
APPENDIX 6

**FLUVIAL GEOMORPHOLOGY AND
HYDRAULIC ASSESSMENTS**



**FLUVIAL GEOMORPHOLOGY AND HYDRAULIC ASSESSMENTS
ENVIRONMENTAL ASSESSMENT (EA) AND PRELIMINARY DESIGN
FOR DRAINAGE IMPROVEMENTS OF HIGHWAY 50 FROM
MAYFIELD ROAD TO HEALEY ROAD
REGION OF PEEL, CALEDON, ONTARIO**

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Prepared for R.V. Anderson Associates Limited, November 2021

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1 INTRODUCTION

In January 2020, R.V. Anderson Associates Limited (RVA) retained Matrix Solutions Inc. to complete a fluvial geomorphic and hydraulic assessment in support of a Schedule B Municipal Class Environmental Assessment (EA) for drainage improvements of culverts and ditches on Highway 50 (Regional Road 50; RR50) in the Region of Peel. As part of the project, active transportation improvements (i.e., pedestrian and cycling amenities) along the corridor will also be developed in accordance with the recommendations of Region of Peel's Sustainable Transportation Strategy.

While the EA extends throughout a 2,400 m length of the RR50 corridor between Mayfield Road and Healy Road, this report documents the existing condition and constraints of the natural watercourse within the study area, West Robinson Creek, which extends from north of Mayfield Road to 50 m north of George Bolton Parkway, an approximate length of 1,400 m. A study area plan is provided in Appendix A.

1.1 Study Area

The study area is within the Rainbow Creek subwatershed of the Humber River watershed and is under the jurisdiction of Toronto and Region Conservation Authority (TRCA). The Rainbow Creek subwatershed is drained by two watercourses: Rainbow Creek and Robinson Creek, which merge approximately 330 m north of Highway 7 to form Plunkett Creek.

Within the study area, RR50 is an urban-undivided, five-lane high-capacity arterial road under the jurisdiction of the Region of Peel, located within the Bolton Community of the Town of Caledon. It is understood that the roadway in the study area is in good condition and there are no plans for widening or rehabilitation at this time; however, there are active transportation measures proposed for implementation (cycle track or multi-use path). Within the reach of interest of this study (north of Mayfield Road to North of George Bolton Parkway) a sidewalk exists on the west side of the road, yet no pedestrian facilities exist on the east side of the road. Despite being urbanized with curb and gutters, ditches and entrance culverts provide urban stormwater conveyance along a significant portion of the road's length, including at many locations where West Robinson Creek is directly adjacent to the roadway, serving as the east roadside ditch.

Adjacent land uses on the east side of the roadway are primarily commercial; mostly utilized for large/open space uses such as vehicle storage, vehicle dealerships, multi-unit plazas, etc. Residential land uses are present on the east side of RR50 toward the southern limit of the study area.

Within the study area West Robinson Creek flows southerly along the east side of roadway, deviating easterly at two pronounced locations behind private land uses. The watercourse crosses through eight culvert structures within the study area, seven of which are entrance culverts, with one crossing RR50 at George Bolton Parkway. Downstream of the study limits is a new crossing structure at Mayfield Road/Albion-Vaughan Road. Upstream of the study limits the natural open watercourse extends

northwesterly, away from RR50, into the industrialized area bound by RR50, George Bolton Parkway, Nixon Road, and McEwan Drive West.

2 EXISTING CONDITIONS

2.1 Field Investigations and Background

A detailed topographic survey of the watercourse corridor was completed by the project team and provided to Matrix in May 2020. During the same time period, a request for historic record drawings was submitted. Applicable record drawings provided to the Matrix team are available in Appendix B. Also during this time period, a request for a historic record of operations/maintenance issues relative to Matrix's study focus was circulated to the project team and owner. Of note, no response to this item was provided.

To ascertain the Matrix team of the current in-field conditions, Matrix staff performed a site walk on September 9, 2020, with a focus to review and document the existing conditions of the watercourse, with a focus on the eight culvert structures identified, below. Detailed crossing sheets and photologs were prepared by Matrix for each structure to document the structure size, orientation, type, and channel approach/departure characteristics, etc. Matrix structure crossing sheets and photologs are available in Appendices C and D, respectively. Of note, although Matrix fieldwork provides general commentary on structure condition, the intention of Matrix appraisals is focused on culvert and channel characteristics, not a detailed condition assessment of the culvert structures.

As a significant portion of the watercourse is within, or interacts with, private property, several permissions-to-enter were obtained prior to mobilization of the site reconnaissance. Also provided prior to the site reconnaissance was structure condition appraisals completed by Region of Peel staff. Notably, not all culvert structures within this study were appraised. Condition appraisals are available in Appendix E.

2.2 Culvert 1

Culvert 1 is located in proximity to the intersection of RR50 and George Bolton Parkway, conveying watercourse flows under RR50 from west to east via a buried culvert/sewer network.

The upstream end is comprised of two protruding culvert barrels: one oriented westerly to convey approaching watercourse flows (Culvert 1) and one oriented northerly to convey approaching roadside ditch flows (Culvert 1A). Culvert 1 is a 600 mm diameter high-density polyethylene (HDPE) pipe with vegetated embankments and no formalized end treatment (Figure 1). Culvert 1A is a 900 mm diameter corrugated steel pipe (CSP) with riprap stone embankments and no formalized end treatment (Figure 2).



FIGURE 1 Culvert 1 Upstream End



FIGURE 2 Culvert 1A Upstream End

The downstream end is a single span cast in place concrete box culvert. The culvert was significantly backwatered and silted-in at the time of the site visit, but it is presumed to be an open bottom structure with span of 1.88 m and rise of 1.05 m (Figures 3 and 4).

The adjacent vacant property upstream of Culvert 1/1A is situated in a low-lying orientation with little freeboard from the normal water levels of the upstream channel. Notably, at the time of the site visit, it was visually evident that utility locates, and small tracked equipment had accessed the site (possibly for a geotechnical investigation) indicating planning for future improvements. The downstream end has riprap stone embankments and no formalized end treatments; discharging directly to a heavily vegetated online pond (see Section 2.11.1).



FIGURE 3 Culvert 1 Downstream End



FIGURE 4 Culvert 1 Downstream End

From a review of available record drawings, it is presumed the culvert system is comprised of a series of historic extensions/enclosures, likely to facilitate roadwork and adjacent private development. A perpendicular box culvert crossing of RR50 extends from the downstream end to a large maintenance hole structure located at the projection of the RR50 west curb line at the centreline of George Bolton

Parkway. Notably, this large maintenance hole structure is also a point of connection for urban stormwater from George Bolton Parkway. From this point the culvert system extends northerly in a single barrel piped system to a maintenance hole located immediately south of the Esso gas station entrance, behind the RR50 west curb line. From this maintenance hole, the dual barrel arrangement extends north of the Esso Station Entrance to the open culvert upstream ends.

Notably the culvert system has minimal cover (less than 1.5 m) and is situated in proximity to several buried infrastructure/utilities and urban surface features. The culvert system is presumed to be situated within the Region of Peel RR50 right-of-way (RoW); however, the upstream end (Culvert 1) appears to extend west of the visible RoW features. Given the enclosed condition of the culvert system, there are significant constraints to visibly assessing the condition/orientation and functionality which may benefit from further investigation (i.e., physical access, cleaning/closed-circuit television [CCTV], downstream pond maintenance, etc.). Resultant of the enclosed condition the culvert system presents a barrier and disconnects the natural environment associated with the natural watercourse. Similarly, the enclosed condition presents less opportunity for larger watercourse flows to access floodplain.

Notably, this structure was not appraised as part of the Region of Peel condition assessments provided to Matrix, likely because of the enclosed condition.

It is recommended, at minimum, the upstream end be further understood by the EA team, as it pertains to ramifications of the assessed alternatives for improvement.

2.3 Culvert 2

Culvert 2 is located at the rear of a private lot, which is currently under the operation of Enterprise car rental. The culvert conveys watercourse flows from north to south via a single barrel 1,500 mm CSP under a gravel parking lot connection road. The culvert is oriented perpendicular to the access road and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within private property.

The upstream end is comprised of a protruding culvert barrel; oriented northerly to convey approaching watercourse flows with vegetated embankments and concrete block end walls. The upstream end is partially obstructed by debris (both natural and “urban” debris), slumping slopes, and overhanging vegetation (Figure 5). The downstream end is comprised of a protruding culvert barrel with vegetated embankments and no formalized end treatments (Figure 6).

Notably, this structure was not appraised as part of the Region of Peel condition assessments provided to Matrix, likely because of its location being situated on private property.



FIGURE 5 Culvert 2 Upstream End



FIGURE 6 Culvert 2 Downstream End

2.4 Culvert 3

Culvert 3 is located adjacent to RR50 to facilitate an elevated concrete pathway connection to a newly constructed multi-unit building situated behind (east of) the YMCA building. The culvert conveys watercourse flows from north to south via a single barrel, open bottom 2,900 mm span × 1,780 mm rise multiplate corrugated steel pipe arch (CSPA) under a concrete pathway. The culvert is oriented at a skew to the pathway (and RR50) and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within public property (RR 50 RoW); however, the culvert appears to extend east of the visible RoW features.

The upstream end is comprised of an open culvert span, oriented northerly to convey approaching watercourse flows with armourstone wingwalls/headwall (Figure 7). The downstream end is comprised of an open culvert span with armourstone wingwalls/headwall (Figure 8).

The watercourse corridor upstream of Culvert 3 is currently under the process of being realigned by a private landowner (see Section 2.11.2). The adjacent private property downstream of Culvert 3 is situated in a low-lying orientation with little freeboard from the normal water levels of the downstream channel.

Notably, this structure was appraised as “Fair Condition” by the structure condition assessments completed by Region of Peel. The corresponding Region of Peel structure ID is: “FROM - RR050-0215 TO - RR050-0216.”



FIGURE 7 Culvert 3 Upstream End



FIGURE 8 Culvert 3 Downstream End

2.5 Culvert 4

Culvert 4 is located adjacent to RR50 to facilitate an asphalt entrance to multi-unit commercial property, including YMCA facilities. The culvert conveys watercourse flows from north to south via a single barrel, closed bottom 2,250 mm span \times 1,620 mm rise CSPA under the paved entrance. The culvert is oriented perpendicular to the entrance and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within public property (RR 50 RoW).

The upstream end is comprised of a protruding culvert barrel, oriented northerly to convey approaching watercourse flows with riprap stone/manicured grass embankments and no formalized end treatment (Figure 9). The downstream end is comprised of a protruding culvert barrel with manicured grass embankments and no formalized end treatment (Figure 10).

The adjacent private property upstream of Culvert 4 is situated in a low-lying orientation with little freeboard from the normal water levels of the upstream channel. Immediately downstream of Culvert 4, an open ditch stormwater drainage feature and a roadway light standard exist.

Notably, this structure was appraised as “Fair Condition” by the structure condition assessments completed by Region of Peel. The corresponding Region of Peel structure ID is: “FROM - RR050-0213 TO - RR050-0214.”



FIGURE 9 Culvert 4 Upstream End



FIGURE 10 Culvert 4 Looking Downstream

2.6 Culvert 5

Culvert 5 is located adjacent to RR50 to facilitate an asphalt entrance to a recreational vehicle sales commercial property, which also forms the east leg of RR50/Parr Boulevard signalized intersection. The culvert conveys watercourse flows from north to south via a single barrel, closed bottom 2,080 mm span \times 1,780 mm rise CSPA under the paved entrance. The culvert is oriented perpendicular to the entrance and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within public property (RR50 RoW).

The upstream end is comprised of a protruding culvert barrel, oriented northerly to convey approaching watercourse flows with riprap stone/manicured grass embankments and no formalized end treatment. The downstream end is comprised of a protruding culvert barrel with riprap stone/manicured grass embankments and no formalized end treatment (Figures 11 and 12).

Immediately downstream of Culvert 5, an open ditch stormwater drainage feature and piped urban stormwater outfall exist.

Notably, this structure was appraised as “Fair Condition” by the structure condition assessments completed by Region of Peel. The corresponding Region of Peel structure ID is: “FROM - RR050-0211 TO - RR050-0212.”



FIGURE 11 Culvert 5 Downstream End



FIGURE 12 Culvert 5 Looking Downstream

2.7 Culvert 6

Culvert 6 is located adjacent to RR50 to facilitate a gravel entrance to a multi-unit commercial property, including U-Haul. The culvert conveys watercourse flows from north to south via a single barrel, closed bottom 2,250 mm span × 1,620 mm rise CSPA under the gravel entrance. The culvert is oriented perpendicular to the entrance and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within public property (RR 50 RoW).

The upstream end is comprised of a protruding culvert barrel, oriented northerly to convey approaching watercourse flows with riprap stone/vegetated embankments and no formalized end treatment. The downstream end is comprised of a protruding culvert barrel with riprap stone/vegetated embankments and no formalized end treatment (Figure 13).

Notably, this structure was appraised as “Fair Condition” by the structure condition assessments completed by Region of Peel. The corresponding Region of Peel structure ID is: “FROM - RR050-0209 TO - RR050-0210.”



FIGURE 13 Culvert 6 Downstream End

2.8 Culvert 7

Culvert 7 is located adjacent to RR50 to facilitate a gravel entrance to a vacant lot which has visibly been recently altered (i.e., demolition, removals etc.). Notably the entrance has been temporarily closed; barricaded by concrete blocks. The culvert conveys watercourse flows from north to south via an open bottom single span 4,550 mm × 1,500 mm rise concrete box culvert under a gravel entrance. The culvert is oriented perpendicular to the entrance and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within public property (RR 50 RoW).

The upstream end is comprised of an open culvert span; oriented northerly to convey approaching watercourse flows with vegetated embankments and no formalized end treatment (Figure 14). The downstream end is comprised of an open culvert span with vegetated embankments and no formalized end treatment (Figure 15).

Notably, this structure was appraised as “Very Good Condition” by the structure condition assessments completed by Region of Peel. The corresponding Region of Peel structure ID is: “501227.”



FIGURE 14 Culvert 7 Upstream End



FIGURE 15 Culvert 7 Looking Downstream

2.9 Culvert 8

Culvert 8 is located adjacent to RR50 to facilitate a paved entrance to a multi-tenant commercial plaza, including Storage Bolton and Bolton Kia and Bolton Toyota car dealerships. The culvert conveys watercourse flows from north to south via an open bottom single span 4,550 mm × 1,620 mm rise concrete box culvert under a paved entrance which is urbanized with curbs, sidewalk, and guiderails. The culvert is oriented perpendicular to the entrance and has minimal cover (less than 1.5 m). The culvert structure is presumed to be situated within public property (RR 50 RoW).

The upstream end is comprised of an open culvert span; oriented northerly to convey approaching watercourse flows with riprap/vegetated embankments, a concrete headwall and armour stone wingwall along the roadside embankment (Figure 16). The downstream end is comprised of an open culvert span with riprap/vegetated embankments and a concrete headwall and armour stone wingwall along the roadside embankment (Figure 17).

Notably, this structure was appraised as “Very Good Condition” by the structure condition assessments completed by Region of Peel. The corresponding Region of Peel structure ID is: “501220.”



FIGURE 16 Culvert 8 Upstream End



FIGURE 17 Culvert 8 Looking Downstream

2.10 Culvert Summary

TABLE 1 Culvert Summary Table

Culvert	Material	Shape	Open/Closed Bottom	Span/Diameter (m)	Rise (m)	Comment:
1 Inlet	HDPE	Round	Closed	0.6	-	Culvert may be partially on private property. Junction of culvert inlet 1/1A/Outlet not fully understood. Condition not fully understood. Suggest further investigation.
1A Inlet	CSP	Round	Closed	0.9	-	
Outlet	Concrete	Box	Open	1.88	1.05	
2	CSP	Round	Closed	1.5	-	Culvert on private property. Coordinate improvements with landowners.
3	CSP	Arch	Open	2.9	1.78	Culvert may be partially on private property. Coordinate culvert improvements with creek improvements upstream. Downstream private properties visually appear “low-lying.”
4	CSP	Pipe Arch	Closed	2.25	1.62	Upstream private properties visually appear “low-lying.” Coordinate improvements with adjacent private/roadside features.
5	CSP	Pipe Arch	Closed	2.08	1.78	Coordinate improvements with adjacent private/roadside features.
6	CSP	Pipe Arch	Closed	2.25	1.62	Coordinate improvements with adjacent private/roadside features.
7	Concrete	Box	Open	4.55	1.5	Culvert appears new.
8	Concrete	Box	Open	4.55	1.62	Culvert appears new.

HDPE – high-density polyethylene

CSP - corrugated steel pipe

2.11 Specific Areas of Interest

2.11.1 Existing Pond

An online pond exists immediately downstream of Culvert 1. The pond appears to have no formalized inlet/outlet controls and appears largely unmaintained, with heavy siltation and overgrown invasive vegetation (Figure 18). Although the pond is not delineated by security fence along the RR50 boundary, the pond appears to be situated largely beyond the RR50 RoW. In addition to the upstream watercourse areas contributing to the pond, one small diameter inlet from the eastern side was located, presumed to provide some function of stormwater servicing to the adjacent private Ontario Provincial Police property.



FIGURE 18 Existing Pond Looking Upstream

It is recommended that better understanding of the ownership/jurisdiction, form/function and maintenance/operation of the pond be further understood by the EA project team, as it pertains to ramifications of the assessed alternatives for improvement. It is understood there is a future easterly extension of George Bolton Parkway, which will require due consideration for Culvert 1 and the pond downstream.

2.11.2 Current Channel Realignment

In consultation with the project team, it has been identified that an approximate 200 m length of the watercourse upstream of Culvert 3 is currently under the process of being realigned by a private landowner (Figure 19).

It is recommended that the status of this realignment be further understood by the EA team, as it pertains to ramifications of the assessed alternatives for improvement.

2.11.3 Previous Channel Realignment

In consultation with the project team, it has been identified that an approximate 80 m length of the watercourse upstream of Culvert 7 has been historically realigned by a private landowner (Figure 20), for which TRCA is currently involved and pursuing restitution.

It is recommended that the status of this realignment be further understood by the EA team, as it pertains to ramifications of the assessed alternatives for improvement.



FIGURE 19 Current Channel Realignment Looking Upstream



FIGURE 20 Previous Channel Realignment Looking Upstream

2.11.4 Landowner Concerns

In consultation with the project team, a private landowner located immediately downstream of Culvert 6 has raised concerns associated with recent stormwater/ditching revisions along the RR50 frontage of the subject property exacerbating/resulting in increased watercourse flows at the rear of the subject property (Figure 21). Furthering landowner concern in this regard is the new establishment of a stormwater management pond on the opposing side of the watercourse, particularly during periods of pond maintenance.

The nature of these issues is deemed beyond the scope of the current study by Matrix and the EA project team. However, if jurisdictions having authority (i.e., Region of Peel/Town of Caledon/TRCA) opt to further investigate the issues cited by the landowner, a series of recommended initial steps include the following:

- meeting with landowner onsite to understand issues
- reviewing historic changes along RR50 frontage, watercourse reach, subject property, stormwater management pond, and adjacent properties

- conducting desktop and detailed field investigation, topo survey, etc. of subject property and adjacent properties
- conducting site-specific hydraulic analysis to review flood extents and frequency



FIGURE 21 Looking Downstream from Culvert 6 (Subject Property on Right)

3 FLUVIAL GEOMORPHIC ASSESSMENT

3.1 Background and Context

In-field geomorphic crossing assessments of the eight existing stream crossings (Culverts 1 to 8) along RR50 between George Bolton Parkway and Mayfield Road were completed by Matrix staff on September 9, 2020. The stream crossing assessment collects data specific to the channel and crossing structure within the vicinity of the road crossing and documents evidence of potential channel-related issues near the crossing (e.g., bank erosion, bed scour, debris trapping, and fish passage). Information regarding crossing type, material, shape, dimensions, and structural conditions are also recorded and is summarized in Section 2.

The reaches of West Robinson Creek within the study area are generally ephemeral, headwater-type streams with a relatively small drainage area (<2 km²). In most locations, the creek is well vegetated with cattails or phragmites, and banks are poorly defined. As a result, it was difficult to accurately ascertain bankfull dimensions of the channel. For the purposes of this assessment, bankfull dimensions were determined as the flow that fills up the channel close to or to the top of bank. Several of the crossings have been historically straightened to serve as roadside drainage ditches along the eastern side of RR50. Crossing locations are illustrated in Appendix A. Seven of the eight crossings within the study area are

located on the east side of RR50. As the proposed cycle track and/or multi-use path is to be constructed on the western side of RR50, West Robinson Creek is expected to have minimal interaction with the pathway, and geomorphic risk to the proposed active transportation measures is considered low. Similarly, for proposed sidewalk on the east side of the roadway between George Bolton Drive and Simona Drive, West Robinson Creek is expected to have minimal interaction with the sidewalk, and geomorphic risk to the proposed active transportation measures is considered low.

Existing geomorphic conditions of each culvert crossing are summarized in the following sections. All references to right or left banks are when looking in the downstream direction.

3.2 Culvert 1

Culvert 1 is located near the intersection of RR50 and George Bolton Parkway, conveying flows under RR50 from west to east. The upstream end consists of two culverts: one oriented westerly to convey approaching watercourse flows (Culvert 1) and one oriented northerly to convey approaching roadside ditch flows (Culvert 1A). Upstream of the crossing the main branch of West Robinson Creek lacks sinuosity and follows a very straight planform with sharp near-90-degree turns. The reach is also largely controlled by ponds both upstream and downstream of RR50. Upstream, the channel contains abundant instream vegetation (cattails) and flow at the time of the field assessment was minimal and generally consisted of stagnant water. The channel is artificially confined along the right bank which borders the Esso gas station. Average bankfull channel dimensions are 3.2 m in width and 0.7 m in depth, with an absence of pool-riffle morphology. The channel is depositional in nature due to the abundance of instream vegetation and substrate dominantly consists of clay and silt. Riprap was previously placed overtop of Culvert 1 and has since slumped into the creek. Average bankfull channel dimensions of the ditch flowing into Culvert 1A are approximately 2.5 m in width and 0.45 m in depth. Roadside banks are near-vertical and stagnant water was present. Similar to Culvert 1, riprap was previously placed overtop of Culvert 1A and has begun to slump into the ditch.

Downstream of RR50, the culvert end was extensively backwatered due to dense instream vegetation (phragmites) and siltation downstream, impeding flow. Backwatering has resulted in local widening of the channel at the culvert, with minor bank erosion noted. Channel banks are poorly defined, making it difficult to accurately determine bankfull dimensions. Locally, at the culvert end the channel, width is larger than the width of the culvert measuring 3.6 m in width with a maximum depth of 1 m. The channel is depositional in nature due to the abundance of instream vegetation and substrate dominantly consists of clay and silt. The watercourse subsequently discharges immediately into a heavily vegetated online pond downstream.

3.3 Culvert 2

Culvert 2 is located approximately 240 m downstream of Culvert 1 at the rear of a private lot and conveys flows from north to south via a single barrel 1,500 mm CSP under a parking lot connection access road.

Upstream, the channel follows a moderately sinuous planform and is confined on both banks. Due to the confined nature of the system, banks were near-vertical and toe/bank erosion was prevalent as evidenced by slumped bank material, fracture lines, and exposed tree roots. Immediately upstream of Culvert 2, a prominent meander exists which is promoting bank erosion and deposition. Exacerbating this issue is a woody debris jam which is currently impeding flow and blocking the connection to the culvert at lower flows. Concrete blocks previously placed as bank protection around the culvert have also failed and begun slumping into the creek. Approximately 90 m upstream of the crossing, the channel is incising with steep bank heights and a suspended armour layer visible in the banks. A man-made weir structure constructed out of concrete has been placed in the channel at this location. Also visible at this location is bank erosion and several displaced small masonry bricks previously placed as bank protection and fill material.

Downstream of the crossing, the channel corridor has been straightened and contains virtually no floodplain as the channel is bordered by an industrial lot. Upstream and downstream, average bankfull channel dimensions were similar, measuring 2.5 m in width and 0.6 m in depth. Channel substrate dominantly consisted of clay and gravel; however, it is possible the gravel is not native and was sourced from the above parking lots during heavy rainfall events.

3.4 Culvert 3

Culvert 3 is located approximately 420 m downstream of Culvert 2 and is adjacent to the east side of RR50. Upstream of the crossing, approximately 200 m of channel is currently in the process of being re-aligned and is under construction, therefore geomorphic observations (i.e., bankfull dimensions, substrate, etc.) were not possible. Wetted channel dimensions at the time of the assessment were 2.95 m in width and 0.5 m in depth at the culvert upstream end. The current crossing appears stable, with the channel width equal to the opening width of the structure and armourstone blocks placed around the culvert for added protection. The channel flows to the right as it enters the culvert, and a gravel point bar has formed toward the downstream end of the culvert. Culvert footings are partially exposed.

Downstream, the channel planform is straight, and the channel serves as a roadside ditch to convey flows parallel to RR50. The watercourse is confined on the right bank by the road embankment and unconfined on the left bank. As a result, at high flow events, flow would dissipate into the adjacent parking lot to the left. The channel is bordered by mowed, well-manicured grass, resulting in minor bank slumping due to the lack of root cohesion. Channel dimensions are much narrower than upstream, with an average bankfull width of 1.2 m and depth of 0.3 m. Rounded to sub-rounded cobble and pebbles were present throughout the reach, in addition to minor sand and clay/silt.

3.5 Culvert 4

Culvert 4 is located approximately 85 m downstream of Culvert 3 and is adjacent to the east side of RR50. Both upstream and downstream of the crossing, the channel serves as a roadside ditch to convey flows parallel to RR50 and is confined by the road embankment to the right, and a parking lot to the left.

Approximately 10 m upstream of the crossing, the channel has been recently armoured with riprap and contains sparse cattails.

Downstream, the entire reach entire reach is filled with cattails. As a result, channel substrate mainly consists of fine sediment (clay and silt) due to the depositional nature of the reach. Average bankfull channel dimensions are approximately 5.5 m in width and 0.4 m in depth.

3.6 Culvert 5

Culvert 5 is located approximately 50 m downstream of Culvert 4 and is adjacent to the east side of RR50. Similar to Culvert 4, the channel serves as a roadside ditch to convey flows and is confined on the right by the road embankment. Immediately downstream of the culvert, there is a stormwater outfall on the right bank, that at the time of the assessment contained standing water. Upstream and downstream of the crossing, the ditch contains abundant cattails. Riprap has been placed over top and around the culvert for added protection. Average bankfull channel dimensions were approximately 3.5 m in width and 0.6 m in depth.

3.7 Culvert 6

Culvert 6 is located approximately 30 m downstream of Culvert 5 and is adjacent to the east side of RR50. Upstream of the crossing, the channel conveys flows as a roadside ditch along RR50, while downstream the channel regains sinuosity and flows easterly behind residential properties through a wooded area. Average bankfull channel dimensions were approximately 3 m in width and 0.4 m in depth.

Downstream of the crossing, most of the reach flows through a wooded area, where woody debris is common within the channel and on the banks. Within this area, the channel is stable with minimal bed and/or bank erosion noted. The channel lacks a sequence of well-defined pool-riffles; however, coarse substrate (gravel, pebbles, cobbles) was observed in the transitional areas. As the creek exits the wooded area and flows back toward RR50, the channel is actively incising, as evidenced by steep bank heights and suspended armour layer in the banks. It is understood that this part of the channel was historically re-aligned by a private landowner, for which TRCA is currently involved and pursuing restitution.

3.8 Culvert 7

Culvert 7 is located approximately 375 m downstream of Culvert 6 and is adjacent to the east side of RR50. Within the vicinity of the crossing, the channel conveys flows as a roadside ditch along RR50. The channel contains abundant instream vegetation such as cattails, tall grasses, and willow shrubs. At the culvert outlet, the presence of dense instream vegetation is impeding flows and has resulted in a buildup of fine sediment and minor debris. Channel substrate mainly consists of fine sediment (clay and silt) due to the depositional nature of the reach. Average bankfull channel dimensions were approximately 4 m in width and 0.6 m in depth.

3.9 Culvert 8

Culvert 8 is located approximately 50 m downstream of Culvert 7 and is adjacent to the east side of RR50. Similar to Culvert 7, the channel conveys flows as a roadside ditch parallel to RR50. Upstream and downstream of the crossing the channel is well vegetated with cattails and tall grasses and as a result, channel substrate dominantly consists of clay and silt. The channel is confined on the right by the road embankment where large armourstone blocks have been placed for added bank/culvert stability. Average bankfull channel dimensions were approximately 3 m in width and 0.7 m in depth.

3.10 Specific Areas of Interest

3.10.1 Culvert 1

The proposed cycle track and/or multi-use path and the resultant drainage improvements are planned on the west side of RR50 over Culvert 1. As such, this is the only location where the creek will have some interaction with the EA improvements, although geomorphic risk to the proposed active transportation measures is considered low. As the pathway is to cross over the Culvert 1, an erosion hazard assessment was not completed. The channel upstream of Culvert 1 is heavily modified (straightened and bermed in locations), and the delineation of the erosion hazard would extend into existing properties, therefore it was deemed not necessary for the purposes of the pathway planning. In this location, West Robinson Creek is an ephemeral, headwater-type feature with a small drainage area (~1 km²) and poorly defined banks and is not expected to migrate laterally. Additionally, there is no evidence of active erosion near the crossing as the channel is densely vegetated and depositional in nature.

Given the existing culvert system is anticipated to require modifications/extensions, it is recommended, at minimum, the upstream end be further understood by the EA project team, as it pertains to ramifications of the assessed alternatives for improvement.

4 HYDRAULIC ASSESSMENT

A hydraulic assessment was completed to analyze the performance of West Robinson Creek, including Culverts 1 to 8 during various design storm events and the Regional event. An existing HEC-RAS hydraulic model was updated with 2020 topographic survey data provided by RVA and collected hydraulic information to ensure the updated model is appropriate for this study. For each culvert, the hydraulic model was used to verify whether the culvert is fully submerged and whether the driveway over the culvert is overtopped by flowing water. In addition, Culvert 1, and Culverts 3 to 8 are adjacent to RR50. the hydraulic model was used to identify whether water is likely to spill onto RR50 due to backwater impact from the culvert.

4.1 Model Development

TRCA provided the current approved HEC-RAS hydraulic model to use in this study. Matrix updated the TRCA model with the latest topography based on survey data and site reconnaissance within the study area. The following summarizes detailed model updates.

- Culvert 3: Matrix site reconnaissance and RVA topographic survey data showed that Culvert 3 is a corrugated steel arch with height approximately 1.8 m. However, Culvert 3 in the TRCA model indicated a height of 1.4 m. Matrix updated the Culvert 3 height to 1.8 m. A 0.5 m blockage of gravel/cobble was observed during the site reconnaissance; however, Matrix omitted this from the model in order to represent full capacity of the existing culvert.
- Culvert 4: Culvert 4 was not included in the provided TRCA model. Matrix added Culvert 4 based on field survey. This culvert is a corrugated steel arch culvert with a width and height approximately 2.26 m and 1.62 m, respectively. Upstream and downstream invert elevations were obtained from RVA topographic survey data.
- Following a detailed comparison of the modelled cross-sections to the topographic survey data provided by RVA, Matrix revised a number of cross-sections to ensure detailed representation of both the channel and overbank areas including the top of the road elevation. This update to precise cross-section data is important to yield accurate results. These revisions are documented within the model notes.
- In addition to cross-section data, the use of appropriate levee elevation and location in the cross-section is important to the assessment of overtopping conditions. Matrix added levees at appropriate locations and elevation in the cross-section profile. In particular, levees were added at the crown of RR50 as flow in Robinson Creek will not have access to the west ditch.
- Matrix found that cross-sections 2223.38 and 2223.15 were not properly geo-referenced. Matrix updated the cross-section outline to an appropriate GIS location.

4.2 Design Flows

Design flows in the HEC-RAS model were provided by TRCA, and confirmed to be consistent with the most current available data which is the TRCA Humber River Hydrology Update Report (Civica 2015). Subsequently, TRCA has updated the design flows for channel section between George Bolton Parkway and Mayfield Road/Albion Vaughan Road. Flowrates from 2-year through 100-year and the Regional event were reduced compared to previous values. The validity of updated flowrates was confirmed by RVA. Design flows, ranging from 2- to 100-year events as well as the Regional event were applied at seven different cross-sections of the watercourse. Details are presented in Table 2.

TABLE 2 Design Flows

Cross-section	Description of Location	Flow Rate (m ³ /s)						
		2-year	5-year	10-year	25-year	50-year	100-year	Regional
2224.08	Model upstream end near McEwan Drive West	1.98	2.82	3.39	4.27	5.05	5.73	8.70
2223.56	70 m upstream of Hopcroft Road	2.46	3.50	4.21	5.30	6.27	7.11	10.80
2223.45	20 m upstream of Culvert 1 (George Bolton Parkway and RR50)	3.11	4.26	5.11	6.18	7.05	7.90	13.80
2223.37	Upstream face of Culvert 2 (Enterprise Car Rental)	3.34	4.58	5.48	6.64	7.57	8.49	14.97
2223.20	Upstream face of Culvert 6 (U-Haul)	3.57	4.89	5.85	7.08	8.08	9.06	16.25
2223.04	220 m downstream of Culvert 8, 70 m upstream of Mayfield Road	5.69	8.09	9.73	11.99	13.77	15.81	18.56
2219.56	100 m downstream of Mayfield Road	6.08	8.72	10.49	12.98	14.95	17.19	38.30

4.3 Culvert 1

Due to its complex hydraulic situation (i.e., two inlet barrels and one outlet barrel), Culvert 1 and Culvert 1A were modelled using a custom rating curve which was provided within the existing TRCA model. The Cole Engineering Group Ltd. report (2015) indicated that the custom rating curve was derived with appropriate setup of dimension and flow values in FlowMaster. Matrix assumed the rating curve approach in the model is correct.

Table 3 presents the hydraulic results of Culverts 1 and 1A. The results indicate that both Culverts 1 and 1A experience full submergence during the 2-year event and greater. The driveway over Culvert 1, which serves as the northern entrance to the gas station, has a ground elevation of 238.5 m according to the RVA topographic survey data. The water level results from the model indicate that this driveway over Culvert 1 experiences overtopping during the 2-year event and greater. Figure 22 shows the water extent on cross-sections adjacent to Culvert 1 for the Regional event. It is shown that water overtopping the adjacent gas station driveway will spill eastly toward RR50 and spill southerly through the gas station.

TABLE 3 Culvert 1 HEC-RAS Results

Component	Value (m)						
C1 Upstream Invert Elevation	236.76						
C1 Upstream Obvert Elevation	237.36						
C1A Upstream Invert Elevation	236.79						
C1A Upstream Obvert Elevation	237.67						
Driveway Elevation	238.50						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.11	4.26	5.11	6.18	7.05	7.90	13.80
Water Surface Elevation (m)	238.50	238.54	238.56	238.59	238.61	238.63	238.75
Freeboard to Obvert Elevation on Culvert 1 (m)	-1.14	-1.18	-1.20	-1.23	-1.25	-1.27	-1.39
Culvert Submergence on Culvert 1	Y	Y	Y	Y	Y	Y	Y
Freeboard to Obvert Elevation on Culvert 1A (m)	-0.83	-0.87	-0.89	-0.92	-0.94	-0.96	-1.08
Culvert Submergence on Culvert 1A	Y	Y	Y	Y	Y	Y	Y
Freeboard to Driveway (m)	0.00	-0.04	-0.06	-0.09	-0.11	-0.13	-0.25
Driveway Overtopping	Y	Y	Y	Y	Y	Y	Y

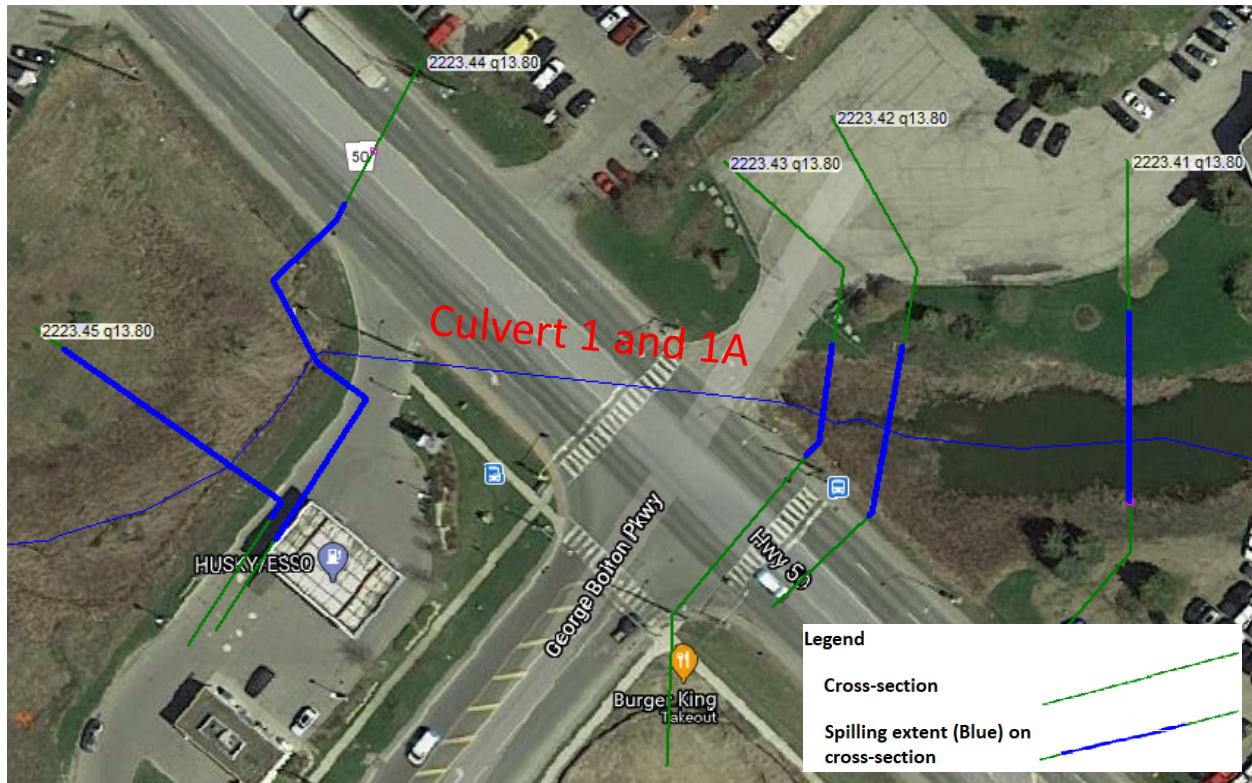


FIGURE 22 Culvert 1 Water Extents on Cross-sections During the Regional Event

4.4 Culvert 2

Table 4 presents the hydraulic results of Culvert 2. The results indicate that Culvert 2 experiences full submergence during the 2-year event and greater. The driveway over Culvert 2 experiences overtopping during the 5-year event and greater. Figure 23 plots water extents on cross-sections adjacent to Culvert 2

during the Regional event. Water overtopping the driveway returns to the channel downstream of the culvert and does not spill toward the north and south directions. As Culvert 2 is located at the rear of a private lot and reasonably distant from RR50 (about 130 m away), water levels at Culvert 2 have no impact on RR50.

TABLE 4 Culvert 2 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	233.38						
Upstream Obvert Elevation	234.93						
Driveway Elevation	235.49						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.34	4.58	5.48	6.64	7.57	8.49	14.97
Water Surface Elevation (m)	235.07	235.53	235.70	235.79	235.86	235.91	236.12
Freeboard to Obvert Elevation (m)	-0.14	-0.60	-0.77	-0.86	-0.93	-0.98	-1.19
Culvert Submergence	Y	Y	Y	Y	Y	Y	Y
Freeboard to Driveway (m)	0.42	-0.04	-0.21	-0.30	-0.37	-0.42	-0.63
Driveway Overtopping	N	Y	Y	Y	Y	Y	Y

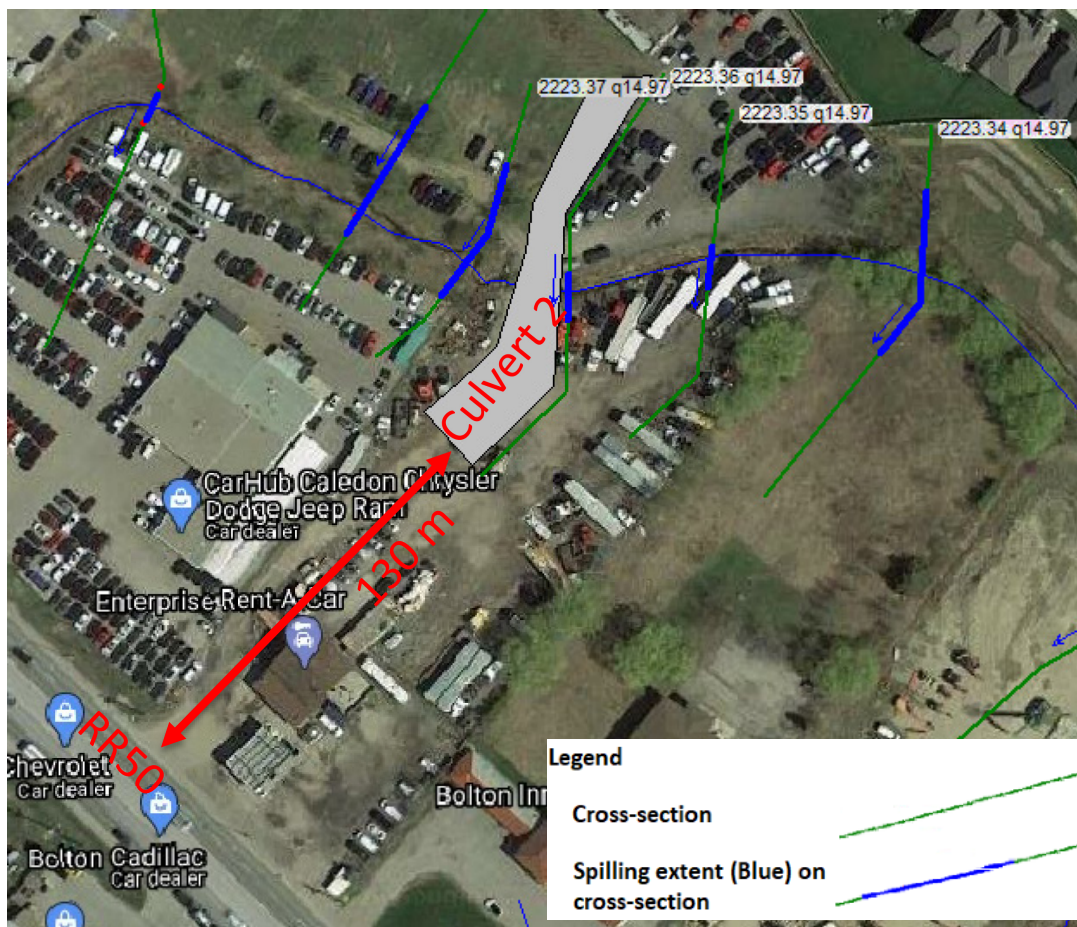


FIGURE 23 Culvert 2 Water Extents on Cross-sections during the Regional Event

4.5 Culvert 3

Tables 5 presents the hydraulic results of Culverts 3. The results indicate that Culvert 3 experiences full submergence during 100-year and Regional events. The driveway over Culvert 3 experiences overtopping during the Regional event.

TABLE 5 Culvert 3 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	231.18						
Upstream Obvert Elevation	233.08						
Driveway Elevation	233.30						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.34	4.58	5.48	6.64	7.57	8.49	14.97
Water Surface Elevation (m)	232.05	232.24	232.40	232.65	232.89	233.09	233.41
Freeboard to Obvert Elevation (m)	1.03	0.84	0.68	0.43	0.19	-0.01	-0.33
Culvert Submergence	N	N	N	N	N	Y	Y
Freeboard to Driveway (m)	1.25	1.06	0.90	0.65	0.41	0.21	-0.11
Driveway Overtopping	N	N	N	N	N	N	Y

4.6 Culvert 4

Tables 6 presents the hydraulic results of Culverts 4. The results indicate Culvert 4 experiences full submergence during the 10-year event and greater. The driveway over Culvert 4 experiences overtopping during the 50-year event and greater.

TABLE 6 Culvert 4 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	230.41						
Upstream Obvert Elevation	232.03						
Driveway Elevation	232.51						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.34	4.58	5.48	6.64	7.57	8.49	14.97
Water Surface Elevation (m)	231.56	231.85	232.05	232.32	232.59	232.75	233.07
Freeboard to Obvert Elevation (m)	0.47	0.18	-0.02	-0.29	-0.56	-0.72	-1.04
Culvert Submergence	N	N	Y	Y	Y	Y	Y
Freeboard to Driveway (m)	0.95	0.66	0.46	0.19	-0.08	-0.24	-0.56
Driveway Overtopping	N	N	N	N	Y	Y	Y

Figure 24 plots water extents on cross-sections adjacent to Culvert 3 and 4 for the 2-year and Regional events. The watercourse in this area experiences high water level during the 2-year through the Regional event. The multi-unit commercial property and its parking lot, which is on the east bank of the watercourse, experience flooding during the 2-year event and greater. RR50, which is on the west bank of the watercourse, does not experience flow on the road during the 2-year through 100-year events. During the Regional event, water at the downstream channel of Culvert 4 encroaches on RR50 but does not overtop the road crown or spill to other side of RR50.

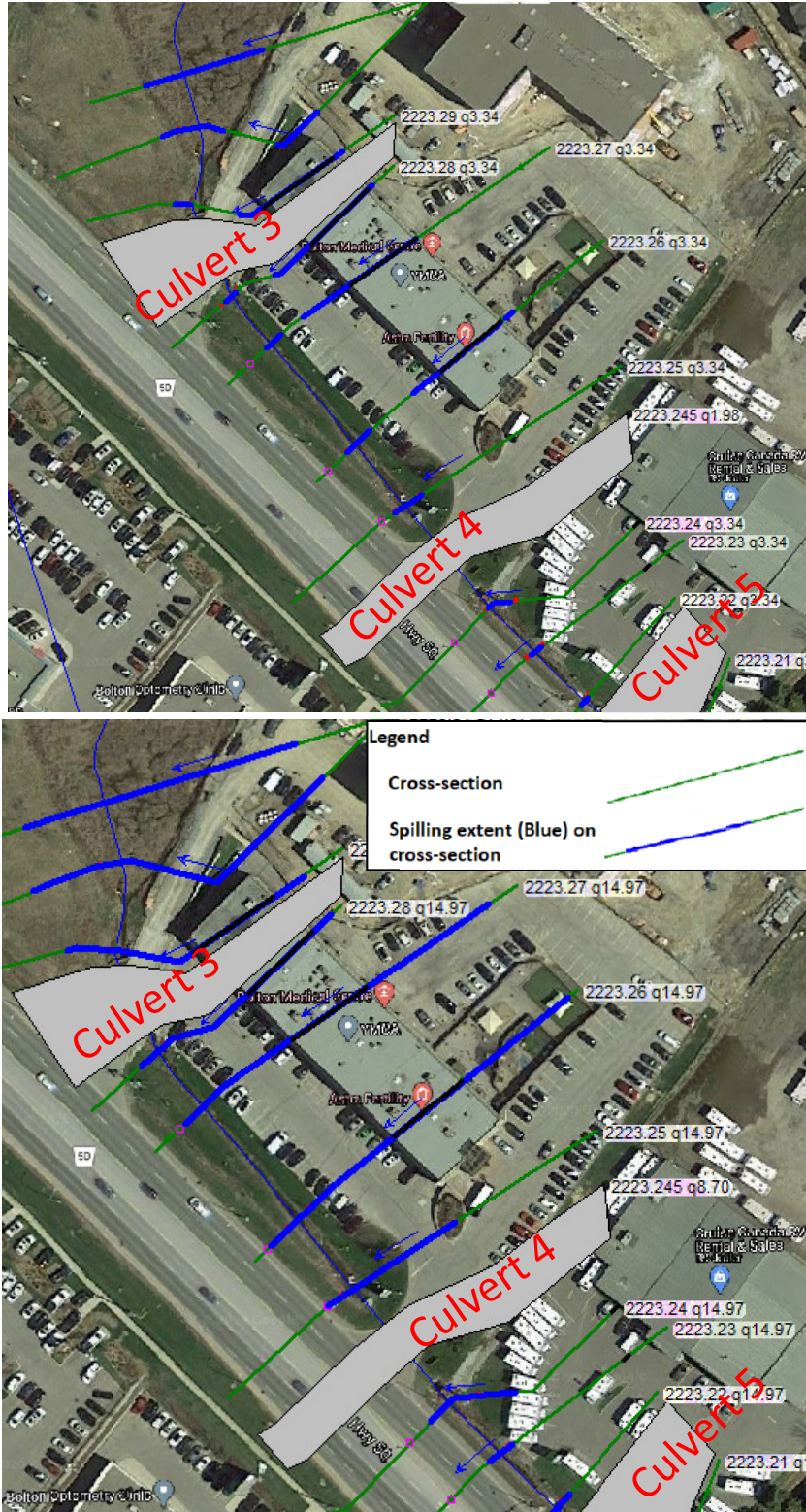


FIGURE 24 Culverts 3 and 4 Water Extents on Cross-sections During the 2-year (Top) and Regional Event (Bottom)

4.7 Culvert 5

Table 7 presents the hydraulic results of Culvert 5. The results indicate that Culvert 5 experiences full submergence during the Regional event. Also, during the Regional event, water encroaches on RR50 and the water level is high enough to overtop to the west side of RR50, as shown in Figure 25. The driveway over Culvert 5 does not experience overtopping during any modelled events.

TABLE 7 Culvert 5 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	230.15						
Upstream Obvert Elevation	231.60						
Driveway Elevation	232.00						
RR50 Elevation	231.85						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.34	4.58	5.48	6.64	7.57	8.49	14.97
Water Surface Elevation (m)	230.81	230.96	231.04	231.26	231.43	231.58	231.98
Freeboard to Obvert Elevation (m)	0.79	0.64	0.56	0.34	0.17	0.02	-0.38
Culvert Submergence	N	N	N	N	N	N	Y
Freeboard to Driveway (m)	1.19	1.04	0.96	0.74	0.57	0.42	0.02
Driveway Overtopping	N	N	N	N	N	N	N
Freeboard to RR50 Elevation (m)	1.04	0.89	0.81	0.59	0.42	0.27	-0.13
Overtopping to the West Side of RR50	N	N	N	N	N	N	Y

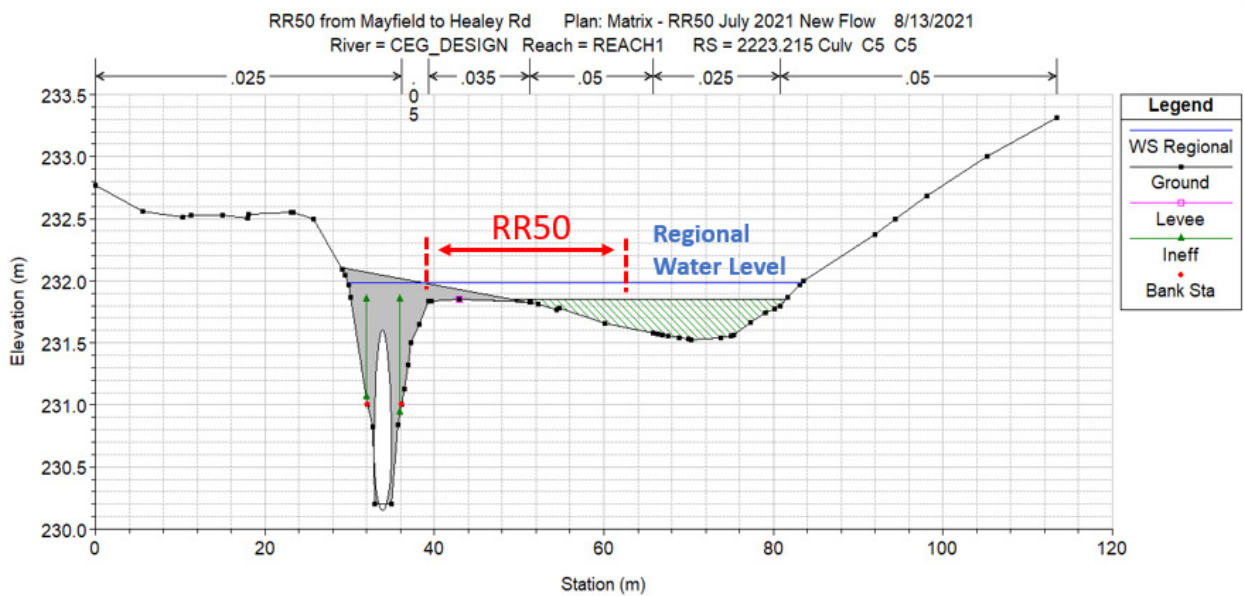


FIGURE 25 Water Levels Overtopping to the West Side of RR50 During the Regional Event at Upstream Face of Culvert 5 (Left to Right Looking Downstream).

4.8 Culvert 6

Table 8 presents the hydraulic results of Culvert 6. The results indicate that Culvert 6 experiences full submergence and driveway overtopping during the Regional event.

TABLE 8 Culvert 6 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	229.30						
Upstream Obvert Elevation	230.90						
Driveway Elevation	231.28						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.57	4.89	5.85	7.08	8.08	9.06	16.25
Water Surface Elevation (m)	230.12	230.27	230.38	230.56	230.67	230.75	231.52
Freeboard to Obvert Elevation (m)	0.78	0.63	0.52	0.34	0.23	0.15	-0.62
Culvert Submergence	N	N	N	N	N	N	Y
Freeboard to Driveway (m)	1.16	1.01	0.90	0.72	0.61	0.53	-0.24
Driveway Overtopping	N	N	N	N	N	N	Y

Figure 26 plots water extents on cross-sections adjacent to Culverts 4, 5, and 6 for the 100-year and Regional events. During 2-year through 100-year events, water is contained in the channel and does not encroach on RR50. During the Regional event, the watercourse experiences high water levels from backwater upstream of Culvert 5. In this case, water encroaches RR50 and spills across to the west side of the road. Water is contained in the channel sections between Culvert 5 and 6 during 2-year through 100-year events. During the Regional event in this reach, water encroaches on RR50 but does not overtop the road crown.

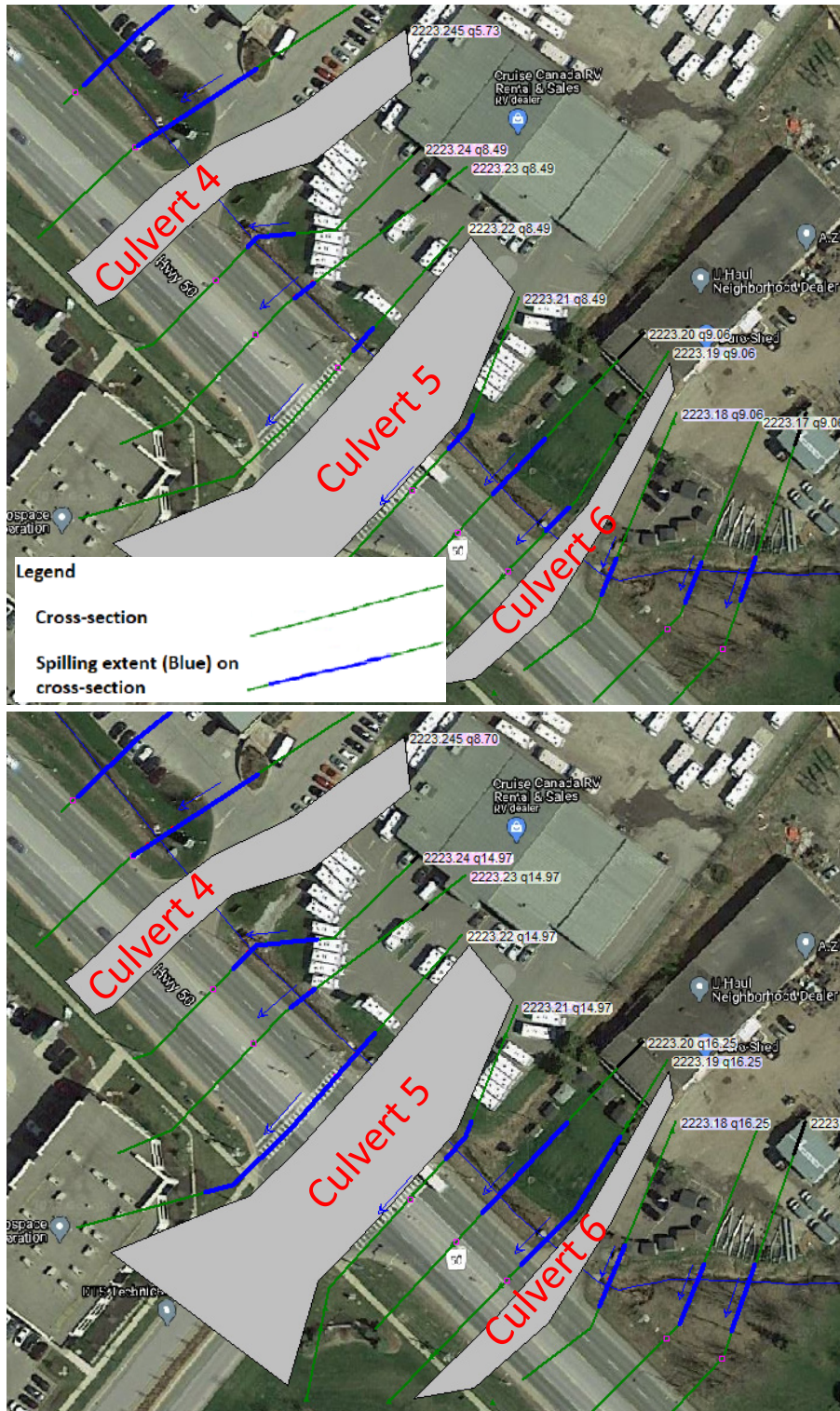


FIGURE 26 Culverts 5 and 6 Water Extents on Cross-sections during the 100-year (Top) and Regional Events (Bottom)

4.9 Culvert 7

Tables 9 presents the hydraulic results of Culverts 7. The results indicate that Culvert 7 experiences full submergence during the 25-year event and greater. The driveway over Culvert 7 experiences overtopping during the Regional event. RR50 Adjacent to Culvert 7 has the same roadway elevation with driveway elevation. During the Regional event, water encroaches on RR50 and the water level is high enough to overtop to the west side of RR50, as shown in Figure 27.

TABLE 9 Culvert 7 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	226.70						
Upstream Obvert Elevation	228.15						
Driveway Elevation	228.74						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.57	4.89	5.85	7.08	8.08	9.06	16.25
Water Surface Elevation (m)	227.85	227.99	228.04	228.19	228.28	228.36	228.82
Freeboard to Obvert Elevation (m)	0.30	0.16	0.11	-0.04	-0.13	-0.21	-0.67
Culvert Submergence	N	N	N	Y	Y	Y	Y
Freeboard to Driveway (m)	0.89	0.75	0.70	0.55	0.46	0.38	-0.08
Driveway Overtopping	N	N	N	N	N	N	Y

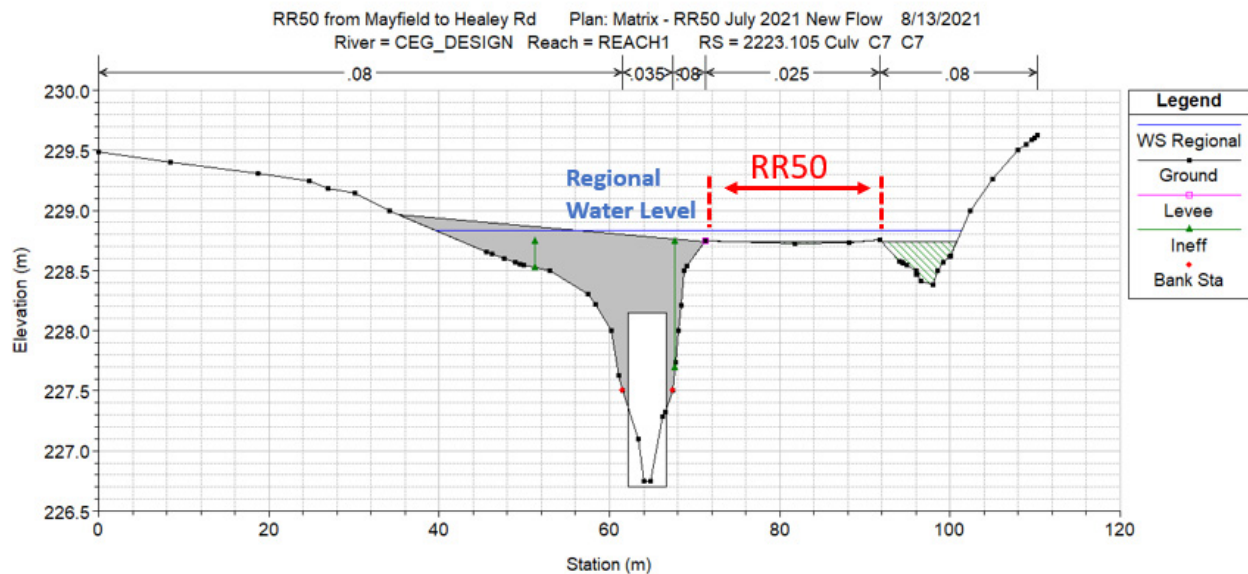


FIGURE 27 Water Levels Overtopping to the West Side of RR50 During the Regional Event at Upstream Face of Culvert 7 (Left to Right Looking Downstream).

4.10 Culvert 8

Tables 10 presents the hydraulic results of Culverts 8. Culvert 8 is capable of conveying flows for all modelled events with no submergence or driveway overtop.

TABLE 10 Culvert 8 HEC-RAS Results

Component	Value (m)						
Upstream Invert Elevation	226.29						
Upstream Obvert Elevation	227.99						
Driveway Elevation	228.25						
Return Period	2-year	5-year	10-year	25-year	50-year	100-year	Regional
Flow (m ³ /s)	3.57	4.89	5.85	7.08	8.08	9.06	16.25
Water Surface Elevation (m)	226.94	227.10	227.19	227.31	227.39	227.46	227.82
Freeboard to Obvert Elevation (m)	1.05	0.89	0.80	0.68	0.60	0.53	0.17
Culvert Submergence	N	N	N	N	N	N	N
Freeboard to Driveway (m)	1.31	1.15	1.06	0.94	0.86	0.79	0.43
Driveway Overtopping	N	N	N	N	N	N	N

Figure 28 plots water extents on cross-sections adjacent to Culverts 7 and 8 for the Regional event. During the 2-year through 100-year events, water does not encroach RR50 at any adjacent. During the Regional event, the watercourse experiences high water levels from backwater upstream of Culvert 7. In this case, water encroaches RR50 and spills across to the west side of the road. For reaches downstream of Culvert 7 and adjacent to Culvert 8, water is contained in the channel and does not encroach RR50.

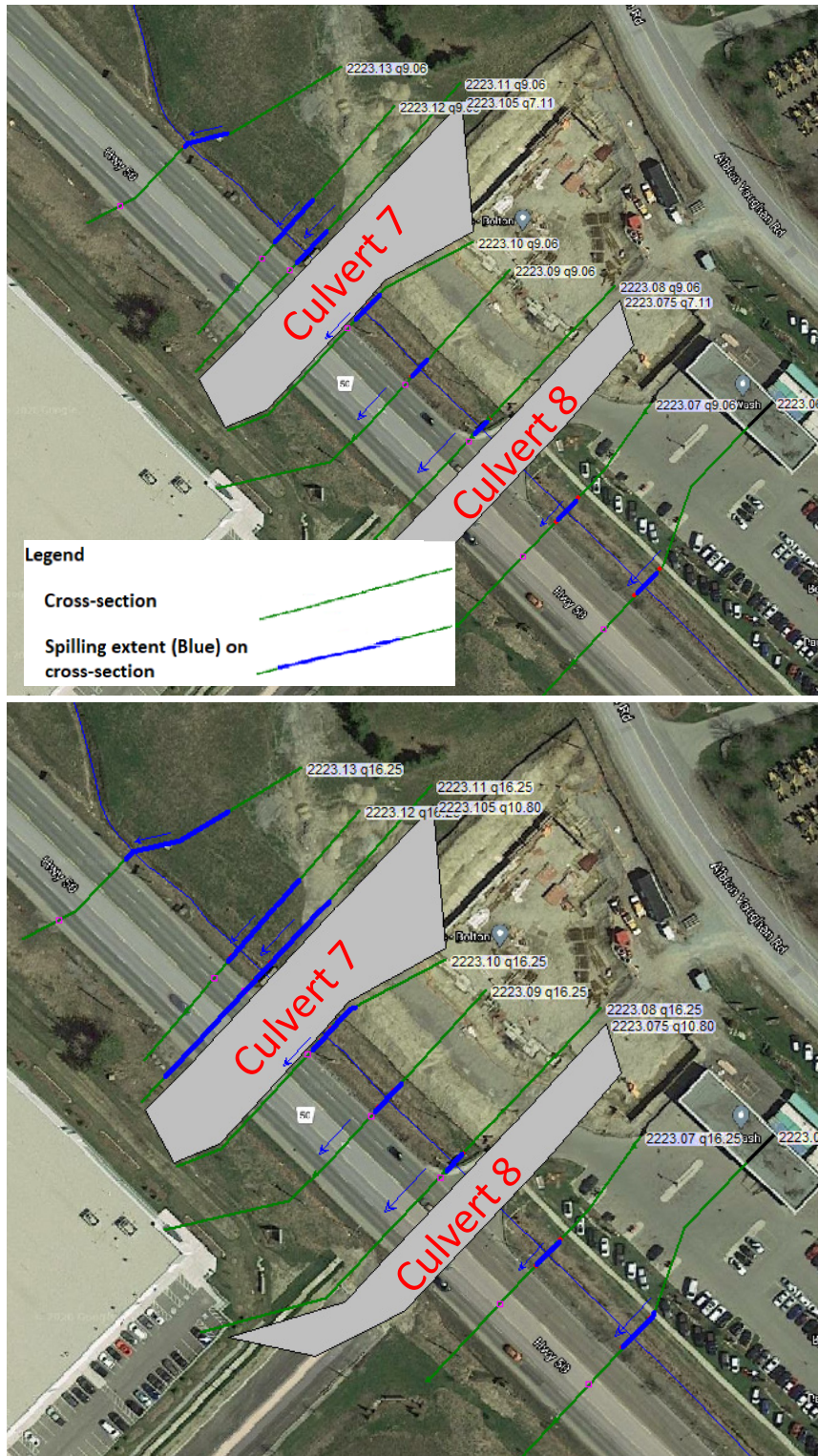


FIGURE 28 Culverts 7 and 8 Water Extents on Cross-sections During the 100-year (Top) and Regional Event (Bottom)

4.11 Specific Areas of Interest

4.11.1 Regional Road 50

Based on Ontario Ministry of Transportation's *Highway Drainage Design Standards* (MTO 2008) for arterial and collector roads adjacent to watercourses, new culverts for parallel watercourses should be designed to convey the 100-year flow and maintain 0.5 m freeboard to the top of the adjacent road subgrade (MTO 2008, Section SD 12). This standard is most commonly applied to new culvert installations and exceptions can be made based on limitations caused by local constraints. Model results of existing conditions showing that Culverts 1 to 7 experience driveway overtopping during high flow events indicate that the culverts are unlikely to meet this standard. Culverts 1, 5, 6, and 7 cause flow to spill onto RR50 while Culverts 2, 3, 4, and 8 do not. Culvert 8 is the only culvert that does not experience submergence or overtopping for all modelled events.

- Backwater from Culvert 1 is expected to spill on RR50 through the entrance driveway of the gas station during the 2-year event.
- As Culvert 2 is distant from RR50, backwater from Culvert 2 has no impact on RR50.
- Backwater from Culverts 3 and 4 generally do not cause flooding on RR50 but do cause flooding on the east bank where the multi-unit commercial property is located.
- Backwater from Culvert 5 contributes to flooding on RR50 during the Regional event. Water is expected to spill over the road crown and to the west side of RR50.
- Backwater from Culvert 6 encroaches RR50 during the Regional event. Water encroaching on RR50 is not high enough to spill over the road crown.
- Backwater from Culvert 7 contributes to flooding on RR50 during the Regional event. Water is expected to spill over the road crown and to the west side of RR50.
- Culverts 8 is capable of conveying water within the channel and not spill on RR50 during all modelled events.

4.11.2 Spilling Extent

Refer to Appendix F for results of flood extents over entire watercourse along Culverts 1 to 8, summarizing water extents on each HEC-RAS cross-section for storm events from 2-year through the Regional event.

4.11.3 Sensitivity Analysis on Proposed Mayfield Road Culvert

RVA informed Matrix that the Mayfield Road culvert, which is located approximately 290 m downstream of Culvert 8, will be replaced with a new design of twin culverts during future construction. To verify the

effects of the proposed twin culverts within the study area, a sensitivity analysis was carried out to compare the hydraulic conditions resulting from the existing culvert and the proposed twin culverts. Table 11 summarizes the dimensions of existing culvert and proposed twin culverts.

TABLE 11 Culvert 8, Dimensions of Existing Culvert and Proposed Twin Culverts at Mayfield Road

Parameters	Existing Culvert	Proposed Twin Culverts
Number of Barrels	1	2
Shape	box	box
Material	concrete	concrete
Height (m)	1.5	1.5
Width (m)	4.5	3
Upstream Invert Elevation (m)	224	224
Downstream Invert Elevation (m)	223.75	223.61

Figure 29 shows water level profiles for existing and proposed conditions during three storm events including the 2-year, 25-year, and the Regional events. The results show that the proposed twin culverts lower water levels immediately upstream, but the improvements do not extend as far upstream as Culvert 8 for any of the events. Near Mayfield Road, the increased capacity of proposed twin culverts leads water level decrease compared with the existing water level. Table 12 shows the water levels and differences between the existing and proposed conditions at the upstream end of Mayfield Road. It is found that water levels are decreased on the proposed conditions from 2-year through the Regional event. Overall, the proposed Mayfield Road twin culverts do not alter the hydraulic performance of Culvert 8 and do not alter spill conditions on RR50 during all modelled events.

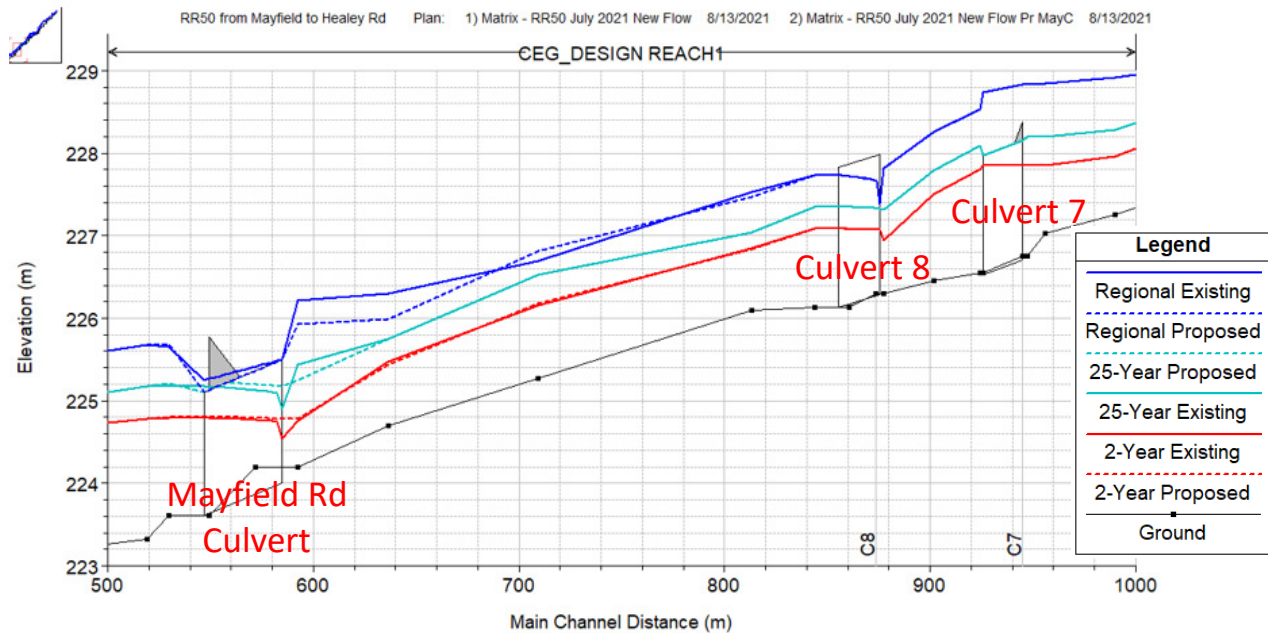


FIGURE 29 Water Level Profile for Existing Mayfield Road Culvert and Proposed Mayfield Road Culvert During the 2-year, 25-year, and the Regional events

TABLE 12 Water Levels and Differences Between Existing Culvert and Proposed Twin Culverts at the Upstream End of Mayfield Road (Cross-section 2223.03)

Event	Existing Culvert Water Surface Elevation at Inlet (m)	Proposed Twin Culverts Water Surface Elevation at Inlet (m)	Difference (Proposed - Existing) (m)
2-year	224.76	224.79	0.03
25-year	225.43	225.25	-0.18
Regional	226.22	225.93	-0.29

5 REFERENCES

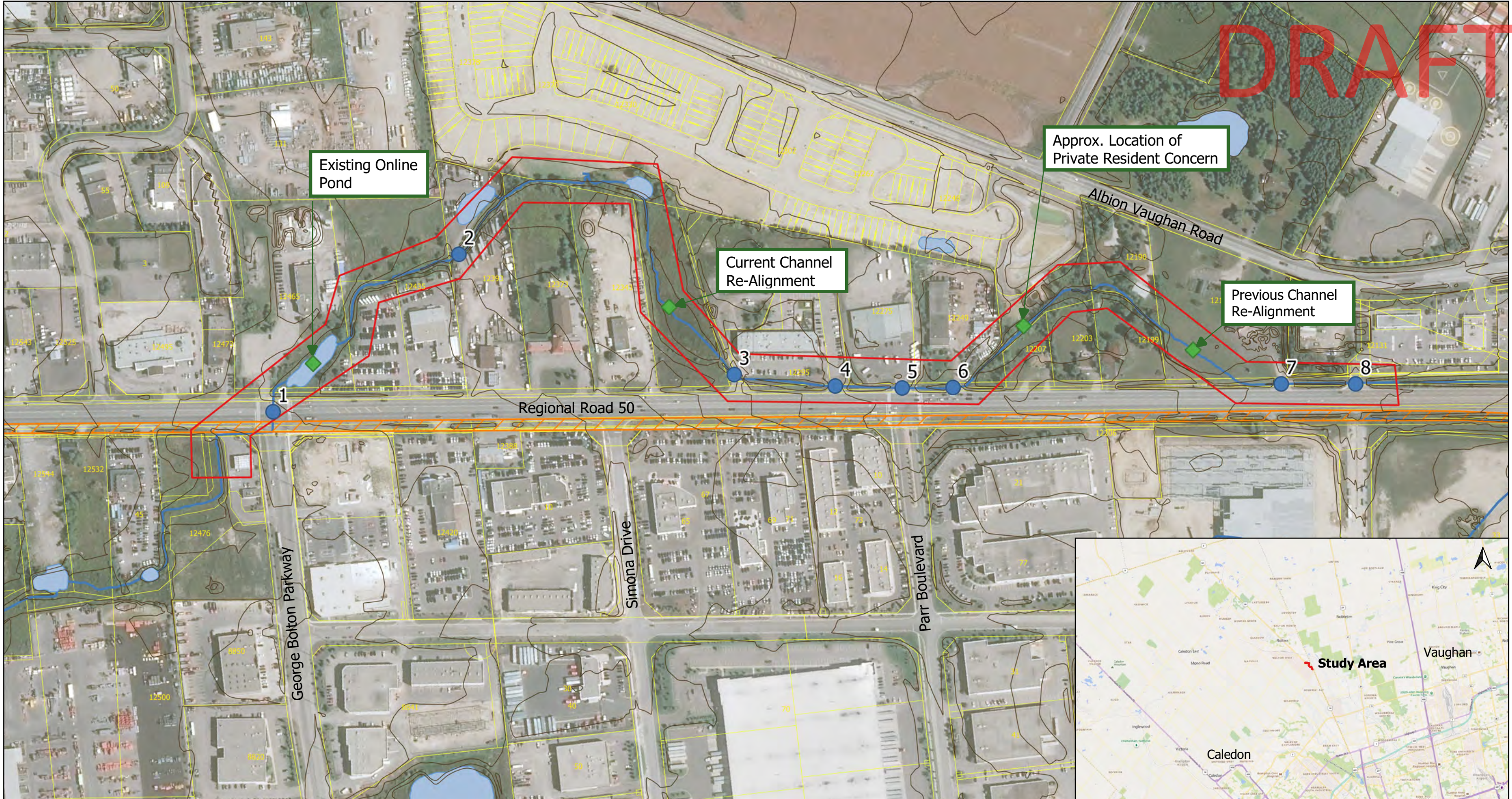
Civica Infrastructure Inc. (Civica). 2015. *Final Report Humber River Hydrology Update*. Prepared for Toronto and Region Conservation Authority (TRCA). Vaughan, Ontario. June 2015.

Cole Engineering Group Ltd. (Cole Engineering). 2015. *Floodplain Mapping Development: Assignment #2 EWR-14-03 Engineering Retainer - 2014 Flood Mapping*. March 2015.

Ontario Ministry of Transportation (MTO). 2008. *Highway Drainage Design Standards*. Downsview, Ontario. January 2008.

APPENDIX A
Study Area Plan

DRAFT



Approx. Location of Private Resident Concern

Existing Online Pond

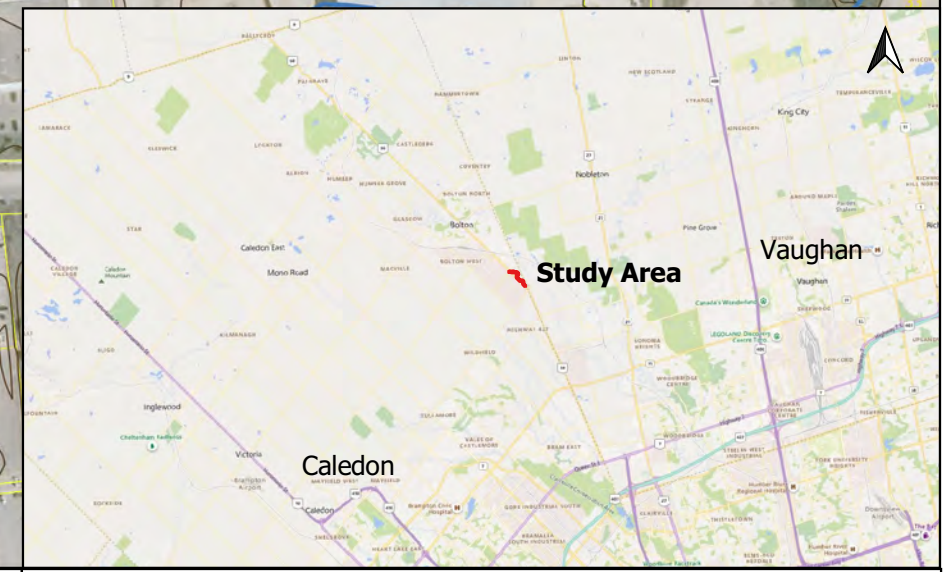
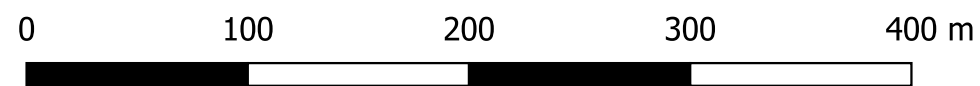
Current Channel Re-Alignment

Previous Channel Re-Alignment

Figure Date: December 4, 2020

- Legend**
- Culvert Crossing
 - ◆ Special Areas of Interest
 - Study Area
 - Contours 1m
 - Active Transportation and Drainage Improvements
 - Waterbody
 - West Robinson Creek
 - Property Boundaries

Notes:
 1. Aerial photo from Bing (2020 Microsoft Corporation)
 2. This drawing must be used in conjunction with the attached report, dated December 2020 and is subject to the same limitations and conditions stated in the memorandum.



Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

30854 - RVA Regional Road 50 EA

Project #:

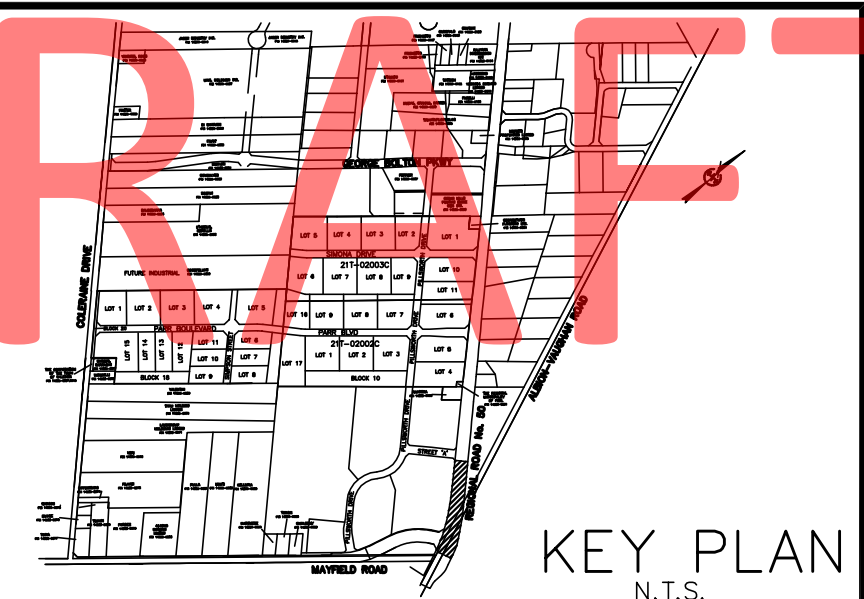
Study Area Plan

Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

msamson
pcampbell
Figure A

APPENDIX B
Applicable Record Drawings

DRAFT



FOR GENERAL NOTES
REFER TO DWG C3

- LEGEND**
- HYDRANT AND VALVE
 - CATCHBASIN
 - PROPOSED STORM MANHOLE
 - PROPOSED SANITARY MANHOLE
 - PROPOSED CATCHBASIN MANHOLE
 - PROPOSED ELEVATION
 - EXISTING ELEVATION
 - VALVE AND BOX
 - VALVE AND CHAMBER

TOWN OF CALEDON
APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____

APPROVED BY: _____
C.A. CAMPBELL, C.E.T.
DIRECTOR OF PUBLIC WORKS & ENGINEERING

CONTRACTOR TO BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ALL EXISTING UNDERGROUND AND ABOVE UTILITIES AND SERVICES. THE CONTRACTOR SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH CONSTRUCTION. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCED NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. A.M. CANDARAS ASSOCIATES INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

PLAN OF SUBDIVISION OF
PART OF THE EAST HALF OF LOT 1,
CONCESSION 6,
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

BENCH MARK

REGION OF PEEL #37 ELEV. 227.187m
ON THE NORTH FACE AT THE EAST CORNER OF A RED INSUL. BRICK HOUSE LOCATED ON THE SOUTH WEST CORNER OF SEVENTEENTH SIDEROAD (REGION ROAD #14) AND HIGHWAY #50

No.	Date	By	REVISIONS
7	08/28/06	M.F.S.	FINAL SUBMISSION, PHASE II FOR REGION
6	02/21/06	M.F.S.	4th SUBMISSION, PHASE II FOR TOWN
5	12/16/07	M.F.S.	3rd SUBMISSION, PHASE II FOR TOWN
4	07/16/07	M.F.S.	3rd SUBMISSION, PHASE II FOR REGION
3	06/28/07	M.F.S.	2nd SUBMISSION, PHASE II FOR TOWN
2	06/22/07	M.F.S.	2nd SUBMISSION, PHASE II FOR REGION
1	07/07/06	M.F.S.	1st SUBMISSION

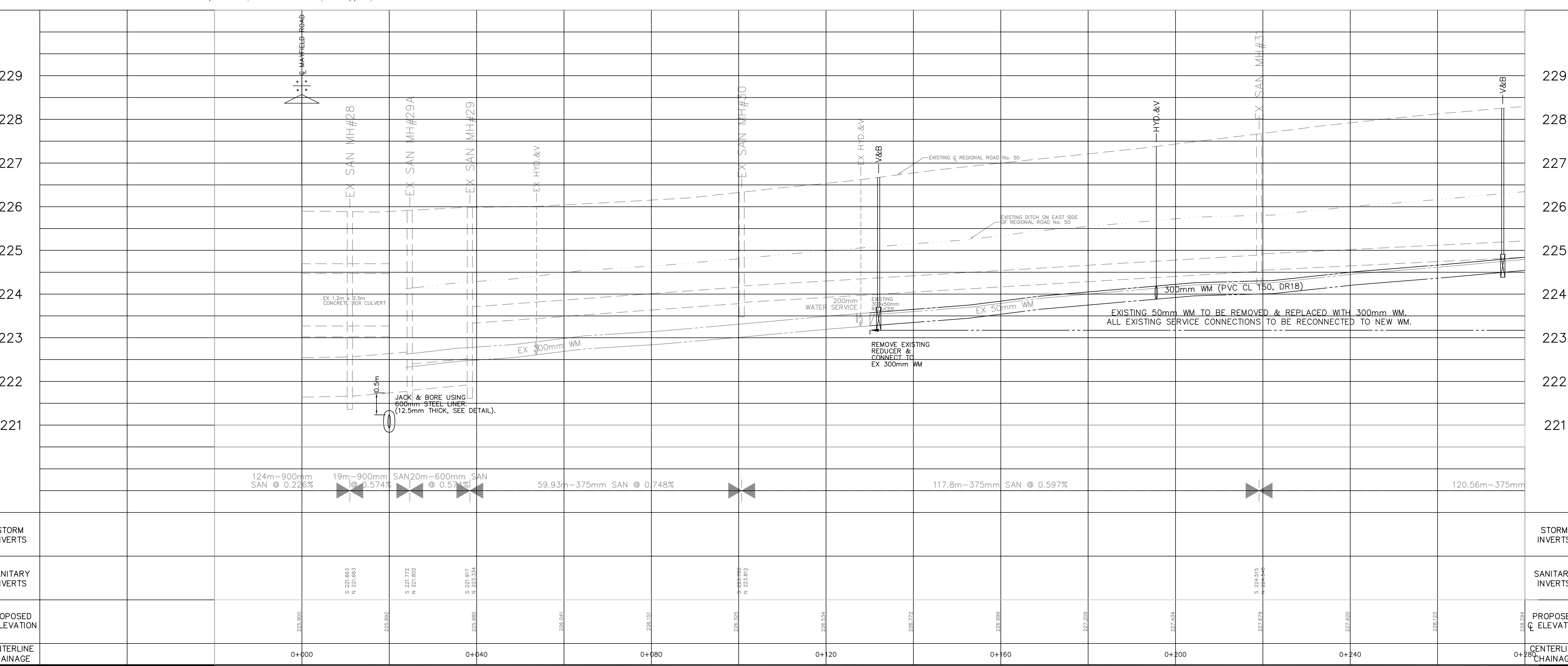
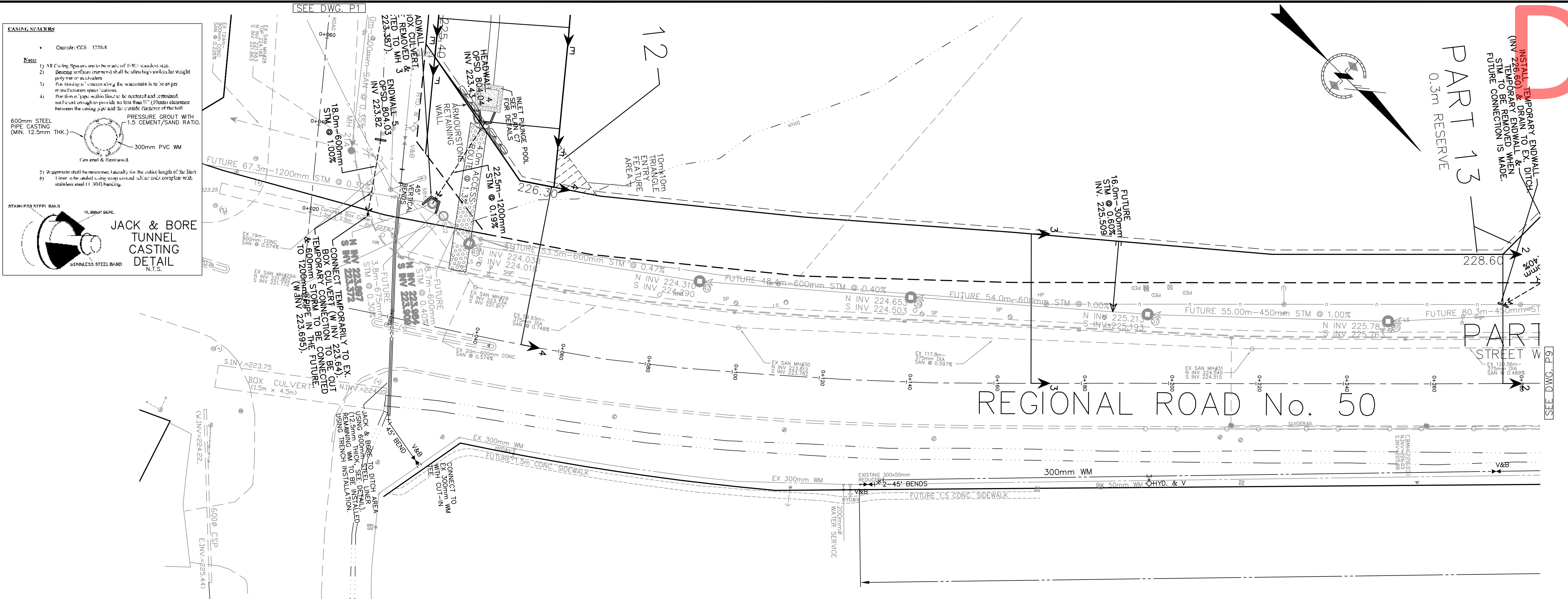
a.m.candaras associates inc.
consulting engineers
8551 Weston rd., suite 203
Woodbridge ont. L4L 9R4
905-850-8020 Fax 905-850-8099
Email: civil@amc.ai.com

21T-06001Ca (PHASE II)
GIFFELS ENTERPRISES
**REGIONAL ROAD No. 50 &
MAYFIELD ROAD
DEVELOPMENT**



REGIONAL ROAD No. 50
0+000.000 TO 0+280.000

SCALE: HORIZ 1:500 VERT 1:50	DATE: APRIL 2006	PROJ No. 0496
DRAWN: M.F.S.	CHK'D: A.M.C.	PLAN No. 56547-D
DESIGNED: M.F.S.	SHEET 8 OF 9	



STORM INVERTS

SANITARY INVERTS

PROPOSED ELEVATION

CENTERLINE CHAINAGE

STORM INVERTS

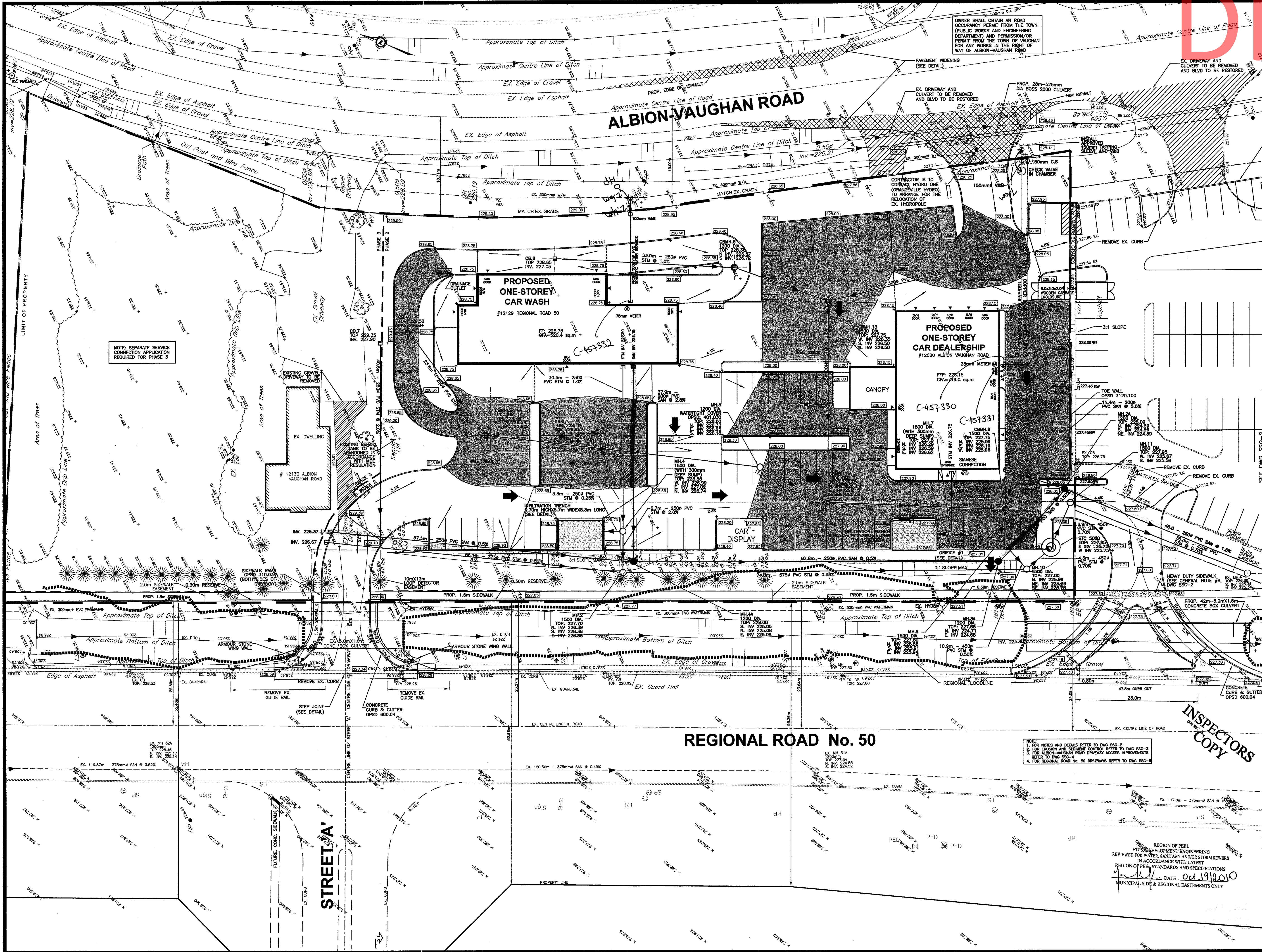
SANITARY INVERTS

PROPOSED ELEVATION

CENTERLINE CHAINAGE

PLANNING: J. CANDARAS
 DRAWING: J. CANDARAS
 CHECKED: J. CANDARAS
 DATE: OCT 14, 2005
 SCALE: 1:500

DRAFT



OWNER SHALL OBTAIN AN ROAD OCCUPANCY PERMIT FROM THE TOWN (PUBLIC WORKS AND ENGINEERING DEPARTMENT) AND PERMISSION/PERMIT FROM THE TOWN OF VAUGHAN FOR ANY WORKS IN THE RIGHT OF WAY OF ALBION-VAUGHAN ROAD

NOTE: SEPARATE SERVICE CONNECTION APPLICATION REQUIRED FOR PHASE 3

NOTES:
1. FOR NOTES AND DETAILS REFER TO DWG SSS-2
2. FOR DESIGN AND PERMIT CONTROL REFER TO DWG SSS-3
3. FOR ALBION-VAUGHAN ROAD DRIVEWAY ACCESS IMPROVEMENTS REFER TO DWG SSS-4
4. FOR REGIONAL ROAD No. 50 DRIVEWAYS REFER TO DWG SSS-5

LEGEND:

- TOP OF WALL
- BOTTOM OF WALL
- EXISTING ELEVATION
- EXISTING CONTOUR
- PROPOSED ELEVATION
- STORM MANHOLE
- STORM CATCHBASIN MANHOLE
- STORM DOUBLE CATCHBASIN MANHOLE
- CATCHBASIN
- SANITARY MANHOLE
- VALVE AND BOX
- WATER METER LOCATION
- VALVED HYDRANT
- FIRE DEPARTMENT CONNECTION
- PROP. OVERLAND FLOW DIRECTION
- FINISHED GROUND FLOOR ELEVATION
- EXTERIOR DOOR LOCATION
- ROAD RESTORATION (SEE DETAIL)
- SURFACE STORMWATER DETENTION AREA - 100 YEAR HRL
- SURFACE DRAINAGE DIVIDE LINE
- PROPERTY LINE
- PHASING LIMITS
- ROOF DRAIN
- REGIONAL FLOODLINE

BENCHMARK:
TOPOGRAPHIC SURVEY PREPARED BY YOUNG & YOUNG SURVEYING INC. O.S. PROJECT: 08-B5874
ELEVATIONS ARE GEODETIC AND REFERRED TO MTO BENCHMARK NO. 758256, ELEVATION = 251.25m.

NO.	DATE	REVISIONS	BY
8.	30/08/10	AS PER REGION COMMENTS	D.G.
7.	02/07/10	REDLINED BY TOWN	D.G.
6.	24/06/10	AS PER REVISED SITE PLAN	D.G.
5.	13/05/10	AS PER REVISED SITE PLAN	D.G.
4.	04/05/10	AS PER TOWN COMMENTS	D.G.
3.	26/04/10	DRIVEWAY DETAILS ADDED	D.G.
2.	07/04/10	RESUBMISSION OF SITE PLAN & H REMOVAL	D.G.
1.	25/03/10	TOWN, REGION & TRCA COMMENTS	D.G.

PROFESSIONAL ENGINEER
D. A. GRIGOROV
MIG 30,201P
PROVINCE OF ONTARIO
DATE BY: T.E.R.
NOV 15/10
R.V.R.

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
561 CHESTER ROAD, SUITE 11, WOODBRIDGE, ONTARIO L4L 8A8
TEL: (905) 884-0084 FAX: (905) 884-0089
EMAIL: info@valdor-engineering.com www.valdor-engineering.com

PROJECT
PROPOSED CAR DEALERSHIP
COFFEY PHASE 2
12129 REGIONAL ROAD 50 &
12080 ALBION VAUGHAN ROAD,
BOLTON, TOWN OF CALEDON
REGION FILE No. D-05011819E

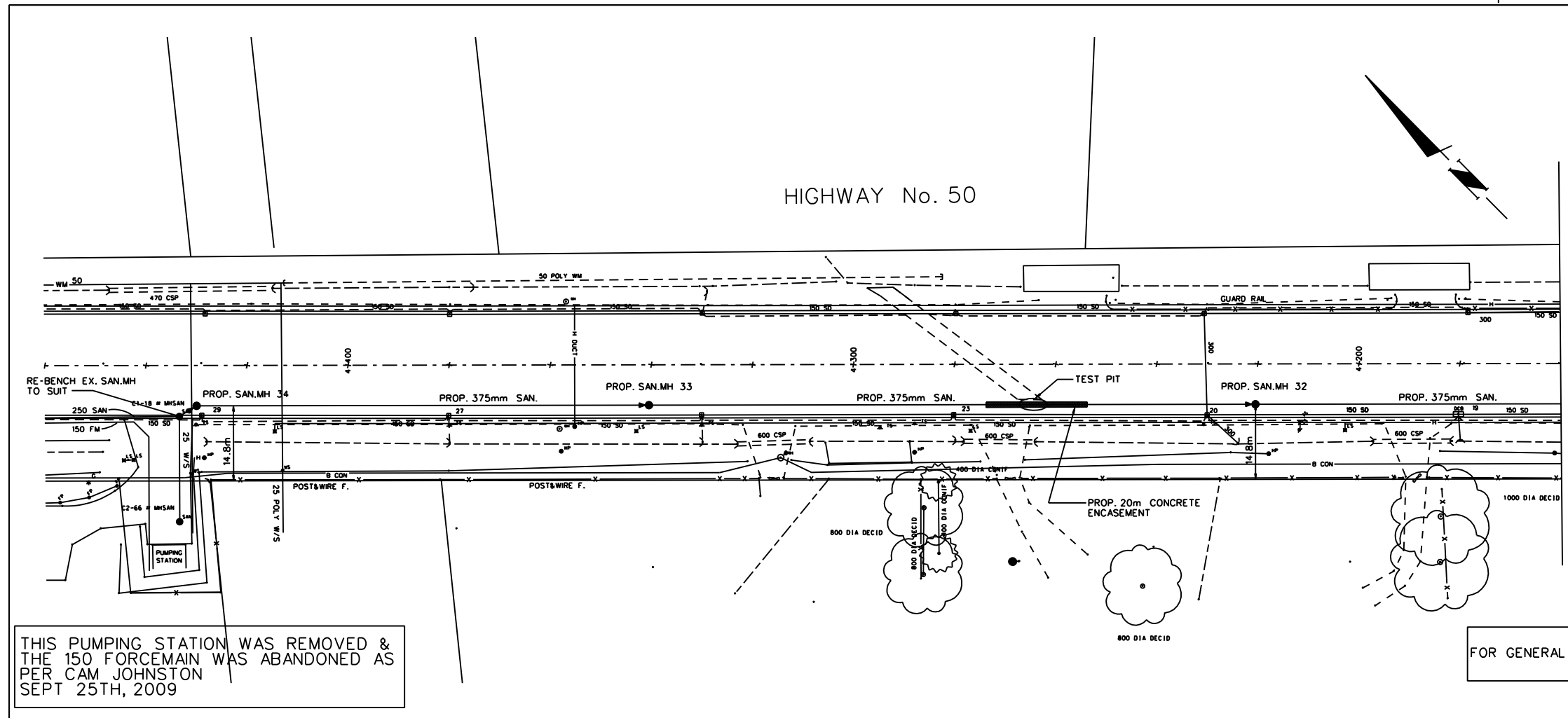
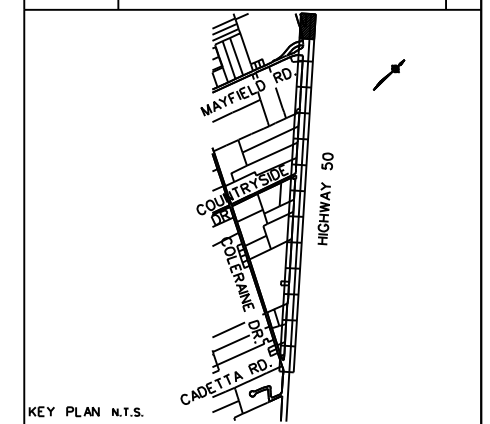
SITE SERVICING & GRADING PLAN

SCALE	PROJECT NO.
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DRAWN BY	DATE
P.C./L.S.	04.19.2010
CHKD BY	
D.G.	

INSPECTORS COPY
sub #9
C-457330

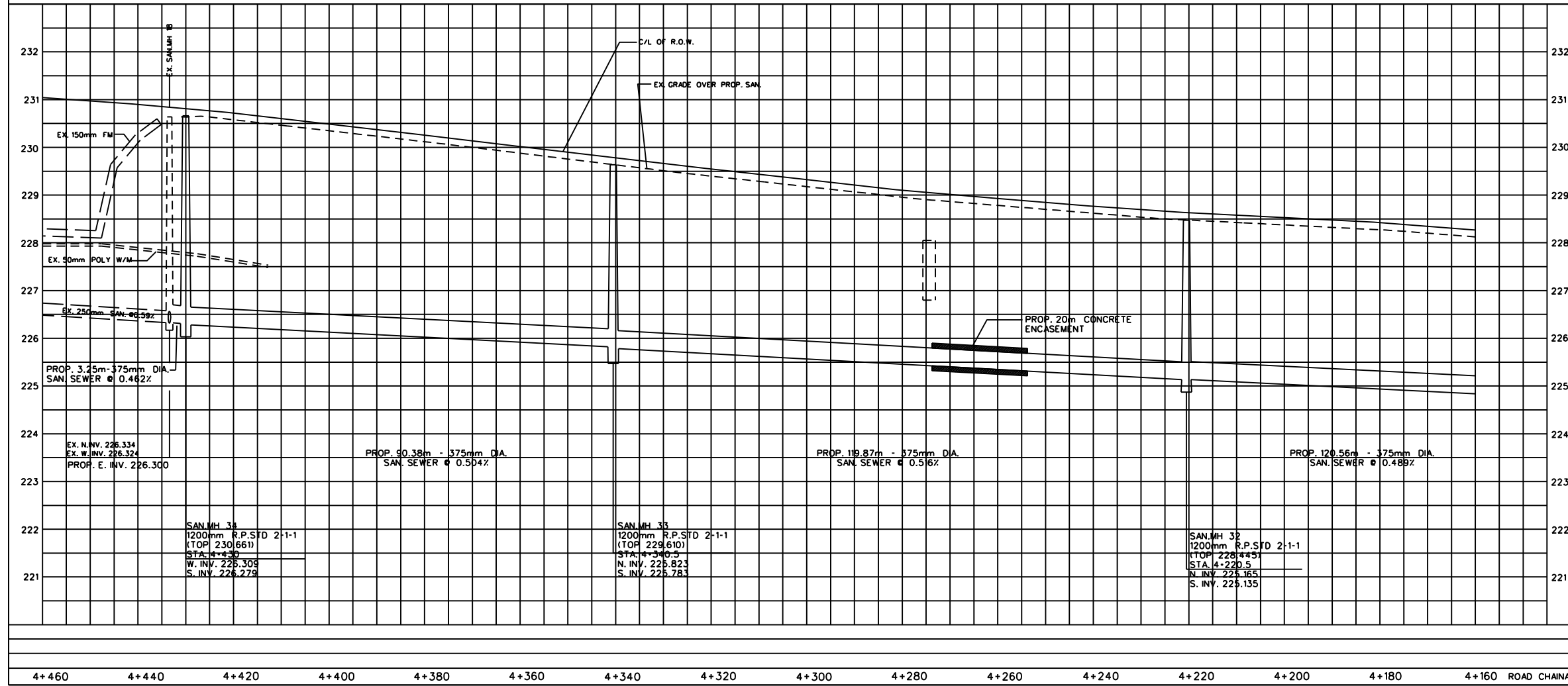
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SAN SEWERS			GAS MAINS	IX/24/01	J.P.
STORM SEWERS	IX/21/01	J.P.	BELL U/G CABLE	XI/22/01	J.P.
WATERMANS			HYDRO U/G CABLE	X/22/01	J.P.
TRANSIT			ONT. HYDRO		
PARKS & REC.			CTV		
ONT. CLEAN WATER	IX/27/01	J.P.		X/16/01	J.P.

REVISIONS		
DATE	DETAILS	INIT.
SEPT.02	AS CONSTRUCTED	J.P.



REFER TO DWG. No. 28260-D

FOR GENERAL NOTES AND DETAILS SEE DWG. No. 28248-D & 28262-D



General Notes

- ALL DRIVEWAYS ASPHALT UNLESS OTHERWISE NOTED.
- ALL SERVICE LOCATIONS ARE APPROXIMATE AND MUST BE LOCATED ACCURATELY IN THE FIELD
- DENOTES BUILDING - NOT LOCATED
- DENOTES BUILDING LOCATED
- TYPE 'B' BEDDING UNLESS OTHERWISE NOTED (SAN)

B.M. NO. ELEV.

THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL EXISTING UTILITIES PRIOR TO AND DURING CONSTRUCTION LOCATION OF EXISTING UTILITIES APPROXIMATE ONLY. TO BE VERIFIED IN FIELD BY CONTRACTOR.

DESIGNED BY: _____ APPROVED BY: _____

NOTICE TO CONTRACTOR
48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING

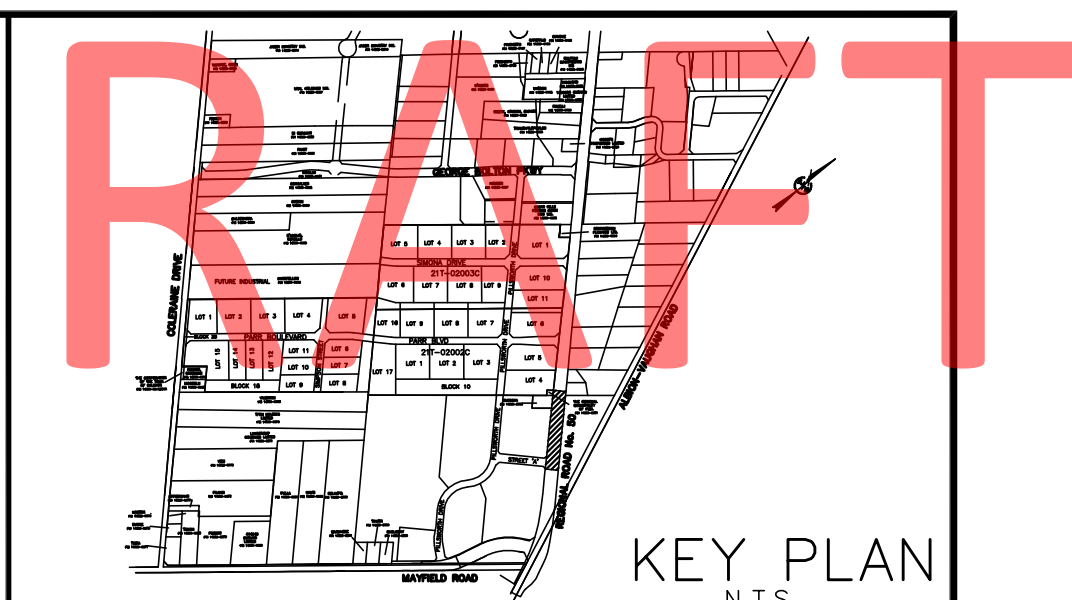
THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL TELEPHONE COMPANY
CONSUMERS GAS COMPANY
MINISTRY OF TRANSPORTATION
ONTARIO CLEAN WATER AGENCY
HYDRO ELECTRIC POWER COMM. OF ONTARIO
HYDRO ELECTRIC COMM. CITY OF MISSISSAUGA
HYDRO ELECTRIC COMM. CITY OF BRAMPTON
CABLE TELEVISION

10m 0 10 20 30m HORIZONTAL SCALE
1m 0 1 2 3m VERTICAL SCALE

Region of Peel
Public Works

BOLTON/BRAMPTON TRUNK SEWER
(FROM COLERAIN DR. TO MAYFIELD RD.)
PROP. 375mm SANITARY SEWER
Sta. 4+160 To Sta. 4+460

LOTS: _____ AREA: B-26/ C-2 PROJECT NO. 02-2140
CHECKED BY: _____ DRAWN BY: J.P. PLAN NO. 28261-D
DATE: MARCH, 2002 SHEET 14 OF 14



KEY PLAN
N.T.S.

FOR GENERAL NOTES REFER TO DWG C3

- LEGEND
- ⊕ HYDRANT AND VALVE
 - CATCHBASIN
 - ▣ DOUBLE CATCHBASIN
 - PROPOSED STORM MANHOLE
 - PROPOSED SANITARY MANHOLE
 - ⊙ PROPOSED CATCHBASIN MANHOLE
 - 236.00 PROPOSED ELEVATION
 - 235.50 EXISTING ELEVATION
 - ⊕ VALVE AND BOX
 - ⊕ VALVE AND CHAMBER

TOWN OF CALEDON
APPROVED AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____
APPROVED BY: _____
C.A. CAMPBELL, C.E.T.
DIRECTOR OF PUBLIC WORKS & ENGINEERING

CONTRACTOR TO BE RESPONSIBLE FOR VERIFYING THE LOCATIONS OF ALL EXISTING UNDERGROUND AND ABOVE UTILITIES AND SERVICES. THE CONTRACTOR SHALL ADVISE THE ENGINEER OF ANY DISCREPANCIES PRIOR TO PROCEEDING WITH CONSTRUCTION. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCED NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. A.M. CANDARAS ASSOCIATES INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.

PLAN OF SUBDIVISION OF PART OF THE EAST HALF OF LOT 1, CONCESSION 6, TOWN OF CALEDON REGIONAL MUNICIPALITY OF PEEL

BENCH MARK
REGION OF PEEL #37 ELEV. 227.187m
ON THE NORTH FACE OF THE EAST CORNER OF A RED INSUL. BRICK HOUSE LOCATED ON THE SOUTH WEST CORNER OF SEVENTEENTH SIDEROAD (REGION ROAD #14) AND HIGHWAY #50

7	08/28/08	M.F.S.	FINAL SUBMISSION, PHASE II FOR REGION
6	02/21/08	M.F.S.	4th SUBMISSION, PHASE II FOR TOWN
5	12/18/07	M.F.S.	3rd SUBMISSION, PHASE II FOR TOWN
4	07/18/07	M.F.S.	3rd SUBMISSION, PHASE II FOR REGION
3	06/28/07	M.F.S.	2nd SUBMISSION, PHASE II FOR TOWN
2	06/22/07	M.F.S.	2nd SUBMISSION, PHASE II FOR REGION
1	07/07/06	M.F.S.	1st SUBMISSION

No.	Date	By	REVISIONS

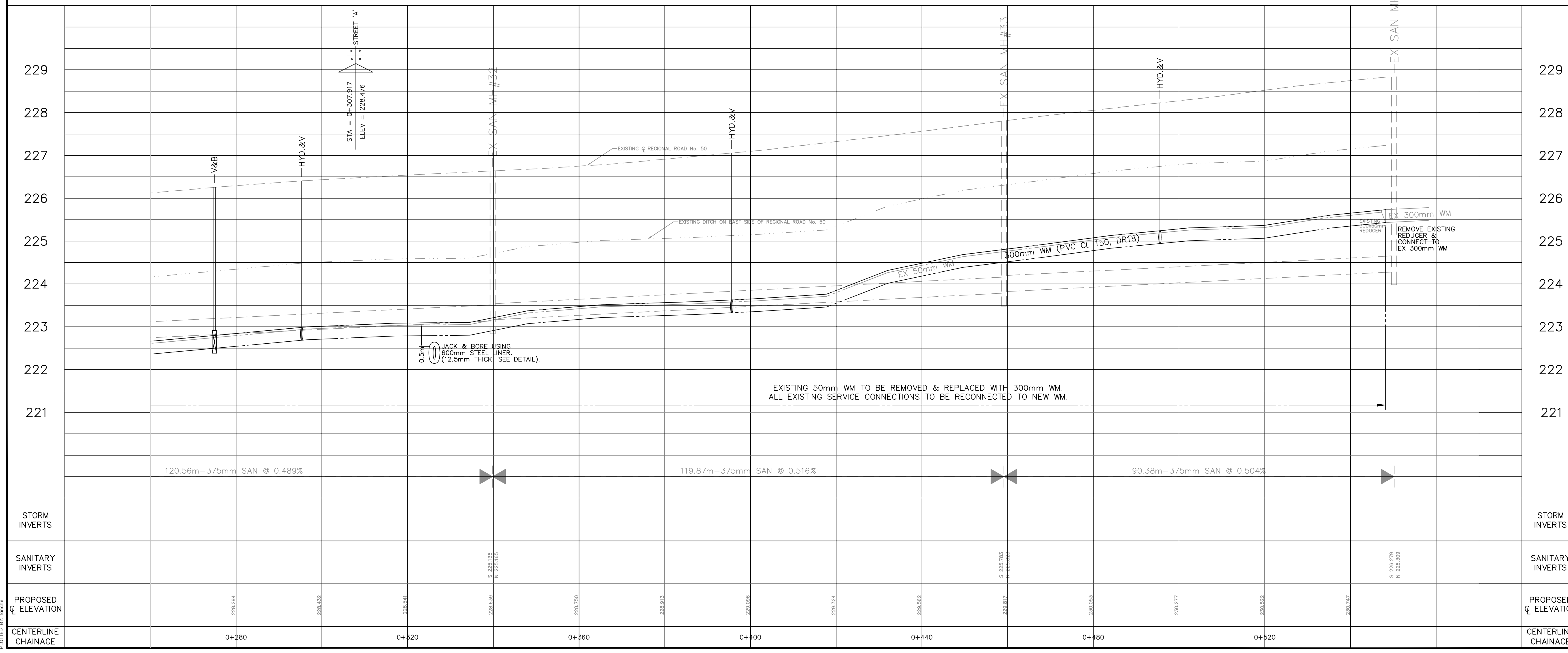
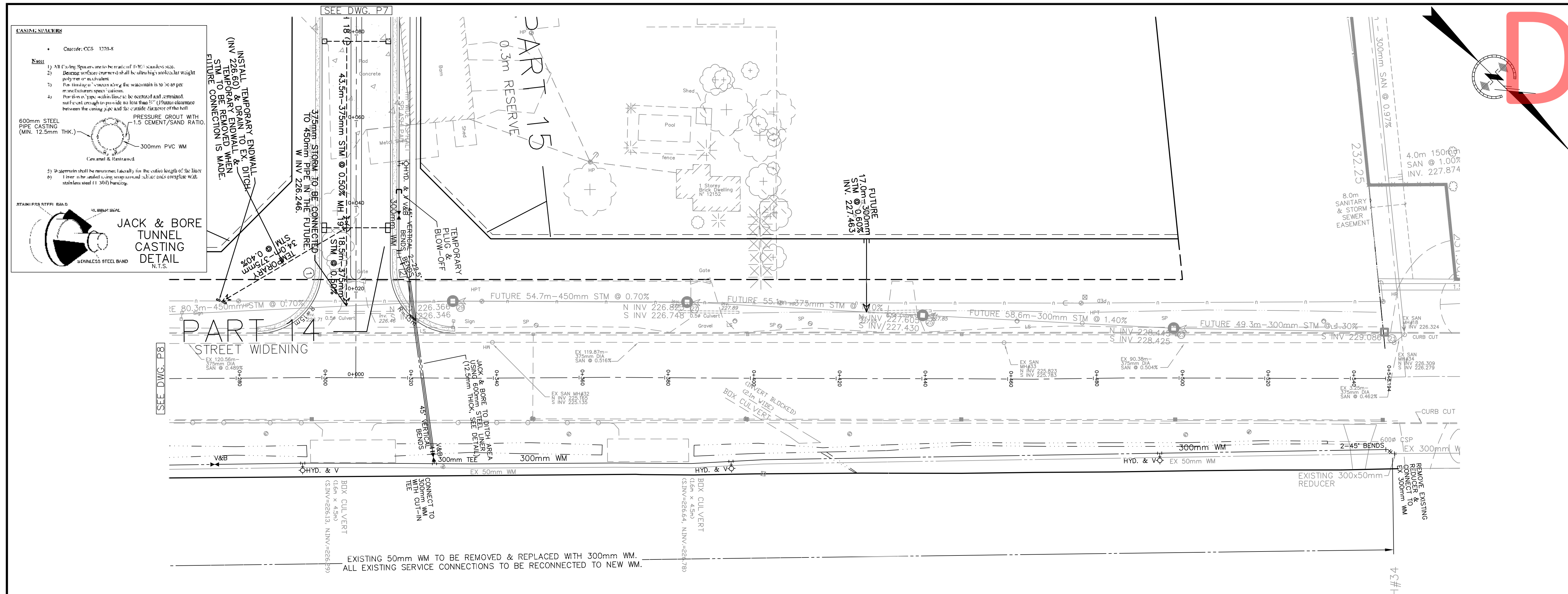
a.m.candarases associates inc.
consulting engineers
8551 Weston rd., suite 203
Woodbridge ont. L4L 9R4
905-850-8020 Fax 905-850-8099
Email: civil@amcai.com

21T-06001Ca (PHASE II)
GIFFELS ENTERPRISES
REGIONAL ROAD No. 50 & MAYFIELD ROAD DEVELOPMENT



TOWN OF CALEDON
REGIONAL ROAD No. 50
0+280.000 TO 0+548.194

SCALE: HORIZ 1:500 VERT 1:50	DATE: APRIL 2006	PROJ No. 0496
DRAWN: M.F.S.	CHK'D: A.M.C.	PLAN No. 56548-D
DESIGNED: M.F.S.	SHEET 9 OF 9	

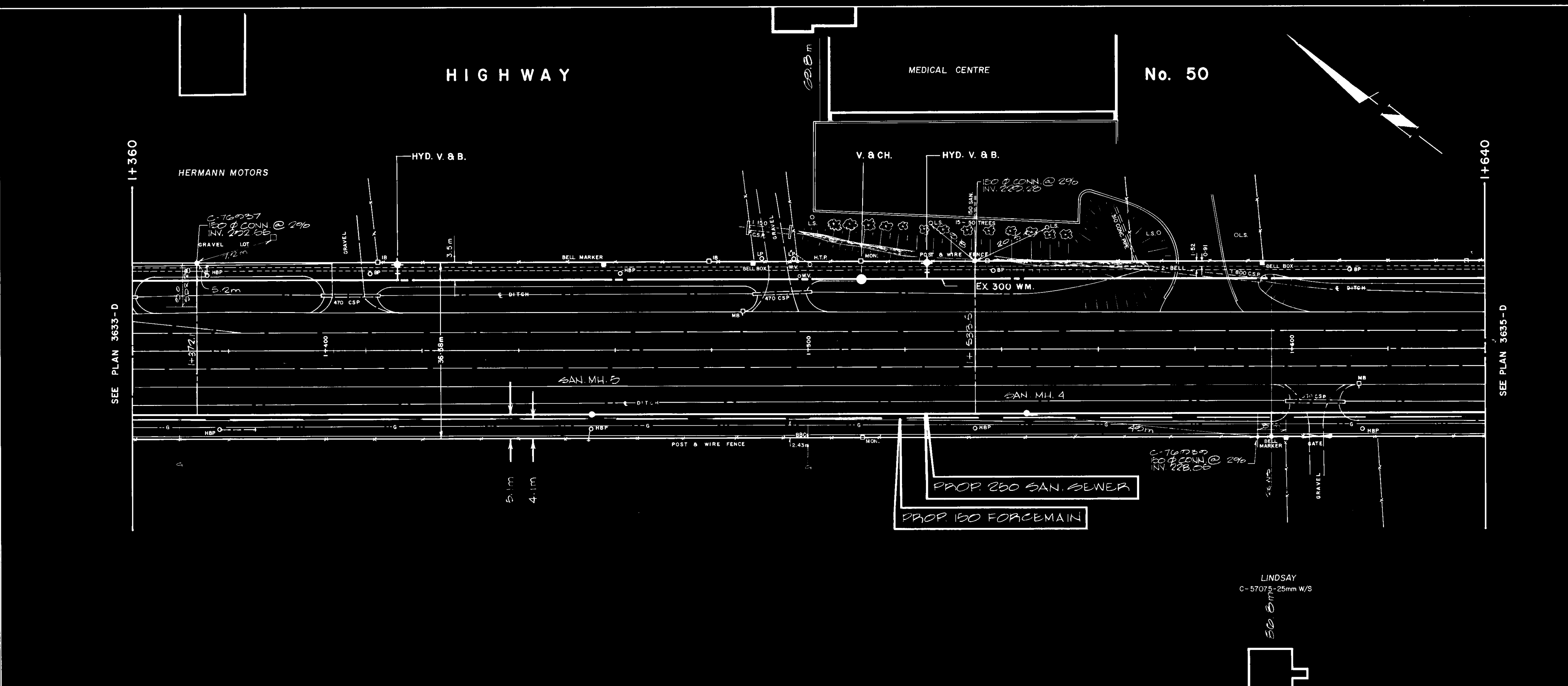


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 PLOTTED BY: borah 2015 - 1:50pm

DRAFT

SERVICE DATA					
SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN. SEWERS			SAN. MAINS	05.08.10	E.F.
STORM SEWERS			SMALL W/S CABLE	12.05.79	E.F.
WATERMANS			HYDRO W/S CABLE		

REVISIONS				
DATE	DETAILED	INIT.	REVISIONS	INIT.
21 Nov 79	GRADE OF WM REVISED & GRADE			E.F.
	OVER WM ADDED			
23 APR 80	AS CONSTRUCTED			
MAY 79	PROP. SANITARY SEWER & FORCEMAIN			E.F.
MAY 84	AS CONSTRUCTED			



229.10	228.70	228.48	228.7	229.06	228.35	227.92	228.50	228.08	228.00	228.41	228.0	228.04	228.10	228.10	EL. BOTTOM WM.
235.70	233.45	233.20	232.75	232.70	232.45	231.85	231.25	230.65	229.90	229.10	228.30	228.25	228.15	228.10	RD. CHAINAGE
+	I+360	I+380	I+400	I+420	I+440	I+460	I+480	I+500	I+520	I+540	I+560	I+580	I+600	I+620	I+640

PROJ. No. 81-2134

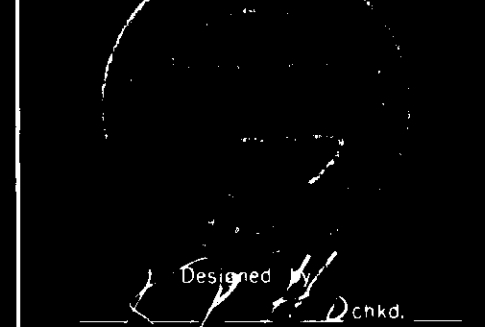


Designed by: *[Signature]*
 Approved by: *[Signature]*

General Notes

- All Elevations Given Unless Otherwise Noted
 - All Service Locations Are Approximate And Must Be Located Accurately In Field.
 - Denotes Building - Not Located
 - Denotes Building - Located
 - Type 'B' Bedding Unless Otherwise Noted (SAN)
 - B.M. No. Elev.
- The Contractor is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

PROJ. No. 78-1101

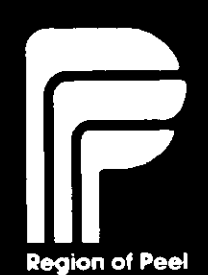


Designed by: *[Signature]*
 Approved by: *[Signature]*

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING:

- THE REGIONAL MUNICIPALITY OF PEELE
- CITY OF MISSISSAUGA WORKS DEPT.
- CITY OF BRAMPTON WORKS DEPT.
- TOWN OF CALEDON WORKS DEPT.
- BELL TELEPHONE COMPANY
- CONSUMERS GAS COMPANY
- MINISTRY OF TRANSPORTATION
- MINISTRY OF ENVIRONMENT
- HYDRO ELECTRIC POWER COMM. OF ONTARIO
- HYDRO ELECTRIC COMM. CITY OF MISSISSAUGA
- HYDRO ELECTRIC COMM. CITY OF BRAMPTON
- HYDRO ELECTRIC COMM. PORT CREDIT
- HYDRO ELECTRIC COMM. STREETSVILLE
- CABLE TELEVISION



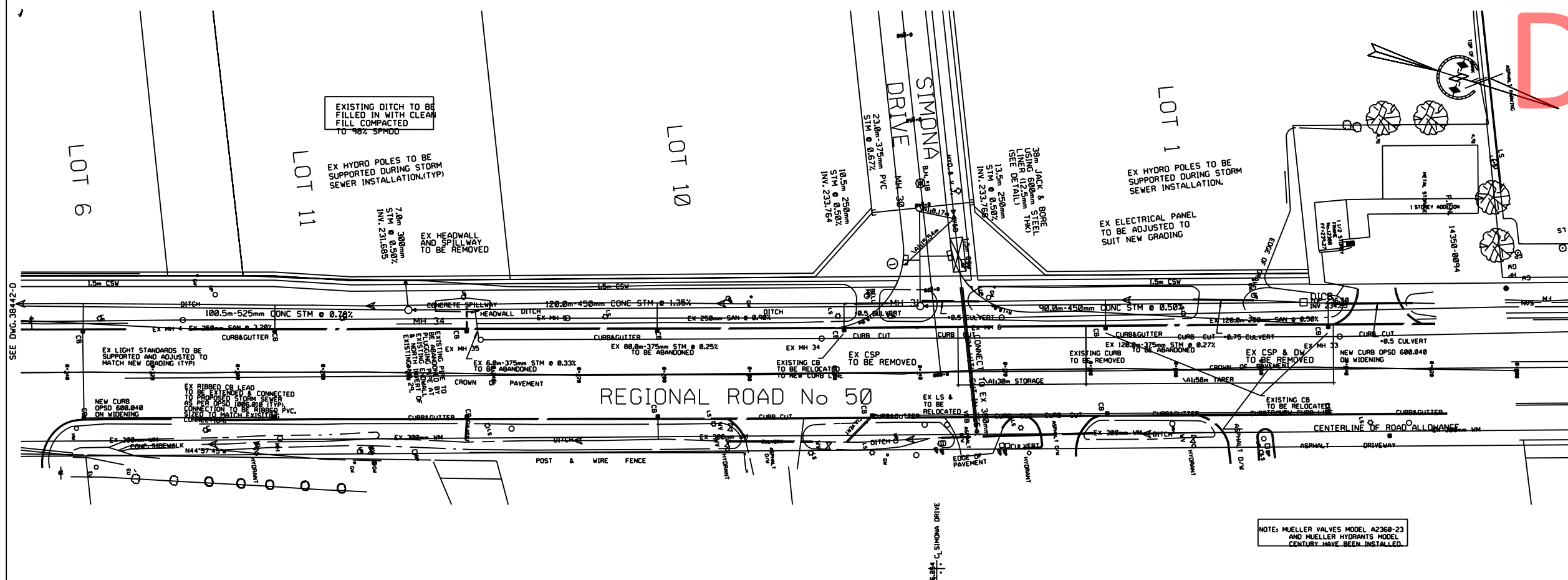
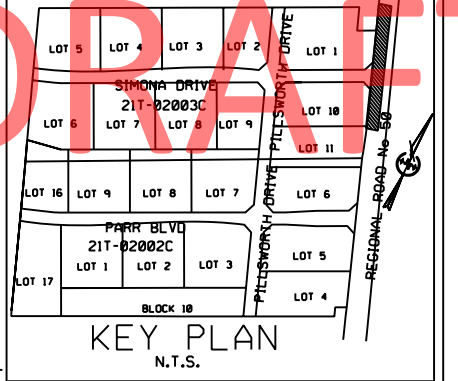
Department of Public Works

HIGHWAY 50
PROPOSED 250 SANITARY SEWER & 150 FORCEMAIN
Sta. I+360 To Sta. I+640

Lots 1-5	Area C-2	Project No. 81-2134
Scale: 1" = 50'	Drawn by: E.W.K.	Checked by: <i>[Signature]</i>
Date: MAY 79	Sheet: 6 of 7	Plan No. 3634-D

3634-D

DRAFT



FOR GENERAL NOTES REFER TO DWG C3

- LEGEND
- HYDRANT AND VALVE
 - CATCHBASIN
 - DOUBLE CATCHBASIN
 - PROPOSED STORM MANHOLE
 - PROPOSED SANITARY MANHOLE
 - PROPOSED CATCHBASIN MANHOLE
 - PROPOSED ELEVATION
 - EXISTING ELEVATION
 - VALVE AND BOX
 - VALVE AND CHAMBER

NO ROAD WORKS ON REGIONAL ROAD NO. 50 TO BE UNDERTAKEN UNTIL APPROVALS HAVE BEEN GIVEN FROM THE REGION OF PEEL & TOWN OF CALEDON.

SATISFACTORY CONSTRUCTION OF WORKS ON REGIONAL ROAD NO. 50 TO BE APPROVED BY THE REGION OF PEEL & TOWN OF CALEDON PRIOR TO REGISTRATION.

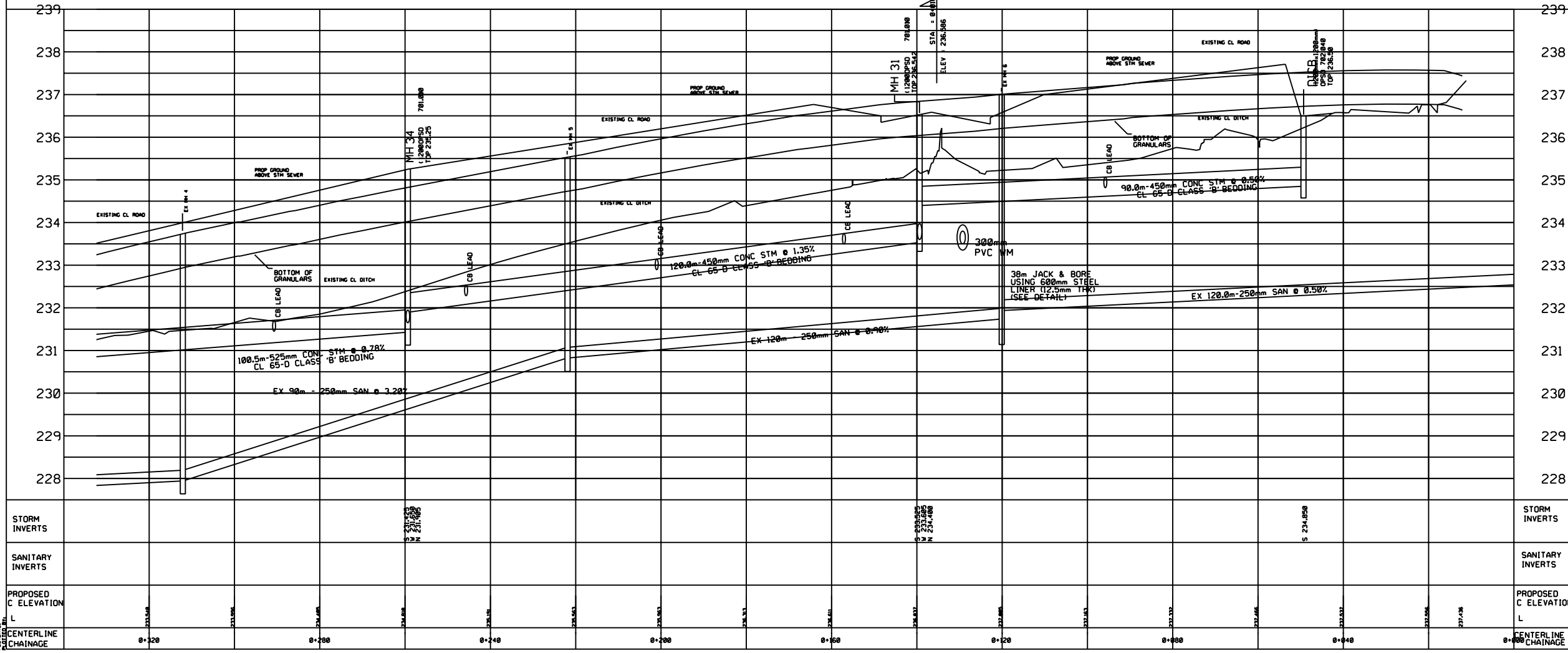
TOWN OF CALEDON
APPROVED
AS NOTED

THIS APPROVAL CONSTITUTES A GENERAL REVIEW AND DOES NOT CERTIFY DIMENSIONAL ACCURACY.

THIS APPROVAL IS SUBJECT TO THE FURTHER CERTIFICATION OF THE "AS CONSTRUCTED" WORKS BY A REGISTERED PROFESSIONAL ENGINEER OF THE PROVINCE OF ONTARIO.

DATE: _____
APPROVED BY: _____
C.A. CAMPBELL, C.E.T.
3888 2300000000

NOTE: MUELLER VALVES MODEL A2360-23 AND MUELLER HYDRANTS MODEL CENTURY HAVE BEEN INSTALLED.




PLAN OF SUBDIVISION OF PART OF THE EAST HALF OF LOT 2, CONCESSION 6, TOWN OF CALEDON, REGIONAL MUNICIPALITY OF PEEL

BENCH MARK
REGION OF PEEL #37 ELEV. 227.187m
ON THE NORTH FACE AT THE EAST CORNER OF A RED INSUL. BRICK HOUSE LOCATED ON THE SOUTH WEST CORNER OF SEVENTEENTH SIDEROAD (REGION ROAD #14) AND HIGHWAY #50

NO.	DATE	BY	REVISIONS
7	02/03/09	M.F.S.	AS-CONSTRUCTED PLAN (REGION OF PEEL)
6	04/19/08	M.F.S.	REVISED AS PER REGION 4th SUBMISSION COMMENTS
5	03/17/08	M.F.S.	REVISED AS PER TOWN 3rd SUBMISSION COMMENTS
4	03/12/08	M.F.S.	REVISED AS PER REGION COMMENTS
3	12/04/07	M.F.S.	REVISED AS PER REGION COMMENTS
2	09/18/07	M.F.S.	REVISED AS PER TOWN 2nd SUBMISSION COMMENTS
1	06/23/07	M.A.C.	REVISED AS PER REGION 1st SUBMISSION COMMENTS

 **A.M. CANDARAS ASSOCIATES INC.**
CONSULTING ENGINEERS
8551 WESTON RD., SUITE 203
WOODBRIEGE ONT. L4L 9R4
905-850-8020 FAX 905-850-8099
EMAIL: CIVIL@AMCAI.COM

21T-02002C/21T-02003C
SOLMAR DEVELOPMENT CORP.
EQUITY PRESTIGE
BUSINESS PARK
EAST PHASE

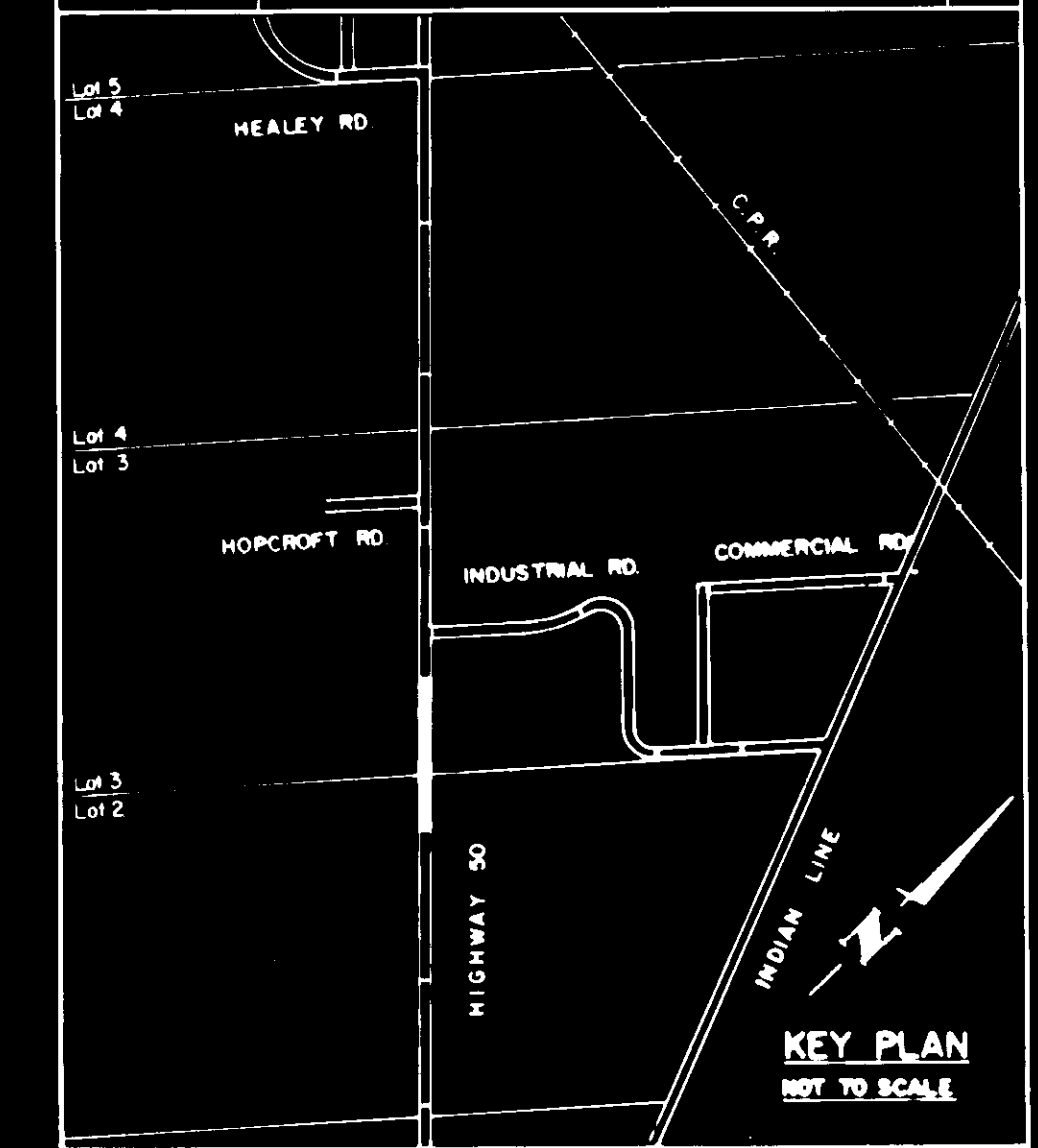

TOWN OF CALEDON
REGIONAL ROAD No. 50
0+000.000 TO 0+320.000

SCALE: HORIZ 1:500
DATE: MAY 2004
PROJ. NO. 0311
DRAWN: E.P. CHECKED: A.M.C.
DESIGNED: A.M.C. SHEET 15 OF 16
PLAN NO. 38441-D


DRAFT

SERVICE DATA			
SERVICE	DATE	INIT	DATE
SAN SEWERS			
STORM SEWERS			
WATERMAINS			


REVISIONS			
DATE	DETAILS	INIT	
13 NOV 79	GRADE OF WM. REVISED & GRADE	AK	
23 APR 80	OVER WM ADDED		
MAY 82	PROP. SANITARY SEWER & FORCEMAIN		
MAY 84	AS CONSTRUCTED		



PROJ. No. 81-2134



Designed by *Chad*



Approved by

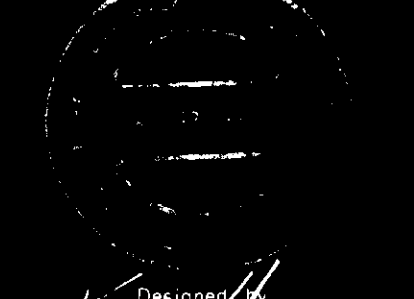
General Notes

- All Driveways Gravel Unless Otherwise Noted.
- All Service Locations Are Approximate And Must Be Located Accurately In Field.
- Denotes Building - Not Located
- Denotes Building Located
- Type B Bedding Unless Otherwise Noted (SAN)


B.M. N.P. Elev.

The Contractor is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location of Existing Utilities, Approximate Only, To Be Verified In Field By Contractor.

PROJ. No. 78-1101



Designed by *Chad*



Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING:

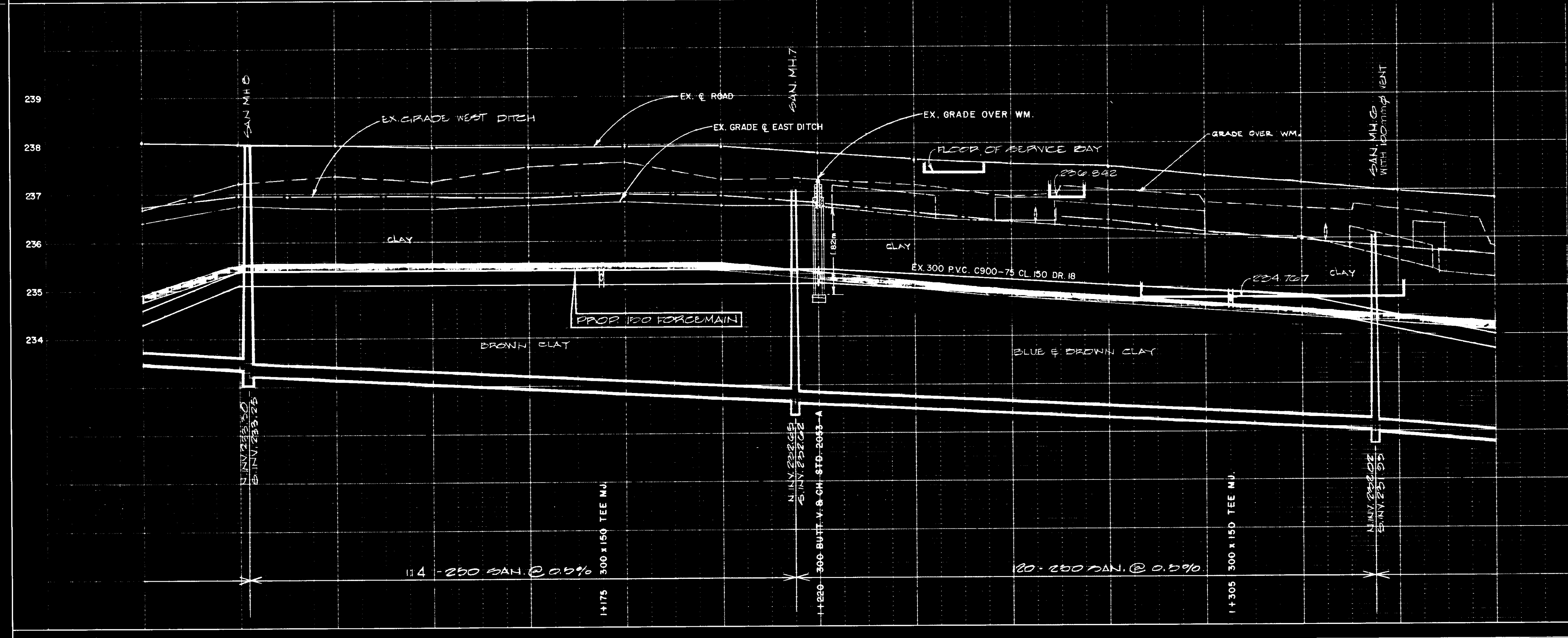
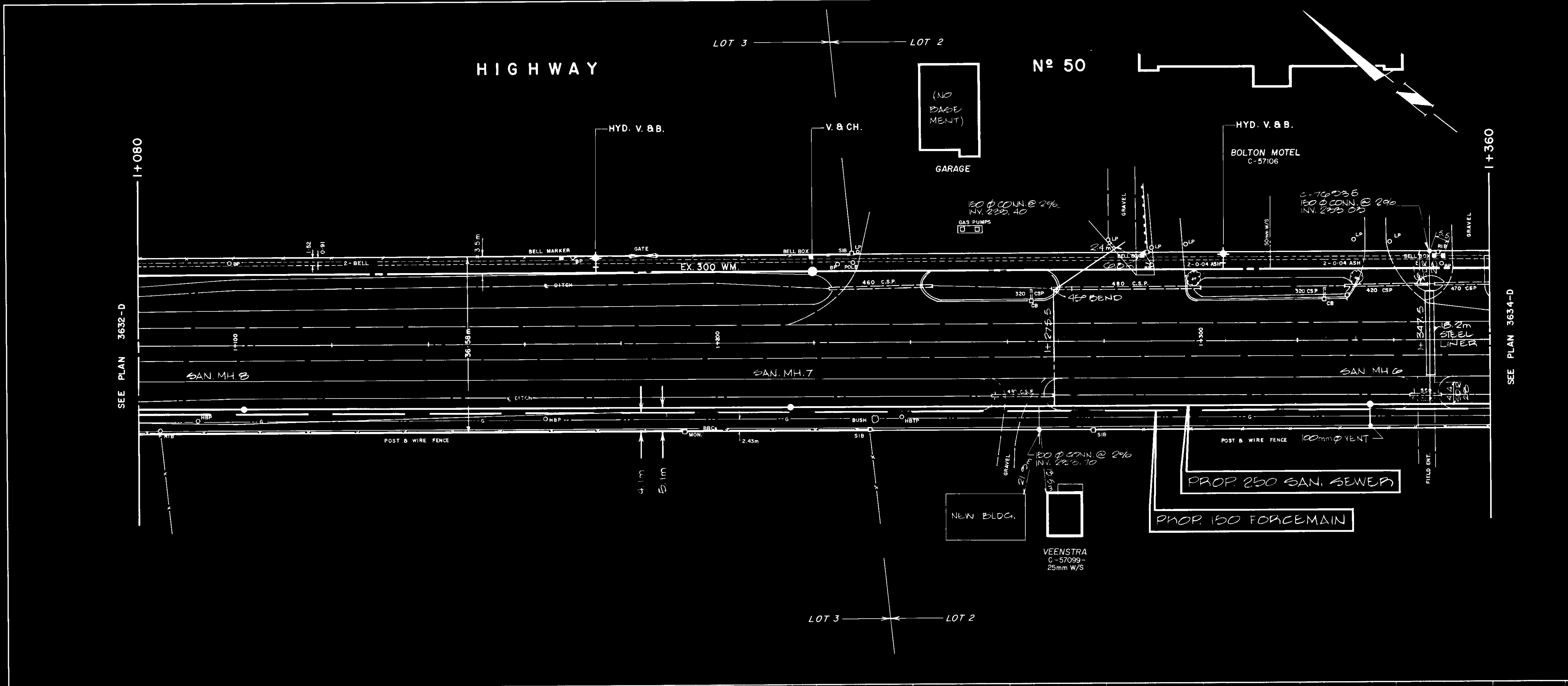
- THE REGIONAL MUNICIPALITY OF PEEL
- CITY OF MISSISSAUGA WORKS DEPT.
- CITY OF BRAMPTON WORKS DEPT.
- TOWN OF CALEDON WORKS DEPT.
- BELL TELEPHONE COMPANY
- CONSUMERS GAS COMPANY
- MINISTRY OF TRANSPORTATION
- MINISTRY OF ENVIRONMENT
- HYDRO ELECTRIC POWER COMM. OF ONTARIO
- HYDRO ELECTRIC COMM. CITY OF MISSISSAUGA
- HYDRO ELECTRIC COMM. CITY OF BRAMPTON
- HYDRO ELECTRIC COMM. PORT CREDIT
- HYDRO ELECTRIC COMM. STREETSVILLE
- CABLE TELEVISION



Department of Public Works
Region of Peel

HIGHWAY 50
PROPOSED 250 SANITARY SEWER & 150 FORCEMAIN
Sta. 1+080 To Sta. 1+360

Lots 1-5	Area C-2	Project No. 81-2134
Scale: Hor. 1:500 Ver. 1:250	Drawn by E.W.K.	Checked by <i>RR</i>
Date MAY 79	Sheet 5 of 7	Plan No. 3633-D



234.75	235.20	235.57	235.95	236.32	236.70	237.08	237.45	237.83	238.20	238.58	238.95	239.33	239.70	240.08	240.45	240.83	241.20	241.58	241.95	242.33	242.70	243.08	243.45	243.83	244.20	244.58	244.95	245.33	245.70	246.08	246.45	246.83	247.20	247.58	247.95	248.33	248.70	249.08	249.45	249.83	250.20	250.58	250.95	251.33	251.70	252.08	252.45	252.83	253.20	253.58	253.95	254.33	254.70	255.08	255.45	255.83	256.20	256.58	256.95	257.33	257.70	258.08	258.45	258.83	259.20	259.58	259.95	260.33	260.70	261.08	261.45	261.83	262.20	262.58	262.95	263.33	263.70	264.08	264.45	264.83	265.20	265.58	265.95	266.33	266.70	267.08	267.45	267.83	268.20	268.58	268.95	269.33	269.70	270.08	270.45	270.83	271.20	271.58	271.95	272.33	272.70	273.08	273.45	273.83	274.20	274.58	274.95	275.33	275.70	276.08	276.45	276.83	277.20	277.58	277.95	278.33	278.70	279.08	279.45	279.83	280.20	280.58	280.95	281.33	281.70	282.08	282.45	282.83	283.20	283.58	283.95	284.33	284.70	285.08	285.45	285.83	286.20	286.58	286.95	287.33	287.70	288.08	288.45	288.83	289.20	289.58	289.95	290.33	290.70	291.08	291.45	291.83	292.20	292.58	292.95	293.33	293.70	294.08	294.45	294.83	295.20	295.58	295.95	296.33	296.70	297.08	297.45	297.83	298.20	298.58	298.95	299.33	299.70	300.08	300.45	300.83	301.20	301.58	301.95	302.33	302.70	303.08	303.45	303.83	304.20	304.58	304.95	305.33	305.70	306.08	306.45	306.83	307.20	307.58	307.95	308.33	308.70	309.08	309.45	309.83	310.20	310.58	310.95	311.33	311.70	312.08	312.45	312.83	313.20	313.58	313.95	314.33	314.70	315.08	315.45	315.83	316.20	316.58	316.95	317.33	317.70	318.08	318.45	318.83	319.20	319.58	319.95	320.33	320.70	321.08	321.45	321.83	322.20	322.58	322.95	323.33	323.70	324.08	324.45	324.83	325.20	325.58	325.95	326.33	326.70	327.08	327.45	327.83	328.20	328.58	328.95	329.33	329.70	330.08	330.45	330.83	331.20	331.58	331.95	332.33	332.70	333.08	333.45	333.83	334.20	334.58	334.95	335.33	335.70	336.08	336.45	336.83	337.20	337.58	337.95	338.33	338.70	339.08	339.45	339.83	340.20	340.58	340.95	341.33	341.70	342.08	342.45	342.83	343.20	343.58	343.95	344.33	344.70	345.08	345.45	345.83	346.20	346.58	346.95	347.33	347.70	348.08	348.45	348.83	349.20	349.58	349.95	350.33	350.70	351.08	351.45	351.83	352.20	352.58	352.95	353.33	353.70	354.08	354.45	354.83	355.20	355.58	355.95	356.33	356.70	357.08	357.45	357.83	358.20	358.58	358.95	359.33	359.70	360.08	360.45	360.83	361.20	361.58	361.95	362.33	362.70	363.08	363.45	363.83	364.20	364.58	364.95	365.33	365.70	366.08	366.45	366.83	367.20	367.58	367.95	368.33	368.70	369.08	369.45	369.83	370.20	370.58	370.95	371.33	371.70	372.08	372.45	372.83	373.20	373.58	373.95	374.33	374.70	375.08	375.45	375.83	376.20	376.58	376.95	377.33	377.70	378.08	378.45	378.83	379.20	379.58	379.95	380.33	380.70	381.08	381.45	381.83	382.20	382.58	382.95	383.33	383.70	384.08	384.45	384.83	385.20	385.58	385.95	386.33	386.70	387.08	387.45	387.83	388.20	388.58	388.95	389.33	389.70	390.08	390.45	390.83	391.20	391.58	391.95	392.33	392.70	393.08	393.45	393.83	394.20	394.58	394.95	395.33	395.70	396.08	396.45	396.83	397.20	397.58	397.95	398.33	398.70	399.08	399.45	399.83	400.20	400.58	400.95	401.33	401.70	402.08	402.45	402.83	403.20	403.58	403.95	404.33	404.70	405.08	405.45	405.83	406.20	406.58	406.95	407.33	407.70	408.08	408.45	408.83	409.20	409.58	409.95	410.33	410.70	411.08	411.45	411.83	412.20	412.58	412.95	413.33	413.70	414.08	414.45	414.83	415.20	415.58	415.95	416.33	416.70	417.08	417.45	417.83	418.20	418.58	418.95	419.33	419.70	420.08	420.45	420.83	421.20	421.58	421.95	422.33	422.70	423.08	423.45	423.83	424.20	424.58	424.95	425.33	425.70	426.08	426.45	426.83	427.20	427.58	427.95	428.33	428.70	429.08	429.45	429.83	430.20	430.58	430.95	431.33	431.70	432.08	432.45	432.83	433.20	433.58	433.95	434.33	434.70	435.08	435.45	435.83	436.20	436.58	436.95	437.33	437.70	438.08	438.45	438.83	439.20	439.58	439.95	440.33	440.70	441.08	441.45	441.83	442.20	442.58	442.95	443.33	443.70	444.08	444.45	444.83	445.20	445.58	445.95	446.33	446.70	447.08	447.45	447.83	448.20	448.58	448.95	449.33	449.70	450.08	450.45	450.83	451.20	451.58	451.95	452.33	452.70	453.08	453.45	453.83	454.20	454.58	454.95	455.33	455.70	456.08	456.45	456.83	457.20	457.58	457.95	458.33	458.70	459.08	459.45	459.83	460.20	460.58	460.95	461.33	461.70	462.08	462.45	462.83	463.20	463.58	463.95	464.33	464.70	465.08	465.45	465.83	466.20	466.58	466.95	467.33	467.70	468.08	468.45	468.83	469.20	469.58	469.95	470.33	470.70	471.08	471.45	471.83	472.20	472.58	472.95	473.33	473.70	474.08	474.45	474.83	475.20	475.58	475.95	476.33	476.70	477.08	477.45	477.83	478.20	478.58	478.95	479.33	479.70	480.08	480.45	480.83	481.20	481.58	481.95	482.33	482.70	483.08	483.45	483.83	484.20	484.58	484.95	485.33	485.70	486.08	486.45	486.83	487.20	487.58	487.95	488.33	488.70	489.08	489.45	489.83	490.20	490.58	490.95	491.33	491.70	492.08	492.45	492.83	493.20	493.58	493.95	494.33	494.70	495.08	495.45	495.83	496.20	496.58	496.95	497.33	497.70	498.08	498.45	498.83	499.20	499.58	500.08
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3633-D

DRAFT

PART OF LOT 2
CONCESSION 7
(ALBION)
TOWN OF CALEDON
REGION OF PEEL

EXISTING UTILITIES:

THERE MAY BE VARIOUS UTILITIES WITHIN THE LIMITS OF THE CONTRACT. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE LOCAL UTILITY AUTHORITIES AND THE LOCAL AGENCY TO DETERMINE THE EXACT LOCATION OF ALL UTILITIES, AND IF NECESSARY TO ENGAGE THE SERVICES OF A PRIVATE LOCATE COMPANY TO LOCATE SERVICES WITHIN THE VICINITY OF THE REQUIRED WORKS ALL AT THE CONTRACTOR'S COST.

NO RESPONSIBILITY WILL BE ASSUMED BY THE ENGINEER OR THE OWNER FOR THE CORRECTNESS OR COMPLETENESS OF ANY DRAWINGS WITH RESPECT TO EXISTING UTILITIES, PIPES, OR OTHER OBJECTS EITHER UNDERGROUND OR ON THE SURFACE AND NEITHER THE ENGINEER OR THE OWNER SHALL BE LIABLE FOR THE INCORRECTNESS OR INADEQUACY THEREOF. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO DETERMINE THE LOCATION OF ALL SUCH UTILITIES, PIPES OR OTHER OBJECTS.

ALL COSTS OF WORKING AROUND, SUPPORTING AND/OR PROTECTING ALL EXISTING UTILITIES AND SERVICES ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

GENERAL NOTES

ALL WORKS, MATERIALS AND INSTALLATIONS MUST CORRESPOND TO THE CURRENT REGION OF PEEL AND TOWN OF CALEDON AND SPECIFICATIONS AND THE CURRENT ONTARIO PROVINCIAL STANDARD DRAWINGS AND SPECIFICATIONS IN THE EVENT OF A DISCREPANCY BETWEEN THEM, THE REGION OF PEEL AND/OR THE TOWN OF CALEDON STANDARDS AND SPECIFICATIONS SHALL PREVAIL.

ALL CONSTRUCTION WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.

1. ALL ELEVATIONS ARE IN METRES AND REFERENCED TO GEODETIC DATUM. ALL DIMENSIONS ARE IN METRIC UNITS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LAYOUT AND SURVEY CONTROL DURING CONSTRUCTION.
3. THE CONTRACTOR SHALL DELINEATE THE REQUIRED WORKING AREA ON-SITE PRIOR TO THE START OF WORK AND SHALL CONFINE OPERATIONS WITHIN THE DEFINED AREA.
4. THE CONTRACTOR SHALL MAINTAIN ACCESS REQUIREMENTS, AND TEMPORARY MATERIAL STORAGE AREAS TO BE MAINTAINED IN GOOD REPAIR BY THE CONTRACTOR AT ALL TIMES. AREAS AFFECTED BY THE CONTRACTOR'S ACTIVITIES ARE TO BE RESTORED TO THE EXISTING CONDITIONS OR BETTER.
5. ALL GENERAL BACKFILL TO BE OF APPROVED MATERIAL AND COMPACTED TO A MINIMUM 85% PROCTOR DENSITY UNLESS OTHERWISE STATED.
6. THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL AND DISPOSAL OF ALL DEBRIS AND EXCESS MATERIAL OFF SITE.
7. ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES ARE TO BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN ORIGINAL ALL TO THE SATISFACTION OF THE OWNER OF THE AFFECTED LANDS.

EROSION & SEDIMENT CONTROL

THE CONTRACTOR IS TO SUPPLY AND INSTALL EROSION AND SEDIMENTATION CONTROL MEASURES, SUCH AS SILT FENCING, CRUSHED STONE BERM, AND OTHER BARRIERS AS MAY BE APPROPRIATE TO THE CONSTRUCTION METHODS BEING EMPLOYED BY THE CONTRACTOR TO STOP THE SILTATION OF ADJACENT LANDS AND/OR LOCAL STORM SEWER SYSTEM, DITCHES, ETC.

CONTRACTOR/BUILDER SHALL REGULARLY INSPECT, MAINTAIN AND REPAIR ALL EROSION CONTROL FACILITIES AND TO ADD ADDITIONAL EROSION AND SEDIMENT CONTROL FACILITIES AT HIS COST DURING THE COURSE OF THE WORK, AS MAY BE NECESSARY BY VIRTUE OF HIS CONSTRUCTION PROCEDURES.

THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL COSTS TO RECTIFY ANY AND ALL DAMAGE EXTERNAL TO THE WORK AREA RESULTING FROM THE WORK AND HIS CONSTRUCTION PROCEDURES.

THE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR THE CONTROL OF DUST, MUD AND OTHER DEBRIS RESULTING FROM HIS WORKS. THIS COST AND THE COST OF ANY CLEANING, FLUSHING, SWEEPING, SCRAPING OF EXISTING ROADS AND/OR DRIVEWAYS USED BY THE CONTRACTOR, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

1. TEMPORARY EROSION AND SEDIMENT CONTROLS TO BE INSTALLED PRIOR TO THE START OF CONSTRUCTION AS IDENTIFIED ON OR IMPLIED BY THE PLANS AND SPECIFICATIONS.
2. ON-SITE EQUIPMENT REFUELING AND MAINTENANCE IS TO BE ONLY COMPLETED IN DESIGNATED AREAS.
3. SILTATION CONTROL FENCING TO BE INSTALLED ALONG THE DOWNSTREAM PERIMETER OF THE SITE LIMITS.
4. SILTATION CONTROLS TO BE INSPECTED AT LEAST WEEKLY AND AFTER EACH RAINFALL EVENT, ACCUMULATIONS OF SILT AND DEBRIS TO BE REMOVED BEFORE IT MAY CAUSE DAMAGE TO THE SILTATION CONTROL MEASURE IN PLACE.
5. DAMAGE TO SILTATION CONTROL MEASURES TO BE PROMPTLY CORRECTED AS MAY BE REQUIRED BY THE CONTRACTOR.
6. THE SILTATION CONTROL MEASURES INDICATED ON THE PLAN ARE CONSIDERED TO BE MINIMUM REQUIREMENTS, ADDITIONAL MEASURES ARE TO BE INSTALLED AS MAY BE REQUIRED TO SUIT CONSTRUCTION PROCEDURES AND CHANGES IN SITE CONDITIONS.
7. IT IS INTENDED THAT THE WORKS PROCEED IN A MANNER WHICH MINIMIZES ANY ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT OF THE PROJECT AND THE LANDS DOWNSTREAM. ALL WORK IS TO BE CARRIED OUT IN A MANNER CONSISTENT WITH AVOIDING ENVIRONMENTAL DAMAGE.
8. TEMPORARY SEDIMENTATION CONTROLS ARE TO BE REMOVED FROM SITE FOLLOWING COMPLETION OF CONSTRUCTION AND WITH THE INSTALLATION OF FINISH SURFACE TREATMENTS (e.g. paving, seeding, planting, etc.)

NOTES: REGION OF PEEL GENERAL CONSTRUCTION STANDARDS

1. ALL WATERMANS AND WATER SERVICE MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT REGION OF PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
2. WATERMANS AND/OR WATER SERVICE MATERIALS 100mm (4") AND LARGER MUST BE P.V.C. CLASS 150, MFD. TO A.W.W.A. SPEC. C900-78. SIZES 50mm (2") AND SMALLER, POLYETHYLENE PIPE TO BE 2004 TUBE SERIES 160 IN ACCORDANCE WITH C.S.A. B.137.1-1970, A.W.W.A. SPEC. C901-78 IN SIZES 20 TO 50mm (1" TO 2").
3. WATERMANS AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7m (5'-0") WITH A MINIMUM HORIZONTAL SPACING OF 1.2m (4'-0") FROM THEMSELVES AND ALL OTHER UTILITIES.
4. PROVISIONS FOR FLUSHING WATER LINES PRIOR TO TESTING MUST BE PROVIDED WITH AT LEAST A 50mm (2") SILET ON 100mm (4") AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END AS SAME AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN INTO A PARKING LOT OR DOWN A DRAIN OR FIRE LINES. FLUSHING OUTLET TO BE 100mm (4") DIA. MINIMUM OR A HYDRANT.
5. ALL CURB STOPS TO BE 3.0m (10') OFF THE FACE OF THE BUILDING UNLESS NOTED OTHERWISE.
6. HYDRANT AND VALVE SET TO REGION STANDARD 1-8-1. DIMENSIONS A AND B - .7m (2') AND .9m (3').
7. ALL HYDRANTS ARE TO HAVE PUMPER NOZZLE OUTLET.
8. WATERMANS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED COPY OF GRADE SHEET WHICH MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK (WHERE REQUESTED BY THE INSPECTOR). GRADE SHEET TO SPECIFY GRADE OF WATERMAN, THE FINISHED GRADE OVER THE WATERMAN AT INTERVALS OF AT LEAST 15 METRES AND THE ELEVATIONS AT POINTS OF CROSSING OF THE WATERMAN AND AND WATER SERVICES WITH OTHER UTILITIES AND DITCHES.
9. WATERMANS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF .15m (6") OVER AND .3m (12") UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
10. ALL PROPOSED WATERMAIN PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND COLORMATING EXISTING SYSTEM.
11. NOTE: 50mm P.E. PIPE IS EQUIVALENT TO 50mm TYPE 'K' COPPER. METER SIZE IS TO BE ONE SIZE SMALLER THAN THE INCOMING WATER SERVICE.
12. WHERE POLYETHYLENE PIPE (OR OTHER NON METALLIC PIPE) IS USED IN PLACE OF COPPER, A 12 GAUGE TWI STRANDED COPPER LIGHT COLOURED PLASTIC COATED TRACER WIRE MUST BE INSTALLED PER REGION OF PEEL STANDARDS.

NOTES: SANITARY SEWER CONSTRUCTION

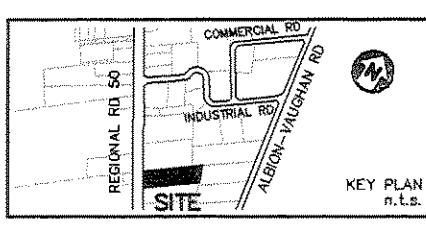
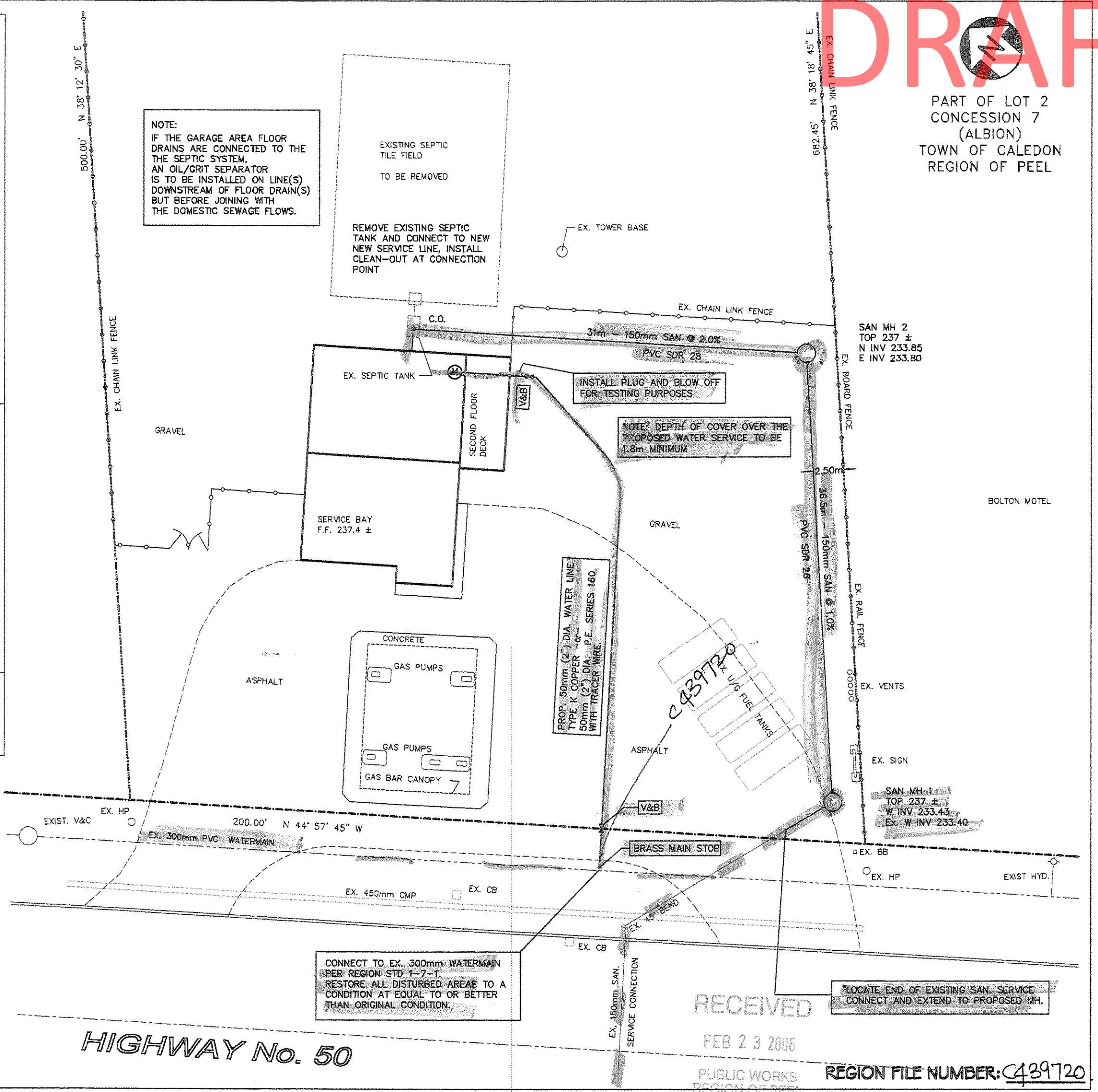
1. ALL SANITARY SEWERS AND SANITARY SERVICE MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT REGION OF PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
2. MAINLINE NON-PRESSURE PIPE SHALL BE POLYVINYL CHLORIDE (PVC) PIPE: 250 TO 375mm INCLUSIVE, TO BE MANUFACTURED TO LATEST EDITION OF C.S.A. STANDARD B182.2 (A.S.T.M. SPECIFICATION D 3034) WITH RUBBER GASKETTED BELL AND SPIGOT JOINTS. PIPE AND FITTINGS SHALL HAVE A MAXIMUM STANDARD DIMENSION RATIO OF 38 (SDR 35) AND A MINIMUM PIPE STIFFNESS OF 320 kPa, OR HIGHER STRENGTH AS MAY BE REQUIRED BY BY DESIGN.
3. SERVICE CONNECTIONS NON-PRESSURE PIPE OUTSIDE CONTROLLED SOLID WALL POLYVINYL CHLORIDE (PVC) PIPE, MANUFACTURED TO THE LATEST EDITION OF C.S.A. STANDARD B182.1 (A.S.T.M. SPECIFICATION D 3034). FITTINGS TO BE MANUFACTURED TO THE RUBBER GASKETTED BELL AND SPIGOT JOINTS. PIPE AND FITTINGS SHALL HAVE A MINIMUM OF PIPE PIPE STIFFNESS OF 630 kPa (SDR 28).
4. FITTINGS SUPPLIED TO A PROJECT SHALL BE COMPATIBLE WITH THE PIPE DELIVERED TO SITE. SHALL HAVE RUBBER GASKETTED BELL AND SPIGOT JOINTS. REFER TO REGION OF PEEL MATERIAL SPECIFICATIONS FOR: MANHOLES, MANHOLE FITTINGS, BEDDING AND BACKFILL AND SERVICE CONNECTIONS.
5. UNLESS OTHERWISE NOTED:
 - MANHOLES SHALL BE 1200mm PRECAST PER STD DWG 2-1-1.
 - MANHOLE BENCHING PER STD DWG 2-1-4.
 - MANHOLE FRAME AND COVERS PER STD DWG 2-2-2.
 - PIPE BEDDING PER STD DWG 2-3-1, CLASS B, COVER MATERIAL GRANULAR C, BEDDING MATERIAL HLS STONE.
 - FLEXIBLE SERVICE CONNECTION PIPE PER STD DWG 2-4-2.

NOTES: COMPACTION

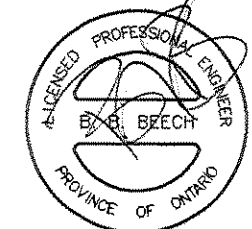
- COMPACT FULL WIDTH OF TRENCH BOTTOM TO AT LEAST 95% S.P.D.
- BEDDING MATERIAL TO AT LEAST 98% S.P.D.
- COVER MATERIAL TO AT LEAST 98% S.P.D.
- TRENCH BACKFILL TO AT LEAST 95% S.P.D.
- GRANULAR SUB-BASE MATERIALS TO AT LEAST 100% S.P.D.
- HOT MIX ASPHALT TO AT LEAST 92% S.P.D.

METER PER REGION OF PEEL
STD 1-4-5, 38mm Ø
DOMESTIC WATER METER.
MIN. 0 GPM, MAX. CONT.
RATE 80 GPM

NOTE:
IF THE GARAGE AREA FLOOR DRAINS ARE CONNECTED TO THE SEPTIC SYSTEM, AN OIL/GRIT SEPARATOR IS TO BE INSTALLED ON LINE(S) DOWNSTREAM OF FLOOR DRAIN(S) BUT BEFORE JOINING WITH THE DOMESTIC SEWAGE FLOWS.



No.	Revision/Issue	Date



Beech
Engineering Limited
236 Longwood Drive
Bolton, Ontario L7E 4A1
Tel: (905) 857-6658

Project Name & Address:
**GREG PANNIA
(SHAMROCK GAS BAR)
1 2393 HIGHWAY 50
BOLTON
TOWN OF CALEDON**

Title:
**WATER & SANITARY SERVICE
SERVICE CONNECTIONS**

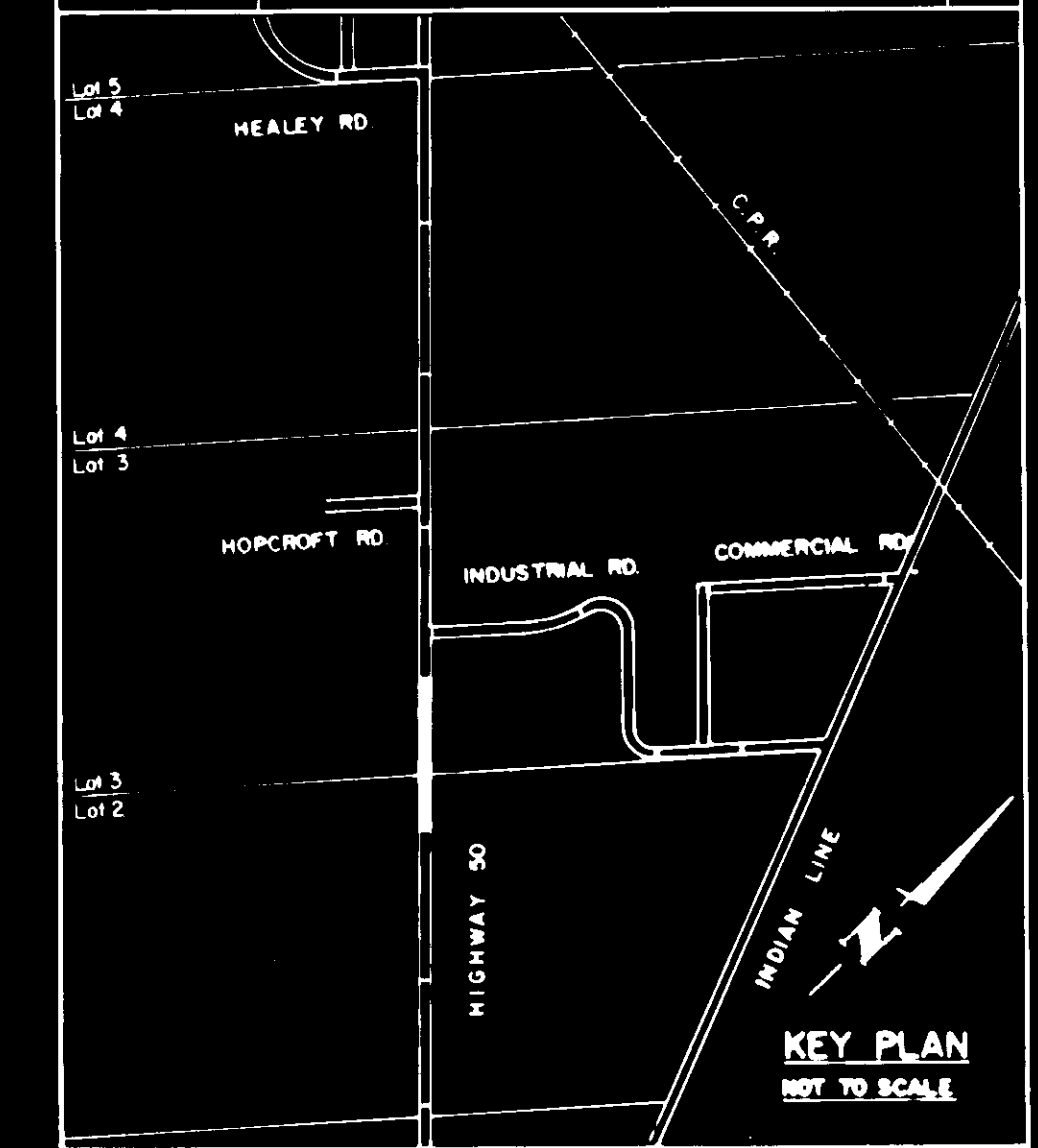
Project No. _____
Date: FEBRUARY 2006
Scale: 1:250

Sheet:
5-1


DRAFT

SERVICE DATA			
SERVICE	DATE	INIT	DATE
SAN SEWERS			
STORM SEWERS			
WATERMAINS			


REVISIONS			
DATE	DETAILS	INIT	
13 NOV 79	GRADE OF WM. REVISED & GRADE OVER WM ADDED	AK	
23 APR 80	AS CONSTRUCTED	AK	
MAY 82	PROP. SANITARY SEWER & FORCEMAIN	E.P.	
MAY 84	AS CONSTRUCTED	E.P.	



PROJ. No. 81-2134



Designed by *Chad*



Approved by

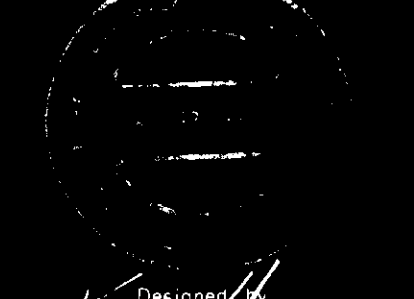
General Notes

- All Driveways Gravel Unless Otherwise Noted.
- All Service Locations Are Approximate And Must Be Located Accurately in Field.
- Denotes Building - Not Located
- Denotes Building Located
- Type B Bedding Unless Otherwise Noted (SAN)


B.M. N.P. Elev.

The Contractor is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction. Location of Existing Utilities, Approximate Only, To Be Verified in Field By Contractor.

PROJ. No. 78-1101



Designed by *Chad*



Approved by

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING:

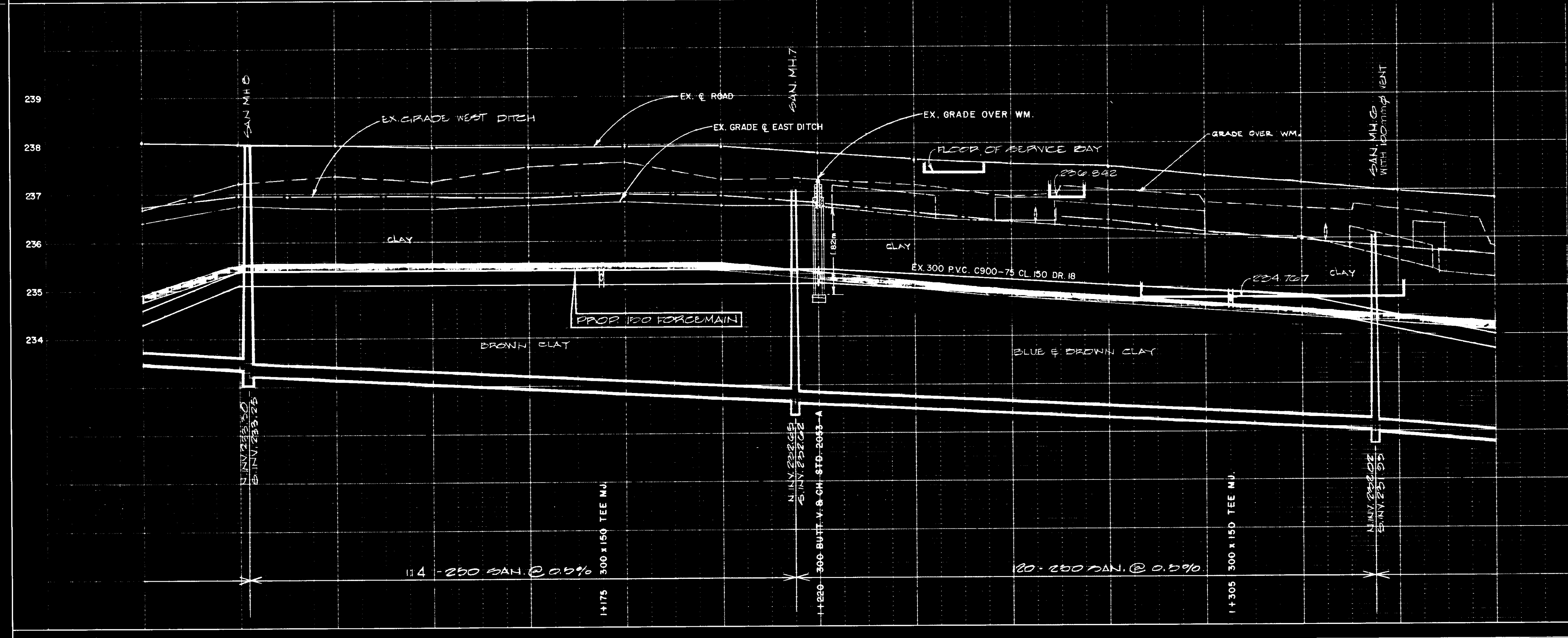
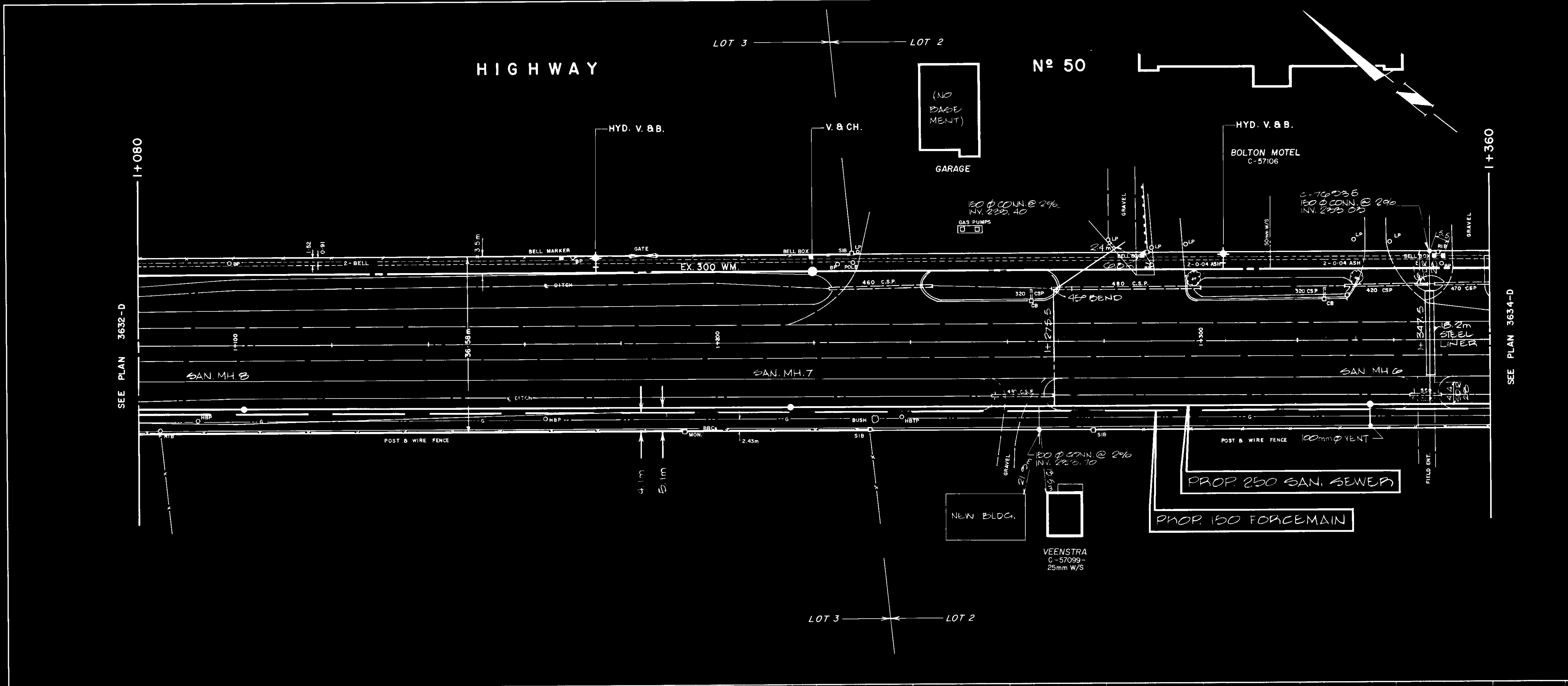
- THE REGIONAL MUNICIPALITY OF PEEL
- CITY OF MISSISSAUGA WORKS DEPT.
- CITY OF BRAMPTON WORKS DEPT.
- TOWN OF CALEDON WORKS DEPT.
- BELL TELEPHONE COMPANY
- CONSUMERS GAS COMPANY
- MINISTRY OF TRANSPORTATION
- MINISTRY OF ENVIRONMENT
- HYDRO ELECTRIC POWER COMM. OF ONTARIO
- HYDRO ELECTRIC COMM. CITY OF MISSISSAUGA
- HYDRO ELECTRIC COMM. CITY OF BRAMPTON
- HYDRO ELECTRIC COMM. PORT CREDIT
- HYDRO ELECTRIC COMM. STREETSVILLE
- CABLE TELEVISION



Department of Public Works
Region of Peel

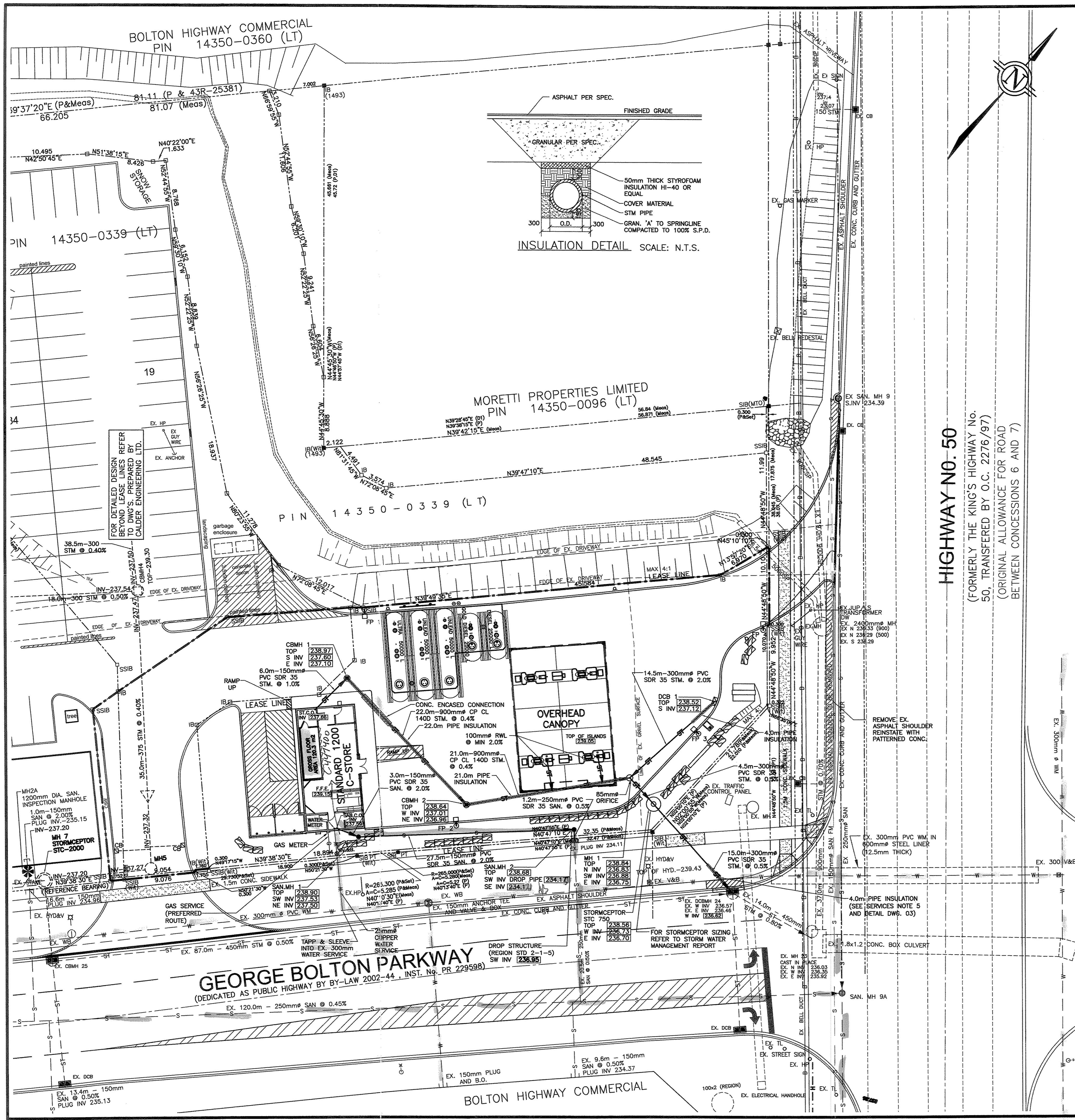
HIGHWAY 50
PROPOSED 250 SANITARY SEWER & 150 FORCEMAIN
Sta. 1+080 To Sta. 1+360

Lots 1-5	Area C-2	Project No. 81-2134
Scale: Hor. 1:500 Ver. 1:250	Drawn by E.W.K.	Checked by <i>AK</i>
Date MAY 79	Sheet 5 of 7	Plan No. 3633-D



234.75	235.20	235.57	235.95	236.32	236.70	237.08	237.45	237.83	238.20	238.58	238.95	239.33	239.70	240.08	240.45	240.83	241.20	241.58	241.95	242.33	242.70	243.08	243.45	243.83	244.20	244.58	244.95	245.33	245.70	246.08	246.45	246.83	247.20	247.58	247.95	248.33	248.70	249.08	249.45	249.83	250.20	250.58	250.95	251.33	251.70	252.08	252.45	252.83	253.20	253.58	253.95	254.33	254.70	255.08	255.45	255.83	256.20	256.58	256.95	257.33	257.70	258.08	258.45	258.83	259.20	259.58	260.00
+	1+080	1+100	1+120	1+140	1+160	1+180	1+200	1+220	1+240	1+260	1+280	1+300	1+320	1+340	1+360																					RD. CHAINAGE																															

3633-D



STORM DRAINAGE:

- (A) ALL STORM WATER SHALL BE DIRECTED IN SUCH A MANNER THAT WATER WILL NOT ACCUMULATE AT OR NEAR A BUILDING INCLUDING FOUNDATION WALLS, WINDOWS, ENTRANCES AND WALKWAYS.
 - (B) WHERE THE EXISTING GRADE IS ALTERED DUE TO GRADING, EXCAVATION, FILLING OR ANY OTHER RELATED WORK ALL SUCH WORK SHALL BE UNDERTAKEN AND COMPLETED IN ACCORDANCE WITH GOOD ENGINEERING PRACTICE TO ENSURE STABLE CONDITIONS AND SO AS NOT TO ADVERSELY AFFECT OR DAMAGE PUBLIC OR PRIVATE PROPERTY.
 - (C) STORM DRAINAGE SYSTEM TO CONFORM TO THE STORM WATER MANAGEMENT REPORT PREPARED BY TROW ASSOCIATES INC.
- THE CONTRACTOR MUST PERFORM ALL NECESSARY WORKS TO ENSURE THAT NO SURFACE DRAINAGE PROBLEMS ARE CREATED ON OR ADJACENT TO PRIVATE OR PUBLIC LANDS BY REASON OF HIS DEVELOPMENT.

SITE SERVICES NOTES:

- LEGAL INFORMATION TAKEN FROM DRAWINGS PREPARED BY YOUNG & YOUNG SURVEYING INC. (PROJECT No. 00-B3756).
- GENERAL CONTRACTOR TO ENGAGE A HYDRO LOCATE COMPANY TO CONFIRM THE LOCATION OF HIGH VOLTAGE CABLES, PRIOR TO START OF CONSTRUCTION.
- MANHOLES SHALL BE LOCATED A MINIMUM OF 1.5m AWAY FROM THE FACE OF CURB AND/OR ANY OTHER SERVICE.
- WHERE THE DIFFERENCE IN ELEVATION BETWEEN THE INLET AND OUTLET PIPES EXCEED 0.9m, A DROP PIPE AS INDICATED ON REGION OF PEEL STANDARD DWG. 2-1-5 SHALL BE PLACED ON THE INLET PIPE.
- THE DEPTH OF COVER OVER THE PROPOSED STORM & SANITARY SEWERS SHOULD BE CHECKED. WHEREVER THE COVER IS 1.2m OR LESS, IT IS TO BE INSULATED WITH 100mm THICK x 1.2m WIDE INSULATION PLACED INTO TWO (2) LAYERS WITH STAGGERED JOINTS, AND TO BE STYROFOAM BRAND H.I. TYPE IV.

STORM SEWERS:

- ALL STORM SEWERS & CONNECTIONS METHODS TO BE IN ACCORDANCE WITH CURRENT MUNICIPAL SPECIFICATION.
- STORM SEWERS AND CONNECTIONS 375mm AND SMALLER TO BE PVC SDR 35.
- STORM SEWERS 675mm AND OVER SHALL BE CONCRETE AND EQUAL TO CSA SPECIFICATION 4257.2 CLASS 500 OR LATEST AMENDMENT, UNLESS NOTED OTHERWISE.
- ALL STORM SEWERS INCLUDING CATCH BASIN LEADS AND SERVICE CONNECTIONS TO BE FITTED WITH RUBBER GASKET JOINTS.
- SEWER BEDDING TO BE IN ACCORDANCE WITH O.P.S.D. 802.03 FOR RIGID PIPE OR O.P.S.D. 802.04 FOR FLEXIBLE PIPE.
- CBM# 1 & 2, MANHOLE 1 TO BE CONSTRUCTED IN ACCORDANCE WITH O.P.S.D. 701.012 (1800mm). CBM# 1 SHALL HAVE CAST IRON COVER & SQUARE FRAME O.P.S.D. 401.010 TYPE 'A' AND MANHOLE 1 SHALL HAVE CAST IRON COVER & SQUARE FRAME O.P.S.D. 401.010 TYPE 'A'.
- CATCH BASINS TO BE IN ACCORDANCE WITH O.P.S.D. 705.01, TWIN INLET CATCH BASIN TO BE IN ACCORDANCE WITH O.P.S.D. 705.02 WITH FRAME AND GRATE AS PER O.P.S.D. 400.01, UNLESS NOTED OTHERWISE.
- ALL CATCH BASINS AND MANHOLES TO HAVE MINIMUM 300mm SUMP AND TOP AS PER MUNICIPAL STANDARDS.

SANITARY SEWERS:

- PVC SEWER PIPE, UNLESS OTHERWISE NOTED MUST MEET THE REQUIREMENTS OF THE FOLLOWING STANDARDS.
 - CSA 182.1 ASTM D-2729 AND ASTM D-3034 OR LATEST AMENDMENT, CLASS SDR35.
 - CSA B183.4-M90 FOR RIBBED PVC SEWER PIPE. (NOTE THAT THE MANUFACTURERS DIRECTIONS FOR INSTALLATION BEDDING AND BACK FILLING MUST BE FOLLOWED).
- MANHOLES TO BE CONSTRUCTED IN ACCORDANCE WITH REGION OF PEEL STD. 2-1-1 (1200mm) WITH RUBBER GASKET JOINTS.
- ALL SANITARY SEWER AND SERVICE CONNECTIONS TO BE FITTED WITH CHEMICALLY RESISTANT JOINTS AS PER MUNICIPAL STANDARDS. SANITARY CONNECTIONS TO BE PER O.P.S.D. 1006.020.
- SEWER BEDDING TO BE IN ACCORDANCE WITH O.P.S.D. 1005. (UNLESS NOTED OTHERWISE).
- SAFETY PLATFORMS TO BE IN ACCORDANCE WITH O.P.S.D. 404.02.
- SANITARY MANHOLES TO HAVE FRAME AND GRATE AS PER O.P.S.D. 401.03.
- MANLINE AND STREETLINE MANHOLES TO BE IN ACCORDANCE WITH REGION OF PEEL STANDARDS.
- MAX. DROP BETWEEN THE INLET AND OUTLET ELEVATIONS OF SANITARY MANHOLE IS 0.03m. MIN. DEPTH OF SANITARY MANHOLE IS 2.13m.

WATERMANS:

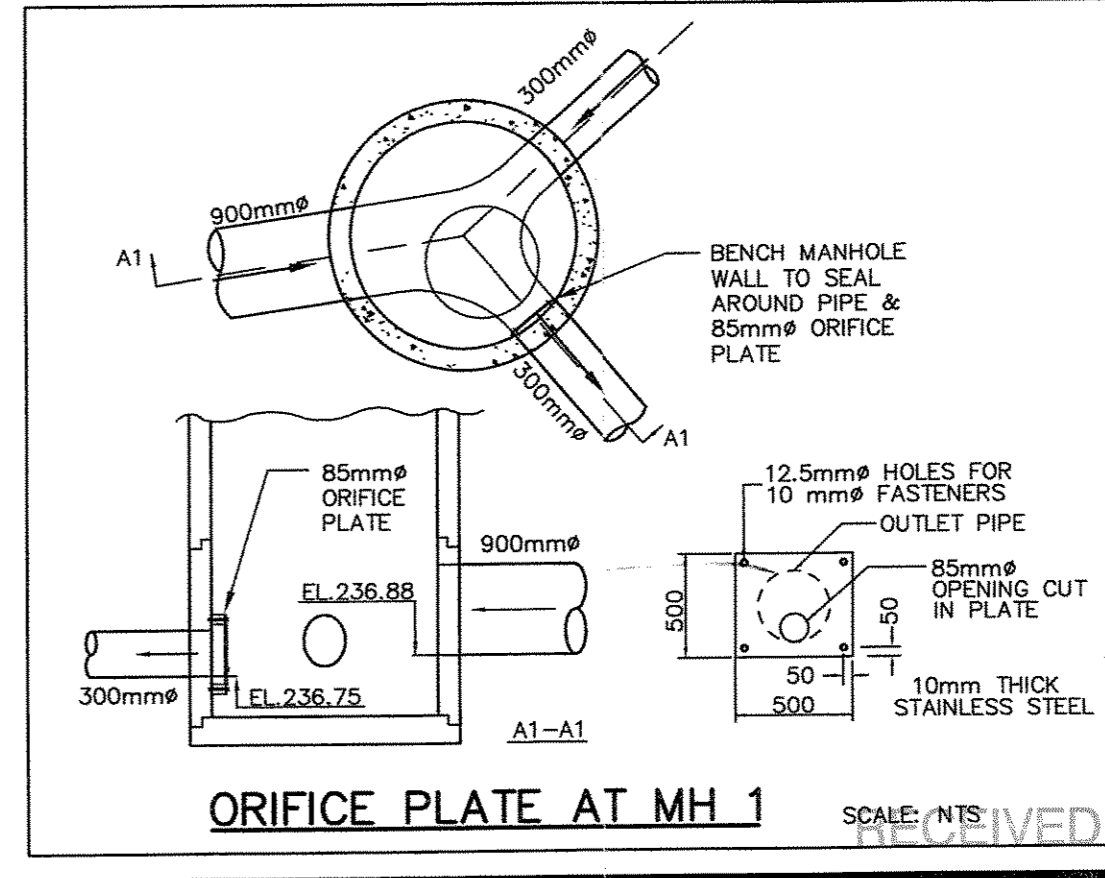
- ALL MATERIAL AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
- WATERMAIN AND/OR WATER SERVICE MATERIALS 100mm AND LARGER MUST BE CLASS 150, A.W.W.A. C 900-75 P.V.C. PIPE. SIZE LARGER THAN 50mm TO BE P.V.C. 2306 TUBE SERIES 160 C.S.A. B.137.1 (A.W.W.A. C901). PIPE 50mm AND SMALLER TO BE SOFT COPPER TYPE 'K'.
- WATERMANS AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7m WITH A MINIMUM HORIZONTAL SPACING OF 1.2m FROM THEMSELVES AND ALL OTHER UTILITIES.
- PROVISIONS FOR FLUSHING WATER LINES PRIOR TO TESTING, ETC. MUST BE PROVIDED WITH AT LEAST A 50mm² OUTLET ON 100mm AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, THE SAME SIZE AS THE LINE THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO A PARKING LOT OR DOWN A DRAIN. ON FIRE LINES, FLUSHING OUTLET TO BE 100mm² MINIMUM ON A HYDRANT.
- ALL CURB STOPS TO BE 3.0m OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
- HYDRANT AND VALVE SET TO REGION STANDARD 1-6-1 DIMENSION A AND B, 0.7m AND 0.9m AND TO HAVE PUMPER NOZZLE.
- WATERMANS TO BE INSTALLED TO GRADE AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
- WATERMANS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.3m OVER / 0.5m UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
- ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATING FROM EXISTING SYSTEMS.
- ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.

TRAFFIC SAFETY AND CONTROL:

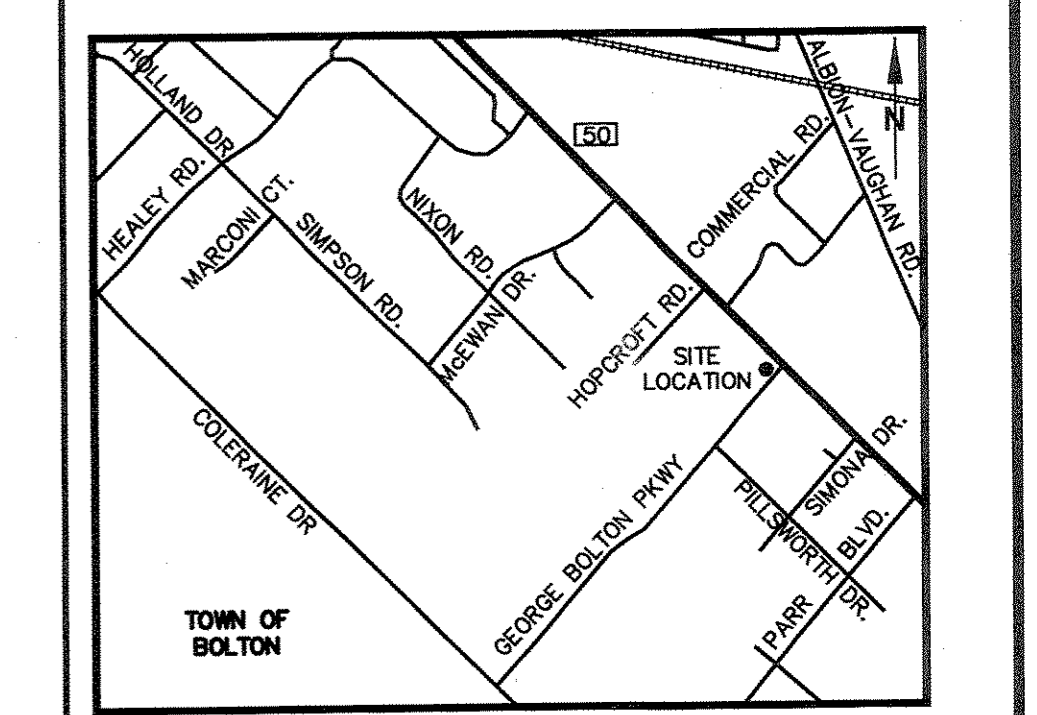
- IT IS THE RESPONSIBILITY OF THE SITE DEVELOPER TO PROVIDE ALL TRAFFIC SAFETY AND CONTROL MEASURES IN ACCORDANCE WITH THE ONTARIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES. TEMPORARY CONDITIONS. THE SITE DEVELOPER SHALL MAKE ARRANGEMENTS WITH THE MUNICIPALITY AT LEAST 30 DAYS PRIOR TO COMMENCING WORK ON ANY PUBLIC ROADS.

FIRE DEPARTMENT:

- FIRE ROUTE WILL BE DESIGNATED AS PER MUNICIPAL BY-LAW.
- THE FIRE DEPARTMENT ACCESS ROUTE SHALL BE DESIGNED TO SUPPORT A LOAD OF NOT LESS THAN 11,363 KG PER AXLE AND HAVE A CHANGE IN SLOPE OF NOT MORE THAN 1 IN 12.5 OVER A MINIMUM DISTANCE OF 15 m.



NO.	REVISIONS	DATE	BY	APP.
E	SANITARY SERVICE, WATER SERVICE, SITE SERVICES NOTE 4, WATERMAIN NOTE 8 REVISED, WATERMAIN NOTE 10 AND SANITARY SEWER NOTE 8 ADDED, STORM SERVICE BEYOND LEASE LINE SHOWN.	OCT 17 2007	A.B.	
D	DWG UPDATED TO REFLECT SITE PLAN REV 'E'.	SEP 10 2007	A.B.	
C	DWG UPDATED TO REFLECT SITE PLAN REV 'D'.	SEP 05 2007	A.B.	
B	DWG UPDATED TO REFLECT SITE PLAN REV 'C', STORM SERVICE REVISED, CITY FILE NUMBER ADDED.	JUL 05 2007	A.B.	
A	ISSUED FOR INFORMATION.	MAR 09 2007	A.B.	

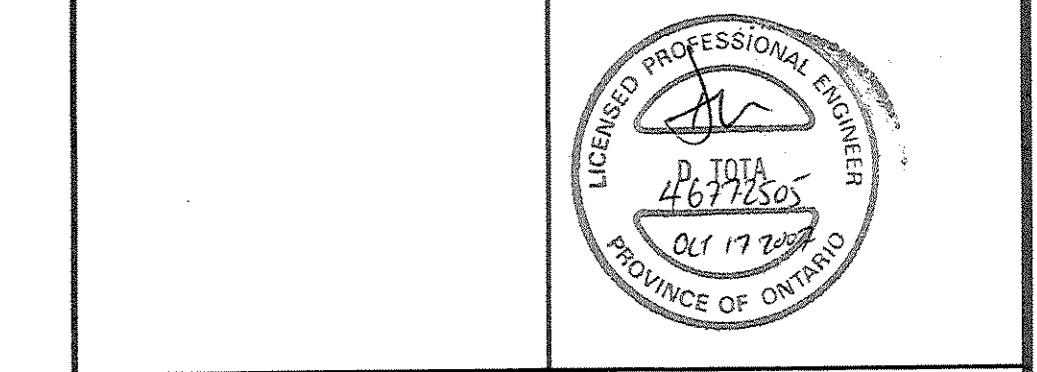


LEGEND:

IB	EX. IRON BAR	ST	EX. STORM SEWER
SIB	EX. STANDARD I.B.	S	EX. SANITARY SEWER
TL	EX. TRAFFIC LIGHT	W	EX. WATER MAINS
HF	EX. HYDRO POLE	G	EX. GAS MAINS
UV	EX. UNDERGROUND VALVE	H	EX. OVERHEAD HYDRO IRRIGATION
WV	EX. WATER VALVE	UH	EX. HYDRO CONTROL VALVE
HYD	EX. FIRE HYDRANT	B	EX. U/G BELL SERVICE EX. FIBER OPTICS LINE
C.O.	NEW CLEAN OUT	FP	NEW STORM SEWER
RW	NEW DOWNSPOUT	FS	NEW SANITARY SEWER
BP	EX. BELL PEDESTAL	W	NEW WATER SERVICE
NP	NEW FLOODEPOLE	GS	NEW GAS SERVICE
SM	EX. STORM M.H.	HW	NEW HYDRO SERVICE
NSM	NEW STORM M.H.	B	NEW BELL SERVICE
ESM	EX. SANITARY M.H.	CB	EX. CONC. CURB
NSM	NEW SANITARY M.H.	NC	NEW CONC. CURB
CS	EX. CATCH BASIN	CC	NEW DEPRESSED CURB
NSC	NEW CATCH BASIN	CC	NEW CURB CUT
NSC	NEW CATCH BASIN M.H.	+	EX. ELEVATION TO REMAIN
NSC	NEW SLOPE	+ [92.53]	EX. ELEVATION (PROPOSED)
NSC	MAJOR OVERLAND FLOW DIRECTION	+ [92.73]	PROPOSED ELEVATION (BY OTHERS)

SCALE: 1:250 METRES

METRIC DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048



OWNER: Farview Holdings
12599 Hwy. 50, Unit 7
Bolton, ON. L7E 1M4
Tel: (416) 420-7709
Fax: (905) 893-3100



Trow Associates Inc.
1595 Clark Boulevard
Brampton, Ontario L6T 4V1
Tel: (905) 793-9800
Fax: (905) 793-0641

LOCATION: 12476 REGIONAL ROAD 50
@ GEORGE BOLTON PKWY
TOWN OF CALEDON, ONTARIO

TITLE: SITE SERVICES PLAN SPA07-021

DESIGNED: A.B. DRAWN: A.B. S/S No.: B. No.:

CHECKED: B.H. REGIONAL ENGINEER FEB 2007
SCALE: 1:250 APPROVED FOR WATER, SANITARY AND/OR STORM SERVICES IN ACCORDANCE WITH LATEST REGION OF CAD FILE: 233513 (M) AND SP0702133130

DWG. NO. 03

HIGHWAY NO. 50
(FORMERLY THE KING'S HIGHWAY NO. 50, TRANSFERRED BY O.C. 2276/97)
(ORIGINAL ALLOWANCE FOR ROAD BETWEEN CONCESSIONS 6 AND 7)

INSPECTORS COPY

APPENDIX C
Matrix Crossing Structure Sheets and Photolog

Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 1 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

Bankfull Width (m) 3.2/3.6/0.5 (main channel d/s) Bankfull Depth (m) 0.75/1 m/ no bankfull downstream

Wetted Width (m) 2.5/2.5/1.5 Wetted Depth (m) 0.1/0.6/0.07

Gradient [X] Low [] Medium [] High Entrenchment [] Low [] Medium [] High

Sinuosity [X] Low [] Medium [] High Valley Setting unconfined

Riparian Vegetation Width (m) ~10 m Type cattails, grass

Channel Disturbance Hardened with riprap around culvert at road

Cross-sectional Sketch:



Planform Sketch:



Road Type (Highway, Regional, Local)

Crossing Type

- Pre-Cast Culvert, Cast-in-place Culvert, Bridge, Other HDPE, closed bottom, Open Bottom, Closed Bottom

Material

- Concrete, Bridge, Aluminum, Corrugated Steel, Other HDPE

Bridge Design

- Free Span, Piers, Abutments, Number of Spans

Culvert Shape

- Circular, Box, Arch, Elliptical, Multiple (#), Other

Dimensions

Width (m) 0.6 m/1.88 m Height (m) 0.6 m/1.05 Length (m) Age HDP new box 10+ years



Stream Crossing Assessment Form

Date: _____ **Stream:** _____ **Crew:** _____
Road Name: _____ **Recorder:** _____

Structure Condition

Good Collapsed Mechanical Damage Rust Other _____
X

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling Minor Pooling Major Pooling
 No Erosion Minor Erosion Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling Minor Pooling Major Pooling
 No Erosion Minor Erosion Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening Channel Width > Opening
channel widened at culvert

Embankment Erosion Protection

Riprap Vegetation Armour Stone
 Slope Paving Retaining Wall Other _____

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	X	no
Cracks running parallel to the structure centerline	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	X	no
Erosion or failure of the embankment slope over the structure	<input checked="" type="checkbox"/>	yes	<input type="checkbox"/>	X	no
Sink holes over the structure	<input type="checkbox"/>	yes	<input checked="" type="checkbox"/>	X	no

Substrate Present Through Crossing? yes no Comment: cattails, depositional

Substrate Type Natural Constructed Comment: _____

Concerns Regarding Fish Passage? yes no Comment: _____

Culvert Perched or Overhanging? yes no Amount (m) _____

Comment on road alignment with respect to the valley and channel planform: part of culvert system

Does Light Penetrate Under Entire Crossing? yes no Comment: _____

Noise Level at Time of Inspection High Medium Low

Photos Taken of Structure? Upstream _____ Downstream _____

Comments: upstream channel choked with cattails, water flowing minimally
HDPE likely a culvert extension from box that is visible downstream
concrete box downstream, channel lined with dense phragmites, outlets to pond downstream



Stream Crossing Assessment Form

Date: Sept 9/20 **Stream:** Crossing 1a **Crew:** NC/PC
Road Name: Regional Road 50 **Recorder:** NC
Location: Caledon **Weather Description:** overcast, 20 degrees

Channel Dimensions (Measured/Estimated) black = upstream of crossing
 red = downstream

Bankfull Width (m) 2.5 m Bankfull Depth (m) 0.45 m
 Wetted Width (m) 1.1 m Wetted Depth (m) 0.1

Gradient Low Medium High Entrenchment Low Medium High
 Sinuosity Low Medium High Valley Setting Straightened ditch

Riparian Vegetation Width (m) ~20 m Type road on left, grass on right

Channel Disturbance Hardened with riprap around culvert at road

Cross-sectional Sketch:



Planform Sketch:



Road Type (Highway, Regional, Local) _____

Crossing Type

- Pre-Cast Culvert Open Bottom Closed Bottom
- Cast-in-place Culvert Open Bottom Closed Bottom
- Bridge
- Other CSP, closed bottom

Material

- Concrete Bridge Aluminum Corrugated Steel Other _____

Bridge Design

- Free Span Piers Abutments Number of Spans _____

Culvert Shape

- Circular Box Arch Elliptical Multiple (# _____) Other _____

Dimensions

Width (m) 0.9 m Height (m) 0.9 m Length (m) _____ Age 10+ years



Stream Crossing Assessment Form

Date: Stream: Crew: Road Name: Recorder:

Structure Condition: Good, Collapsed, Mechanical Damage, Rust, Other

Evidence of Flow Restriction and Erosion Upstream of Crossing: No Pooling, Minor Pooling, Major Pooling, No Erosion, Minor Erosion, Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing: No Pooling, Minor Pooling, Major Pooling, No Erosion, Minor Erosion, Major Erosion

Relative Crossing Sizing: Channel Width < Opening, Channel Width = Opening, Channel Width > Opening

Embankment Erosion Protection: Rip Rap, Slope Paving, Vegetation, Retaining Wall, Armour Stone, Other

Debris Trapping: No Debris, Minor Debris, Major Debris

Evidence of: Patching or pavement built-up, Cracks running parallel to the structure centerline, Erosion or failure of the embankment slope over the structure, Sink holes over the structure

Substrate Present Through Crossing? yes, no

Substrate Type: Natural, Constructed

Concerns Regarding Fish Passage? yes, no

Culvert Perched or Overhanging? yes, no, Amount (m)

Comment on road alignment with respect to the valley and channel planform: part of culvert system

Does Light Penetrate Under Entire Crossing? yes, no

Noise Level at Time of Inspection: High, Medium, Low

Photos Taken of Structure? Upstream, Downstream

Comments: ditch along Highway 50, filled with cattails, banks near-vertical ~0.15 m high

Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 2 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

black = upstream of crossing
red = downstream

Channel Dimensions (Measured/Estimated)

Bankfull Width (m) 2.5 m Bankfull Depth (m) 0.6 m

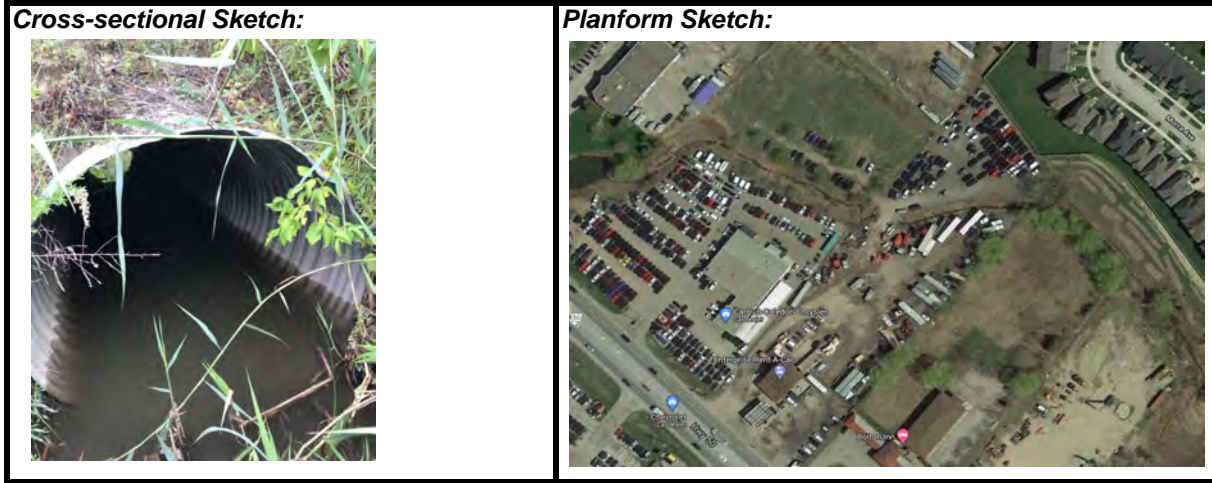
Wetted Width (m) 1.1 m Wetted Depth (m) 0.03/0.15

Gradient [] Low [X] Medium [] High Entrenchment [] Low [] Medium [] High

Sinuosity [] Low [X] Medium [] High Valley Setting Partially confined

Riparian Vegetation Width (m) ~5 m Type Meadow, then gravel car lots beyond meadow

Channel Disturbance Old concrete blocks around culvert sides (failing)



Road Type (Highway, Regional, Local)

Crossing Type

- [] Pre-Cast Culvert [] Open Bottom [] Closed Bottom
[] Cast-in-place Culvert [] Open Bottom [] Closed Bottom
[] Bridge
[X] Other CSP, closed bottom

Material

- [] Concrete [] Bridge [] Aluminum [X] Corrugated Steel [] Other

Bridge Design

- [] Free Span [] Piers [] Abutments [] Number of Spans

Culvert Shape

- [X] Circular [] Box [] Arch [] Elliptical [] Multiple (#) [] Other

Dimensions

Width (m) 1.55 m Height (m) 1.5 m Length (m) Age 10+ years

Stream Crossing Assessment Form

Date: Stream: Crew: Road Name: Recorder:

Structure Condition

Good Collapsed Mechanical Damage Rust Other

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling No Erosion Minor Pooling Minor Erosion Major Pooling Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling No Erosion Minor Pooling Minor Erosion Major Pooling Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening Channel Width > Opening

Embankment Erosion Protection

Rip Rap Slope Paving Vegetation Retaining Wall Armour Stone Other concrete blocks None

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up Cracks running parallel to the structure centerline Erosion or failure of the embankment slope over the structure Sink holes over the structure

Substrate Present Through Crossing? yes no Comment:

Substrate Type Natural Constructed Comment:

Concerns Regarding Fish Passage? yes no Comment: woody debris jam blocking upstream culvert connection

Culvert Perched or Overhanging? yes no Amount (m)

Comment on road alignment with respect to the valley and channel planform: Away from road N/A

Does Light Penetrate Under Entire Crossing? yes no Comment:

Noise Level at Time of Inspection High Medium Low

Photos Taken of Structure? Upstream Downstream

Comments: sinuous upstream, bank erosion around meanders, channel substrate clay and fine gravel gravel potentially sourced from parking lots above during rainfall

no erosion downstream, channels straight not sinuous, no floodplain channel is bordered by gravel lots Channel substrate consists of clay and fine gravel

Stream Crossing Assessment Form

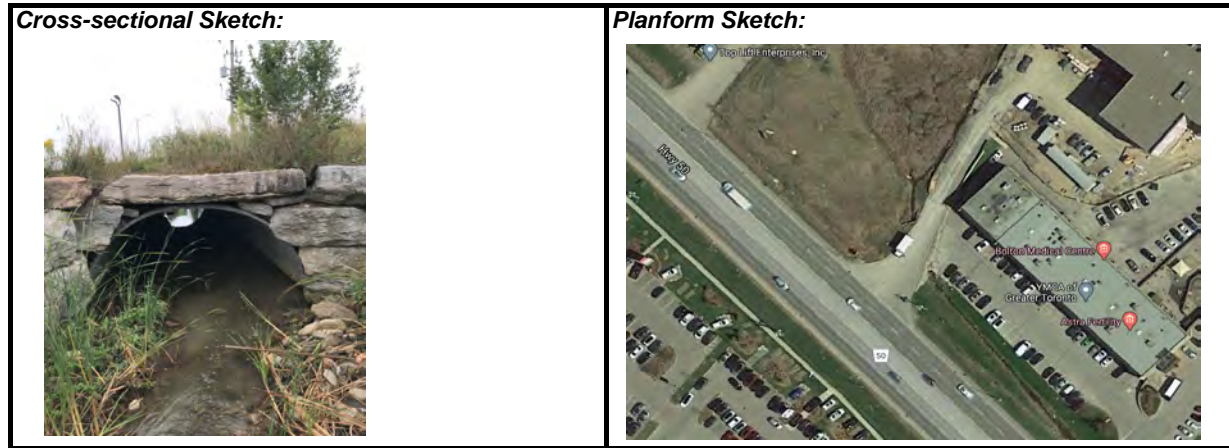
Date: Sept 9/20 Stream: Crossing 3 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

Bankfull Width (m) no bankfull upstream (design) 1.2 m
Wetted Width (m) 2.95 at culvert 0.6 m
Gradient [X] Low [] Medium [] High
Sinuosity [X] Low [] Medium [] High
Riparian Vegetation Width (m) ~10 m Type cattails, grass

Channel Disturbance Channel being realigned upstream (ongoing construction)



Road Type (Highway, Regional, Local)

Crossing Type

- Pre-Cast Culvert, Cast-in-place Culvert, Bridge, Other CSP arch, open bottom, Open Bottom, Closed Bottom

Material

- Concrete, Bridge, Aluminum, Corrugated Steel, Other

Bridge Design

- Free Span, Piers, Abutments, Number of Spans

Culvert Shape

- Circular, Box, Arch, Elliptical, Multiple (#), Other

Dimensions

Width (m) 2.90 Height (m) 1.78 Length (m) Age 10+ years



Stream Crossing Assessment Form

Date: _____ **Stream:** _____ **Crew:** _____
Road Name: _____ **Recorder:** _____

Structure Condition

Good Collapsed Mechanical Damage Rust Other _____

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling Minor Pooling Major Pooling
 No Erosion Minor Erosion Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling Minor Pooling Major Pooling
 No Erosion Minor Erosion Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening Channel Width > Opening
channel widened at culvert

Embankment Erosion Protection

Riprap Vegetation Armour Stone Other _____
 Slope Paving Retaining Wall

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Cracks running parallel to the structure centerline	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Erosion or failure of the embankment slope over the structure	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Sink holes over the structure	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no

Substrate Present Through Crossing? yes no Comment: gravel, cobbles (sourced from bank likely)

Substrate Type Natural Constructed Comment: _____

Concerns Regarding Fish Passage? yes no Comment: _____

Culvert Perched or Overhanging? yes no Amount (m) _____

Comment on road alignment with respect to the valley and channel planform: skewed ~45 degrees to road

Does Light Penetrate Under Entire Crossing? yes no Comment: _____

Noise Level at Time of Inspection High Medium Low

Photos Taken of Structure? Upstream _____ Downstream _____

Comments: channel undergoing realignment, being shifted east
channel flows towards right of culvert, gravel bar has formed towards downstream end of culvert
can see culvert footings, minor bed erosion, outlets into ditch with mowed lawn on either side
cobbles on bed throughout ditch (possibly placed?)

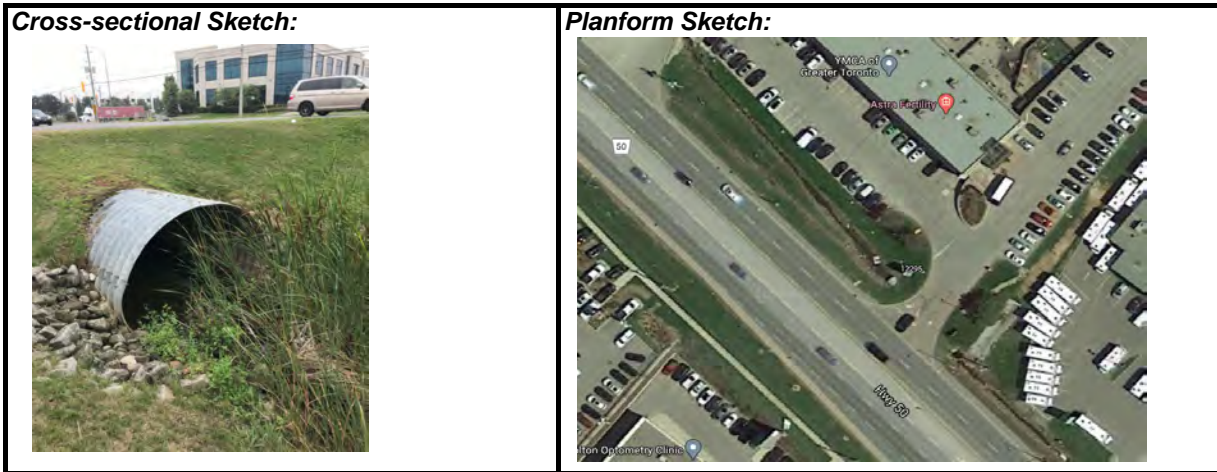
Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 4 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

Bankfull Width (m) 5.5 m Bankfull Depth (m) 0.4 m
Wetted Width (m) 2.1 m Wetted Depth (m) 0.1
Gradient [X] Low [] Medium [] High Entrenchment [] Low [] Medium [] High
Sinuosity [X] Low [] Medium [] High Valley Setting confined by road
Riparian Vegetation Width (m) Type straightened ditch, mowed grass on either side
Channel Disturbance riprap at crossing on banks



Road Type (Highway, Regional, Local)

Crossing Type

- Pre-Cast Culvert, Cast-in-place Culvert, Bridge, Other CSP arch, closed bottom
Open Bottom, Closed Bottom

Material

- Concrete, Bridge, Aluminum, [X] Corrugated Steel, Other

Bridge Design

- Free Span, Piers, Abutments, Number of Spans

Culvert Shape

- Circular, Box, [X] Arch, Elliptical, Multiple (#), Other

Dimensions

Width (m) 2.25 m Height (m) 1.62 m Length (m) Age 10+yrs



Stream Crossing Assessment Form

Date: _____ Stream: _____ Crew: _____
 Road Name: _____ Recorder: _____

Structure Condition

Good Collapsed Mechanical Damage Rust Other light rust marks

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling Minor Pooling Major Pooling
 No Erosion Minor Erosion Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling Minor Pooling Major Pooling
 No Erosion Minor Erosion Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening Channel Width > Opening

Embankment Erosion Protection

Riprap Slope Paving Vegetation Retaining Wall Armour Stone Other _____

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Cracks running parallel to the structure centerline	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Erosion or failure of the embankment slope over the structure	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Sink holes over the structure	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no

Substrate Present Through Crossing? yes no Comment: _____

Substrate Type Natural Constructed Comment: _____

Concerns Regarding Fish Passage? yes no Comment: _____

Culvert Perched or Overhanging? yes no Amount (m) _____

Comment on road alignment with respect to the valley and channel planform: parallel to road

Does Light Penetrate Under Entire Crossing? yes no Comment: _____

Noise Level at Time of Inspection High Medium Low

Photos Taken of Structure? Upstream _____ Downstream _____

Comments: cattails ~10 m upstream of crossing, fine substrates, culvert protected by riprap

pooling downstream, remains ditched, channel choked with cattails

Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 5 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

Bankfull Width (m) 3.5 m Bankfull Depth (m) 0.6 m

Wetted Width (m) 1.7 m Wetted Depth (m) 0.2

Gradient [X] Low [] Medium [] High Entrenchment [] Low [] Medium [] High

Sinuosity [X] Low [] Medium [] High Valley Setting confined by road

Riparian Vegetation Width (m) Type straightened ditch, grass on either side

Channel Disturbance riprap at crossing on banks and road embankment

Cross-sectional Sketch:



Planform Sketch:



Road Type (Highway, Regional, Local)

Crossing Type

- Pre-Cast Culvert, Cast-in-place Culvert, Bridge, Other CSP arch, closed bottom
Open Bottom, Closed Bottom

Material

- Concrete, Bridge, Aluminum, [X] Corrugated Steel, Other

Bridge Design

- Free Span, Piers, Abutments, Number of Spans

Culvert Shape

- Circular, Box, [X] Arch, Elliptical, Multiple (#), Other

Dimensions

Width (m) 2.08 m Height (m) 1.45 m Length (m) Age 10+ yrs

Stream Crossing Assessment Form

Date: Stream: Crew: Road Name: Recorder:

Structure Condition

Good Collapsed Mechanical Damage Rust X Other rusting through bottom

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling No Erosion Minor Pooling Minor Erosion Major Pooling Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling No Erosion Minor Pooling Minor Erosion Major Pooling Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening X Channel Width > Opening

Embankment Erosion Protection

Riprap X Slope Paving Vegetation Retaining Wall Armour Stone Other

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up Cracks running parallel to the structure centerline Erosion or failure of the embankment slope over the structure Sink holes over the structure

Substrate Present Through Crossing? yes no X Comment:

Substrate Type Natural Constructed Comment:

Concerns Regarding Fish Passage? yes no X Comment:

Culvert Perched or Overhanging? yes no X Amount (m)

Comment on road alignment with respect to the valley and channel planform: parallel to road

Does Light Penetrate Under Entire Crossing? yes no X Comment:

Noise Level at Time of Inspection High Medium X Low

Photos Taken of Structure? Upstream Downstream

Comments: ditch lined with cattails upstream

0.9 m concrete box on right bank (likely storm sewer related) ditch downstream lined with more cattails

Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 6 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

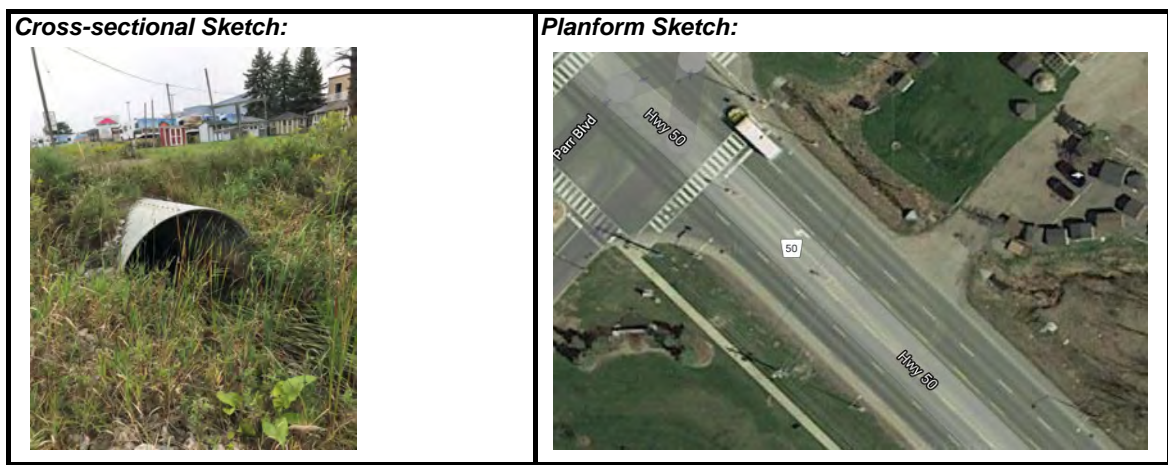
Bankfull Width (m) 3 m Bankfull Depth (m) 0.4 m
Wetted Width (m) 1.6 m Wetted Depth (m) 0.06 m

Gradient [X] Low [] Medium [] High Entrenchment [] Low [] Medium [] High

Sinuosity [X] Low [] Medium [] High Valley Setting confined by road

Riparian Vegetation Width (m) Type straightened ditch, road and parking lot on either side

Channel Disturbance none



Road Type (Highway, Regional, Local)

Crossing Type
[] Pre-Cast Culvert [] Open Bottom [] Closed Bottom
[] Cast-in-place Culvert [] Open Bottom [] Closed Bottom
[] Bridge
[X] Other CSP arch, closed bottom

Material
[] Concrete [] Bridge [] Aluminum [X] Corrugated Steel [] Other

Bridge Design
[] Free Span [] Piers [] Abutments [] Number of Spans

Culvert Shape
[] Circular [] Box [X] Arch [] Elliptical [] Multiple (#) [] Other

Dimensions
Width (m) 2.25 m Height (m) 1.62 m Length (m) Age 10+yrs



Stream Crossing Assessment Form

Date: Stream: Crew: Road Name: Recorder:

Structure Condition

Good Collapsed Mechanical Damage Rust Other light rust marks

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling No Erosion Minor Pooling Minor Erosion Major Pooling Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling No Erosion Minor Pooling Minor Erosion Major Pooling Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening Channel Width > Opening

Embankment Erosion Protection

Riprap Slope Paving Vegetation Retaining Wall Armour Stone Other none

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up Cracks running parallel to the structure centerline Erosion or failure of the embankment slope over the structure Sink holes over the structure

Substrate Present Through Crossing? yes no Comment:

Substrate Type Natural Constructed Comment:

Concerns Regarding Fish Passage? yes no Comment:

Culvert Perched or Overhanging? yes no Amount (m)

Comment on road alignment with respect to the valley and channel planform: parallel to road

Does Light Penetrate Under Entire Crossing? yes no Comment:

Noise Level at Time of Inspection High Medium Low

Photos Taken of Structure? Upstream Downstream

Comments: cattails upstream of culvert

downstream becomes sinuous as channel meanders through forested area

Empty lines for additional comments

Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 7 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

Bankfull Width (m) 4 m Bankfull Depth (m) 0.6 m

Wetted Width (m) 2.5 m Wetted Depth (m) 0.3 m at culvert, 0.15 m u/s

Gradient [X] Low [] Medium [] High Entrenchment [] Low [] Medium [] High

Sinuosity [X] Low [] Medium [] High Valley Setting confined by road

Riparian Vegetation Width (m) Type straightened ditch, meadow on left

Channel Disturbance none



Road Type (Highway, Regional, Local)

Crossing Type

- Pre-Cast Culvert [] Open Bottom [] Closed Bottom
Cast-in-place Culvert [X] Open Bottom [X] Closed Bottom
Bridge []
Other []

Material

- Concrete [X] Bridge [] Aluminum [] Corrugated Steel [] Other []

Bridge Design

- Free Span [] Piers [] Abutments [] Number of Spans []

Culvert Shape

- Circular [] Box [X] Arch [] Elliptical [] Multiple (# []) Other []

Dimensions

Width (m) 4.55 m Height (m) 1.5 m Length (m) Age new



Stream Crossing Assessment Form

Date: Stream: Crew: Road Name: Recorder:

Structure Condition

Good Collapsed Mechanical Damage Rust Other

Evidence of Flow Restriction and Erosion Upstream of Crossing

No Pooling Minor Pooling Major Pooling No Erosion Minor Erosion Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

No Pooling Minor Pooling Major Pooling No Erosion Minor Erosion Major Erosion

Relative Crossing Sizing

Channel Width < Opening Channel Width = Opening Channel Width > Opening

Embankment Erosion Protection

Riprap Slope Paving Vegetation Retaining Wall Armour Stone Other none

Debris Trapping

No Debris Minor Debris Major Debris

Evidence of:

Patching or pavement built-up Cracks running parallel to the structure centerline Erosion or failure of the embankment slope over the structure Sink holes over the structure

Substrate Present Through Crossing? yes no Comment: silt, small gravel, sediment buildup at downstream end

Substrate Type Natural Constructed Comment:

Concerns Regarding Fish Passage? yes no Comment:

Culvert Perched or Overhanging? yes no Amount (m)

Comment on road alignment with respect to the valley and channel planform: parallel to road

Does Light Penetrate Under Entire Crossing? yes no Comment:

Noise Level at Time of Inspection High Medium Low

Photos Taken of Structure? Upstream Downstream

Comments: ditch with cattails upstream, no erosion

sediment buildup at downstream culvert outlet, debris caught in cattails, ditch continues

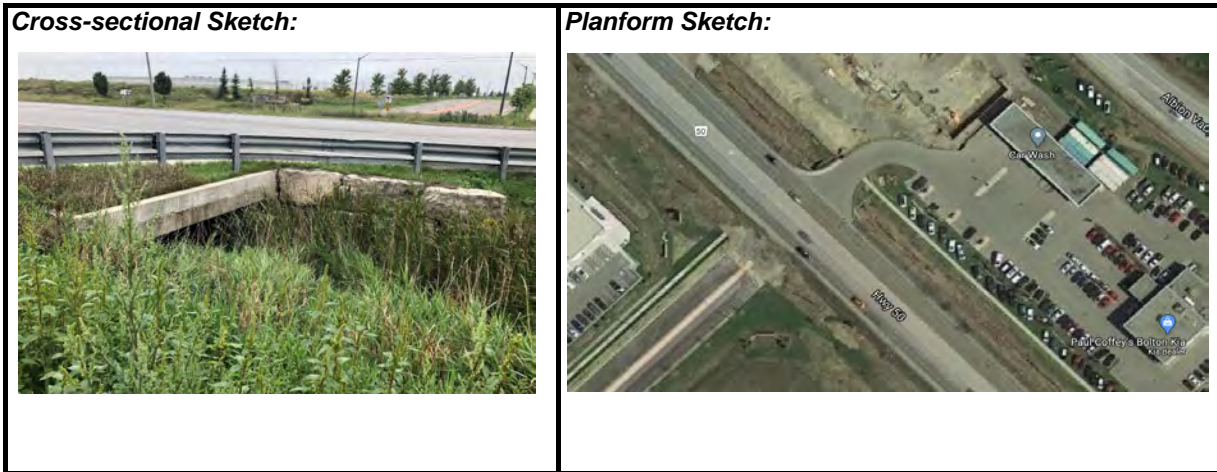
Stream Crossing Assessment Form

Date: Sept 9/20 Stream: Crossing 8 Crew: NC/PC
Road Name: Regional Road 50 Recorder: NC
Location: Caledon Weather Description: overcast, 20 degrees

Channel Dimensions (Measured/Estimated)

black = upstream of crossing
red = downstream

Bankfull Width (m) 3 m Bankfull Depth (m) 0.7 m
Wetted Width (m) 1.1 m Wetted Depth (m) 0.2 m
Gradient [X] Low [] Medium [] High Entrenchment [] Low [] Medium [] High
Sinuosity [X] Low [] Medium [] High Valley Setting confined by road
Riparian Vegetation Width (m) Type straightened ditch, no floodplain
Channel Disturbance armourstone on bank against road



Road Type (Highway, Regional, Local)

Crossing Type

- Pre-Cast Culvert [] Open Bottom [] Closed Bottom
Cast-in-place Culvert [X] Open Bottom [X] Closed Bottom
Bridge []
Other []

Material

- Concrete [X] Bridge [] Aluminum [] Corrugated Steel [] Other []

Bridge Design

- Free Span [] Piers [] Abutments [] Number of Spans []

Culvert Shape

- Circular [] Box [X] Arch [] Elliptical [] Multiple (# []) Other []

Dimensions

Width (m) 4.55 m Height (m) 1.62 m Length (m) Age new

Stream Crossing Assessment Form

Date: Stream: Crew: Road Name: Recorder:

Structure Condition

Structure Condition checkboxes: Good, Collapsed, Mechanical Damage, Rust, Other

Evidence of Flow Restriction and Erosion Upstream of Crossing

Evidence of Flow Restriction and Erosion Upstream checkboxes: No Pooling, Minor Pooling, Major Pooling, No Erosion, Minor Erosion, Major Erosion

Evidence of Scour Pool and Erosion Downstream of Crossing

Evidence of Scour Pool and Erosion Downstream checkboxes: No Pooling, Minor Pooling, Major Pooling, No Erosion, Minor Erosion, Major Erosion

Relative Crossing Sizing

Relative Crossing Sizing checkboxes: Channel Width < Opening, Channel Width = Opening, Channel Width > Opening

Embankment Erosion Protection

Embankment Erosion Protection checkboxes: Riprap, Slope Paving, Vegetation, Retaining Wall, Armour Stone, Other

Debris Trapping

Debris Trapping checkboxes: No Debris, Minor Debris, Major Debris

Evidence of:

Evidence of checkboxes: Patching or pavement built-up, Cracks running parallel to the structure centerline, Erosion or failure of the embankment slope over the structure, Sink holes over the structure

Substrate Present Through Crossing? checkboxes: yes, no

Substrate Type checkboxes: Natural, Constructed

Concerns Regarding Fish Passage? checkboxes: yes, no

Culvert Perched or Overhanging? checkboxes: yes, no

Comment on road alignment with respect to the valley and channel planform: parallel to road

Does Light Penetrate Under Entire Crossing? checkboxes: yes, no

Noise Level at Time of Inspection checkboxes: High, Medium, Low

Photos Taken of Structure? Upstream, Downstream

Comments: ditch with cattails upstream, no erosion

cattails at culvert outlet, armoustone against road, no erosion

APPENDIX D
Matrix Photolog

Matrix Solutions Inc. - September 9, 2020



1. Upstream of Culvert 1

Matrix Solutions Inc. - September 9, 2020



2. Upstream of Culvert 1

Matrix Solutions Inc. - September 9, 2020



3. Upstream of Culvert 1

Matrix Solutions Inc. - September 9, 2020



4. Upstream of Culvert 1

Matrix Solutions Inc. - September 9, 2020



5. Upstream of Culvert 1

Matrix Solutions Inc. - September 9, 2020



6. Culvert C1 (Inlet)

Matrix Solutions Inc. - September 9, 2020



7. Culvert C1 (Inlet)

Matrix Solutions Inc. - September 9, 2020



8. Culvert C1 (Inlet)

Matrix Solutions Inc. - September 9, 2020



9. Culvert C1a (Inlet)

Matrix Solutions Inc. - September 9, 2020



10. Culvert C1a (Inlet)

Matrix Solutions Inc. - September 9, 2020



11. Culvert C1a (Inlet)

Matrix Solutions Inc. - September 9, 2020



12. Culvert C1a (Inlet)

Matrix Solutions Inc. - September 9, 2020



13. Culvert C1a (Inlet)

Matrix Solutions Inc. - September 9, 2020



14. Culvert 1 Outlet

Matrix Solutions Inc. - September 9, 2020



15. Culvert 1 Outlet

Matrix Solutions Inc. - September 9, 2020



16. Culvert 1 Outlet

Matrix Solutions Inc. - September 9, 2020



17. Culvert 1 Outlet

Matrix Solutions Inc. - September 9, 2020



18. Culvert 1 Outlet



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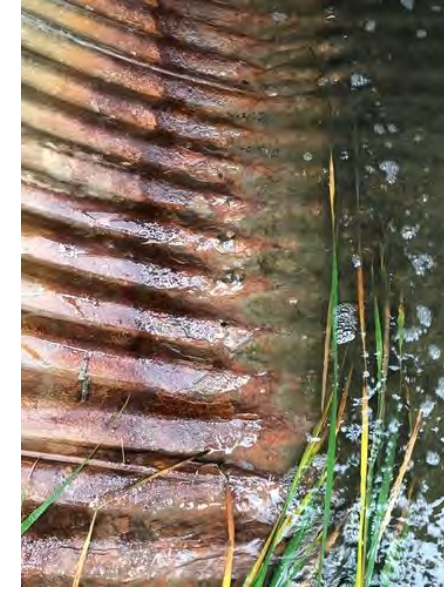
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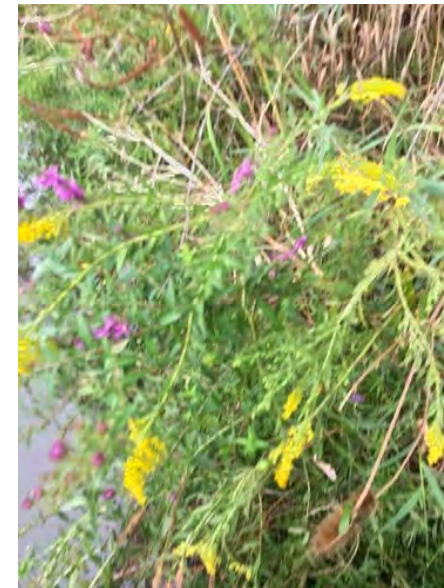
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12.

Matrix Solutions Inc. - September 9, 2020



1. 177651

Matrix Solutions Inc. - September 9, 2020



2. 177651

Matrix Solutions Inc. - September 9, 2020



3. 177651

Matrix Solutions Inc. - September 9, 2020



4. 177651

Matrix Solutions Inc. - September 9, 2020



5. 177651

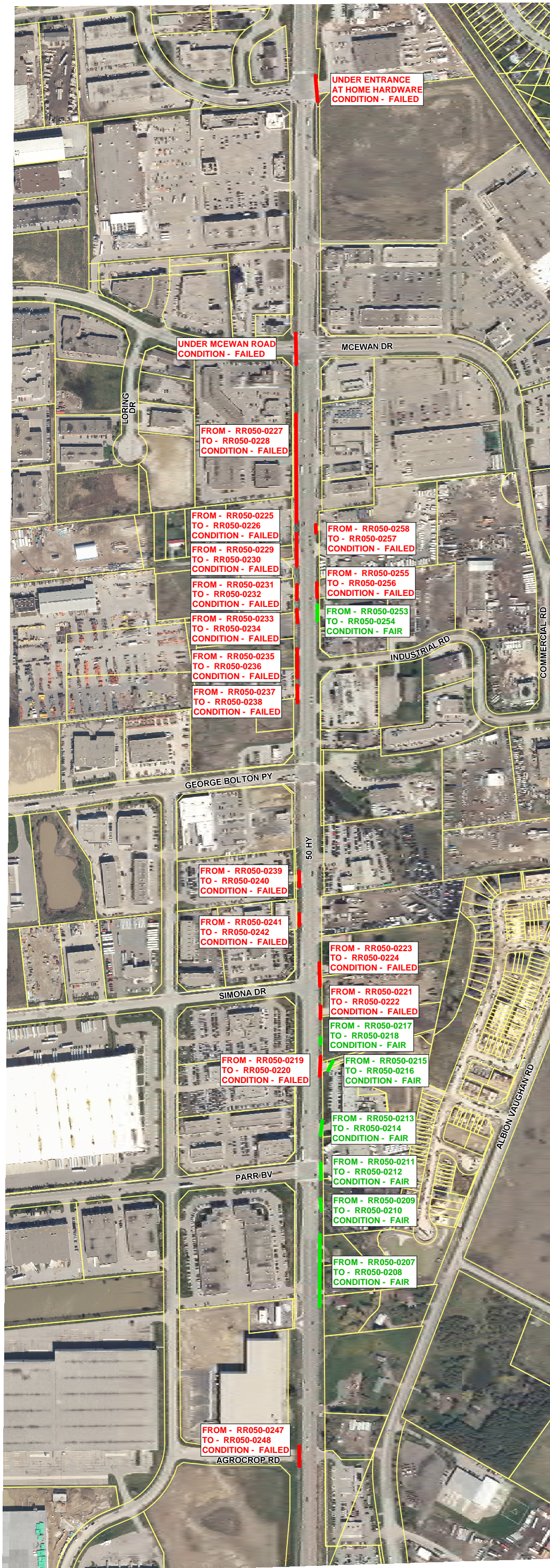
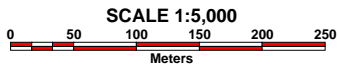
Matrix Solutions Inc. - September 9, 2020



6. 177651

APPENDIX E
Region of Peel Structure Condition Appraisals

MINOR CULVERT CONDITION ASSESSMENT HIGHWAY 50 - REGION OF PEEL



- LEGEND**
- STORM CULVERT - FAIR CONDITION
 - STORM CULVERT - FAILED CONDITION
 - PROPERTY PARCEL
 - MAIN ST STREET NAME

DRAFT

ASSET # INLET	ASSET # OUTLET	ADDRESS	CONDITION	OPTION	LENGTH	SIZE -MM	GRANULAR	HL3	TOPSOIL	CONCRETE CURB REP	SAW CUTTING	RESTORATION/M	SOIL DISPOSAL (GRANULAR X 1.25)	HRS TO REPAIR
NORTHBOUND FROM MAYFIELD RD														
RR050-0219	RR050-0220	12295 NORTH ENTRANCE AT ROAD	STARTING TO LOSE BOTTOM	LINER	30	600	67	23		\$ 15,937.50	13	\$ 1,200.00	\$ 2,000.00	30
RR050-0221	RR050-0222	12343 SOUTH	BOTTOM FAILING	LINER	19	525	42	15		\$ 10,093.75	8	\$ 760.00	\$ 1,266.67	19
RR050-0223	RR050-0224	12343 NORTH	BOTTOM FAILING	LINER	35	500	78	27		\$ 18,593.75	16	\$ 1,400.00	\$ 2,333.33	35
RR050-0255	RR050-0256	1553	HOLE IN TOP IN OUTLET - HOLDING WATER		22	600	49	17		\$ 11,687.50	10	\$ 880.00	\$ 1,466.67	22
RR050-0258	RR050-0257	12585	FULL OF DEBRIS - LOOKS TO BE FAILING		12	600	27	9		\$ 6,375.00	5	\$ 480.00	\$ 800.00	12
		PIPE UNDER ENTRANCE AT HOME HARDWARE	PLUGGED, FAILING, UNKNOWN OUTLET		30	450	66.66666667	23		\$ 15,937.50	13	\$ 1,200.00	\$ 2,000.00	30
SOUTHBOUND FROM HEALEY RD														
ASSET # INLET	ASSET # OUTLET	ADDRESS	CONDITION	OPTION	LENGTH	SIZE - MM								HRS TO REPAIR
		UNDER MCEWEN	UNABLE TO SEE DUE TO WATER; OUTLET HAS 2M EXTENSION AND CONCRETED OVER BOTH PIPES FOR COUPLER		24	900	53	19		\$ 12,750.00	11	\$ 960.00	\$ 1,600.00	24
RR050-0227	RR050-0228	S/O MCEWEN	STORM/CULVERT FAILED BOTTOM		163.73	900	364	0	6000	\$ 86,981.56	73	\$ 6,549.20	\$ 10,915.33	164
RR050-0225	RR050-0226	12596 - TIM'S DRIVETHROUGH	FAILED		10.86	900	24	8		\$ 5,769.38	5	\$ 434.40	\$ 724.00	11
RR050-0229	RR050-0230	HOPCROFT	FAILED		34.85	900	77	27		\$ 18,514.06	15	\$ 1,394.00	\$ 2,323.33	35
RR050-0231	RR050-0232	12550	FAILED		22.14	600	49	17		\$ 11,761.88	10	\$ 885.60	\$ 1,476.00	22
RR050-0233	RR050-0234	12544	FAILED		19.68	900	44	15		\$ 10,455.00	9	\$ 787.20	\$ 1,312.00	20
RR050-0235	RR050-0235	12532	FAILED		43.16	900	96	34		\$ 22,928.75	19	\$ 1,726.40	\$ 2,877.33	43
RR050-0237	RR050-0238	12500	FAILED		26.02	700	58	20		\$ 13,823.13	12	\$ 1,040.80	\$ 1,734.67	26
RR050-0239	RR050-0240	12420	FAILED		23.17	600	51	18		\$ 12,309.06	10	\$ 926.80	\$ 1,544.67	23
RR050-0241	RR050-0242	12388	FAILING		17.93	600	40	14		\$ 9,525.31	8	\$ 717.20	\$ 1,195.33	18
RR050-0247	RR050-0248	GREEN PVC AT NEW ROADWAY (AGROCROP RD??)	NEEDS PROPER CULVERT		30.811	400	68	24		\$ 16,368.34	14	\$ 1,232.44	\$ 2,054.07	31
		TOPSOIL							6000	\$ 299,811.47	251	\$ 22,574.04	\$ 37,623.40	
		GRANULAR "A"							1254					
		HL3							312					
		C&G REPAIR												
		SAW CUTTING												
		RESTORATION										\$ 22,574.04		
		SOIL DISPOSAL										\$ 37,623.40		

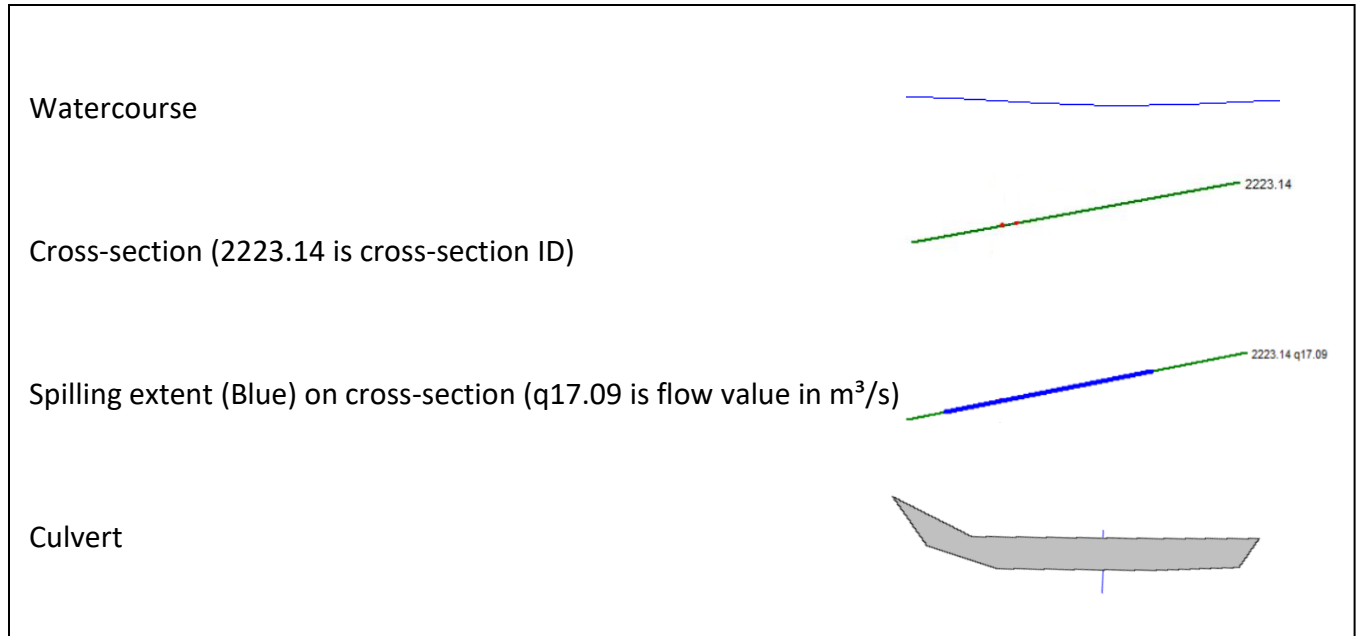
* AVG HOURS FOR REPAIR IS 10 FOR EVERY 9 M

APPENDIX F
HEC-RAS Output

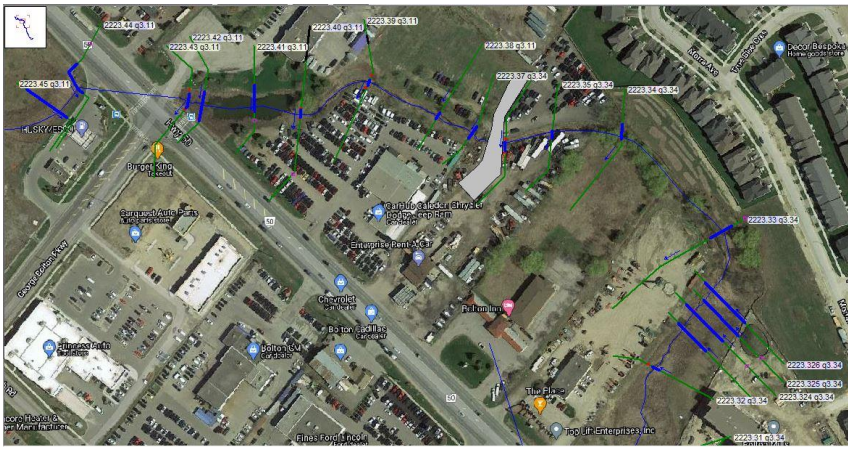
APPENDIX F HEC-RAS OUTPUT

Item 1 – Spilling Extent on Cross-sections

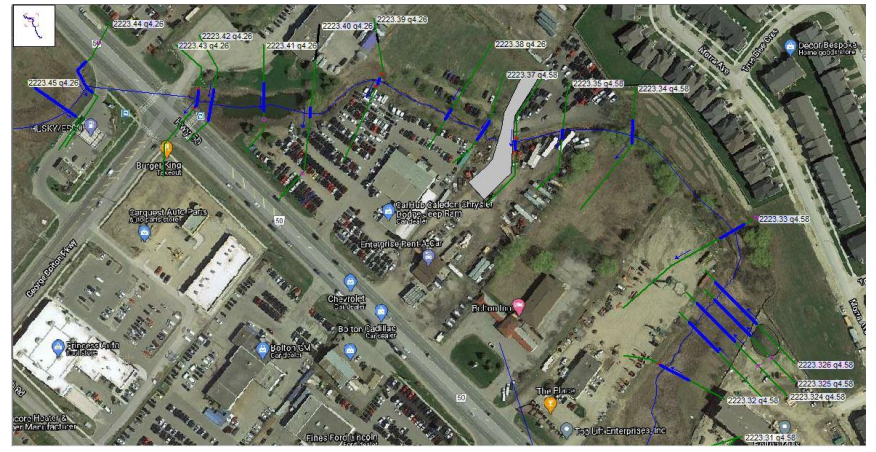
Legend for Spilling Extent Figures



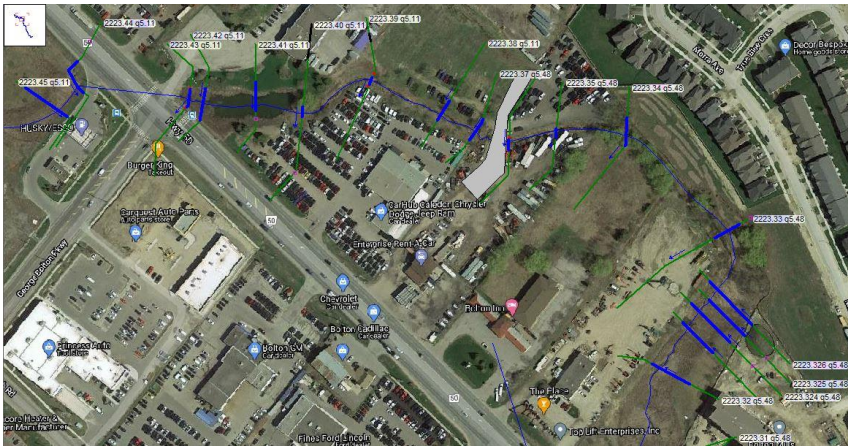
2-Year



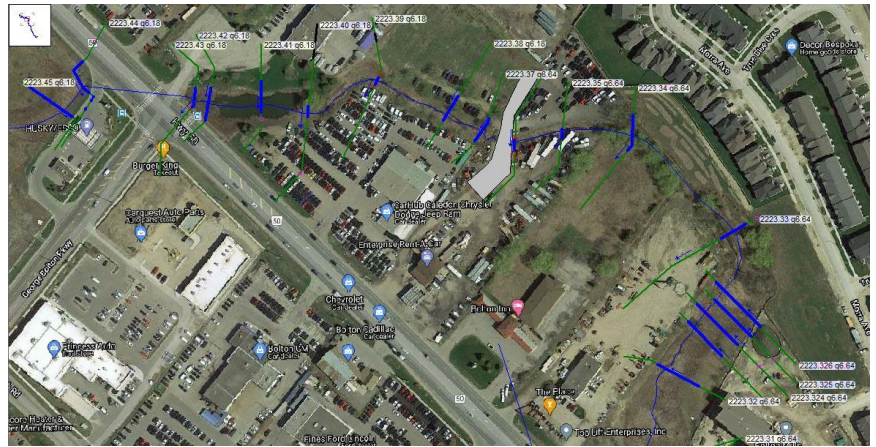
5-Year



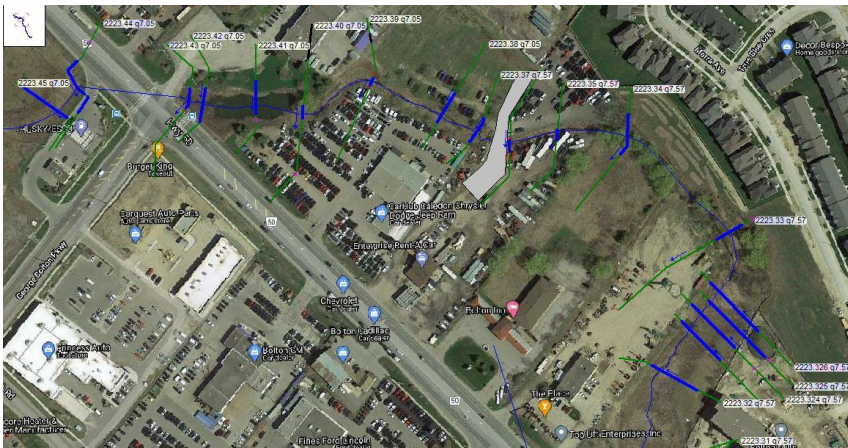
10-Year



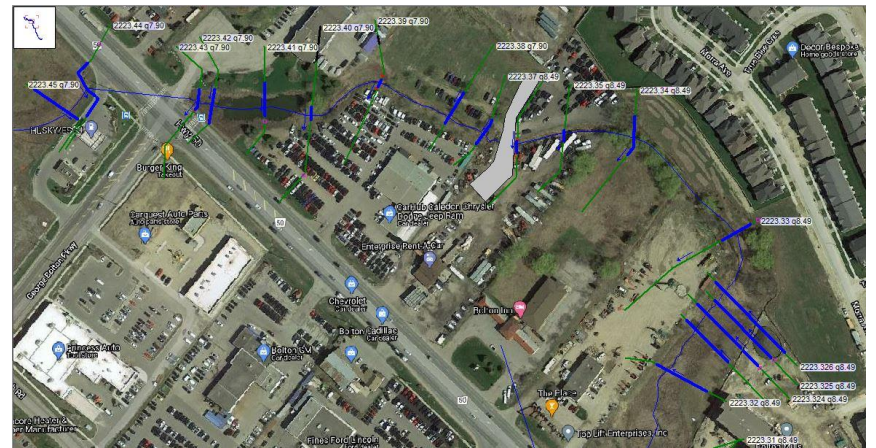
25-Year



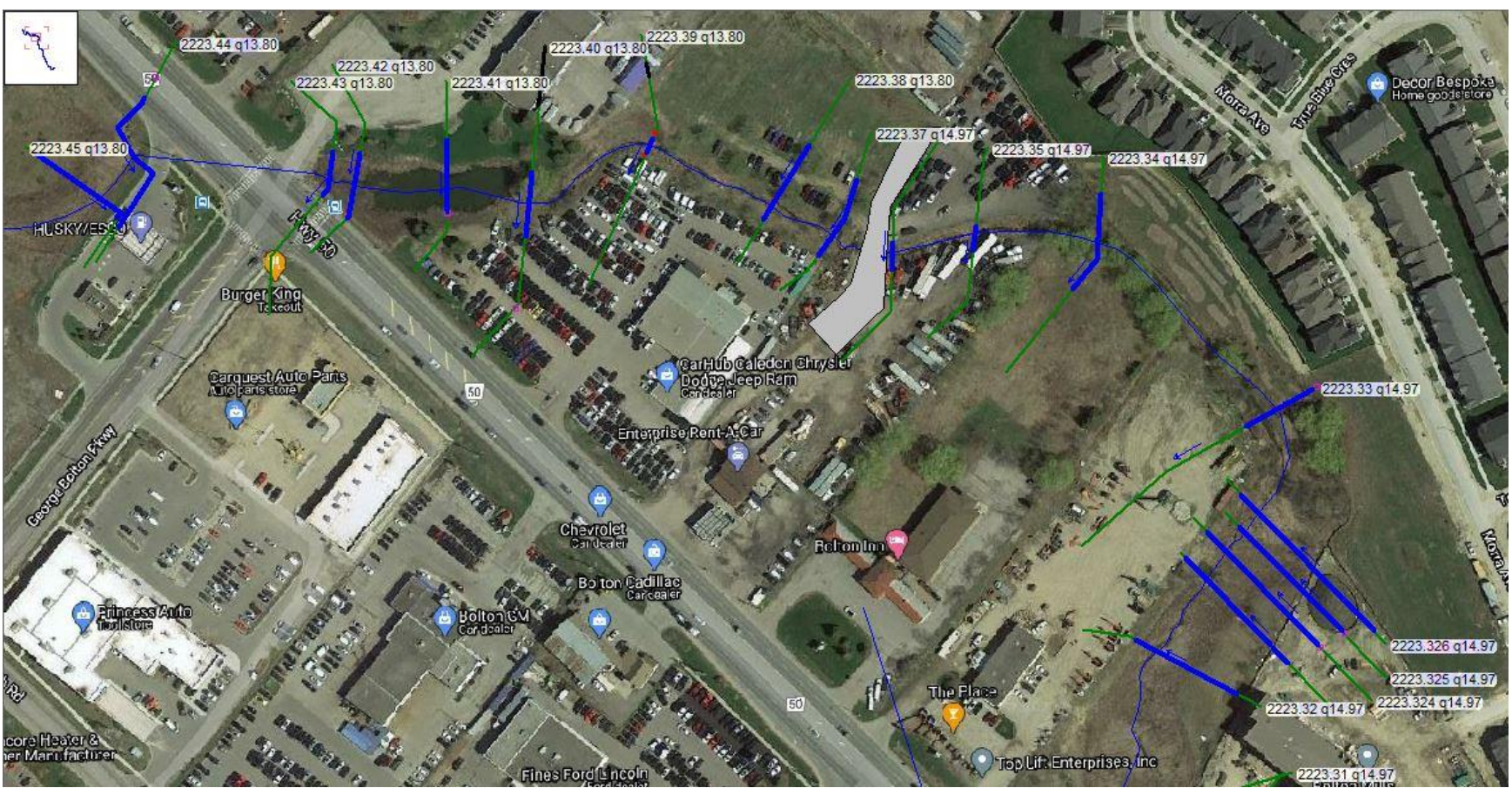
50-Year



100-Year



Regional



2-Year



5-Year



10-Year



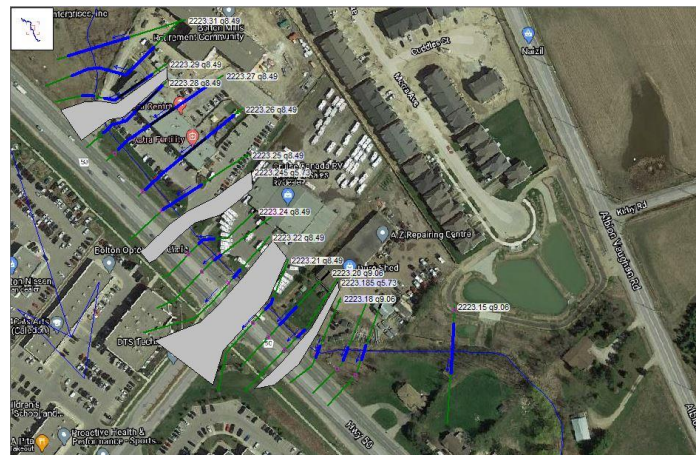
25-Year



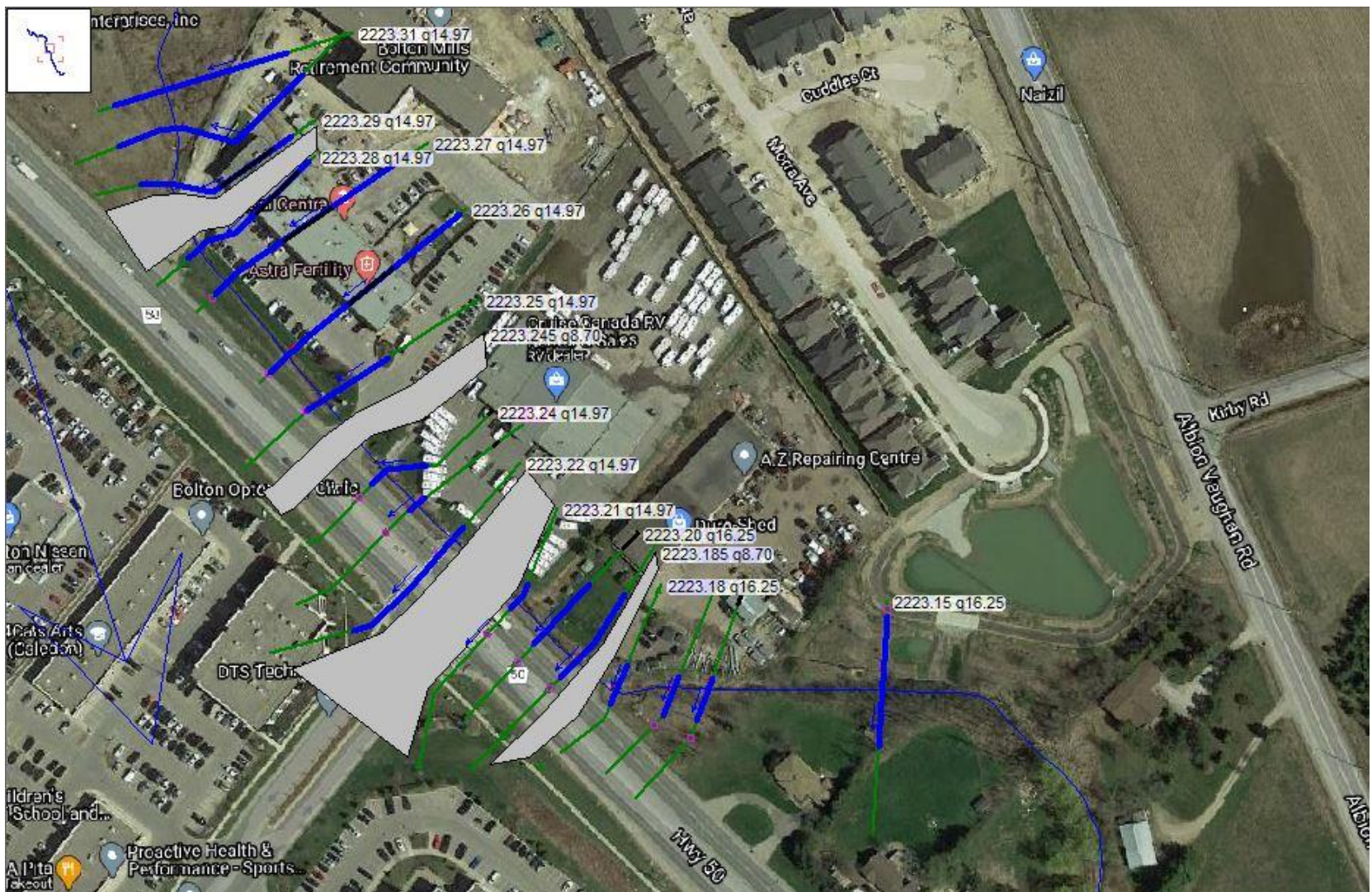
50-Year



100-Year



Regional



2-Year



5-Year



10-Year



25-Year



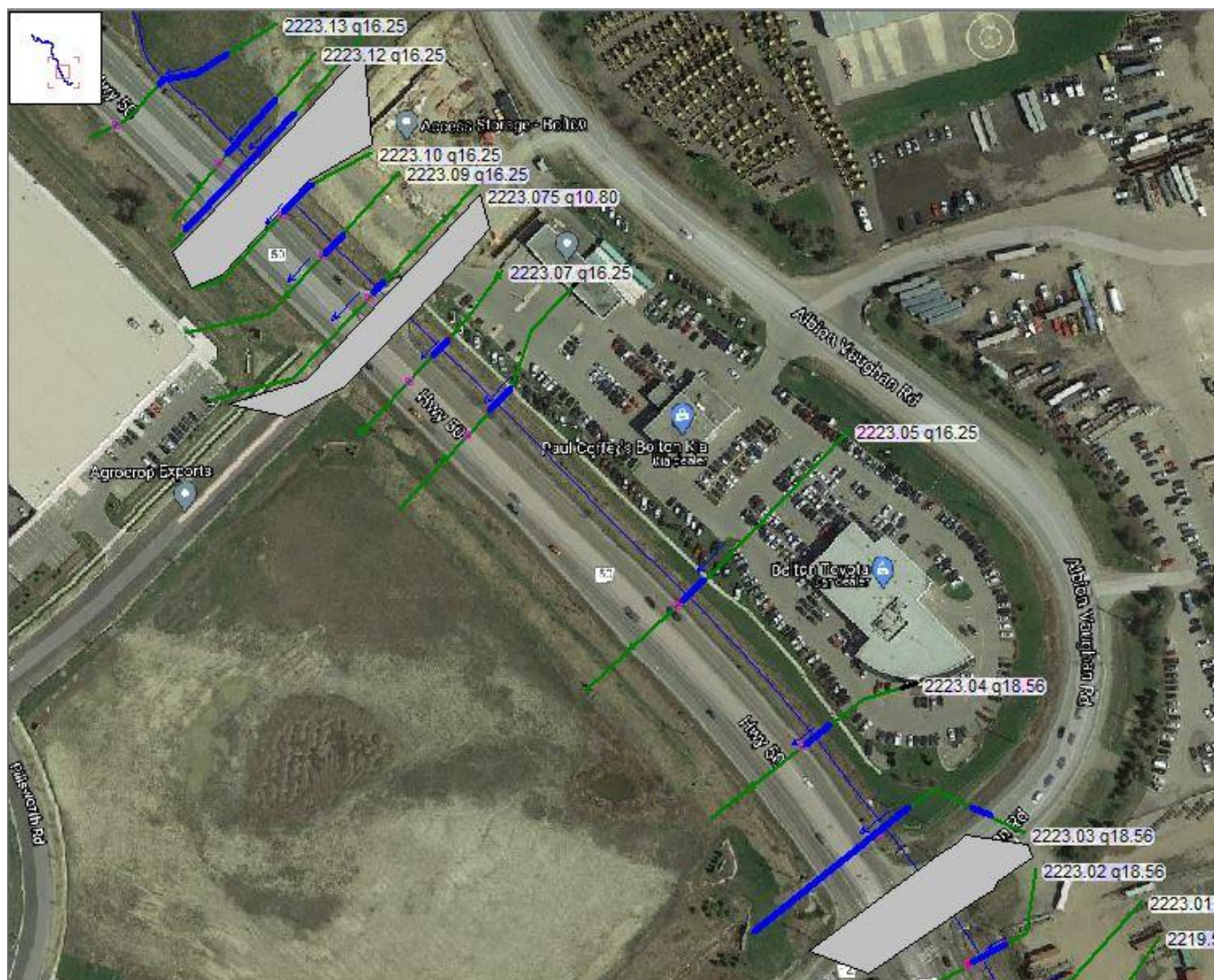
50-Year



100-Year



Regional



APPENDIX F HEC-RAS OUTPUT

Item 2 – Hydraulic Table of Cross-section

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG_DESIGN Reach: REACH1												
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
			(m ³ /s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m ²)	(m)	
REACH1	2224.08	2-Year	1.98	242.90	243.42	243.29	243.44	0.004498	0.88	2.93	18.18	0.49
REACH1	2224.08	5-Year	2.82	242.90	243.46		243.49	0.004513	0.95	3.78	18.29	0.50
REACH1	2224.08	10-Year	3.39	242.90	243.50		243.53	0.003958	0.93	4.45	18.37	0.48
REACH1	2224.08	25-Year	4.27	242.90	243.55		243.58	0.003331	0.93	5.45	19.68	0.45
REACH1	2224.08	50-Year	5.05	242.90	243.60		243.63	0.002866	0.92	6.37	20.78	0.42
REACH1	2224.08	100-Year	5.73	242.90	243.64		243.67	0.002455	0.90	7.29	22.70	0.40
REACH1	2224.08	Regional	8.70	242.90	243.67	243.56	243.73	0.004438	1.26	7.93	24.02	0.54
REACH1	2224.07	2-Year	1.98	241.78	242.27	242.25	242.42	0.011890	1.75	1.34	4.63	0.85
REACH1	2224.07	5-Year	2.82	241.78	242.39	242.35	242.54	0.009610	1.85	1.94	5.59	0.79
REACH1	2224.07	10-Year	3.39	241.78	242.43	242.41	242.61	0.010802	2.04	2.15	5.89	0.85
REACH1	2224.07	25-Year	4.27	241.78	242.47	242.47	242.71	0.012643	2.32	2.43	6.27	0.93
REACH1	2224.07	50-Year	5.05	241.78	242.51	242.49	242.79	0.014533	2.58	2.67	7.09	1.00
REACH1	2224.07	100-Year	5.73	241.78	242.53	242.49	242.88	0.016907	2.85	2.85	8.47	1.09
REACH1	2224.07	Regional	8.70	241.78	242.82	242.82	242.96	0.005979	2.13	7.93	27.28	0.69
REACH1	2224.06	2-Year	1.98	241.50	241.80	241.77	241.85	0.008355	1.04	2.20	14.08	0.66
REACH1	2224.06	5-Year	2.82	241.50	241.81	241.81	241.90	0.013974	1.38	2.36	14.59	0.86
REACH1	2224.06	10-Year	3.39	241.50	241.84	241.84	241.93	0.013434	1.44	2.74	15.73	0.86
REACH1	2224.06	25-Year	4.27	241.50	241.87	241.87	241.97	0.012895	1.52	3.29	17.25	0.86
REACH1	2224.06	50-Year	5.05	241.50	241.90	241.90	242.00	0.012625	1.58	3.75	18.43	0.86
REACH1	2224.06	100-Year	5.73	241.50	241.92	241.92	242.03	0.012263	1.62	4.16	19.41	0.85
REACH1	2224.06	Regional	8.70	241.50	242.00	242.00	242.12	0.011498	1.78	5.78	22.97	0.85
REACH1	2224.05	2-Year	1.98	241.00	241.54		241.57	0.003806	0.88	5.78	55.74	0.46
REACH1	2224.05	5-Year	2.82	241.00	241.65		241.65	0.001173	0.58	11.85	62.04	0.27
REACH1	2224.05	10-Year	3.39	241.00	241.67		241.68	0.001236	0.61	13.20	63.67	0.28
REACH1	2224.05	25-Year	4.27	241.00	241.70		241.71	0.001231	0.64	15.46	66.84	0.28
REACH1	2224.05	50-Year	5.05	241.00	241.73		241.74	0.001244	0.66	17.24	69.24	0.28
REACH1	2224.05	100-Year	5.73	241.00	241.75		241.76	0.001247	0.68	18.72	70.45	0.28
REACH1	2224.05	Regional	8.70	241.00	241.82		241.83	0.001403	0.77	23.58	74.12	0.31
REACH1	2224.04	2-Year	1.98	240.50	241.56		241.56	0.000003	0.04	52.52	116.35	0.01
REACH1	2224.04	5-Year	2.82	240.50	241.65		241.65	0.000004	0.05	64.00	125.07	0.02
REACH1	2224.04	10-Year	3.39	240.50	241.67		241.67	0.000005	0.06	66.73	127.06	0.02
REACH1	2224.04	25-Year	4.27	240.50	241.71		241.71	0.000007	0.07	71.15	130.21	0.02
REACH1	2224.04	50-Year	5.05	240.50	241.73		241.73	0.000008	0.08	74.56	132.59	0.03
REACH1	2224.04	100-Year	5.73	240.50	241.75		241.75	0.000010	0.09	77.36	134.51	0.03
REACH1	2224.04	Regional	8.70	240.50	241.82		241.82	0.000018	0.13	86.55	140.57	0.04
REACH1	2224.03	2-Year	1.98	240.50	241.56		241.56	0.000002	0.04	60.27	71.69	0.01
REACH1	2224.03	5-Year	2.82	240.50	241.65		241.65	0.000003	0.05	67.12	72.43	0.02
REACH1	2224.03	10-Year	3.39	240.50	241.67		241.67	0.000004	0.06	68.69	72.60	0.02
REACH1	2224.03	25-Year	4.27	240.50	241.71		241.71	0.000006	0.08	71.18	72.87	0.02
REACH1	2224.03	50-Year	5.05	240.50	241.73		241.73	0.000008	0.09	73.19	94.10	0.03
REACH1	2224.03	100-Year	5.73	240.50	241.75		241.75	0.000010	0.10	75.54	131.16	0.03
REACH1	2224.03	Regional	8.70	240.50	241.82		241.82	0.000019	0.14	86.71	182.90	0.04
REACH1	2224.02	2-Year	1.98	240.27	241.53	241.06	241.55	0.002733	0.72	5.02	37.72	0.39
REACH1	2224.02	5-Year	2.82	240.27	241.63	241.45	241.65	0.001557	0.65	9.24	43.57	0.31
REACH1	2224.02	10-Year	3.39	240.27	241.65	241.48	241.67	0.001876	0.73	10.00	44.55	0.34
REACH1	2224.02	25-Year	4.27	240.27	241.68	241.49	241.70	0.002236	0.83	11.30	46.17	0.38
REACH1	2224.02	50-Year	5.05	240.27	241.70	241.56	241.72	0.002573	0.92	12.27	47.33	0.41
REACH1	2224.02	100-Year	5.73	240.27	241.71	241.58	241.74	0.003444	1.07	12.64	55.71	0.47
REACH1	2224.02	Regional	8.70	240.27	241.71	241.65	241.79	0.007943	1.63	12.83	60.26	0.72
REACH1	2224.015		Culvert									
REACH1	2224.01	2-Year	1.98	239.91	240.78	240.78	241.17	0.013871	2.77	0.71	12.20	1.00
REACH1	2224.01	5-Year	2.82	239.91	240.99	240.99	241.48	0.012867	3.12	0.90	70.67	1.01
REACH1	2224.01	10-Year	3.39	239.91	241.23	241.23	241.28	0.010668	1.32	7.69	88.32	0.75
REACH1	2224.01	25-Year	4.27	239.91	241.26	241.26	241.30	0.009672	1.32	9.96	95.46	0.72
REACH1	2224.01	50-Year	5.05	239.91	241.27	241.27	241.32	0.012007	1.49	10.47	96.06	0.81
REACH1	2224.01	100-Year	5.73	239.91	241.27	241.27	241.33	0.012889	1.57	11.29	97.26	0.84
REACH1	2224.01	Regional	8.70	239.91	241.31	241.31	241.38	0.015252	1.82	14.68	101.37	0.93
REACH1	2223.56	2-Year	2.46	239.85	240.63	240.63	240.69	0.007054	1.31	5.93	60.54	0.62
REACH1	2223.56	5-Year	3.50	239.85	240.66	240.66	240.73	0.008519	1.50	7.93	70.32	0.68
REACH1	2223.56	10-Year	4.21	239.85	240.68	240.68	240.74	0.008975	1.57	9.17	71.70	0.71
REACH1	2223.56	25-Year	5.30	239.85	240.70	240.70	240.77	0.009588	1.68	10.87	73.55	0.74
REACH1	2223.56	50-Year	6.27	239.85	240.72	240.72	240.79	0.010353	1.78	12.10	74.87	0.77
REACH1	2223.56	100-Year	7.11	239.85	240.74	240.74	240.80	0.009930	1.78	13.57	75.78	0.76
REACH1	2223.56	Regional	10.80	239.85	240.78	240.78	240.86	0.012542	2.11	16.97	77.18	0.86
REACH1	2223.55	2-Year	2.46	239.56	240.53		240.53	0.000055	0.18	28.81	89.49	0.06
REACH1	2223.55	5-Year	3.50	239.56	240.55		240.55	0.000097	0.25	30.60	90.86	0.09
REACH1	2223.55	10-Year	4.21	239.56	240.56		240.56	0.000130	0.29	31.75	91.75	0.10
REACH1	2223.55	25-Year	5.30	239.56	240.58		240.59	0.000184	0.35	33.53	93.10	0.12
REACH1	2223.55	50-Year	6.27	239.56	240.60		240.60	0.000236	0.40	34.85	94.09	0.14
REACH1	2223.55	100-Year	7.11	239.56	240.61		240.61	0.000284	0.44	35.95	94.91	0.15
REACH1	2223.55	Regional	10.80	239.56	240.65		240.66	0.000514	0.61	40.06	97.90	0.20
REACH1	2223.54	2-Year	2.46	239.55	240.52	240.44	240.53	0.002920	0.62	9.81	104.96	0.39
REACH1	2223.54	5-Year	3.50	239.55	240.53	240.46	240.54	0.003696	0.72	11.50	107.82	0.44

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

Reach	River Sta	Profile	Q Total (m ³ /s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m ²)	Top Width (m)	Froude # Chl
REACH1	2223.54	10-Year	4.21	239.55	240.54	240.48	240.55	0.003961	0.77	12.67	109.74	0.46
REACH1	2223.54	25-Year	5.30	239.55	240.56	240.51	240.57	0.003967	0.80	14.62	112.76	0.46
REACH1	2223.54	50-Year	6.27	239.55	240.57	240.52	240.59	0.004144	0.84	15.96	114.11	0.48
REACH1	2223.54	100-Year	7.11	239.55	240.58	240.53	240.60	0.004210	0.86	17.12	115.25	0.48
REACH1	2223.54	Regional	10.80	239.55	240.62	240.56	240.64	0.004748	0.98	21.21	119.76	0.52
REACH1	2223.535		Culvert									
REACH1	2223.53	2-Year	2.46	239.25	240.35	240.35	240.39	0.017492	1.23	4.77	51.87	0.88
REACH1	2223.53	5-Year	3.50	239.25	240.36	240.36	240.43	0.026762	1.58	5.33	52.65	1.10
REACH1	2223.53	10-Year	4.21	239.25	240.39	240.39	240.44	0.020302	1.49	6.84	55.19	0.98
REACH1	2223.53	25-Year	5.30	239.25	240.40	240.40	240.47	0.022731	1.65	7.83	57.60	1.05
REACH1	2223.53	50-Year	6.27	239.25	240.41	240.41	240.49	0.026366	1.83	8.38	58.20	1.13
REACH1	2223.53	100-Year	7.11	239.25	240.42	240.42	240.51	0.030906	2.00	8.67	58.50	1.23
REACH1	2223.53	Regional	10.80	239.25	240.49	240.49	240.58	0.026290	2.15	13.11	74.68	1.18
REACH1	2223.52	2-Year	2.46	239.15	239.84		239.89	0.007753	1.18	4.15	24.75	0.65
REACH1	2223.52	5-Year	3.50	239.15	239.89		239.95	0.008378	1.35	5.51	28.49	0.69
REACH1	2223.52	10-Year	4.21	239.15	239.96		240.01	0.005720	1.24	7.67	33.78	0.58
REACH1	2223.52	25-Year	5.30	239.15	240.03		240.08	0.004617	1.23	10.20	38.07	0.54
REACH1	2223.52	50-Year	6.27	239.15	240.09		240.13	0.003993	1.22	12.34	40.39	0.51
REACH1	2223.52	100-Year	7.11	239.15	240.14		240.17	0.003491	1.20	14.34	42.44	0.48
REACH1	2223.52	Regional	10.80	239.15	240.31		240.34	0.002624	1.22	22.11	49.67	0.43
REACH1	2223.51	2-Year	2.46	238.75	239.42		239.49	0.004474	1.24	2.60	8.95	0.54
REACH1	2223.51	5-Year	3.50	238.75	239.59		239.64	0.002809	1.17	4.35	12.17	0.45
REACH1	2223.51	10-Year	4.21	238.75	239.58		239.66	0.004353	1.44	4.22	11.98	0.55
REACH1	2223.51	25-Year	5.30	238.75	239.62		239.73	0.005087	1.63	4.83	12.83	0.60
REACH1	2223.51	50-Year	6.27	238.75	239.66		239.79	0.005785	1.79	5.29	13.44	0.65
REACH1	2223.51	100-Year	7.11	238.75	239.67	239.60	239.83	0.006932	1.99	5.45	13.65	0.71
REACH1	2223.51	Regional	10.80	238.75	239.77	239.76	240.01	0.009373	2.50	6.90	15.46	0.85
REACH1	2223.50	2-Year	2.46	238.52	239.44		239.44	0.000088	0.25	22.23	38.65	0.08
REACH1	2223.50	5-Year	3.50	238.52	239.60		239.60	0.000089	0.28	28.62	41.86	0.09
REACH1	2223.50	10-Year	4.21	238.52	239.59		239.60	0.000132	0.34	28.44	41.78	0.11
REACH1	2223.50	25-Year	5.30	238.52	239.65		239.65	0.000170	0.40	30.65	42.87	0.12
REACH1	2223.50	50-Year	6.27	238.52	239.68		239.69	0.000207	0.45	32.32	43.67	0.13
REACH1	2223.50	100-Year	7.11	238.52	239.70		239.71	0.000249	0.50	33.10	44.05	0.15
REACH1	2223.50	Regional	10.80	238.52	239.82		239.83	0.000391	0.66	38.22	46.40	0.19
REACH1	2223.49	2-Year	2.46	238.04	239.41	238.84	239.43	0.001205	0.76	9.00	38.47	0.29
REACH1	2223.49	5-Year	3.50	238.04	239.59	239.05	239.59	0.000617	0.63	15.88	42.52	0.22
REACH1	2223.49	10-Year	4.21	238.04	239.57	239.35	239.59	0.000966	0.78	15.40	42.23	0.27
REACH1	2223.49	25-Year	5.30	238.04	239.62	239.39	239.64	0.001099	0.86	17.53	43.50	0.29
REACH1	2223.49	50-Year	6.27	238.04	239.66	239.42	239.68	0.001230	0.94	19.10	44.42	0.31
REACH1	2223.49	100-Year	7.11	238.04	239.67	239.44	239.69	0.001462	1.03	19.68	44.75	0.34
REACH1	2223.49	Regional	10.80	238.04	239.78	239.51	239.81	0.001897	1.26	24.47	47.41	0.39
REACH1	2223.485		Culvert									
REACH1	2223.48	2-Year	2.46	237.92	238.84	238.84	239.25	0.014988	2.81	0.87	19.40	1.01
REACH1	2223.48	5-Year	3.50	237.92	239.05	239.05	239.56	0.013924	3.17	1.10	22.56	1.01
REACH1	2223.48	10-Year	4.21	237.92	239.29	239.29	239.38	0.009684	1.63	4.89	28.59	0.75
REACH1	2223.48	25-Year	5.30	237.92	239.32	239.32	239.42	0.010260	1.75	5.80	29.39	0.78
REACH1	2223.48	50-Year	6.27	237.92	239.36	239.36	239.45	0.009149	1.73	6.94	30.37	0.74
REACH1	2223.48	100-Year	7.11	237.92	239.36	239.36	239.48	0.010943	1.90	7.13	30.53	0.81
REACH1	2223.48	Regional	10.80	237.92	239.45	239.45	239.58	0.010451	2.05	9.88	32.75	0.81
REACH1	2223.47	2-Year	2.46	237.80	238.51		238.51	0.000225	0.22	11.32	31.31	0.12
REACH1	2223.47	5-Year	3.50	237.80	238.55		238.56	0.000318	0.28	12.65	31.50	0.14
REACH1	2223.47	10-Year	4.21	237.80	238.59		238.59	0.000361	0.31	13.62	31.64	0.15
REACH1	2223.47	25-Year	5.30	237.80	238.63		238.63	0.000429	0.36	14.89	31.82	0.17
REACH1	2223.47	50-Year	6.27	237.80	238.65		238.66	0.000496	0.40	15.79	31.95	0.18
REACH1	2223.47	100-Year	7.11	237.80	238.68		238.69	0.000542	0.43	16.61	32.07	0.19
REACH1	2223.47	Regional	10.80	237.80	238.83		238.84	0.000553	0.50	21.40	32.74	0.20
REACH1	2223.46	2-Year	2.46	237.57	238.51		238.51	0.000055	0.20	26.92	43.66	0.07
REACH1	2223.46	5-Year	3.50	237.57	238.54		238.55	0.000094	0.27	28.59	44.14	0.09
REACH1	2223.46	10-Year	4.21	237.57	238.57		238.57	0.000121	0.31	29.84	44.50	0.10
REACH1	2223.46	25-Year	5.30	237.57	238.61		238.61	0.000165	0.37	31.44	44.95	0.12
REACH1	2223.46	50-Year	6.27	237.57	238.63		238.64	0.000209	0.42	32.54	45.25	0.13
REACH1	2223.46	100-Year	7.11	237.57	238.65		238.66	0.000247	0.47	33.54	45.53	0.14
REACH1	2223.46	Regional	10.80	237.57	238.80		238.80	0.000339	0.60	40.15	47.31	0.17
REACH1	2223.45	2-Year	3.11	237.00	238.50		238.50	0.000064	0.29	29.54	34.04	0.08
REACH1	2223.45	5-Year	4.26	237.00	238.54		238.54	0.000109	0.38	30.76	34.88	0.10
REACH1	2223.45	10-Year	5.11	237.00	238.56		238.57	0.000146	0.45	31.67	35.47	0.12
REACH1	2223.45	25-Year	6.18	237.00	238.60		238.60	0.000194	0.53	32.85	36.13	0.13
REACH1	2223.45	50-Year	7.05	237.00	238.62		238.62	0.000237	0.59	33.63	36.57	0.15
REACH1	2223.45	100-Year	7.90	237.00	238.64		238.64	0.000282	0.65	34.35	36.96	0.16
REACH1	2223.45	Regional	13.80	237.00	238.76		238.77	0.000616	1.00	39.17	43.30	0.24
REACH1	2223.44	2-Year	3.11	236.30	238.50		238.50	0.000030	0.19	26.51	26.55	0.05
REACH1	2223.44	5-Year	4.26	236.30	238.54		238.54	0.000052	0.25	27.45	27.53	0.07

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

Reach	River Sta	Profile	Q Total (m ³ /s)	Min Ch El (m)	W. S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m ²)	Top Width (m)	Froude # Chl
REACH1	2223.44	10-Year	5.11	236.30	238.56		238.56	0.000071	0.30	28.16	28.25	0.08
REACH1	2223.44	25-Year	6.18	236.30	238.59		238.60	0.000096	0.35	29.09	31.27	0.09
REACH1	2223.44	50-Year	7.05	236.30	238.61		238.62	0.000118	0.39	29.90	42.90	0.10
REACH1	2223.44	100-Year	7.90	236.30	238.63		238.64	0.000142	0.43	30.76	46.48	0.11
REACH1	2223.44	Regional	13.80	236.30	238.75		238.77	0.000304	0.66	37.38	65.05	0.16
REACH1	2223.43 C1	2-Year	3.11	236.13	236.78		236.85	0.009824	1.13	2.74	10.59	0.71
REACH1	2223.43 C1	5-Year	4.26	236.13	236.89		236.95	0.006413	1.07	3.98	12.21	0.60
REACH1	2223.43 C1	10-Year	5.11	236.13	236.96		237.02	0.005150	1.05	4.86	13.00	0.55
REACH1	2223.43 C1	25-Year	6.18	236.13	237.04		237.10	0.004083	1.04	5.94	13.94	0.50
REACH1	2223.43 C1	50-Year	7.05	236.13	237.10		237.16	0.003497	1.04	6.80	14.45	0.47
REACH1	2223.43 C1	100-Year	7.90	236.13	237.16		237.21	0.003110	1.05	7.62	14.92	0.45
REACH1	2223.43 C1	Regional	13.80	236.13	237.47		237.54	0.002051	1.14	12.72	17.71	0.40
REACH1	2223.42	2-Year	3.11	236.07	236.80		236.81	0.000314	0.32	9.95	21.37	0.14
REACH1	2223.42	5-Year	4.26	236.07	236.91		236.91	0.000314	0.37	12.24	22.19	0.15
REACH1	2223.42	10-Year	5.11	236.07	236.98		236.98	0.000316	0.39	13.78	22.67	0.15
REACH1	2223.42	25-Year	6.18	236.07	237.06		237.07	0.000318	0.43	15.61	23.19	0.16
REACH1	2223.42	50-Year	7.05	236.07	237.12		237.13	0.000320	0.45	17.02	23.62	0.16
REACH1	2223.42	100-Year	7.90	236.07	237.17		237.18	0.000322	0.47	18.34	24.00	0.16
REACH1	2223.42	Regional	13.80	236.07	237.49		237.50	0.000345	0.60	26.26	26.46	0.17
REACH1	2223.41	2-Year	3.11	236.00	236.80	236.13	236.80	0.000059	0.18	17.33	23.18	0.07
REACH1	2223.41	5-Year	4.26	236.00	236.91	236.16	236.91	0.000071	0.22	19.84	24.38	0.07
REACH1	2223.41	10-Year	5.11	236.00	236.98	236.18	236.98	0.000079	0.24	21.54	25.17	0.08
REACH1	2223.41	25-Year	6.18	236.00	237.05	236.21	237.06	0.000088	0.27	23.59	26.56	0.08
REACH1	2223.41	50-Year	7.05	236.00	237.11	236.23	237.12	0.000094	0.29	25.23	27.78	0.09
REACH1	2223.41	100-Year	7.90	236.00	237.17	236.25	237.18	0.000100	0.30	26.81	28.92	0.09
REACH1	2223.41	Regional	13.80	236.00	237.49	236.36	237.49	0.000130	0.41	36.96	35.36	0.11
REACH1	2223.40	2-Year	3.11	236.00	236.63	236.63	236.78	0.018419	1.74	1.79	5.77	1.00
REACH1	2223.40	5-Year	4.26	236.00	236.71	236.71	236.88	0.017670	1.85	2.30	6.73	1.00
REACH1	2223.40	10-Year	5.11	236.00	236.76	236.76	236.95	0.016685	1.94	2.65	7.30	0.99
REACH1	2223.40	25-Year	6.18	236.00	236.81	236.81	237.03	0.015769	2.05	3.08	7.94	0.98
REACH1	2223.40	50-Year	7.05	236.00	236.85	236.85	237.09	0.015295	2.14	3.40	8.40	0.98
REACH1	2223.40	100-Year	7.90	236.00	236.89	236.89	237.14	0.014789	2.21	3.74	8.84	0.98
REACH1	2223.40	Regional	13.80	236.00	237.18	237.18	237.46	0.009447	2.37	7.75	25.29	0.84
REACH1	2223.39	2-Year	3.11	234.75	235.59		235.66	0.003323	1.12	2.78	4.43	0.45
REACH1	2223.39	5-Year	4.26	234.75	235.68		235.77	0.004372	1.35	3.16	4.65	0.52
REACH1	2223.39	10-Year	5.11	234.75	235.80		235.90	0.003899	1.36	3.76	4.98	0.50
REACH1	2223.39	25-Year	6.18	234.75	235.89		236.00	0.004132	1.46	4.23	5.22	0.52
REACH1	2223.39	50-Year	7.05	234.75	235.96		236.08	0.004388	1.55	4.56	5.38	0.54
REACH1	2223.39	100-Year	7.90	234.75	236.00		236.14	0.004731	1.64	4.82	5.52	0.56
REACH1	2223.39	Regional	13.80	234.75	236.23		236.49	0.007723	2.24	6.17	6.37	0.73
REACH1	2223.38	2-Year	3.11	234.50	235.11	235.11	235.30	0.016960	1.92	1.67	5.13	0.98
REACH1	2223.38	5-Year	4.26	234.50	235.51		235.58	0.002635	1.21	4.42	8.66	0.44
REACH1	2223.38	10-Year	5.11	234.50	235.68		235.75	0.001873	1.16	6.41	16.01	0.38
REACH1	2223.38	25-Year	6.18	234.50	235.78		235.85	0.001827	1.23	8.19	20.34	0.38
REACH1	2223.38	50-Year	7.05	234.50	235.85		235.92	0.001823	1.28	9.61	23.24	0.39
REACH1	2223.38	100-Year	7.90	234.50	235.89		235.97	0.001899	1.34	10.76	25.32	0.40
REACH1	2223.38	Regional	13.80	234.50	236.12		236.23	0.002462	1.71	17.49	34.32	0.46
REACH1	2223.37	2-Year	3.34	233.51	235.07	234.28	235.10	0.000631	0.74	4.49	10.92	0.21
REACH1	2223.37	5-Year	4.58	233.51	235.53	234.38	235.54	0.000201	0.49	13.35	15.89	0.13
REACH1	2223.37	10-Year	5.48	233.51	235.70	234.45	235.71	0.000190	0.51	16.15	17.63	0.13
REACH1	2223.37	25-Year	6.64	233.51	235.79	234.54	235.81	0.000223	0.58	17.92	18.68	0.14
REACH1	2223.37	50-Year	7.57	233.51	235.86	234.60	235.88	0.000250	0.63	19.15	19.40	0.15
REACH1	2223.37	100-Year	8.49	233.51	235.91	234.66	235.93	0.000284	0.68	20.07	19.94	0.16
REACH1	2223.37	Regional	14.97	233.51	236.12	235.04	236.17	0.000617	1.08	25.61	34.10	0.24
REACH1	2223.365 C2		Culvert									
REACH1	2223.36	2-Year	3.34	233.69	234.41	234.30	234.55	0.007386	1.66	2.01	6.31	0.70
REACH1	2223.36	5-Year	4.58	233.69	234.53	234.40	234.71	0.007499	1.89	2.42	6.98	0.73
REACH1	2223.36	10-Year	5.48	233.69	234.58	234.47	234.80	0.008426	2.10	2.61	7.22	0.78
REACH1	2223.36	25-Year	6.64	233.69	234.64	234.56	234.92	0.009605	2.36	2.81	7.50	0.85
REACH1	2223.36	50-Year	7.57	233.69	234.68	234.62	235.01	0.010323	2.54	2.98	7.72	0.89
REACH1	2223.36	100-Year	8.49	233.69	234.73	234.68	235.10	0.010965	2.71	3.13	7.93	0.92
REACH1	2223.36	Regional	14.97	233.69	235.07	235.07	235.67	0.011519	3.45	4.34	10.65	1.00
REACH1	2223.35	2-Year	3.34	233.50	234.07	234.04	234.22	0.013153	1.72	1.96	5.49	0.88
REACH1	2223.35	5-Year	4.58	233.50	234.13	234.13	234.34	0.015973	2.06	2.27	5.86	0.99
REACH1	2223.35	10-Year	5.48	233.50	234.18	234.18	234.43	0.015279	2.18	2.61	6.24	0.99
REACH1	2223.35	25-Year	6.64	233.50	234.25	234.25	234.52	0.014301	2.31	3.06	6.71	0.98
REACH1	2223.35	50-Year	7.57	233.50	234.31	234.31	234.59	0.013750	2.40	3.42	7.07	0.97
REACH1	2223.35	100-Year	8.49	233.50	234.35	234.35	234.66	0.013315	2.48	3.77	7.39	0.97
REACH1	2223.35	Regional	14.97	233.50	234.65	234.65	235.06	0.011140	2.91	6.29	9.35	0.94
REACH1	2223.34	2-Year	3.34	233.00	233.48	233.45	233.59	0.012328	1.56	2.64	10.76	0.84
REACH1	2223.34	5-Year	4.58	233.00	233.57	233.52	233.69	0.010139	1.64	3.82	16.17	0.79
REACH1	2223.34	10-Year	5.48	233.00	233.62	233.58	233.75	0.009126	1.69	4.83	20.24	0.77
REACH1	2223.34	25-Year	6.64	233.00	233.70	233.64	233.82	0.007259	1.66	6.67	25.88	0.70

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

Reach	River Sta	Profile	Q Total (m ³ /s)	Min Ch El (m)	W. S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m ²)	Top Width (m)	Froude # Chl
REACH1	2223.34	50-Year	7.57	233.00	233.75	233.68	233.86	0.006829	1.69	7.89	28.94	0.69
REACH1	2223.34	100-Year	8.49	233.00	233.74	233.72	233.89	0.009315	1.95	7.57	28.16	0.80
REACH1	2223.34	Regional	14.97	233.00	233.92	233.90	234.10	0.008986	2.28	13.74	40.46	0.82
REACH1	2223.33	2-Year	3.34	232.50	233.11		233.14	0.002235	0.72	5.07	17.64	0.37
REACH1	2223.33	5-Year	4.58	232.50	233.16		233.20	0.002772	0.87	5.97	18.87	0.42
REACH1	2223.33	10-Year	5.48	232.50	233.19		233.24	0.003159	0.97	6.54	19.59	0.45
REACH1	2223.33	25-Year	6.64	232.50	233.20		233.27	0.004321	1.15	6.72	19.82	0.53
REACH1	2223.33	50-Year	7.57	232.50	233.22		233.30	0.004812	1.25	7.15	20.33	0.56
REACH1	2223.33	100-Year	8.49	232.50	233.33		233.39	0.002962	1.11	9.53	23.01	0.45
REACH1	2223.33	Regional	14.97	232.50	233.63		233.70	0.002061	1.21	17.53	30.07	0.41
REACH1	2223.326	2-Year	3.34	232.03	232.63	232.63	232.69	0.008943	1.50	6.07	39.43	0.72
REACH1	2223.326	5-Year	4.58	232.03	232.70		232.74	0.006617	1.42	8.86	40.77	0.63
REACH1	2223.326	10-Year	5.48	232.03	232.75		232.79	0.005291	1.35	11.02	41.75	0.57
REACH1	2223.326	25-Year	6.64	232.03	232.88		232.90	0.002418	1.05	16.73	43.99	0.40
REACH1	2223.326	50-Year	7.57	232.03	233.05		233.06	0.001038	0.80	24.56	46.86	0.27
REACH1	2223.326	100-Year	8.49	232.03	233.23		233.24	0.000688	0.74	34.28	67.74	0.23
REACH1	2223.326	Regional	14.97	232.03	233.59		233.59	0.000422	0.70	60.19	74.88	0.19
REACH1	2223.325	2-Year	3.34	232.00	232.62	232.48	232.64	0.001881	0.66	9.82	38.35	0.33
REACH1	2223.325	5-Year	4.58	232.00	232.69	232.52	232.70	0.001871	0.73	12.26	38.60	0.34
REACH1	2223.325	10-Year	5.48	232.00	232.74	232.54	232.75	0.001741	0.75	14.18	38.81	0.34
REACH1	2223.325	25-Year	6.64	232.00	232.87	232.57	232.89	0.000983	0.66	19.48	39.36	0.26
REACH1	2223.325	50-Year	7.57	232.00	233.05	232.59	233.06	0.000496	0.55	27.28	58.72	0.19
REACH1	2223.325	100-Year	8.49	232.00	233.23	232.60	233.23	0.000322	0.51	38.02	61.26	0.16
REACH1	2223.325	Regional	14.97	232.00	233.58	232.71	233.59	0.000256	0.55	60.20	63.04	0.15
REACH1	2223.324	2-Year	3.34	231.99	232.60	232.48	232.61	0.003095	0.98	9.43	36.12	0.44
REACH1	2223.324	5-Year	4.58	231.99	232.66	232.53	232.68	0.003070	1.06	11.78	37.13	0.45
REACH1	2223.324	10-Year	5.48	231.99	232.71	232.55	232.73	0.002796	1.07	13.76	37.95	0.43
REACH1	2223.324	25-Year	6.64	231.99	232.86	232.57	232.87	0.001449	0.89	19.53	39.72	0.32
REACH1	2223.324	50-Year	7.57	231.99	233.04	232.59	233.05	0.000716	0.72	26.93	41.63	0.23
REACH1	2223.324	100-Year	8.49	231.99	233.22	232.61	233.23	0.000417	0.61	34.86	56.76	0.18
REACH1	2223.324	Regional	14.97	231.99	233.58	232.71	233.59	0.000425	0.74	56.09	61.27	0.19
REACH1	2223.323	2-Year	3.34	231.98	232.56		232.59	0.002562	0.88	7.27	28.79	0.41
REACH1	2223.323	5-Year	4.58	231.98	232.61		232.65	0.002939	1.01	8.91	30.21	0.44
REACH1	2223.323	10-Year	5.48	231.98	232.67		232.70	0.002751	1.04	10.58	31.57	0.43
REACH1	2223.323	25-Year	6.64	231.98	232.84		232.86	0.001332	0.86	16.29	35.51	0.32
REACH1	2223.323	50-Year	7.57	231.98	233.03		233.04	0.000653	0.70	23.54	39.39	0.23
REACH1	2223.323	100-Year	8.49	231.98	233.21		233.22	0.000390	0.61	31.16	43.31	0.18
REACH1	2223.323	Regional	14.97	231.98	233.57		233.58	0.000385	0.73	48.63	59.07	0.19
REACH1	2223.32	2-Year	3.34	231.67	232.21	232.21	232.39	0.018616	1.85	1.80	5.40	1.01
REACH1	2223.32	5-Year	4.58	231.67	232.40	232.35	232.49	0.007998	1.36	4.81	22.57	0.69
REACH1	2223.32	10-Year	5.48	231.67	232.57		232.61	0.002781	0.97	9.27	29.21	0.43
REACH1	2223.32	25-Year	6.64	231.67	232.80		232.82	0.000927	0.71	16.40	32.47	0.26
REACH1	2223.32	50-Year	7.57	231.67	233.01		233.02	0.000453	0.59	23.57	35.47	0.19
REACH1	2223.32	100-Year	8.49	231.67	233.20		233.21	0.000282	0.52	30.63	38.55	0.15
REACH1	2223.32	Regional	14.97	231.67	233.56		233.57	0.000312	0.65	45.22	44.38	0.17
REACH1	2223.31	2-Year	3.34	231.51	232.24		232.24	0.000265	0.30	12.68	30.53	0.13
REACH1	2223.31	5-Year	4.58	231.51	232.42		232.43	0.000170	0.29	18.66	33.99	0.11
REACH1	2223.31	10-Year	5.48	231.51	232.57		232.57	0.000123	0.28	23.85	36.08	0.10
REACH1	2223.31	25-Year	6.64	231.51	232.80		232.80	0.000077	0.26	32.35	38.28	0.08
REACH1	2223.31	50-Year	7.57	231.51	233.01		233.01	0.000053	0.24	40.67	40.33	0.07
REACH1	2223.31	100-Year	8.49	231.51	233.20		233.20	0.000041	0.24	48.69	43.44	0.06
REACH1	2223.31	Regional	14.97	231.51	233.56		233.56	0.000055	0.32	67.78	62.34	0.07
REACH1	2223.30	2-Year	3.34	231.50	232.20	231.96	232.23	0.002103	0.97	6.27	28.25	0.39
REACH1	2223.30	5-Year	4.58	231.50	232.39	232.04	232.42	0.001365	0.93	9.36	34.12	0.33
REACH1	2223.30	10-Year	5.48	231.50	232.54	232.08	232.57	0.001005	0.89	12.06	39.10	0.29
REACH1	2223.30	25-Year	6.64	231.50	232.78	232.13	232.80	0.000642	0.82	16.87	50.82	0.24
REACH1	2223.30	50-Year	7.57	231.50	233.01	232.17	233.01	0.000153	0.45	42.27	58.71	0.12
REACH1	2223.30	100-Year	8.49	231.50	233.20	232.20	233.20	0.000091	0.38	54.00	63.01	0.09
REACH1	2223.30	Regional	14.97	231.50	233.55	232.41	233.56	0.000093	0.43	77.74	71.77	0.10
REACH1	2223.29	2-Year	3.34	231.18	232.05	231.80	232.15	0.005815	1.40	2.38	13.06	0.56
REACH1	2223.29	5-Year	4.58	231.18	232.24	231.93	232.35	0.004537	1.48	3.15	15.10	0.52
REACH1	2223.29	10-Year	5.48	231.18	232.40	232.01	232.51	0.003600	1.48	3.81	17.02	0.47
REACH1	2223.29	25-Year	6.64	231.18	232.65	232.10	232.75	0.002457	1.42	4.85	19.44	0.41
REACH1	2223.29	50-Year	7.57	231.18	232.89	232.16	232.98	0.001762	1.35	5.87	21.47	0.35
REACH1	2223.29	100-Year	8.49	231.18	233.09	232.23	233.17	0.001435	1.32	6.76	24.14	0.33
REACH1	2223.29	Regional	14.97	231.18	233.41	232.59	233.52	0.001702	1.62	14.77	35.64	0.37
REACH1	2223.285 C3											
REACH1	2223.28	2-Year	3.34	231.14	231.82	231.74	231.99	0.012304	1.81	1.84	16.88	0.81
REACH1	2223.28	5-Year	4.58	231.14	231.87	231.87	232.13	0.018296	2.26	2.02	19.11	1.00
REACH1	2223.28	10-Year	5.48	231.14	232.02	231.94	232.24	0.011719	2.05	2.67	27.52	0.83
REACH1	2223.28	25-Year	6.64	231.14	232.31	232.02	232.45	0.005176	1.67	3.98	31.14	0.58
REACH1	2223.28	50-Year	7.57	231.14	232.55	232.09	232.66	0.002884	1.48	5.16	32.57	0.45
REACH1	2223.28	100-Year	8.49	231.14	232.71	232.15	232.82	0.002301	1.44	5.93	33.30	0.41

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

Reach	River Sta	Profile	Q Total (m ³ /s)	Min Ch El (m)	W. S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m ²)	Top Width (m)	Froude # Chl
REACH1	2223.28	Regional	14.97	231.14	232.98	232.48	233.20	0.003734	2.09	7.22	34.56	0.54
REACH1	2223.27	2-Year	3.34	231.10	231.71	231.71	231.79	0.008203	1.45	3.19	19.90	0.70
REACH1	2223.27	5-Year	4.58	231.10	231.91	231.75	231.93	0.001221	0.72	8.12	37.32	0.29
REACH1	2223.27	10-Year	5.48	231.10	232.11	231.78	232.12	0.000357	0.47	13.37	42.37	0.16
REACH1	2223.27	25-Year	6.64	231.10	232.37	231.81	232.38	0.000133	0.34	20.48	47.97	0.10
REACH1	2223.27	50-Year	7.57	231.10	232.60	231.83	232.61	0.000073	0.29	26.88	52.30	0.08
REACH1	2223.27	100-Year	8.49	231.10	232.76	231.85	232.76	0.000057	0.27	31.29	55.05	0.07
REACH1	2223.27	Regional	14.97	231.10	233.08	231.94	233.09	0.000077	0.36	43.21	62.48	0.09
REACH1	2223.26	2-Year	3.34	230.74	231.59	231.28	231.63	0.002213	0.91	4.12	20.22	0.38
REACH1	2223.26	5-Year	4.58	230.74	231.90	231.37	231.91	0.000308	0.45	13.31	41.76	0.15
REACH1	2223.26	10-Year	5.48	230.74	232.11	231.44	232.11	0.000128	0.33	20.10	46.22	0.10
REACH1	2223.26	25-Year	6.64	230.74	232.37	231.51	232.37	0.000060	0.26	29.08	52.50	0.07
REACH1	2223.26	50-Year	7.57	230.74	232.60	231.66	232.61	0.000036	0.23	37.13	58.07	0.06
REACH1	2223.26	100-Year	8.49	230.74	232.76	231.70	232.76	0.000029	0.22	42.67	61.14	0.05
REACH1	2223.26	Regional	14.97	230.74	233.08	231.82	233.09	0.000043	0.29	56.76	66.81	0.07
REACH1	2223.25	2-Year	3.34	230.50	231.56	231.03	231.60	0.001112	0.86	3.91	7.82	0.29
REACH1	2223.25	5-Year	4.58	230.50	231.85	231.13	231.89	0.000842	0.89	5.13	11.15	0.26
REACH1	2223.25	10-Year	5.48	230.50	232.05	231.20	232.10	0.000719	0.91	5.99	14.09	0.25
REACH1	2223.25	25-Year	6.64	230.50	232.32	231.28	232.36	0.000597	0.93	7.11	20.08	0.23
REACH1	2223.25	50-Year	7.57	230.50	232.59	231.33	232.60	0.000294	0.55	21.01	28.53	0.13
REACH1	2223.25	100-Year	8.49	230.50	232.75	231.39	232.76	0.000226	0.51	25.61	28.89	0.12
REACH1	2223.25	Regional	14.97	230.50	233.07	231.73	233.08	0.000299	0.65	34.96	30.35	0.14
REACH1	2223.245 C4		Culvert									
REACH1	2223.24	2-Year	3.34	230.20	231.24	230.75	231.29	0.002046	0.98	3.40	6.73	0.35
REACH1	2223.24	5-Year	4.58	230.20	231.40	230.87	231.46	0.002097	1.12	4.08	8.36	0.37
REACH1	2223.24	10-Year	5.48	230.20	231.49	230.95	231.57	0.002194	1.22	4.49	9.28	0.38
REACH1	2223.24	25-Year	6.64	230.20	231.59	231.04	231.68	0.002392	1.35	4.91	10.23	0.40
REACH1	2223.24	50-Year	7.57	230.20	231.68	231.11	231.79	0.002403	1.43	5.30	11.13	0.41
REACH1	2223.24	100-Year	8.49	230.20	231.78	231.18	231.90	0.002333	1.48	5.73	12.09	0.41
REACH1	2223.24	Regional	14.97	230.20	232.28	231.52	232.33	0.001035	1.10	16.62	22.35	0.29
REACH1	2223.23	2-Year	3.34	230.20	231.11	230.86	231.22	0.006357	1.48	2.26	3.48	0.59
REACH1	2223.23	5-Year	4.58	230.20	231.25	231.00	231.39	0.007031	1.63	2.81	4.08	0.63
REACH1	2223.23	10-Year	5.48	230.20	231.34	231.09	231.49	0.007398	1.73	3.17	4.43	0.65
REACH1	2223.23	25-Year	6.64	230.20	231.41	231.19	231.59	0.008247	1.88	3.54	4.76	0.70
REACH1	2223.23	50-Year	7.57	230.20	231.54	231.27	231.71	0.006840	1.82	4.16	5.26	0.64
REACH1	2223.23	100-Year	8.49	230.20	231.68	231.34	231.83	0.005113	1.75	4.91	5.77	0.57
REACH1	2223.23	Regional	14.97	230.20	231.96	231.69	232.24	0.006409	2.33	6.73	6.88	0.67
REACH1	2223.22	2-Year	3.34	230.20	230.81	230.81	231.06	0.009991	2.24	1.49	2.90	1.00
REACH1	2223.22	5-Year	4.58	230.20	230.96	230.96	231.23	0.009493	2.29	2.00	3.79	1.00
REACH1	2223.22	10-Year	5.48	230.20	231.04	231.04	231.33	0.009092	2.40	2.29	4.22	1.00
REACH1	2223.22	25-Year	6.64	230.20	231.26	231.12	231.49	0.004481	2.09	3.20	5.28	0.74
REACH1	2223.22	50-Year	7.57	230.20	231.43	231.18	231.63	0.003139	1.98	3.86	5.97	0.64
REACH1	2223.22	100-Year	8.49	230.20	231.58	231.24	231.77	0.002415	1.91	4.47	7.00	0.57
REACH1	2223.22	Regional	14.97	230.20	231.98	231.98	232.15	0.001857	2.00	13.16	53.46	0.53
REACH1	2223.215 C5		Culvert									
REACH1	2223.21	2-Year	3.34	230.00	230.62	230.51	230.74	0.003953	1.58	2.11	5.80	0.70
REACH1	2223.21	5-Year	4.58	230.00	230.76	230.60	230.91	0.003256	1.70	2.70	6.83	0.66
REACH1	2223.21	10-Year	5.48	230.00	230.88	230.67	231.03	0.002706	1.72	3.18	7.58	0.62
REACH1	2223.21	25-Year	6.64	230.00	231.02	230.75	231.18	0.002329	1.78	3.73	8.46	0.59
REACH1	2223.21	50-Year	7.57	230.00	231.11	230.80	231.29	0.002168	1.84	4.12	9.17	0.58
REACH1	2223.21	100-Year	8.49	230.00	231.21	230.86	231.39	0.002052	1.89	4.49	9.82	0.57
REACH1	2223.21	Regional	14.97	230.00	231.38	231.21	231.80	0.003954	2.89	5.19	11.05	0.81
REACH1	2223.20	2-Year	3.57	229.70	230.55	230.44	230.85	0.007848	1.38	2.59	6.45	0.68
REACH1	2223.20	5-Year	4.89	229.70	230.74	230.53	230.82	0.004218	1.30	3.95	8.21	0.53
REACH1	2223.20	10-Year	5.85	229.70	230.88	230.59	230.95	0.002940	1.24	5.20	9.92	0.46
REACH1	2223.20	25-Year	7.08	229.70	231.03	230.65	231.10	0.002178	1.21	6.86	11.86	0.41
REACH1	2223.20	50-Year	8.08	229.70	231.14	230.70	231.21	0.001879	1.21	8.28	14.93	0.39
REACH1	2223.20	100-Year	9.06	229.70	231.24	230.75	231.30	0.001618	1.20	9.91	17.49	0.36
REACH1	2223.20	Regional	16.25	229.70	231.50	231.05	231.60	0.002145	1.58	15.54	28.56	0.43
REACH1	2223.19	2-Year	3.57	229.45	230.12	230.12	230.44	0.025252	2.53	1.41	2.16	1.00
REACH1	2223.19	5-Year	4.89	229.45	230.27	230.27	230.67	0.026322	2.80	1.74	2.19	1.00
REACH1	2223.19	10-Year	5.85	229.45	230.38	230.38	230.82	0.026648	2.96	1.98	2.20	1.00
REACH1	2223.19	25-Year	7.08	229.45	230.56	230.56	230.99	0.021560	2.93	2.52	5.66	0.90
REACH1	2223.19	50-Year	8.08	229.45	230.67	230.67	231.11	0.019417	2.96	2.92	6.75	0.87
REACH1	2223.19	100-Year	9.06	229.45	230.75	230.75	231.21	0.019062	3.06	3.21	7.53	0.87
REACH1	2223.19	Regional	16.25	229.45	231.52	231.22	231.56	0.001457	1.16	19.51	37.66	0.26
REACH1	2223.185 C6		Culvert									
REACH1	2223.18	2-Year	3.57	229.37	230.17	229.93	230.26	0.004028	1.33	2.72	4.98	0.51
REACH1	2223.18	5-Year	4.89	229.37	230.32	230.03	230.43	0.003959	1.49	3.35	5.63	0.52
REACH1	2223.18	10-Year	5.85	229.37	230.39	230.10	230.53	0.004236	1.64	3.68	5.95	0.55
REACH1	2223.18	25-Year	7.08	229.37	230.48	230.19	230.64	0.004554	1.80	4.05	6.32	0.58

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

Reach	River Sta	Profile	Q Total (m ³ /s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m ²)	Top Width (m)	Froude # Chl
REACH1	2223.18	50-Year	8.08	229.37	230.54	230.25	230.72	0.004875	1.94	4.31	7.41	0.60
REACH1	2223.18	100-Year	9.06	229.37	230.58	230.31	230.80	0.005276	2.07	4.52	8.70	0.63
REACH1	2223.18	Regional	16.25	229.37	230.80	230.69	231.27	0.009125	3.08	5.48	14.70	0.85
REACH1	2223.17	2-Year	3.57	228.87	229.77	229.77	230.06	0.015749	2.42	1.67	3.81	0.96
REACH1	2223.17	5-Year	4.89	228.87	229.95	229.95	230.24	0.012091	2.49	2.59	6.32	0.87
REACH1	2223.17	10-Year	5.85	228.87	230.06	230.06	230.35	0.010348	2.51	3.40	7.86	0.82
REACH1	2223.17	25-Year	7.08	228.87	230.16	230.16	230.47	0.010041	2.64	4.20	8.74	0.83
REACH1	2223.17	50-Year	8.08	228.87	230.23	230.23	230.55	0.009905	2.74	4.83	9.38	0.83
REACH1	2223.17	100-Year	9.06	228.87	230.29	230.29	230.62	0.009740	2.82	5.45	9.97	0.83
REACH1	2223.17	Regional	16.25	228.87	230.63	230.63	231.06	0.010332	3.43	9.40	14.67	0.89
REACH1	2223.16	2-Year	3.57	228.57	229.49	229.49	229.68	0.018599	1.93	1.85	4.85	0.99
REACH1	2223.16	5-Year	4.89	228.57	229.58	229.58	229.81	0.016879	2.11	2.37	6.26	0.98
REACH1	2223.16	10-Year	5.85	228.57	229.65	229.65	229.89	0.015289	2.19	2.83	7.36	0.96
REACH1	2223.16	25-Year	7.08	228.57	229.72	229.72	229.99	0.014013	2.29	3.44	8.62	0.94
REACH1	2223.16	50-Year	8.08	228.57	229.78	229.78	230.06	0.013491	2.38	3.93	9.50	0.93
REACH1	2223.16	100-Year	9.06	228.57	229.83	229.83	230.12	0.012846	2.45	4.45	10.36	0.92
REACH1	2223.16	Regional	16.25	228.57	230.15	230.15	230.50	0.010337	2.79	8.57	16.00	0.88
REACH1	2223.15	2-Year	3.57	228.50	229.19	228.87	229.21	0.002540	0.56	6.87	19.66	0.26
REACH1	2223.15	5-Year	4.89	228.50	229.27	228.94	229.29	0.002963	0.65	8.46	23.02	0.28
REACH1	2223.15	10-Year	5.85	228.50	229.32	228.97	229.34	0.003158	0.71	9.67	25.57	0.29
REACH1	2223.15	25-Year	7.08	228.50	229.37	229.02	229.40	0.003400	0.77	11.14	28.36	0.30
REACH1	2223.15	50-Year	8.08	228.50	229.41	229.05	229.44	0.003510	0.81	12.41	30.85	0.30
REACH1	2223.15	100-Year	9.06	228.50	229.45	229.08	229.48	0.003624	0.84	13.64	33.65	0.31
REACH1	2223.15	Regional	16.25	228.50	229.65	229.27	229.70	0.004290	1.05	21.61	45.24	0.34
REACH1	2223.14	2-Year	3.57	227.98	228.75	228.64	228.80	0.003584	1.12	5.44	26.66	0.48
REACH1	2223.14	5-Year	4.89	227.98	228.84	228.89	228.89	0.003059	1.14	8.14	33.94	0.46
REACH1	2223.14	10-Year	5.85	227.98	228.89	228.93	228.93	0.002956	1.18	9.87	38.38	0.45
REACH1	2223.14	25-Year	7.08	227.98	228.94	228.98	228.98	0.002906	1.22	11.79	41.03	0.46
REACH1	2223.14	50-Year	8.08	227.98	228.96	229.01	229.01	0.003052	1.28	12.92	42.21	0.47
REACH1	2223.14	100-Year	9.06	227.98	228.99	229.04	229.04	0.003129	1.33	14.04	43.10	0.48
REACH1	2223.14	Regional	16.25	227.98	229.21	229.26	229.26	0.002689	1.45	24.71	57.59	0.46
REACH1	2223.13	2-Year	3.57	227.25	227.96	227.96	228.19	0.017754	2.14	1.67	3.57	1.00
REACH1	2223.13	5-Year	4.89	227.25	228.14	228.14	228.34	0.018056	1.96	2.50	6.38	1.00
REACH1	2223.13	10-Year	5.85	227.25	228.22	228.22	228.41	0.017497	1.94	3.02	8.08	0.99
REACH1	2223.13	25-Year	7.08	227.25	228.29	228.27	228.48	0.014783	1.97	3.65	9.55	0.93
REACH1	2223.13	50-Year	8.08	227.25	228.37	228.32	228.55	0.010976	1.88	4.53	11.16	0.82
REACH1	2223.13	100-Year	9.06	227.25	228.45	228.37	228.61	0.008528	1.80	5.47	12.42	0.74
REACH1	2223.13	Regional	16.25	227.25	228.91	228.61	229.01	0.002935	1.53	14.78	28.99	0.48
REACH1	2223.12	2-Year	3.57	227.02	227.85	227.62	227.91	0.003056	1.11	3.53	7.43	0.46
REACH1	2223.12	5-Year	4.89	227.02	228.00	227.70	228.07	0.002711	1.21	4.70	8.72	0.45
REACH1	2223.12	10-Year	5.85	227.02	228.04	227.76	228.13	0.003110	1.35	5.15	9.63	0.48
REACH1	2223.12	25-Year	7.08	227.02	228.20	227.83	228.28	0.002393	1.33	6.88	12.68	0.44
REACH1	2223.12	50-Year	8.08	227.02	228.29	227.89	228.38	0.002222	1.36	8.09	14.44	0.43
REACH1	2223.12	100-Year	9.06	227.02	228.37	227.93	228.46	0.002064	1.38	9.38	16.11	0.42
REACH1	2223.12	Regional	16.25	227.02	228.84	228.26	228.94	0.001600	1.54	19.47	27.83	0.39
REACH1	2223.11	2-Year	3.57	226.75	227.85	227.46	227.88	0.001397	0.83	4.48	7.30	0.31
REACH1	2223.11	5-Year	4.89	226.75	227.99	227.54	228.04	0.001402	0.94	5.52	7.83	0.32
REACH1	2223.11	10-Year	5.85	226.75	228.04	227.60	228.10	0.001666	1.06	5.89	8.28	0.36
REACH1	2223.11	25-Year	7.08	226.75	228.20	227.66	228.26	0.001420	1.09	7.21	9.87	0.34
REACH1	2223.11	50-Year	8.08	226.75	228.29	227.71	228.35	0.001398	1.14	8.06	10.82	0.34
REACH1	2223.11	100-Year	9.06	226.75	228.37	227.76	228.44	0.001379	1.19	8.96	12.63	0.34
REACH1	2223.11	Regional	16.25	226.75	228.84	228.04	228.92	0.001194	1.37	21.32	61.79	0.34
REACH1	2223.105 C7		Culvert									
REACH1	2223.10	2-Year	3.57	226.55	227.81	227.43	227.87	0.002377	1.07	3.48	5.77	0.39
REACH1	2223.10	5-Year	4.89	226.55	227.93	227.55	228.01	0.002678	1.26	4.21	6.30	0.43
REACH1	2223.10	10-Year	5.85	226.55	228.01	227.62	228.10	0.002864	1.37	4.68	6.71	0.45
REACH1	2223.10	25-Year	7.08	226.55	228.10	227.70	228.21	0.003070	1.51	5.25	8.08	0.47
REACH1	2223.10	50-Year	8.08	226.55	228.16	227.76	228.29	0.003250	1.62	5.66	9.09	0.49
REACH1	2223.10	100-Year	9.06	226.55	228.21	227.82	228.36	0.003430	1.71	6.02	10.02	0.51
REACH1	2223.10	Regional	16.25	226.55	228.53	228.18	228.77	0.004335	2.27	10.52	15.58	0.59
REACH1	2223.09	2-Year	3.57	226.45	227.51	227.50	227.71	0.019425	1.98	1.80	4.44	0.99
REACH1	2223.09	5-Year	4.89	226.45	227.63	227.61	227.84	0.016413	2.06	2.38	4.87	0.94
REACH1	2223.09	10-Year	5.85	226.45	227.71	227.68	227.93	0.014981	2.11	2.78	5.13	0.91
REACH1	2223.09	25-Year	7.08	226.45	227.79	227.75	228.04	0.014075	2.19	3.24	5.93	0.90
REACH1	2223.09	50-Year	8.08	226.45	227.86	227.82	228.12	0.013365	2.25	3.63	6.18	0.89
REACH1	2223.09	100-Year	9.06	226.45	227.91	227.87	228.19	0.012867	2.31	3.99	6.41	0.88
REACH1	2223.09	Regional	16.25	226.45	228.26	228.20	228.60	0.009877	2.62	6.76	10.10	0.83
REACH1	2223.08	2-Year	3.57	226.30	226.94	226.94	227.22	0.020316	2.32	1.54	2.78	1.00
REACH1	2223.08	5-Year	4.89	226.30	227.10	227.10	227.40	0.019477	2.46	1.99	3.20	1.00
REACH1	2223.08	10-Year	5.85	226.30	227.19	227.19	227.52	0.019028	2.53	2.31	3.55	1.00
REACH1	2223.08	25-Year	7.08	226.30	227.31	227.31	227.64	0.018250	2.56	2.77	4.12	1.00
REACH1	2223.08	50-Year	8.08	226.30	227.39	227.39	227.73	0.017973	2.60	3.10	4.51	1.00
REACH1	2223.08	100-Year	9.06	226.30	227.46	227.46	227.81	0.017694	2.64	3.43	4.85	1.00

HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

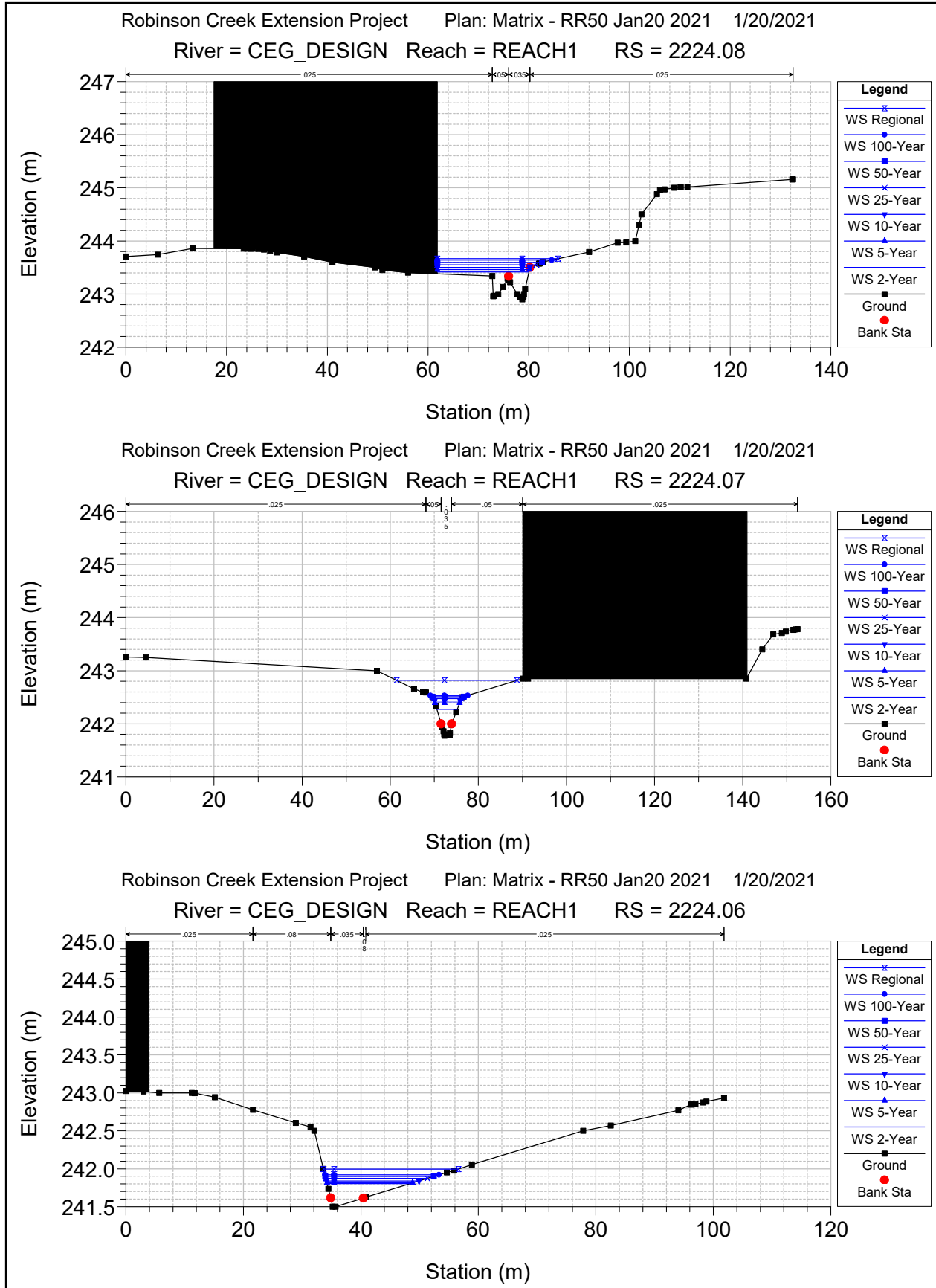
Reach	River Sta	Profile	Q Total (m ³ /s)	Min Ch El (m)	W. S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m ²)	Top Width (m)	Froude # Chl
REACH1	2223.08	Regional	16.25	226.30	227.82	227.82	228.28	0.016409	3.02	5.38	5.86	1.01
REACH1	2223.075 C8		Culvert									
REACH1	2223.07	2-Year	3.57	226.13	227.08	226.55	227.12	0.001346	0.80	4.45	5.68	0.29
REACH1	2223.07	5-Year	4.89	226.13	227.20	226.65	227.25	0.001721	0.95	5.15	6.24	0.33
REACH1	2223.07	10-Year	5.85	226.13	227.27	226.71	227.33	0.001939	1.05	5.59	6.56	0.36
REACH1	2223.07	25-Year	7.08	226.13	227.35	226.79	227.42	0.002180	1.16	6.11	6.94	0.38
REACH1	2223.07	50-Year	8.08	226.13	227.41	226.85	227.49	0.002337	1.25	6.47	7.21	0.40
REACH1	2223.07	100-Year	9.06	226.13	227.46	226.90	227.55	0.002484	1.33	6.81	7.45	0.42
REACH1	2223.07	Regional	16.25	226.13	227.73	227.27	227.92	0.003695	1.89	8.58	8.70	0.53
REACH1	2223.06	2-Year	3.57	226.10	226.85	226.84	227.00	0.017399	1.75	2.04	6.23	0.98
REACH1	2223.06	5-Year	4.89	226.10	226.93	226.93	227.11	0.017581	1.91	2.56	6.93	1.00
REACH1	2223.06	10-Year	5.85	226.10	226.98	226.98	227.18	0.016600	1.98	2.96	7.30	0.99
REACH1	2223.06	25-Year	7.08	226.10	227.04	227.04	227.26	0.016489	2.09	3.39	7.62	1.00
REACH1	2223.06	50-Year	8.08	226.10	227.08	227.08	227.32	0.016080	2.16	3.74	7.87	1.00
REACH1	2223.06	100-Year	9.06	226.10	227.13	227.13	227.38	0.015776	2.22	4.08	8.10	1.00
REACH1	2223.06	Regional	16.25	226.10	227.53	227.38	227.75	0.007993	2.09	7.86	12.06	0.76
REACH1	2223.05	2-Year	3.57	225.27	226.16	225.93	226.22	0.003960	1.11	3.23	6.42	0.50
REACH1	2223.05	5-Year	4.89	225.27	226.33	226.02	226.39	0.003235	1.10	4.45	7.67	0.46
REACH1	2223.05	10-Year	5.85	225.27	226.42	226.08	226.49	0.003179	1.13	5.16	8.38	0.46
REACH1	2223.05	25-Year	7.08	225.27	226.53	226.15	226.60	0.003001	1.15	6.14	9.30	0.45
REACH1	2223.05	50-Year	8.08	225.27	226.60	226.21	226.67	0.002881	1.18	6.85	10.27	0.45
REACH1	2223.05	100-Year	9.06	225.27	226.67	226.26	226.74	0.002781	1.22	7.52	11.50	0.45
REACH1	2223.05	Regional	16.25	225.27	226.69	226.55	226.92	0.008060	2.11	7.82	11.95	0.76
REACH1	2223.04	2-Year	5.69	224.70	225.48	225.43	225.66	0.012720	1.92	2.96	6.19	0.89
REACH1	2223.04	5-Year	8.09	224.70	225.57	225.57	225.83	0.015542	2.28	3.55	6.66	1.00
REACH1	2223.04	10-Year	9.73	224.70	225.64	225.64	225.93	0.015236	2.38	4.08	7.06	1.00
REACH1	2223.04	25-Year	11.99	224.70	225.74	225.74	226.06	0.014802	2.50	4.80	7.56	1.00
REACH1	2223.04	50-Year	13.77	224.70	225.81	225.81	226.15	0.014534	2.57	5.35	7.92	1.00
REACH1	2223.04	100-Year	15.81	224.70	225.92	225.89	226.25	0.012875	2.55	6.19	8.45	0.95
REACH1	2223.04	Regional	18.56	224.70	226.29	225.99	226.48	0.004515	1.93	9.92	11.49	0.60
REACH1	2223.03	2-Year	5.69	224.20	224.76	224.76	225.01	0.016821	2.20	2.59	5.23	1.00
REACH1	2223.03	5-Year	8.09	224.20	225.03	224.90	225.23	0.009309	1.99	4.07	6.03	0.77
REACH1	2223.03	10-Year	9.73	224.20	225.21	224.99	225.39	0.006404	1.86	5.22	6.97	0.66
REACH1	2223.03	25-Year	11.99	224.20	225.43	225.10	225.60	0.004390	1.80	6.65	8.11	0.57
REACH1	2223.03	50-Year	13.77	224.20	225.59	225.17	225.75	0.003607	1.80	7.67	8.97	0.53
REACH1	2223.03	100-Year	15.81	224.20	225.76	225.25	225.92	0.003053	1.81	8.76	14.43	0.50
REACH1	2223.03	Regional	18.56	224.20	226.22	225.35	226.34	0.001587	1.58	11.73	81.66	0.38
REACH1	2223.025 Mayfield Culvert		Culvert									
REACH1	2223.02	2-Year	5.69	223.68	224.79	224.23	224.84	0.001404	0.95	6.00	7.99	0.32
REACH1	2223.02	5-Year	8.09	223.68	224.97	224.37	225.04	0.001567	1.13	7.17	9.01	0.34
REACH1	2223.02	10-Year	9.73	223.68	225.07	224.46	225.15	0.001708	1.25	7.81	9.57	0.36
REACH1	2223.02	25-Year	11.99	223.68	225.17	224.57	225.27	0.001966	1.41	8.48	10.16	0.40
REACH1	2223.02	50-Year	13.77	223.68	225.24	224.64	225.36	0.002215	1.55	8.89	10.52	0.42
REACH1	2223.02	100-Year	15.81	223.68	225.29	224.71	225.44	0.002539	1.70	9.27	10.85	0.46
REACH1	2223.02	Regional	18.56	223.68	225.66	224.81	225.79	0.001643	1.60	11.63	12.98	0.38
REACH1	2223.01	2-Year	5.69	223.33	224.78	224.20	224.82	0.001112	0.77	7.35	9.59	0.28
REACH1	2223.01	5-Year	8.09	223.33	224.97	224.34	225.01	0.001218	0.88	9.20	10.62	0.30
REACH1	2223.01	10-Year	9.73	223.33	225.07	224.41	225.11	0.001298	0.94	10.30	11.18	0.31
REACH1	2223.01	25-Year	11.99	223.33	225.18	224.51	225.23	0.001447	1.04	11.55	11.79	0.33
REACH1	2223.01	50-Year	13.77	223.33	225.24	224.58	225.31	0.001591	1.11	12.35	12.17	0.35
REACH1	2223.01	100-Year	15.81	223.33	225.31	224.65	225.38	0.001776	1.20	13.14	12.53	0.38
REACH1	2223.01	Regional	18.56	223.33	225.68	224.74	225.73	0.001016	1.02	18.20	14.62	0.29
REACH1	2219.56	2-Year	6.08	223.16	224.62	224.30	224.70	0.004223	1.26	4.84	7.82	0.51
REACH1	2219.56	5-Year	8.72	223.16	224.78	224.47	224.88	0.004558	1.41	6.20	9.03	0.54
REACH1	2219.56	10-Year	10.49	223.16	224.87	224.56	224.98	0.004802	1.50	7.03	15.67	0.56
REACH1	2219.56	25-Year	12.98	223.16	224.96	224.67	225.09	0.004875	1.61	9.57	33.53	0.58
REACH1	2219.56	50-Year	14.95	223.16	225.02	224.75	225.16	0.005003	1.70	11.68	43.36	0.59
REACH1	2219.56	100-Year	17.19	223.16	225.03	224.82	225.21	0.006068	1.89	12.44	45.59	0.65
REACH1	2219.56	Regional	38.30	223.16	225.47	225.34	225.61	0.003778	1.97	39.45	95.39	0.55
REACH1	2219.55	2-Year	6.08	222.82	223.49	223.49	223.68	0.017370	1.95	3.13	8.30	1.01
REACH1	2219.55	5-Year	8.72	222.82	223.61	223.61	223.83	0.016430	2.09	4.16	9.48	1.01
REACH1	2219.55	10-Year	10.49	222.82	223.68	223.68	223.92	0.015544	2.15	4.87	10.21	1.00
REACH1	2219.55	25-Year	12.98	222.82	223.77	223.77	224.02	0.015250	2.24	5.80	11.33	1.00
REACH1	2219.55	50-Year	14.95	222.82	223.84	223.83	224.09	0.014297	2.25	6.64	12.23	0.98
REACH1	2219.55	100-Year	17.19	222.82	223.97	223.89	224.18	0.010286	2.07	8.30	13.53	0.84
REACH1	2219.55	Regional	38.30	222.82	224.31	224.31	224.69	0.013501	2.74	13.99	18.41	1.00
REACH1	2219.54	2-Year	6.08	221.60	223.01		223.01	0.000307	0.54	30.36	53.22	0.16
REACH1	2219.54	5-Year	8.72	221.60	223.63		223.64	0.000071	0.35	70.91	74.26	0.08
REACH1	2219.54	10-Year	10.49	221.60	223.77		223.77	0.000071	0.36	81.42	78.02	0.08
REACH1	2219.54	25-Year	12.98	221.60	223.90		223.90	0.000081	0.40	91.21	81.27	0.09
REACH1	2219.54	50-Year	14.95	221.60	223.97		223.97	0.000090	0.44	97.20	83.19	0.10
REACH1	2219.54	100-Year	17.19	221.60	224.07		224.07	0.000096	0.47	105.59	86.51	0.10

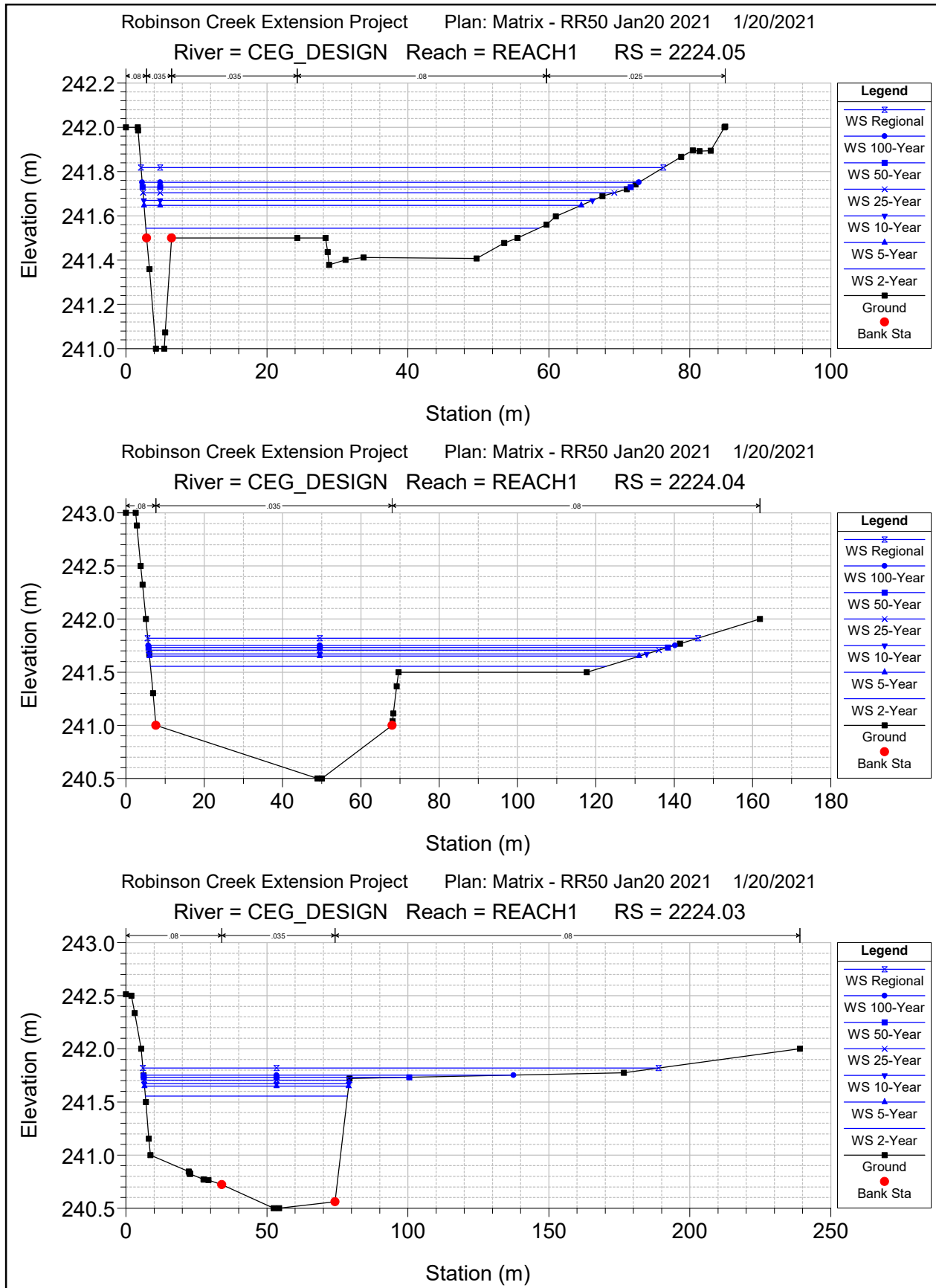
HEC-RAS Plan: Matrix - RR50 Aug 2021 River: CEG DESIGN Reach: REACH1 (Continued)

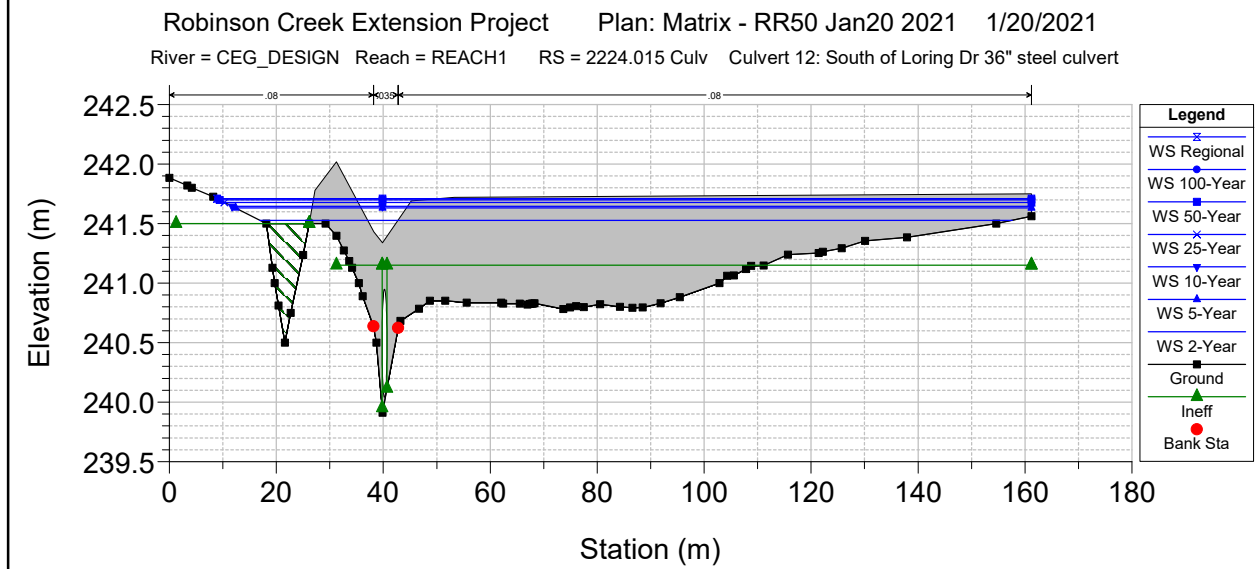
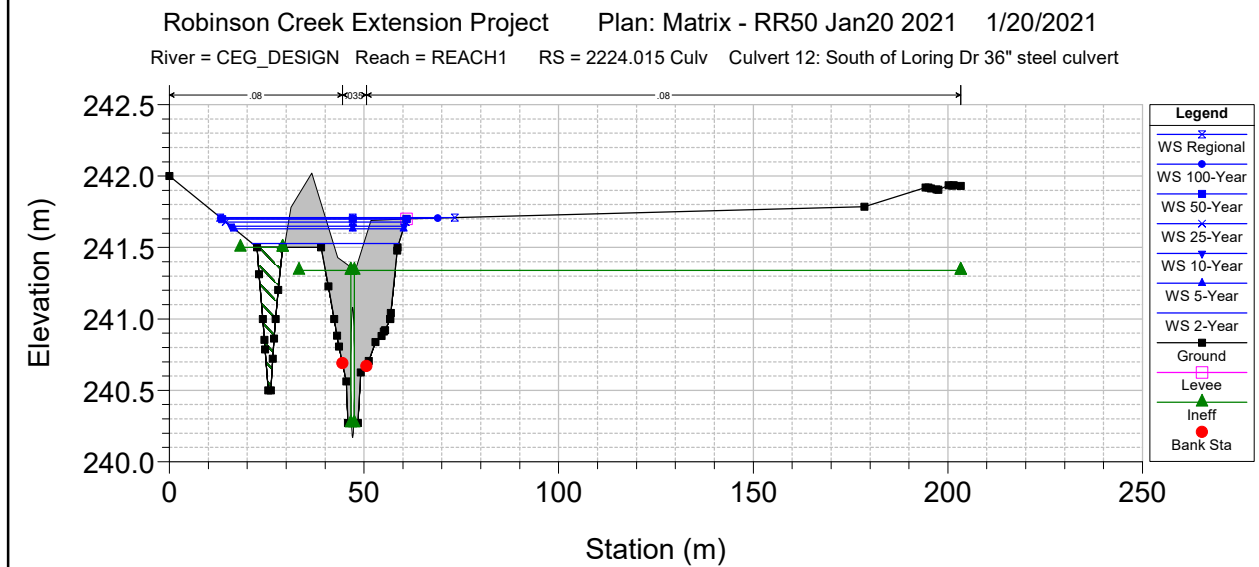
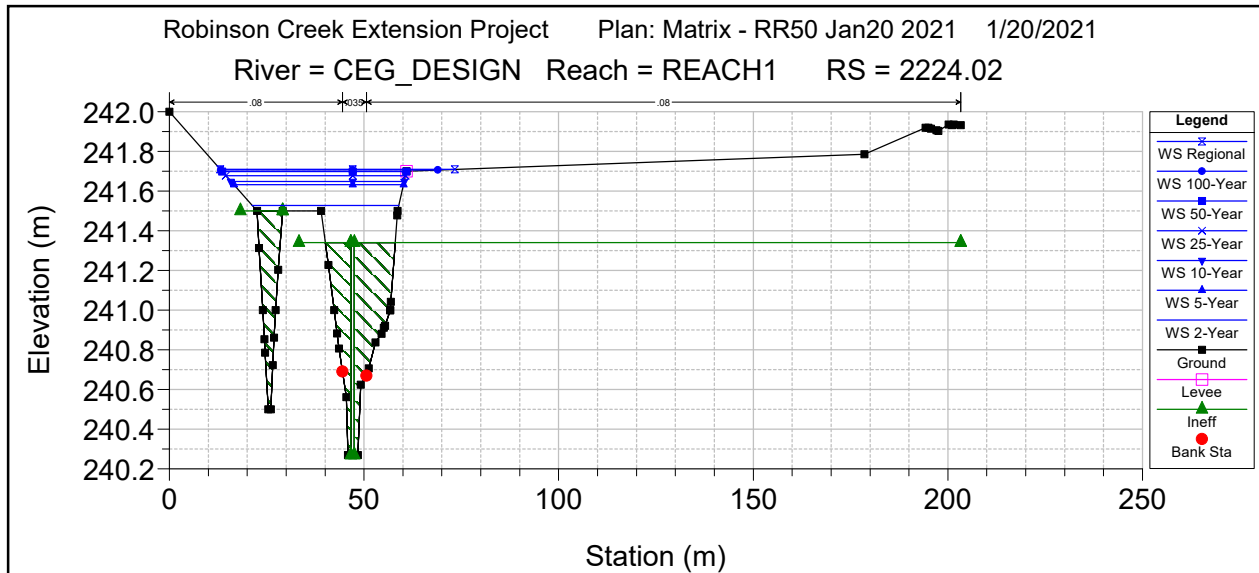
Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W. S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
REACH1	2219.54	Regional	38.30	221.60	224.23		224.24	0.000353	0.94	120.28	95.14	0.19
REACH1	2219.53	2-Year	6.08	220.75	222.79	221.91	222.93	0.004266	1.64	3.76	29.07	0.39
REACH1	2219.53	5-Year	8.72	220.75	223.52	222.19	223.60	0.004015	1.33	12.78	77.30	0.46
REACH1	2219.53	10-Year	10.49	220.75	223.74	222.36	223.76	0.001256	0.86	29.86	84.55	0.26
REACH1	2219.53	25-Year	12.98	220.75	223.87	222.59	223.88	0.000892	0.78	41.36	89.62	0.23
REACH1	2219.53	50-Year	14.95	220.75	223.94	222.76	223.96	0.000819	0.78	48.13	93.57	0.22
REACH1	2219.53	100-Year	17.19	220.75	224.04	222.93	224.06	0.000679	0.75	57.99	98.72	0.20
REACH1	2219.53	Regional	38.30	220.75	224.15	223.82	224.19	0.002147	1.40	68.99	103.55	0.36
REACH1	2219.525		Culvert									
REACH1	2219.52	2-Year	6.08	220.65	222.06	222.06	222.60	0.036106	3.26	1.86	1.74	1.01
REACH1	2219.52	5-Year	8.72	220.65	222.40	222.40	223.02	0.031508	3.50	2.51	28.84	0.99
REACH1	2219.52	10-Year	10.49	220.65	222.57	222.57	223.26	0.029531	3.69	2.89	43.58	0.97
REACH1	2219.52	25-Year	12.98	220.65	222.79	222.79	223.58	0.028379	3.96	3.36	51.32	0.98
REACH1	2219.52	50-Year	14.95	220.65	222.95	222.95	223.81	0.027241	4.13	3.73	58.99	0.97
REACH1	2219.52	100-Year	17.19	220.65	223.12	223.12	224.06	0.026424	4.32	4.11	65.41	0.97
REACH1	2219.52	Regional	38.30	220.65	223.73	223.73	223.93	0.010384	3.01	38.89	95.57	0.66
REACH1	2219.51	2-Year	6.08	220.50	222.03	221.82	222.04	0.003166	0.88	14.69	40.93	0.37
REACH1	2219.51	5-Year	8.72	220.50	222.11		222.13	0.003388	1.00	18.41	43.88	0.39
REACH1	2219.51	10-Year	10.49	220.50	222.18		222.20	0.003308	1.05	21.12	45.92	0.39
REACH1	2219.51	25-Year	12.98	220.50	222.25		222.27	0.003233	1.11	24.72	48.37	0.40
REACH1	2219.51	50-Year	14.95	220.50	222.31		222.33	0.003187	1.15	27.39	49.85	0.40
REACH1	2219.51	100-Year	17.19	220.50	222.36		222.39	0.003172	1.20	30.26	51.47	0.40
REACH1	2219.51	Regional	38.30	220.50	222.76		222.80	0.003201	1.53	53.54	63.73	0.43
REACH1	2219.50	2-Year	6.08	220.15	221.37	221.37	221.59	0.017409	2.11	2.98	7.56	1.00
REACH1	2219.50	5-Year	8.72	220.15	221.55	221.55	221.74	0.010478	2.03	6.04	23.95	0.82
REACH1	2219.50	10-Year	10.49	220.15	221.61	221.61	221.81	0.009838	2.11	7.76	27.46	0.80
REACH1	2219.50	25-Year	12.98	220.15	221.69	221.69	221.90	0.009545	2.22	9.96	31.10	0.81
REACH1	2219.50	50-Year	14.95	220.15	221.74	221.74	221.96	0.009391	2.30	11.66	33.62	0.81
REACH1	2219.50	100-Year	17.19	220.15	221.80	221.80	222.02	0.009170	2.38	13.61	36.31	0.81
REACH1	2219.50	Regional	38.30	220.15	222.14	222.14	222.42	0.009216	2.97	29.44	54.20	0.85

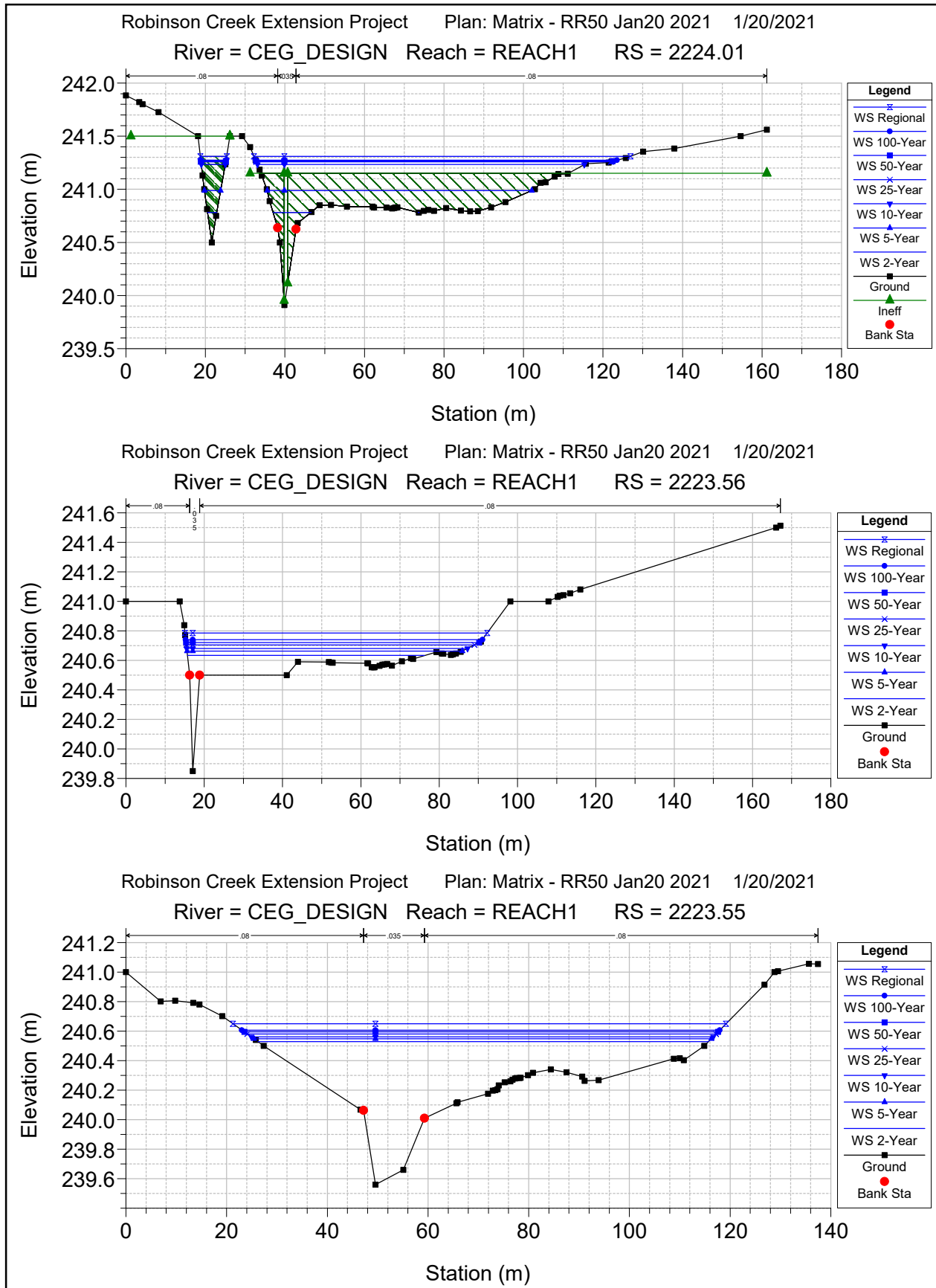
APPENDIX F HEC-RAS OUTPUT

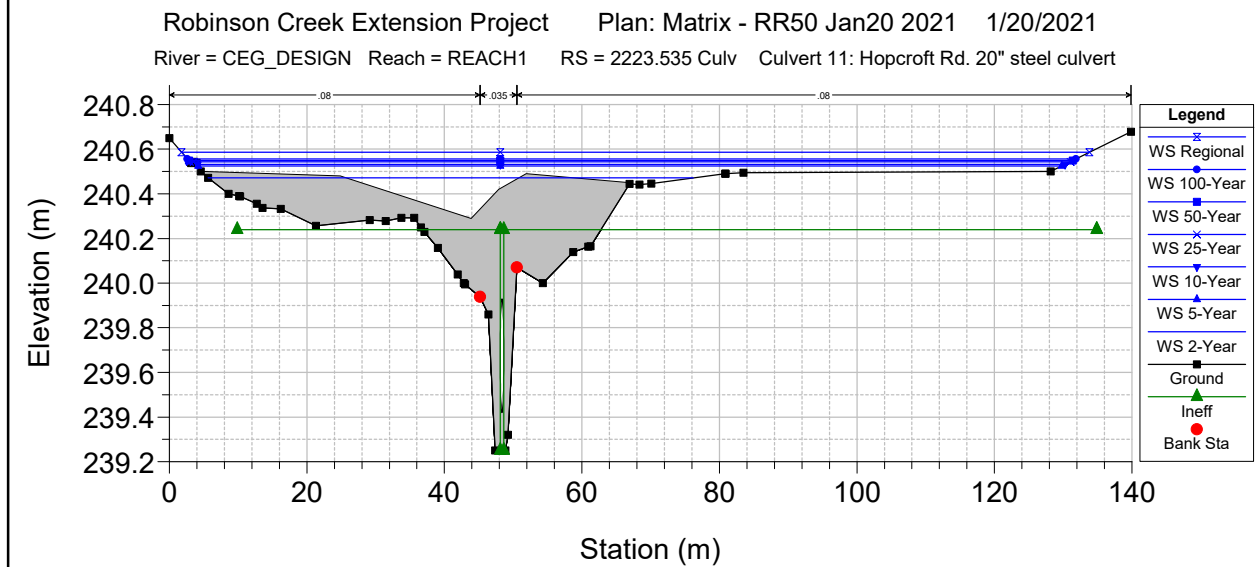
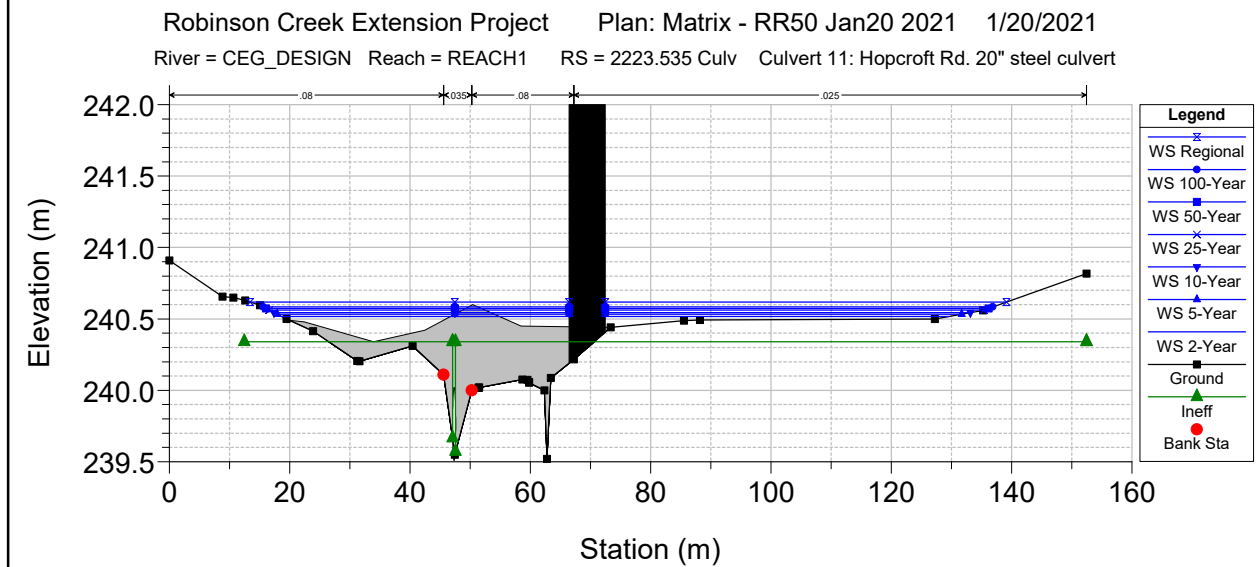
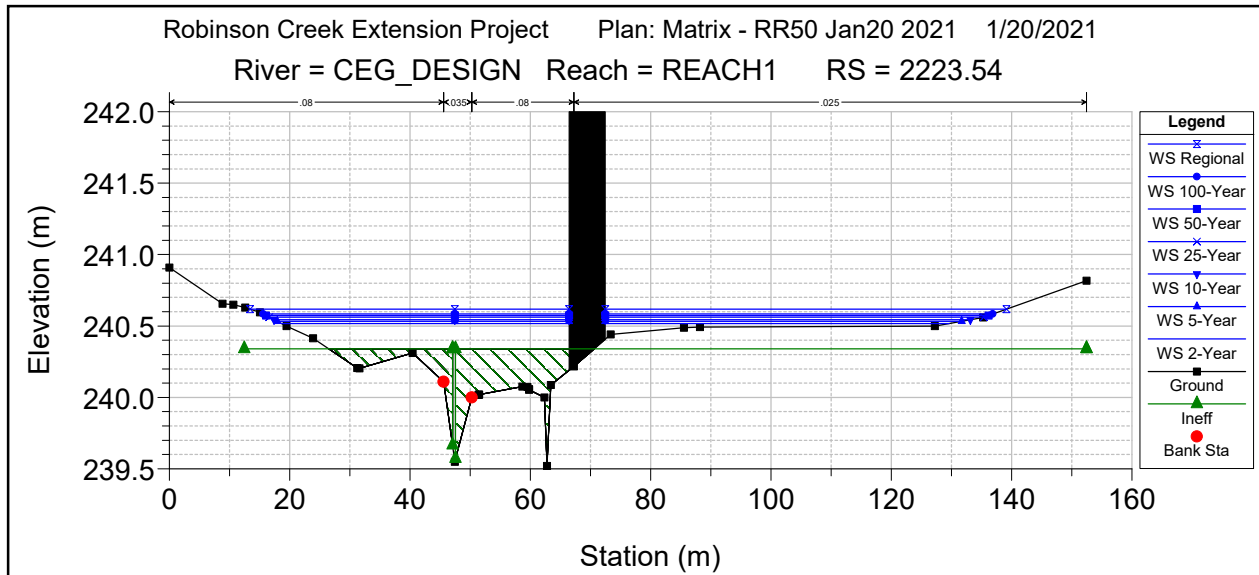
Item 3 – Cross-section Profile

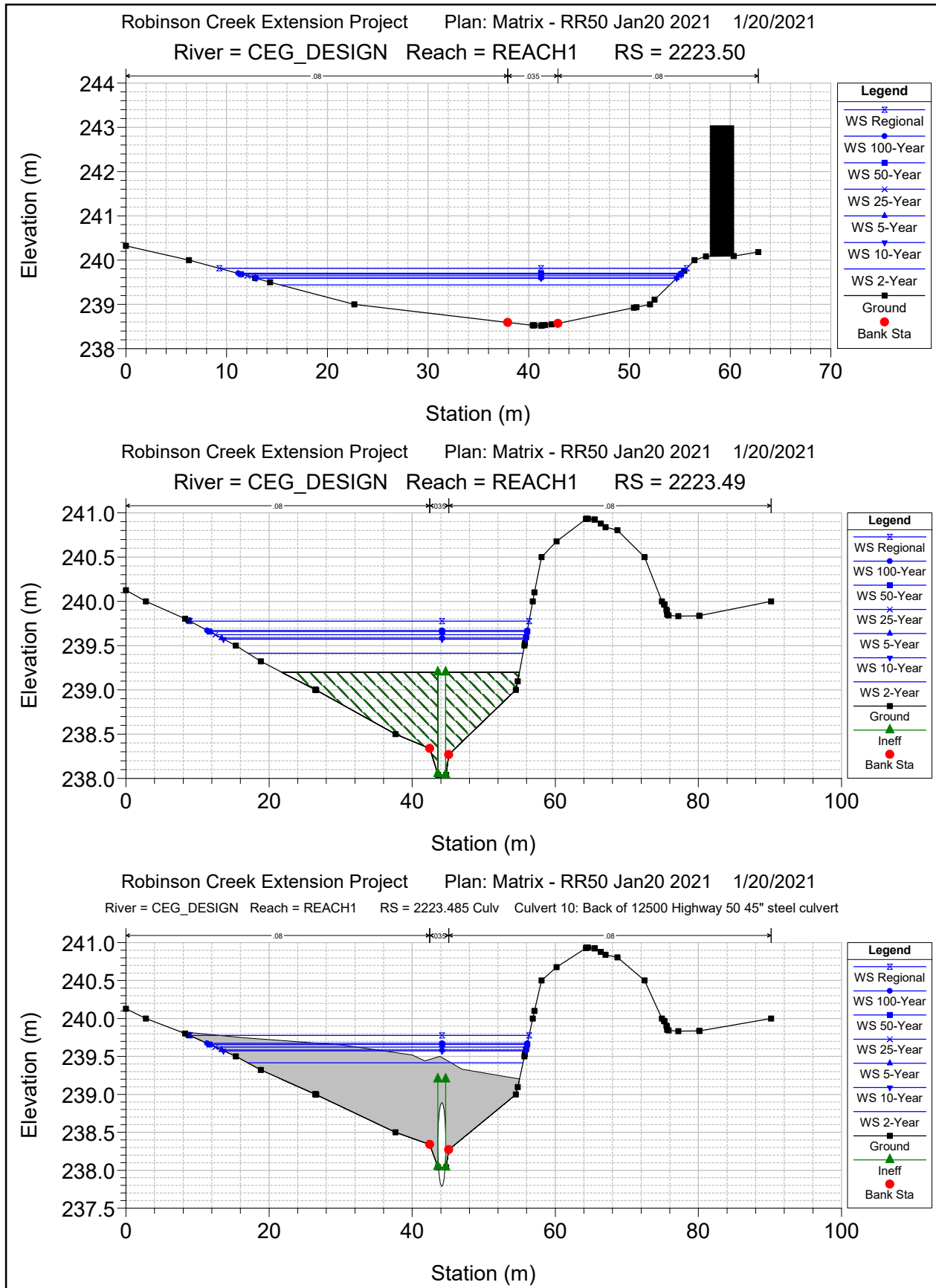


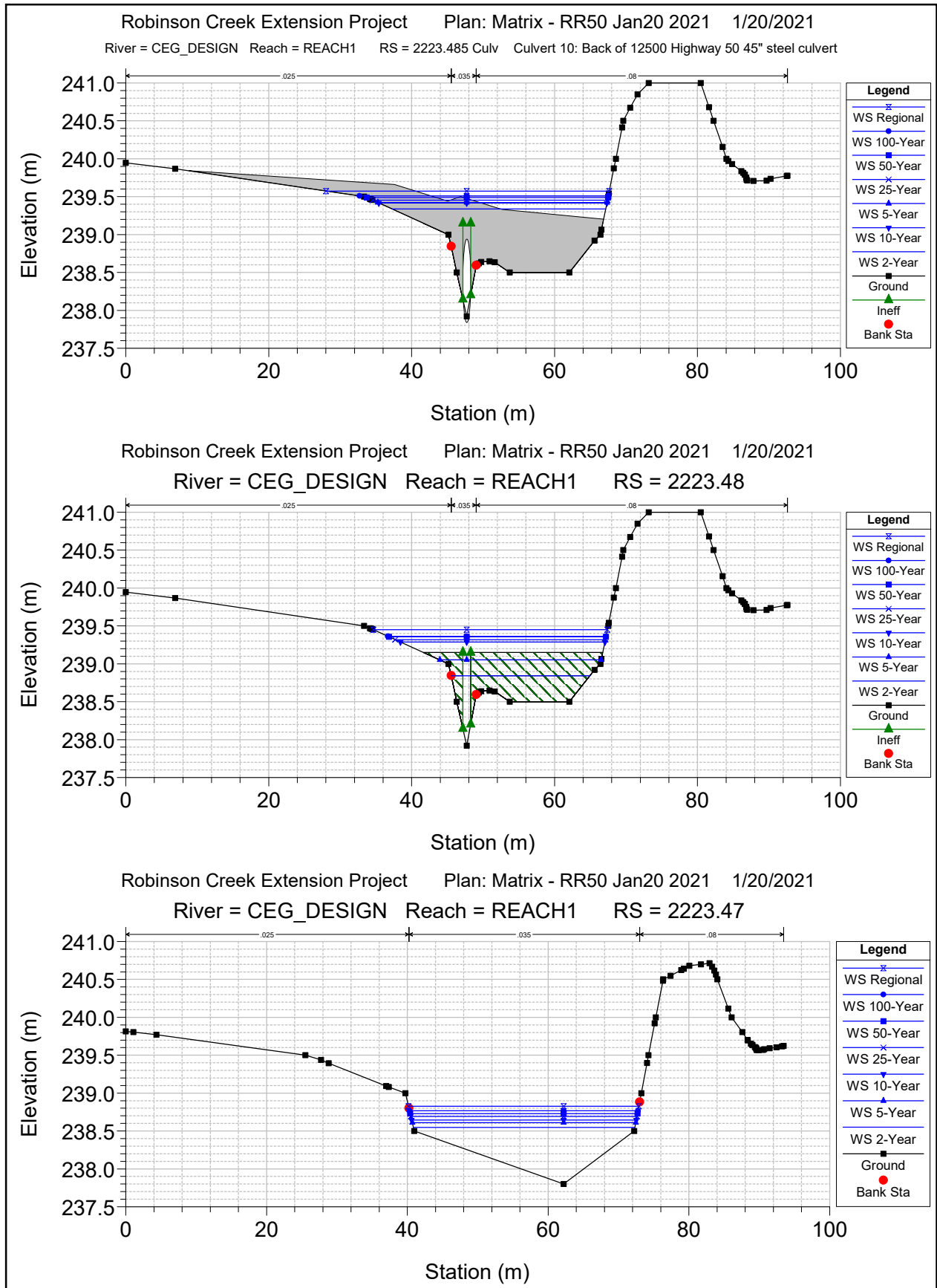


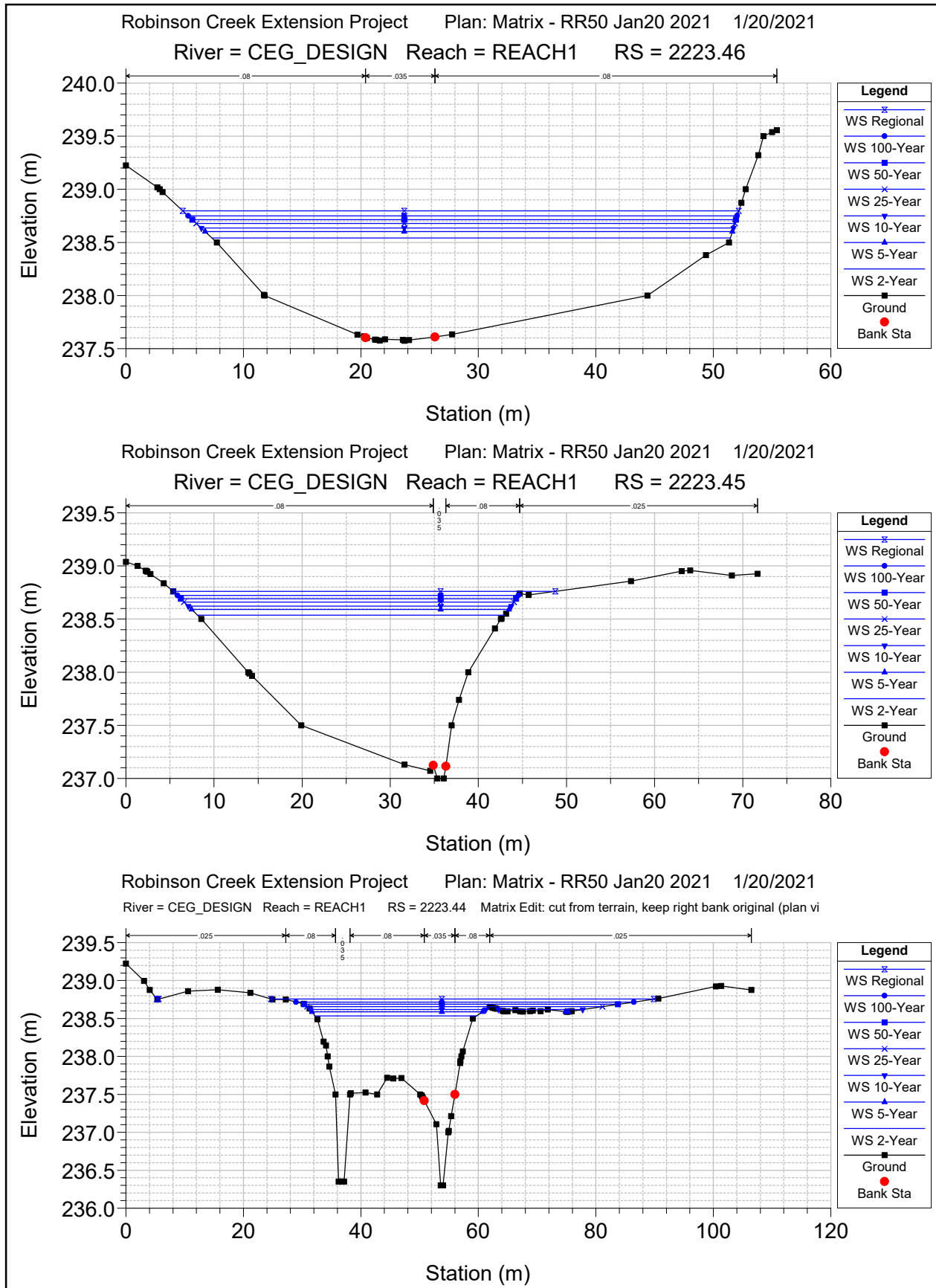


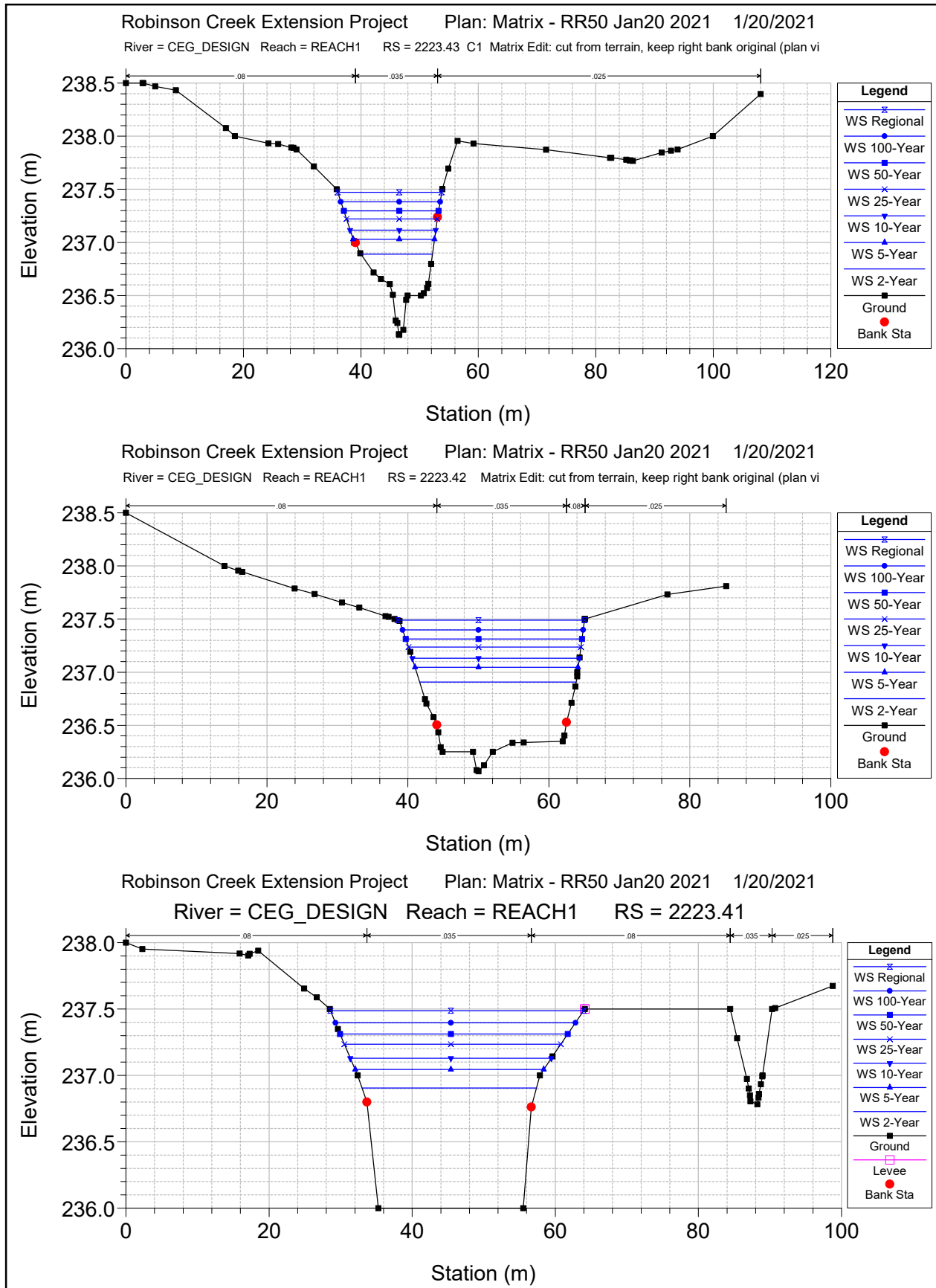


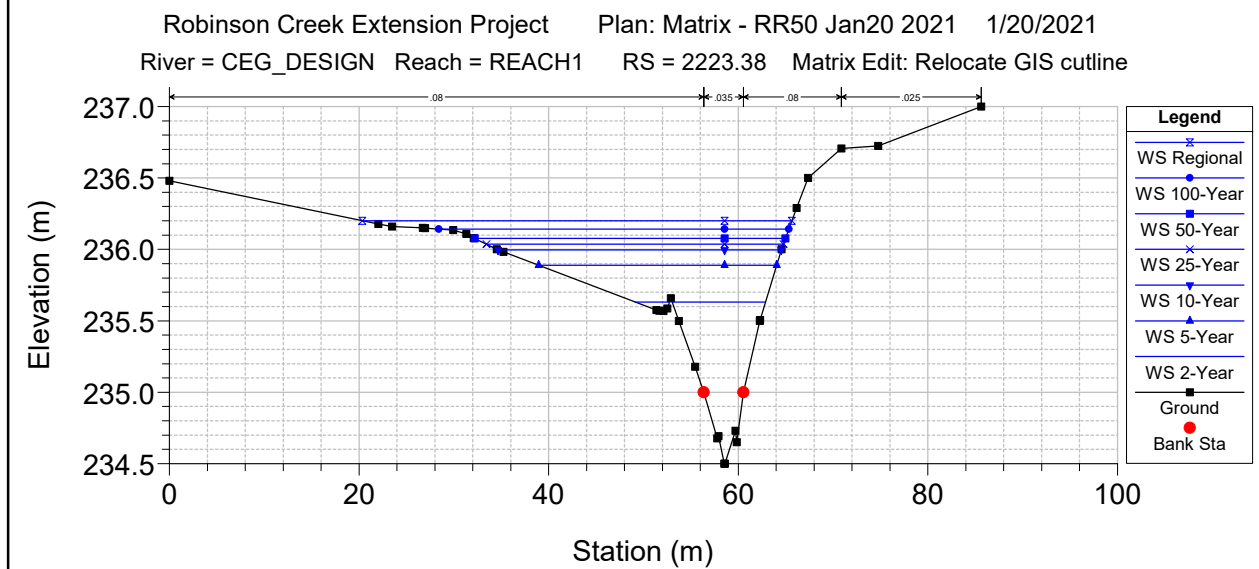
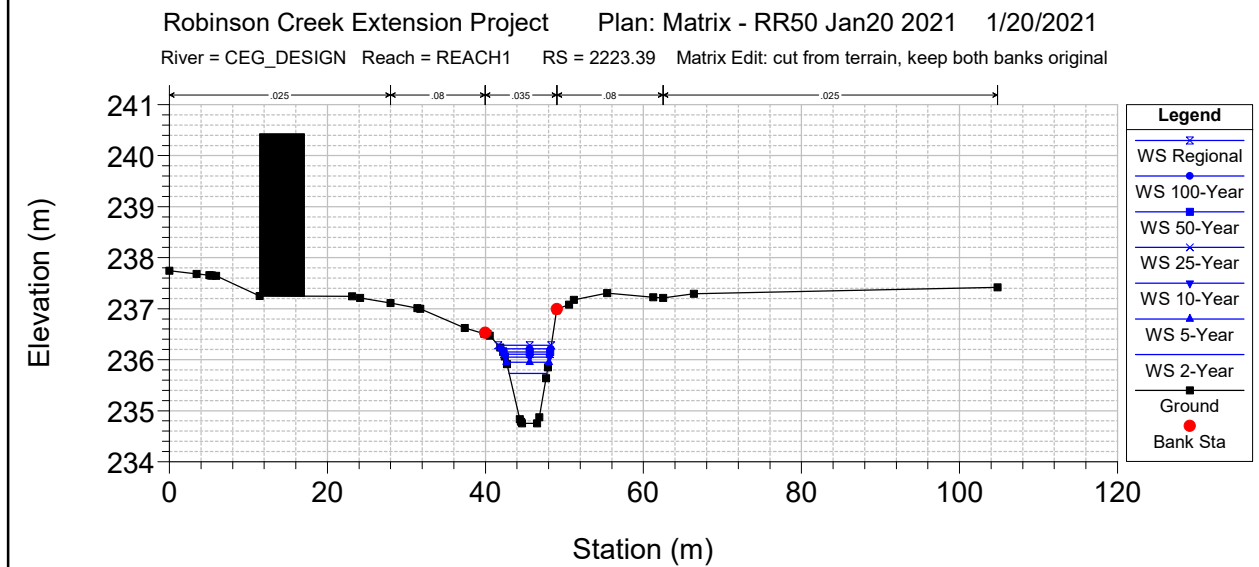
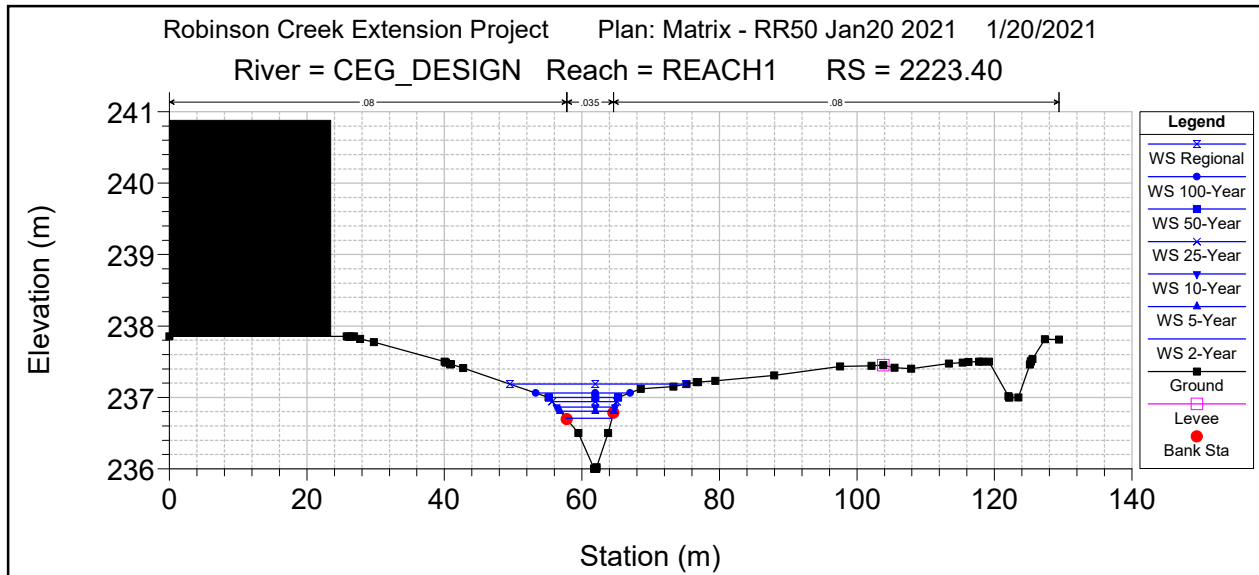


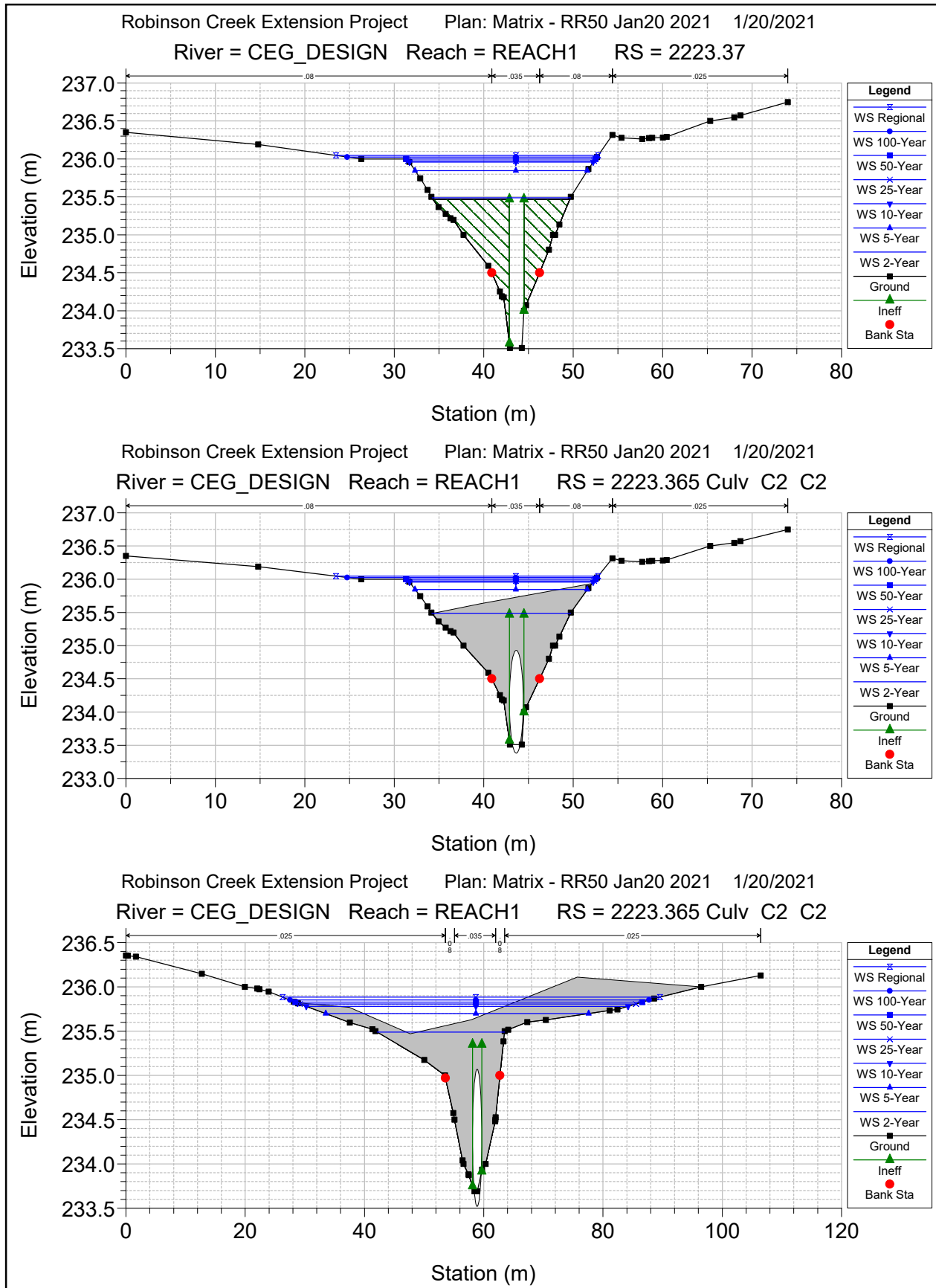


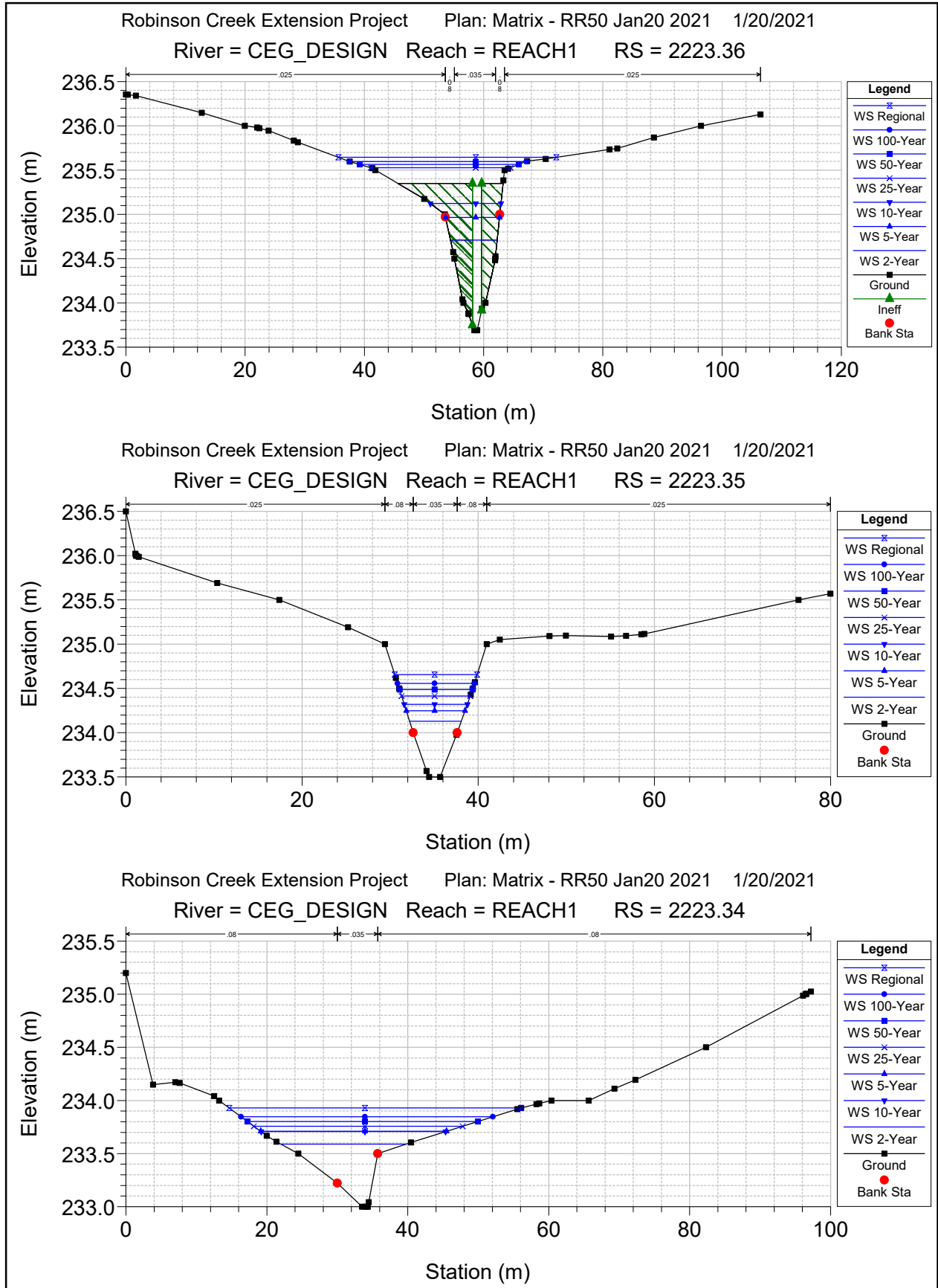


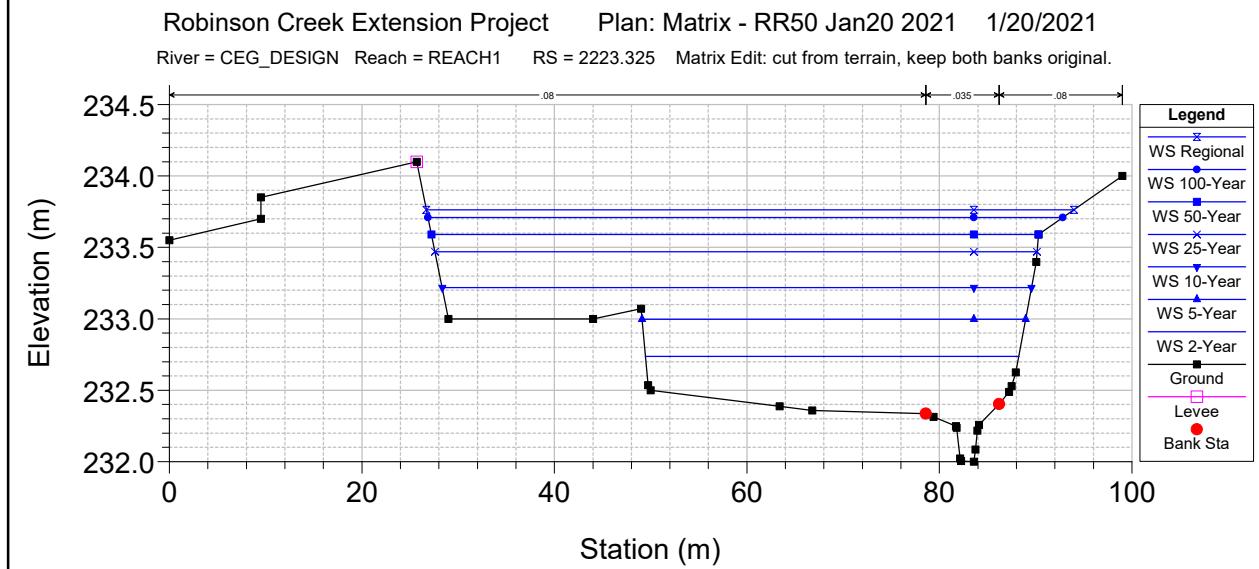
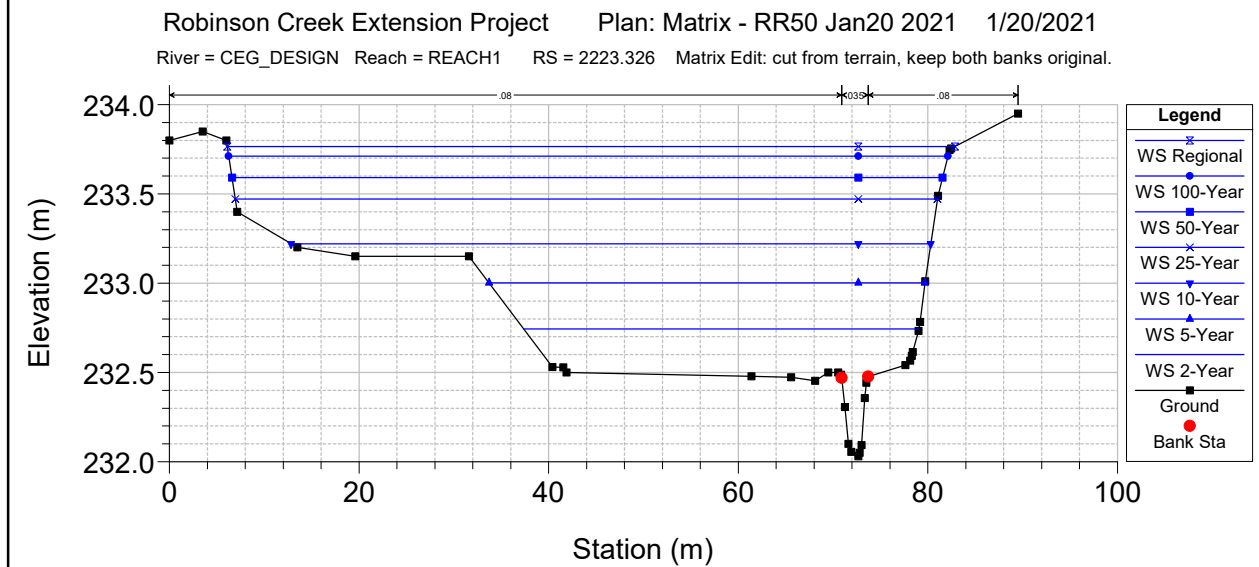
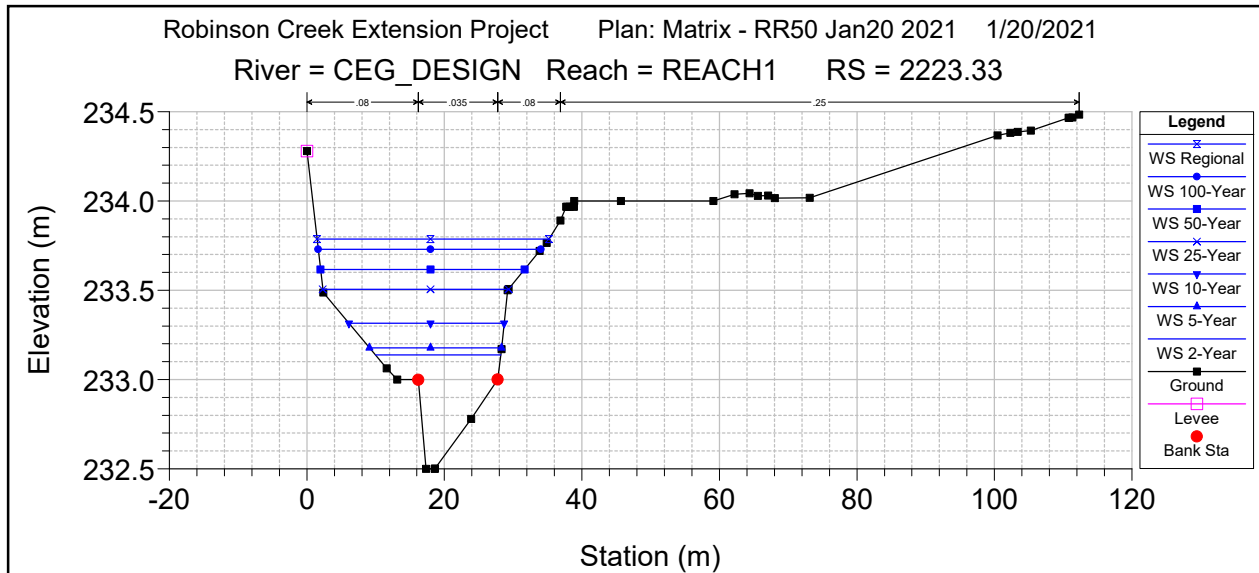


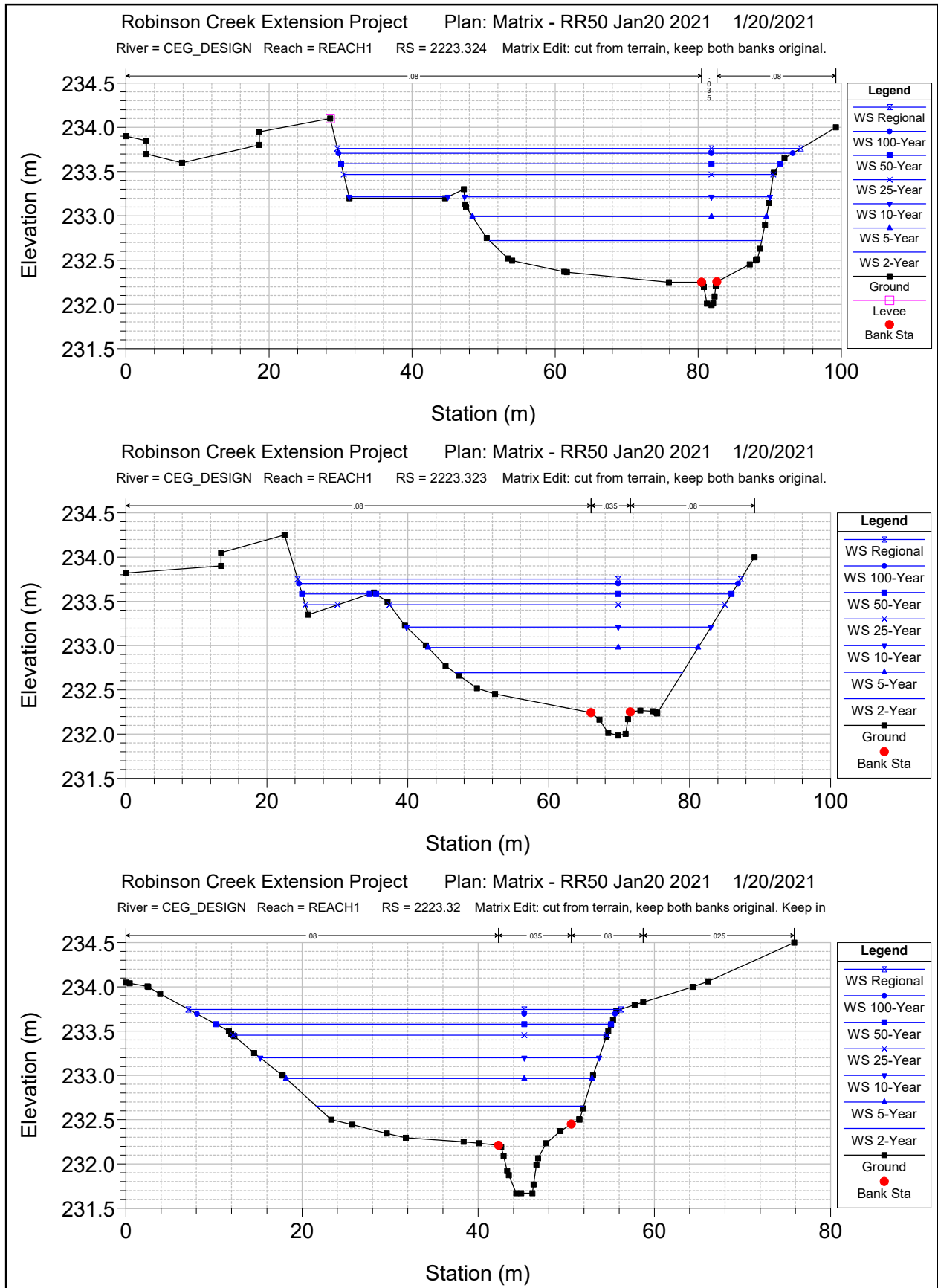


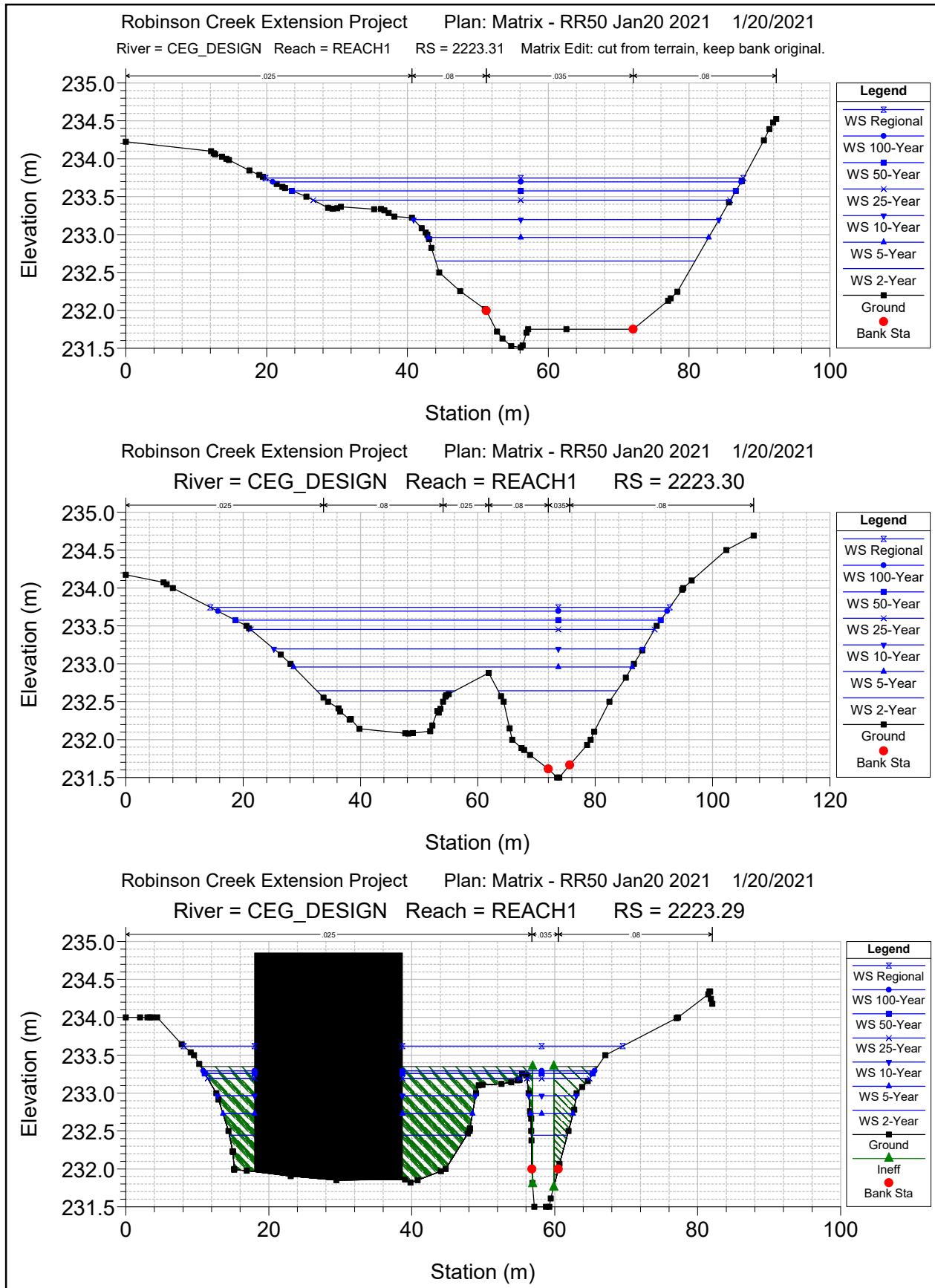


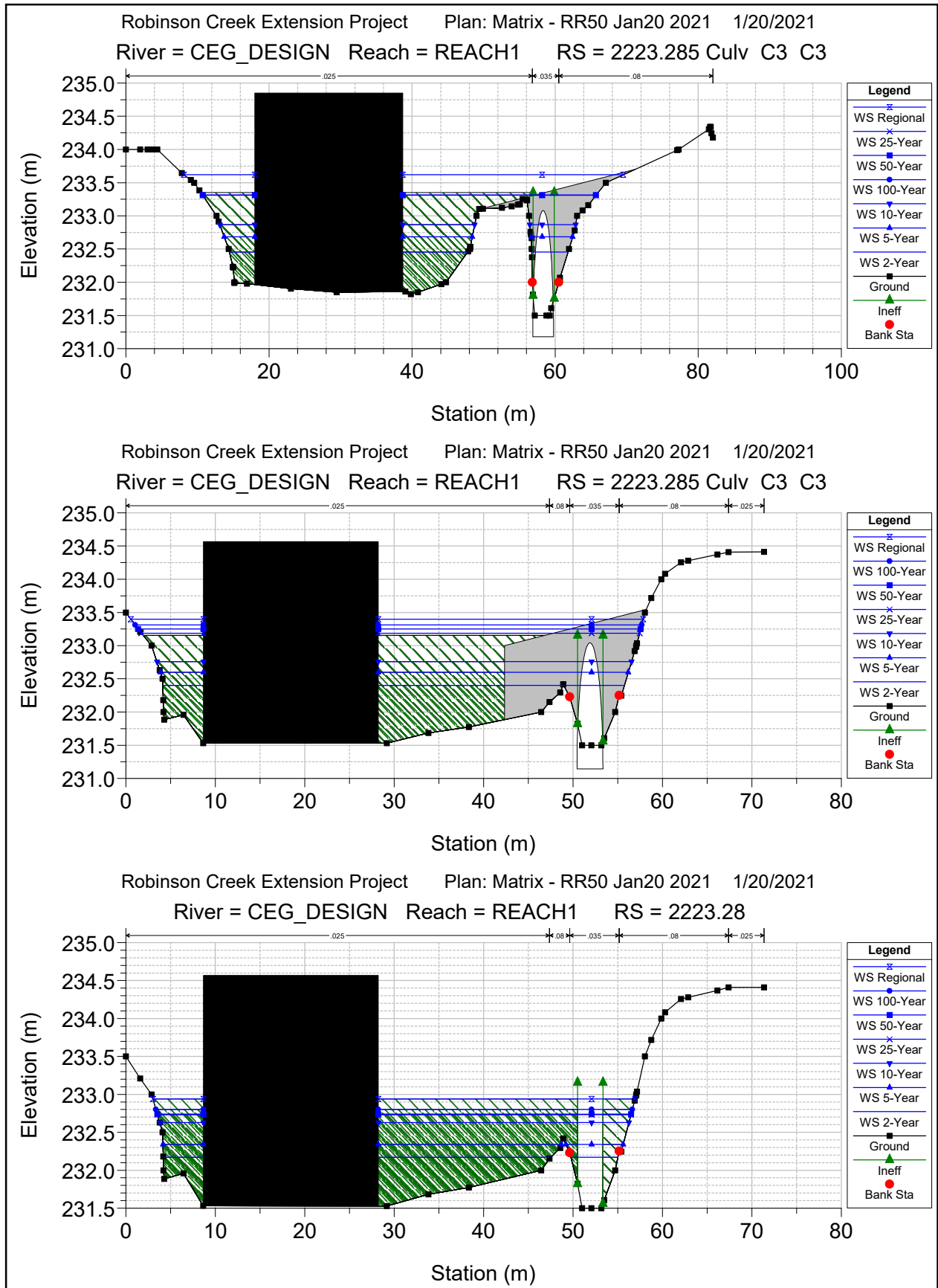


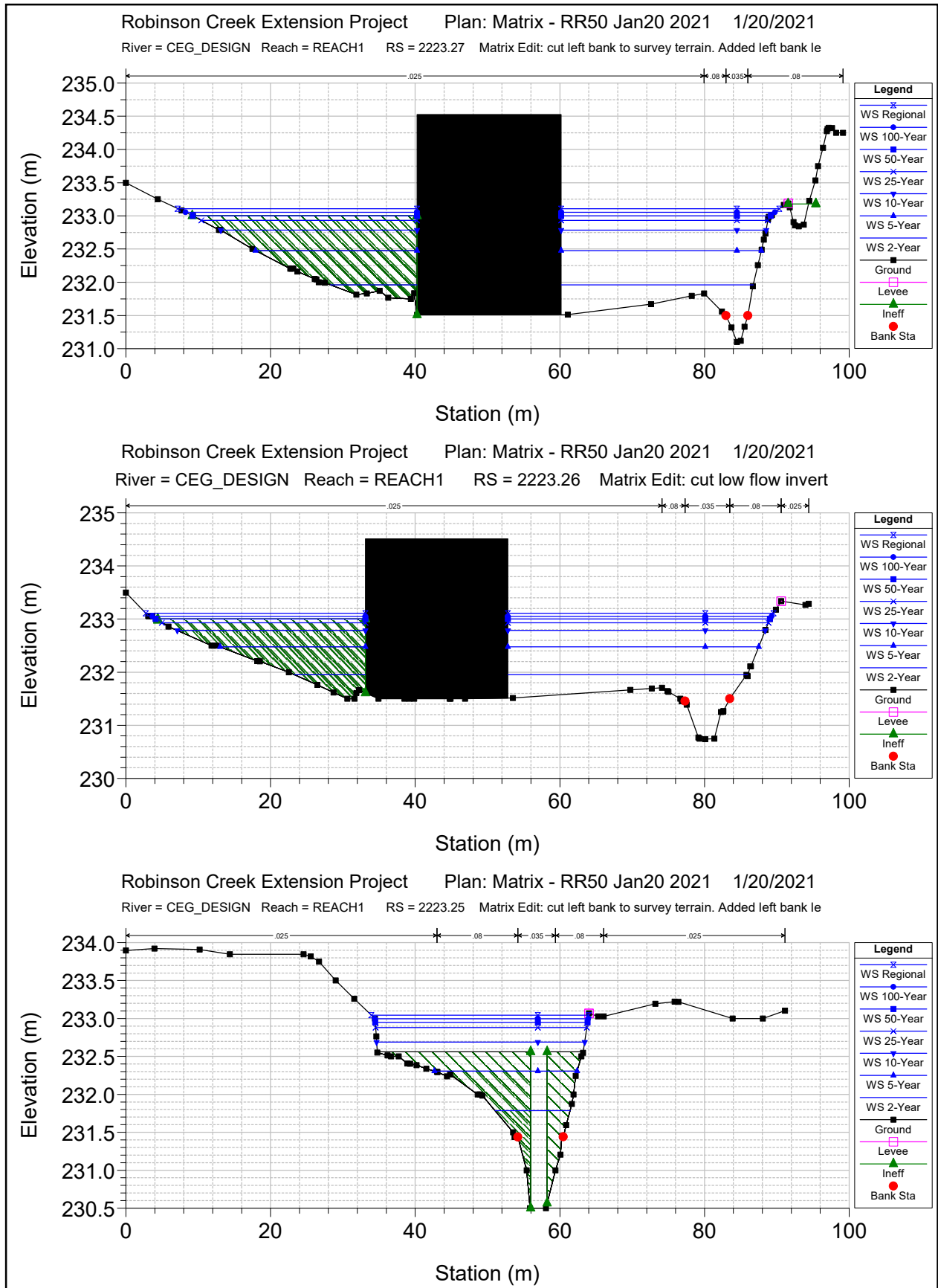


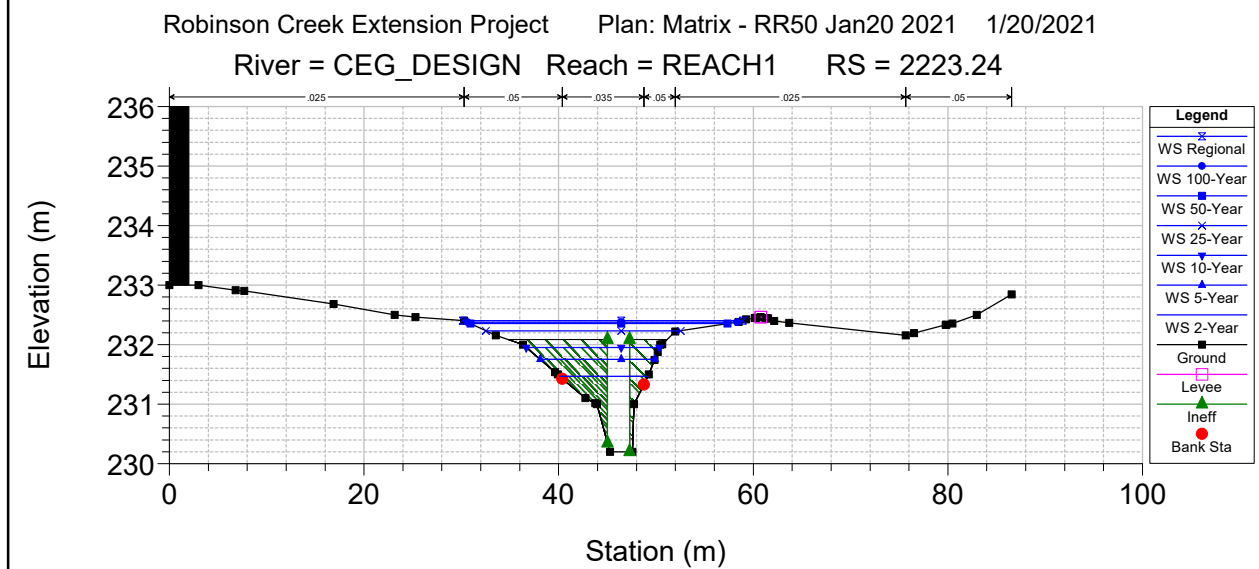
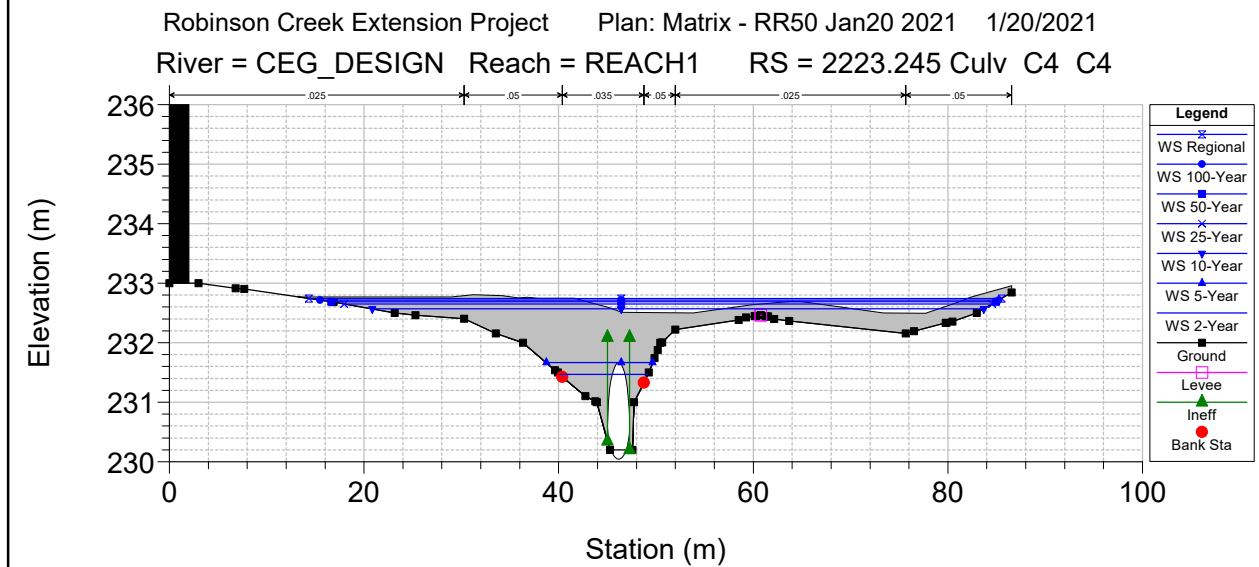
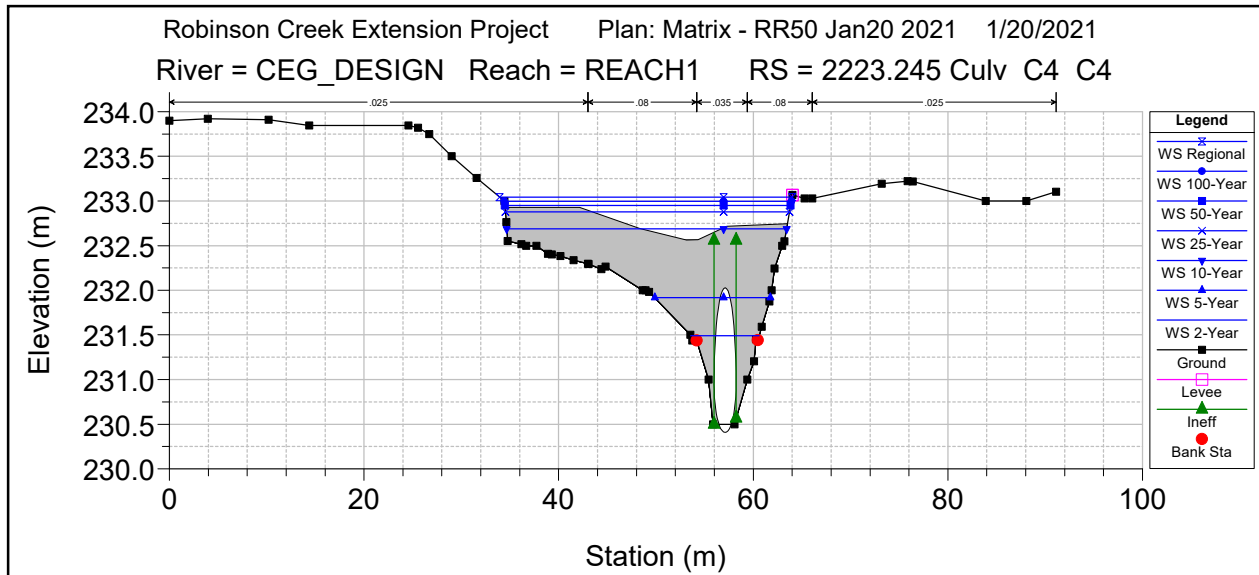


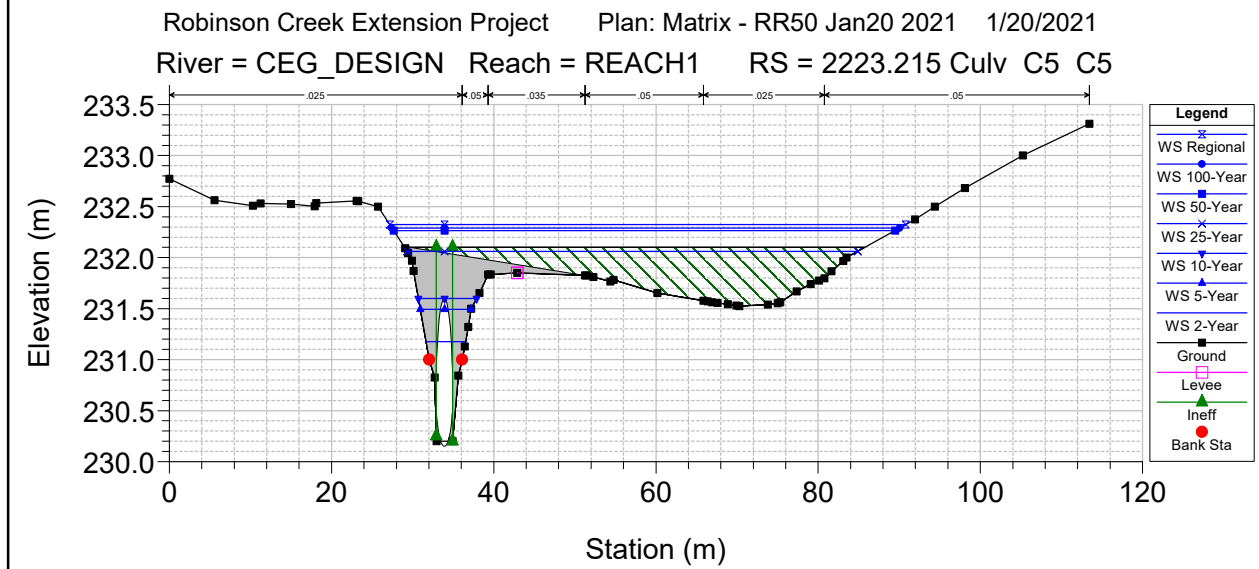
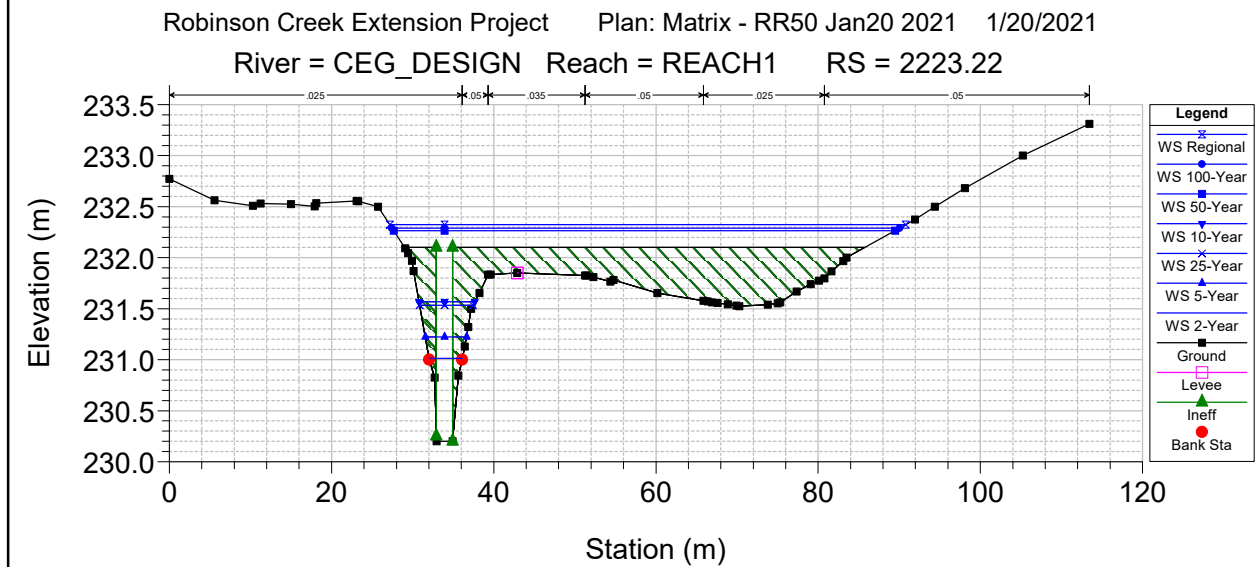
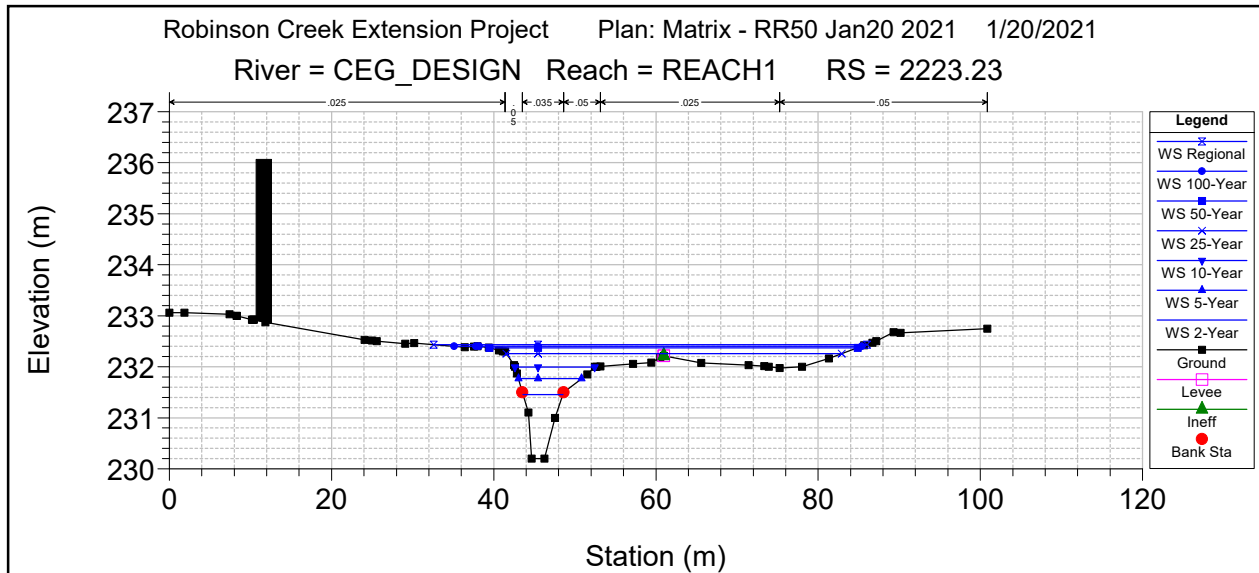


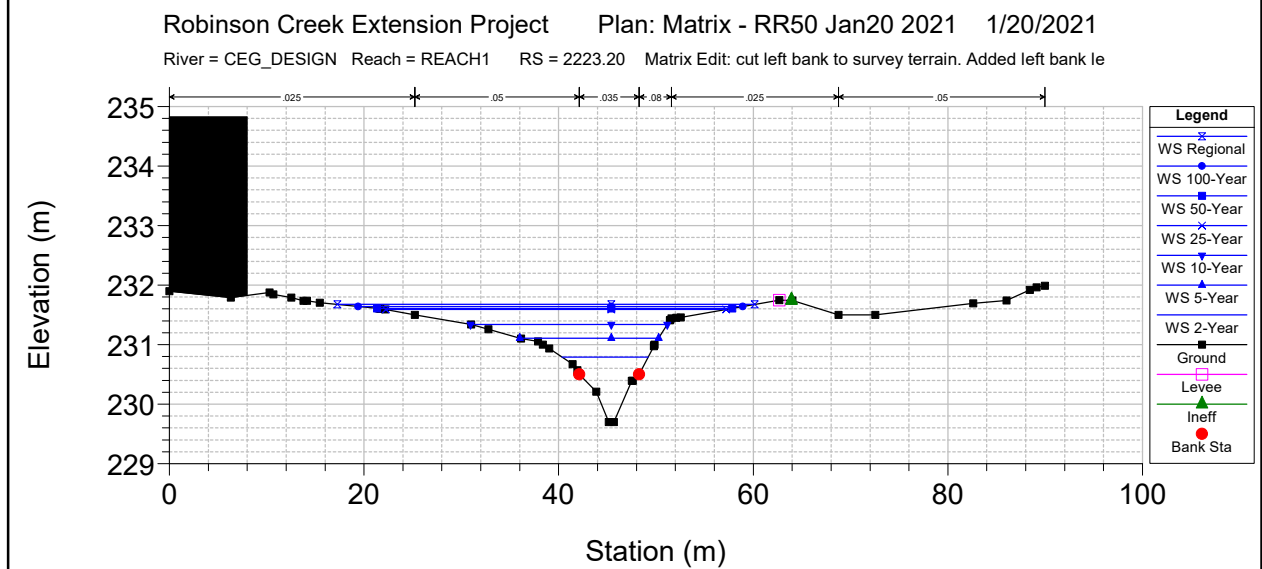
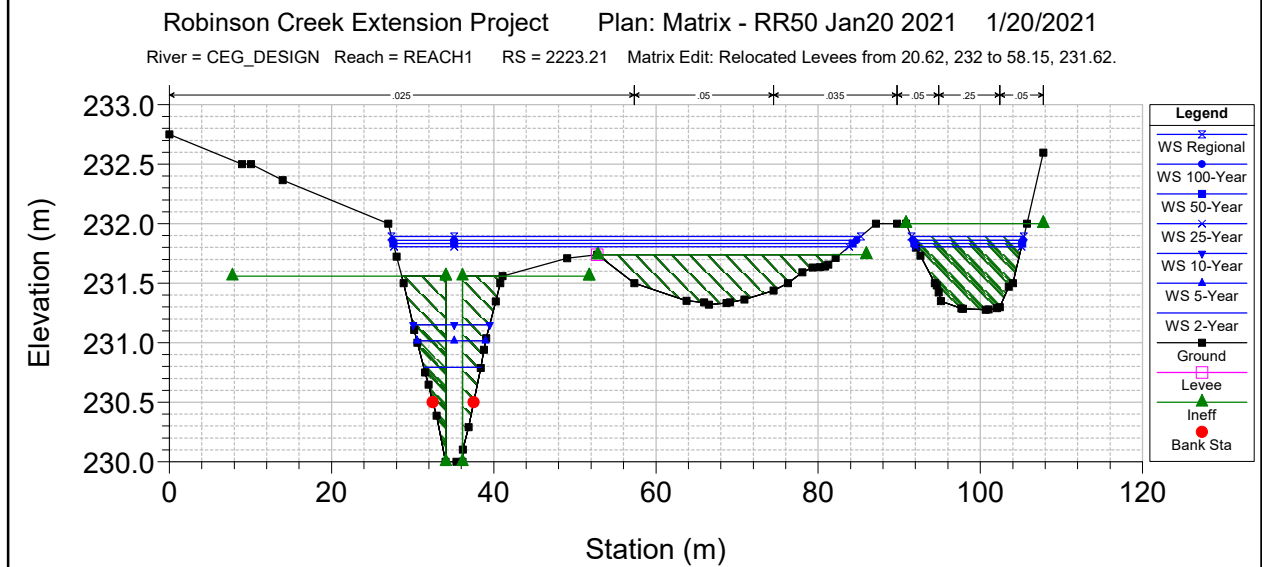
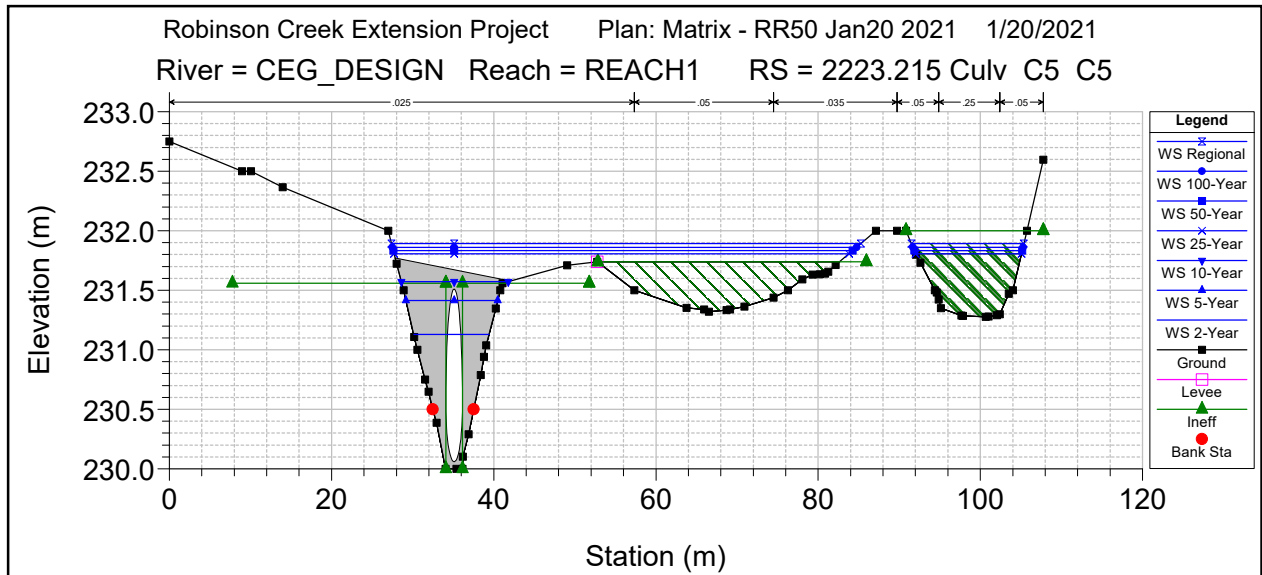


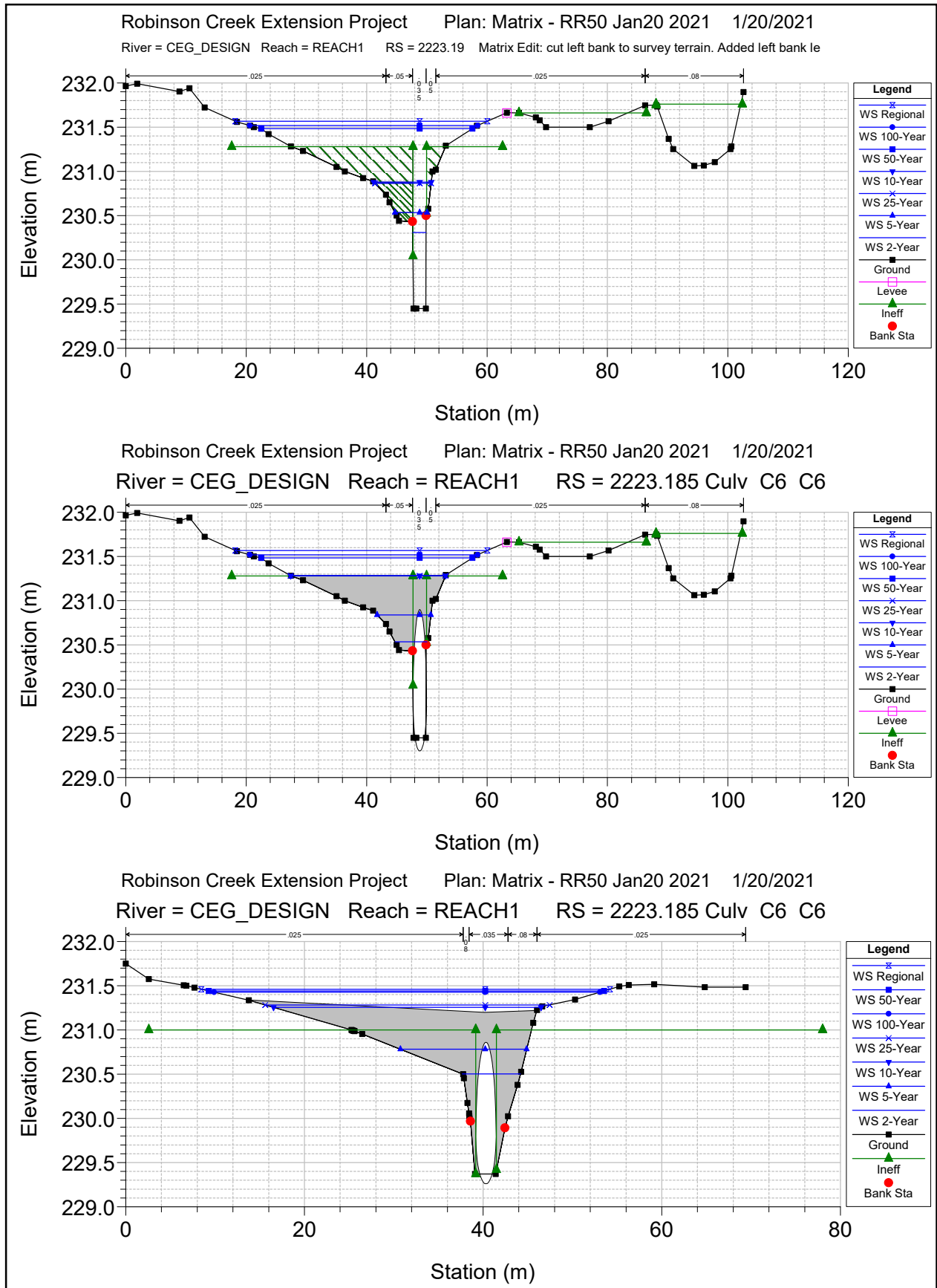


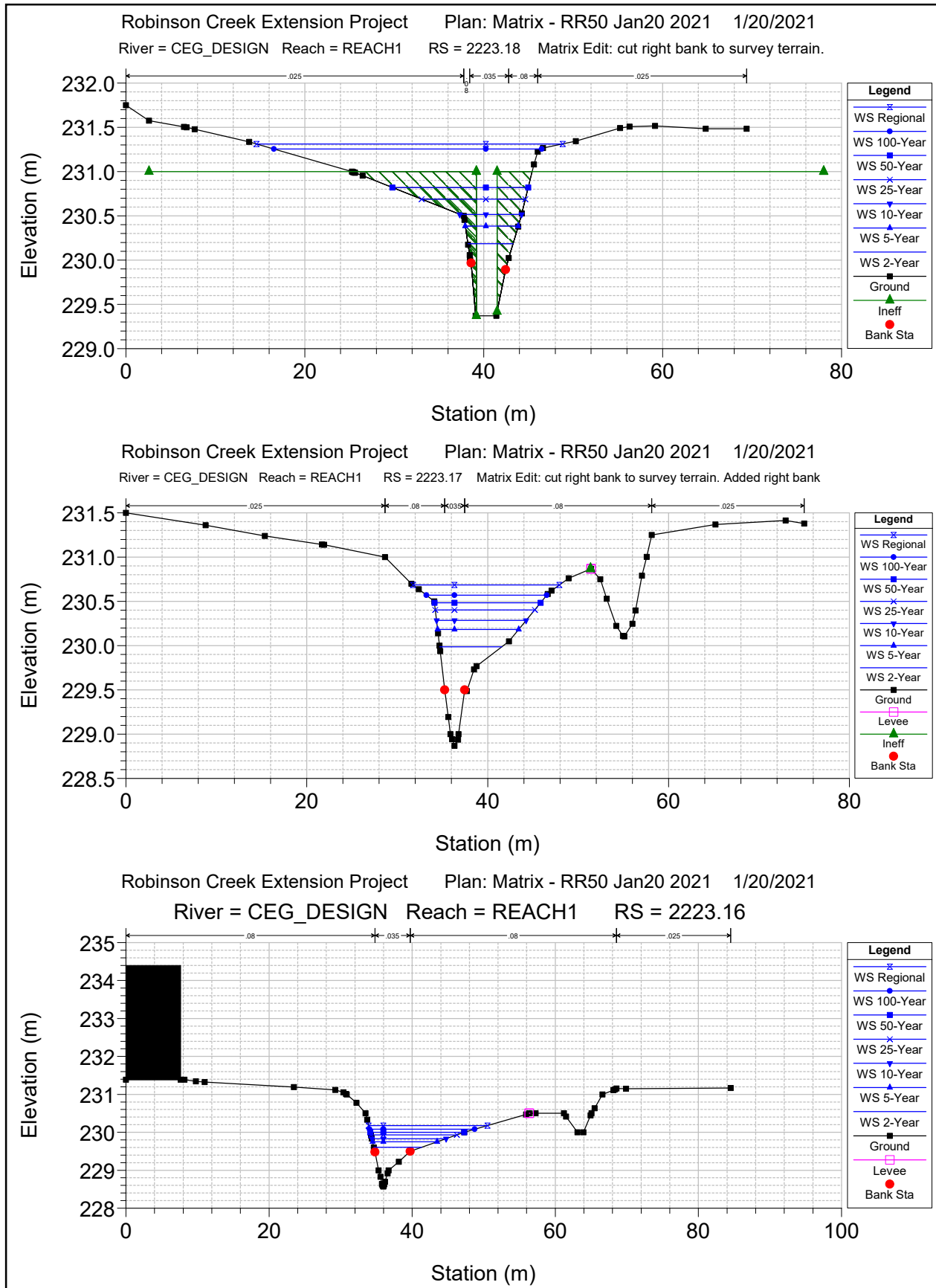


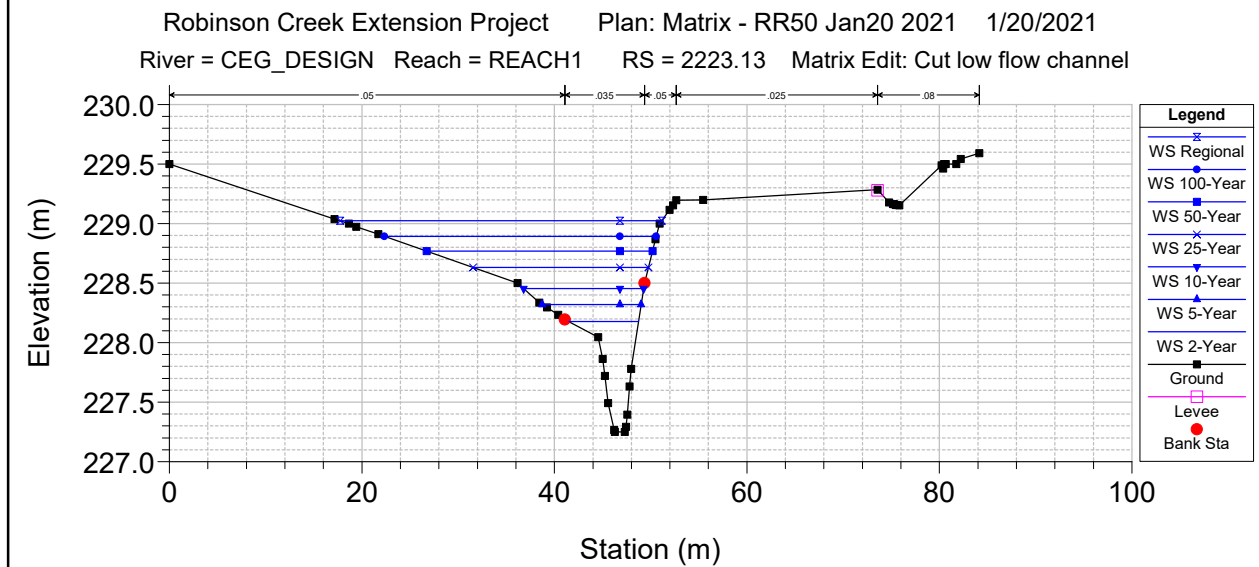
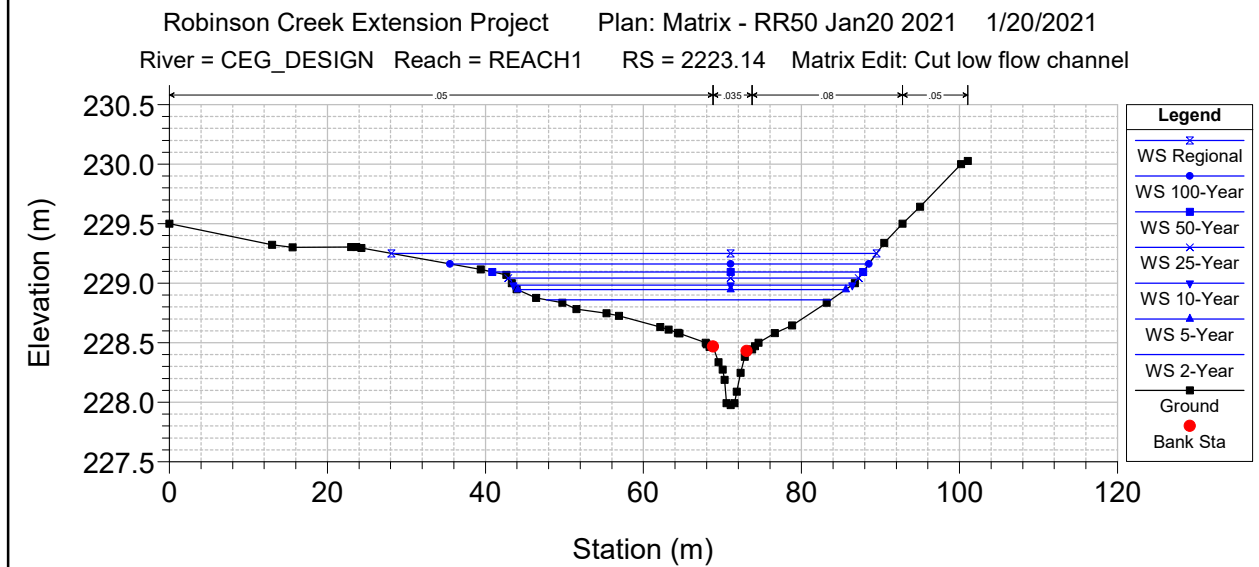
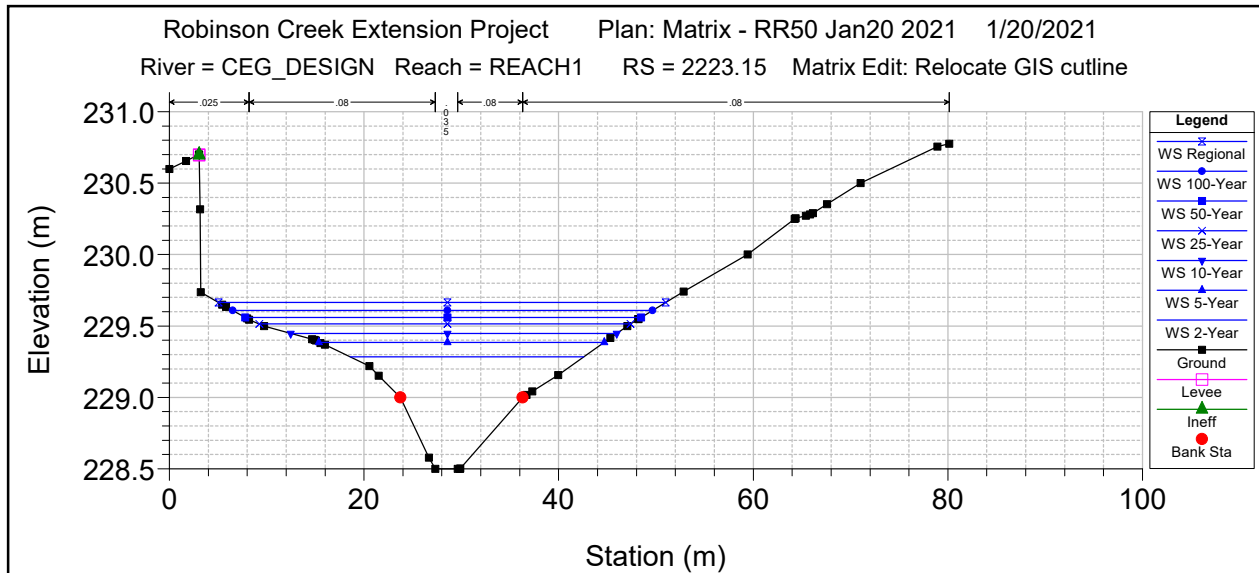


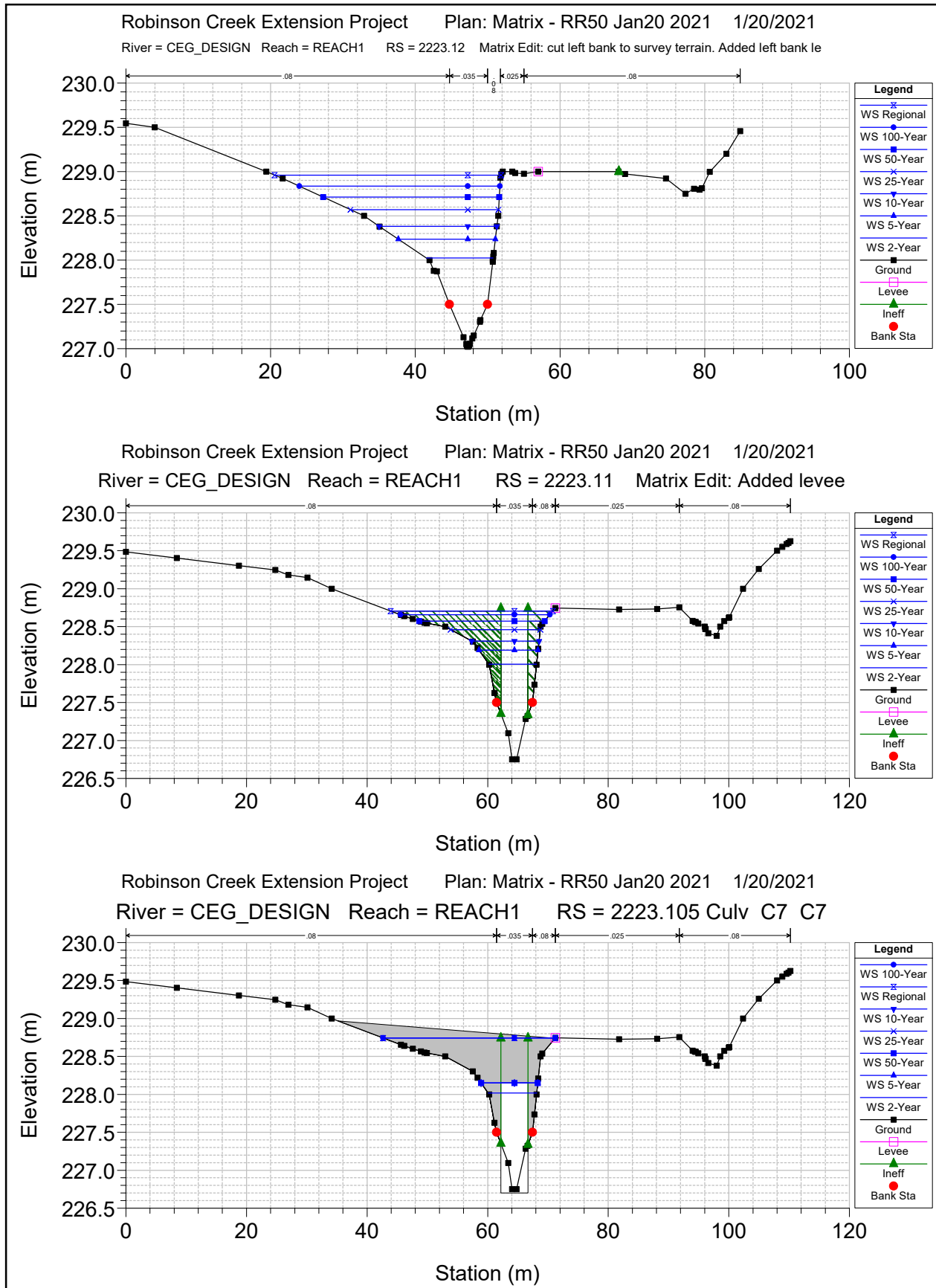


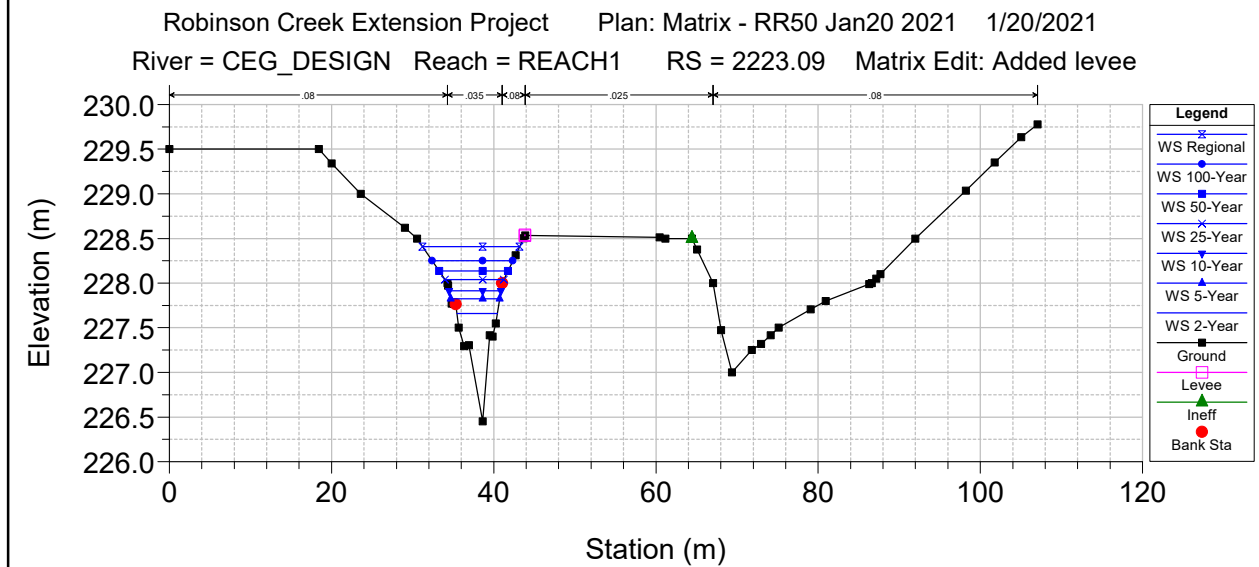
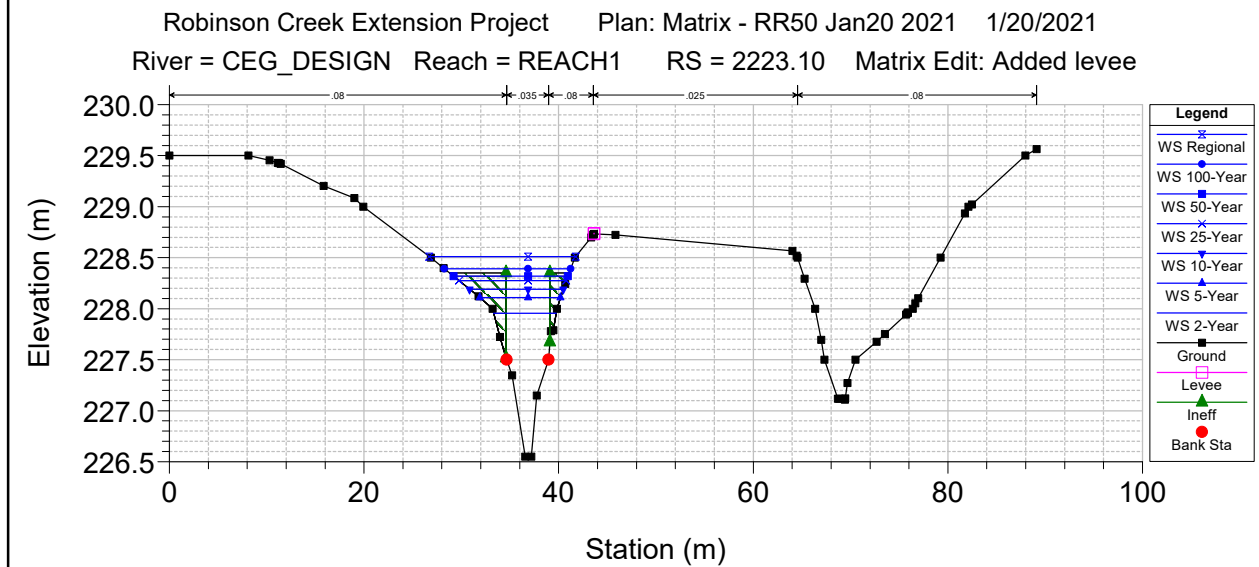
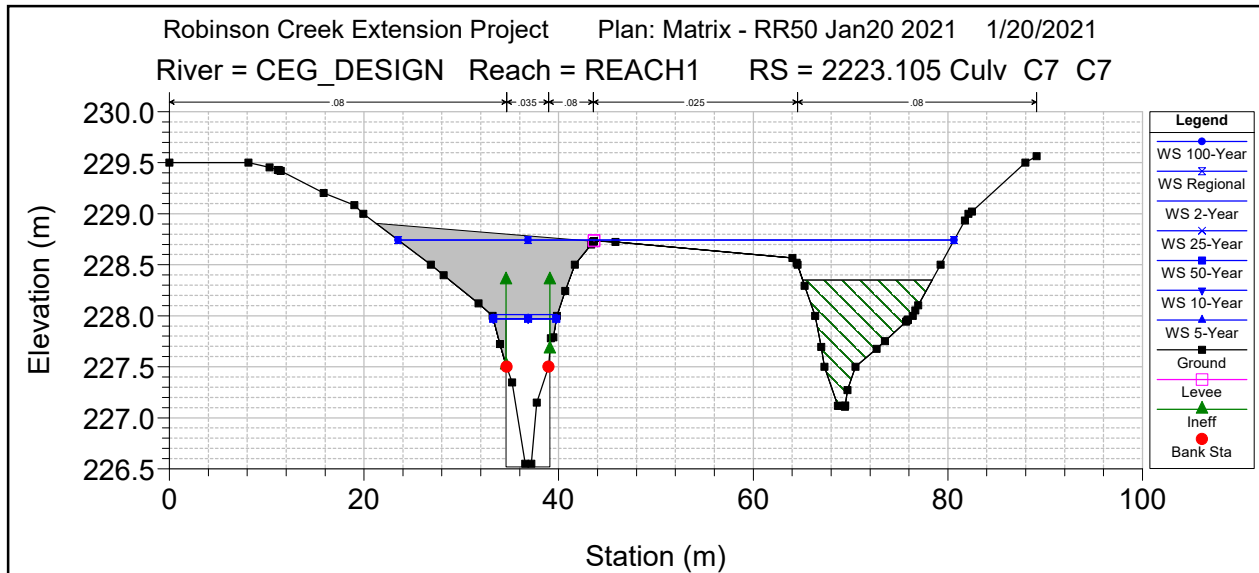


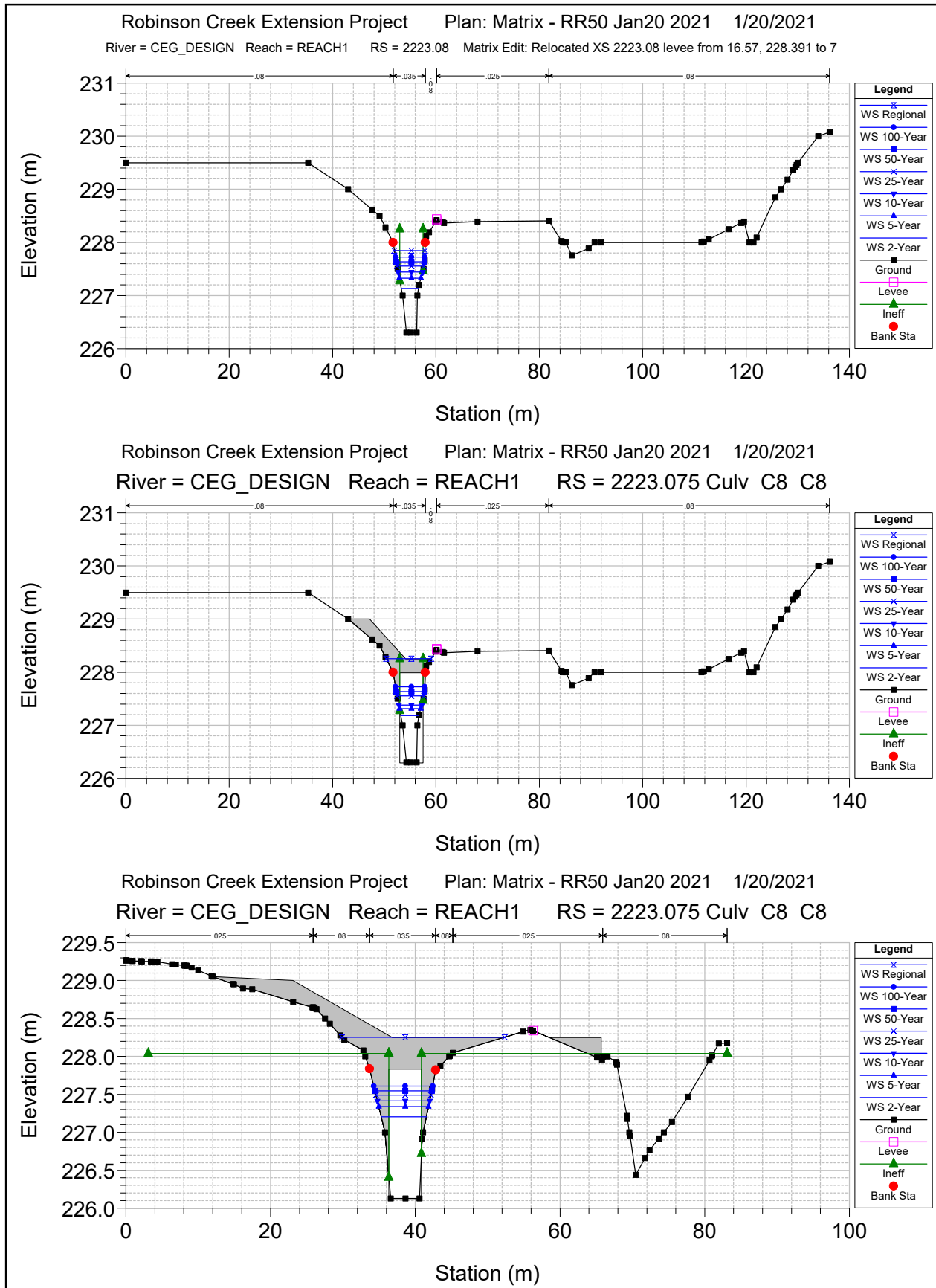


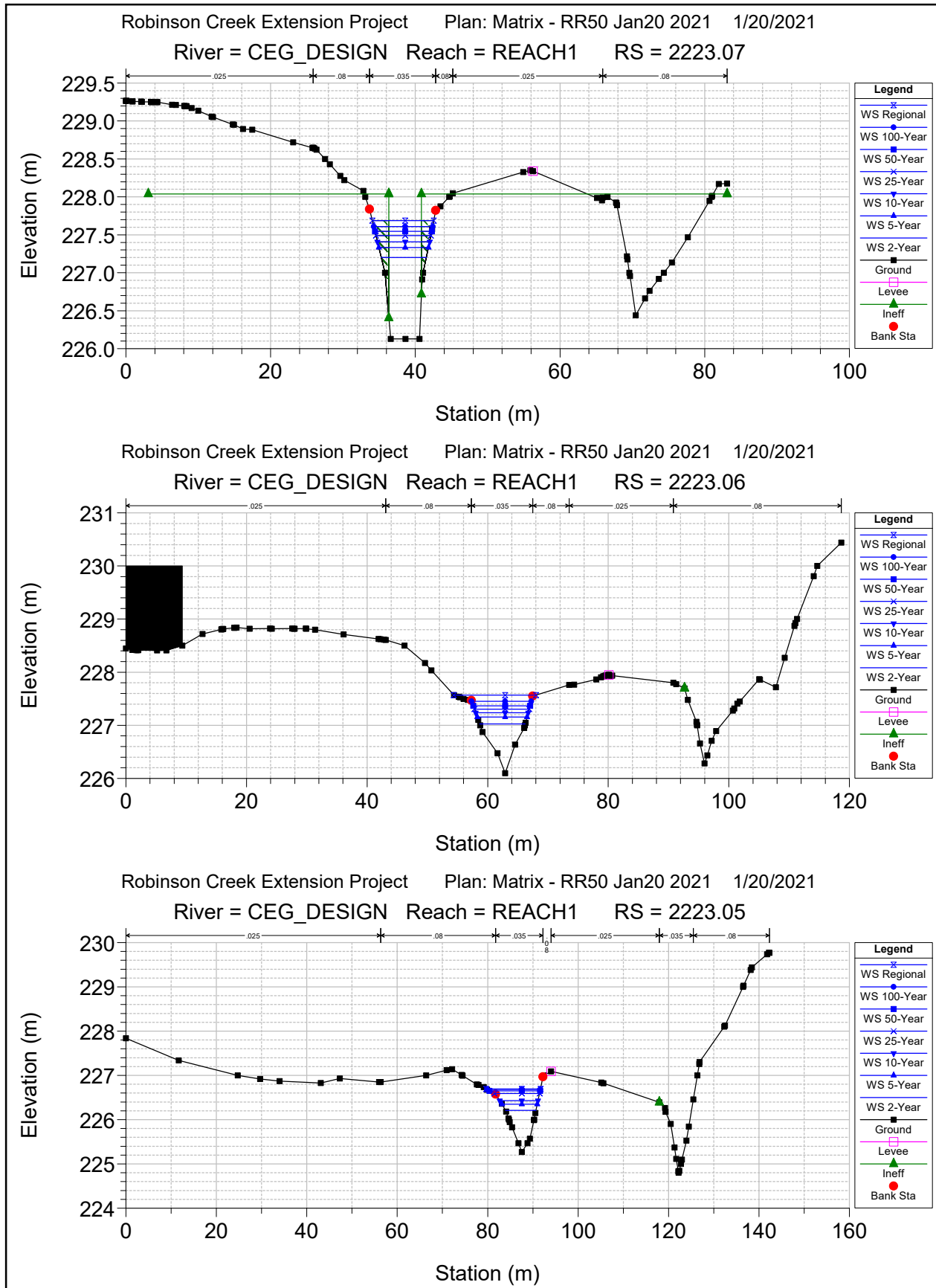


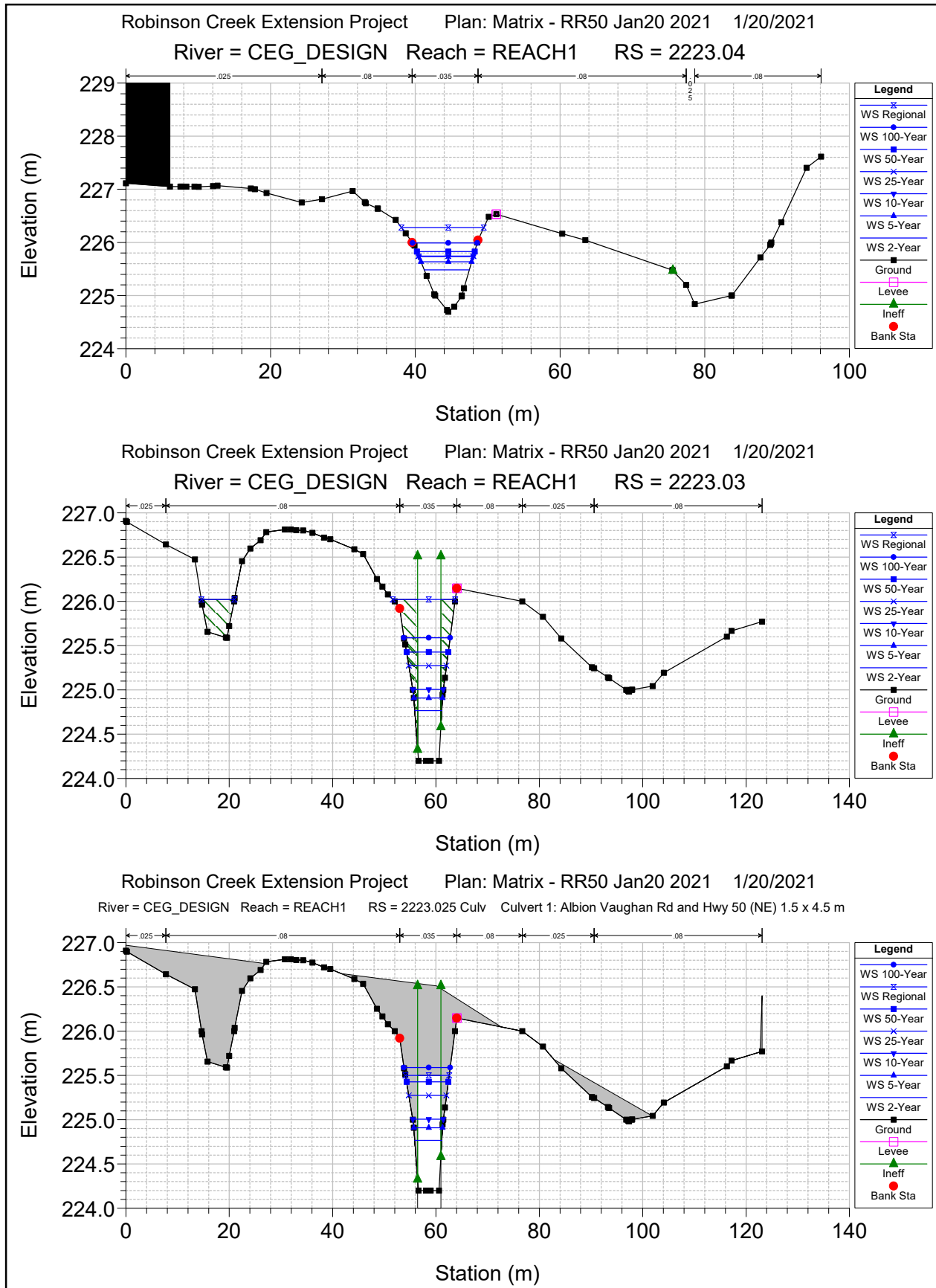


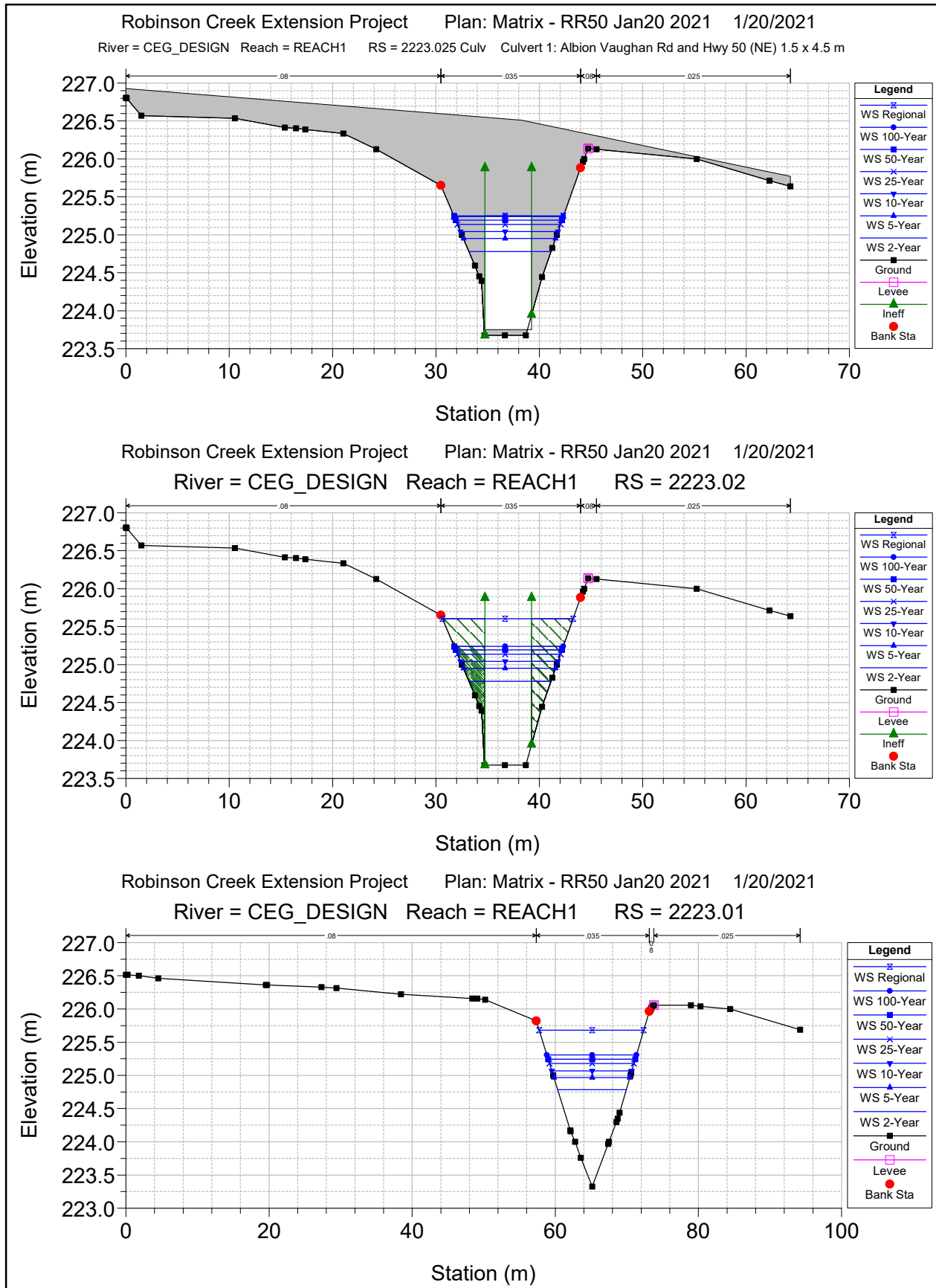


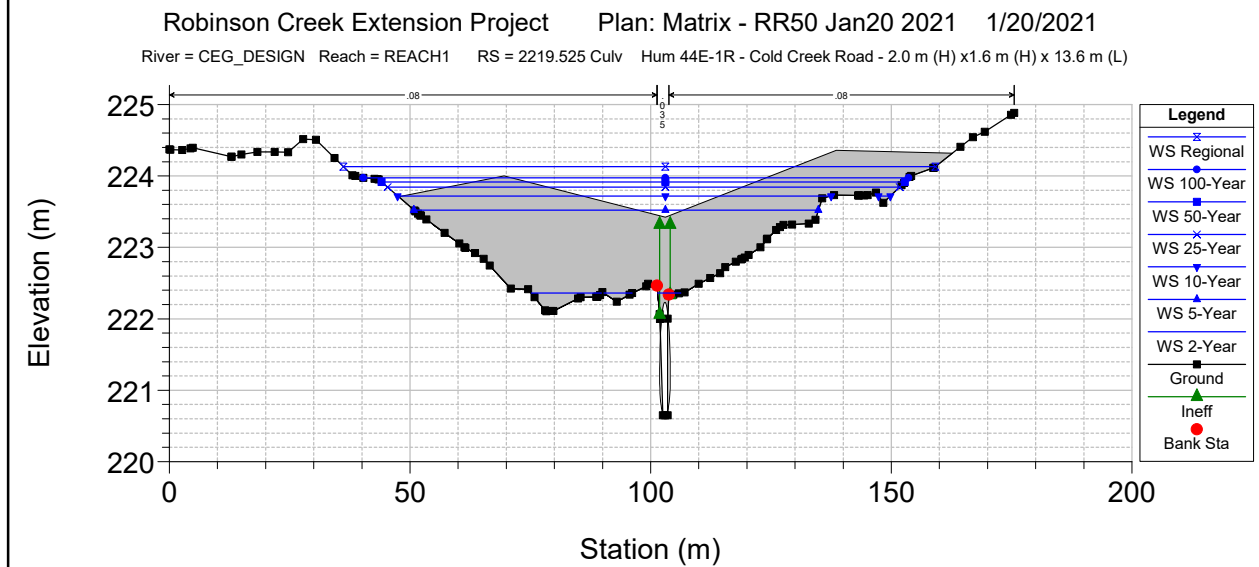
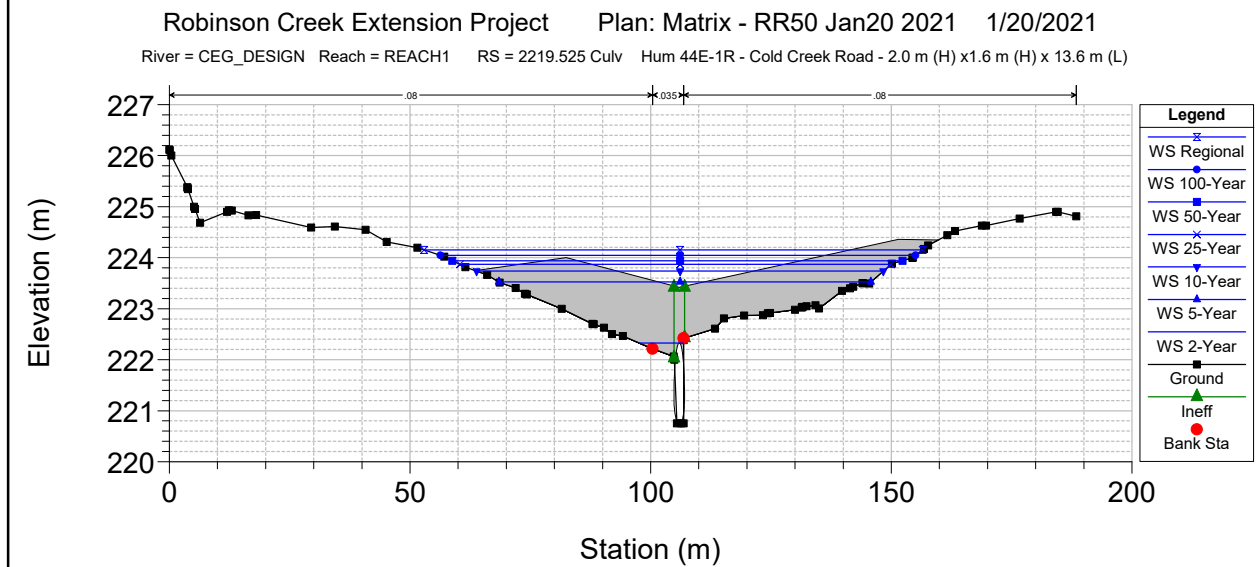
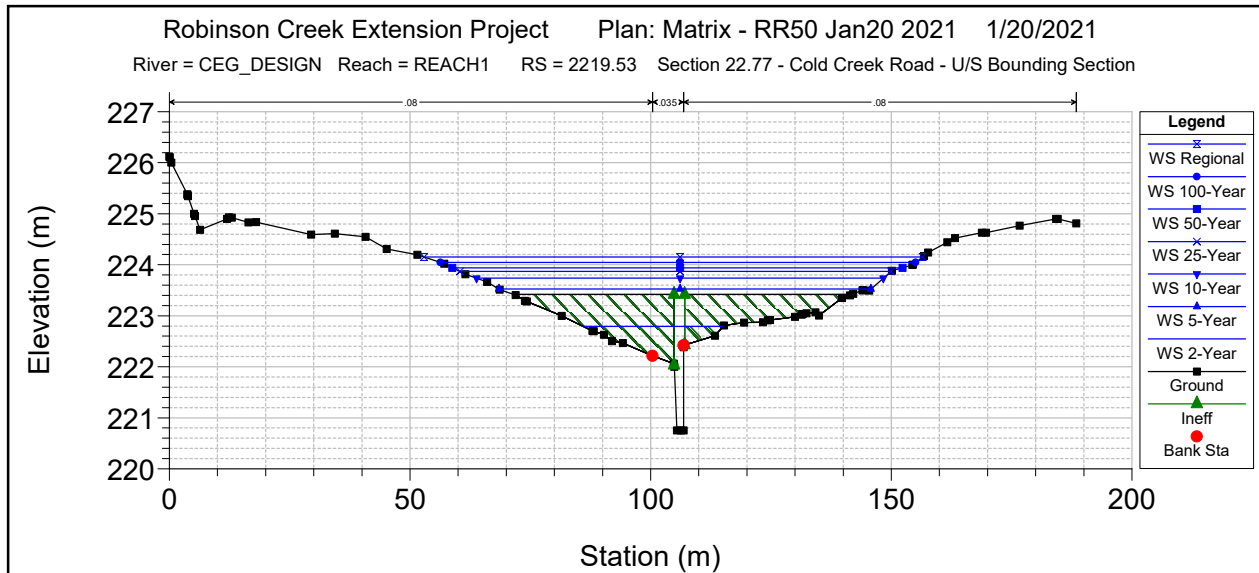


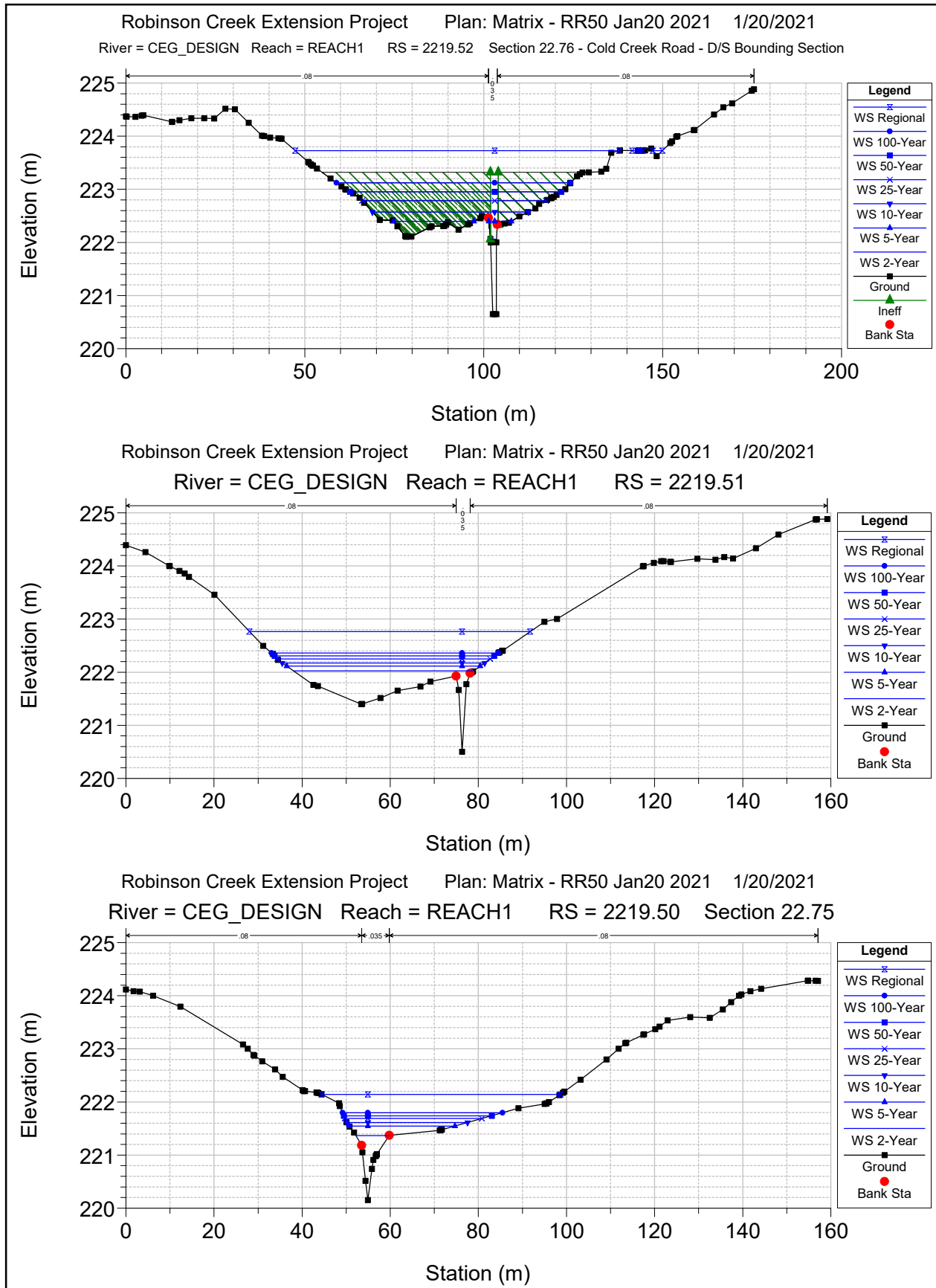












APPENDIX F HEC-RAS OUTPUT

Item 4 – Water Surface Elevation Profile

