian vegetation on the easterly bank of the Applewood Creek, and re-vegetated with native shrubs and trees (refer to Sheet 6 of design drawings).

Specific details of the design elements are discussed in the following sub-sections. Reference to specific sheets of the design drawing package that accompanies this detailed design brief report is made in the sub-sections.

4.2 Hydraulic Analysis

The proposed restoration of the river segment of Applewood Creek, which is located between St. James Avenue and Lakeshore Road, would result in an increase in flood storage within the channel, and therefore allow for all Regulatory flows to be conveyed within the riparian corridor and not to spill onto the neighbouring properties.

In order to evaluate the impacts on the Regulatory floodplain elevation caused by the proposed creek restoration, the Existing Conditions HEC-RAS model received from CVC was revised to reflect the proposed channel alterations by updating the related cross sections. The revised, i.e., Proposed Conditions, HEC-RAS model was coded to widen the channel corridor by removing the existing fill material within the channel and the fill the adjacent property to the east of the channel. The placement of additional fill will allow the adjacent property stay outside of the proposed floodplain and be ready for future development. In terms of cut-fill volume, a cut-fill analysis was completed to confirm that the proposed removal of existing fill material and the placement of additional fill would results in a net-zero fill operation for the proposed alterations.

The cross-section geometry updated were the Cross Section 11015 through 11064 based on the proposed channel alterations. The Manning's 'n' values and contraction and expansion coefficients at the updated cross sections were coded accordingly to remain consistent with the values used for the original cross sections in the Existing Condition model. The flows, i.e., increase flows, and other model parameters were kept unchanged. Based on the HEC-RAS modeling exercises, it can be confirmed that the proposed Applewood Creek channel restorations will not have adverse impacts on the adjacent properties upstream or downstream of the site. The proposed earth work results a net-zero filling volume under the proposed floodlines, and hence, riparian storage maintains unchanged, and cause the proposed Regulatory floodline elevation dropped slightly. The new existing Regulatory flows between the channel segments from St. James Avenue to Lakeshore Road will be contained within the riparian corridor and not spilt over the proposed top of bank. To be conservative, the proposed building will be waterproofed as per the Existing Conditions floodline elevation.

The Existing Conditions and Proposed Conditions models were run using the updated 2019 estimated hydrology data obtained from CVC. Table 4-1 below provides a summary of the model outputs for the Regulatory storm for cross sections within the vicinity of the restoration work. The detailed HEC-RAS outputs for the Existing and Proposed Conditions models are provided in Appendix B.

Table 4-1. Water Surface Elevation (WSEL) Comparisons for Applewood Creek Restoration

River Station ID	Existing Regulatory WS Elevation (m)	Proposed Regulatory WS Elevation (m)	Difference (+/- m)
11121	85.32	85.13	-0.19
11085	85.36	85.20	-0.16
11064	85.04	84.05	+0.01
11047	84.37	83.90	-0.47
11015	83.99	83.79	-0.20
10962	82.98	83.01	+0.03
10914	82.46	82.46	0
10874	81.42	81.42	0
10869	81.41	81.41	0
10822	80.96	80.96	0

The results of the HEC-RAS model exercise demonstrate that the WSEL for the Regulatory storm event in proposed conditions is generally lower than existing conditions in the segment of the channel where restoration is proposed. There is a slight increase in the WSEL downstream of the restoration area, however elevations remain unchanged downstream of Lakeshore Road and the resultant impacts are minor.

The above WSEL results were used in AutoCAD Civil 3D to generate the Regulatory floodplain in both existing and proposed conditions. Refer to Drawing FP-1, found in Appendix B for the floodplain delineation. As illustrated in Drawing FP-1, the proposed floodplain is now contained within the riparian corridor and will not spill over the proposed top of bank located along the future development site to the east.

4.3 Channel Form

An approximately 1 m wide low flow channel, matching the existing creek bottom, will be created with an approximately 4.4:1 side slope for the Eastside Creek Bank from the creek bottom to the floodline elevation at each cross section. The Westside Creek Bank will primarily maintain the existing slope. A 6 m buffer with approximately 10% slope will be created and match the existing ground for the Eastside of Creek Bank. The Westside of Creek Bank will be kept primarily unchanged.

The grades on the proposed riffles are between 3.3% and 4%. Riffles with higher slopes under existing conditions may be located on shale bedrock. The proposed riffles will be constructed of angular stone (for fish habitat). Steeper slopes result in higher velocities and shear stresses which would necessitate larger stone. As such, the proposed channel has riffle grades within the lower range of the grades. Under proposed conditions, riffle lengths are between 6.3m and 10.7m. Additionally, the total length of riffles is 50.7m under proposed conditions. In designing the proposed pools, residual depths are designed with the depths of 0.3m. Total of six pools are proposed as specified in Sheet 3 of the detailed design drawings.

4.4 Stone Sizing for Riffles

Results from the hydraulic model were used to determine an appropriate substrate gradation for the proposed channel bed along the riffles. The intent of the angular stone is to provide a stable riffle base which will limit channel degradation, and use vegetation incorporated into the stone mixture on the banks to reduce lateral erosion. Channel shear values were taken from the proposed HEC model, and shear stress values under 2-year and regional events are used to size D_{50} and D_{84} of the gradation respectively. The size of D_{50} and D_{84} are calculated based on the following formula:

$$D = \frac{\tau}{Kg(\rho_s - \rho)}$$

where τ is the bead shear stress (N/m^2), K is the Shields parameter, g is the gravitational acceleration (m/s^2), ρ_s is the density of the sediment, and ρ is the density of water.

Table 4-2 summarizes the recommended stone sizing for the channel bed. The smaller material has been specified to fill the voids between the larger material and to contribute to fish habitat. Larger particles, keystones, are included to provide stabilization of the overall riffle structures, particularly at the riffle toe and crest under all potential flood flow conditions, including the regional and range of return period events.

Table 4-2. Proposed Stone Sizing for Stream Bed

Stone Sizing		Percent Composition
(mm)	(in)	
0-75	0.5-3	10
75-200	3-7	20
200-300 (D_{50})	7-12	25
300-500	12-19	25
500-700 (D_{84})	>19	20

4.5 Vegetated Bank Treatments

Vegetated rock buttresses are proposed on the easterly bank of the channel. The use of the treatments is dependent upon the creek corridor width. Where the corridor width is greater, vegetated rock buttresses are proposed to allow for integration of more vegetation in the channel design. Vegetated rock buttresses are proposed on the channel from approximately 0+000 m to 0+100 m (from start to the tie in existing grade control structure). The vegetated

rock buttress will be composed of layers of roundstone with the void space filled with smaller roundstone and native soil. The surface will be amended with topsoil, planted with native shrubs (potted stock), and Terraseeded with a native seed mix. A detailed drawing for the vegetated rock buttress is shown on Sheet 8 of the detailed design drawings.

4.6 Vegetation Restoration

In order for the proposed restoration to be implemented, disturbance to the easterly vegetation will occur. In an effort to minimize the disturbance, sediment and erosion control fencing will be erected at the onset of the construction and will be used to delineate the extents of machinery access and minimize creep into surrounding areas.

All disturbed areas will be restored following completion of construction. The planting plan meets City of Mississauga requirements. The planting plan also meets CVC's requirement for replacements at 3:1 for mature trees. A total of 51 trees are being removed and a total of 153 trees are being planted. Shrubs have been specified at a ratio of 5:1 (shrubs planted:trees planted). A total of 255 shrubs have been specified for the riparian and forest areas. All disturbed areas along the banks and floodplain will be Terraseeded with herbaceous seed mix of native species. The details of the restoration plan are outlined in Sheet 6 of the detailed design drawings.

Overall, the restoration plan provides an ecological benefit to aquatic and terrestrial habitats. Once established, shrubs and trees along the bank will provide over-hanging vegetation which will shade the creek and help maintain cooler water temperatures. Over-hanging vegetation also provides secondary inputs, such as insects and leaf litter, which contribute to aquatic habitat. Rooting masses of established plants will help to stabilize the bank and reduce sediment release. The use of native vegetation provides habitat for wildlife (e.g. food sources for birds) and will increase the vegetation diversity in the creek corridor.

4.7 Tie-In Locations

At the upstream end of the study area, works will be tied into existing channel at 0+000 (elevation of 82.26 m). At the downstream end of the study area, the works will tie into existing grade control structure at 0+100 m (elevation of 81.15 m). Details of the tie ins are shown on Sheet 3 (plan and profile) of the detailed design drawings.

5 DESIGN EXPECTATIONS AND IMPLENTATION RECOMMENDATIONS

5.1 Permits

Prior to construction it will be necessary to coordinate environmental approvals and permits necessary to complete the intended works. At this time, it is Aquafor's understanding that approvals from CVC, MNRF, and DFO may be required. A brief summary of permits and approvals is included below:

CVC – O. Reg. 166/06 Permit - This typically involves detailed design submission and will include supporting design brief information.

DFO – Assessment under the Federal Fisheries Act
Aquafor's certified fisheries biologist will complete a Self-Assessment based on the detailed design for the proposed works. Based on similar experiences, at minimum a Letter of Advice may will be required from DFO.

MNRF 17(2) (b / c) Species at Risk Permit – Depending on the results of the IGF and further field investigations, MNRF will confirm whether a SAR permit will be required.

Approvals may be also required from the Region of Peel and other utilities for working adjacent to their infrastructure.

5.2 Construction Services

Aquafor will provide inspection and resident services during construction under the guidance of a professional engineer who has been integrated in the design and well versed in similar construction projects. Tasks undertaken as part of the supervision role will include:

- Attend regular (bi-weekly) progress meetings, including pre-construction meeting, prepare and distribute meeting minutes within 3 days of the meeting;
- Respond to inquiries and request for information from external agencies, public stakeholders;
- Preparation of progress payment certificates and recording material quantities as they arrive to site;
- Overseeing the day-to-day construction and providing interpretation of the drawings;
- Ensuring that contractor's methodology complies with requirements of design;
- Monitor the traffic control measures to ensure they are consistent with traffic control plans;
- Inspect all layout and construction work to ensure compliance with the contract specifications and drawings;
- Provide advice to the contractor regarding the interpretation of the contract drawings and specifications and the preparation of supplemental details, instruction and clarifications as required;
- Notify the contractor of any deficiencies in the construction of the work, instructing the contractor to take appropriate corrective measures, confirm and report results of the corrective measures during construction. The deficiency list will be maintained and coordination of rectification throughout the 2-year maintenance period;
- Review, monitor and ensure compliance with contractor environmental conditions (i.e. E&SC Plan).
- Preparation and issuance of substantial Performance certificate and recommendations; and
- Undertake a complete and thorough inspection of the contractor's work and prepare a report which lists all outstanding deficiencies at the end of the warranty period and coordinate and ensure that contractor corrects all warranty deficiencies expeditiously and to the satisfaction of the City.

5.3 Monitoring Program

A 2-year annual monitoring plan is recommended following implementation, which will include Warranty Period engineering review, as well as assessment of the efficacy of restoration plantings. The program should include time for inspection of both the channel works and vegetation plantings by the project geomorphologist / engineer, as well as arborist. Both the monitoring and warrantee will be defined to suit the detailed design, and satisfy City, Conservation, and other agency requirements.

5.4 As-Constructed Drawings and Analysis

This task will set baseline conditions following construction, which will enable future monitoring and comparative analysis. Specifically, Aquafor will undertake an as-built survey of completed channel works (plan, profile, and cross sections) to verify implementation of design within reasonable tolerances. As-constructed drawings, together with a report summarizing pre- and post-construction conditions would be provided. The report would comment on significant deficiencies found with recommendations for correction or adaptive management as required.

Should CVC or the City wish the HEC model be updated to match as-built conditions (should the comparative analysis to the design highlight differential conditions), Aquafor will update the HEC model accordingly to confirm no negative impacts to flooding.

Appendix A – Slope Stability Study from Toronto Inspection Limited

TorontoInspection LTD.
GEO-ENVIRONMENTAL CONSULTANTS

110 KONRAD CRESCENT,
UNIT 16
MARKHAM, ONTARIO
L3R 9X2
TEL.: 905-940-8509
FAX : 905-940-8192

August 13, 2019
Project No.: 4738-17-G-VAN-A

Vandyk Group Of Companies
1944 Fowler Drive
Mississauga, Ontario
L5K 0A1

Attention : Mr. Justin Mamone

Re: Addendum To Slope Stability Study
1345 Lakeshore Road East, Mississauga, Ontario

Further to our Slope Stability Study Report, Project No.: 4738-17-G-VAN-A, dated May 11, 2018, ***Toronto Inspection Ltd.*** was authorised to carry out an additional slope stability analysis of the slope resulting at the site following the proposed cut and fill operation within the floodplain. The following drawings were provided by the client for reference:

- Figure No.: FP-2, Cut Fill Balance, prepared by Cole Engineering, dated January 2019,
- Drawing Nos. GP, General Plan - Proposed and Drawing No. XS, Cross Sections, prepared by Aquafor Beech Limited, dated April 17 and 18, 2019.

The Cut Fill Balance drawing, prepared by Cole Engineering, indicates that the proposed cut and fill operation will be limited to the northwest portion of the site. The regrading, following the cut and fill operation, will result in shifting of the existing Regulatory Floodline from CVC due west, almost parallel to the Applewood Creek. The new proposed regulatory floodline will be approximately 10m east of the west property line of the Site. The associated proposed Regulatory Flood elevations at the proposed Cross Sections 11064, 11047 and 11015 are at 84.28m, 84.00m and 84.00m(83.90m), respectively.

Drawing Nos. GP, General Plan – Proposed, shows the locations of the sections XS-1(11064), XS-2(11047) and XS-3(11015). Drawing No. XS, Cross Sections, shows their cross sections within the area proposed to be regraded. The sections indicate that the regrading will result in almost flat areas approximately 5m from the proposed centre line of the creek, rising gradually at slopes of 5.0H:1V, 4.6H:1V to 3.5H:1V, to the edges of the proposed 6m erosion access allowance.

In addition, to mitigate the failure due to the rapid draw-down, a reinforced earth structure installed at the proposed top of slope is also considered in the analysis.

4.0 SLOPE STABILITY STUDY

A computerised slope stability analysis was carried out on the proposed slope profile close to the location of BH-1, based on the, Drawing No. XS, Cross Sections, prepared by Aquafor Beech Limited, dated April 17, 2019.

We have assumed that the proposed mid rise building will be a free standing structure. The loads from the proposed building were, therefore, not considered in the stability analysis.

The subsoil data from BH-1, located close to the top of slope, was used to evaluate the soil parameters for slope stability analysis in computerised Simplified Bishop method. The soil parameters for slope analysis are as follows:

SLOPE SECTION	SOIL TYPE	UNIT WEIGHT γ (kN/m^3)	SHEAR STRENGTH PARAMETERS	
			c' (kPa)	φ'
Cross Sections: XS-1(11064), XS-2(11047), XS-3(11015), through BH-1	Fill	18	0	28º
	Sandy Silt	20.5	0	35º
	Clayey Silt	21	5	30º
	Weathered Shale	22.5	10	38º
	Building / Reinforced Earth Structure	24	0	50º

Two separate analyses were carried out at each of the proposed Cross Sections XS-1(11064), XS-2(11047) and XS-3(11015).

- The groundwater in the fist analysis (Figure Nos. 11(XS-1), 21(XS-2) and 31(XS-3)) was considered in the sandy silt deposit at an elevation of 82.27m, as documented at BH-1 location. The perimeter wall of the underground parking garage of the proposed building will have a permanent perimeter drainage system, which will result in lowering of the water around the building.
- The groundwater in the second analysis (Figure Nos. 12(XS-1), 22(XS-2) and 32(XS-3)) was considered in the fill at the new proposed Regulatory Flood elevations of 84.28m, 84.00m and 84.00m(83.90m), as shown at the proposed Cross Sections XS-1(11064), XS-2(11047) and XS-3(11015), respectively.

The results of the additional slope stability analyses indicated that:

Groundwater Table at Elevation of 82.27m

The analyses carried out at the proposed Cross Sections indicate that the minimum factor of safety of a slip failure, with groundwater at an elevation of 82.27m, is more than 1.5, with F=2.28, 2.37 and 1.89 at Figure Nos. 11(XS-1), 21(XS-2) and 31(XS-3), respectively.

Rapid Draw-down Following Flooding

Slope failure normally occurred more frequently after a rapid draw-down following a flooding period, where the soil is saturated. The analyses indicate that the failure plane, with the minimum factor of safety of F=1.5 at proposed Cross Sections XS-1(11064), XS-2(11047) and XS-3(11015), intersects the tableland at distances of approximately 3.8m, 3.5m and 1.2m east of the proposed new top of slope, closer to the proposed building, as Figure Nos. 12(XS-1), 22(XS-2) and 32(XS-3), respectively.

A third analysis was carried out at each of the proposed Cross Sections XS-1(11064), XS-2(11047) and XS-3(11015), which included a reinforced earth retaining wall, installed at the proposed top of slope, to mitigate the slope failure due to the rapid draw-down following a flooding period. The bottom of the reinforced earth retaining wall was below the bottom of the slip failure surface due to the rapid draw-down.

Rapid Draw-down Following Flooding with Reinforced Earth Retaining Wall

The analyses indicate that the failure plane, with the factor of safety of $F \geq 1.47$ at proposed Cross Sections XS-1(11064), XS-2(11047) and XS-3(11015), does not intersect the tableland, as Figure Nos. 13(XS-1), 23(XS-2) and 33(XS-3), respectively.

Comments and Conclusion

The results of the additional slope stability analyses indicated that the proposed slopes, following regrading, will have adequate factor of safety against failures ($F \geq 1.5$).

Taking into account the worst case scenario, rapid draw-down following a flood season, the long term stable top of slope, with a minimum factor of safety of F=1.5, will intersect the new tableland at distances of 3.8m, 3.5m and 1.2m at Sections XS-1(11064), XS-2(11047) and XS-3(11015)(Figure Nos. 12(XS-1), 22(XS-2) and 32(XS-3).

However, rapid draw-down following a flood season under the installation of a reinforced earth retaining wall at the proposed top of slope, the long term stable top of slope, with a minimum factor of safety of F=1.47, will be at the proposed top of slope at Sections XS-1(11064), XS-2(11047) and XS-3(11015)(Figure Nos. 13(XS-1), 23(XS-2) and 33(XS-3).

It is our opinion that the revised regrading option, cutting back the slope and shifting the top of slope approximately 10m into the current tableland, including the installation of a reinforced earth retaining wall at the proposed top of slope, have adequate setback allowance for the proposed development of the site.

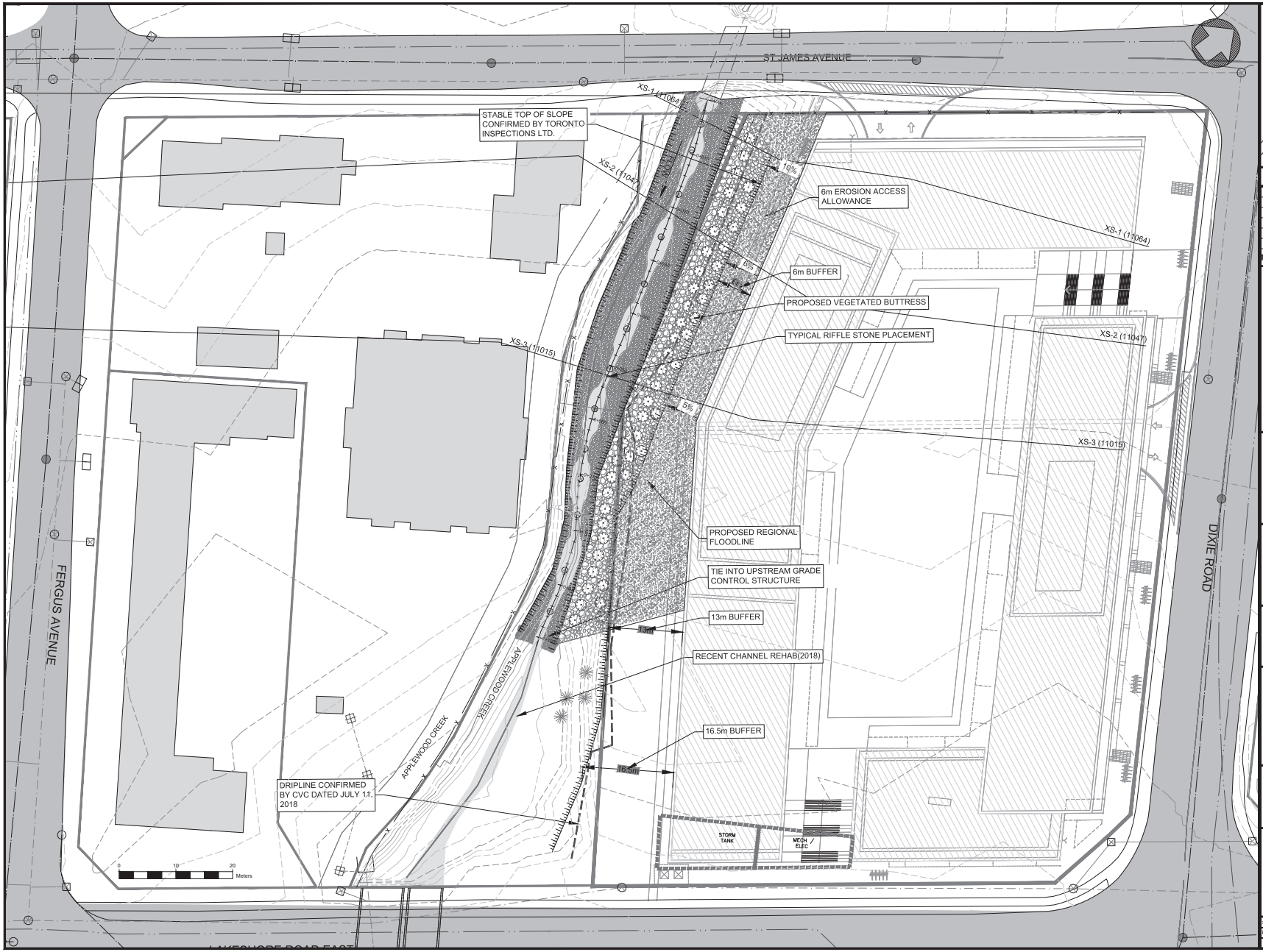
We understand that the proposed slopes will be vegetated. This will further enhance the stability of the slopes during the dry season and prevent surface erosion during the wet seasons.

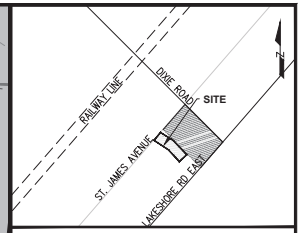
Should you have any questions regarding the information provided, please contact this office.

Yours very sincerely,
TORONTO INSPECTION LTD.

David S. Wang, P. Eng.
Senior Engineer

Upkar S. Sappal, P. Eng.
Principal Engineer





Key Map - NTS

No.	REVISION	By	DATE
1	ISSUED FOR CVC REVIEW	R.A.	2018-04-18

LEGEND

- CROSS - SECTION # / LOCATION SHEET #
- PROPERTY/ BULDING LINE
- EXISTING TOP OF SLOPE
- CHANNEL CHAINAGE
- EXISTING FENCE
- STORM SEWER
- SANITARY SEWER
- WATERMAIN
- EXISTING CONTOUR
- LOW FLOW
- STORM MANHOLE
- SANITARY MANHOLE
- DOUBLE CATCH BASIN
- EXISTING GABION

THE POSITION OF THE POLE LINES, CONDUITS, WATERMAINS, SEWERS, AND OTHER UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED.

BEFORE STARTING WORK

THE CONTRACTOR SHALL CONFIRM THE POSITION AND EXACT LOCATION OF ALL SUCH UTILITIES, AND SHALL ASSUME ALL LIABILITY FOR ANY DAMAGE TO THEM MADE DURING THE COURSE OF THE CONTRACT WORK.

JOB TITLE

DIXIE AND LAKESHORE

VANDYK GROUP OF COMPANIES

MISSISSAUGA, ONTARIO

SHEET TITLE

General Plan - Proposed

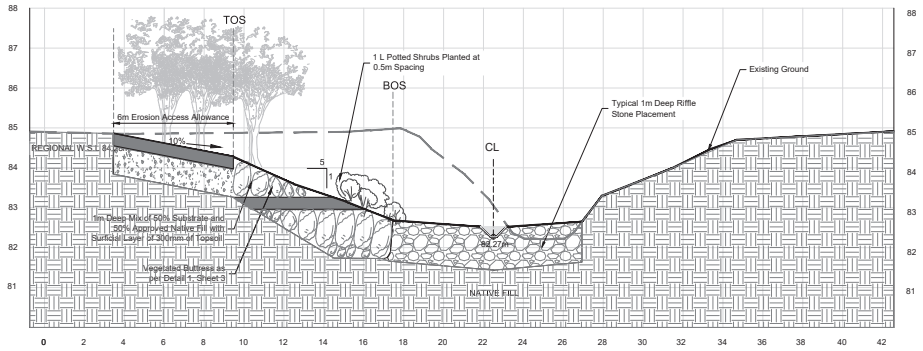
DESIGNED BY:	APPROVED BY:

MISSISSAUGA

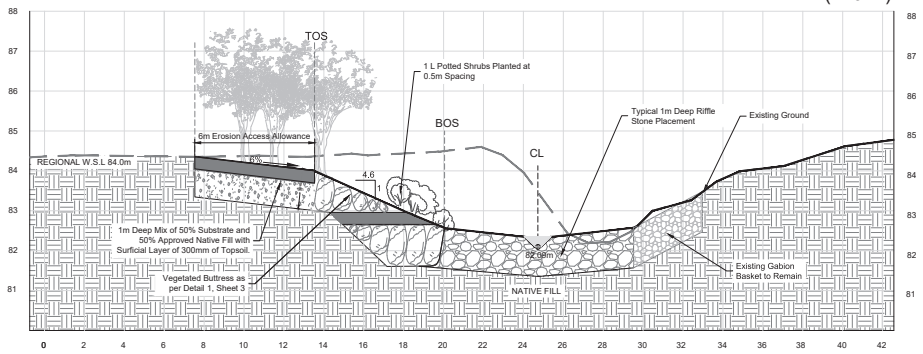
Aquafor Beech Limited
#4-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099, FAX: (905) 629-0089

SCALE: 1:300	REVIEWED BY:	CONTRACT No.
DRAWN BY: S.G.	DESIGNED BY: R.A.	DWG. No. GP
DATE: 18 April, 2019	SHEET No. 1 OF 6	

XS-1 (11064)



XS-2 (11047)



XS-3 (11015)

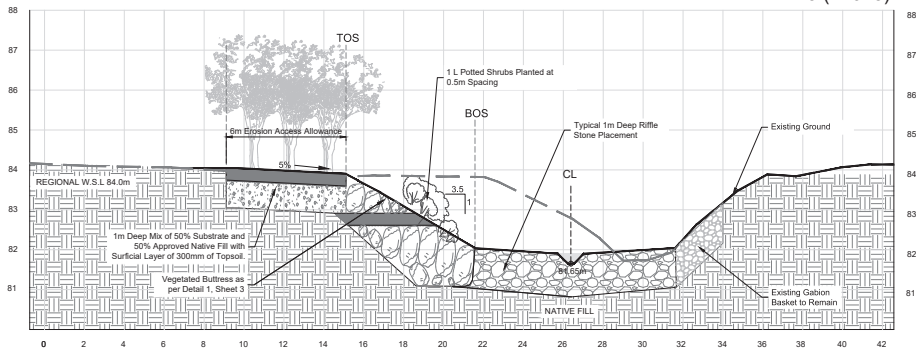
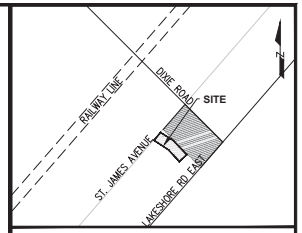


TABLE 1 - POTTED SHRUBS FOR VEGETATED BUTTRESS

Species		Amount
Scientific Name	Common Name	
Cornus stolonifera	Red-osier Dogwood	135
Cornus racemosa	Gray Dogwood	135
Salix exigua	Sandbar Willow	130
Salix discolor	Pussy Willow	130

NOTE:

- 1 L POTTED SHRUBS PLANTED AT 0.5M SPACING



Key Map - NTS

No.	REVISION	By	DATE
1	ISSUED FOR CVC REVIEW	R.A.	2018-04-18

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JOB TITLE

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MISSISSAUGA, ONTARIO

SHEET TITLE

CROSS SECTIONS

DESIGNED BY:	APPROVED BY:

MISSISSAUGA

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SCALE: 1:300	REVIEWED BY:	CONTRACT No.	
DRAWN BY: S.G.	DESIGNED BY: R.A.	DWG. No.	XS
DATE: 18 April, 2019	SHEET No. 3 OF 6		

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.20m
File Name: 4738 - 1345 Lakeshore Rd E-XS-1(11064).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg	24.0	0	40º

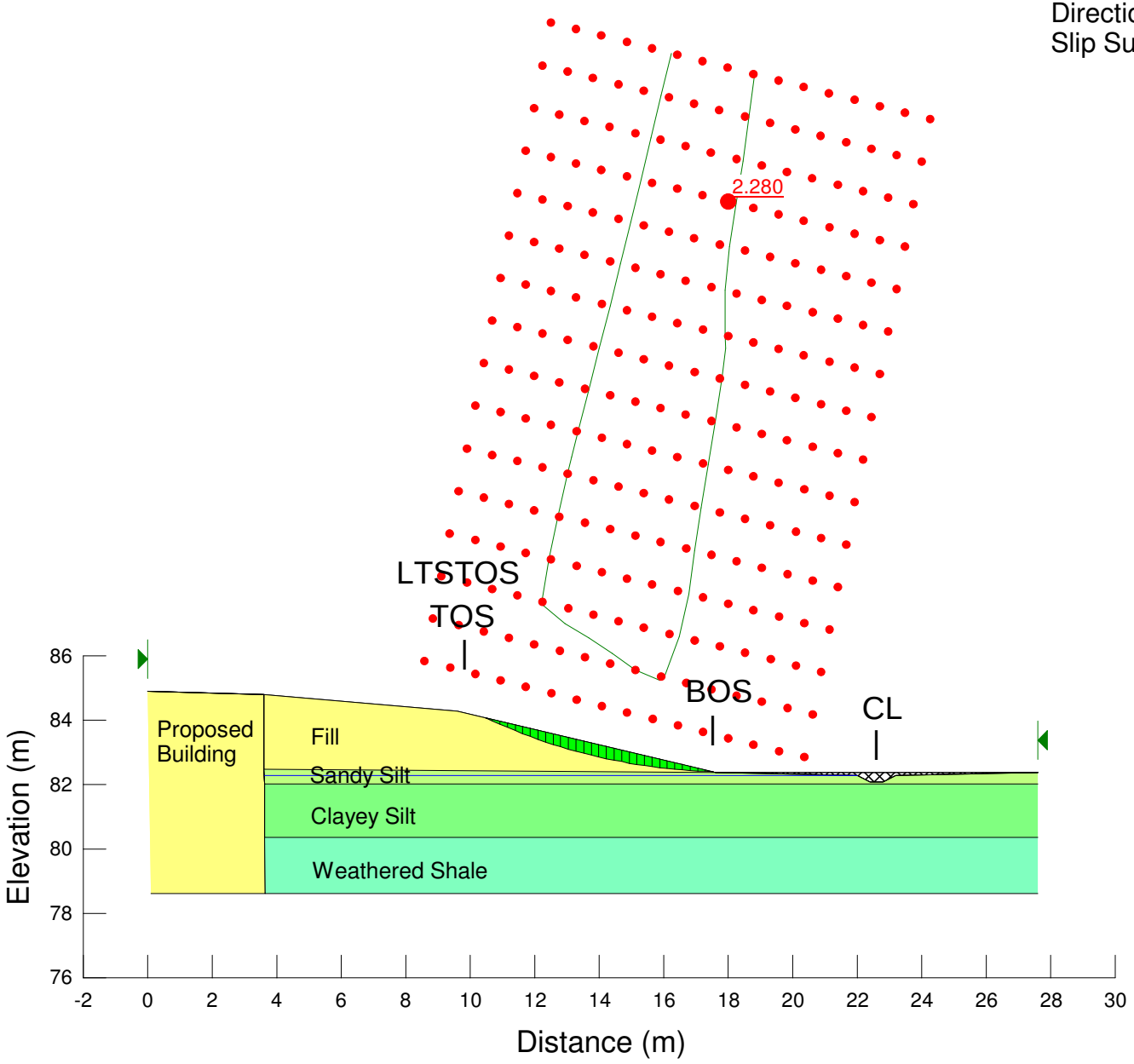


Figure No. 11 (XS-1)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.20m
File Name: 4738 - 1345 Lakeshore Rd E-XS-1(11064).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg	24.0	0	40º

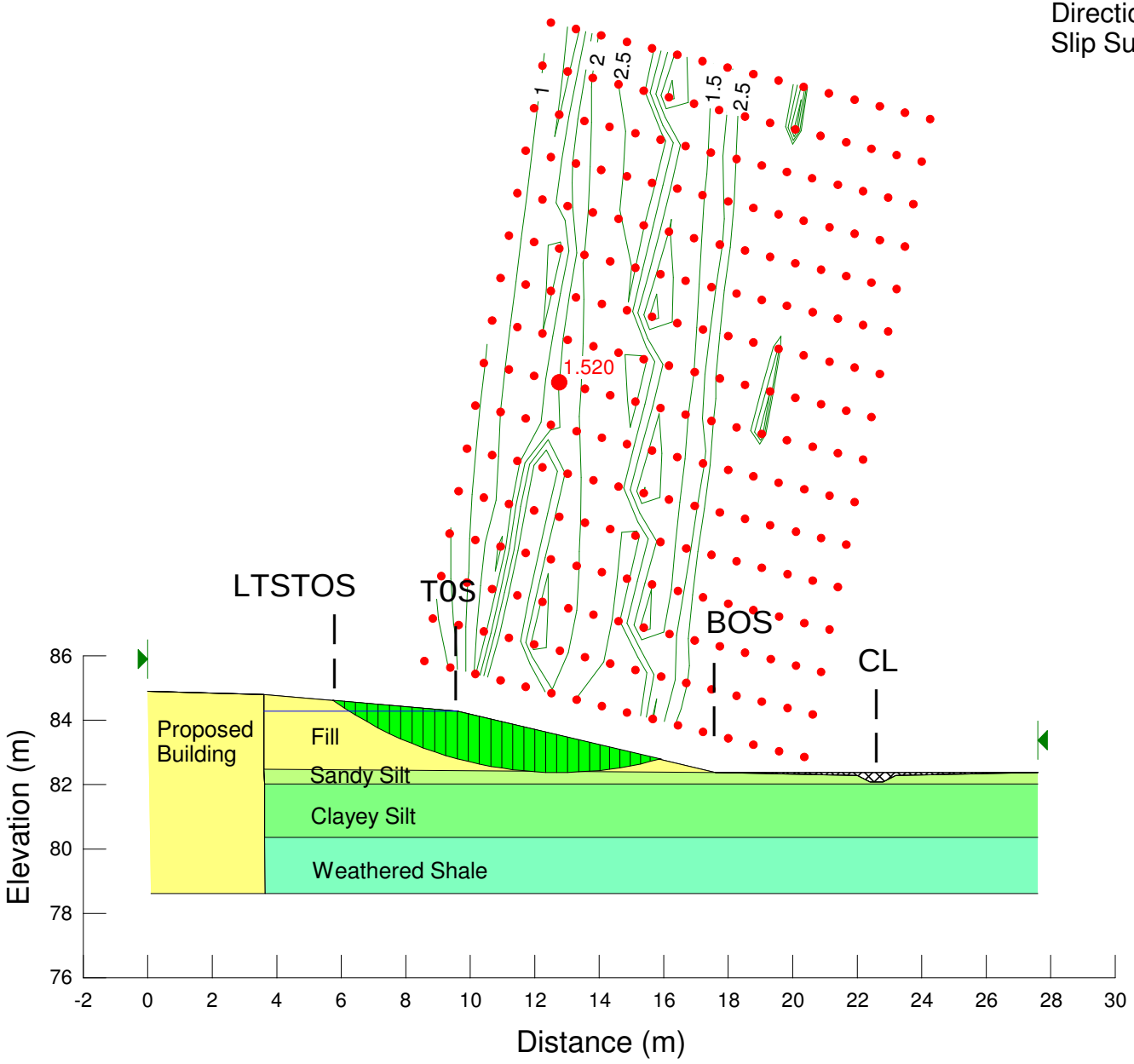


Figure No. 12 (XS-1)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.28m
File Name: 4738 - 1345 Lakeshore Rd E-XS-1(11064).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg Rein. Earth	24.0	0	50º

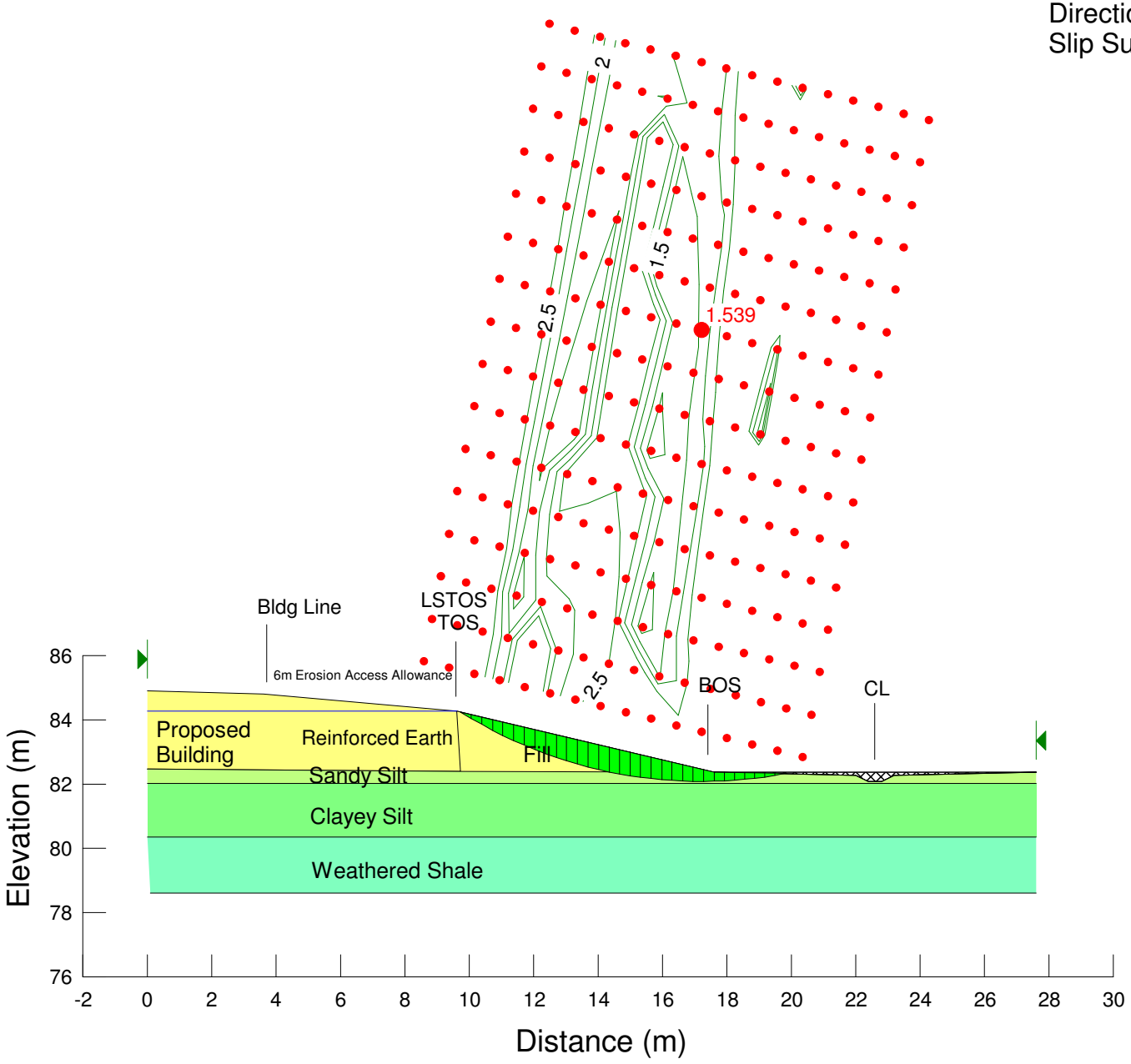


Figure No. 13 (XS-1)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.20m
File Name: 4738 - 1345 Lakeshore Rd E-XS-2(11047).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg	24.0	0	40º

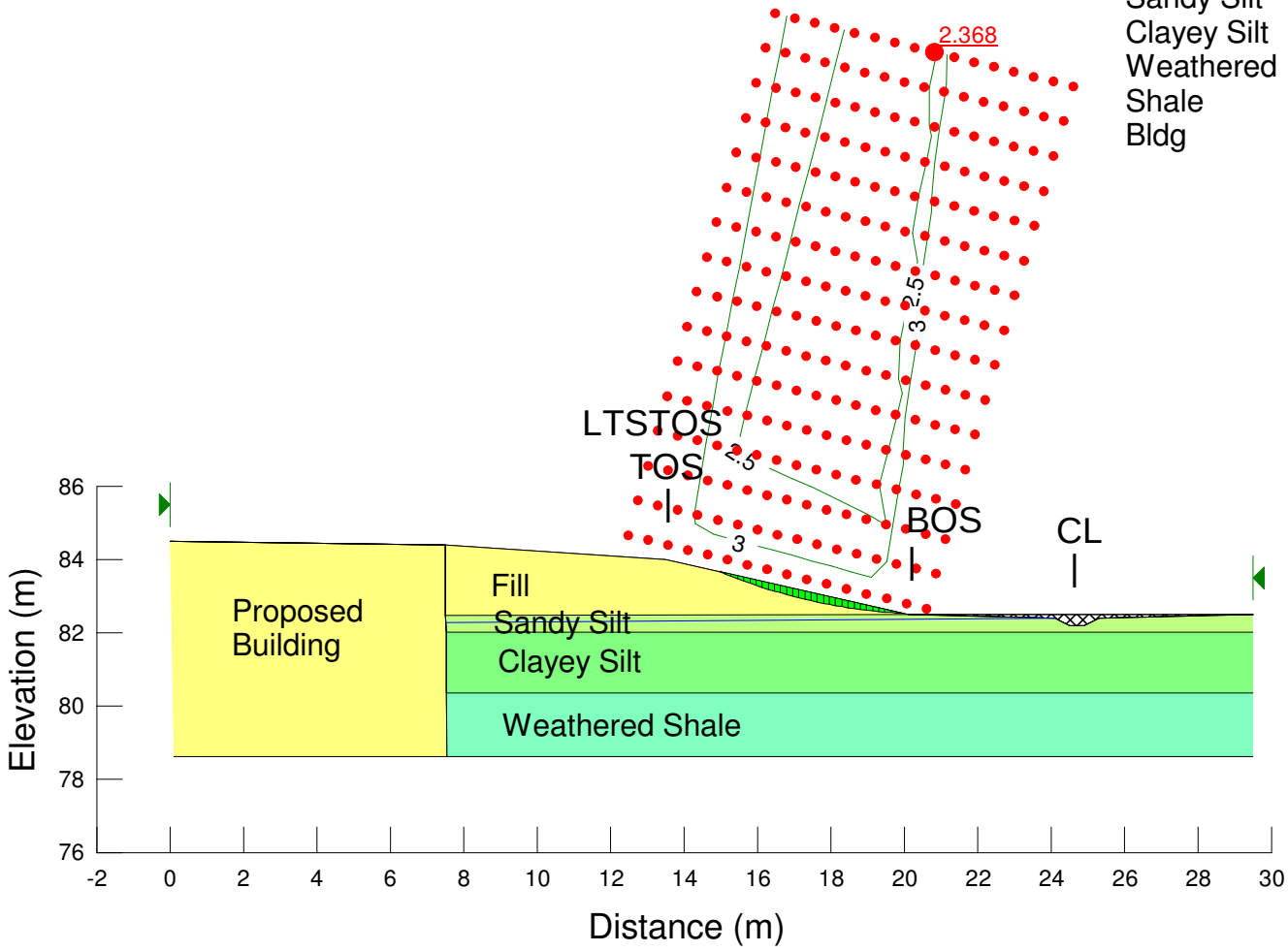


Figure No. 21 (XS-2)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.20m
File Name: 4738 - 1345 Lakeshore Rd E-XS-2(11047).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg	24.0	0	40º

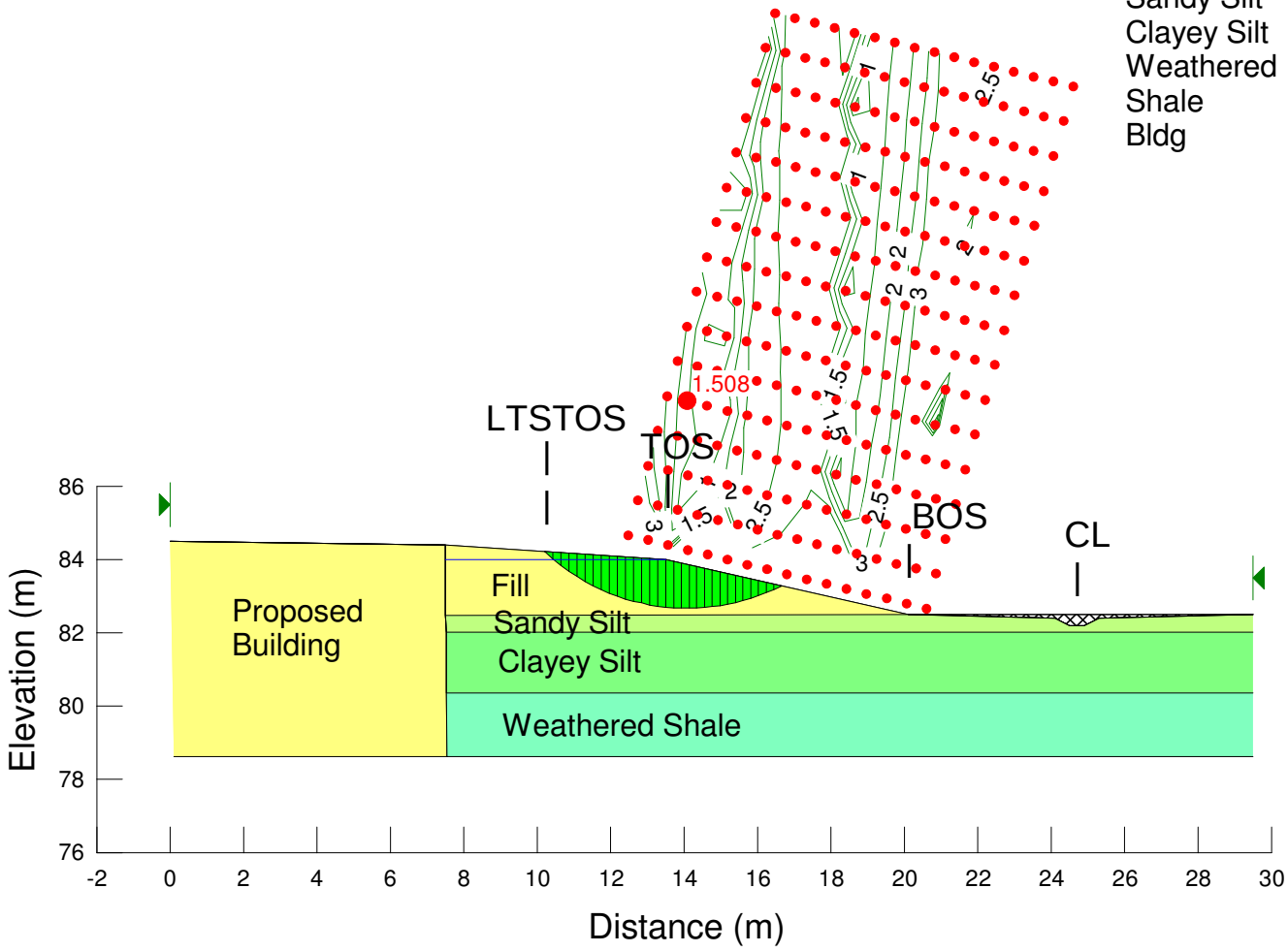


Figure No. 22 (XS-2)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.00m
File Name: 4738 - 1345 Lakeshore Rd E-XS-2(11047).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg Rein. Earth	24.0	0	50º

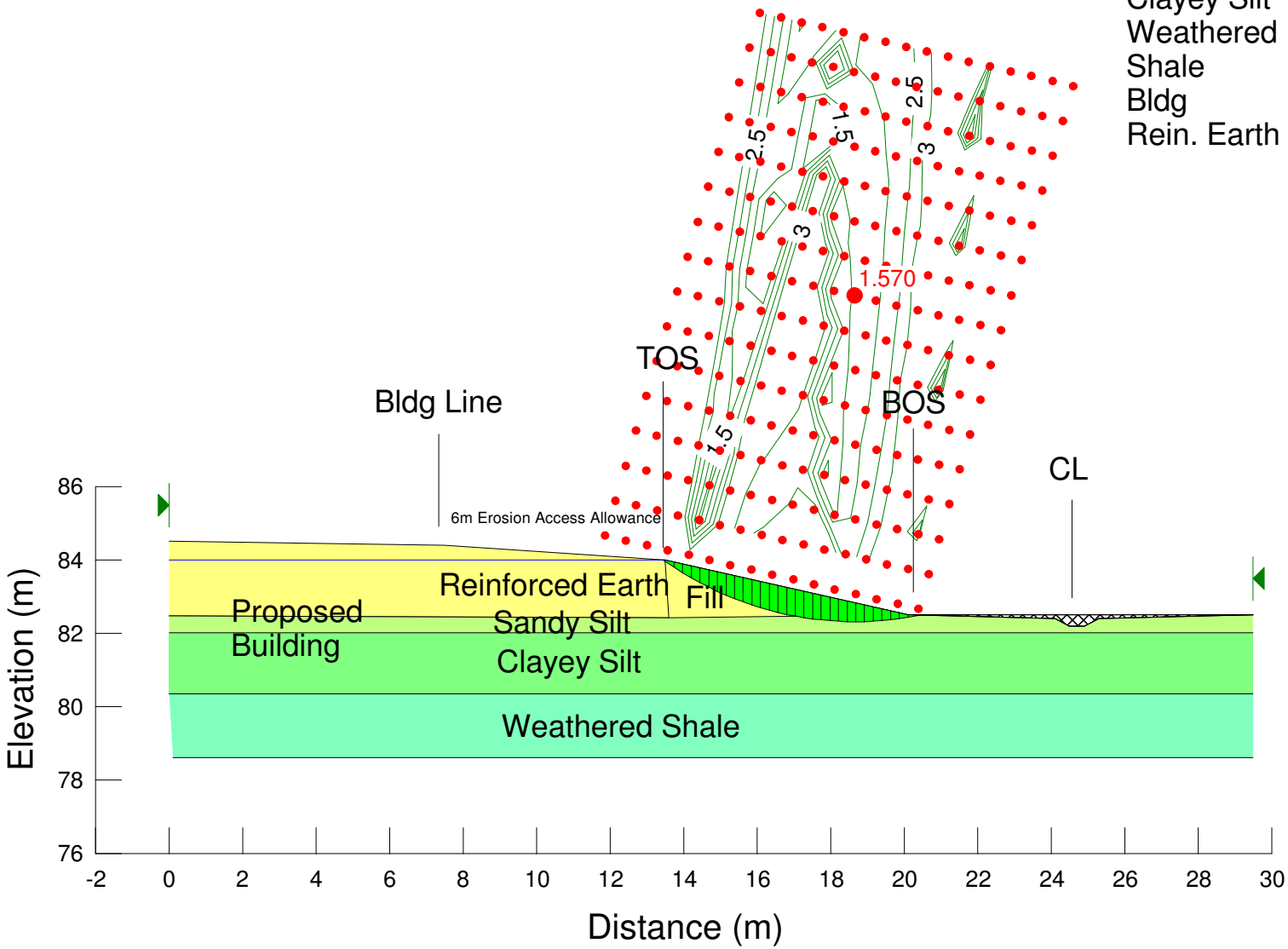


Figure No. 23 (XS-2)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.20m
File Name: 4738 - 1345 Lakeshore Rd E-XS-3(11015).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg	24.0	0	40º

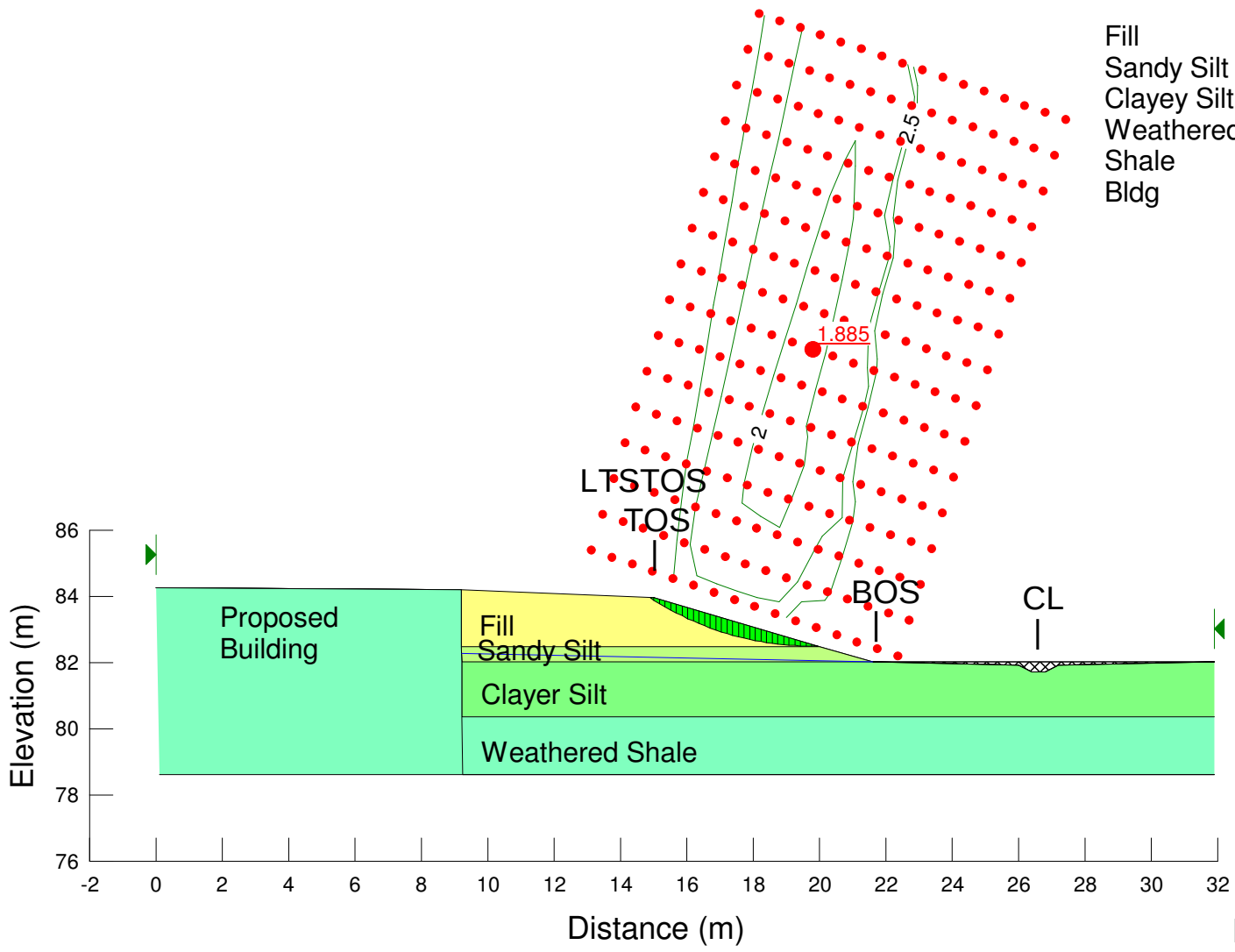


Figure No. 31 (XS-3)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.20m
File Name: 4738 - 1345 Lakeshore Rd E-XS-3(11015).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg	24.0	0	40º

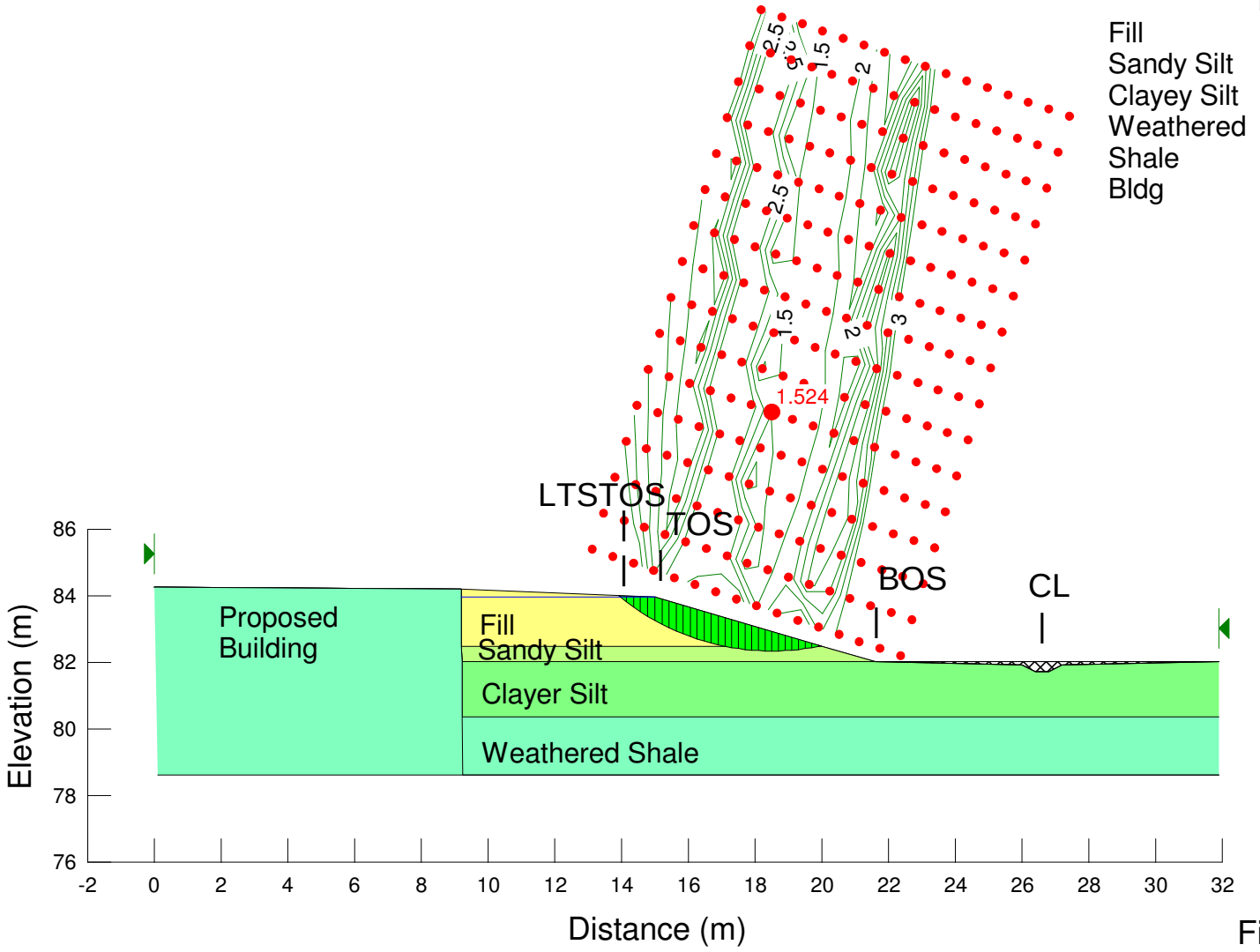


Figure No. 32 (XS-3)

Description: Slope Stability Study 4738-17-G-VAN-A
Comments: Regional WSE 84.00m
File Name: 4738 - 1345 Lakeshore Rd E-XS-3(11015).slp
Analysis Method: Bishop
Direction of Slip Movement: Left to Right
Slip Surface Option: Grid and Radius

	r (kN/m3)	C' (kPa)	Angle of Int. Friction
Fill	18.0	0	28º
Sandy Silt	20.5	0	35º
Clayey Silt	21.0	5	30º
Weathered Shale	22.5	10	38º
Bldg Rein. Earth	24.0	0	50º

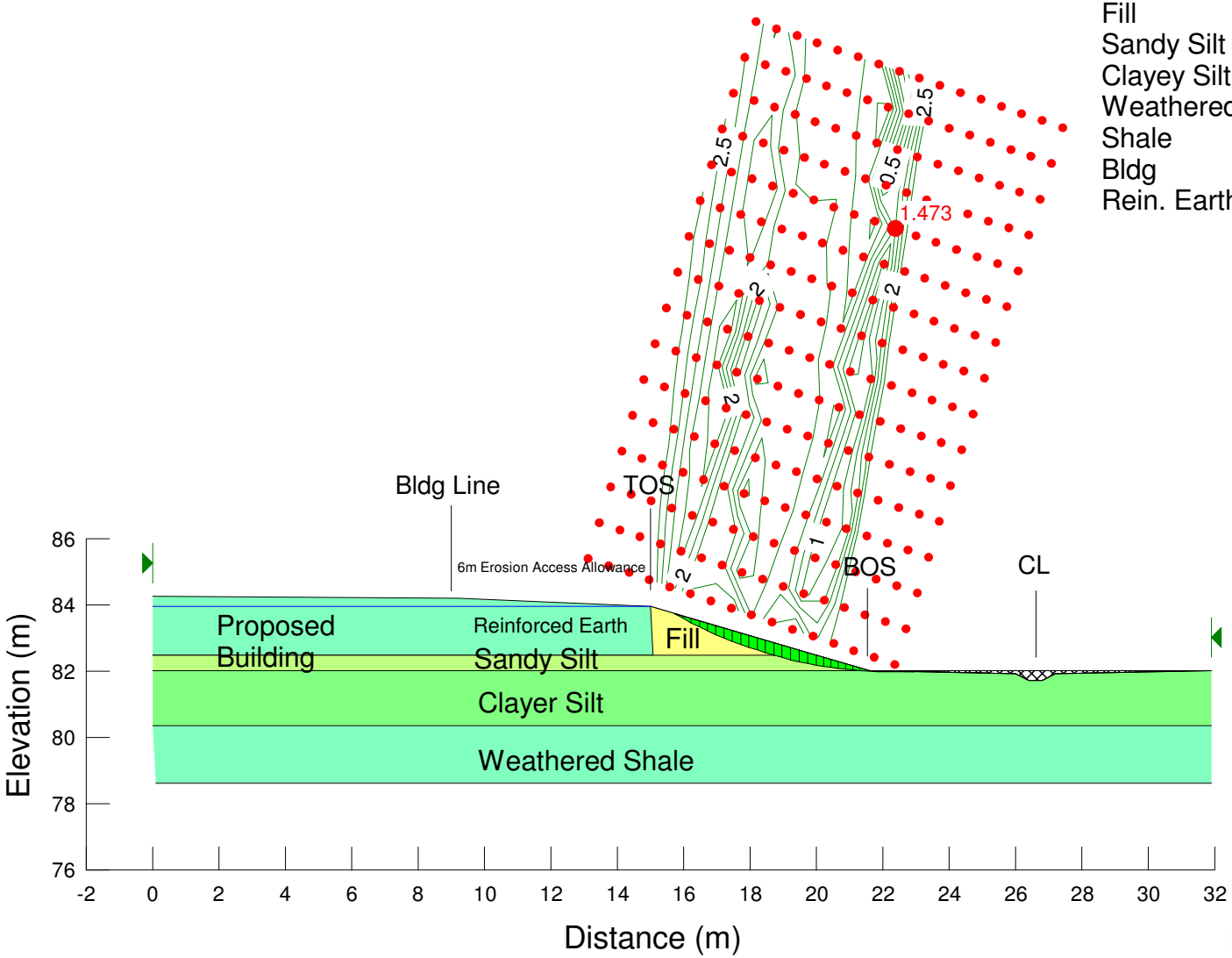
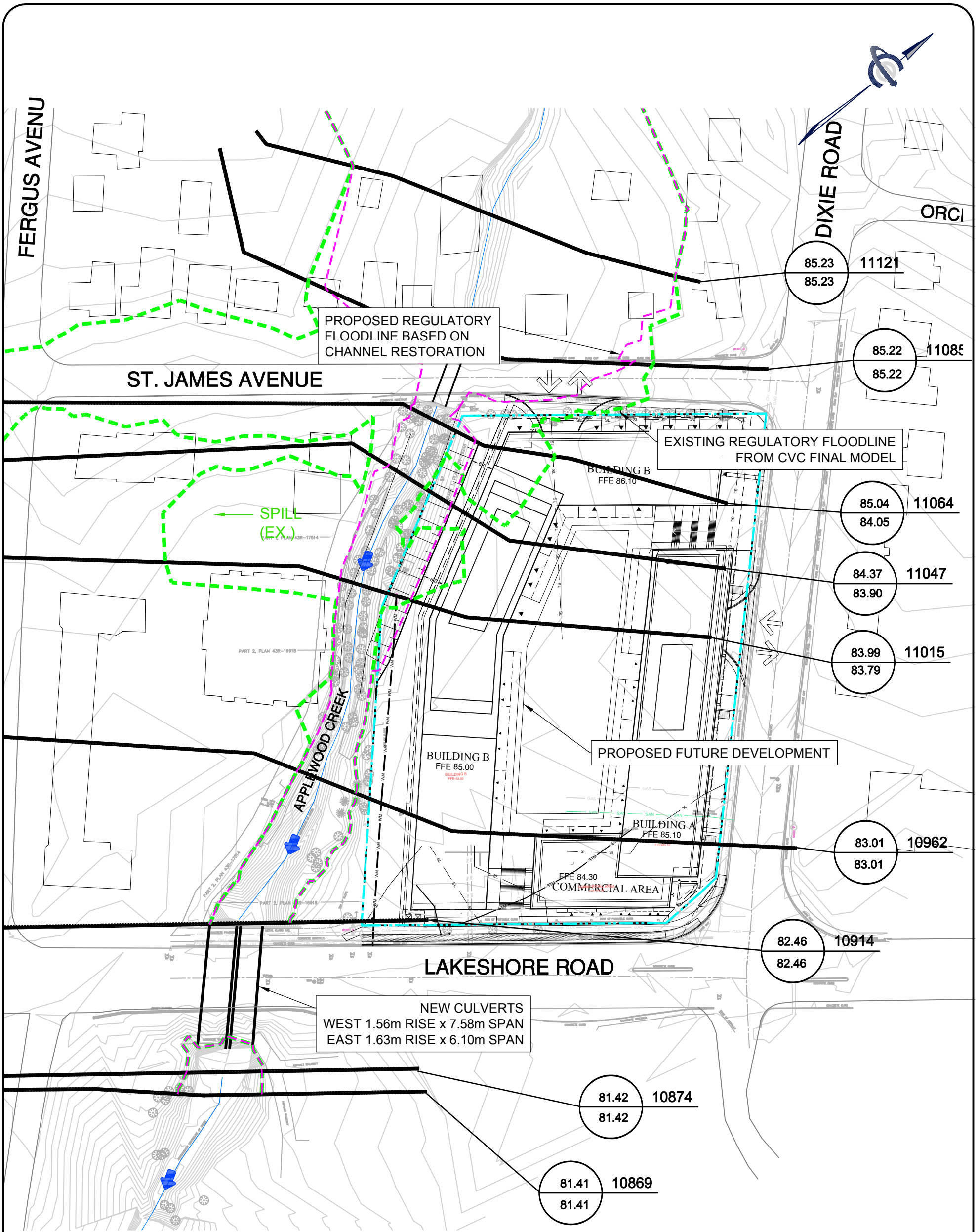


Figure No. 33 (XS-3)

Appendix B – Hydraulic Model Summary from Cole Engineering



LEGEND

BASELINE REGULATORY FLOODLINE BASED ON 2019 FINAL CVC MODEL (REGIONAL STORM IS REGULATORY STORM)

PROPOSED REGULATORY FLOODLINE BASED ON GRADING FOR CUT FILL BALANCE

COLE ENGINEERING
70 Valleywood Drive, Markham, ON Canada L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

PROPERTY BOUNDARY
CROSS-SECTION
FLOW DIRECTION
PROPOSED GRADES (+84.397)

BASELINE REGULATORY WSEL (FINAL MODEL) 81.53 / 81.53 10869 (CROSS-SECTION ID#)

PROPOSED REGULATORY WSEL (FINAL MODEL)

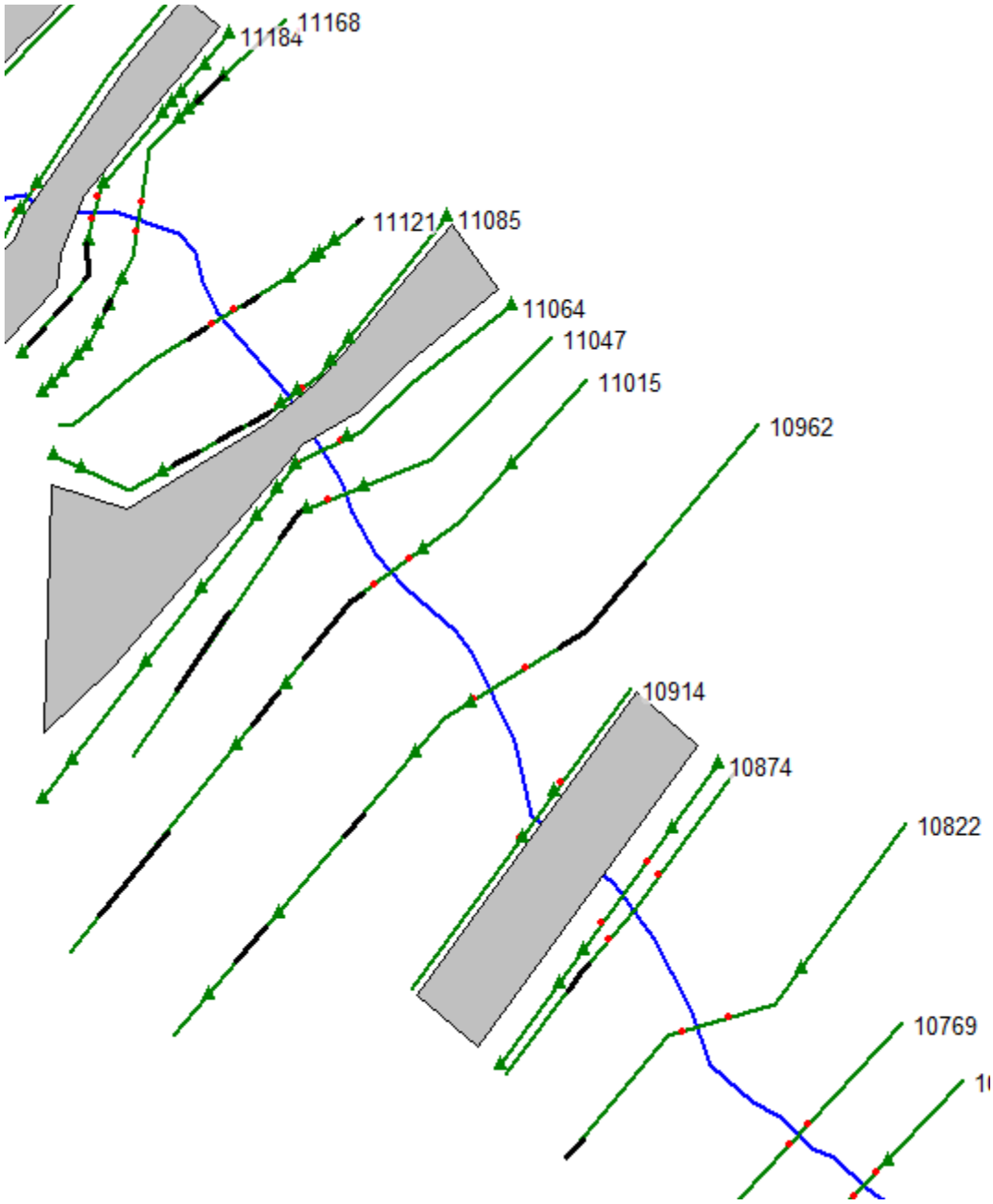
PROPOSED REGULATORY FLOODPLAIN MAPPING

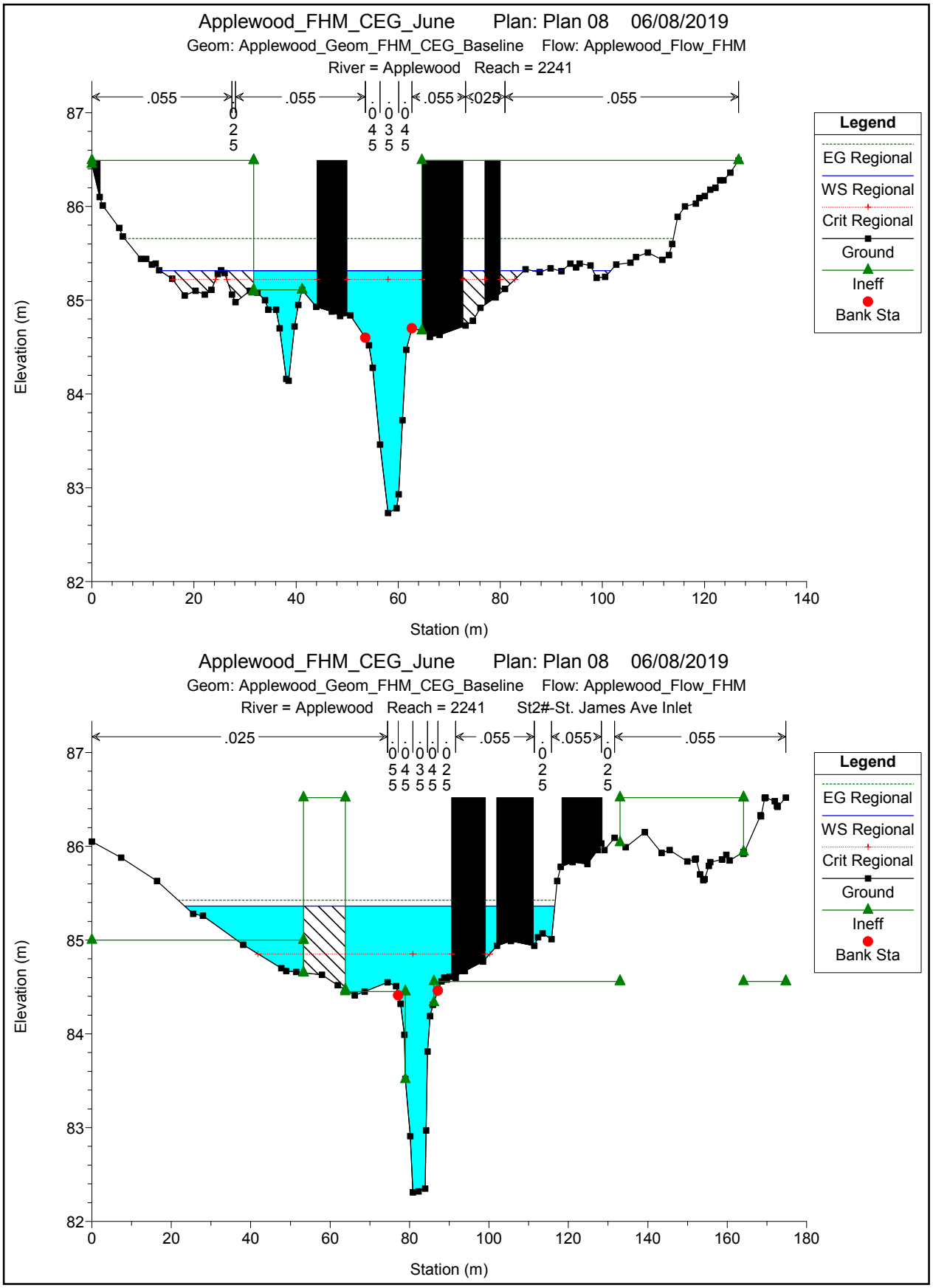
ST. JAMES AVE. AND LAKESHORE RD.
CHANNEL RESTORATION
CITY OF MISSISSAUGA REGIONAL MUNICIPALITY OF PEEL

DATE:	JUNE 2019	PROJECT No.:	2018-0023
SCALE:	1:1000	FIGURE No.:	FP-1

P:\MRK\2018\2018-0023\500_CAD\30_SHT\01_CIV\C_SGR\FIGURES\FLOODPLAIN FIGURES\2018_0023-FLOODPLAIN MAPPING JUNE 2019.DWG

Applewood Creek – St. James Avenue to Lakeshore Road
Existing Conditions Schematic
April, 2019




Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
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Legend
EG Regional
WS Regional
Crit Regional
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St2#-St. James Ave Inlet
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Crit Regional
Ground
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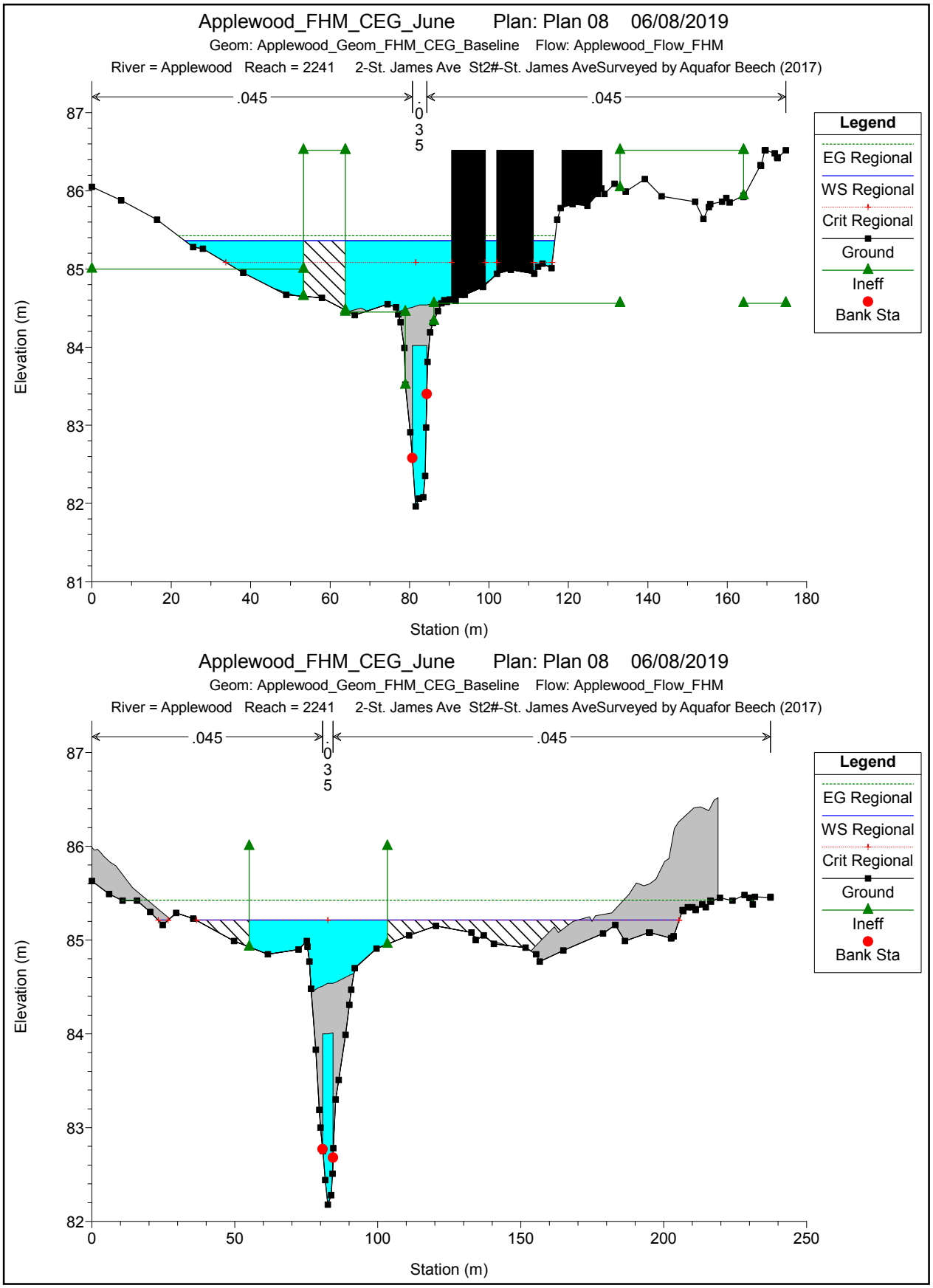
Elevation (m)
Station (m)


Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 2-St. James Ave St2#-St. James AveSurveyed by Aquafor Beech (2017)
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Elevation (m)
Station (m)
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Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 2-St. James Ave St2#-St. James AveSurveyed by Aquafor Beech (2017)
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Crit Regional
Ground
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Elevation (m)
Station (m)
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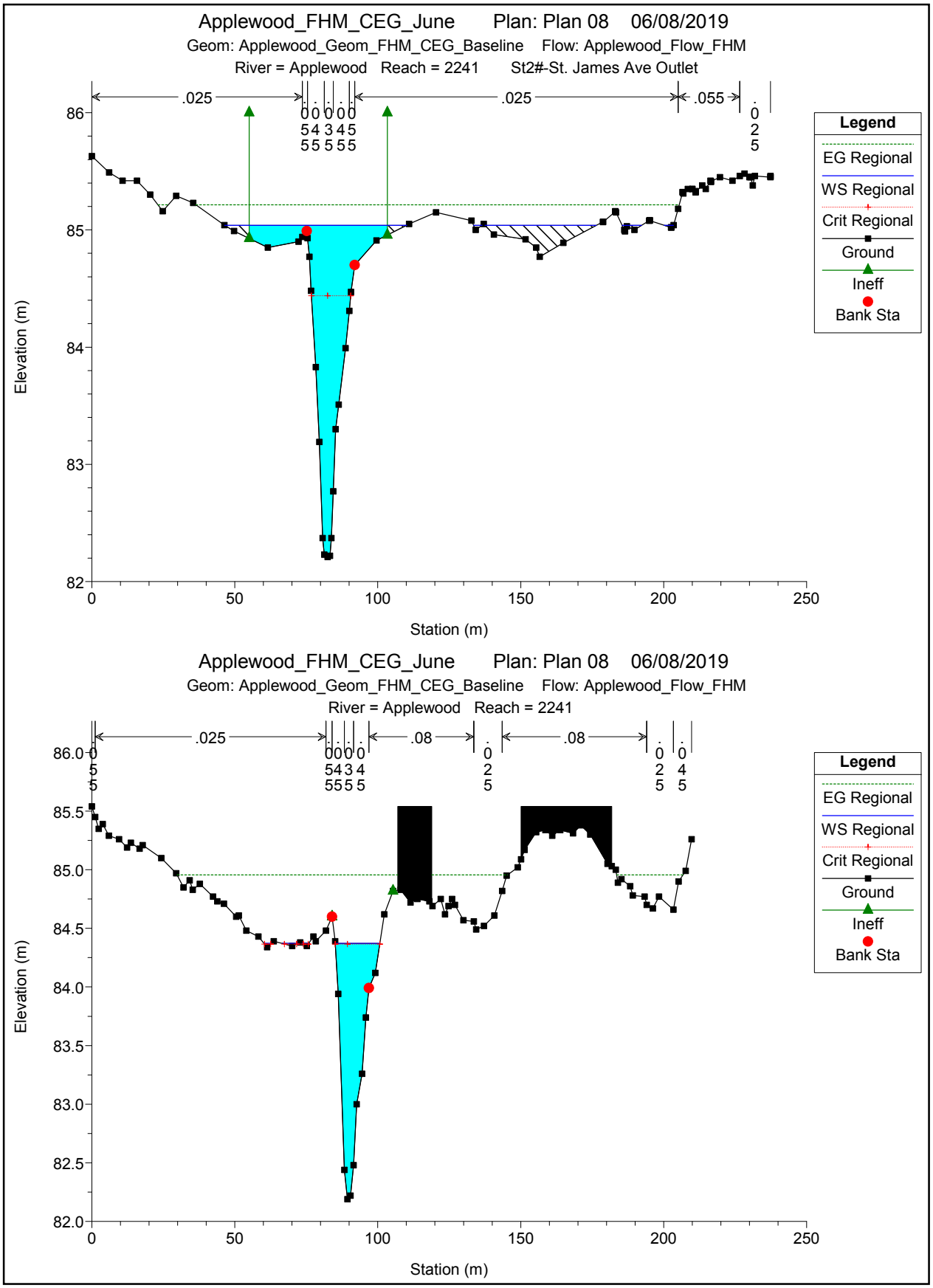
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St2#-St. James Ave Outlet
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Elevation (m)
Station (m)
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
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Crit Regional
Ground
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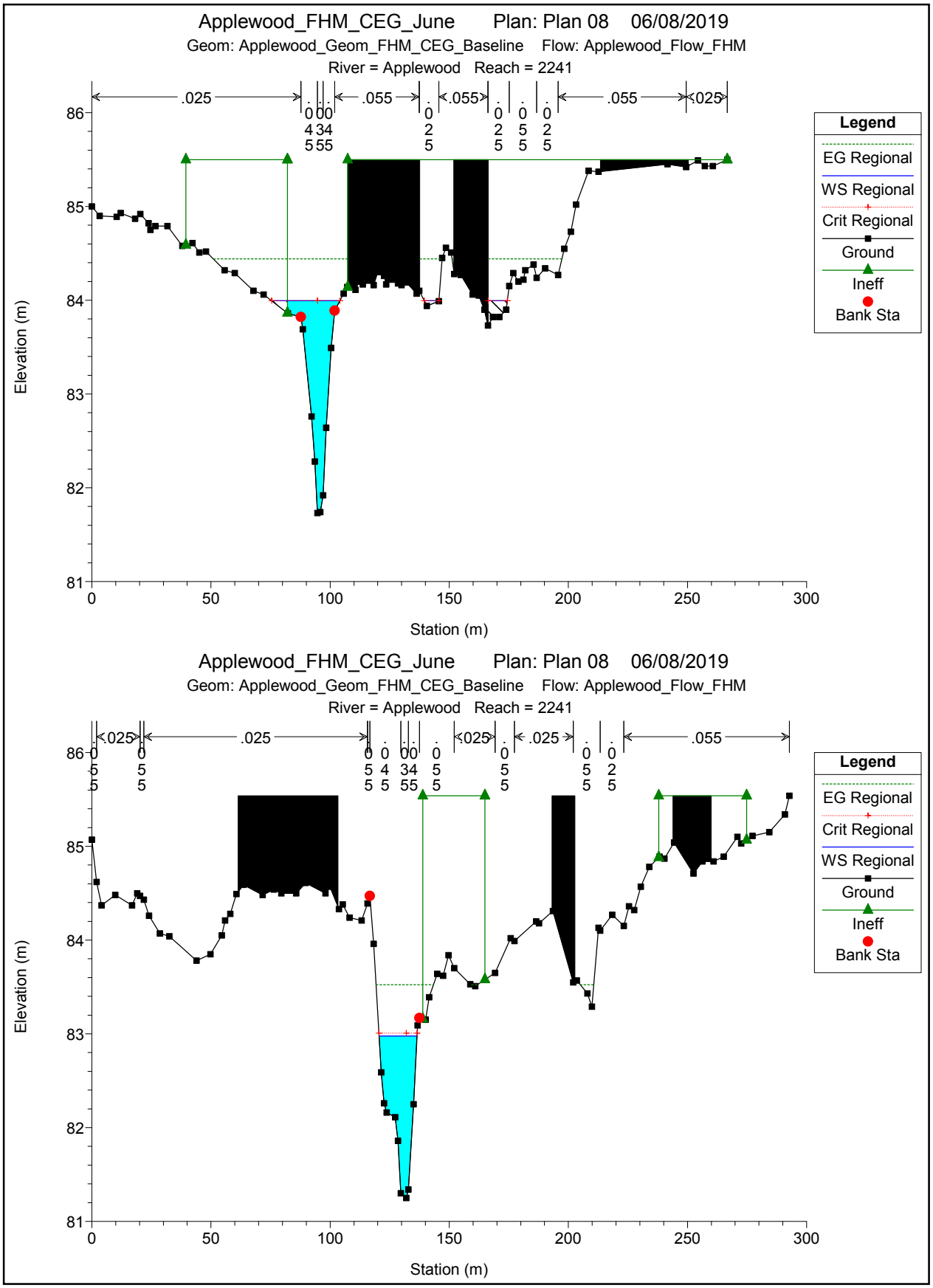
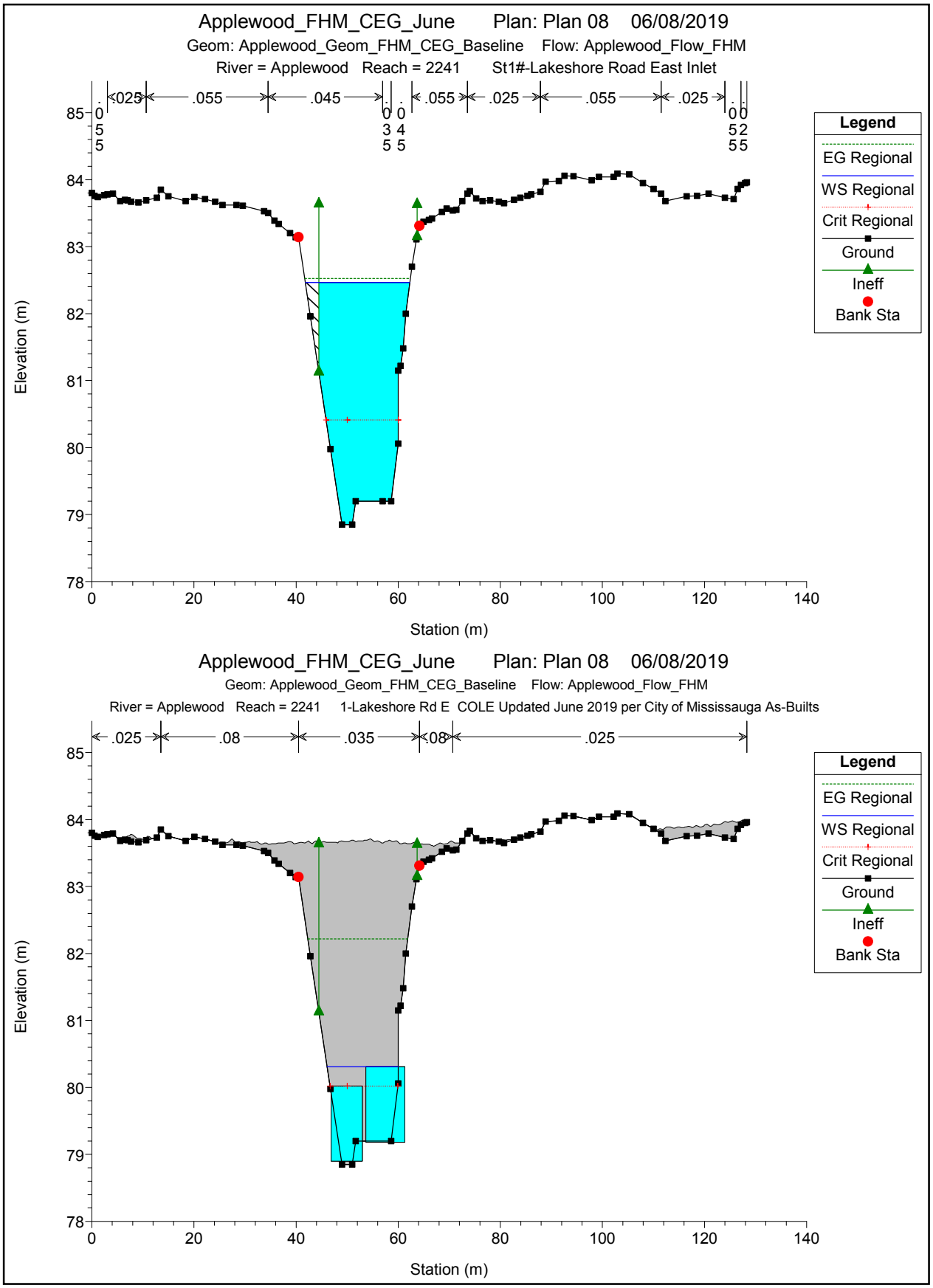
Elevation (m)
Station (m)


Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
Elevation (m)
Station (m)
Legend
EG Regional
WS Regional
Crit Regional
Ground
Ineff
Bank Sta
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
Elevation (m)
Station (m)
Legend
EG Regional
Crit Regional
WS Regional
Ground
Ineff
Bank Sta


Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St1#-Lakeshore Road East Inlet
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Crit Regional
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Elevation (m)
Station (m)
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 1-Lakeshore Rd E COLE Updated June 2019 per City of Mississauga As-Builts
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Crit Regional
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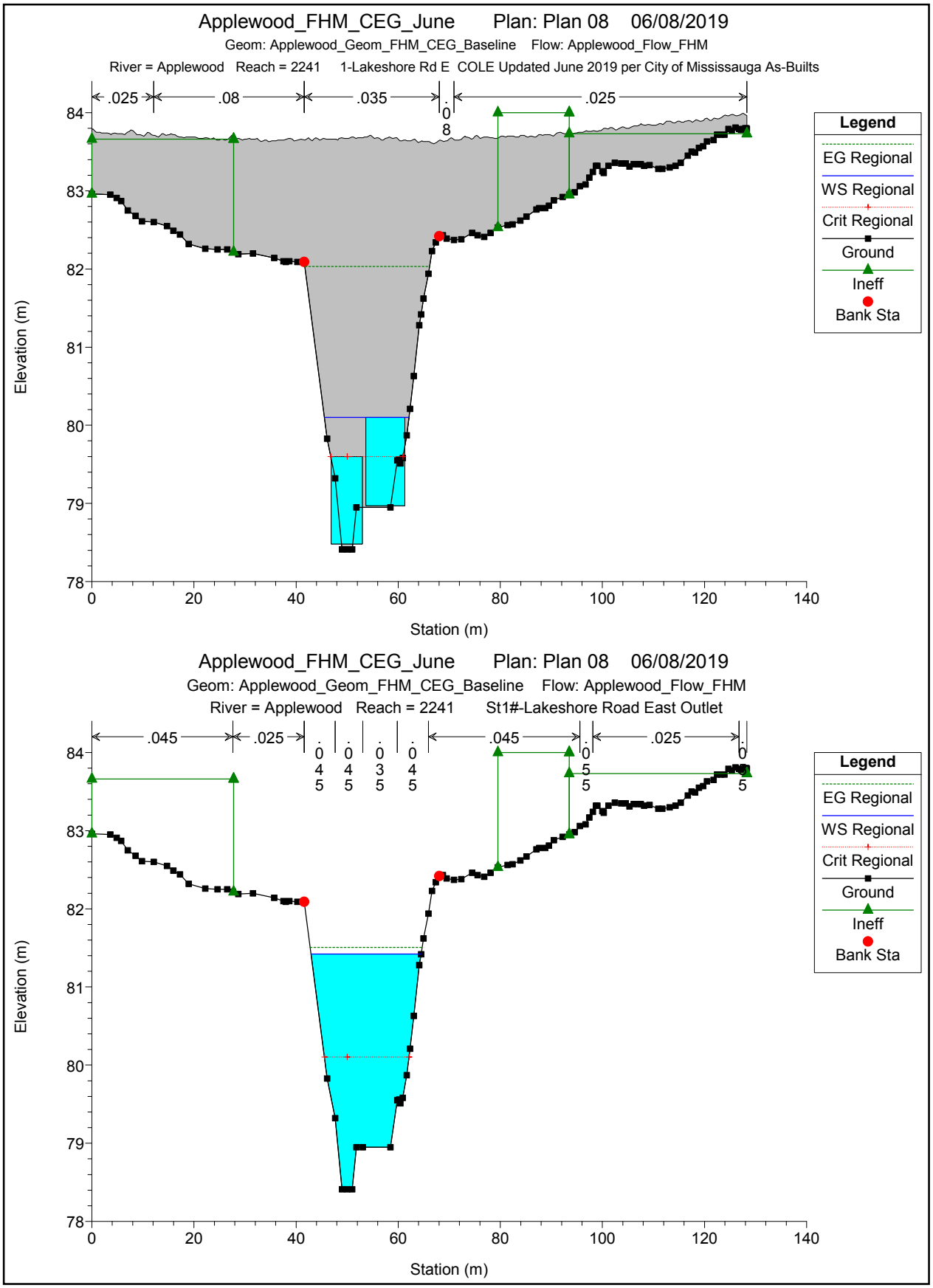
Elevation (m)
Station (m)


Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 1-Lakeshore Rd E COLE Updated June 2019 per City of Mississauga As-Built
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Crit Regional
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Elevation (m)
Station (m)
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St1#-Lakeshore Road East Outlet
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EG Regional
WS Regional
Crit Regional
Ground
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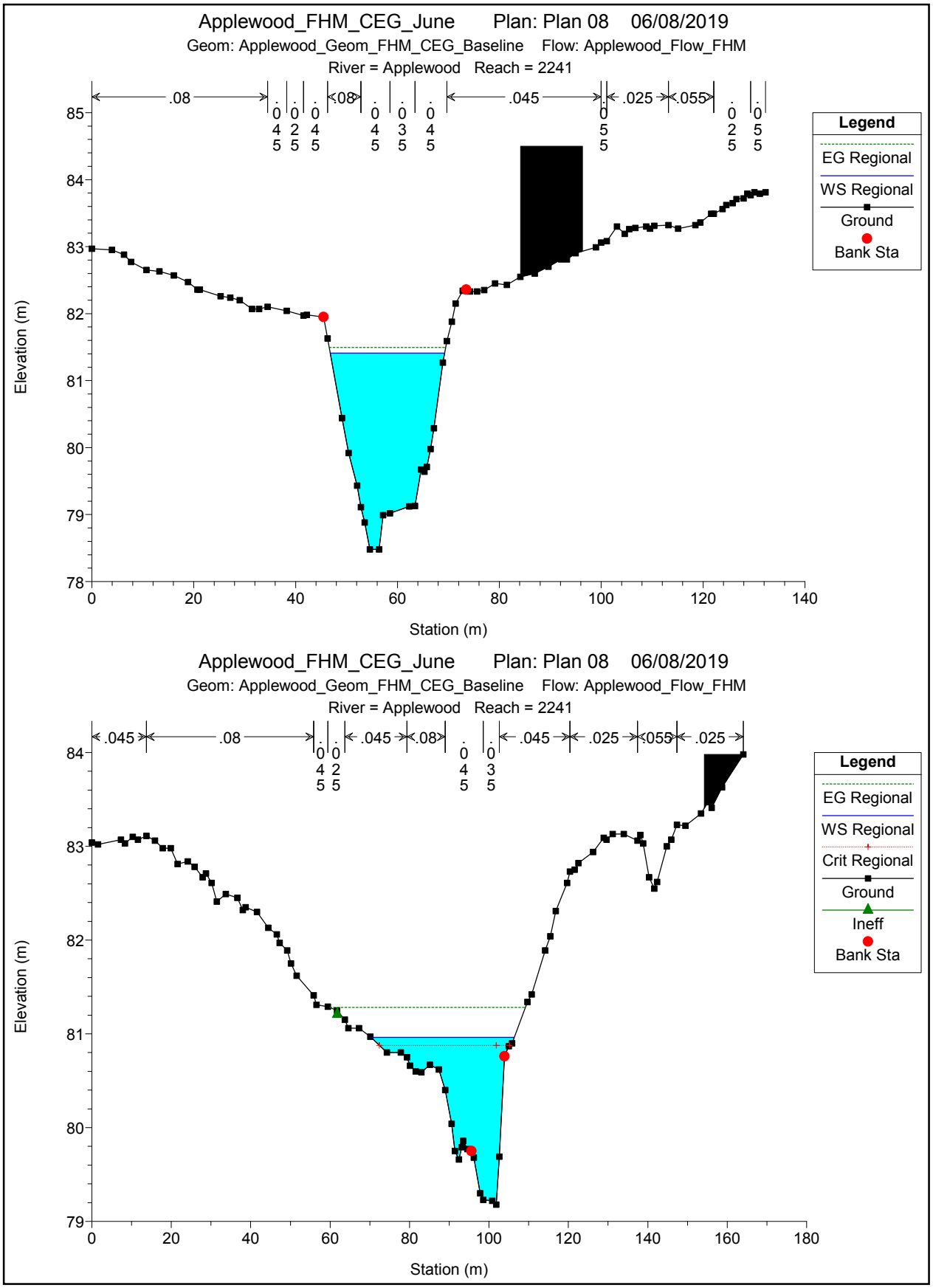
Bank Sta
Elevation (m)
Station (m)


Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
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Legend
EG Regional
WS Regional
Ground
Bank Sta
Elevation (m)
Station (m)
Applewood_FHM_CEG_June Plan: Plan 08 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Baseline Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
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Legend
EG Regional
WS Regional
Crit Regional
Ground
Ineff
Bank Sta
Elevation (m)
Station (m)

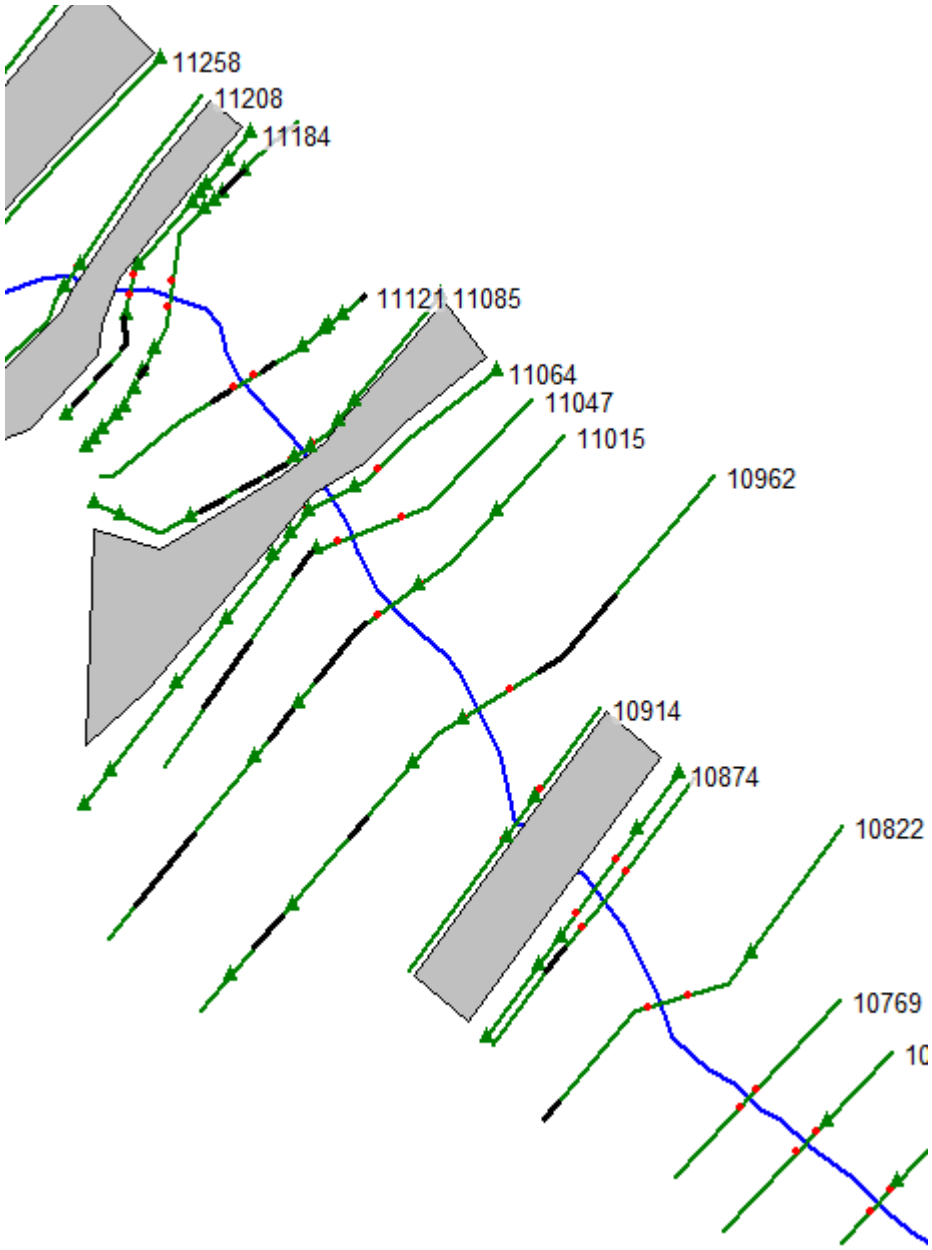
HEC-RAS Plan: Plan 06 River: Applewood Reach: 2241 (Continued)

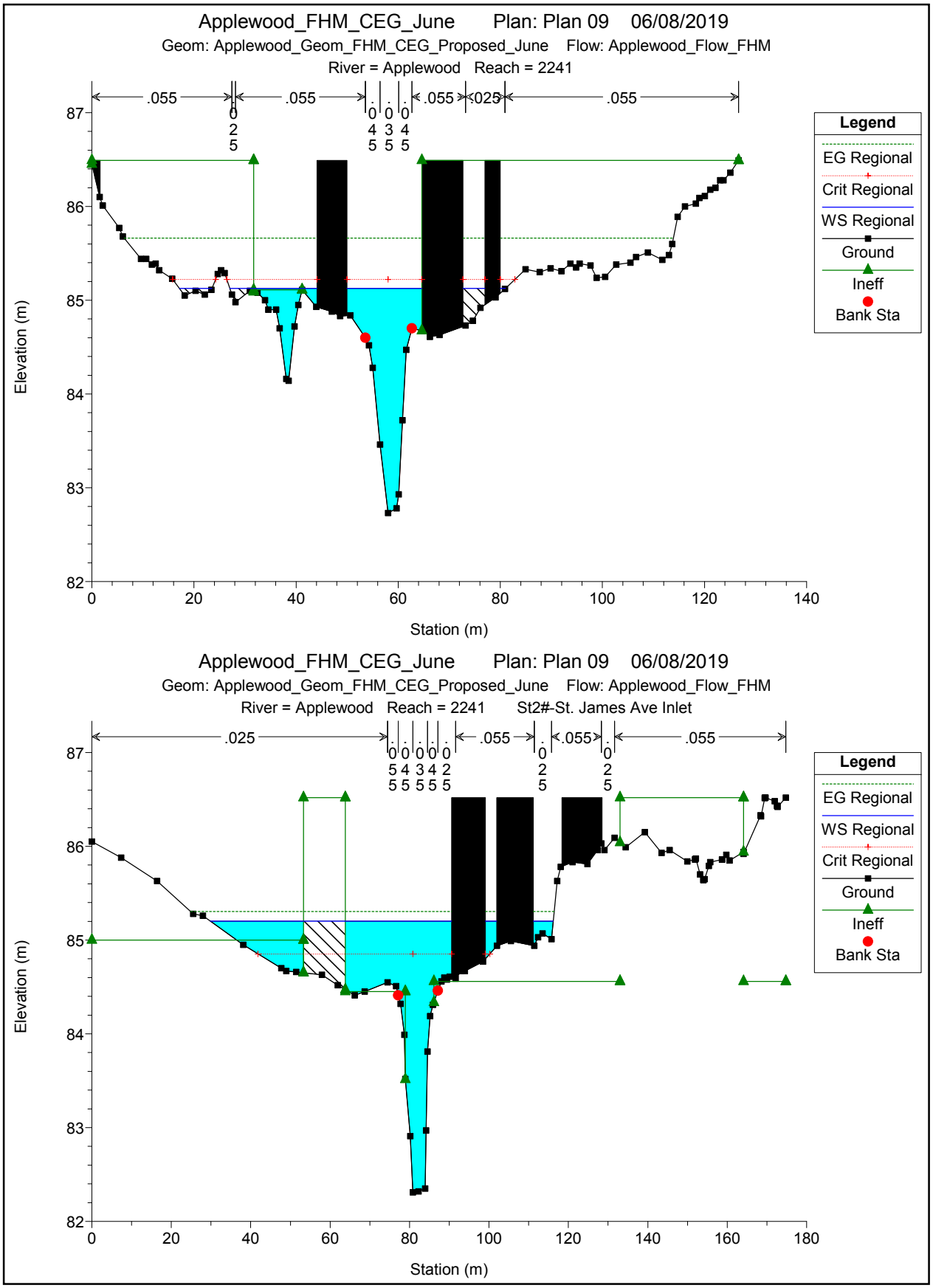
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
2241	11208	100yr	51.10	83.66	86.49	85.63	86.57	0.001496	1.52	52.20	80.38	0.33
2241	11208	Regional	51.90	83.66	86.50	85.65	86.58	0.001497	1.52	52.88	80.84	0.33
2241	11196 3-St. Mary Ave		Bridge									
2241	11184	100yr	51.10	83.37	86.18	85.94	86.32	0.004015	1.93	38.51	67.41	0.45
2241	11184	Regional	51.90	83.37	86.19	85.95	86.33	0.004025	1.94	38.99	67.51	0.45
2241	11168	100yr	51.10	83.59	85.86	85.86	86.18	0.008181	2.85	26.83	81.72	0.71
2241	11168	Regional	51.90	83.59	85.88	85.88	86.19	0.008123	2.86	27.38	82.17	0.71
2241	11121	100yr	51.10	82.73	85.29	85.22	85.64	0.008201	2.83	23.90	55.25	0.70
2241	11121	Regional	51.90	82.73	85.32	85.22	85.66	0.007969	2.81	24.49	60.48	0.69
2241	11085	100yr	51.20	82.31	85.34	84.84	85.41	0.001388	1.29	48.46	74.87	0.29
2241	11085	Regional	52.60	82.31	85.36	84.85	85.43	0.001354	1.28	49.89	75.49	0.29
2241	11075 2-St. James Ave		Bridge									
2241	11064	100yr	51.20	82.21	84.99	84.41	85.18	0.005396	2.01	27.72	88.00	0.54
2241	11064	Regional	52.60	82.21	85.04	84.44	85.22	0.004687	1.92	30.35	115.73	0.50
2241	11047	100yr	51.20	82.19	84.36	84.34	84.92	0.015908	3.34	16.01	20.64	0.94
2241	11047	Regional	52.60	82.19	84.37	84.37	84.96	0.016321	3.40	16.19	26.00	0.96
2241	11015	100yr	51.20	81.73	83.97	83.97	84.42	0.014120	2.97	17.74	39.11	0.87
2241	11015	Regional	52.60	81.73	83.99	83.99	84.44	0.013920	2.98	18.20	42.84	0.86
2241	10962	100yr	51.20	81.25	82.96	82.99	83.50	0.020796	3.25	15.77	15.84	1.04
2241	10962	Regional	52.60	81.25	82.98	83.01	83.52	0.020906	3.28	16.04	15.91	1.04
2241	10914	100yr	51.30	78.85	82.35	80.38	82.41	0.000743	1.09	47.00	20.03	0.21
2241	10914	Regional	53.40	78.85	82.46	80.41	82.52	0.000708	1.09	49.08	20.46	0.21
2241	10898 1-Lakeshore Rd E		Culvert									
2241	10874	100yr	51.30	78.41	81.39	80.07	81.47	0.001246	1.24	41.32	21.42	0.29
2241	10874	Regional	53.40	78.41	81.42	80.10	81.51	0.001290	1.27	42.00	21.56	0.29
2241	10868	100yr	51.30	78.48	81.38		81.46	0.002228	1.26	40.61	22.31	0.30
2241	10868	Regional	53.40	78.48	81.41		81.49	0.002307	1.29	41.31	22.46	0.30

HEC-RAS Plan: Plan 06 River: Applewood Reach: 2241 (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)	
2241	10822	100yr	51.30	79.18	80.94	80.85	81.25	0.008744	2.83	23.37	35.31	0.75
2241	10822	Regional	53.40	79.18	80.96	80.88	81.28	0.008851	2.87	24.16	36.06	0.76
2241	10769	100yr	51.30	78.80	80.48	80.48	80.78	0.008388	2.79	26.00	43.43	0.75
2241	10769	Regional	53.40	78.80	80.50	80.50	80.80	0.008439	2.82	26.85	43.63	0.75
2241	10741	100yr	51.30	78.53	80.36	80.21	80.54	0.005309	2.18	32.96	46.24	0.59
2241	10741	Regional	53.40	78.53	80.38	80.23	80.56	0.005270	2.20	34.09	46.70	0.59
2241	10704	100yr	51.30	78.18	80.24	79.97	80.36	0.003686	1.87	37.33	45.86	0.48
2241	10704	Regional	53.40	78.18	80.26	79.99	80.38	0.003664	1.88	38.50	46.28	0.48
2241	10668	100yr	51.30	78.13	79.77	79.77	80.12	0.013402	3.02	26.36	38.31	0.84
2241	10668	Regional	53.40	78.13	79.80	79.80	80.15	0.013354	3.05	27.28	38.79	0.84
2241	10633	100yr	51.30	77.65	79.23	79.16	79.51	0.013625	3.08	29.06	39.74	0.91
2241	10633	Regional	53.40	77.65	79.26	79.17	79.54	0.013262	3.09	30.25	40.21	0.90
2241	10591	100yr	51.30	77.00	78.94		79.18	0.005491	2.41	30.42	31.12	0.60
2241	10591	Regional	53.40	77.00	78.96		79.21	0.005583	2.45	31.19	31.25	0.61
2241	10574	100yr	51.30	77.04	78.85		79.08	0.006238	2.53	33.92	39.50	0.66
2241	10574	Regional	53.40	77.04	78.87		79.11	0.006312	2.58	34.86	39.66	0.67
2241	10556	100yr	51.30	76.81	78.58	78.58	78.94	0.008565	3.13	29.21	41.37	0.83
2241	10556	Regional	53.40	76.81	78.61	78.61	78.97	0.008569	3.16	30.22	41.53	0.83
2241	10525	100yr	51.30	76.56	78.27	78.10	78.43	0.008224	2.51	41.15	51.47	0.69
2241	10525	Regional	53.40	76.56	78.29	78.11	78.45	0.008353	2.56	42.10	51.63	0.70
2241	10504	100yr	51.30	76.45	77.99		78.23	0.010526	2.80	35.63	53.26	0.81
2241	10504	Regional	53.40	76.45	78.03		78.26	0.010036	2.78	37.37	53.55	0.79
2241	10457	100yr	51.30	76.00	77.75	77.41	77.90	0.005511	2.19	42.59	50.99	0.59
2241	10457	Regional	53.40	76.00	77.81	77.41	77.94	0.005104	2.16	44.98	52.06	0.57
2241	10424	100yr	51.30	75.81	77.62	77.28	77.73	0.004659	2.05	46.31	47.58	0.54
2241	10424	Regional	53.40	75.81	77.69	77.30	77.79	0.004124	1.99	49.69	50.73	0.51
2241	10396	100yr	51.30	75.67	77.53	77.09	77.62	0.002948	1.88	56.20	53.44	0.46
2241	10396	Regional	53.40	75.67	77.62	77.11	77.69	0.002558	1.81	60.58	53.77	0.43

Applewood Creek – St. James Avenue to Lakeshore Road
Proposed Conditions Schematic
April, 2019

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River = Applewood Reach = 2241
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Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St2#-St. James Ave Inlet
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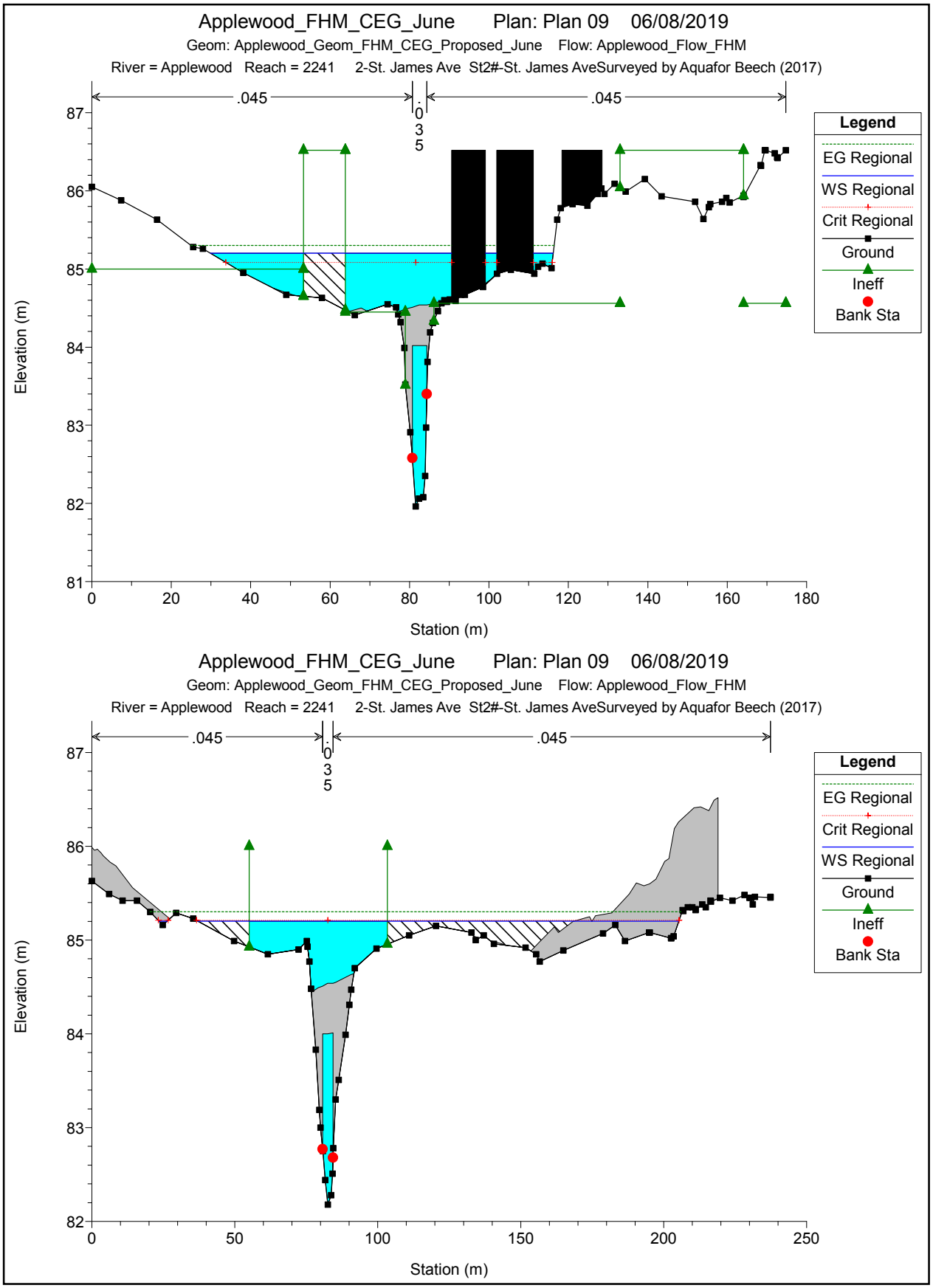
Station (m)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River = Applewood Reach = 2241 2-St. James Ave St2#-St. James AveSurveyed by Aquafor Beech (2017)
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Station (m)
Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 2-St. James Ave St2#-St. James AveSurveyed by Aquafor Beech (2017)
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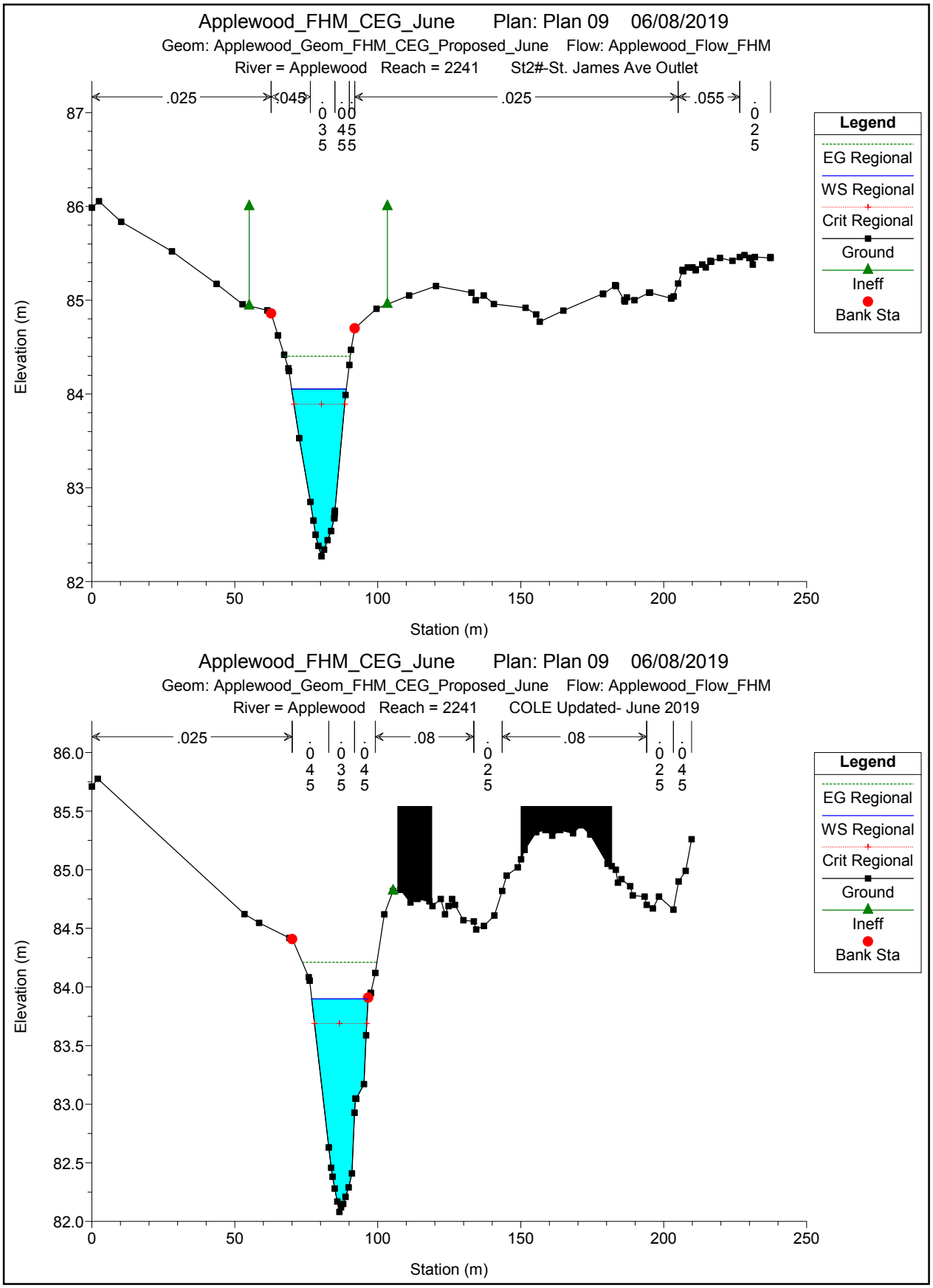
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Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St2#-St. James Ave Outlet
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Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
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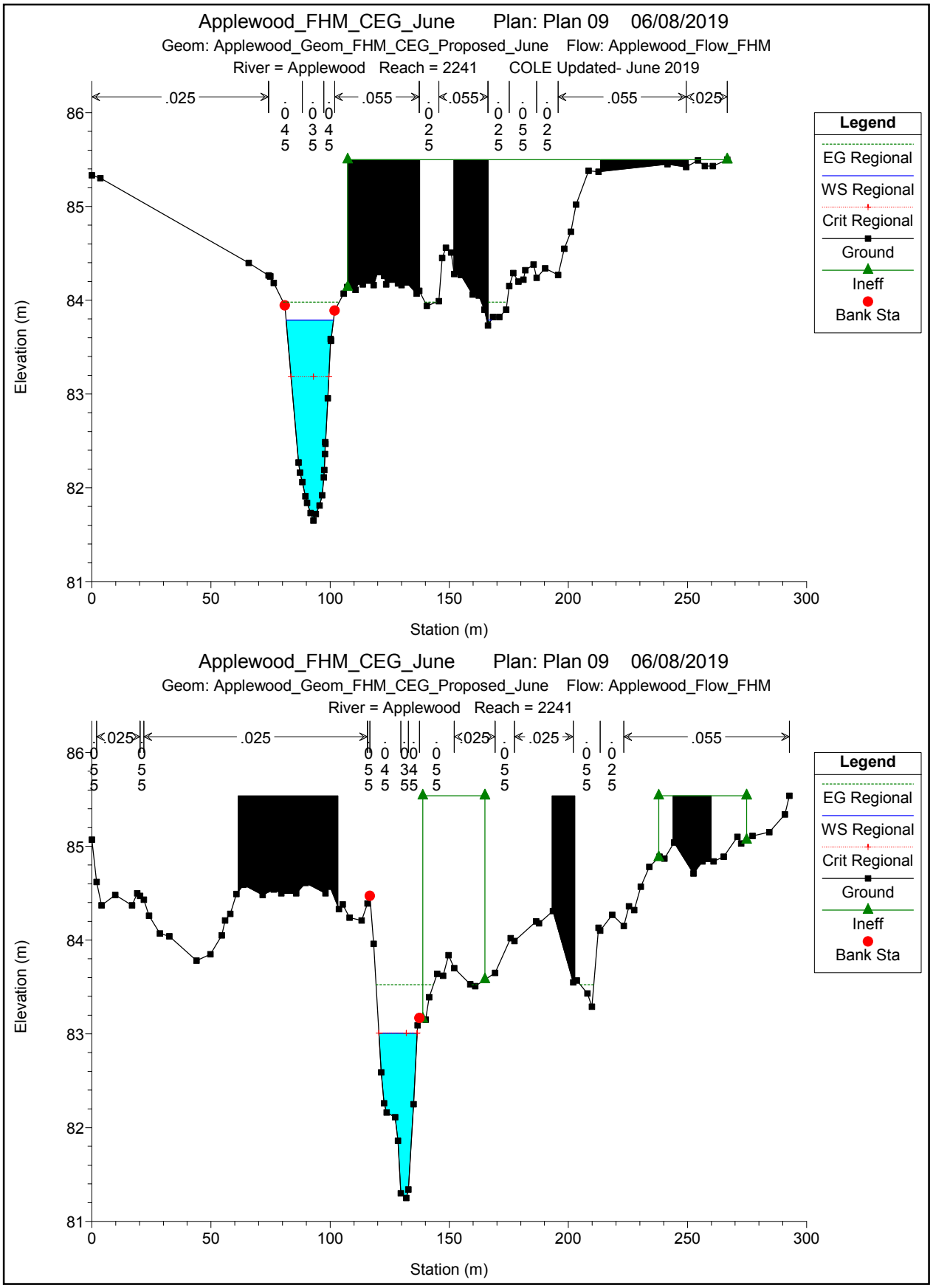
Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 COLE Updated- June 2019
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Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
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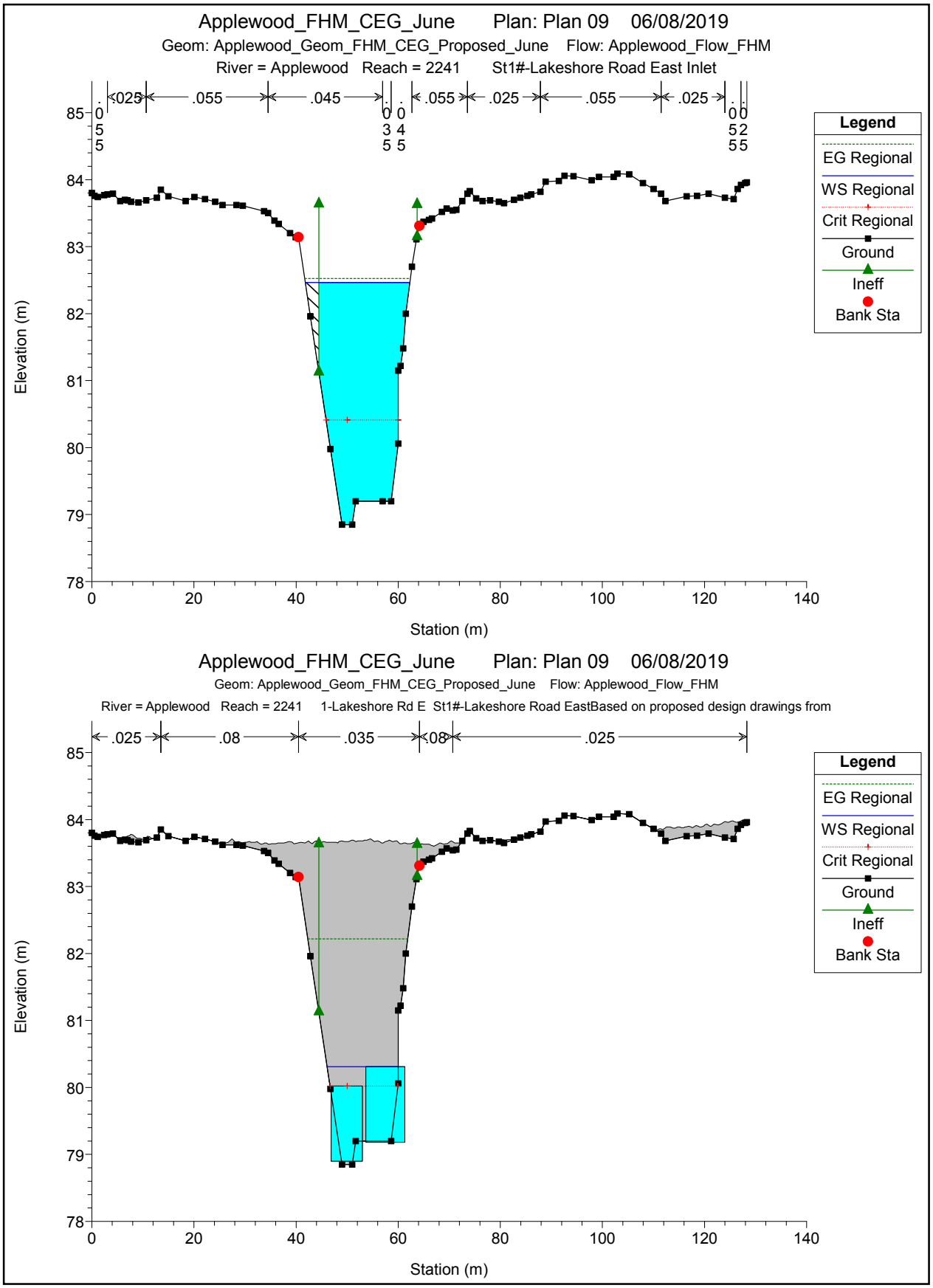
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Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 1-Lakeshore Rd E St1#-Lakeshore Road EastBased on proposed design drawings from
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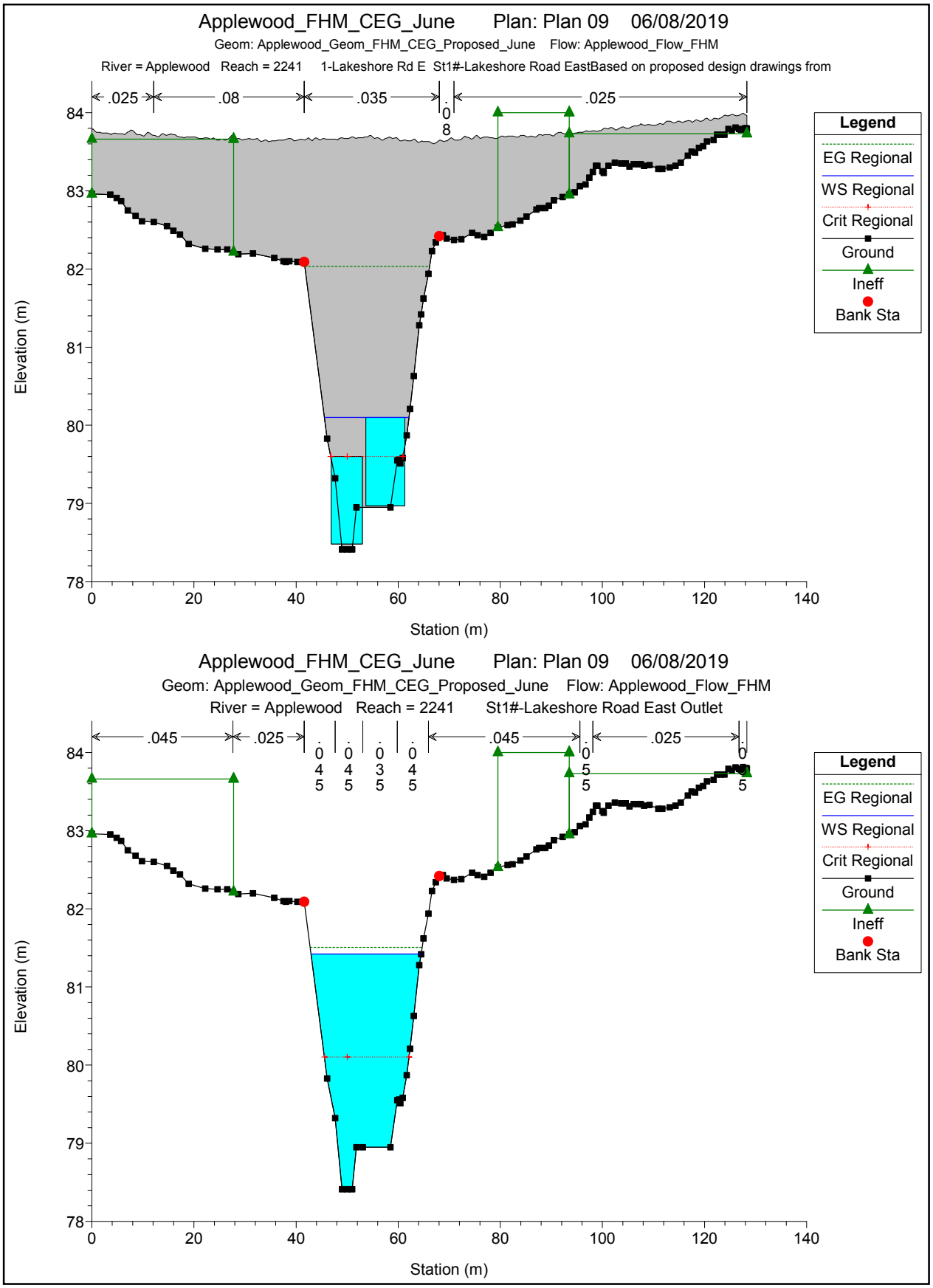
Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 1-Lakeshore Rd E St1#-Lakeshore Road EastBased on proposed design drawings from
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Elevation (m)
Station (m)
Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241 St1#-Lakeshore Road East Outlet
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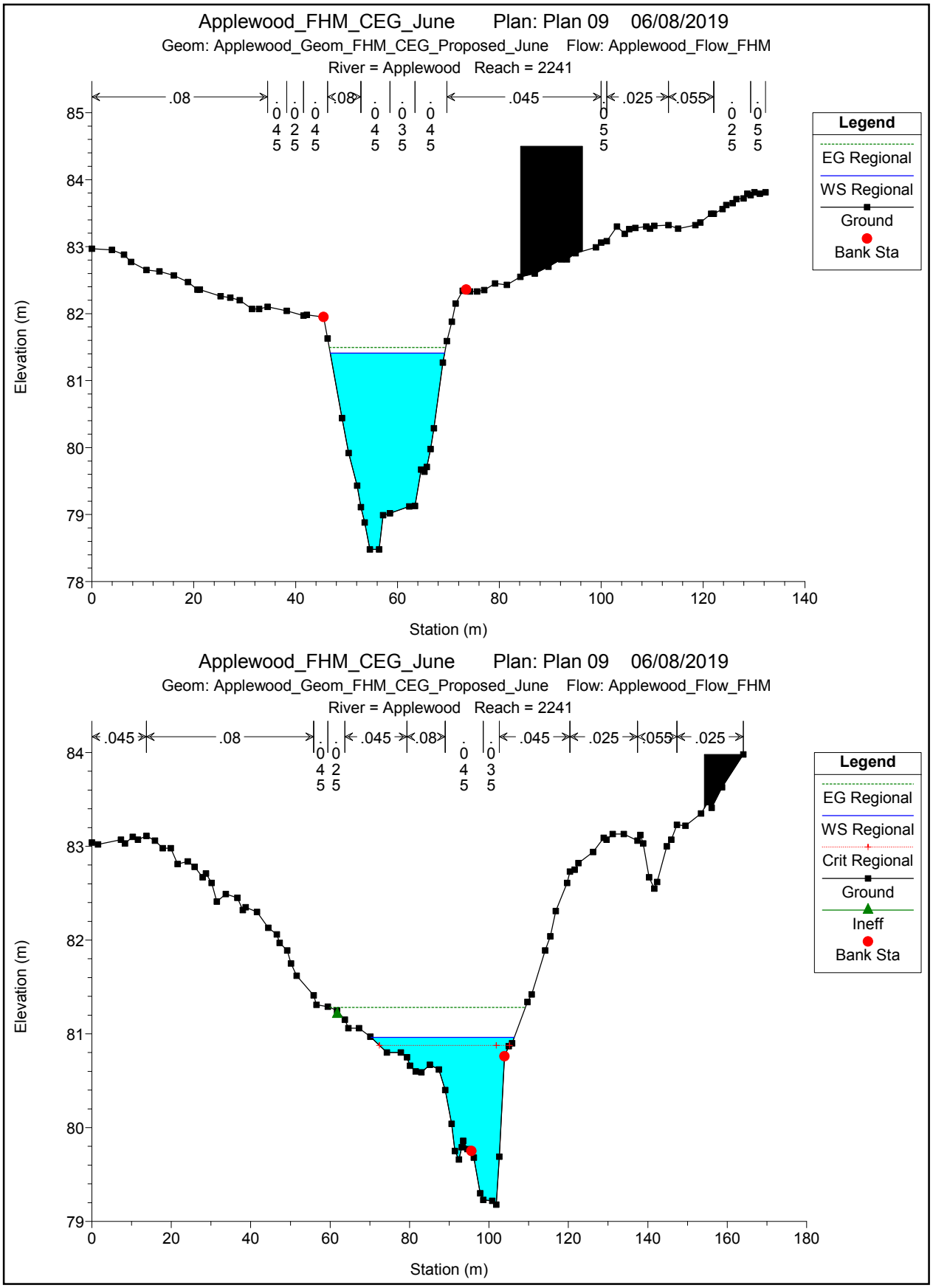
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River = Applewood Reach = 2241
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Elevation (m)
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Applewood_FHM_CEG_June Plan: Plan 09 06/08/2019
Geom: Applewood_Geom_FHM_CEG_Proposed_June Flow: Applewood_Flow_FHM
River = Applewood Reach = 2241
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Elevation (m)
Station (m)

HEC-RAS Plan: Plan 06 River: Applewood Reach: 2241 (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)	
2241	11208	100yr	51.10	83.66	86.49	85.63	86.57	0.001491	1.52	52.26	80.43	0.33
2241	11208	Regional	51.90	83.66	86.50	85.65	86.58	0.001492	1.52	52.95	80.89	0.33
2241	11196 3-St. Mary Ave		Bridge									
2241	11184	100yr	51.10	83.37	86.18	85.94	86.32	0.004007	1.93	38.54	67.42	0.45
2241	11184	Regional	51.90	83.37	86.19	85.95	86.33	0.004017	1.94	39.03	67.52	0.45
2241	11168	100yr	51.10	83.59	85.86	85.86	86.18	0.008181	2.85	26.83	81.72	0.71
2241	11168	Regional	51.90	83.59	85.88	85.88	86.19	0.008123	2.86	27.38	82.17	0.71
2241	11121	100yr	51.10	82.73	85.14	85.22	85.64	0.012850	3.32	19.73	44.09	0.87
2241	11121	Regional	51.90	82.73	85.13	85.22	85.66	0.013809	3.42	19.37	43.47	0.90
2241	11085	100yr	51.20	82.31	85.18	84.84	85.28	0.002410	1.61	38.86	67.97	0.38
2241	11085	Regional	52.60	82.31	85.20	84.85	85.30	0.002372	1.61	39.95	68.63	0.37
2241	11075 2-St. James Ave		Bridge									
2241	11064	100yr	51.20	82.27	84.03	83.87	84.38	0.011099	2.61	19.59	18.94	0.82
2241	11064	Regional	52.60	82.27	84.05	83.89	84.40	0.011042	2.62	20.05	19.16	0.82
2241	11047	100yr	51.20	82.08	83.87	83.67	84.18	0.009567	2.47	20.76	19.55	0.76
2241	11047	Regional	52.60	82.08	83.90	83.69	84.21	0.009437	2.47	21.28	19.73	0.76
2241	11015	100yr	51.20	81.65	83.76	83.16	83.95	0.004277	1.92	26.66	20.34	0.53
2241	11015	Regional	52.60	81.65	83.79	83.18	83.98	0.004308	1.94	27.18	21.17	0.53
2241	10962	100yr	51.20	81.25	82.99	82.99	83.50	0.019226	3.16	16.20	15.95	1.00
2241	10962	Regional	52.60	81.25	83.01	83.01	83.52	0.019071	3.18	16.55	16.05	1.00
2241	10914	100yr	51.30	78.85	82.35	80.38	82.41	0.000743	1.09	47.00	20.03	0.21
2241	10914	Regional	53.40	78.85	82.46	80.41	82.52	0.000708	1.09	49.08	20.46	0.21
2241	10898 1-Lakeshore Rd E		Culvert									
2241	10874	100yr	51.30	78.41	81.39	80.07	81.47	0.001246	1.24	41.32	21.42	0.29
2241	10874	Regional	53.40	78.41	81.42	80.10	81.51	0.001290	1.27	42.00	21.56	0.29
2241	10868	100yr	51.30	78.48	81.38		81.46	0.002228	1.26	40.61	22.31	0.30
2241	10868	Regional	53.40	78.48	81.41		81.49	0.002307	1.29	41.31	22.46	0.30

HEC-RAS Plan: Plan 06 River: Applewood Reach: 2241 (Continued)

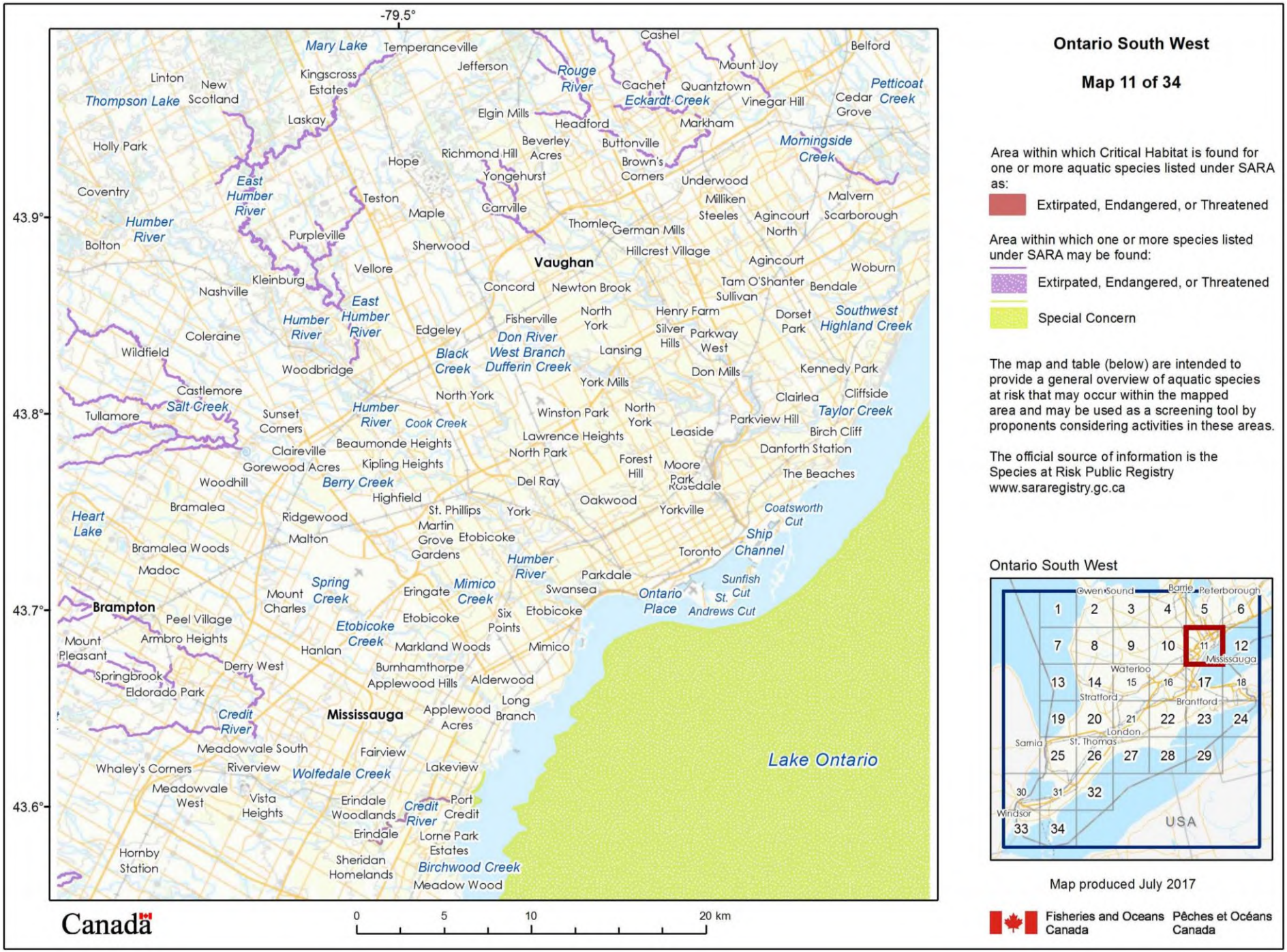
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
2241	10822	100yr	51.30	79.18	80.94	80.85	81.25	0.008744	2.83	23.37	35.31	0.75
2241	10822	Regional	53.40	79.18	80.96	80.88	81.28	0.008851	2.87	24.16	36.06	0.76
2241	10769	100yr	51.30	78.80	80.48	80.48	80.78	0.008388	2.79	26.00	43.43	0.75
2241	10769	Regional	53.40	78.80	80.50	80.50	80.80	0.008439	2.82	26.85	43.63	0.75
2241	10741	100yr	51.30	78.53	80.36	80.21	80.54	0.005309	2.18	32.96	46.24	0.59
2241	10741	Regional	53.40	78.53	80.38	80.23	80.56	0.005270	2.20	34.09	46.70	0.59
2241	10704	100yr	51.30	78.18	80.24	79.97	80.36	0.003686	1.87	37.33	45.86	0.48
2241	10704	Regional	53.40	78.18	80.26	79.99	80.38	0.003664	1.88	38.50	46.28	0.48
2241	10668	100yr	51.30	78.13	79.77	79.77	80.12	0.013402	3.02	26.36	38.31	0.84
2241	10668	Regional	53.40	78.13	79.80	79.80	80.15	0.013354	3.05	27.28	38.79	0.84
2241	10633	100yr	51.30	77.65	79.23	79.16	79.51	0.013625	3.08	29.06	39.74	0.91
2241	10633	Regional	53.40	77.65	79.26	79.17	79.54	0.013262	3.09	30.25	40.21	0.90
2241	10591	100yr	51.30	77.00	78.94		79.18	0.005491	2.41	30.42	31.12	0.60
2241	10591	Regional	53.40	77.00	78.96		79.21	0.005583	2.45	31.19	31.25	0.61
2241	10574	100yr	51.30	77.04	78.85		79.08	0.006238	2.53	33.92	39.50	0.66
2241	10574	Regional	53.40	77.04	78.87		79.11	0.006312	2.58	34.86	39.66	0.67
2241	10556	100yr	51.30	76.81	78.58	78.58	78.94	0.008565	3.13	29.21	41.37	0.83
2241	10556	Regional	53.40	76.81	78.61	78.61	78.97	0.008569	3.16	30.22	41.53	0.83
2241	10525	100yr	51.30	76.56	78.27	78.10	78.43	0.008224	2.51	41.15	51.47	0.69
2241	10525	Regional	53.40	76.56	78.29	78.11	78.45	0.008353	2.56	42.10	51.63	0.70
2241	10504	100yr	51.30	76.45	77.99		78.23	0.010526	2.80	35.63	53.26	0.81
2241	10504	Regional	53.40	76.45	78.03		78.26	0.010036	2.78	37.37	53.55	0.79
2241	10457	100yr	51.30	76.00	77.75	77.41	77.90	0.005511	2.19	42.59	50.99	0.59
2241	10457	Regional	53.40	76.00	77.81	77.41	77.94	0.005104	2.16	44.98	52.06	0.57
2241	10424	100yr	51.30	75.81	77.62	77.28	77.73	0.004659	2.05	46.31	47.58	0.54
2241	10424	Regional	53.40	75.81	77.69	77.30	77.79	0.004124	1.99	49.69	50.73	0.51
2241	10396	100yr	51.30	75.67	77.53	77.09	77.62	0.002948	1.88	56.20	53.44	0.46
2241	10396	Regional	53.40	75.67	77.62	77.11	77.69	0.002558	1.81	60.58	53.77	0.43

Appendix C – Vegetation Communities and Flora

Flora recorded within corridor between St. James Ave. and Lakeshore Rd. E. on May 1 2018

Species Name		Coefficient of Conservation	Coefficient of Wetness	Ranking				Introduced (0=yes, I=no)
Scientific Name	Common Names			COSEWIC	COSSARO	S-Rank	G-Rank	
Acer negundo	Manitoba Maple	0	-2	-	-	S5	G5	I
Acer platanoides	Norway Maple	0	5	-	-	SE5	G?	I
Acer rubrum	Red Maple	4	0	-	-	S5	G5	0
Acer X *freemanii*	Freeman's Maple	-	-	-	-	S5	G?	0
Ailanthus altissima	Tree-of-heaven	0	5	-	-	SE5	G?	I
Ajuga reptans	Common Bugle	0	5	-	-	SE2	G?	I
Alliaria petiolata	Garlic Mustard	0	0	-	-	SE5	G?	I
Aquilegia sp.	Columbine species	-	-	-	-	-	-	-
Arctium minus ssp. *minus*	Common Burdock	0	5	-	-	SE5	G?	I
Chelidonium majus	Celandine	0	5	-	-	SE5	G?	I
Cornus stolonifera	Red-osier Dogwood	2	-3	-	-	S5	G5	0
Cynanchum rossicum	White Swallow-wort	0	5	-	-	SE5	G?	I
Dactylis glomerata	Orchard Grass	0	3	-	-	SE5	G?	I
Daucus carota	Wild Carrot	0	5	-	-	SE5	G?	I
Euonymus alata	Winged Euonymus	0	5	-	-	SE2	G?	I
Fraxinus pennsylvanica	Red Ash	3	-3	-	-	S5	G5	0
Geum aleppicum	Yellow Avens	2	-1	-	-	S5	G5	0
Glechoma hederacea	Ground Ivy	0	3	-	-	SE5	G?	I
Hesperis matronalis	Dame's Rocket	0	5	-	-	SE5	G4G5	I
Lapsana communis	Nipplewort	0	5	-	-	SE5	G?	I
Ligustrum vulgare	Common Privet	0	1	-	-	SE5	G?	I
Lonicera tatarica	Tartarian Honeysuckle	0	3	-	-	SE5	G?	I
Morus alba	White Mulberry	0	0	-	-	SE5	G?	I
Picea abies	Norway Spruce	0	5	-	-	SE3	G?	I
Poa sp.	Blue Grass Species	-	-	-	-	-	-	-
Prunus avium	Sweet Cherry	0	5	-	-	SE4	G?	I
Prunus virginiana ssp. *virginiana*	Choke Cherry	2	1	-	-	S5	G5	0
Rhamnus cathartica	Common Buckthorn	0	3	-	-	SE5	G?	I
Rhus typhina	Staghorn Sumac	1	5	-	-	S5	G5	0
Salix X *rubens*	Hybrid White Willow	0	-4	-	-	SE4	G?	I
Scilla sibirica	Squill	0	5	-	-	SE2	G?	I
Solidago canadensis var. *canadensis*	Canada Goldenrod	1	3	-	-	S5	G5	0
Symphyotrichum lanceolatum var. *lanceolatum*	Panicled Aster	3	-3	-	-	S5	G5	0
Taraxacum officinale	Common Dandelion	0	3	-	-	SE5	G5	I
Ulmus americana	White Elm	3	-2	-	-	S5	G5?	0
Ulmus pumila	Siberian Elm	0	5	-	-	SE3	G?	I
Vitis riparia	Riverbank Grape	0	-2	-	-	S5	G5	0

Aquatic SAR Mapping (DFO, 2017)



Ontario South West

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Area within which Critical Habitat is found for one or more aquatic species listed under SARA as:

Extirpated, Endangered, or Threatened

Area within which one or more species listed under SARA may be found:

Extirpated, Endangered, or Threatened

Special Concern

The map and table (below) are intended to provide a general overview of aquatic species at risk that may occur within the mapped area and may be used as a screening tool by proponents considering activities in these areas.

The official source of information is the Species at Risk Public Registry www.sararegistry.gc.ca

Ontario South West

Map produced July 2017

Fisheries and Oceans Canada | Pêches et Océans Canada