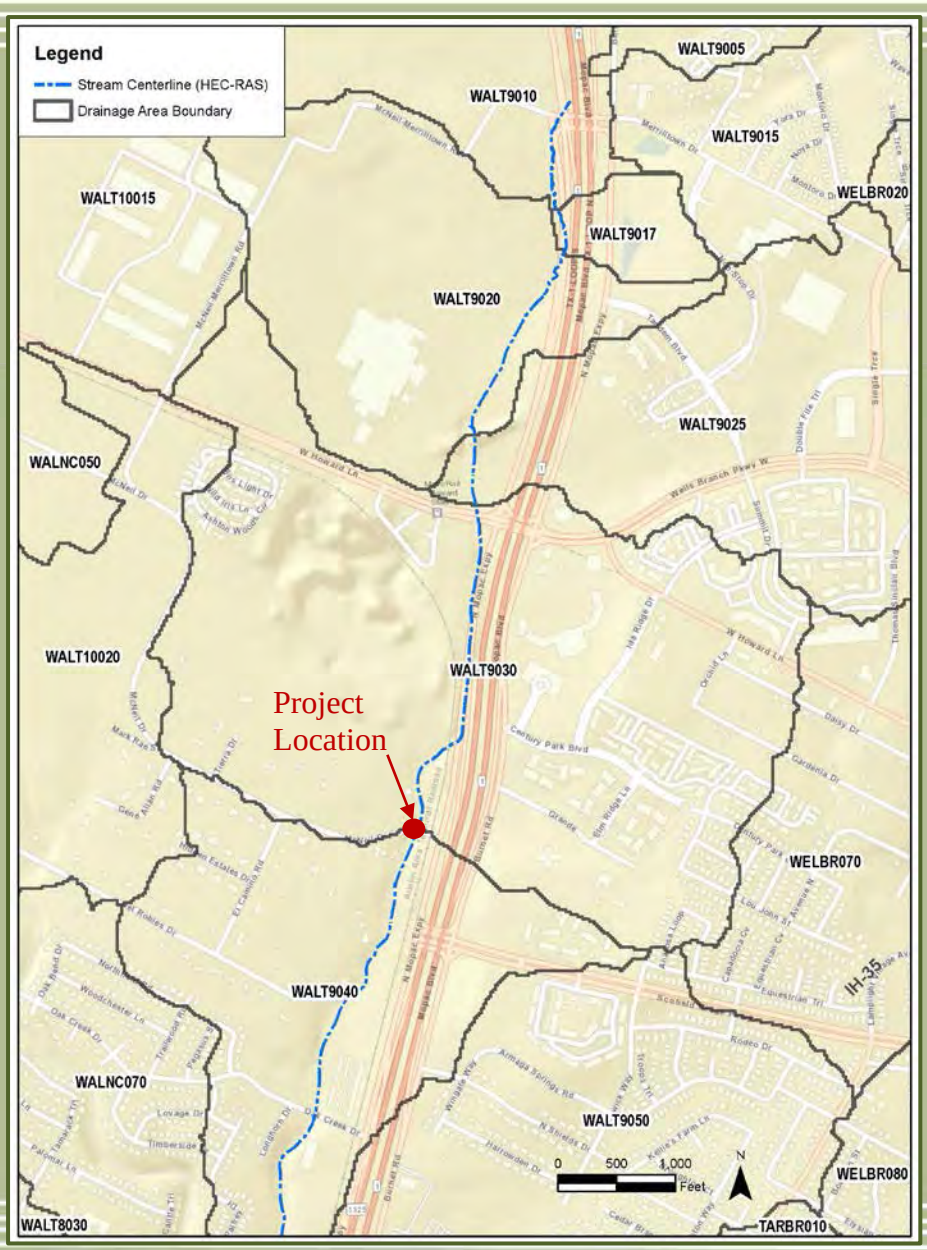
McNeil Drive
Low Water Crossing Improvement Project

ALTERNATIVES EVALUATION REPORT
February 5, 2019



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McNeil Drive Low Water Crossing Improvement Project

Alternatives Evaluation Report

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City of Austin

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February 5, 2019

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SECTION 1 INTRODUCTION

McNeil Drive is a two-lane residential collector located in the upper portion of the Walnut Creek Watershed on Tributary 9 of Walnut Creek (refer to Figure 1-1 below). McNeil Drive is aligned from east to west from its intersection with the Loop 1 (North MoPac) access road to the Gene Allan Road intersection, then is aligned from south to north from the Gene Allan Road intersection to its intersection with Howard Lane. The right-of-way width varies, but in general it is approximately 55 feet in width at its Tributary 9 of Walnut Creek (Tributary 9) low water crossing. The roadway currently consists of two-lane asphalt pavement less than 24-ft wide. The low-water hydraulic structure at the creek crossing consists of two 36-inch diameter corrugated metal pipe culverts. The existing roadway's low-water crossing and hydraulic structure at the creek crossing do not comply with the City of Austin (COA) hydraulic design standards for roadways.

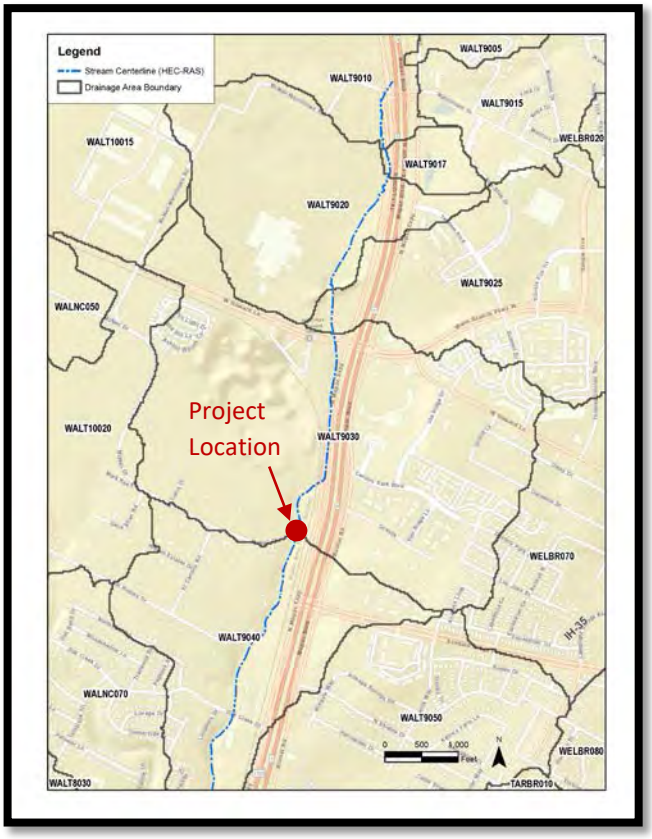


Figure 1-1 Drainage Basin and Project Location Map (Not to Scale)

The COA Watershed Protection Department (WPD) has identified the McNeil Drive low water crossing over Tributary 9 of Walnut Creek as a routine emergency closure that needs improvements. The WPD prepared a draft Preliminary Investigation Report (PIR) for the McNeil Drive low water crossing in February 2015 (Reference 1). The PIR includes project history, mission integration, preliminary hydraulic

modeling, preliminary design assessments of alternative creek crossing improvements, preliminary opinions of costs, and recommendations for further assessments. As a continuation of the hydraulic analysis effort, the City of Austin (COA) requested Doucet + Chan (D+C), a Division of Doucet & Associates, Inc., to perform engineering services to complete the alternatives evaluation for the project improvements and make recommendations for the creek crossing structure to be designed and constructed. The following paragraphs summarize the project area and issues to be resolved with the project improvements.

Periodic flooding of the existing McNeil Drive low water crossings at Tributary 9 near the roadway intersection with Mopac and at Tributary 10 near the roadway intersection with Howard Lane restricts access by neighborhood traffic and poses a significant threat to public safety and welfare. In some cases, both low-water crossings are simultaneously flooded, completely isolating the adjacent neighborhood. The roadway is classified as a City Collector Street. Under non-flood conditions, McNeil Drive provides the adjacent neighborhood with access to both North Mopac to the east and to Howard Lane to the north and serves as a bypass around the Howard Lane/Mopac intersection. There are approximately 165 single family residences in the neighborhood that use McNeil Drive for access. The 2010 Annual Average Daily Traffic Count (AADT) collected by TxDOT at the McNeil Drive/Mopac intersection is 770 (24-hour, bi-directional), and the AADT count at the McNeil Drive/Howard Lane intersection is 490 (24-hour, bi-directional) (Reference 1).

Within the vicinity of the Tributary 9 low water crossing, the McNeil Drive right-of-way contains an 8-inch PVC water main, 18-inch RCP wastewater main, and pole-mounted power line. The existing utilities within the right-of-way are discussed in Section 6 of this report. The Capital Metropolitan Transportation Authority (CMTA) Red Line/Austin Northwestern rail line runs parallel to Tributary 9 and is within the McNeil Drive intersection with MoPac access road. The CMTA rail line is discussed in Section 6 of this report. There are three private driveways within the limits of this project that will be impacted by proposed low water crossing improvements. The driveways are discussed in Section 6 of this report.

The COA PIR hydrologic and hydraulic analysis determined the following overtopping depths for fully developed conditions (Reference 1):

Storm Event	Overtopping Depth (ft)	Peak Flow (cfs)
50% (2-yr)	3.07	1,260
10% (10-yr)	3.79	2,620
4% (25-yr)	4.09	3,250
1% (100-yr)	4.58	4,520

The hydrologic and hydraulic analyses is discussed in Section 3 of this report.

Figure 1-2 Vicinity Map (Not to Scale)

Figure 1-3 Aerial View of Existing Low Water Crossing (Not to Scale)

Figure 1-4 Existing Roadway with Low Water Crossing in Background (View Looking East)

Figure 1-5 Existing Low Water Crossing

The purpose of this project is to replace the existing low water crossing at Tributary 9 with a hydraulic structure that has increased conveyance capacity and that complies with COA drainage and transportation criteria. Increased conveyance capacity will improve public safety by reducing the frequency that the crossing will be overtopped and will allow for emergency access during storm events. The improved conveyance will also reduce oversight and maintenance required by COA staff during future rainfall events. Reconstructing the crossing and approach roadways will provide for safer pedestrian and bicycle traffic crossing the creek.

SECTION 2 SCOPE OF WORK

D+C scope of work for this study includes evaluating alternatives for proposed low water crossing improvements for McNeil Drive at Tributary 9 of Walnut Creek. A review of the existing draft Preliminary Investigation Report (PIR) prepared by the COA, dated February 2015, was conducted. Five alternative crossing configurations were evaluated in the COA PIR as summarized below in Table 2-1 (Reference 1).

Table 2-1 COA PIR Creek Crossing Improvement Alternatives

Alternative	Name	Description
1	Clear-Span Bridge	270’ bridge length, pass 100-yr event, deck elev. 754.7’
1a	Clear-Span Bridge + Culverts	120’ bridge length + 20 6’x3’ box culverts, pass <25-yr event, deck elev. >754.7’
2	Culverts	4 4’x4’ box culverts, pass <2-yr event, deck elev. 749.5’
3	CrownSpan Bridge	20’ length, pass <2-yr event, deck elev. 749.5’
4	Clear-Span Bridge	25’ length, pass <2-yr event, deck elev. 749.5’

The impacts of the proposed low water crossing improvements upon the 25-year (4%) and 100-year (1%) events at the crossing, as assessed in the COA PIR, are summarized as follows:

- **Alternative 1**: reduces water surface elevation of the 25-yr event by 1.41’ and of the 100-yr event by 1.16’ and is the only alternative that complies with COA Drainage Criteria Manual (DCM).
- **Alternative 1a**: this configuration does not pass the 25-yr event so COA did not assess this configuration’s impact upon the 25-yr and 100-yr events at the crossing.
- **Alternative 2**: increases the water surface elevation of the 25-yr event by 0.59’ and of the 100-yr event by 0.61’.
- **Alternative 3**: increases water surface elevation of the 25-yr event by 0.48’ and of the 100-yr event by 0.54’.
- **Alternative 4:** increases water surface elevation of the 25-yr event by 1.05’ and of the 100-yr event by 1.03’.

Each alternative evaluated by the COA included a proposed paved bridge section of 30 feet to accommodate two 12-ft traffic lanes and a single 6-ft sidewalk. COA recognized that this proposed bridge section did not comply with the COA residential collector typical section of 40 feet from curb-face

to curb-face (see Figure 2-1) and recommended that a waiver from the City's standards for residential collectors be requested. The PIR also recommended continued discussion with COA Public Works Department (Street & Bridge and Neighborhood Connectivity) to coordinate the selection of the bridge section.

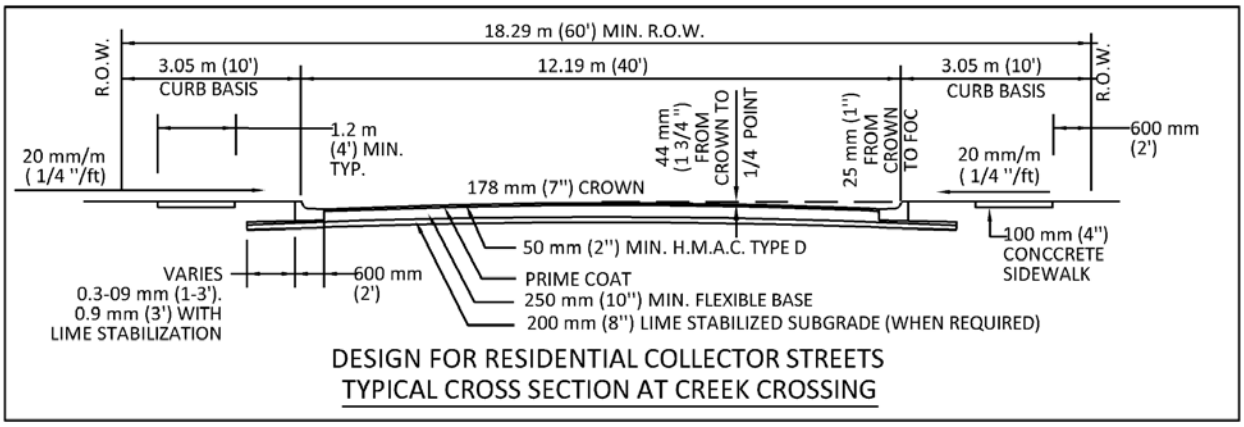


Figure 2-1 Residential Collector Typical Section (COA Standard Detail 1000S-11)

The COA PIR did not include preliminary environmental field observations.

The following primary conclusions were reached in the COA PIR:

- **Alternative 1** is the most expensive of the alternatives; it complies with COA DCM hydraulic requirements; has potential issues with the railroad at the east approach to the crossing; has potential issues with driveways at the west approach to the crossing; relatively low clearance on the west side of the crossing could catch debris, presenting a performance and maintenance issue.
- **Alternative 1a** has the same low-chord elevation as Alternative 1, but because it does not pass the 25-year storm event, the bridge deck would be higher than for Alternative 1.
- **Alternatives 2, 3 and 4** do not offer real improvement over the existing structure; the bridge decks are overtopped even in the 2-yr storm event.

The D+C alternatives evaluation effort completed in this study is based on the recommendations, data and information provided in the COA PIR and additional direction provided by COA staff throughout the completion of this assessment. Site reconnaissance of the existing structure and surrounding area was conducted by D+C and its sub-consultants. A topographic design and tree survey was performed within the project Right-of-Way (ROW), including topographic survey of the existing Tributary 9 channel within the ROW. Existing conditions and proposed conditions HEC-RAS hydraulic models were created and are

discussed in length in Section 3 of this report. A preliminary environmental field investigation and assessment of the impacts of creek crossing improvements were performed and are summarized in Section 5 of this report. AULCC coordination was conducted and the results of the utility coordination efforts are summarized in Section 6.1.17 of this report.

D+C evaluated alternative configurations of clear-span bridges, multiple-arch bridges and box culverts for creek crossing improvements and roadway approach transitions using the following preliminary design criteria and project considerations:

- The COA effective hydrologic and hydraulic models for fully developed land use conditions are the basis for the hydraulic analysis.
- The hydraulic structure's (i.e. creek crossing improvement) typical paved section includes two 12-ft vehicle lanes, two 2-ft shoulder double-striping zones, two 8-ft emergency shoulder/shared use lanes, and two 1'-2" bridge railing zones for a total bridge deck width of 46'-4". A waiver to the COA Transportation Criteria Manual Section 1.3.2.B.1 will not be required for this proposed section if COA Street & Bridge Department considers the two 8-ft emergency shoulder/shared use lanes as part of the 40-ft minimum required vehicle travel lanes width. The proposed bridge typical section is illustrated in Figure 6-1 in Section 6.
- The roadway approach embankment's typical fill section to the east and to the west of the hydraulic structure's abutments includes two 12-ft vehicle travel lanes and two 10-ft emergency shoulder/shared use lanes for a total pavement section width of 44 feet. A waiver to the COA Transportation Criteria Manual Section 1.3.2.B.1 will not be required for this proposed roadway embankment section if COA Street & Bridge Department considers the two 8-ft emergency shoulder/shared use lanes as part of the 40-ft minimum required vehicle travel lanes width. The proposed typical roadway embankment section is illustrated in Figure F-13 in Appendix F.
- The roadway approaches to the east and west abutments of the hydraulic structure must transition to the existing roadway configurations in compliance with the COA Transportation Criteria Manual Section 1.3.1.A.4 and 1.3.1.E for the vertical curves and horizontal tapers for a residential collector with a posted speed limit of 35 miles per hour (mph).
- The roadway approach to the east abutment of the bridge must comply with Federal and State criteria for railroad and highway crossings (Reference 2).
- Three primary types of hydraulic structures are to be assessed for low water crossing improvements:

  (a) Clear-span bridge;

  (b) Multiple-arch bridge;

  (c) Multiple box culverts.
- The three primary types of hydraulic structures (i.e. clear-span bridge, multiple-arch bridge, and multiple box culverts) are sized for two hydraulic conditions:

(a) pass the fully developed 100-year flood event without upstream storm water detention, without overtopping the crossing, and without increasing the water surface elevations upstream or downstream of the crossing; and

(b) pass the fully developed 100-year flood event with upstream storm water detention, without overtopping the crossing, and without increasing the water surface elevations upstream or downstream of the crossing.

- Two alternative configurations of the roadway embankment section shoulders are assessed:

  (a) retaining wall;

  (b) sloped fill shoulders.

- Upstream storm water detention is provided to the maximum extent possible to reduce peak flows at the crossing and to reduce the size of the proposed hydraulic structures.

- Construction of the low-water crossing improvements and the roadway embankment section is assessed assuming two alternative construction phasing assumptions:

  (a) McNeil Drive within the limits of construction to be closed to through traffic for the duration of construction; and

  (b) McNeil Drive two-way traffic to be maintained through the limits of construction for the duration of construction, except possibly close the road for a maximum duration of 3 months at most, required phased construction of the hydraulic structure and roadway embankment.

- Regardless of phased construction of the crossing improvements, local access to the private residences within the proposed limits of construction must be maintained at all times.

- All proposed improvements are to be contained within the existing right-of-way as much as possible to minimize land acquisition costs.

Fully developed flow conditions (un-detained and detained) HEC-RAS hydraulic models were prepared for the low-water crossing improvement alternatives. Quality control reviews were conducted of the HEC-RAS hydraulic models. A detailed discussion of the alternatives and hydraulic modeling performed is included in Section 3 and Section 4 of this report. Plan and profile exhibits were prepared for the alternatives (for profile exhibits refer to Figures 3-1 through 3-4 of Section 3 and for plan/profile exhibits refer to Appendix F).

A series of meetings were conducted with COA staff to review the alternatives assessed prior to completing the alternatives evaluation. A preliminary environmental assessment was performed and is discussed in Section 5 of this report. Engineer's preliminary opinions of probable project costs were prepared for the alternatives and are discussed in Section 6 of this report. Project recommendations were prepared and are included in Section 7 of this report.

SECTION 3 HYDROLOGIC AND HYDRAULIC ANALYSES

The U.S. Army Corps of Engineers (USACE) hydrologic modeling program Hydrologic Engineering Center – Hydrologic Modeling System (HEC-HMS) was used to prepare the fully-developed land use conditions hydrologic modeling. The USACE hydraulic modeling program Hydrologic Engineering Center-River Analysis System (HEC-RAS) was used to perform the fully developed land use conditions hydraulic modeling. The draft "Preliminary Investigation Report for Flooding Issues at the McNeil Drive Low Water Crossing, February 2015" (PIR), prepared by the City of Austin Watershed Protection Department (Reference 1), served as the primary guidance for the hydrologic and hydraulic analysis performed and the crossing improvement alternatives evaluated in this study. Detailed discussions of the hydraulic analysis are presented in the Crespo Consulting Services, Inc. (Crespo) technical report in Appendix C. The methodology and findings of the hydrologic and hydraulic analyses are summarized in the following sub-sections.

3.1 Effective Hydrologic Models

The COA current effective HEC-HMS hydraulic model for fully developed land use conditions for Walnut Creek was acquired from the COA floodplain office and was used unchanged to define the 25-year and 100-year peak flows (Q25/Q100) at the project site for un-detained flow conditions. This COA effective HEC-HMS hydrologic model was modified by inserting detention diversions to model proposed storm water detention improvements on the Austin White Lime property upstream of the Tributary 9 McNeil Drive crossing (see detention discussion in Section 3.2). Another modified effective HEC-HMS hydrologic model, provided by Miller Gray Engineering, was used to define the Q25/Q100 peak flows at the project site for detained flow conditions created by detention on the ICU Medical site (see detention discussion in Section 3.2). Table 3-1 summarizes the peak Q25 and Q100 fully-developed land use conditions flows at the Tributary 9 crossing for un-detained and for detained flow conditions. Storm water detention is discussed in Section 3.2 of this report.

Table 3-1 Peak Flows at Tributary 9 Crossing

Storm Event	Un-Detained Peak Flow (cfs)	Detained Peak Flow (cfs)*
4% (25-yr)	3,250	2,567
1% (100-yr)	4,520	3,570

*Note: Detained flow conditions based upon storm water detention on the ICU Medical site.

3.2 Storm Water Detention

Howard Station Site. The original scope of services for this report assumed that storm water detention would be assessed for a detention structure to be constructed within the TxDOT right-of-way at the intersection of Howard Lane and North MoPac access road, immediately adjacent to the Capitol Metropolitan Transportation Authority (CMTA) Howard Station and its existing detention pond. However, this site was not assessed for storm water detention, because it is owned by TxDOT and because of CMTA potential expansion of the Howard Station parking facility into the right-of-way that would conflict with the proposed storm water detention pond.

Austin White Lime Property Site. An alternative storm water detention site was assessed on the Austin White Lime property, on Tributary 9, between Howard Station and the Tributary 9 McNeil Drive crossing. Once the clear-span bridge alternative was sized for un-detained flow conditions (i.e. 300-ft long bridge), the COA fully developed effective HEC-HMS hydrologic model was modified to determine the volume of storm water detention needed upstream of the Tributary 9 crossing to reduce the clear-span bridge length to 200 feet and to 100 feet. Table 3-2 summarizes the Q100 off-channel detention storage volumes, pond footprint areas and flow reductions needed to reduce the clear-span bridge lengths to 200 feet and to 100 feet, based upon an assumed average ponding depth of 4 feet adjacent to the Tributary 9 channel.

Table 3-2 Storm Water Detention Requirements with Pond on Austin White Lime Property

Bridge Length (ft)	Q100 (cfs)	Detention Volume (AF)	Detention Pond Footprint (Ac)
300*	4,520		
200	3,000	383	96
100	2,275	459	115

*Note: 300-ft clear-span bridge length is for un-detained flow conditions.

The alternative detention pond site on the Austin White Lime property was determined to not be feasible due to the cost of land acquisition for the pond (approximately $3/SF).

ICU Medical Site. Another alternative storm water detention site was assessed on the ICU Medical property at the northwest corner of the Howard Lane/North MoPac access road intersection. The Miller Gray Engineering firm was preparing assessments of potential expansion of the existing private storm water detention on the site using a modification of the COA effective fully-developed HEC-HMS hydrologic model. The reduction in Q100 peak flows created by the expansion of the existing storm water detention structure on the ICU Medical site is summarized on Table 3-1. This modified HEC-HMS

hydrologic model for fully developed land use detained flow conditions was the basis for the peak flows used in the HEC-RAS model prepared for sizing the hydraulic structure improvements at the Tributary 9 crossing for detained flow conditions.

3.3 Existing Conditions Hydraulic Model

The revised effective HEC-RAS hydraulic model served as the base model for comparison to the alternatives hydraulic models and was created from the COA effective hydraulic model. The existing conditions effective model was modified by incorporating the topographic design survey data that was collected as part of this study by MWM Design Group, Inc. (survey dated June of 2017). Refer to Appendix C for the Crespo Consulting Services, Inc. (Crespo) technical report.

3.4 Proposed Conditions Hydraulic Models

Starting with the revised effective hydraulic model, modifications were made, as applicable, to create the creek crossing improvement alternatives' proposed fully developed conditions HEC-RAS hydraulic models for un-detained and detained flows. Section 2 of this report summarizes the preliminary design criteria and project considerations used in the development of the proposed alternatives. In addition to the recommendations provided by the COA, including input from the COA Public Works Department's Austin Transportation Department, Street & Bridge Division and Neighborhood Connectivity Division, preliminary geotechnical engineering and preliminary structural design recommendations and requirements for the hydraulic structure configurations were also considered during the development of the fully developed conditions hydraulic models of the alternatives. The following common hydraulic structure configurations and factors were incorporated into the HEC-RAS hydraulic models of the alternatives:

- Clear-span bridge type: Con-Struct Single Tub Prefabricated Bridge System;
- Multiple-arch bridge type: Redi-Span Arch Bridge System;
- Bridge piers/columns: Piers are at 60-ft maximum spacing and are 3-ft diameter;
- Total clear span bridge deck thickness: 30-5/8 inches; (refer to Figure 6-1 in Section 6);
- Railing: entire height of the railing is assumed to be 100% blocked to overtopping flows.

Discussion of HEC-RAS hydraulic modeling of each alternative is provided in the sub-sections below.

3.4.1 Alternative 1: Clear-Span Bridge

Alternative 1U Undetained Flow Conditions. At a 300-ft clear span bridge length, the fully developed undetained flows do not overtop the bridge deck at elevation 758.50 ft-msl and do not create an increase in water surface elevations through the 100-yr flood event. Tables 3-3 and 3-4 summarize the fully developed 100-year and 25-year flood event water surface elevations created by Alternative 1U. Immediately upstream of the bridge, the Q100 flow is at peak elevation 752.57 ft-msl as compared to the bridge low chord elevation of 755.48 ft-msl. Figure 3-1 illustrates the profile of the Alternative 1U clear-span bridge. The Alternative 1U bridge and roadway alternate plans, profiles and sections are shown on Figures F-2 and F-3 in Appendix F.

Alternative 1D Detained Flow Conditions. At a 230-ft clear span bridge length, the fully developed detained flows do not overtop the bridge deck at elevation 758.50 ft-msl and do not create an increase in water surface elevations through the 100-yr flood event. Immediately upstream of the bridge, the Q100 flow is at peak elevation 752.09 ft-msl as compared to the bridge low chord elevation of 755.48 ft-msl. Tables 3-3 and 3-4 summarize the fully developed 100-year flood and 25-year event water surface elevations created by Alternative 1D. Figure 3-2 illustrates the profile of the Alternative 1D clear-span bridge. The Alternative 1D bridge and roadway alternate plans, profiles and sections are shown on Figures F-4 and F-5 in Appendix F.

3.4.2 Alternative 2: Multiple-Arch Bridge

Alternative 2U Undetained Flow Conditions. At a total 320 feet of 10 multiple arches (i.e. 4-24'x4.93', 5-28'x5.75', 1-46'x10.06'), the fully developed undetained flows do not overtop the pavement centerline overlying the multiple arch spans of elevation 758.50 ft-msl and do not create an increase in water surface elevations through the 100-yr flood event. Tables 3-3 and 3-4 summarize the fully developed 100-year and 25-year flood event water surface elevations created by Alternative 2U. Immediately upstream of the bridge, the Q100 flow is peak elevation 752.22 ft-msl as compared to the pavement centerline elevation of 758.50 ft-msl. Figure 3-3 illustrates the profile of the Alternative 2U multiple arch bridge. The Alternative 2U multiple arch and roadway alternate plans, profiles and sections are shown on Figures F-6 and F-7 in Appendix F.

Alternative 2D Detained Flow Conditions. At a total of 210 feet of 6 multiple arches (i.e. 1-24'x4.93', 4-28-x5.75', 1-46'x10.06'), the fully developed detained flows do not overtop the pavement centerline overlying the multiple arch spans of elevation 758.50 ft-msl and do not create an increase in water surface elevations through the 100-yr flood event. Tables 3-3 and 3-4 summarize the fully developed 100-year and 25-year flood event water surface elevations created by Alternative 2D. Immediately upstream of the bridge, the Q100 flow is peak elevation 751.58 ft-msl as compared to the pavement centerline elevation of 758.50 ft-msl. Figure 3-4 illustrates the profile of the Alternative 2D multiple arch

bridge. The Alternative 2D multiple arch and roadway alternate plans, profiles and sections are shown on Figures F-8 and F-9 in Appendix F.

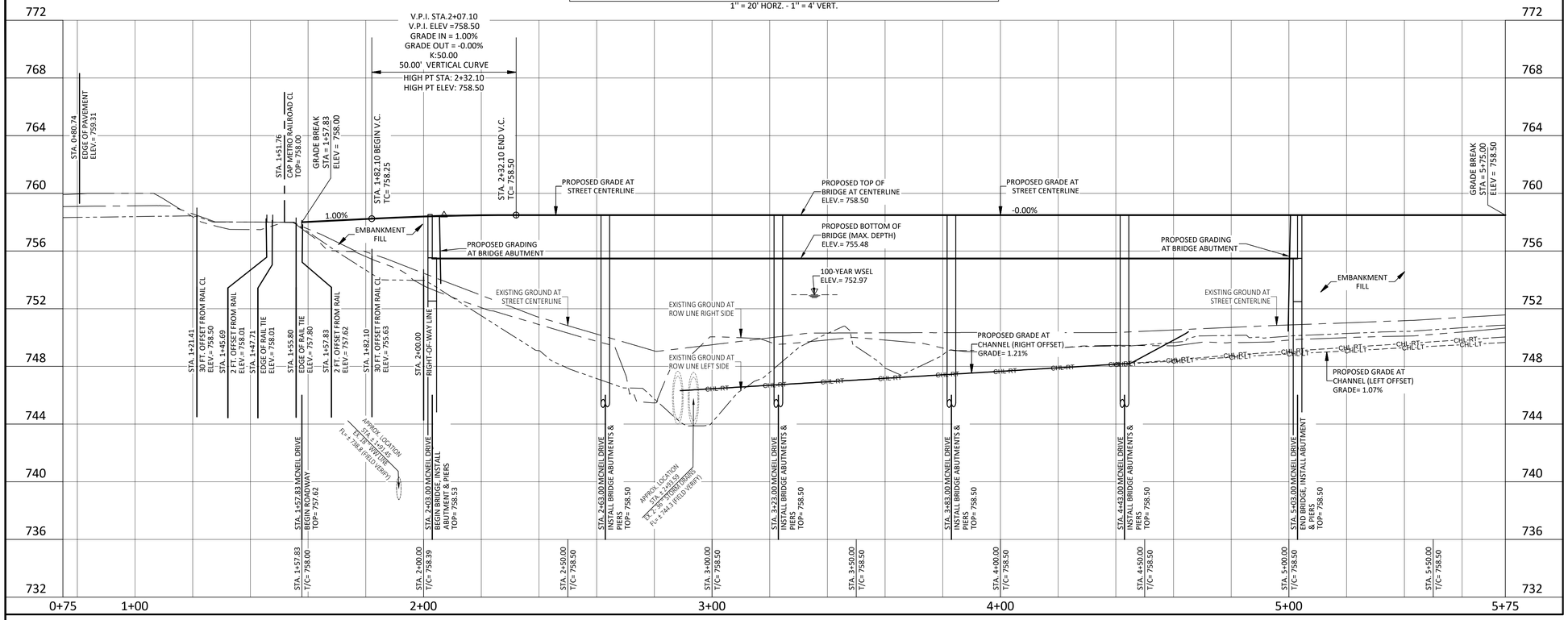
3.4.3 Alternative 3: Multiple Box Culverts

Alternative 3U Undetained Flow Conditions. At a total 340 feet of 24 multiple box culverts at 12-ft width each, the fully developed undetained flows do not overtop the pavement centerline overlying the multiple box culverts of elevation 758.50 ft-msl and do not create an increase in water surface elevations at the 100-yr flood event. Due to the magnitude of the required box culverts to prevent an increase in the Q100 water surface elevation, no further hydraulic modeling was performed to refine the box culvert configuration or to assess impacts to Q2-Q100 water surface elevations. No figures or cost estimates were prepared for the box culvert configuration.

Alternative 3D Detained Flow Conditions. Based upon the results of the undetained flow conditions hydraulic modeling, no hydraulic modeling was performed for sizing multiple box culverts for detained flow conditions.

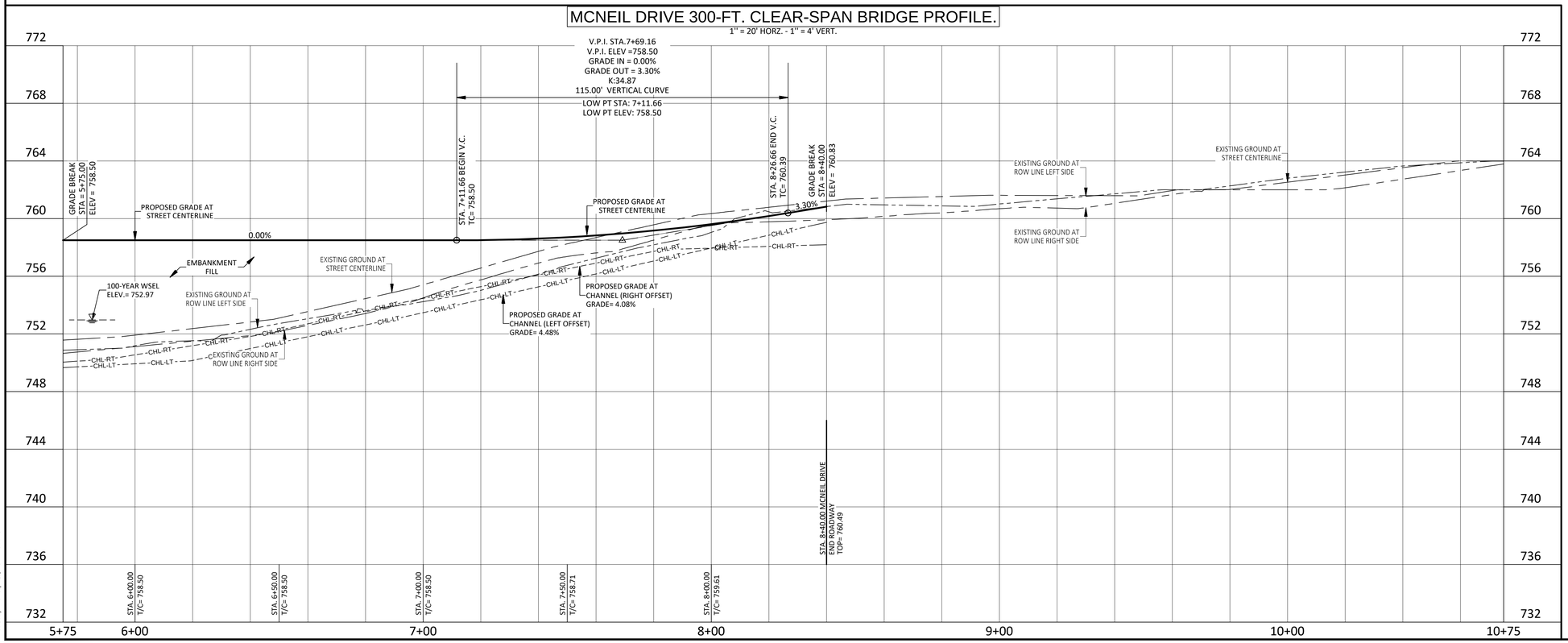
MCNEIL DRIVE 300-FT. CLEAR-SPAN BRIDGE PROFILE

1" = 20' HORZ. - 1" = 4' VERT.



MCNEIL DRIVE 300-FT. CLEAR-SPAN BRIDGE PROFILE.

1" = 20' HORZ. - 1" = 4' VERT.



CONTRACTOR NOTES:

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CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.

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300-FT. CLEAR-SPAN BRIDGE OPTION

ALT. 1U MCNEIL DRIVE
PROPOSED BRIDGE PROFILE

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Reviewed:	JK
Date:	9/25/2018

SHEET

FIGURE 3-1

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-Alt-BRIDGE-RET-WALL.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 15:42
Plot Date/Time: Sep. 25, 18 - 15:46:18

MCNEIL DRIVE 230-FT. CLEAR-SPAN BRIDGE PROFILE

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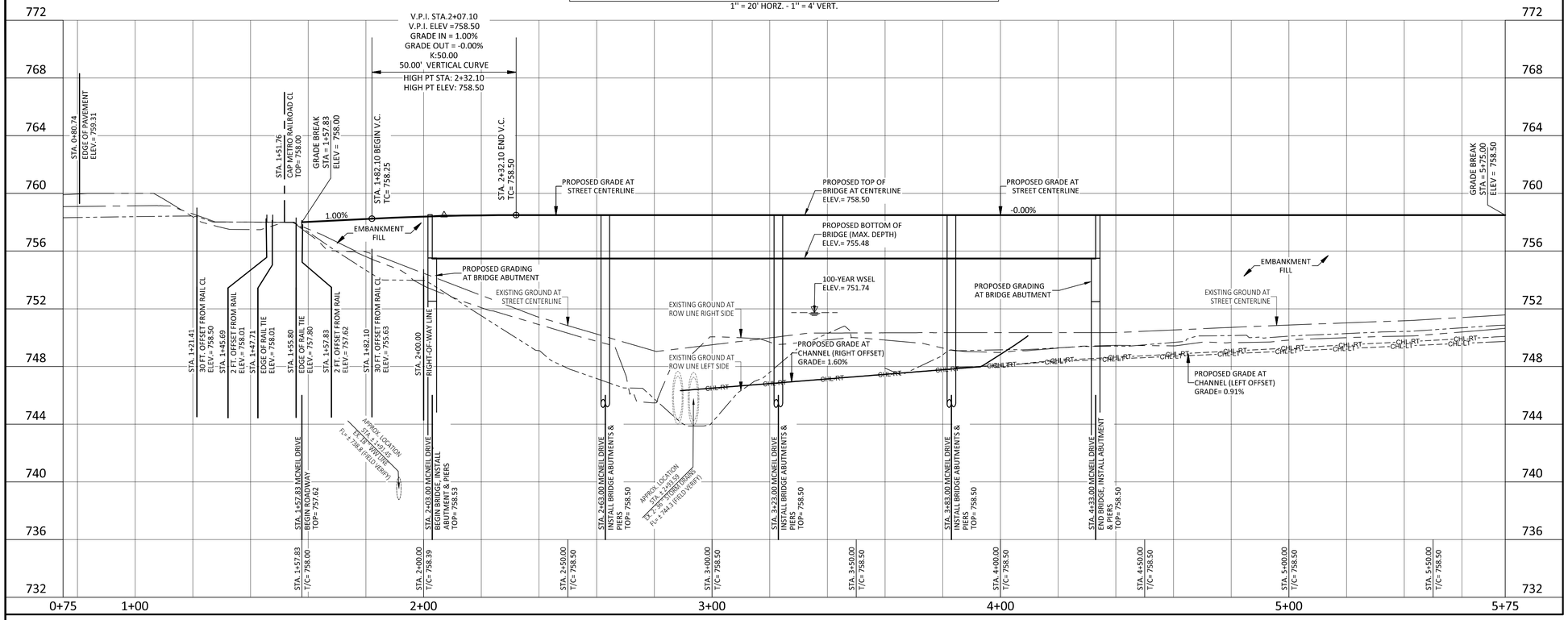
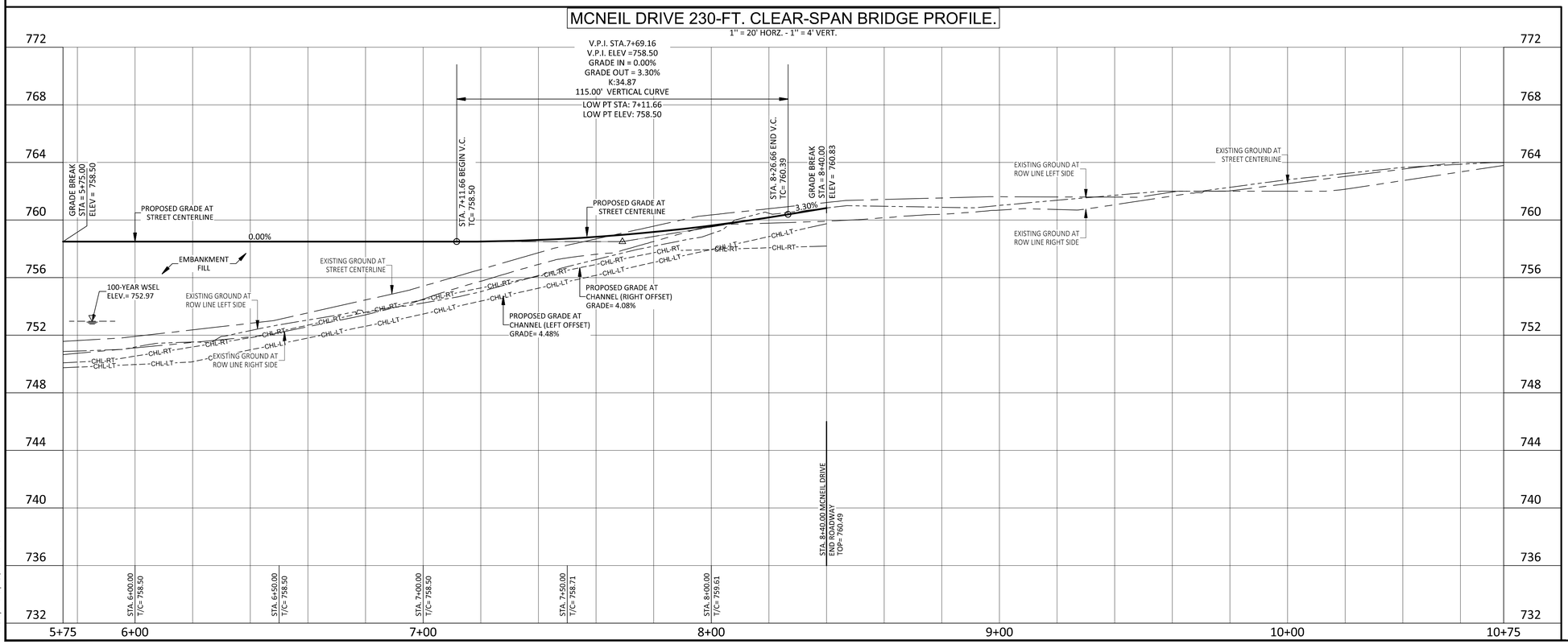


MCNEIL DRIVE 230-FT. CLEAR-SPAN BRIDGE PROFILE.

1" = 20' HORZ. - 1" = 4' VERT.



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300-FT. CLEAR-SPAN BRIDGE OPTION

ALT. 1D. MCNEIL DRIVE
PROPOSED BRIDGE PROFILE

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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FIGURE 3-2

OF .

Project No.: 1570-022

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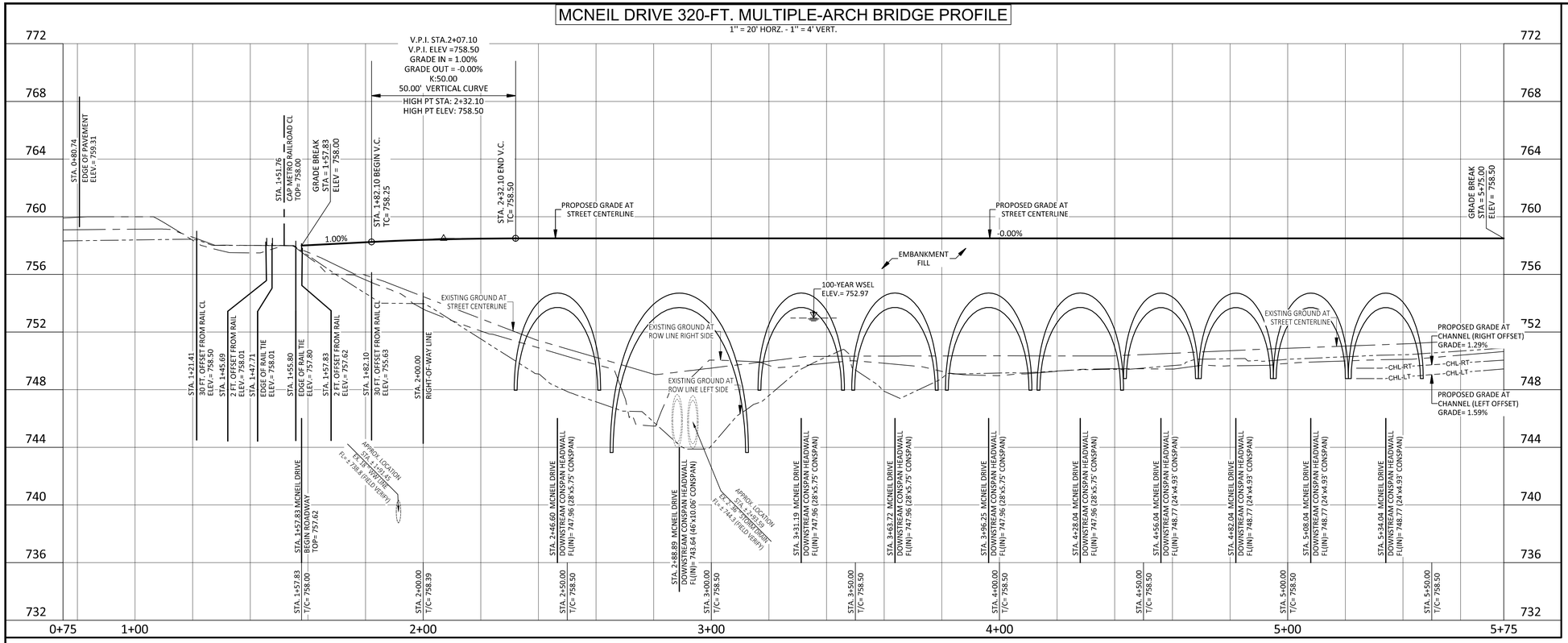

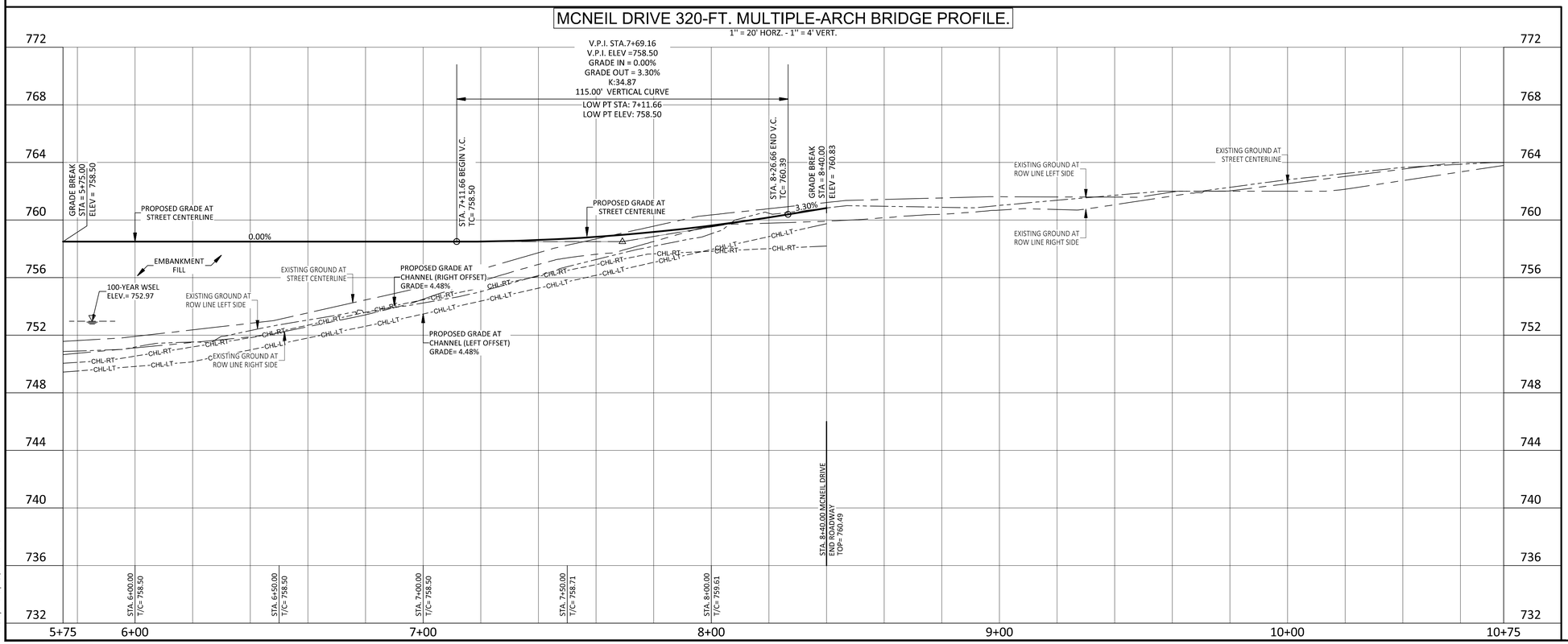

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320-FT. MULTIPLE -ARCH BRIDGE

ALT. 2U. MCNEIL DRIVE PROPOSED BRIDGE PROFILE

MCNEIL DRIVE CROSSING
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Reviewed:	JK
Date:	9/25/2018

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FIGURE 3-3

OF .

Project No.: 1570-022

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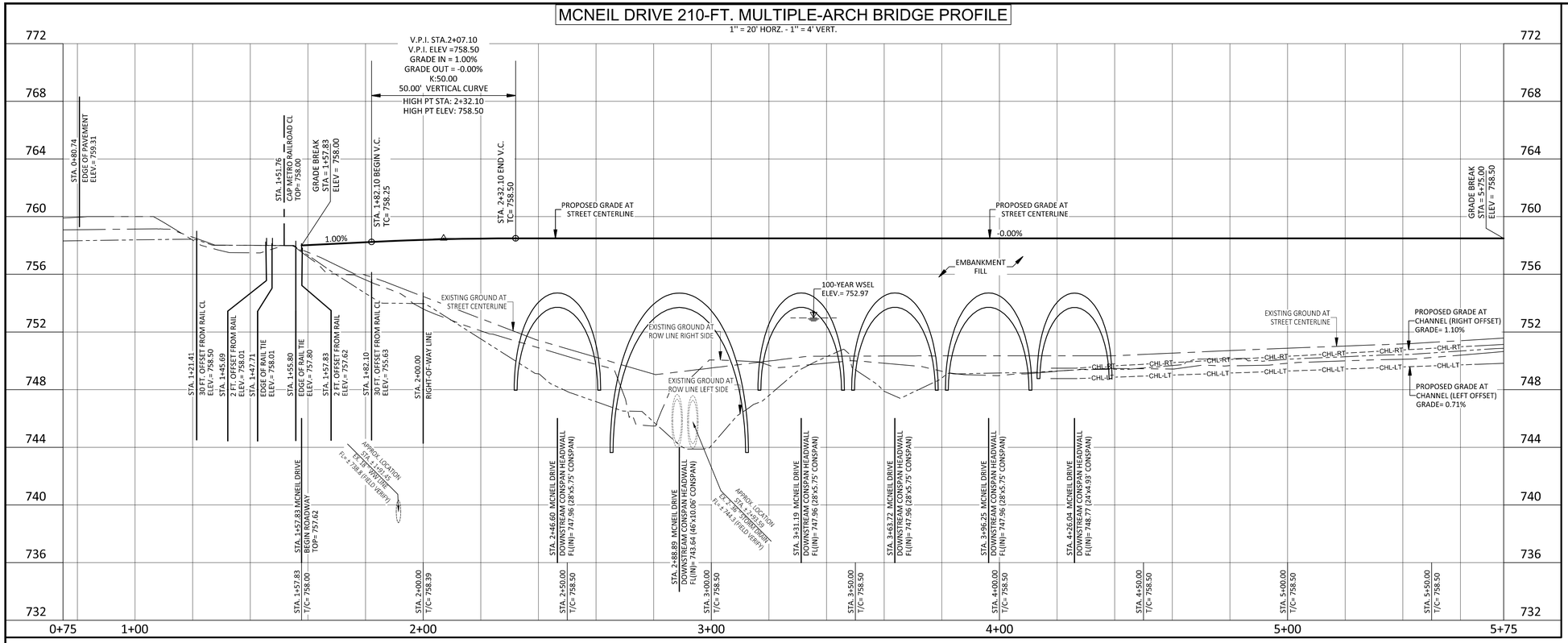

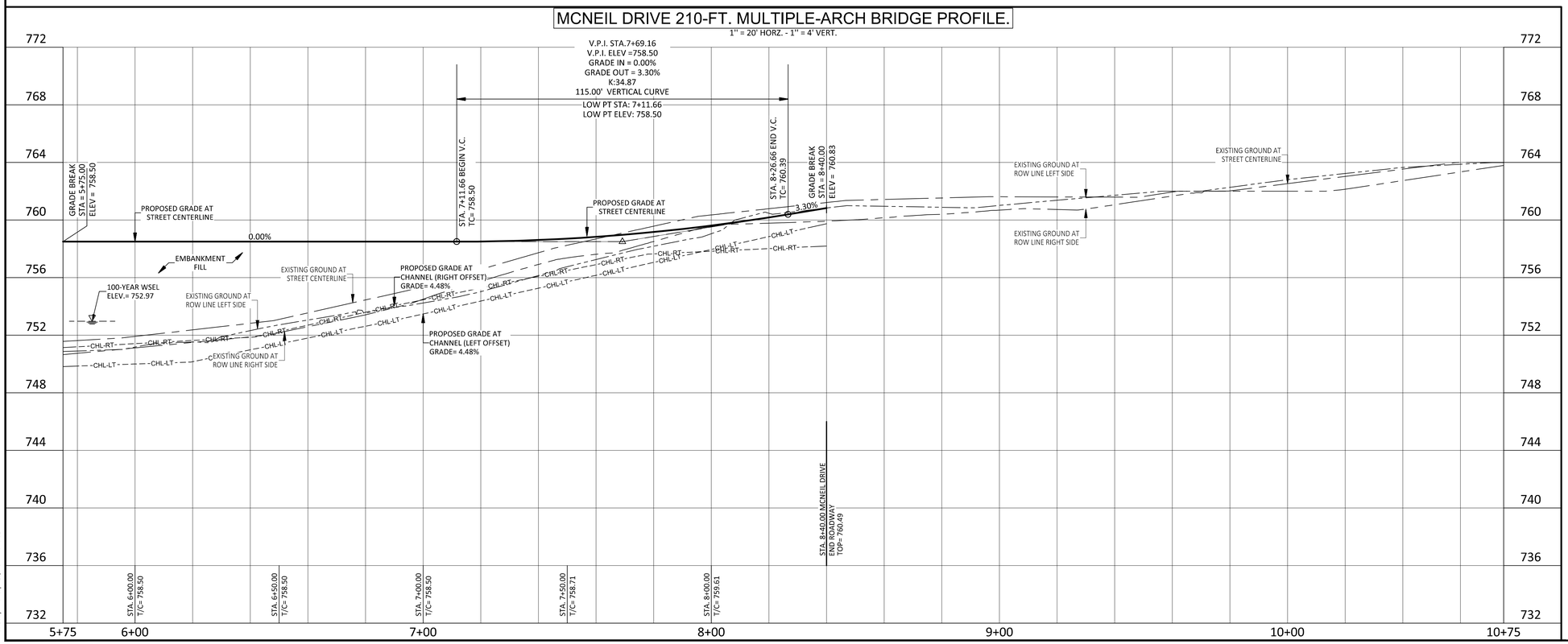

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210-FT. MULTIPLE-ARCH BRIDGE

ALT. 2D. MCNEIL DRIVE
PROPOSED BRIDGE PROFILE

MCNEIL DRIVE CROSSING
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Reviewed:	JK
Date:	9/25/2018

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FIGURE 3-4

OF .

Project No.: 1570-022

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User: CDOLLERY
Last Modified: Sep. 25, 18 - 11:21
Plot Date/Time: Sep 25, 18 - 12:19:32

Table 3-3 Summary of Fully Developed 100-Year Water Surface Elevations (FT-MSL) along Tributary 9 (Reach 1) of Walnut Creek at Selected River Stations

RAS River Sta.	Existing Conditions	Alt 1U	Alt 1D	Alt 2U	Alt 2D
9947	785.94	785.94	785.94	785.94	785.94
9898	Culvert				
9269	772.53	772.53	772.30	772.53	772.30
9180	Culvert				
7224	762.26	762.26	760.27	762.26	760.27
7196	Bridge				
7026	757.31	757.31	756.78	757.31	756.78
6925	757.38	757.38	756.82	757.38	756.82
6723	756.44	756.44	755.95	756.44	755.95
6475	753.73	753.72	753.38	753.72	753.38
6371	753.05	753.05	752.53	752.35	751.65
6348	752.97	752.57	752.09	752.22	751.58
6325	Proposed Bridge				
6297	752.13	752.11	751.46	752.19	751.58
6250	752.08	752.08	751.44	752.08	751.44
4990	741.36	741.36	740.81	741.36	740.81
4969	Culvert				
4486	736.91	736.91	736.17	736.91	736.17
4471	Culvert				
3707	735.15	735.15	734.71	735.15	734.71
3668	Culvert				
1840	719.02	719.02	717.91	719.02	717.91
1839	Lateral Structure				
1683	718.55	718.55	717.48	718.55	717.48
1665	Bridge				
1646	716.90	716.90	715.74	716.90	715.74
1645	Lateral Structure				
1334	715.83	715.83	714.65	715.83	714.65
1264	Bridge				
658	709.75	709.75	709.12	709.75	709.12
635	Bridge				
209	707.23	707.23	707.04	707.23	707.04
188	Culvert				
118	704.63	704.63	704.37	704.63	704.37

Table 3-4 Summary of Fully Developed 25-Year Water Surface Elevations (FT-MSL) along Tributary 9 (Reach 1) of Walnut Creek at Selected River Stations

RAS River Sta.	Existing Conditions	Alt 1U	Alt 1D	Alt 2U	Alt 2D
9947	784.77	784.77	784.77	784.77	784.77
9898	Culvert				
9269	771.51	771.51	771.30	771.51	771.30
9180	Culvert				
7224	759.90	759.90	759.39	759.90	759.39
7196	Bridge				
7026	756.58	756.58	756.18	756.57	756.14
6925	756.61	756.61	756.19	756.60	756.16
6723	755.77	755.77	755.53	755.76	755.45
6475	753.25	753.25	752.52	753.27	752.77
6371	752.53	752.41	751.77	751.55	751.32
6348	752.47	752.04	751.48	751.26	750.64
6325	Proposed Bridge				
6297	751.24	751.23	750.63	751.34	750.78
6250	751.20	751.20	750.59	751.20	750.59
4990	740.61	740.61	740.16	740.61	740.16
4969	Culvert				
4486	736.02	736.02	735.63	736.02	735.63
4471	Culvert				
3707	734.46	734.46	733.95	734.46	733.95
3668	Culvert				
1840	717.34	717.34	716.51	717.34	716.51
1839	Lateral Structure				
1683	716.87	716.87	715.93	716.87	715.93
1665	Bridge				
1646	715.11	715.11	714.49	715.11	714.49
1645	Lateral Structure				
1334	714.00	714.00	713.00	714.00	713.00
1264	Bridge				
658	708.05	708.05	707.70	708.05	707.70
635	Bridge				
209	706.66	706.66	706.52	706.66	706.52
188	Culvert				
118	703.81	703.81	703.58	703.81	703.58

SECTION 4 HYDRAULIC ANALYSIS RESULTS

The proposed alternatives presented in Section 3 meet the objective of reducing McNeil Drive flood overtopping at its Tributary 9 of Walnut Creek crossing. Alternatives 1U, 1D, 2U and 2D pass the fully developed floods up through the 100-year flood event without overtopping the top of bridge/pavement and without increasing 100-year water surface elevations upstream or downstream of the crossing. Table 4-1 summarizes the fully developed 25-year and 100-year water surface elevations for the four creek crossing improvement alternatives at the creek crossing.

Table 4-1 Summary of Fully Developed 25-Year and 100-Year Water Surface Elevations Immediately Upstream of the Alternative Bridge Configurations

Alternative	Proposed Top of Deck/Pavement (ft-msl)	25-Year WSEL (ft-msl)	100-Year WSEL (ft-msl)
Alternative 1U Clear-Span Bridge	758.50	752.04	752.57
Alternative 1D Clear-Span Bridge	758.50	751.26	752.22
Alternative 2U Multiple-Arch Bridge	758.50	751.48	752.09
Alternative 2D Multiple-Arch Bridge	758.50	750.64	751.58

The fully developed 100-year and 25-year water surface elevations for the four alternatives were compared to the revised effective existing condition fully developed 100-year and 25-year water surface elevations. The Crespo Hydraulic Report (see Appendix C) provides 100-year flood event water surface profiles for existing and proposed conditions and RAS cross-section plots comparing existing versus proposed grades for the four alternatives. Tables 3-3 and 3-4 and the data provided in the Crespo Hydraulic Report indicate the four alternatives do not increase the fully developed 100-year or 25-year water surface elevations upstream or downstream of the McNeil Drive creek crossing at HEC-RAS Reach 1 River Station 6325.

Drainage easements are not required for any of the assessed creek crossing improvement alternatives, because the crossing configurations were sized to not increase the 100-year peak water surface elevations either upstream or downstream of the crossing. However, construction of the creek crossing improvements will require additional right-of-way land, water/wastewater easement, house-buy-out, and power easement acquisitions (see Section 6.1.21 discussion of land acquisition requirements).

SECTION 5 PRELIMINARY ASSESSMENT AND PERMITTING REQUIREMENTS

The COA Preliminary Engineering Report (PER) did not include preliminary identification of potential Critical Environmental Features at or near the project site. The D+C environmental consultant, Cox/McLain Environmental Consulting, Inc. (CMEC) prepared preliminary design environmental constraints assessments based upon the Alternatives 1U, 1D, 2U and 2D configurations. The CMEC environmental report is included in Appendix D. This section of the Alternatives Evaluation Report (AER) discusses the D+C and CMEC findings and recommendations of the preliminary environmental constraint assessments.

5.1 Hydrogeologic Element

The Walnut Creek watershed is classified as a Suburban Watershed (COA Land Development Code (LDC) 25-8-2). The creek is classified as a major waterway at the project site, because it has a drainage area of 2.246 square miles (1,437 acres) (COA LDC 25-8-91).

Tributary 9 of Walnut Creek is the only regulated water body within the project area. The creek is defined as a "waters of the U.S.".

The surface soils, as defined by the NRCS mapping, consist of Oakalla soils, Heiden clay, and Tarrant and Speck soils (see the CMEC report in Appendix D).

The project site is underlain by two geological formations (see the Geotechnical Data Report in Appendix C and CMEC report in Appendix D): (1) Del Rio Clay and Georgetown Limestone Formation (Kgt), and (2) Edwards Limestone Formation (Ked). Almost all the project is located on an outcrop of the Georgetown Limestone Formation, but the Edwards Limestone Formation outcrops along a fault line at the west end of the project. The field assessment conducted by the CMEC licensed geologist found no karst or recharge features (hydrogeological critical environmental features) visible at the surface. However, the project is located within two karst zones:

- western portion of the Karst Zone 1 (areas known to contain one or more of the listed karst invertebrates);
- eastern portion of the Karst Zone 3 (areas that probably do not contain listed karst invertebrates).

Karst invertebrates are discussed in Section 5.10.

The Recharge Zone of the Edwards Aquifer is characterized by highly fractured and faulted limestone that allows large quantities of water to flow from the surface directly into the Edwards Aquifer. Minimum groundwater depths recorded at the six nearest wells are in excess of 50 feet below the ground surface. Project excavations (included utility trenches and drilled piers) are not anticipated to reach these depths; therefore, direct impacts to the Edwards Aquifer are not anticipated. However, COA criteria requires all excavations greater than 5 feet of depth within the Edwards Aquifer Recharge Zone to be observed by a licensed geologist for the presence of sub-surface recharge/karst/cave features.

5.2 Vegetative Element

The project area is within four vegetative cover types: juniper woodland, disturbed roadside, riparian, and pasture (see the CMEC report in Appendix D). There is relatively heavy tree coverage in the woodland and riparian areas. The woodlands lack the extent and connectivity to additional suitable habitat patches to provide adequate habitat for the Golden-cheeked warbler. Tree removal and mitigation are discussed in Section 5.14.

No occurrences of hydrophytic (i.e. obligate or facultative wet) vegetation dominate any of the vegetative zones; therefore, impact to wetlands at the site are not a concern.

No occurrences of rare or protected vegetation types will be disturbed by construction of the proposed creek crossing improvements.

A riparian zone (wildlife resource natural zone) exists along the Tributary 9 creek channel. of Walnut Creek. Construction of the creek crossing improvements must retain the integrity of the riparian areas and minimize damage to the physical and biological characteristics of such areas (COA Environmental Criteria Manual Section 1.7.2.A). Revegetation for disturbed and lost riparian vegetation, including trees will be required.

The site survey performed by the D+C survey consultant MWM Design Group, Inc. (MWM) maps the existing trees within the project site (see Figure F-1 in Appendix F). The final design of the selected alternative will include a final tree list of all existing trees at the project site, identification of existing trees to be removed, identification of protected and heritage trees, and identification of trees for pre- and post-construction root treatment (see Section 5.14 discussion of tree mitigation requirements).

The CWQZ within the right-of-way at the creek crossing contains native vegetation that will be disturbed for construction of the creek crossing improvement elements. The disturbed native vegetation within the CWQZ will be re-established with COA Standard Specification 609S Native Grassland Seeding and Plantings.

5.3 Critical Water Quality Zone (CWQZ)

The Tributary 9 of Walnut Creek waterway, with a major Suburban waterway classification at the project site, has a CWQZ boundary that is 300 feet from the centerline of the creek channel centerline (COA LDC 25-8-92).

The COA LDC 25-8-262 allows only an arterial street (as identified in the COA Transportation Plan) to cross the CWQZ of a Suburban Watershed major waterway. An approved variance to LDC 25-8-262 is required to allow construction of McNeil Drive creek crossing improvements as a Residential Collector across the CWQZ of the Tributary 9 of Walnut Creek major waterway.

Development within the CWQZ must be designed to protect the natural hydrologic function, long-term channel stability, and ecological function of the floodplain (see CMEC report in Appendix D). Section 5.2 discusses re-vegetation requirements within the CWQZ and of protection/mitigation of riparian zones along the Tributary 9 creek channel that are within the CWQZ.

5.4 Water Quality Transition Zone (WQTZ)

COA Ordinance No. 20131017-046 deleted the WQTZ for a Suburban Watershed, including the Walnut Creek basin.

5.5 COA and FEMA Floodplains

Construction of the proposed creek crossing improvements cannot adversely impact the 100-year floodplain on either a temporary construction or permanent basis. The proposed creek crossing improvements are configured to not cause an adverse impact to the 100-year floodplain (see Sections 3 and 4 discussion of 25-year and 100-year water surface elevations). Construction spoils cannot be located within the 100-year floodplain (COA Section 25-8-342). A normal strategy during construction is to require daily removal of construction spoils out of the floodplain and not allow storage of fuels and/or hazardous compounds within the floodplain. Development criteria within the Recharge Zone of the Edwards Aquifer has additional floodplain disturbance restrictions (see Section 5.6).

5.6 Edwards Aquifer Recharge Zone

The project site is located over the Recharge Zone of the Edwards Aquifer; therefore, the project is subject to both the City of Austin and Texas Commission on Environmental Quality (TCEQ) criteria for

development over the recharge zone. The potential for the existence of karst and recharge features at the site and the potential for excavations impacting the Edwards Aquifer are discussed in Section 5.1. Development within the Recharge Zone of the Edwards Aquifer must not adversely impact the Edwards Aquifer water quality and is subject to the following primary requirements:

- a Water Pollution Abatement Plan (WPAP) must be prepared and approved by the TCEQ to provide temporary erosion/sedimentation/pollution controls during construction and to provide permanent water quality controls to insure that 80% of the incremental increase in the annual mass loading of Total Suspended Solids (TSS) from the site caused by the regulated activities is removed (30 TAC 213) (see Section 5.16 discussion of permit requirements);
- temporary erosion and sedimentation control BMPs must be installed and maintained during construction (see Section 5.13 discussion of temporary erosion and sedimentation controls);
- excavations of 5 feet or deeper into the sub-surface (e.g. utility trenches, power pole foundations, retaining wall footings, drilled piers) must be observed by a licensed geologist and appropriate mitigative effort must be taken to minimize direct contact with and/or impacts to karst/recharge structures.

5.7 Parkland

The proposed construction will not take place in a city-owned and dedicated publicly-accessible recreational facility, park or greenbelt. Chapter 26 of the TPWD Code will not apply to this project.

5.8 Natural Gradient

The project site is situated on generally level upland terrain. Slopes in the project area are generally less than 2% and none are 9% or steeper (see CMC report in Appendix D). No roadway embankment fill is proposed to be placed on the natural gradients in excess of 15%. An approved variance to COA LDC 25-8-301 is required if roadway embankment fill is placed on the natural gradients in excess of 15%.

5.9 Critical Environmental Features and Buffer Zones

Critical Environmental Features (CEF) are features that are of critical importance to the protection of environmental resources and include bluffs, canyon rimrocks, caves, sinkholes, springs, and wetlands (COA LDC 25-8-1). Drainage patterns and buffer zones must be designed as part of the project improvements to protect the CEFs from adverse impacts. Within the buffer zone the natural vegetative cover must be retained to the maximum extent practicable and construction is prohibited (COA LDC 25-8-281). If the wetland CEF is disturbed, wetland mitigation, including wetland replacement, must be

provided (COA LDC 25-8-282). With some exceptions, the COA requires a development/land disturbing setback distance of 150 feet from a CEF.

A 150-feet buffer around the maximum project footprint was investigated by the CMEC preliminary environmental site investigation to identify potential CEFs. No CEFs were found within the project site are within 150 feet of the maximum project footprint. However, because the project is located within zones for potential karst/recharge features, the potential exists for uncovering or penetrating karst/recharge features.

5.10 Endangered, Threatened and Rare Species

There are no occurrences of threatened or endangered species having been reported within the immediate project area (see CMEC report in Appendix D). A search of the Texas Parks and Wildlife Department's TXNDD lists 31 Elements of Occurrence (EO) records within a 5-mile buffer of the project site. These EOs generally occur west of the project area; however, they illustrate the potential for encountering the habitat of subsurface species, especially the bone cave harvestman and the Jollyville Plateau Salamander.

The risk of impacts to these species increases within increased subsurface impacts, especially in cases where the Edwards Aquifer is directly intercepted or where significant recharge features are encountered. Preliminary geologic evaluations did not indicate the presence of geologic formations that are consistent with habitat for karst-associated invertebrates. However, excavations and other ground disturbance could reveal potential habitat. COA and TCEQ require notification in certain instances of karst void discovery during construction. These notification procedures should be followed, and, if warranted, the U.S. Fish & Wildlife Service should be notified of the discovery of potential habitat.

Though TXNDD EOs for the Golden-cheeked Warbler and the Black-capped vireo are reported within a 5-mile buffer of the project area, suitable habitat for these species does not occur in the project area.

None of the project site is within the Balcones Canyonlands Conservation Plan participation area.

5.11 Cultural Resources

Due to the lack of consistent soil cover, the project area has a low probability of containing buried archaeological deposits (see CMEC report in Appendix D). Given the apparent lack of previous surface disturbance, it is possible that as-yet unknown sites similar to nearby sites (surface artifacts and structural remains) may be located within the project area. The Texas Historical Commission (THC) may require a survey even though the project falls below the 5-acre Antiquities Code threshold, especially

associated with the sloped shoulder fill's footprint disturbance outside of the existing roadway right-of-way. At a minimum, consultation with THC will be required during final design.

The U.S. Army Corps of Engineers (USACE) Regulatory Archaeologist might require informal notification/consultation assuming authorization under any Nationwide Section 404 Permit (see Section 5.16 discussion of permit requirements).

5.12 Impervious Cover and Water Quality Controls

According to COA LDC 25-8-63, new and/or re-developed impervious cover calculations for the site for purposes of water quality treatment include roadway pavement, driveways, and concrete but exclude sidewalks in the public right-of-way, water quality controls, and drainage swales and conveyances for water quality treatment purposes. The COA Environmental Criteria Manual (ECM) Section 1.8.0 provides guidelines for calculation of impervious cover. According to the COA LDC 25-8-211, water quality controls are not required for low-water crossing upgrades that create less than 8,000 SF of new roadway impervious cover. If the new impervious cover equals or exceeds 8,000 SF, water quality controls must be installed that capture, isolate and treat the water draining from the contributing area with a required capture volume of the first ½" of runoff plus 1/10" for each 10% increase in impervious cover over 20% of gross site area (COA LDC 25-8-213). The COA ECM Section 1.6.0 provides guidelines for design of water quality controls.

Since the project is located within the Recharge Zone of the Edwards Aquifer, permanent Best Management Practices (BMP) must be provided so that 80% of the incremental increase on the annual mass loading of Total Suspended Solids (TSS) from the site caused by the regulated activities (i.e. clearing, excavation, utility relocations, roadway construction) is removed. TCEQ's Technical Guidance Manual provides design, construction, operation, and maintenance requirements for BMPs. For this project, a combination of grass swales, vegetative filter strips, sand filter system, and/or bioretention system strategies are acceptable (Reference 3).

Layout assumptions for permanent water quality controls for the proposed improvements are discussed in Section 6.1.10 of this report.

5.13 Temporary Erosion and Sedimentation Controls

According to the COA LDC Section 25-8-181, installation and maintenance of temporary erosion and sedimentation controls are required until permanent vegetation is established and must be removed after permanent vegetation is established. According to the COA LDC Section 25-8-185, the primary purposes of the temporary erosion and sedimentation controls are to (a) prevent erosion, (b) maintain

infiltration and recharge of local seeps and springs, (c) attenuate the harm of contaminants collected and transported by stormwater, and (d) maintain overland sheet flow, maintain natural drainage features and patterns, and disperse runoff back to sheet flow.

Temporary erosion and sedimentation controls are to be designed, installed and maintained in accordance with the COA ECM Section 1.4.0 and are discussed in Section 6.1.14 of this report.

5.14 Tree Protection and Mitigation

If project construction removes a tree 8 inches or larger in diameter, the COA may require mitigation, including the planting of replacement trees, as a condition of permit approval (COA LDC 25-8-604). Removal of a protected tree (i.e. a tree with a diameter of 19 inches or greater) must be approved by permit issued by Planning and Development Review Department (COA LDC 25-8-621). Removal of a heritage tree (i.e. a tree with a diameter of 24 inches or greater and of a species specified in COA LDC 25-8-602) must be by approved variance to COA LDC 25-8-641 and by permit issued by Planning and Development Review Department (COA LDC 25-8-642).

The project survey that defines existing site conditions (see Figure F-1 in Appendix F) indicates there are no protected trees or heritage trees proposed to be removed or impacted by construction within the survey area. However, the preliminary design survey does not encompass the entire footprint of proposed improvements; therefore, a final design survey will be required of the entire project footprint that includes a survey of all trees to supplement the preliminary design survey.

Measures to protect trees from damage during construction are to comply with COA ECM Section 3.5 and are discussed in Section 6.1.13 of this report.

5.15 Environmental Mitigation

Mitigation for removal of trees of 8 inches or larger diameter is to comply with COA ECM Section 3.5.4. Tree mitigation efforts can include planting replacement trees, preserving or restoring natural areas, ecosystems or plant communities, providing a maintenance program for trees to be retained, requiring special construction techniques, and/or alternative mitigation proposals for enhancement of the urban forest (e.g. payment into the Urban Forest Replenishment Fund).

Mitigation for disturbance of existing CWQZ natural vegetation will be by re-vegetation using COA Standard Specification 609S Native Grassland Seeding and Plantings.

Mitigation for disturbance of existing wetlands, if wetlands are discovered, will be by wetland plantings at a ratio of 1:1 area of wetlands disturbed by construction.

5.16 Environmental Permitting Requirements

Following is a summary of the environmental permitting and approvals, including approvals discussed in the CMEC environmental assessment report (see Appendix D):

- The CMEC Environmental Report fulfills the COA requirements (LDC 25-8-121) for an environmental assessment. A Wastewater Report is not required, because no wastewater lines are proposed. However, because improvements are proposed to be constructed within the CWQZ, an Environmental Resources Inventory (ERI) report will be required during final design (Environmental Criteria Manual Section 1.3.0).
- COA Oak Wilt Prevention Policy must be followed for any tree trimming or removal of live oaks or red oaks.
- The Critical Root Zones of trees impacted by construction must be protected against damage (see COA ECM Section 3.5.2).
- Mitigation is required in the event of tree removal or if root zone or tree canopy disturbance by construction is too adverse.
- Any alterations allowed in the floodplain or CRWQ must be located, designed and maintained to retain the integrity of protected riparian areas and minimize damage to the physical and geological characteristics of such areas (see COA ECM Section 1.7.7.A). Re-vegetation criteria for all disturbed areas must comply with COA ECM Sections 1.4 and 1.5.
- The project can proceed under the authority of Nationwide Permit (NWP) #14, Linear Transportation Projects, if the project adheres to the permit's regional and general conditions. Because less than 0.1 acres of the water of the U.S. will be impacted as a result of the proposed project, pre-construction notification (PCN) will not be required. However, General Condition 18 might require a PCN if final design results in a potential to impact federally protected species.
- A Geologic Assessment and Water Pollution Abatement Plan (WPAP) must be prepared and approved by the TCEQ (30 TAC 213), because the proposed construction-related activities are located over the Recharge Zone of the Edwards Aquifer.
- The proposed project will likely disturb more than 1 acre but less than 5 acres. Under the Texas Pollutant Discharge Elimination System (TPDES) program, the requirements for such an area of disturbance include: development and implementation of a Stormwater Pollution Prevention Plan (SW3P), completion and posting of a site notice, and submission of the site notice to the Municipal Separate Storm Sewer (MS4) operators.

- Consultation and coordination with the Texas Historical Commission (THC) will be required during final design to resolve any potential historic and/or archeological resource issues.

5.17 Site Development Permit

City of Austin approval for construction of the McNeil Drive creek crossing approvals must be through the Site Development Permit (SDP) process, because there will be construction within the Critical Water Quality Zone and environmental variances will be required. The SDP process is specified in the COA LDC 25-5.

In conjunction with City of Austin SDP approval process, Capital Metropolitan Transportation Authority (CMTA) will be required for construction within the Red Line/Austin Northwestern rail line right-of-way. Construction within the CMTA right-of-way is discussed in Section 6.1.19.

SECTION 6 ALTERNATIVE LAYOUTS AND PRELIMINARY OPINIONS OF PROBABLE PROJECT COSTS

Clear-span bridge layouts and multiple-arch bridge layouts were developed for the McNeil Drive creek crossing improvement alternatives selected for preliminary design assessments. Roadway and clear-span bridge preliminary design layouts were developed for un-detained and detained flow conditions, for roadway embankment fill zone contained by retaining walls and uncontained within shoulder fill zones and for local traffic only for full two-way traffic control conditions. Engineer's preliminary opinions of probable project costs were prepared for the alternative layouts.

6.1 Alternative Layout Considerations

6.1.1 Preliminary Geotechnical Engineering Investigations and Recommendations

D+C geotechnical consultant Holt Engineering, Inc (Holt) conducted preliminary geotechnical engineering field investigations, bore-hole sampling, and laboratory testing and provided preliminary design recommendations for the clear-span bridge foundations. The preliminary field investigations included drilling, logging and sampling at four (4) bore-hole locations to a depth of 50 feet below existing grade. The top of limestone formation was generally found within 0 feet to 4.5 feet below the pavement surface. The top layer of the limestone formation was severely weathered. Preliminary laboratory testing of the bore-hole samples included moisture content, classification tests, and unconfined compression tests. The results of the field investigations and laboratory testing and the logs of borings are found in the Geotechnical Data Report in Appendix C.

Holt provided the following primary geotechnical engineering preliminary design recommendations in its Geotechnical Design Memorandum (see Appendix C):

- Support bridge abutments and interior bents on drilled shaft piers seated a minimum of 10 feet into the tan limestone. Drilled shaft piers can be seated a minimum depth of 15 feet below finished grade if sized for an allowable bearing value of 35,000psf.
- Extend drilled shaft piers at least 10 feet below the scour line of the creek channel bottom. Skin friction of 2,000psf may be used for that portion of the pier penetration into either tan or gray limestone rock but omitting the top 10 feet.
- Reinforced concrete spread footings for retaining walls should be seated a minimum of 24 inches into undisturbed tan limestone rock at a minimum depth of 36 inches below finished grade and sized for an allowable bearing value of 4,000psf. No fill should be placed under the bottom of footing if over-excavated.

- A shear key should be used with footings if needed to resist sliding and seated a minimum of 12 inches below bottom of wall footing. Lateral bearing value of 1,000psf on the face of the shear key should be used to resist sliding, and a friction factor of 0.4 applied on the bottom of footing to also resist sliding.
- Footings should be protected against scour or seated an additional 18 inches into rock if no scour protection is used.
- Retaining wall gravel envelope material should be uniformly graded crushed rock with a minimum size of ¾-inch with minimum thickness of 36 inches and extending to within 18 inches of top of wall.
- Retaining wall backfill material behind the gravel envelope should be low plasticity (P.I.<15) well graded granular soil with a maximum rock size of 4 inches (COA Class A Select Borrow) or flexible base material.
- Retaining walls should be designed for an equivalent fluid pressure of 45pcf for the active condition. Surcharge loading for vehicle or construction traffic is extra loading.
- All embankment and roadway fill should be low plasticity (P.I.<15) well graded granular soil with maximum rock size of 4 inches (COA Class A Select Borrow) or flexible base.
- Pavement thickness, based on average daily traffic of approximately 2,000 VPD and assuming low plasticity embankment fill/subgrade, is recommended to be:

Materials	**Min. Thickness**
Crushed Limestone Base	14.0”
HMAC	2.0”

6.1.2 Typical Clear-Span Bridge Section

D+C and D+C structural consultant Frank Lam & Associates, Inc. (FLA) developed a typical bridge section, in collaboration with COA Street & Bridge Department and Neighborhood Connectivity Department, that applies to all clear-span bridge alternatives (see Figure 6-1). The typical bridge deck section consists of a prefabricated single-tub girder bridge system for an overall bridge deck width of 46’-4” and two vehicle travel lanes for an overall vehicle travel lane width of 24 feet.

The COA Transportation Criteria Manual (TCM) Section 1.3.2.B.1 and Figure 1-27 (see Figure 2-1 in Section 2) require a minimum roadway width of 40 feet from curb face to curb face for a Residential Collector street. Construction of a bridge roadway width of 44 feet will not require an approved waiver to the COA TCM Section 1.3.2.B.1 if COA Street & Bridge Department considers the emergency shoulder/shared use lanes as part of the overall roadway width.

COA TCM Table 4-1 requires a pedestrian sidewalk along both sides of a Residential Collector with a 4-ft minimum width sidewalk. A dedicated pedestrian sidewalk is not proposed for the bridge, but the two 8-feet wide emergency shoulder/shared use lanes are proposed to serve as joint use lanes for emergency pull-over for vehicles to not block the bridge and for pedestrian and bicycle traffic. Construction of no raised dedicated pedestrian sidewalk on the bridge may require an approved waiver to TCM Table 4-1.

The 46'-4" wide clear-span bridge deck is integral with prefabricated single-tub steel girders, which are supported by 30-in x 30-in pier caps and 4-3-ft diameter columns/drilled shafts (see Figure 6-1). Maximum spacing of columns/drilled shafts (i.e. each bent) is 60 feet. The depths of drilled shafts are assumed to penetrate at least 10 feet into competent tan limestone and terminate at least 10 feet below the flow line grade of the creek channel for the drilled shafts adjacent to the creek channel (see Section 6.1.1 for Geotechnical recommendations). Figures 3-1 through 3-4 in Section 3 provide profile views of the bridge column and drilled shaft locations.

COA Street & Bridge Department recommended that the bridge rail be TxDOT C101. This bridge rail is not currently used by TxDOT, because its design speed rating is lower than normal design speeds of TxDOT bridges. However, Street & Bridge Department felt that the maximum 35 mph design speed of the proposed clear-span bridge fell well within the allowable range for a C101 rail. The cost estimates for bridge construction include using C101 rail as a temporary rail if temporary two-way through-traffic is routed across the half-completed bridge (see Section 6.1.18).

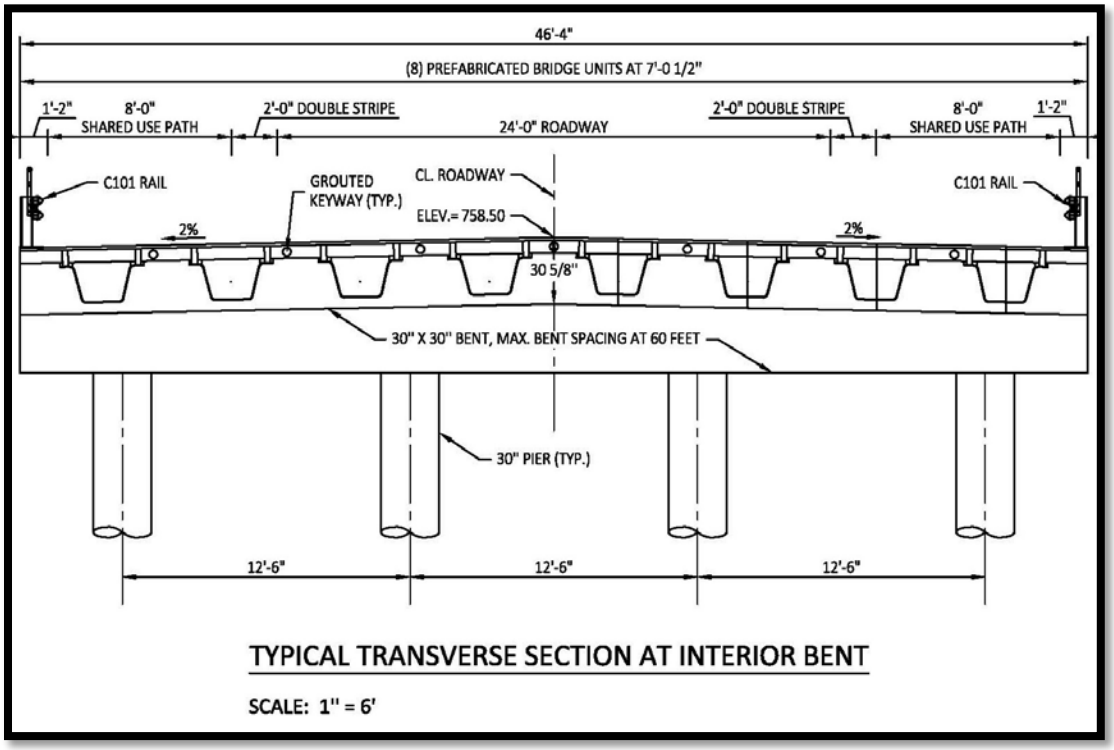


Figure 6-1 Typical Bridge Section

It should be noted if McNeil Drive is closed to two-way, through-traffic for the duration of construction for a maximum of 3 months (see Section 6.1.18), bridge construction will likely have to be accelerated, including the use of concrete strength accelerators in piers, columns, pier caps and retaining walls. Concrete strengths will be addressed during final design once traffic control restrictions are determined.

6.1.3 Permanent Bridge and Roadway Retaining Wall

At the bridge abutments and the alternative configuration where the roadway shoulder is contained by a retaining wall, a TxDOT RW(1H) cast-in-place retaining wall configuration was assumed for cost estimation purposes. See the roadway and bridge retaining wall alignments on Figures F-2 through F-9 in Appendix F.

6.1.4 Temporary Roadway Retaining Wall

The option for maintaining two-way through-traffic for the duration of construction (see Section 6.1.18 concerning temporary traffic controls) will require the temporary construction of roughly half of the embankment fill zones. A TxDOT RW(TEW) temporary earth retaining wall configuration was assumed for cost estimation purposes. See the roadway section Figure F-15 in Appendix F for the placement of the temporary retaining wall.

6.1.5 Roadway Horizontal and Vertical Curves

Horizontal Curve. There will be two horizontal curves: one in the bridge section and one in the embankment fill section at the west end of the project. The 300-ft radius horizontal curve was selected using COA TCM Section 1.3.1.B for a 30-mph design speed. The 300-ft radius best fits the centerline alignment of the existing right-of-way to minimize right-of-way acquisition costs for all alternatives.

Vertical Curves. There will be a combination set of sag/crest vertical curves at each end of the project where the new roadway ties back into the existing pavement. The roadway vertical curve and grade determination, common for all alternatives for creek crossing improvements, was based upon the following primary criteria and assumptions:

- COA TCM Figure 1-4: k = 50.0 for a crest vertical curve based upon a 35-mph design speed;
- COA TCM Figure 1-5: k = 34.9 for a sag vertical curve based upon a 25-mph design speed;
- adjust the vertical grade at the railroad crossing (see Section 6.1.19 for discussion of vertical intersection grades at the railroad crossing);

- include no vertical curve (or minimal vertical grade change) within the limits of the bridge requiring all vertical grade changes to occur between the railroad crossing and the east bridge abutment.

It should be noted that a 35-mph design speed within the vertical curves, especially approaching the railroad crossing, creates a vertical grade change that results in a roadway centerline profile that drops below the 100-year water surface level and creates vertical grade changes on the bridge. It is recommended that the posted speed on the bridge, and approaching the bridge, be maximum 25 mph.

It also should be noted that the preliminary design survey did not include a survey within the CMTA railroad right-of-way. The final design survey should extend across the railroad right-of-way to better define existing grades, especially at the tracks, that cannot be modified by construction of the embankment approach fill from the railroad crossing to the east bridge abutment.

Figures 3-1 through 3-4 in Section 3 provide vertical profile grade information for the roadway embankment approach sections and bridge crossing. Figures F-2 through F-9 in Appendix 9 provide horizontal alignment information.

6.1.6 Roadway Horizontal Taper

COA TCM equation 1-4 was used, based upon a 35 mph posted speed limit, 44-ft proposed roadway width at the bridge, and existing roadway widths at the ends of the pavement transition sections to calculate an approximate 205 feet horizontal taper length within which to transition from the 44-ft. pavement width at the bridge to existing pavement width of 24 feet at the west end of the project. The taper in the roadway section is proposed to be located in the emergency shoulder/shared use lanes (see Section 6.1.8).

The plan and profile drawings for the four alternatives, Figures F-2 through F-9 in Appendix F do not show the layout of the taper at the west end of the project. The taper should be configured during final design to include the transition from no existing shoulder to full 8-ft side emergency shoulder/shared use lanes at the bridge.

6.1.7 Roadway Width and Typical Cross-Section

The COA TCM Section 1.3.2.B.1 and Figure 1-27 require a minimum roadway width of 40 feet from curb face to curb face for a Residential Collector street (see Figure 2-1 in Section 2 of this report). Construction of a total embankment section roadway width of 44 feet at the bridge (face-of-rail to face-

of-rail) and tapering to existing roadway widths at the ends of the horizontal taper transitions may require an approved waiver to the COA TCM Section 1.3.2.B.1.

Two alternative configurations were assessed for embankment shoulder fill:

- shoulder fill is contained by a reinforced concrete cast-in-place retaining wall (see Section 6.1.8);
- shoulder fill is constructed within a 4H:1V sloped fill zone.

For either shoulder fill configuration, a standard embankment section TxDOT metal beam guard fence (e.g. TxDOT GF (31) – 14) is assumed to be installed along the edge of shoulder.

Geotechnical analyses and recommendations will be made for the roadway transition pavement sections as part of the final design assessments. For preliminary cost estimation purposes, it was assumed that the typical roadway pavement transition section consists of sub-grade preparation (including removal of existing roadway and topsoil), 18 inches of flexible base material, and 3 inches of HMAC Type C. It should be noted that the Geotechnical Engineer's recommendations for minimum pavement section is 14 inches of flexible base material and 2 inches of HMAC.

Roadway embankment section typical sections are shown on Figure F-13 in Appendix F.

6.1.8 Pedestrian Sidewalk along Roadway Section

A pedestrian sidewalk is not proposed to be constructed along the roadway embankment sections outside the bridge section. Two emergency shoulder/shared use lanes are proposed to provide pedestrian access along the embankment section. However, these two lanes will taper from the full 8-ft width to no width at the end of the taper where the existing pavement has no shoulder. The COA TCM Table 4-1 requires a pedestrian sidewalk along both sides of a residential collector with a 4-ft minimum width sidewalk. Construction of the roadway embankment sections without including raised pedestrian sidewalks along both shoulders might require an approved waiver to TCM Table 4-1.

6.1.9 Bicycle Lanes

COA Resolution No. 020418-40 requires the construction of bicycle facilities as defined in the Austin Bicycle Plan. The Austin Bicycle Plan currently does not show a bicycle facility aligned along McNeil Drive at the creek crossing. Even though the Austin Bicycle Plan does not require the construction of bicycle lanes along this segment of McNeil Drive, COA Street & Bridge Department and Neighborhood Connectivity Department desire the ability of cyclists and pedestrians to safely cross the bridge. The

typical bridge deck section includes two 8-ft wide emergency shoulder/shared use lanes adjacent to the two vehicle travel lanes that are intended for cyclist and pedestrian travel across the bridge.

6.1.10 Permanent Water Quality Controls

The proposed McNeil Drive creek crossing improvements are located within the Walnut Creek Watershed, which is classified as a Suburban Watershed, and are within the Recharge Zone of the Edwards Aquifer Zones. The COA Environmental Criteria Manual (ECM) Section 1.9.2.C requires treatment of storm water runoff from the new and re-developed impervious cover if the new and re-developed impervious cover created by the low-water crossing improvements exceeds 8,000 sf, as compared to the existing impervious cover (see discussion in Section 5.12 of this report). The existing impervious cover for each alternative is the existing pavement and low water bridge surface area within the footprint of the proposed limits of construction. The new and re-developed impervious cover for water quality treatment purposes includes the proposed pavement and new clear-span bridge surface areas, excluding the surface area of the multi-use shoulder lanes (COA ECM Section 1.8.1 excludes water quality treatment of multi-use pavement and sidewalks within the public right-of-way and ECM Section 1.9.4.B excludes water quality treatment for maintenance of existing roadway and driveway pavements) within the footprint of the proposed limits of construction for each alternative.

The TCEQ's Edwards Aquifer Program rules require the installation of permanent Best Management Practices (BMP) so that 80% of the incremental increase in the annual mass loading of Total Suspended Solids (TSS) from the site caused by the regulated activity is removed (30 TAC 213)

The largest footprint of the four alternatives has the following impervious cover information:

Total existing Impervious Cover in Project Area	20,857 sf
Total proposed Impervious Cover in Project Area	37,105 sf
Net Change in Impervious Cover in Project Area	16,248 sf

To satisfy TCEQ Edwards Aquifer Program requirements, the type and sizing of the permanent BMP will be based removal of the TSS loading from the incremental increase of impervious cover of 16,248 sf. To satisfy COA ECM requirements, the type and sizing of the permanent BMP will be based upon the amount of the 37,105 sf that is considered by the COA to be new and re-developed impervious cover.

Since the project is located within the Recharge Zone of the Edwards Aquifer, infiltration BMPs cannot be used because of the potential for the filtrate to contaminate the groundwater. The TCEQ's Technical Guidance Manual (Reference 3) indicates grassy swales (70% TSS removal efficiency), vegetative filter strips (85% TSS removal efficiency), sand filter system (89% TSS removal efficiency) and/or bioretention systems (89% TSS removal efficiency) are acceptable. This study assumes for preliminary construction

cost estimating purposes that water quality treatment of the runoff from the new and re-developed impervious cover will be provided by lined bio-filtration structures (e.g. rain gardens) constructed within the roadway shoulders outside the 100-year floodplain limits.

6.1.11 Creek Channel Stabilization Measures

Clear-span bridge columns/drilled shafts for the are proposed to be placed on either side of the creek channel (see Figures 3-1 through 3-4 in Section 3). This study assumes for preliminary construction cost estimating purposes that the creek channel will not be improved for flood conveyance purposes but assumes that the creek channel banks will be stabilized with rock riprap adjacent to the column/drilled shaft locations to prevent loss of limestone formation material from around the drilled shafts to comply with the Geotechnical recommendations for the drilled shafts (see Section 6.1.1). During final design, value engineering will be performed to compare the cost of deepening the drilled shafts versus the cost of stabilizing the creek channel and the cost of providing riparian or wetland mitigation for disturbing the creek channel to install the stabilization measures (see Section 6.1.12).

6.1.12 Wetland and Riparian Mitigation

This study assumes for preliminary construction cost estimating purposes that the stabilization of creek channel to protect the bridge drilled shafts (see Section 6.1.11) and/or demolition of the existing low water crossing bridge structure might impact existing wetlands and/or riparian vegetation along Tributary 9. Wetland and/or riparian vegetation mitigation plantings may be required in addition to the use of native seeding within the Critical Water Quality Zone. An environmental assessment of wetland and riparian mitigation requirements will be required during final design based upon the final improvement configuration. It should be noted that wetlands were not found during the CMEC preliminary environmental site reconnaissance (see Section 5.2).

6.1.13 Tree Protection and Removal

Construction of the clear-span bridge and roadway transition sections will impact existing trees. During construction some trees will be removed that are in direct conflict with construction, some trees will be trimmed to prevent construction damage and to provide proper clearances along the roadway and access-ways, and all trees remaining in place will be protected with tree protection fencing along the limits of construction and construction access-ways. Table 6-1 summarizes the existing trees to be removed for each alternative.

Table 6-1 Summary of Existing Trees to be Removed

Alternative	Total Caliper Removed (in.)
Alternatives with Retaining Wall	2,276.7
Alternatives with Fill Slopes under Undetained Flow Conditions	3,018.8
Alternatives with Fill Slopes under Detained Flow Conditions	3,277.3

This study assumes for preliminary project cost estimating purposes that the removed trees will be mitigated at a ratio of 1:1 caliper-inches regardless of tree size (over 8" caliper) at a cost of $200 per caliper-inch in accordance with the COA ECM Section 3.5.4. It should be noted the limits of proposed construction of the alternatives extend beyond the limits of survey of the existing trees. The tree removal values of Table 6-2 were prorated based upon the tree removal within the footprints of the alternative configurations within the tree survey areas.

6.1.14 Temporary and Permanent Erosion and Sedimentation Controls

Construction of the clear-span bridge and roadway transition sections will create sedimentation and could accelerate erosion processes from the disturbed ground surfaces. Temporary erosion and sedimentation controls will be designed, installed and maintained in accordance with the COA ECM Section 1.4.0. Temporary erosion and sedimentation control strategies will include mulch, soil retention blankets, rock berms, silt fences, temporary grassing, and stabilized construction entrances.

Permanent erosion and sedimentation controls will include rock riprap in the drainage ditches (see Section 6.1.13), topsoil replacement, native grassland seeding and plantings over disturbed ground surfaces within the Critical Water Quality Zone (CWQZ), and non-native seeding over disturbed ground surfaces outside the CWQZ.

6.1.15 Local Storm Drain Improvements

The existing McNeil Drive local storm drain system consists of open shoulder ditches without curb and gutters. The roadway transition section is proposed to be constructed without curb and gutters and to maintain the open shoulder ditches with capacity to convey the fully developed 25-year storm event flows (Q25) without inundating the road section and to contain the fully developed 100-year storm event flows (Q100) within the right-of-way as required by COA DCM Section 1.2.2. The shoulder ditches

will be stabilized with combinations of vegetation, soil retention blanket and rock riprap depending upon the imposed shear stresses.

The predominant drainage patterns along the roadway and bridge parallel the roadway to flow to the creek so that the primary drainage areas contributing runoff to the proposed drainage ditches are the roadway surface and right-of-way. A standard shoulder ditch of 3-ft bottom width and up to 2 feet in depth should have adequate Q25 and Q100 conveyance capacity. The configurations of the proposed shoulder ditches will be adjusted during final design to accommodate water quality treatment structures (see Section 6.1.10).

6.1.16 Local Access

Construction of the creek crossing will impact access to three private driveways (see Figures F-2 through F-9 in Appendix F). Access to these three private driveways must remain open to local traffic and to emergency vehicles at all times. This study assumes for preliminary construction cost estimating purposes that the private driveways will be re-aligned and reconstructed with HMAC pavement of the right-of-way and reconstructed with COA Type 1 reinforced concrete driveways in the right-of-way to match new roadway grades.

The alignments of the local access driveways, shown on Figures F-2 through F-9 in Appendix F, are based upon the assumption that driveway relocations are constructed outside the new right-of-way and utility easements and intersect with the reconstructed roadway west of the bridge where fill height is minimal so that a driveway ramp onto the roadway is of reasonable height.

6.1.17 Utility Conflicts

Construction of the McNeil Drive roadway, bridge and creek crossing improvements will impact the following existing utilities (see Figures F-1 through F-9 in Appendix F):

Power and Telecommunications Lines. There are existing aerial power and telecommunications lines sharing the same poles, aligned along the McNeil Drive right-of-way. Construction of the roadway and bridge improvements will require relocation of the power and telecommunications lines and poles and their service drops to the private residences.

Wastewater Mains. An existing 18-inch north-south wastewater main is aligned along the west railroad right-of-way boundary line. It is assumed that a section of this wastewater main will be encased where it crosses under the proposed embankment retaining wall footings. There are no existing east-west wastewater mains or services along McNeil Drive within the project area. An existing 8-inch wastewater

main ends at a manhole in McNeil Drive approximately 250 feet to the west of the proposed west end of the project. This preliminary design assessment assumes that the private residences along the roadway improvements have private septic systems that will not be impacted by this project. This assumption is to be confirmed by survey and site reconnaissance during final design.

8-inch Water Main. There is an existing 8-inch water main aligned along McNeil Drive that provides domestic water service to the existing residences along the roadway and provides fire flow to two existing fire hydrants. Construction of the roadway improvements will require the water main to be relocated outside the limits of construction within a new water easement (see Section 6.1.21). For preliminary cost estimation purposes, it is assumed that all domestic water meters and fire hydrants will be relocated and that water mains and domestic services routed under compacted fill or under retaining walls will be encased. Water system improvements must be designed and constructed in accordance with COA Utility Criteria Manual.

Utility coordination with Austin Energy, AT&T, and Austin Water (AW) will continue during final design as part of the AULCC coordination process (ROWID 11925255).

6.1.18 Temporary Traffic Controls

This study assumes two primary alternative temporary traffic control assumptions for preliminary cost estimation purposes:

McNeil Drive open only to local traffic. Under this assumption, during construction, McNeil Drive within the limits of construction is closed to all two-way, through-traffic and is open only to construction and local traffic. See Section 6.1.16 for discussion of local access. It should be noted that Austin Fire Department (AFD) has requested that the maximum length of shutting McNeil Drive to through-traffic to be 3 months. To provide local access to the private residences throughout the construction duration, the driveways are assumed to be relocated at the beginning of construction and access to the driveways is maintained at the west end of the project. Signage will be required on the MoPac Access Road and on McNeil Drive west of the project to indicate the road is closed to all but local traffic during construction and to detour traffic around this closed section of roadway. It is anticipated that as much of the project will be constructed as possible before closing the road to through-traffic to close McNeil Road for no longer than 3 months. During this initial construction period, before road closure, concrete traffic barricades will likely be installed along significant sections of the roadway to allow as much of the improvements to be constructed as close to the roadway as possible before closing the roadway. McNeil Drive will be closed to through-traffic when bridge construction and/or embankment fill prevents the safe flow of traffic through the site. Figure F-16 in Appendix F shows full road closure plan and alignments of the private driveways.

McNeil Drive open to through traffic. Under this assumption, during construction, McNeil Drive remains open to tow-way, through-traffic for the duration of construction, except for very short-duration road closures such as for traffic control lane shifting and setting pre-fabricated bridge deck sections. Signage will be installed on MoPac Access Road and on McNeil Drive west of the project to warn traffic of impending construction conditions and for lane shifting between the two phases of construction and at the end of the second phase of construction. To maintain two-way, through-traffic at all times, it is assumed that McNeil Drive is temporarily widened along its south shoulder, and the two traffic lanes are shifted to the south to allow construction of essentially the north half of the bridge and embankment sections as Phase 1 (see Figure F-14 in Appendix F). Construction of the north half of the project requires the installation of concrete barriers along the entire shoulder of the widened roadway at grade to allow construction of the north half of embankment and bridge as close to the roadway as possible. All of the embankment/roadway section between the railroad crossing and east bridge abutment is constructed during Phase 1 to provide a safe, temporary intersection at the west side of the railroad crossing so that traffic is shifted back to an alignment that is compatible with the intersection configuration on the east side of the railroad crossing. Figure F-15 in Appendix F shows the temporary Phase 1 roadway section using an MSE soil retention wall. At the beginning of Phase 2, two-way traffic is shifted to the completed north half of the embankment and bridge (see Figure F-14 in Appendix F). This traffic shifting allows the south half of the embankment and bridge to be constructed. During Phase 2, temporary railing is installed along the south shoulder of the embankment and bridge to provide a safe barrier along the relatively narrow short-term travel lane.

In addition to re-aligning and reconstructing the private driveways, the temporary traffic controls will include standard temporary traffic control strategies, including temporary striping and signage, flagging operations, and traffic/lane shifting.

6.1.19 Construction at the Intersection with Red Line/Austin Northwestern Rail Line

The very close proximity of the east abutment of the proposed bridge to the Capital Metropolitan Transportation Authority (CMTA) railroad right-of-way and the required grade controls at the railroad intersection (discussed in Section 6.1.5) requires roadway improvements to extend into the CMTA railroad right-of-way and to be within the 25-ft wide “Foul Zone” of the closest rail. Construction within the railroad right-of-way will require close coordination with CMTA and strict compliance with CMTA safety and security requirements. Probable construction restrictions within the railroad right-of-way include use of flagmen, scheduling work around the CMTA train schedule, and temporary vacation of the right-of-way during train passage. Railroad right-of-way work zone restrictions will be defined during final design in cooperation with CMTA.

6.1.20 Construction Duration

The estimated duration of construction, from mobilization to the site to fully opening the roadway and bridge to two-way traffic depends upon whether McNeil Drive is to remain open or closed to two-way, through-traffic curing construction or is to remain open only to local traffic.

McNeil drive open only to local traffic. If McNeil Drive is to remain open only to local traffic during construction, it is estimated that the total construction duration will be approximately 6 to 8 months, because Austin Fire Department requested that the roadway be closed to two-way, through-traffic for no longer than 3 months. Major elements of construction will have to be accelerated and as much of the project constructed before the roadway is closed (see Section 6.1.18).

McNeil Drive open to two-way, through-traffic. If McNeil Drive is to remain open to two-way, through-traffic during construction, it is estimated that the total construction duration will be approximately 9 to 11 months. Constructing the project in two phases adds 3 months to the duration of the project as compared to closing the roadway to all but local traffic.

6.1.21 Land Acquisition

Construction of the roadway improvements will require widening of the existing right-of-way, relocation of power/telecommunication lines and poles, water main and water service connections within new utility easements, and potentially, a house buy-out. The preliminary design alignments of proposed right-of-way and utility easement acquisition are shown on Figures F-11 and F-12 in Appendix F, under the following assumptions:

- Right-of-way is widened to accommodate the embankment fill zones, retaining walls and shoulder drainage ditches (see Figure F-13 in Appendix F for typical sections);
- Power/telecommunication lines and water main utility relocations are aligned outside of, but adjacent to, the widened right-of-way to route the utility relocations outside the footprint of the roadway improvements;
- Power/telecommunication lines and poles are aligned within a 15-ft wide electric easement;
- Water main is aligned within a 15-ft wide water easement.
- If the embankment shoulder is constructed with 4H:1V sloped fill, the residential structure at 3501 McNeil Drive (TCAD #379087) will be located within the footprint of the widened roadway right-of-way and of the embankment fill and must be purchased and demolished.

Table 6-2 summarizes the right-of-way and utility easement acquisition areas for the alternatives.

Table 6-2 Right-of-Way and Utility Easement Acquisition Areas

Alternative	ROW Area (SF)	Electric Easement Area (SF)	Water Easement Area (SF)	Total Land Acquisition Area (SF)
ALT 1U/2U with Fill Retaining Wall	19,972	9,994	9,683	39,649
ALT 1U with Fill Side Slopes	36,827	10,303	9,890	57,020
ALT 1D with Fill Side Slopes	42,093	10,247	9,954	62,294

Right-of-way and utility easements will be adjusted during final design, based upon the final design configuration of the roadway and bridge improvements and coordination with the utility providers.

6.2 Engineer's Preliminary Opinions of Probable Project Costs

Engineer's preliminary opinions of probable project costs were developed for alternatives for improvements to the McNeil Drive crossing at Tributary 9 of Walnut Creek. Quantities for the preliminary opinions of probable construction costs are based on the preliminary layouts and assumptions discussed in Section 6.1 of this report. Construction unit costs are based on recently bid COA and TxDOT projects and from the bridge manufacturer. Engineering, surveying (design and easements), permit fees, and printing costs are based upon recent D+C civil projects with the COA. City administrative costs were provided by the COA on a recent similar project. Right-of-way, easement and house buy-out acquisition costs were based upon property values reported on the Travis County Appraisal District (TCAD) WEB site, and appraisal and survey costs were based on input from COA Real Estate Division on a recent similar project. Final design and construction costs will be impacted by the alternative selected by the COA for implementation. Construction costs will also be impacted by the findings of the supplemental geotechnical and environmental assessments and design surveys of the project site to be performed during the final design phase. A summary of the preliminary opinions of probable project costs is provided in Table 6-3.

Table 6-3 Summary of Engineer's Preliminary Opinions of Probable Project Costs

Alternative	Fill Retaining Wall	Fill Slopes	Closed to Thru Traffic	Open to Thru Traffic	Preliminary Opinion of Probable Project Cost
ALT 1U	X		X		$5,631,047
ALT 1U	X			X	$6,824,486
ALT 1U		X	X		$5,710,532
ALT 1U		X		X	$7,723,682
ALT 1D	X		X		$5,399,421
ALT 1D	X			X	$6,676,632
ALT 1D		X	X		$5,587,351
ALT 1D		X		X	$6,979,888
ALT 2U	X		X		$8,998,344

Detailed preliminary opinions of probable project costs and information for the creek crossing improvements alternatives are provided in Appendix G.

Table 6-3 illustrates the following findings with respect to cost:

- A clear-span bridge is about $3.3 million less expensive than a multiple-arch bridge. Because of this cost differential, the COA concurred with D+C that the cost estimates should concentrate on the clear-span bridge alternative with no further consideration of the multiple-arch bridge configuration.
- The least costly clear-span bridge alternative has embankment retaining walls and is closed to two-way, through-traffic during construction.
- A clear-span bridge with fill slopes has approximately $100,000 higher cost than a clear-span bridge with retaining walls. This cost differential is within the accuracy of the cost estimates; therefore, the cost of providing retaining walls versus the cost of providing fill slopes should be considered roughly equivalent.
- Maintaining two-way, through-traffic for the duration of construction adds approximately $1.2 million to the project cost, as compared to closing McNeil Drive to all but local traffic during construction.

SECTION 7 SUMMARY OF PRELIMINARY FINDINGS AND RECOMMENDATIONS

7.1 Summary of Findings

Table 7-1 provides a summary of the primary preliminary design findings of alternatives to improve the McNeil Drive crossing at Tributary 9 of Walnut Creek. Preliminary design hydraulic analyses were performed for clear-span bridge, multiple-arch bridge and multiple-box bridge configurations to size the span lengths under 100-year flood event undetained-flow conditions and 100-year flood event detained flow conditions, under the primary assumption that the peak 100-year water surface elevation will not overtop the bridge deck level. Undetained 100-year flow conditions were taken from the City of Austin (COA) effective HEC-HMS hydrologic model for Tributary 9 of Walnut Creek. Detained 100-year flow conditions were taken from the Miller Gray Engineering firm's hydrologic model for proposed expansion of the detention facility at the ICU Medical site at the northwest corner of the Howard Lane and MoPac Access Road intersection. Once the bridge span lengths were determined under undetained flow and detained flow conditions, clear-span bridge layouts were developed under variable assumptions of embankment section compacted fill (retaining wall to confine the fill versus 4H:1V shoulder fill slopes) and under variable traffic control conditions during construction (closing the roadway to all but local traffic versus maintaining two-way, through-traffic). Because the estimated total cost for a multiple-arch bridge under undetained flow, embankment section retaining wall, and roadway closure to all but local traffic conditions exceeded the cost for a clear-span bridge under similar layout conditions/constraints by about $3.37 million, no further preliminary design assessments of multiple-arch or multiple-box bridges were performed.

Following are the significant preliminary design findings that are discussed in the body of this report with respect to a clear-span bridge:

1. Under 25-year and 100-year undetained and detained flow conditions, the clear-span bridge does not adversely impact existing 25-year or 100-year water surface elevations upstream or downstream of the creek crossing. This condition was a primary constraint on the sizing of the bridge configuration, because there are no drainage easements along Tributary 9 of Walnut Creek, except at the roadway right-of-way crossings.

2. A single-tub prefabricated bridge deck system provides the most efficient bridge deck thickness versus maximum allowable bridge bent spacing versus freeboard of the low chord of the bridge deck above the peak 100-year water surface elevation. The single-tub prefabricated bridge deck has a thickness of 30-5/8 inches with a maximum bridge bent spacing of 60 feet. The freeboard of the low chord above the peak 100-year water surface elevation is approximately 2.9 feet.

3. The project is located within the Walnut Creek Watershed, which is classified by COA as a Suburban Watershed. Tributary 9 has a FEMA regulatory 100-year floodplain and a COA fully-

developed conditions 100-year floodplain. Since the creek has a Suburban Watershed classified, the creek has a Critical Water Quality Zone (CWQZ) that is bound by 300 feet either side of the creek channel centerline. The COA has development and land-disturbing restrictions within the 100-year floodplains and the CWQZ.

4. Tributary 9 of Walnut Creek is the only regulated water body within the project area. The creek is defined as a "waters of the U.S." The preliminary design environmental field investigation found no wetlands, springs or hydrophytic vegetation.

5. The project is located within the Recharge Zone of the Edwards Aquifer. Construction of the roadway and crossing improvements is defined as a regulated activity under the Edwards Aquifer Rules to prevent pollution of the Edwards Aquifer. Permanent and temporary Best Management Practices (BMP) will have to be used to prevent pollution of the Edwards Aquifer and to remove Total Suspended Solids (TSS) created by the proposed roadway and bridge improvements. The preliminary design environmental field investigation found no surface evidence of recharge or karst features, though the Edwards Limestone Formation outcrops at the west end of the project.

6. The project is located within a zone of potential karst features with potential occurrence of karst invertebrate habitat. The preliminary design environmental field investigation found no surface evidence of karst features; however, there is the potential that sub-surface karst features exist that might be exposed by excavations during construction of this project.

7. The preliminary design environmental field investigation found no signs of rare or protected vegetation types or wildlife species or habitat for such rare or protected species.

8. The project will likely impact riparian vegetation along the creek channel and will remove trees. Mitigation of loss of riparian vegetation and of trees will be required.

9. The preliminary design environmental field investigation and data research found no occurrences of Critical Environmental Features (CEF) within 150 feet of the footprint of the improvements for this project.

10. The preliminary design environmental field investigation and data research found no occurrences of cultural resources that would require remediation under the Antiquities Code; however, consultation with the Texas Historical Commission and with the U.S. Army Corps of Engineer's Regulatory Archaeologist might be required during final design.

11. The roadway and bridge pavement improvements will create new and/or redeveloped impervious cover. Both the COA and the TCEQ (under Edwards Aquifer Rules) requires permanent water quality treatment (Best Management Practices) of the runoff from the new and/or redeveloped impervious cover. Potential permanent BMP strategies include combinations of grass swales, vegetative filter strips, san filter system and/or bioretention system.

12. Formal permit approvals for this project will include: COA Site Development Permit, TCEQ approval of the Edwards Aquifer Program Water Pollution Abatement Plan (WPAP), and Capital Metropolitan Transportation Authority (CMTA) approval to construct within the railroad right-of-way.

13. The project can proceed under the authority of Nationwide Permit (NWP) #14, Linear Transportation Projects, if the project adheres to the permit's regional and general conditions.

14. During final design, consultation will be required with the Texas Historical Commission.

15. Notice of Intent (NOI) will have to be submitted to the Municipal Separate Storm Sewer (MS4) operators.

16. The bridge piers and embankment retaining wall footings are to be founded within the tan limestone rock formations.

17. The pavement design section is a minimum of 14 inches of flexible base and 2 inches of HMAC.

18. Vertical curve and grade restrictions, especially at the CMTA railroad crossing, requires the bridge deck centerline to be at elevation 758.50 and requires roadway improvements to extend into the CMTA railroad right-of-way and within the "Foul Zone" of the closest track to the project. CMTA will have construction, safety and security restrictions while working within the right-of-way.

19. The proposed bridge typical bridge deck section is 46'-4" width and is comprised of the following elements: two 12-ft vehicle travel lanes, two 2-ft shoulder double-striping zones, two 8-ft emergency shoulder/shared use lanes, and two 1'-2" bridge railing zone.

20. The proposed roadway section outside the bridge deck is 44-ft width and is comprised of the following elements: two 12-ft vehicle travel lanes and two 10-ft emergency shoulder/shared use lanes.

21. A raised pedestrian sidewalk or dedicated bicycle lane is not proposed along the bridge or shoulders of the road, because Street & Bridge Department is following TxDOT protocol of providing an emergency shoulder lane adjacent to the travel lanes on its bridges. Street & Bridge Department proposes the emergency shoulder lanes also serve as shared use for pedestrian and bicycle traffic.

22. Local access to the private residences along the roadway improvements must be maintained at all times. The existing private driveways will be relocated and reconstructed to intersect the new roadway on the west side of the bridge.

23. Roadway and bridge improvements will require relocation of an existing 8-inch water main with associated domestic service to the private residences and feed to two fire hydrants and relocation of an existing pole line that supports power and telecommunications lines. An existing 18-inch wastewater main, aligned north-south along the west railroad right-of-way boundary line, will be protected with encasement where it crosses under the proposed embankment retaining walls between the creek crossing and railroad crossing. No central wastewater service or mains exist along McNeil Drive within the project site. On-site private septic systems are assumed to be located on the properties bounding the project site which may have to be relocated.

24. Austin Fire Department requested that the maximum length of closure of McNeil Drive to two-way, through-traffic be 3 months. If McNeil Drive is closed to two-way, through-traffic for up to 3 months, then as much of the project must be constructed prior to closing the roadway and

significant elements of construction will have to be accelerated including the use of concrete strength accelerators.

25. If McNeil Drive remains open to two-way, through-traffic during construction, then the project must be constructed in at least two phases of work and traffic shifting: Phase 1 is widening the existing roadway to shift traffic to the south to allow construction of at least half of the embankment fill zone and bridge, and Phase 2 is shifting traffic onto the half-section of embankment section and bridge to allow construction of the remaining half of the project.

26. The embankment and bridge improvements will require the acquisition of additional right-of-way, electric easements and water easements. The area of land acquisition and buy-out of the residential structure at 3501 McNeil Drive will depend upon the footprint of the proposed improvements and utility relocations.

27. The primary findings with respect to the Engineer's preliminary opinion of probable project cost are as follows:

- A clear-span bridge is about $3.3 million less expensive than a multiple-arch bridge. Because of this cost differential, the COA concurred with D+C that the cost estimates should concentrate on the clear-span bridge alternative with no further consideration of the multiple-arch bridge configuration.
- The least costly clear-span bridge alternative has embankment retaining walls and is closed to two-way, through-traffic during construction.
- A clear-span bridge with fill slopes has approximately $100,000 higher cost than a clear-span bridge with retaining walls. This cost differential is within the accuracy of the cost estimates; therefore, the cost of providing retaining walls versus the cost of providing fill slopes should be considered roughly equivalent.
- Maintaining two-way, through-traffic for the duration of construction adds approximately $1.2 million to the project cost, as compared to closing McNeil Drive to all but local traffic during construction.

7.2 Summary of Recommendations

The following recommendations are made respect to the preliminary design evaluation findings:

1. A clear-span bridge configuration with a single-tub prefabricated bridge deck system is the recommended alternative.

2. Since the cost of containing the embankment fill with a retaining wall is roughly equivalent to the cost of using a shoulder fill zone on a 4H:1V slope, the use of either configuration should be based upon reducing the footprint of proposed construction, reducing land acquisition, reducing impact to the local residences, and reducing construction duration, especially with respect to Austin Fire

Department request to close McNeil Drive to two-way, through-traffic for no longer than 3 months.

3. Since the cost to maintain two-way, through-traffic during construction adds approximately 3 months to construction duration and $1.2 million to the construction cost, it is recommended that McNeil Drive be close to all but local traffic during construction, but up to a maximum duration of 3 months, as requested by the Austin Fire Department.

4. The results of these preliminary design evaluations are contingent on the design criteria and project considerations documented in this report. When the COA selects the preferred alternative and final design details are established, the hydraulic models and opinion of probable construction cost of the selected alternative need to be refined. The COA current effective hydraulic model for fully developed land use (ultimate) conditions will have to be refined with the proposed design configuration to confirm that the proposed improvements do not create an adverse impact to the 25-year and 100-year water surface levels within the creek.

5. This preliminary design assessment included four geotechnical engineering boreholes, with associated testing and bore logs, at the proposed clear-span bridge crossing site. Supplemental final design geotechnical investigations, laboratory testing and design recommendations are needed for all proposed bridge drilled shaft locations, bridge and embankment retaining wall footing locations, pavement reconstruction, and roadway embankment and retaining wall backfill.

6. This preliminary design assessment included a preliminary environmental constraints assessment, based upon the assumed maximum footprint of proposed improvements. The preliminary environmental constraints findings need to be confirmed during final design with respect to the final selected configuration, especially with respect to identification of environmental impacts, Critical Environmental Features, recharge and karst features, and required environmental mitigation.

7. This preliminary design assessment included a limit of site survey that does not encompass the entire footprint of proposed improvements. Final design surveys will be required to supplement the preliminary design survey to encompass the footprint of all proposed improvements and to define all trees, structures, septic systems and surface features within the project area.

8. This preliminary design assumed central wastewater service is not provided to the private residences along the roadway improvements but that the private residences are on septic systems. Final design investigations will be required to define the locations of the septic systems and to confirm that the proposed improvements do not impact the septic systems.

9. This preliminary design assumed the electric and water easement widths are 15 feet. Coordination with utility providers will be required to define easement and relocation requirements.

Table 7-1
Summary of Preliminary Design Findings

Alternative	Bridge Type	Detention (Yes/No)	Bridge Span (FT)(1)	Deck/Pavement Elev. (FT-MSL)	100-Yr Peak WSEL (FT-MSL)	Fill Retaining Wall	Fill Slopes	Closed to Thru Road	Open to Traffic	Land Acquisition (SF)(2)	Total Cost
1U	Clear Span	No	300	758.50	752.57	X		X		39,649	**$5,631,047**
1U	Clear Span	No	300	758.50	752.57	X			X	39,649	**$6,824,486**
1U	Clear Span	No	300	758.50	752.57		X	X		57,020	**$5,710,532**
1U	Clear Span	No	300	758.50	752.57		X		X	57,020	**$7,236,682**
1D	Clear Span	Yes	230	758.50	752.09	X		X		62,294	**$5,399,421**
1D	Clear Span	Yes	230	758.50	752.09	X			X	62,294	**$6,676,632**
1D	Clear Span	Yes	230	758.50	752.09		X	X		62,294	**$5,587,351**
1D	Clear Span	Yes	230	758.50	752.09		X		X	62,294	**$6,979,888**
2U	Multiple Arch	No	320	758.50	752.22	X		X		39,649	**$8,998,344**
2D	Multiple Arch	Yes	210	758.50	751.58						
3U	Multiple Box	No	340	758.5							

Notes:
(1) Multiple-arch or multiple-box bridge "span" length is the horizontal distance from the first arch or box through the last arch or box.
(2) Land acquisition includes acquisition for new right-of-way and utility easements (electric and water).

Appendix A

References

References

City of Austin

"Preliminary Investigation Report for Flood Issues at the McNeil Drive Low Water Crossing", Draft, February 2015.

U.S. Department of Transportation, Federal Highway Administration

"Railroad – Highway Grade Crossing Handbook", Revised Second Edition August, 2007.

Texas Commission on Environmental Quality

"Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices", Revised July 2005.

Appendix B

Hydraulic Cross Section Plan Layout

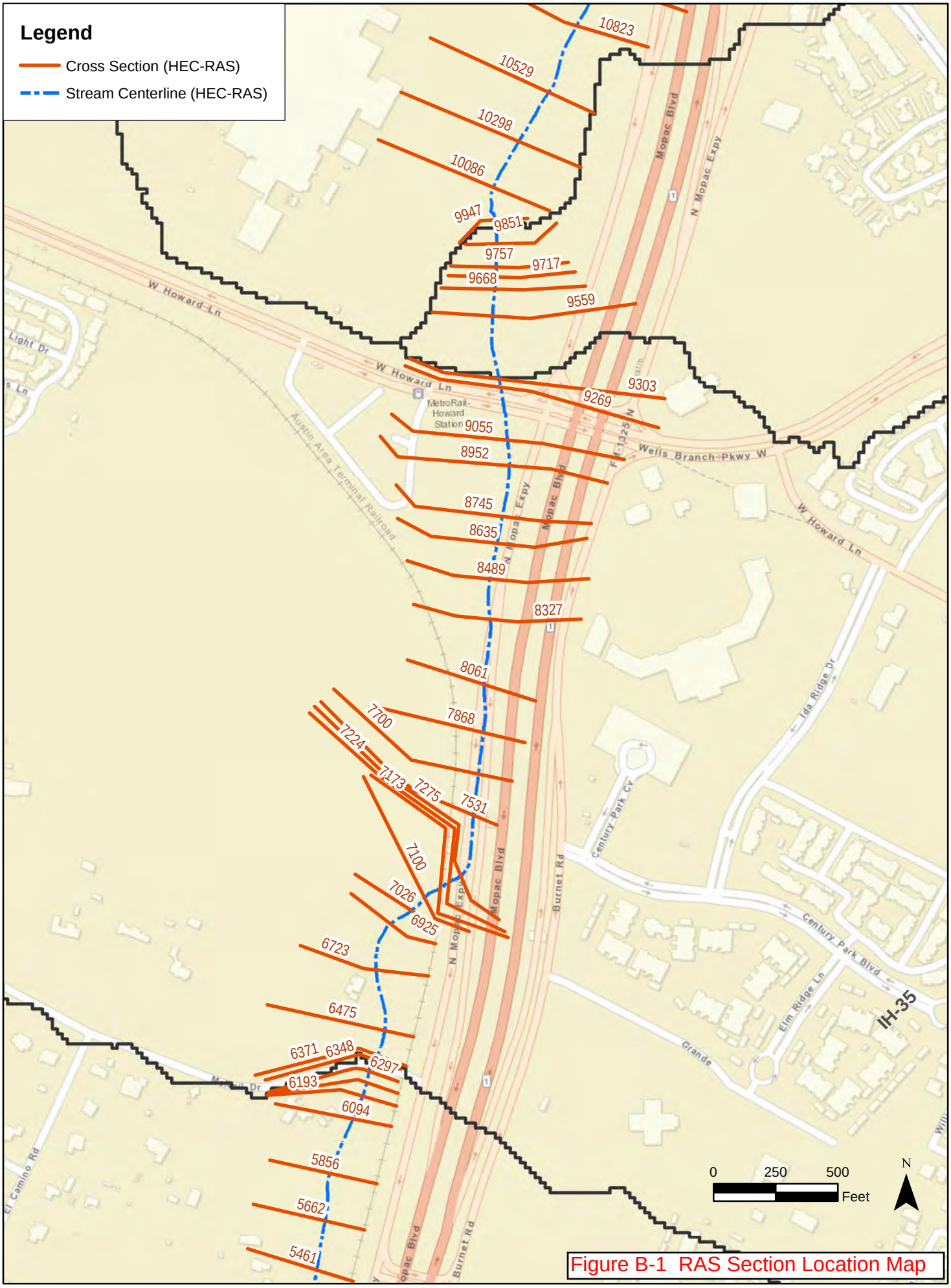


Figure B-1 RAS Section Location Map

Appendix C

HEC-RAS Technical Report

Crespo Consulting Services, Inc.
Civil & Environmental Engineering

City of Austin Watershed Protection - McNeil Drive at Walnut Creek Tributary 9

Technical Report

Hydraulic Model Update and Bridge Alternative Modeling

September 20, 2018

Scope of Work

Crespo performed HEC-RAS modeling to evaluate improvement needed to address flooding issues at the McNeil Drive at Walnut Creek Tributary 9. The modeling work included revising the City of Austin (COA) existing effective HEC-RAS model to incorporate new survey data and modeling four alternative bridge configurations. The City of Austin 25-year and 100-year future flows were utilized for the alternatives analysis simulations. Crespo addressed comments made during the review of the models and provided output summary tables along with the models.

Methodology

The following is a summary of the overall methodology.

1. The FEMA effective and City Future models were obtained from the City of Austin.
2. The FEMA Effective Walnut Creek model geometry was utilized.
3. The FEMA flows and the City Future 25-year and 100-year flows were included in the HEC-RAS flow file. The Future 25-year and 100-year flows were utilized for the alternatives analysis.
4. Based on the project survey performed by MWM Design Group, completed in June 2017, five cross sections in the HEC-RAS model geometry were revised. These sections include two upstream and two downstream of the low-water crossing and one on the bridge deck.
5. For the existing conditions, the internal sections for McNeil Drive were updated with the survey data and field visit data obtained by Crespo in the Bridge Editor to more accurately represent the low-water structure openings.
6. A 20-degree skew was included for the bridge since the road crosses the creek at an angle.
7. Two initial alternatives were provided to Crespo for analysis to determine which bridge types should be assessed further. The results of this were compared to the revised existing conditions.
8. The alternatives included four design plans provided by Doucet and Chan that were analyzed with HEC-RAS. The four plans varied in length and bridge type for existing and detained flows.

9. The water surface elevations were compared to the existing bridge for the 25-year and 100-year future flows.

Alternatives

The four following bridge alternatives were developed in HEC-RAS:

ALT 1 – 300-ft clear span Bridge without upstream detention
ALT 2 – approximate 300-ft Arch Bridge without upstream detention
ALT 3 – 230-ft clear span Bridge with upstream detention
ALT 4 – approximate 230-ft Arch Bridge with upstream detention

The modeling included adjustments by Crespo for the presumed grading for the alternatives 2 and 4 associated with matching the flowlines of the arches. Additional grading may be required upstream and downstream of the bridge as a transition from natural ground.

For alternatives 3 and 4, the 25 year flows were estimated based on the 100 year reductions.

Alternative 2 results in a 0.02 ft WSEL increase at XS 6475 and a 0.1 ft WSEL increase at XS 6297. The increase is not improved by the adding additional grading to the areas directly upstream and downstream of the bridge.

Appendices

Appendix 1 - ALT 1 – 300-ft clear span bridge without upstream detention HEC-RAS Results
Appendix 2 - ALT 2 – approximate 300-ft Arch Bridge without upstream detention HEC-RAS Results
Appendix 3- ALT 3 – 230-ft clear span bridge with upstream detention
Appendix 4- ALT 4 – approximate 230-ft Arch Bridge with upstream detention
Appendix 5- Profile Plot comparing Existing and Alternatives 1, 3
Appendix 6- Profile Plot comparing Existing and Alternatives 2, 4
Appendix 7- Cross Section comparing Existing and Alternative 1 Bridge Upstream
Appendix 8- Cross Section comparing Existing and Alternative 2 Bridge Upstream
Appendix 9- Cross Section comparing Existing and Alternatives 3 Bridge Upstream
Appendix 10- Cross Section comparing Existing and Alternatives 4 Bridge Upstream
Appendix 11 - HEC-RAS Plans

Results Summary

The following tables are a summary of the results for the Bridge alternatives.

			Alternative 1				Alternative 2			
	Existing		300 ft Clearspan				300 ft Arch			
	1%	4%	1%		4%		1%		4%	
River Sta	Flow	Flow	Flow	Diff from Existing	Flow	Diff from Existing	Flow	Diff from Existing	Flow	Diff from Existing
	(cfs)	(cfs)	(cfs)		(cfs)		(cfs)		(cfs)	
7026	4520	3250	4520	0	3250	0	4520	0	3250	0
6925	4520	3250	4520	0	3250	0	4520	0	3250	0
6723	4520	3250	4520	0	3250	0	4520	0	3250	0
6475	4520	3250	4520	0	3250	0	4520	0	3250	0
6371	4520	3250	4520	0	3250	0	4520	0	3250	0
6348	4520	3250	4520	0	3250	0	4520	0	3250	0
6325	Culvert	Culvert	Bridge		Bridge		Culvert		Culvert	
6297	4520	3250	4520	0	3250	0	4520	0	3250	0
6250	4520	3250	4520	0	3250	0	4520	0	3250	0

			Alternative 3				Alternative 4			
	Existing		230 Clearspan w US Det				230 Arch w US Det			
	1%	4%	0.01		0.04		0.01		0.04	
River Sta	Flow	Flow	Flow	Diff from Existing	Flow	Diff from Existing	Flow	Diff from Existing	Flow	Diff from Existing
	(cfs)	(cfs)	(cfs)		(cfs)		(cfs)		(cfs)	
7026	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6925	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6723	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6475	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6371	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6348	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6325	Culvert	Culvert	Bridge		Bridge		Culvert		Culvert	
6297	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07
6250	4520	3250	3570	-950	2566.93	-683.07	3570	-950	2566.93	-683.07

			Alternative 1				Alternative 2			
	Existing		300 ft Clearspan				300 ft Arch			
	1%	4%	1%		4%		1%		4%	
River Sta	W.S. Elev	W.S. Elev	W.S. Elev	Diff from Existing	W.S. Elev	Diff from Existing	W.S. Elev	Diff from Existing	W.S. Elev	Diff from Existing
	(ft)	(ft)	(ft)		(ft)		(ft)		(ft)	
7026	757.31	756.58	757.31	0	756.58	0	757.31	0	756.57	-0.01
6925	757.38	756.61	757.38	0	756.61	0	757.38	0	756.6	-0.01
6723	756.44	755.77	756.44	0	755.77	0	756.44	0	755.76	-0.01
6475	753.73	753.25	753.72	-0.01	753.25	0	753.72	-0.01	753.27	0.02
6371	753.05	752.53	753.05	0	752.41	-0.12	752.35	-0.7	751.55	-0.98
6348	752.97	752.47	752.57	-0.4	752.04	-0.43	752.22	-0.75	751.26	-1.21
6325										
6297	752.13	751.24	752.11	-0.02	751.23	-0.01	752.19	0.06	751.34	0.1
6250	752.08	751.2	752.08	0	751.2	0	752.08	0	751.2	0

			Alternative 3				Alternative 4			
	Existing		230 Clearspan w US Det				230 Arch w US Det			
	1%	4%	1%		4%		1%		4%	
River Sta	W.S. Elev	W.S. Elev	W.S. Elev	Diff from Existing	W.S. Elev	Diff from Existing	W.S. Elev	Diff from Existing	W.S. Elev	Diff from Existing
	(ft)	(ft)	(ft)		(ft)		(ft)		(ft)	
7026	757.31	756.58	756.78	-0.53	756.18	-0.4	756.78	-0.53	756.14	-0.44
6925	757.38	756.61	756.82	-0.56	756.19	-0.42	756.82	-0.56	756.16	-0.45
6723	756.44	755.77	755.95	-0.49	755.53	-0.24	755.95	-0.49	755.45	-0.32
6475	753.73	753.25	753.38	-0.35	752.52	-0.73	753.38	-0.35	752.77	-0.48
6371	753.05	752.53	752.53	-0.52	751.77	-0.76	751.65	-1.4	751.32	-1.21
6348	752.97	752.47	752.09	-0.88	751.48	-0.99	751.58	-1.39	750.64	-1.83
6325										
6297	752.13	751.24	751.46	-0.67	750.63	-0.61	751.58	-0.55	750.78	-0.46
6250	752.08	751.2	751.44	-0.64	750.59	-0.61	751.44	-0.64	750.59	-0.61

Appendix 1
ALT 1 – 300-ft clear span Bridge without upstream detention HEC-RAS Results

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	1% Future	2610	797.58	801.75	801.68	802.28	0.011235	8.71	556.59	374.78	0.93
Reach 1	12470	1% Future	2610	794.68	798.47		798.8	0.007989	6.81	601.97	360.88	0.76
Reach 1	12091	1% Future	2610	790.01	795.51	795.42	796.09	0.006978	8.65	578.79	369.89	0.77
Reach 1	11865	1% Future	2610	789.19	793.81	793.71	794.39	0.008466	9.25	546.36	350.57	0.85
Reach 1	11579	1% Future	2610	788.01	792.04		792.48	0.005988	7.02	621.12	398.99	0.7
Reach 1	11385	1% Future	2610	785.68	791.28		791.68	0.003549	7.02	726.89	414.68	0.57
Reach 1	11319	1% Future	2610	785.49	790.67	790.67	791.35	0.006511	8.73	560.26	367.04	0.76
Reach 1	11194	1% Future	2610	784.81	788.99	788.99	789.72	0.006153	9.23	554.96	340.55	0.85
Reach 1	11035	1% Future	2610	783.25	787.74	787.74	788.46	0.005222	9.37	590.9	360.61	0.8
Reach 1	10823	1% Future	2610	781.11	786.14	784.64	786.33	0.001124	4.74	1071.19	520.17	0.38
Reach 1	10529	1% Future	2610	777.6	786.14	782.39	786.17	0.000186	2.68	2406.54	619.73	0.17
Reach 1	10298	1% Future	2610	775.49	786.13	780.24	786.15	0.000064	1.83	2726.23	669.09	0.1
Reach 1	10086	1% Future	2610	774.33	786.12		786.14	0.00003	1.3	2919.24	481.32	0.07
Reach 1	9947	1% Future	3140	771.9	785.94	778.77	786.11	0.000421	4.12	1260.07	204.61	0.2
Reach 1	9898		Culvert									
Reach 1	9851	1% Future	3140	769.28	777.47	774.26	778.25	0.002728	7.1	460.77	89.61	0.45
Reach 1	9757	1% Future	3140	769.16	775.31	775.31	777.62	0.012475	12.33	267.54	116.98	0.95
Reach 1	9717	1% Future	3140	769.1	776.04	775.26	776.78	0.004322	7.73	528.38	285.31	0.57
Reach 1	9668	1% Future	3320	768.63	775.93	775.06	776.56	0.003622	7.45	633.71	310.94	0.53
Reach 1	9559	1% Future	3320	767.86	775.83	774.46	776.18	0.002105	5.99	925.75	458.17	0.41
Reach 1	9303	1% Future	3320	765.59	775.36	771.91	775.75	0.001323	5.56	698.75	638.5	0.34
Reach 1	9269	1% Future	3320	764.89	772.53	772.53	775.02	0.012764	12.78	266.85	98.9	0.96
Reach 1	9180		Culvert									
Reach 1	9055	1% Future	3320	763.5	770.32	770.32	772.78	0.010701	12.59	263.68	381.46	1
Reach 1	8952	1% Future	3320	766.68	768.6	767.72	768.8	0.002872	3.59	927.56	466.36	0.46
Reach 1	8745	1% Future	3320	765.1	768.32	766.53	768.44	0.001017	2.79	1209.2	415.29	0.27
Reach 1	8635	1% Future	3320	764.33	768.23	766.04	768.34	0.000773	2.73	1307.07	417.47	0.24
Reach 1	8489	1% Future	3320	766	767.26	767.26	767.98	0.015481	7.27	514.73	351.12	1.06
Reach 1	8327	1% Future	3320	761.79	765.7	764.44	765.98	0.002469	4.56	825.36	297.06	0.38
Reach 1	8061	1% Future	4520	757	764.57	763.46	765.1	0.003955	6.32	825.16	347.44	0.37
Reach 1	7868	1% Future	4520	755.75	763.89	762.39	764.41	0.003297	6.2	823.53	360.34	0.36
Reach 1	7700	1% Future	4520	754.6	763.14	761.4	763.82	0.003554	6.7	710.16	343.92	0.4
Reach 1	7531	1% Future	4520	753.86	762.27	760.75	763.14	0.004439	7.51	612.8	417.83	0.45

Reach		1%										
1	7275	Future	4520	752.1	762.25	758.49	762.42	0.001246	3.82	1572.39	601.31	0.25
Reach		1%										
1	7224	Future	4520	750.19	762.26	756.93	762.35	0.000473	2.79	2378.64	777.79	0.16
Reach												
1	7196		Bridge									
Reach		1%										
1	7173	Future	4520	750.53	759.7	759.7	761.45	0.012274	11.22	526.47	587.48	0.78
Reach		1%										
1	7100	Future	4520	750.57	758.71	757.84	759.21	0.006697	8.48	1054.66	487.52	0.58
Reach		1%										
1	7026	Future	4520	749.79	757.31	756.71	758.46	0.011391	9.38	616.98	261.89	0.73
Reach		1%										
1	6925	Future	4520	748.59	757.38	754.63	757.74	0.002608	5.12	1086.35	309.7	0.36
Reach		1%										
1	6723	Future	4520	749.3	756.44	755.22	756.97	0.006299	7.23	922.19	424.65	0.55
Reach		1%										
1	6475	Future	4520	746.76	753.72	753.72	754.72	0.013447	9.95	870.61	417.77	0.79
Reach		1%										
1	6371	Future	4520	745.47	753.05		753.3	0.004082	5.6	1254.16	453.04	0.43
Reach		1%										
1	6348	Future	4520	744.36	752.57	751.8	753.08	0.007035	7.84	884.32	430.22	0.56
Reach												
1	6325		Bridge									
Reach		1%										
1	6297	Future	4520	740.79	752.11	750.78	752.49	0.002883	6.38	1110.14	418.17	0.38
Reach		1%										
1	6250	Future	4520	741.13	752.08		752.32	0.001918	5.61	1420.53	383.36	0.32
Reach		1%										
1	6193	Future	4520	740.29	751.35		752.04	0.005918	8.99	1098.96	328.19	0.52
Reach		1%										
1	6094	Future	4520	740.2	750.44		751.35	0.007083	9.61	912.49	265.98	0.57
Reach		1%										
1	5856	Future	4520	738.98	747.36	747.25	748.96	0.014289	11.55	616.58	195.64	0.78
Reach		1%										
1	5662	Future	4520	736.06	744.92	744.92	746.23	0.013064	11.7	719.45	247.08	0.75
Reach		1%										
1	5461	Future	4520	734.46	743.23		744.06	0.007387	9.26	787.33	251.51	0.62
Reach		1%										
1	5270	Future	4520	735.05	742.35		742.84	0.004888	6.97	908.85	245.17	0.49
Reach		1%										
1	5037	Future	4520	733.11	741.85		742.06	0.002096	5.26	1389.05	355.29	0.33
Reach		1%										
1	4990	Future	4520	732.27	741.36	740.09	741.85	0.003532	7.13	1044.95	305.17	0.43
Reach												
1	4969		Culvert									
Reach		1%										
1	4948	Future	4520	732.27	740.52	740.07	741.57	0.007665	9.86	724.83	242.52	0.63
Reach		1%										
1	4889	Future	4520	730.53	739.5	739.25	740.92	0.010369	10.82	610.47	215.28	0.73
Reach		1%										
1	4691	Future	4520	729.26	738.38		739.1	0.006908	9.31	863.25	308.33	0.6
Reach		1%										
1	4529	Future	4520	729.11	737.14		737.8	0.007642	9.09	872.05	324.78	0.62
Reach		1%										
1	4486	Future	4520	728.62	736.91	736.17	737.43	0.006402	8.81	969.71	344.67	0.57
Reach												
1	4471		Culvert									
Reach		1%										
1	4456	Future	4520	728.62	736.95	735.76	737.33	0.004906	7.81	1086.82	362.49	0.5
Reach		1%										
1	4358	Future	4520	725.74	735.76	735.02	736.69	0.005381	8.91	766.08	309.7	0.58
Reach		1%										
1	4239	Future	4520	724.36	735.68		736.21	0.001903	5.91	830.01	128.56	0.36
Reach		1%										
1	4077	Future	4520	725.28	735.44	731.23	735.9	0.001681	5.49	885.04	160.53	0.34
Reach		1%										
1	3881	Future	4520	724.18	735.49		735.65	0.000457	3.27	1486.81	181.76	0.18
Reach		1%										
1	3767	Future	4520	723.09	735.46		735.6	0.000334	3.05	1654.54	187.29	0.16
Reach		1%										
1	3707	Future	4520	722.9	735.15	731.03	735.5	0.0012	5.4	1339.05	302.35	0.3
Reach												
1	3668		Culvert									

Reach		1%										
1	3628	Future	4520	721.9	730.72	730.72	733	0.015276	12.87	498.61	147.14	0.87
Reach		1%										
1	3538	Future	4520	719.92	730.64		731.47	0.004604	7.68	760.74	187.25	0.49
Reach		1%										
1	3423	Future	4790	719.27	730.22		730.94	0.00409	7.22	843.38	169.11	0.46
Reach		1%										
1	3230	Future	4790	717.88	729.22		730.1	0.004363	7.83	749.1	145.94	0.49
Reach		1%										
1	3117	Future	4790	716.04	726.66	726.66	729.11	0.015558	13.4	484.92	118.58	0.88
Reach		1%										
1	2909	Future	4790	716.16	726.42		727.05	0.003239	6.54	857.87	165.69	0.42
Reach		1%										
1	2646	Future	4790	713.01	723.41	723.09	725.42	0.012476	12.01	525.58	146.62	0.79
Reach		1%										
1	2480	Future	4790	710.81	721.43	721.43	723.29	0.012578	11.71	578.6	191.64	0.79
Reach		1%										
1	2200	Future	4790	710.52	720.44		720.9	0.003469	6.44	1131.41	345.58	0.42
Reach		1%										
1	1987	Future	4790	708.81	720	718.61	720.37	0.002188	6.39	1352.24	406.27	0.38
Reach		1%										
1	1840	Future	4790	706.14	719.02	717.7	719.95	0.003986	8.81	795.67	485.92	0.51
Reach			Lat									
1	1839		Struct									
Reach		1%										
1	1736	Future	4790	706.14	718.75	716.62	719.58	0.002734	8.27	738.16	618.27	0.48
Reach		1%										
1	1683	Future	4790	706.14	718.55	715.42	719.43	0.002311	7.87	659.35	509.75	0.45
Reach												
1	1665		Bridge									
Reach		1%										
1	1646	Future	4790	706.06	716.9	715.72	719.16	0.006657	12.32	415.8	101	0.74
Reach			Lat									
1	1645		Struct									
Reach		1%										
1	1609	Future	4790	705.45	716.78	715.52	718.82	0.005971	11.9	447.12	193.96	0.71
Reach		1%										
1	1556	Future	4790	704.61	717.36	713.33	718.32	0.002198	8.08	713.75	365.36	0.44
Reach		1%										
1	1463	Future	4790	704.01	717.12	712.99	718.12	0.002206	8.23	674.21	432.16	0.44
Reach		1%										
1	1370	Future	4790	703.44	715.75	713.87	717.72	0.005054	11.61	451.26	352.73	0.65
Reach		1%										
1	1334	Future	4790	702.62	715.83	712.52	717.36	0.003376	10.16	508.11	334.4	0.54
Reach												
1	1264		Bridge									
Reach		1%										
1	1194	Future	4790	702.62	712.57	712.57	716.1	0.011835	15.21	326.79	303.11	0.95
Reach		1%										
1	1056	Future	4790	700.98	711.46	709.47	712.85	0.004484	9.56	524.99	191.94	0.61
Reach		1%										
1	908	Future	5150	700.2	709.63	709.03	711.87	0.008386	12.2	445.6	108.12	0.82
Reach		1%										
1	691	Future	5150	699.34	709.78	706.47	710.58	0.002281	7.46	852.6	205.32	0.44
Reach		1%										
1	658	Future	5150	699.89	709.75	706.09	710.47	0.001953	7.05	948.21	242.36	0.41
Reach												
1	635		Bridge									
Reach		1%										
1	612	Future	5150	698.25	707.34	705.55	708.78	0.005477	9.83	609.42	163.35	0.66
Reach		1%										
1	548	Future	5150	697.44	707.31		708.27	0.003415	8.3	772.27	196.18	0.53
Reach		1%										
1	363	Future	5150	696.13	707.34		707.76	0.001236	5.71	1280.18	356.55	0.33
Reach		1%										
1	267	Future	5150	695.7	707.16		707.63	0.001328	6.13	1267.02	357.34	0.34
Reach		1%										
1	209	Future	5150	691.65	707.23	701.16	707.46	0.000602	4.43	1805.01	413.58	0.23
Reach												
1	188		Culvert									
Reach		1%										
1	167	Future	5150	691.65	706.7	704.46	707.06	0.001171	6.03	1400.28	350.15	0.31
Reach		1%										
1	118	Future	5150	695.06	704.63	704.48	706.48	0.008004	12.51	547.49	125.42	0.81

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	4% Future	1910	797.58	801.45	801.44	801.93	0.011578	8.17	444.21	364.92	0.92
Reach 1	12470	4% Future	1910	794.68	798.14		798.42	0.007932	6.17	487.15	339.9	0.74
Reach 1	12091	4% Future	1910	790.01	795.17	795.17	795.73	0.00688	8.09	457.84	354.77	0.76
Reach 1	11865	4% Future	1910	789.19	793.49	793.42	794.01	0.008117	8.53	438.14	322.15	0.82
Reach 1	11579	4% Future	1910	788.01	791.65		792.07	0.006414	6.65	472.94	357.14	0.71
Reach 1	11385	4% Future	1910	785.68	790.9		791.27	0.003341	6.43	574.1	380.4	0.55
Reach 1	11319	4% Future	1910	785.49	790.39	790.39	790.96	0.005636	7.74	461.42	340.22	0.7
Reach 1	11194	4% Future	1910	784.81	788.65	788.65	789.29	0.005612	8.28	447.5	326.83	0.8
Reach 1	11035	4% Future	1910	783.25	787.24	787.24	787.97	0.005665	8.98	431.97	295.57	0.82
Reach 1	10823	4% Future	1910	781.11	784.8	784.25	785.21	0.00298	6.22	505.42	298.55	0.59
Reach 1	10529	4% Future	1910	777.6	784.91	782.08	784.94	0.000209	2.54	1747.39	473.2	0.17
Reach 1	10298	4% Future	1910	775.49	784.9	779.81	784.91	0.000063	1.67	2235.94	628.34	0.1
Reach 1	10086	4% Future	1910	774.33	784.89		784.91	0.000025	1.11	2380.12	407.53	0.06
Reach 1	9947	4% Future	2250	771.9	784.77	777.88	784.89	0.00031	3.32	1047.46	163.79	0.17
Reach 1	9898		Culvert									
Reach 1	9851	4% Future	2250	769.28	776.23	773.33	776.81	0.002539	6.1	369.78	57.37	0.42
Reach 1	9757	4% Future	2250	769.16	774.91	774.23	776.33	0.008434	9.62	243.36	59.92	0.77
Reach 1	9717	4% Future	2250	769.1	775.12	774.62	775.86	0.005068	7.44	384.5	201.5	0.6
Reach 1	9668	4% Future	2420	768.63	774.82	774.5	775.6	0.005282	7.88	425.04	210.74	0.62
Reach 1	9559	4% Future	2420	767.86	774.22	773.79	775.01	0.005441	8	441.45	263.72	0.63
Reach 1	9303	4% Future	2420	765.59	773.87	771.14	774.22	0.001504	5.2	549.61	575.48	0.35
Reach 1	9269	4% Future	2420	764.89	771.51	771.51	773.58	0.013844	11.6	212.28	64.22	0.97
Reach 1	9180		Culvert									
Reach 1	9055	4% Future	2420	763.5	769.38	769.38	771.37	0.011518	11.34	213.35	372.05	1
Reach 1	8952	4% Future	2420	766.68	768.14	767.47	768.32	0.003477	3.38	717.57	455.82	0.49
Reach 1	8745	4% Future	2420	765.1	767.87	766.25	767.96	0.000917	2.39	1024.68	409.77	0.25
Reach 1	8635	4% Future	2420	764.33	767.8	765.71	767.88	0.000636	2.29	1128.13	408.66	0.21
Reach 1	8489	4% Future	2420	766	766.98	766.98	767.57	0.01592	6.55	417.1	347.19	1.09
Reach 1	8327	4% Future	2420	761.79	765	764.09	765.26	0.002973	4.34	626.03	271.44	0.4
Reach 1	8061	4% Future	3250	757	763.68	762.94	764.19	0.004939	6.12	610.33	277.92	0.39
Reach 1	7868	4% Future	3250	755.75	762.81	761.84	763.31	0.004223	6.04	605.72	302.06	0.38
Reach 1	7700	4% Future	3250	754.6	761.99	760.74	762.59	0.004241	6.32	534.82	280.5	0.4
Reach 1	7531	4% Future	3250	753.86	760.64	760.04	761.62	0.007752	7.96	411.52	286.9	0.54
Reach 1	7275	4% Future	3250	752.1	760.31	758.01	760.5	0.00214	4.03	1063.36	438.03	0.32
Reach 1	7224	4% Future	3250	750.19	759.9	755.97	760.33	0.002154	5.29	626.47	548.05	0.34

Reach 1	7196		Bridge									
Reach 1	7173	4% Future	3250	750.53	758.08	757.95	760.08	0.019247	11.58	301.72	297.12	0.93
Reach 1	7100	4% Future	3250	750.57	757.67	757.37	758.3	0.009449	9.02	741.96	436.04	0.66
Reach 1	7026	4% Future	3250	749.79	756.58	755.98	757.49	0.010695	8.2	499.54	248.62	0.69
Reach 1	6925	4% Future	3250	748.59	756.61	753.97	756.87	0.002219	4.32	901.29	289.87	0.33
Reach 1	6723	4% Future	3250	749.3	755.77	754.7	756.19	0.00578	6.34	757.39	398.92	0.51
Reach 1	6475	4% Future	3250	746.76	753.25	753.25	754.12	0.012266	8.89	677.68	397.09	0.74
Reach 1	6371	4% Future	3250	745.47	752.41		752.64	0.004517	5.41	968.23	434.2	0.44
Reach 1	6348	4% Future	3250	744.36	752.04	751.38	752.45	0.006343	7	731.58	410.75	0.52
Reach 1	6325		Bridge									
Reach 1	6297	4% Future	3250	740.79	751.23	750.23	751.61	0.003007	6.06	853.75	395.83	0.38
Reach 1	6250	4% Future	3250	741.13	751.2		751.43	0.001909	5.25	1096.35	353.96	0.31
Reach 1	6193	4% Future	3250	740.29	750.24		751.08	0.007185	9.1	751.69	298.71	0.56
Reach 1	6094	4% Future	3250	740.2	749.35		750.31	0.007825	9.26	638.65	233.81	0.59
Reach 1	5856	4% Future	3250	738.98	746.56	746.23	747.9	0.013192	10.22	469.98	170.12	0.73
Reach 1	5662	4% Future	3250	736.06	744.29	744.29	745.44	0.011751	10.46	566.02	235.6	0.7
Reach 1	5461	4% Future	3250	734.46	742.47		743.24	0.007516	8.66	602.72	231.54	0.61
Reach 1	5270	4% Future	3250	735.05	741.58		742	0.004905	6.4	723.7	237.42	0.48
Reach 1	5037	4% Future	3250	733.11	741.06		741.24	0.00208	4.87	1111.86	342.91	0.33
Reach 1	4990	4% Future	3250	732.27	740.61	739.03	741.04	0.003265	6.43	823.25	282.87	0.41
Reach 1	4969		Culvert									
Reach 1	4948	4% Future	3250	732.27	739.35	739.1	740.55	0.009655	9.89	476.09	182.89	0.69
Reach 1	4889	4% Future	3250	730.53	738.81	738.37	739.95	0.009006	9.4	475.41	177.95	0.67
Reach 1	4691	4% Future	3250	729.26	737.65		738.32	0.006722	8.58	655.77	260.46	0.58
Reach 1	4529	4% Future	3250	729.11	736.37		737.03	0.008078	8.61	643.03	273.42	0.63
Reach 1	4486	4% Future	3250	728.62	736.02	735.67	736.63	0.008131	9.12	682.7	300.52	0.63
Reach 1	4471		Culvert									
Reach 1	4456	4% Future	3250	728.62	735.93	735.3	736.4	0.006853	8.37	745.03	313.69	0.58
Reach 1	4358	4% Future	3250	725.74	734.76	734.25	735.67	0.005851	8.42	563.42	256.43	0.59
Reach 1	4239	4% Future	3250	724.36	734.85		735.2	0.001414	4.75	727.24	120.05	0.3
Reach 1	4077	4% Future	3250	725.28	734.68	730.3	734.97	0.00122	4.39	784.95	155.34	0.28
Reach 1	3881	4% Future	3250	724.18	734.7		734.8	0.000313	2.56	1346.71	174.22	0.15
Reach 1	3767	4% Future	3250	723.09	734.69		734.77	0.000221	2.37	1511.87	179.25	0.13
Reach 1	3707	4% Future	3250	722.9	734.46	729.7	734.7	0.00086	4.37	1140.33	271.39	0.25
Reach 1	3668		Culvert									
Reach 1	3628	4% Future	3250	721.9	729.97	729.97	732.9	0.018223	13.88	253.24	123.86	0.95
Reach 1	3538	4% Future	3250	719.92	729.41		730.07	0.004519	6.76	570.62	132.76	0.47

Reach		4%										
1	3423	Future	3500	719.27	728.91		729.54	0.00448	6.66	635.97	148.94	0.47
Reach		4%										
1	3230	Future	3500	717.88	727.95		728.68	0.004362	7	577.34	125.56	0.47
Reach		4%										
1	3117	Future	3500	716.04	725.5	725.5	727.68	0.016641	12.33	356.92	101.5	0.88
Reach		4%										
1	2909	Future	3500	716.16	725.16		725.68	0.003308	5.86	662.43	143.43	0.41
Reach		4%										
1	2646	Future	3500	713.01	722.6	721.91	724.14	0.010762	10.29	417.62	122.14	0.72
Reach		4%										
1	2480	Future	3500	710.81	720.49	720.35	722.17	0.01287	10.73	411.69	161.42	0.78
Reach		4%										
1	2200	Future	3500	710.52	719.48		719.96	0.004012	6.3	814.54	313.45	0.44
Reach		4%										
1	1987	Future	3500	708.81	718.62	717.97	719.21	0.003669	7.37	823.93	350.72	0.48
Reach		4%										
1	1840	Future	3500	706.14	717.34	716.03	718.53	0.00592	9.39	490.07	245.08	0.6
Reach			Lat									
1	1839		Struct									
Reach		4%										
1	1736	Future	3500	706.14	716.89	715.41	717.98	0.004312	8.95	483.58	276.67	0.58
Reach		4%										
1	1683	Future	3500	706.14	716.87	713.93	717.64	0.002566	7.28	519.51	266.32	0.46
Reach												
1	1665		Bridge									
Reach		4%										
1	1646	Future	3500	706.06	715.11	714.3	717.19	0.008149	11.67	311.45	54.77	0.79
Reach			Lat									
1	1645		Struct									
Reach		4%										
1	1609	Future	3500	705.45	714.83	714.09	716.88	0.008056	11.71	318.39	107.43	0.79
Reach		4%										
1	1556	Future	3500	704.61	715.46	712.07	716.3	0.002436	7.44	494.18	139.15	0.45
Reach		4%										
1	1463	Future	3500	704.01	715.24	711.73	716.08	0.002357	7.48	494.34	167.92	0.44
Reach		4%										
1	1370	Future	3500	703.44	713.91	712.42	715.66	0.005808	10.83	343.74	190.93	0.68
Reach		4%										
1	1334	Future	3500	702.62	714	710.99	715.25	0.003458	9.12	403.98	322.52	0.53
Reach												
1	1264		Bridge									
Reach		4%										
1	1194	Future	3500	702.62	711.02	711.02	714.05	0.013401	14	253.92	95.19	0.98
Reach		4%										
1	1056	Future	3500	700.98	710.4	708.34	711.43	0.004031	8.21	439.12	124.78	0.56
Reach		4%										
1	908	Future	3910	700.2	708.28	707.96	710.4	0.010366	11.75	342.87	76.67	0.87
Reach		4%										
1	691	Future	3910	699.34	708.1	705.54	708.92	0.002959	7.36	575.23	126.12	0.49
Reach		4%										
1	658	Future	3910	699.89	708.05	705.19	708.78	0.002519	6.97	628.35	149.82	0.45
Reach												
1	635		Bridge									
Reach		4%										
1	612	Future	3910	698.25	706.81	704.95	707.84	0.00427	8.23	526.89	149.81	0.58
Reach		4%										
1	548	Future	3910	697.44	706.76		707.47	0.002691	7.02	669.03	178.27	0.46
Reach		4%										
1	363	Future	3910	696.13	706.74		707.07	0.001004	4.92	1077.34	325.07	0.29
Reach		4%										
1	267	Future	3910	695.7	706.6		706.97	0.001053	5.25	1074.02	335.92	0.3
Reach		4%										
1	209	Future	3910	691.65	706.66	699.98	706.83	0.000462	3.75	1574.83	390.9	0.2
Reach												
1	188		Culvert									
Reach		4%										
1	167	Future	3910	691.65	705.51	701.83	705.97	0.001509	6.38	993.22	330.05	0.35
Reach		4%										
1	118	Future	3910	695.06	703.81	703.75	705.46	0.008003	11.57	445.69	122.37	0.79

Appendix 2
ALT 2 – approximate 300-ft Arch Bridge without upstream detention HEC-RAS Results

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	1% Future	2610	797.58	801.75	801.68	802.28	0.011235	8.71	556.59	374.78	0.93
Reach 1	12470	1% Future	2610	794.68	798.47		798.8	0.007989	6.81	601.97	360.88	0.76
Reach 1	12091	1% Future	2610	790.01	795.51	795.42	796.09	0.006978	8.65	578.79	369.89	0.77
Reach 1	11865	1% Future	2610	789.19	793.81	793.71	794.39	0.008466	9.25	546.36	350.57	0.85
Reach 1	11579	1% Future	2610	788.01	792.04		792.48	0.005988	7.02	621.12	398.99	0.7
Reach 1	11385	1% Future	2610	785.68	791.28		791.68	0.003549	7.02	726.89	414.68	0.57
Reach 1	11319	1% Future	2610	785.49	790.67	790.67	791.35	0.006511	8.73	560.26	367.04	0.76
Reach 1	11194	1% Future	2610	784.81	788.99	788.99	789.72	0.006153	9.23	554.96	340.55	0.85
Reach 1	11035	1% Future	2610	783.25	787.74	787.74	788.46	0.005222	9.37	590.9	360.61	0.8
Reach 1	10823	1% Future	2610	781.11	786.14	784.64	786.33	0.001124	4.74	1071.19	520.17	0.38
Reach 1	10529	1% Future	2610	777.6	786.14	782.39	786.17	0.000186	2.68	2406.54	619.73	0.17
Reach 1	10298	1% Future	2610	775.49	786.13	780.24	786.15	0.000064	1.83	2726.23	669.09	0.1
Reach 1	10086	1% Future	2610	774.33	786.12		786.14	0.00003	1.3	2919.24	481.32	0.07
Reach 1	9947	1% Future	3140	771.9	785.94	778.77	786.11	0.000421	4.12	1260.07	204.61	0.2
Reach 1	9898		Culvert									
Reach 1	9851	1% Future	3140	769.28	777.47	774.26	778.25	0.002728	7.1	460.77	89.61	0.45
Reach 1	9757	1% Future	3140	769.16	775.31	775.31	777.62	0.012475	12.33	267.54	116.98	0.95
Reach 1	9717	1% Future	3140	769.1	776.04	775.26	776.78	0.004322	7.73	528.38	285.31	0.57
Reach 1	9668	1% Future	3320	768.63	775.93	775.06	776.56	0.003622	7.45	633.71	310.94	0.53
Reach 1	9559	1% Future	3320	767.86	775.83	774.46	776.18	0.002105	5.99	925.75	458.17	0.41
Reach 1	9303	1% Future	3320	765.59	775.36	771.91	775.75	0.001323	5.56	698.75	638.5	0.34
Reach 1	9269	1% Future	3320	764.89	772.53	772.53	775.02	0.012764	12.78	266.85	98.9	0.96
Reach 1	9180		Culvert									
Reach 1	9055	1% Future	3320	763.5	770.32	770.32	772.78	0.010701	12.59	263.68	381.46	1
Reach 1	8952	1% Future	3320	766.68	768.6	767.72	768.8	0.002872	3.59	927.56	466.36	0.46
Reach 1	8745	1% Future	3320	765.1	768.32	766.53	768.44	0.001017	2.79	1209.2	415.29	0.27
Reach 1	8635	1% Future	3320	764.33	768.23	766.04	768.34	0.000773	2.73	1307.07	417.47	0.24
Reach 1	8489	1% Future	3320	766	767.26	767.26	767.98	0.015481	7.27	514.73	351.12	1.06
Reach 1	8327	1% Future	3320	761.79	765.7	764.44	765.98	0.002469	4.56	825.36	297.06	0.38
Reach 1	8061	1% Future	4520	757	764.57	763.46	765.1	0.003955	6.32	825.16	347.44	0.37
Reach 1	7868	1% Future	4520	755.75	763.89	762.39	764.41	0.003297	6.2	823.53	360.34	0.36
Reach 1	7700	1% Future	4520	754.6	763.14	761.4	763.82	0.003554	6.7	710.16	343.92	0.4
Reach 1	7531	1% Future	4520	753.86	762.27	760.75	763.14	0.004439	7.51	612.8	417.83	0.45

Reach		1%										
1	7275	Future	4520	752.1	762.25	758.49	762.42	0.001246	3.82	1572.39	601.31	0.25
Reach		1%										
1	7224	Future	4520	750.19	762.26	756.93	762.35	0.000473	2.79	2378.64	777.79	0.16
Reach												
1	7196		Bridge									
Reach		1%										
1	7173	Future	4520	750.53	759.7	759.7	761.45	0.012274	11.22	526.47	587.48	0.78
Reach		1%										
1	7100	Future	4520	750.57	758.71	757.84	759.21	0.006698	8.48	1054.64	487.52	0.58
Reach		1%										
1	7026	Future	4520	749.79	757.31	756.71	758.46	0.011396	9.38	616.89	261.88	0.73
Reach		1%										
1	6925	Future	4520	748.59	757.38	754.63	757.74	0.002609	5.12	1086.21	309.69	0.36
Reach		1%										
1	6723	Future	4520	749.3	756.44	755.22	756.96	0.006307	7.23	921.79	424.61	0.55
Reach		1%										
1	6475	Future	4520	746.76	753.72	753.72	754.72	0.013404	9.94	871.78	417.88	0.79
Reach		1%										
1	6371	Future	4520	745.47	752.35		752.82	0.009498	7.77	940.68	432.06	0.64
Reach		1%										
1	6348	Future	4520	744.36	752.22	751.05	752.58	0.005103	6.42	998.28	417.63	0.47
Reach												
1	6325		Culvert									
Reach		1%										
1	6297	Future	4520	740.79	752.19	750.08	752.4	0.001646	4.85	1385.44	420.36	0.29
Reach		1%										
1	6250	Future	4520	741.13	752.08		752.32	0.001918	5.61	1420.53	383.36	0.32
Reach		1%										
1	6193	Future	4520	740.29	751.35		752.04	0.005918	8.99	1098.96	328.19	0.52
Reach		1%										
1	6094	Future	4520	740.2	750.44		751.35	0.007083	9.61	912.49	265.98	0.57
Reach		1%										
1	5856	Future	4520	738.98	747.36	747.25	748.96	0.014289	11.55	616.58	195.64	0.78
Reach		1%										
1	5662	Future	4520	736.06	744.92	744.92	746.23	0.013064	11.7	719.45	247.08	0.75
Reach		1%										
1	5461	Future	4520	734.46	743.23		744.06	0.007387	9.26	787.33	251.51	0.62
Reach		1%										
1	5270	Future	4520	735.05	742.35		742.84	0.004888	6.97	908.85	245.17	0.49
Reach		1%										
1	5037	Future	4520	733.11	741.85		742.06	0.002096	5.26	1389.05	355.29	0.33
Reach		1%										
1	4990	Future	4520	732.27	741.36	740.09	741.85	0.003532	7.13	1044.95	305.17	0.43
Reach												
1	4969		Culvert									
Reach		1%										
1	4948	Future	4520	732.27	740.52	740.07	741.57	0.007665	9.86	724.83	242.52	0.63
Reach		1%										
1	4889	Future	4520	730.53	739.5	739.25	740.92	0.010369	10.82	610.47	215.28	0.73
Reach		1%										
1	4691	Future	4520	729.26	738.38		739.1	0.006908	9.31	863.25	308.33	0.6
Reach		1%										
1	4529	Future	4520	729.11	737.14		737.8	0.007642	9.09	872.05	324.78	0.62
Reach		1%										
1	4486	Future	4520	728.62	736.91	736.17	737.43	0.006402	8.81	969.71	344.67	0.57
Reach												
1	4471		Culvert									
Reach		1%										
1	4456	Future	4520	728.62	736.95	735.76	737.33	0.004906	7.81	1086.82	362.49	0.5
Reach		1%										
1	4358	Future	4520	725.74	735.76	735.02	736.69	0.005381	8.91	766.08	309.7	0.58
Reach		1%										
1	4239	Future	4520	724.36	735.68		736.21	0.001903	5.91	830.01	128.56	0.36
Reach		1%										
1	4077	Future	4520	725.28	735.44	731.23	735.9	0.001681	5.49	885.04	160.53	0.34
Reach		1%										
1	3881	Future	4520	724.18	735.49		735.65	0.000457	3.27	1486.81	181.76	0.18
Reach		1%										
1	3767	Future	4520	723.09	735.46		735.6	0.000334	3.05	1654.54	187.29	0.16
Reach		1%										
1	3707	Future	4520	722.9	735.15	731.03	735.5	0.0012	5.4	1339.05	302.35	0.3
Reach												
1	3668		Culvert									

Reach		1%										
1	3628	Future	4520	721.9	730.72	730.72	733	0.015276	12.87	498.61	147.14	0.87
Reach		1%										
1	3538	Future	4520	719.92	730.64		731.47	0.004604	7.68	760.74	187.25	0.49
Reach		1%										
1	3423	Future	4790	719.27	730.22		730.94	0.00409	7.22	843.38	169.11	0.46
Reach		1%										
1	3230	Future	4790	717.88	729.22		730.1	0.004363	7.83	749.1	145.94	0.49
Reach		1%										
1	3117	Future	4790	716.04	726.66	726.66	729.11	0.015558	13.4	484.92	118.58	0.88
Reach		1%										
1	2909	Future	4790	716.16	726.42		727.05	0.003239	6.54	857.87	165.69	0.42
Reach		1%										
1	2646	Future	4790	713.01	723.41	723.09	725.42	0.012476	12.01	525.58	146.62	0.79
Reach		1%										
1	2480	Future	4790	710.81	721.43	721.43	723.29	0.012578	11.71	578.6	191.64	0.79
Reach		1%										
1	2200	Future	4790	710.52	720.44		720.9	0.003469	6.44	1131.41	345.58	0.42
Reach		1%										
1	1987	Future	4790	708.81	720	718.61	720.37	0.002188	6.39	1352.24	406.27	0.38
Reach		1%										
1	1840	Future	4790	706.14	719.02	717.7	719.95	0.003986	8.81	795.67	485.92	0.51
Reach			Lat									
1	1839		Struct									
Reach		1%										
1	1736	Future	4790	706.14	718.75	716.62	719.58	0.002734	8.27	738.16	618.27	0.48
Reach		1%										
1	1683	Future	4790	706.14	718.55	715.42	719.43	0.002311	7.87	659.35	509.75	0.45
Reach												
1	1665		Bridge									
Reach		1%										
1	1646	Future	4790	706.06	716.9	715.72	719.16	0.006657	12.32	415.8	101	0.74
Reach			Lat									
1	1645		Struct									
Reach		1%										
1	1609	Future	4790	705.45	716.78	715.52	718.82	0.005971	11.9	447.12	193.96	0.71
Reach		1%										
1	1556	Future	4790	704.61	717.36	713.33	718.32	0.002198	8.08	713.75	365.36	0.44
Reach		1%										
1	1463	Future	4790	704.01	717.12	712.99	718.12	0.002206	8.23	674.21	432.16	0.44
Reach		1%										
1	1370	Future	4790	703.44	715.75	713.87	717.72	0.005054	11.61	451.26	352.73	0.65
Reach		1%										
1	1334	Future	4790	702.62	715.83	712.52	717.36	0.003376	10.16	508.11	334.4	0.54
Reach												
1	1264		Bridge									
Reach		1%										
1	1194	Future	4790	702.62	712.57	712.57	716.1	0.011835	15.21	326.79	303.11	0.95
Reach		1%										
1	1056	Future	4790	700.98	711.46	709.47	712.85	0.004484	9.56	524.99	191.94	0.61
Reach		1%										
1	908	Future	5150	700.2	709.63	709.03	711.87	0.008386	12.2	445.6	108.12	0.82
Reach		1%										
1	691	Future	5150	699.34	709.78	706.47	710.58	0.002281	7.46	852.6	205.32	0.44
Reach		1%										
1	658	Future	5150	699.89	709.75	706.09	710.47	0.001953	7.05	948.21	242.36	0.41
Reach												
1	635		Bridge									
Reach		1%										
1	612	Future	5150	698.25	707.34	705.55	708.78	0.005477	9.83	609.42	163.35	0.66
Reach		1%										
1	548	Future	5150	697.44	707.31		708.27	0.003415	8.3	772.27	196.18	0.53
Reach		1%										
1	363	Future	5150	696.13	707.34		707.76	0.001236	5.71	1280.18	356.55	0.33
Reach		1%										
1	267	Future	5150	695.7	707.16		707.63	0.001328	6.13	1267.02	357.34	0.34
Reach		1%										
1	209	Future	5150	691.65	707.23	701.16	707.46	0.000602	4.43	1805.01	413.58	0.23
Reach												
1	188		Culvert									
Reach		1%										
1	167	Future	5150	691.65	706.7	704.46	707.06	0.001171	6.03	1400.28	350.15	0.31
Reach		1%										
1	118	Future	5150	695.06	704.63	704.48	706.48	0.008004	12.51	547.49	125.42	0.81

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	4% Future	1910	797.58	801.45	801.44	801.93	0.011578	8.17	444.21	364.92	0.92
Reach 1	12470	4% Future	1910	794.68	798.14		798.42	0.007932	6.17	487.15	339.9	0.74
Reach 1	12091	4% Future	1910	790.01	795.17	795.17	795.73	0.00688	8.09	457.84	354.77	0.76
Reach 1	11865	4% Future	1910	789.19	793.49	793.42	794.01	0.008117	8.53	438.14	322.15	0.82
Reach 1	11579	4% Future	1910	788.01	791.65		792.07	0.006414	6.65	472.94	357.14	0.71
Reach 1	11385	4% Future	1910	785.68	790.9		791.27	0.003341	6.43	574.1	380.4	0.55
Reach 1	11319	4% Future	1910	785.49	790.39	790.39	790.96	0.005636	7.74	461.42	340.22	0.7
Reach 1	11194	4% Future	1910	784.81	788.65	788.65	789.29	0.005612	8.28	447.5	326.83	0.8
Reach 1	11035	4% Future	1910	783.25	787.24	787.24	787.97	0.005665	8.98	431.97	295.57	0.82
Reach 1	10823	4% Future	1910	781.11	784.8	784.25	785.21	0.00298	6.22	505.42	298.55	0.59
Reach 1	10529	4% Future	1910	777.6	784.91	782.08	784.94	0.000209	2.54	1747.39	473.2	0.17
Reach 1	10298	4% Future	1910	775.49	784.9	779.81	784.91	0.000063	1.67	2235.94	628.34	0.1
Reach 1	10086	4% Future	1910	774.33	784.89		784.91	0.000025	1.11	2380.12	407.53	0.06
Reach 1	9947	4% Future	2250	771.9	784.77	777.88	784.89	0.00031	3.32	1047.46	163.79	0.17
Reach 1	9898		Culvert									
Reach 1	9851	4% Future	2250	769.28	776.23	773.33	776.81	0.002539	6.1	369.78	57.37	0.42
Reach 1	9757	4% Future	2250	769.16	774.91	774.23	776.33	0.008434	9.62	243.36	59.92	0.77
Reach 1	9717	4% Future	2250	769.1	775.12	774.62	775.86	0.005068	7.44	384.5	201.5	0.6
Reach 1	9668	4% Future	2420	768.63	774.82	774.5	775.6	0.005282	7.88	425.04	210.74	0.62
Reach 1	9559	4% Future	2420	767.86	774.22	773.79	775.01	0.005441	8	441.45	263.72	0.63
Reach 1	9303	4% Future	2420	765.59	773.87	771.14	774.22	0.001504	5.2	549.61	575.48	0.35
Reach 1	9269	4% Future	2420	764.89	771.51	771.51	773.58	0.013844	11.6	212.28	64.22	0.97
Reach 1	9180		Culvert									
Reach 1	9055	4% Future	2420	763.5	769.38	769.38	771.37	0.011518	11.34	213.35	372.05	1
Reach 1	8952	4% Future	2420	766.68	768.14	767.47	768.32	0.003477	3.38	717.57	455.82	0.49
Reach 1	8745	4% Future	2420	765.1	767.87	766.25	767.96	0.000917	2.39	1024.68	409.77	0.25
Reach 1	8635	4% Future	2420	764.33	767.8	765.71	767.88	0.000636	2.29	1128.13	408.66	0.21
Reach 1	8489	4% Future	2420	766	766.98	766.98	767.57	0.01592	6.55	417.1	347.19	1.09
Reach 1	8327	4% Future	2420	761.79	765	764.09	765.26	0.002973	4.34	626.03	271.44	0.4
Reach 1	8061	4% Future	3250	757	763.68	762.94	764.19	0.004939	6.12	610.33	277.92	0.39
Reach 1	7868	4% Future	3250	755.75	762.81	761.84	763.31	0.004223	6.04	605.72	302.06	0.38
Reach 1	7700	4% Future	3250	754.6	761.99	760.74	762.59	0.004241	6.32	534.82	280.5	0.4
Reach 1	7531	4% Future	3250	753.86	760.64	760.04	761.62	0.007751	7.96	411.54	286.91	0.54
Reach 1	7275	4% Future	3250	752.1	760.31	758.01	760.5	0.002139	4.03	1063.39	438.04	0.32
Reach 1	7224	4% Future	3250	750.19	759.9	755.97	760.33	0.002154	5.29	626.48	548.06	0.34

Reach 1	7196		Bridge									
Reach 1	7173	4% Future	3250	750.53	758.08	757.95	760.08	0.019245	11.58	301.73	297.23	0.93
Reach 1	7100	4% Future	3250	750.57	757.67	757.37	758.3	0.009454	9.02	741.83	436.02	0.67
Reach 1	7026	4% Future	3250	749.79	756.57	755.98	757.48	0.010758	8.22	498.48	248.51	0.69
Reach 1	6925	4% Future	3250	748.59	756.6	753.97	756.87	0.002229	4.33	899.74	289.68	0.33
Reach 1	6723	4% Future	3250	749.3	755.76	754.7	756.18	0.005874	6.38	753.11	397.69	0.52
Reach 1	6475	4% Future	3250	746.76	753.27	753.27	754.12	0.011944	8.8	685.98	397.96	0.73
Reach 1	6371	4% Future	3250	745.47	751.55	751.55	752.24	0.016498	9.04	609.52	396.62	0.81
Reach 1	6348	4% Future	3250	744.36	751.26	750.68	751.65	0.007632	6.94	713.5	381.74	0.56
Reach 1	6325		Culvert									
Reach 1	6297	4% Future	3250	740.79	751.34	749.62	751.52	0.001591	4.45	1125.33	398.56	0.28
Reach 1	6250	4% Future	3250	741.13	751.2		751.43	0.001909	5.25	1096.35	353.96	0.31
Reach 1	6193	4% Future	3250	740.29	750.24		751.08	0.007185	9.1	751.69	298.71	0.56
Reach 1	6094	4% Future	3250	740.2	749.35		750.31	0.007825	9.26	638.65	233.81	0.59
Reach 1	5856	4% Future	3250	738.98	746.56	746.23	747.9	0.013192	10.22	469.98	170.12	0.73
Reach 1	5662	4% Future	3250	736.06	744.29	744.29	745.44	0.011751	10.46	566.02	235.6	0.7
Reach 1	5461	4% Future	3250	734.46	742.47		743.24	0.007516	8.66	602.72	231.54	0.61
Reach 1	5270	4% Future	3250	735.05	741.58		742	0.004905	6.4	723.7	237.42	0.48
Reach 1	5037	4% Future	3250	733.11	741.06		741.24	0.00208	4.87	1111.86	342.91	0.33
Reach 1	4990	4% Future	3250	732.27	740.61	739.03	741.04	0.003265	6.43	823.25	282.87	0.41
Reach 1	4969		Culvert									
Reach 1	4948	4% Future	3250	732.27	739.35	739.1	740.55	0.009655	9.89	476.09	182.89	0.69
Reach 1	4889	4% Future	3250	730.53	738.81	738.37	739.95	0.009006	9.4	475.41	177.95	0.67
Reach 1	4691	4% Future	3250	729.26	737.65		738.32	0.006722	8.58	655.77	260.46	0.58
Reach 1	4529	4% Future	3250	729.11	736.37		737.03	0.008078	8.61	643.03	273.42	0.63
Reach 1	4486	4% Future	3250	728.62	736.02	735.67	736.63	0.008131	9.12	682.7	300.52	0.63
Reach 1	4471		Culvert									
Reach 1	4456	4% Future	3250	728.62	735.93	735.3	736.4	0.006853	8.37	745.03	313.69	0.58
Reach 1	4358	4% Future	3250	725.74	734.76	734.25	735.67	0.005851	8.42	563.42	256.43	0.59
Reach 1	4239	4% Future	3250	724.36	734.85		735.2	0.001414	4.75	727.24	120.05	0.3
Reach 1	4077	4% Future	3250	725.28	734.68	730.3	734.97	0.00122	4.39	784.95	155.34	0.28
Reach 1	3881	4% Future	3250	724.18	734.7		734.8	0.000313	2.56	1346.71	174.22	0.15
Reach 1	3767	4% Future	3250	723.09	734.69		734.77	0.000221	2.37	1511.87	179.25	0.13
Reach 1	3707	4% Future	3250	722.9	734.46	729.7	734.7	0.00086	4.37	1140.33	271.39	0.25
Reach 1	3668		Culvert									
Reach 1	3628	4% Future	3250	721.9	729.97	729.97	732.9	0.018223	13.88	253.24	123.86	0.95
Reach 1	3538	4% Future	3250	719.92	729.41		730.07	0.004519	6.76	570.62	132.76	0.47

Reach		4%										
1	3423	Future	3500	719.27	728.91		729.54	0.00448	6.66	635.97	148.94	0.47
Reach		4%										
1	3230	Future	3500	717.88	727.95		728.68	0.004362	7	577.34	125.56	0.47
Reach		4%										
1	3117	Future	3500	716.04	725.5	725.5	727.68	0.016641	12.33	356.92	101.5	0.88
Reach		4%										
1	2909	Future	3500	716.16	725.16		725.68	0.003308	5.86	662.43	143.43	0.41
Reach		4%										
1	2646	Future	3500	713.01	722.6	721.91	724.14	0.010762	10.29	417.62	122.14	0.72
Reach		4%										
1	2480	Future	3500	710.81	720.49	720.35	722.17	0.01287	10.73	411.69	161.42	0.78
Reach		4%										
1	2200	Future	3500	710.52	719.48		719.96	0.004012	6.3	814.54	313.45	0.44
Reach		4%										
1	1987	Future	3500	708.81	718.62	717.97	719.21	0.003669	7.37	823.93	350.72	0.48
Reach		4%										
1	1840	Future	3500	706.14	717.34	716.03	718.53	0.00592	9.39	490.07	245.08	0.6
Reach			Lat									
1	1839		Struct									
Reach		4%										
1	1736	Future	3500	706.14	716.89	715.41	717.98	0.004312	8.95	483.58	276.67	0.58
Reach		4%										
1	1683	Future	3500	706.14	716.87	713.93	717.64	0.002566	7.28	519.51	266.32	0.46
Reach												
1	1665		Bridge									
Reach		4%										
1	1646	Future	3500	706.06	715.11	714.3	717.19	0.008149	11.67	311.45	54.77	0.79
Reach			Lat									
1	1645		Struct									
Reach		4%										
1	1609	Future	3500	705.45	714.83	714.09	716.88	0.008056	11.71	318.39	107.43	0.79
Reach		4%										
1	1556	Future	3500	704.61	715.46	712.07	716.3	0.002436	7.44	494.18	139.15	0.45
Reach		4%										
1	1463	Future	3500	704.01	715.24	711.73	716.08	0.002357	7.48	494.34	167.92	0.44
Reach		4%										
1	1370	Future	3500	703.44	713.91	712.42	715.66	0.005808	10.83	343.74	190.93	0.68
Reach		4%										
1	1334	Future	3500	702.62	714	710.99	715.25	0.003458	9.12	403.98	322.52	0.53
Reach												
1	1264		Bridge									
Reach		4%										
1	1194	Future	3500	702.62	711.02	711.02	714.05	0.013401	14	253.92	95.19	0.98
Reach		4%										
1	1056	Future	3500	700.98	710.4	708.34	711.43	0.004031	8.21	439.12	124.78	0.56
Reach		4%										
1	908	Future	3910	700.2	708.28	707.96	710.4	0.010366	11.75	342.87	76.67	0.87
Reach		4%										
1	691	Future	3910	699.34	708.1	705.54	708.92	0.002959	7.36	575.23	126.12	0.49
Reach		4%										
1	658	Future	3910	699.89	708.05	705.19	708.78	0.002519	6.97	628.35	149.82	0.45
Reach												
1	635		Bridge									
Reach		4%										
1	612	Future	3910	698.25	706.81	704.95	707.84	0.00427	8.23	526.89	149.81	0.58
Reach		4%										
1	548	Future	3910	697.44	706.76		707.47	0.002691	7.02	669.03	178.27	0.46
Reach		4%										
1	363	Future	3910	696.13	706.74		707.07	0.001004	4.92	1077.34	325.07	0.29
Reach		4%										
1	267	Future	3910	695.7	706.6		706.97	0.001053	5.25	1074.02	335.92	0.3
Reach		4%										
1	209	Future	3910	691.65	706.66	699.98	706.83	0.000462	3.75	1574.83	390.9	0.2
Reach												
1	188		Culvert									
Reach		4%										
1	167	Future	3910	691.65	705.51	701.83	705.97	0.001509	6.38	993.22	330.05	0.35
Reach		4%										
1	118	Future	3910	695.06	703.81	703.75	705.46	0.008003	11.57	445.69	122.37	0.79

Appendix 3
ALT 3 – 230-ft clear span Bridge with upstream detention

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	1% Future	2610	797.58	801.75	801.68	802.28	0.011235	8.71	556.59	374.78	0.93
Reach 1	12470	1% Future	2610	794.68	798.47		798.8	0.007989	6.81	601.97	360.88	0.76
Reach 1	12091	1% Future	2610	790.01	795.51	795.42	796.09	0.006978	8.65	578.79	369.89	0.77
Reach 1	11865	1% Future	2610	789.19	793.81	793.71	794.39	0.008466	9.25	546.36	350.57	0.85
Reach 1	11579	1% Future	2610	788.01	792.04		792.48	0.005988	7.02	621.12	398.99	0.7
Reach 1	11385	1% Future	2610	785.68	791.28		791.68	0.003549	7.02	726.89	414.68	0.57
Reach 1	11319	1% Future	2610	785.49	790.67	790.67	791.35	0.006511	8.73	560.26	367.04	0.76
Reach 1	11194	1% Future	2610	784.81	788.99	788.99	789.72	0.006153	9.23	554.96	340.55	0.85
Reach 1	11035	1% Future	2610	783.25	787.74	787.74	788.46	0.005222	9.37	590.9	360.61	0.8
Reach 1	10823	1% Future	2610	781.11	786.14	784.64	786.33	0.001124	4.74	1071.22	520.19	0.38
Reach 1	10529	1% Future	2610	777.6	786.14	782.39	786.17	0.000186	2.68	2406.58	619.73	0.17
Reach 1	10298	1% Future	2610	775.49	786.13	780.24	786.15	0.000064	1.83	2726.25	669.1	0.1
Reach 1	10086	1% Future	2610	774.33	786.12		786.14	0.00003	1.3	2919.27	481.33	0.07
Reach 1	9947	1% Future	3140	771.9	785.94	778.77	786.11	0.000421	4.12	1260.08	204.61	0.2
Reach 1	9898		Culvert									
Reach 1	9851	1% Future	3140	769.28	777.47	774.26	778.25	0.002728	7.1	460.77	89.61	0.45
Reach 1	9757	1% Future	3140	769.16	775.31	775.31	777.62	0.012475	12.33	267.54	116.98	0.95
Reach 1	9717	1% Future	3140	769.1	775.69	775.26	776.63	0.005818	8.59	472.71	259.85	0.66
Reach 1	9668	1% Future	3110	768.63	775.64	774.94	776.31	0.004048	7.63	577.83	290.66	0.56
Reach 1	9559	1% Future	3110	767.86	775.47	774.38	775.89	0.002596	6.4	806.53	420.03	0.45
Reach 1	9303	1% Future	3110	765.59	775.03	771.76	775.41	0.001357	5.48	665.44	629.39	0.34
Reach 1	9269	1% Future	3110	764.89	772.3	772.3	774.7	0.012941	12.52	254.91	88.83	0.96
Reach 1	9180		Culvert									
Reach 1	9055	1% Future	3110	763.5	770.1	770.1	772.46	0.01092	12.34	252.01	379.28	1
Reach 1	8952	1% Future	3110	766.68	768.5	767.66	768.69	0.002984	3.54	881.17	465.66	0.46
Reach 1	8745	1% Future	3110	765.1	768.22	766.47	768.34	0.000996	2.7	1168.3	414.13	0.27
Reach 1	8635	1% Future	3110	764.33	768.14	765.97	768.24	0.000743	2.63	1267.23	415.57	0.23
Reach 1	8489	1% Future	3110	766	767.2	767.2	767.89	0.015596	7.12	492.62	350.25	1.07
Reach 1	8327	1% Future	3110	761.79	765.21	764.36	765.57	0.003774	5.12	682.7	277.59	0.46
Reach 1	8061	1% Future	3570	757	763.89	763.07	764.41	0.004727	6.21	660.91	289.25	0.39
Reach 1	7868	1% Future	3570	755.75	763.06	761.99	763.58	0.004025	6.13	656	318.39	0.38
Reach 1	7700	1% Future	3570	754.6	762.23	760.9	762.87	0.004212	6.52	570.92	290.19	0.41
Reach 1	7531	1% Future	3570	753.86	760.86	760.22	761.91	0.007727	8.23	437.65	297.54	0.55

Reach		1%										
1	7275	Future	3570	752.1	760.56	758.14	760.77	0.002156	4.18	1127.17	453.65	0.32
Reach		1%										
1	7224	Future	3570	750.19	760.27	756.22	760.63	0.001827	5.03	869.71	591.73	0.31
Reach												
1	7196		Bridge									
Reach		1%										
1	7173	Future	3570	750.53	758.23	758.23	760.48	0.02091	12.31	312.13	345.09	0.98
Reach		1%										
1	7100	Future	3570	750.57	757.96	757.5	758.54	0.008366	8.77	829.16	450.82	0.63
Reach		1%										
1	7026	Future	3570	749.79	756.78	756.19	757.75	0.01084	8.51	531.63	252.2	0.7
Reach		1%										
1	6925	Future	3570	748.59	756.82	754.14	757.11	0.002326	4.54	950.22	295.72	0.34
Reach		1%										
1	6723	Future	3570	749.3	755.95	754.84	756.4	0.005928	6.58	801.56	411.28	0.52
Reach		1%										
1	6475	Future	3570	746.76	753.38	753.38	754.28	0.01261	9.18	728.7	402.39	0.75
Reach		1%										
1	6371	Future	3570	745.47	752.53		752.76	0.004637	5.15	1018.75	438.11	0.44
Reach		1%										
1	6348	Future	3570	744.36	752.09	751.19	752.57	0.005001	7.08	755.95	412.79	0.49
Reach												
1	6325		Bridge									
Reach		1%										
1	6297	Future	3570	740.79	751.46	749.64	751.82	0.002414	5.93	939.69	401.77	0.36
Reach		1%										
1	6250	Future	3570	741.13	751.44		751.67	0.001914	5.35	1179.87	362.44	0.32
Reach		1%										
1	6193	Future	3570	740.29	750.56		751.35	0.006667	9	850.73	306.66	0.54
Reach		1%										
1	6094	Future	3570	740.2	749.66		750.6	0.007569	9.35	713.15	246.12	0.58
Reach		1%										
1	5856	Future	3570	738.98	746.77	746.54	748.19	0.01367	10.63	505.37	176.96	0.75
Reach		1%										
1	5662	Future	3570	736.06	744.48	744.48	745.65	0.011877	10.71	612.51	239.09	0.71
Reach		1%										
1	5461	Future	3570	734.46	742.67		743.46	0.007485	8.83	650.83	236.79	0.61
Reach		1%										
1	5270	Future	3570	735.05	741.79		742.23	0.004891	6.55	773.14	239.59	0.49
Reach		1%										
1	5037	Future	3570	733.11	741.27		741.46	0.002079	4.97	1186.19	346.42	0.33
Reach		1%										
1	4990	Future	3570	732.27	740.81	739.55	741.26	0.003361	6.64	880.51	289.8	0.42
Reach												
1	4969		Culvert									
Reach		1%										
1	4948	Future	3570	732.27	739.57	739.37	740.82	0.009797	10.19	517.51	193.82	0.7
Reach		1%										
1	4889	Future	3570	730.53	739	738.67	740.22	0.009416	9.8	509.27	186.85	0.68
Reach		1%										
1	4691	Future	3570	729.26	737.85		738.53	0.006715	8.75	710.51	272.03	0.58
Reach		1%										
1	4529	Future	3570	729.11	736.53		737.21	0.008408	8.94	685.25	283.51	0.64
Reach		1%										
1	4486	Future	3570	728.62	736.17	735.82	736.8	0.008333	9.37	728.47	308.51	0.64
Reach												
1	4471		Culvert									
Reach		1%										
1	4456	Future	3570	728.62	736.21	735.44	736.65	0.006092	8.12	835.46	325.25	0.55
Reach		1%										
1	4358	Future	3570	725.74	735.09	734.48	735.97	0.005478	8.43	628.7	283.18	0.58
Reach		1%										
1	4239	Future	3570	724.36	735.12		735.51	0.001512	5.03	759.69	122.75	0.32
Reach		1%										
1	4077	Future	3570	725.28	734.93	730.54	735.26	0.001309	4.65	818.13	157.05	0.29
Reach		1%										
1	3881	Future	3570	724.18	734.97		735.08	0.000343	2.74	1392.48	176.72	0.16
Reach		1%										
1	3767	Future	3570	723.09	734.95		735.04	0.000245	2.53	1558.64	181.93	0.14
Reach		1%										
1	3707	Future	3570	722.9	734.71	730.07	734.97	0.000924	4.6	1207.41	282.64	0.26
Reach												
1	3668		Culvert									

Reach		1%										
1	3628	Future	3570	721.9	730.31	730.31	732.02	0.012233	11.04	441.02	132.45	0.77
Reach		1%										
1	3538	Future	3570	719.92	729.87		730.54	0.004229	6.85	634.63	146.18	0.46
Reach		1%										
1	3423	Future	3940	719.27	729.39		730.05	0.004303	6.85	708.43	155.54	0.47
Reach		1%										
1	3230	Future	3940	717.88	728.42		729.2	0.004345	7.29	637.5	133.24	0.48
Reach		1%										
1	3117	Future	3940	716.04	725.91	725.91	728.2	0.016369	12.77	399.19	107.49	0.89
Reach		1%										
1	2909	Future	3940	716.16	725.61		726.17	0.003284	6.11	729.28	151.62	0.41
Reach		1%										
1	2646	Future	3940	713.01	722.93	722.34	724.61	0.01115	10.84	459.46	131.52	0.74
Reach		1%										
1	2480	Future	3940	710.81	720.8	720.8	722.59	0.01315	11.21	462.4	171.92	0.79
Reach		1%										
1	2200	Future	3940	710.52	719.77		720.26	0.003989	6.47	906.26	323.46	0.45
Reach		1%										
1	1987	Future	3940	708.81	719.1	718.21	719.6	0.003048	7.01	1000.37	375.15	0.44
Reach		1%										
1	1840	Future	3940	706.14	717.91	716.52	719.03	0.005256	9.28	578.61	286.38	0.57
Reach			Lat									
1	1839		Struct									
Reach		1%										
1	1736	Future	3940	706.14	717.56	715.87	718.53	0.003605	8.67	575.2	342.31	0.54
Reach		1%										
1	1683	Future	3940	706.14	717.48	714.74	718.28	0.002444	7.47	570.38	368.21	0.45
Reach												
1	1665		Bridge									
Reach		1%										
1	1646	Future	3940	706.06	715.74	714.81	717.89	0.007584	11.94	346.28	57.3	0.77
Reach			Lat									
1	1645		Struct									
Reach		1%										
1	1609	Future	3940	705.45	715.51	714.63	717.57	0.007217	11.8	360.97	117.09	0.76
Reach		1%										
1	1556	Future	3940	704.61	716.13	712.53	717.02	0.002358	7.7	542.73	168.27	0.45
Reach		1%										
1	1463	Future	3940	704.01	715.91	712.18	716.81	0.002293	7.74	542.42	283.67	0.44
Reach		1%										
1	1370	Future	3940	703.44	714.56	712.93	716.4	0.005525	11.13	380.31	266.34	0.67
Reach		1%										
1	1334	Future	3940	702.62	714.65	711.55	716	0.003438	9.51	439.7	326.88	0.53
Reach												
1	1264		Bridge									
Reach		1%										
1	1194	Future	3940	702.62	711.6	711.6	714.79	0.012595	14.39	280.37	140.83	0.96
Reach		1%										
1	1056	Future	3940	700.98	711.33	708.73	712.31	0.00322	8.01	514.23	181.34	0.51
Reach		1%										
1	908	Future	4740	700.2	709.11	708.69	711.38	0.009355	12.24	405.03	95.71	0.85
Reach		1%										
1	691	Future	4740	699.34	709.15	706.17	709.99	0.002589	7.56	736.33	172.28	0.47
Reach		1%										
1	658	Future	4740	699.89	709.12	705.79	709.86	0.0022	7.13	812.13	194.16	0.43
Reach												
1	635		Bridge									
Reach		1%										
1	612	Future	4740	698.25	707.16	705.55	708.47	0.005115	9.34	581.61	159.33	0.64
Reach		1%										
1	548	Future	4740	697.44	707.12		708.01	0.00321	7.92	736.75	191.22	0.51
Reach		1%										
1	363	Future	4740	696.13	707.14		707.53	0.001172	5.48	1210.08	344.38	0.32
Reach		1%										
1	267	Future	4740	695.7	706.96		707.41	0.001254	5.88	1199.47	350.28	0.33
Reach		1%										
1	209	Future	4740	691.65	707.04	700.78	707.25	0.000562	4.23	1725.14	406.43	0.22
Reach												
1	188		Culvert									
Reach		1%										
1	167	Future	4740	691.65	706.33	704.21	706.71	0.001255	6.11	1272.22	343.68	0.32
Reach		1%										
1	118	Future	4740	695.06	704.37	704.24	706.16	0.008004	12.21	514.99	124.41	0.8

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	4% Future	1910	797.58	801.45	801.44	801.93	0.011578	8.17	444.21	364.92	0.92
Reach 1	12470	4% Future	1910	794.68	798.14		798.42	0.007932	6.17	487.15	339.9	0.74
Reach 1	12091	4% Future	1910	790.01	795.17	795.17	795.73	0.00688	8.09	457.84	354.77	0.76
Reach 1	11865	4% Future	1910	789.19	793.49	793.42	794.01	0.008117	8.53	438.14	322.15	0.82
Reach 1	11579	4% Future	1910	788.01	791.65		792.07	0.006414	6.65	472.94	357.14	0.71
Reach 1	11385	4% Future	1910	785.68	790.9		791.27	0.003341	6.43	574.1	380.4	0.55
Reach 1	11319	4% Future	1910	785.49	790.39	790.39	790.96	0.005636	7.74	461.42	340.22	0.7
Reach 1	11194	4% Future	1910	784.81	788.65	788.65	789.29	0.005612	8.28	447.5	326.83	0.8
Reach 1	11035	4% Future	1910	783.25	787.24	787.24	787.97	0.005665	8.98	431.97	295.57	0.82
Reach 1	10823	4% Future	1910	781.11	784.79	784.25	785.21	0.002987	6.23	504.91	298.4	0.59
Reach 1	10529	4% Future	1910	777.6	784.91	782.08	784.94	0.000209	2.54	1746.62	473.12	0.17
Reach 1	10298	4% Future	1910	775.49	784.89	779.81	784.91	0.000063	1.67	2235.29	628.3	0.1
Reach 1	10086	4% Future	1910	774.33	784.89		784.9	0.000025	1.11	2379.45	407.44	0.06
Reach 1	9947	4% Future	2250	771.9	784.77	777.88	784.89	0.00031	3.32	1047.18	163.74	0.17
Reach 1	9898		Culvert									
Reach 1	9851	4% Future	2250	769.28	776.21	773.33	776.79	0.002568	6.12	368.5	57.35	0.42
Reach 1	9757	4% Future	2250	769.16	774.77	774.23	776.28	0.009319	9.92	235.21	59.14	0.81
Reach 1	9717	4% Future	2250	769.1	774.9	774.62	775.78	0.006332	8.05	350.84	192.39	0.67
Reach 1	9668	4% Future	2266.93	768.63	774.71	774.38	775.46	0.0052	7.7	404.78	202.56	0.61
Reach 1	9559	4% Future	2266.93	767.86	773.92	773.63	774.82	0.006489	8.38	376.94	211.56	0.68
Reach 1	9303	4% Future	2266.93	765.59	773.6	770.99	773.94	0.001546	5.13	522.55	558.28	0.35
Reach 1	9269	4% Future	2266.93	764.89	771.3	771.3	773.32	0.014301	11.42	201.21	59.5	0.98
Reach 1	9180		Culvert									
Reach 1	9055	4% Future	2266.93	763.5	769.21	769.21	771.12	0.011599	11.07	204.72	370.43	1
Reach 1	8952	4% Future	2266.93	766.68	768.06	767.42	768.23	0.003606	3.34	679.67	451.31	0.5
Reach 1	8745	4% Future	2266.93	765.1	767.79	766.2	767.88	0.000893	2.31	991.61	408.76	0.25
Reach 1	8635	4% Future	2266.93	764.33	767.72	765.65	767.79	0.000608	2.2	1096.37	406.99	0.21
Reach 1	8489	4% Future	2266.93	766	766.93	766.93	767.49	0.016208	6.43	397.74	346.28	1.1
Reach 1	8327	4% Future	2266.93	761.79	764.66	764.02	764.98	0.004192	4.75	535.36	269.12	0.47
Reach 1	8061	4% Future	2566.93	757	763.22	762.62	763.69	0.005366	5.82	503.22	250.76	0.39
Reach 1	7868	4% Future	2566.93	755.75	762.24	761.48	762.72	0.004778	5.82	494.66	270.54	0.38
Reach 1	7700	4% Future	2566.93	754.6	761.44	760.35	761.95	0.004289	5.82	455.52	263.38	0.39
Reach 1	7531	4% Future	2566.93	753.86	760.11	759.6	760.96	0.00815	7.4	348.34	262.5	0.52
Reach 1	7275	4% Future	2566.93	752.1	759.66	757.71	759.83	0.002226	3.75	900.47	402.82	0.31
Reach 1	7224	4% Future	2566.93	750.19	759.39	755.43	759.7	0.001688	4.47	583.53	507.21	0.29

Reach 1	7196		Bridge									
Reach 1	7173	4% Future	2566.93	750.53	757.84	757.32	759.23	0.014361	9.66	284.75	251.93	0.8
Reach 1	7100	4% Future	2566.93	750.57	757.09	757.09	757.86	0.012029	9.46	566.33	406.2	0.74
Reach 1	7026	4% Future	2566.93	749.79	756.18	755.53	756.92	0.009718	7.33	435.85	241.5	0.65
Reach 1	6925	4% Future	2566.93	748.59	756.19	753.56	756.4	0.001857	3.75	807.26	278.89	0.29
Reach 1	6723	4% Future	2566.93	749.3	755.53	754.38	755.84	0.004562	5.44	697.52	379.27	0.45
Reach 1	6475	4% Future	2566.93	746.76	752.52	752.52	753.71	0.018694	9.75	411.24	258.87	0.89
Reach 1	6371	4% Future	2566.93	745.47	751.77		752.06	0.007074	5.58	698.07	412.69	0.53
Reach 1	6348	4% Future	2566.93	744.36	751.48	750.69	751.88	0.004612	6.36	614.27	390.55	0.46
Reach 1	6325		Bridge									
Reach 1	6297	4% Future	2566.93	740.79	750.63	747.93	750.98	0.002409	5.54	721.19	358.48	0.35
Reach 1	6250	4% Future	2566.93	741.13	750.59		750.83	0.002101	5.24	882.52	341.85	0.33
Reach 1	6193	4% Future	2566.93	740.29	749.43	748.43	750.42	0.008451	9.21	529.96	248.32	0.6
Reach 1	6094	4% Future	2566.93	740.2	748.6	747.32	749.59	0.008372	8.95	478.2	196.41	0.6
Reach 1	5856	4% Future	2566.93	738.98	746.04	745.36	747.19	0.012227	9.26	386.7	149.86	0.69
Reach 1	5662	4% Future	2566.93	736.06	743.87	743.87	744.93	0.010942	9.68	468.41	228.12	0.67
Reach 1	5461	4% Future	2566.93	734.46	741.99	741.71	742.74	0.007542	8.23	495.43	219.56	0.6
Reach 1	5270	4% Future	2566.93	735.05	741.1		741.48	0.00498	6.05	609.64	232.23	0.48
Reach 1	5037	4% Future	2566.93	733.11	740.55		740.72	0.002105	4.66	939.13	333.31	0.33
Reach 1	4990	4% Future	2566.93	732.27	740.16	738.61	740.53	0.002943	5.86	699.28	263.06	0.39
Reach 1	4969		Culvert									
Reach 1	4948	4% Future	2566.93	732.27	738.79	738.48	739.9	0.009456	9.21	381.77	156.63	0.67
Reach 1	4889	4% Future	2566.93	730.53	738.32	737.43	739.31	0.008282	8.53	393.82	154.53	0.63
Reach 1	4691	4% Future	2566.93	729.26	737.18		737.79	0.006368	7.97	541.8	227.92	0.56
Reach 1	4529	4% Future	2566.93	729.11	735.99		736.58	0.007616	7.99	541.68	253.16	0.6
Reach 1	4486	4% Future	2566.93	728.62	735.63	735.34	736.21	0.00798	8.66	568.11	278.68	0.62
Reach 1	4471		Culvert									
Reach 1	4456	4% Future	2566.93	728.62	735.27	734.99	735.86	0.0089	8.89	553.02	272.47	0.65
Reach 1	4358	4% Future	2566.93	725.74	734.05	733.02	735.01	0.006674	8.3	419.98	218.31	0.62
Reach 1	4239	4% Future	2566.93	724.36	734.27		734.53	0.001164	4.09	658.85	114.03	0.27
Reach 1	4077	4% Future	2566.93	725.28	734.12	729.72	734.34	0.000993	3.76	714.18	151.63	0.25
Reach 1	3881	4% Future	2566.93	724.18	734.14		734.21	0.000242	2.16	1249.9	169.24	0.13
Reach 1	3767	4% Future	2566.93	723.09	734.13		734.19	0.000167	1.98	1413.06	173.94	0.11
Reach 1	3707	4% Future	2566.93	722.9	733.95	728.92	734.13	0.000687	3.76	1007.73	246.37	0.22
Reach 1	3668		Culvert									
Reach 1	3628	4% Future	2566.93	721.9	728.97	728.97	731.6	0.020067	13.06	204.41	100.17	0.97
Reach 1	3538	4% Future	2566.93	719.92	728.76		729.3	0.004169	6.04	488.9	120.34	0.45

Reach		4%										
1	3423	Future	2878.91	719.27	728.19		728.77	0.004829	6.37	530.93	139.59	0.48
Reach		4%										
1	3230	Future	2878.91	717.88	727.24		727.88	0.004382	6.52	492.38	113.28	0.46
Reach		4%										
1	3117	Future	2878.91	716.04	724.83	724.83	726.86	0.017697	11.75	292.13	91.04	0.89
Reach		4%										
1	2909	Future	2878.91	716.16	724.46		724.92	0.003363	5.47	566.61	130.58	0.4
Reach		4%										
1	2646	Future	2878.91	713.01	721.99	721.18	723.37	0.010783	9.63	347.98	106.41	0.71
Reach		4%										
1	2480	Future	2878.91	710.81	720.11	719.18	721.51	0.011514	9.7	352.15	146.8	0.73
Reach		4%										
1	2200	Future	2878.91	710.52	719.28		719.67	0.003206	5.51	754.98	305.76	0.4
Reach		4%										
1	1987	Future	2878.91	708.81	717.47	717.01	718.65	0.007357	9.31	457.5	290.36	0.66
Reach		4%										
1	1840	Future	2878.91	706.14	716.51	715.29	717.67	0.006445	9.06	383.44	161.52	0.62
Reach			Lat									
1	1839		Struct									
Reach		4%										
1	1736	Future	2878.91	706.14	715.94	714.75	717.06	0.005162	8.94	375.88	190.07	0.62
Reach		4%										
1	1683	Future	2878.91	706.14	715.93	713.47	716.66	0.002829	7.02	441.4	181.19	0.47
Reach												
1	1665		Bridge									
Reach		4%										
1	1646	Future	2878.91	706.06	714.49	713.56	716.23	0.007695	10.64	278.25	52.22	0.75
Reach			Lat									
1	1645		Struct									
Reach		4%										
1	1609	Future	2878.91	705.45	713.79	713.35	715.83	0.009785	11.57	259	64.85	0.84
Reach		4%										
1	1556	Future	2878.91	704.61	714.45	711.44	715.21	0.002578	7.03	423.96	102.31	0.45
Reach		4%										
1	1463	Future	2878.91	704.01	714.22	711.04	714.97	0.002471	7.05	424.92	109.93	0.44
Reach		4%										
1	1370	Future	2878.91	703.44	712.91	711.61	714.54	0.006365	10.36	290.66	78.39	0.69
Reach		4%										
1	1334	Future	2878.91	702.62	713	710.22	714.11	0.003501	8.5	351.53	278.43	0.52
Reach												
1	1264		Bridge									
Reach		4%										
1	1194	Future	2878.91	702.62	710.24	710.24	712.94	0.014124	13.18	219.95	60.68	0.98
Reach		4%										
1	1056	Future	2878.91	700.98	710.2	707.74	710.95	0.003034	6.98	423.64	117.86	0.48
Reach		4%										
1	908	Future	3598.72	700.2	708	707.67	710.01	0.010527	11.44	322.56	72.1	0.87
Reach		4%										
1	691	Future	3598.72	699.34	707.75	705.3	708.53	0.002997	7.17	534.21	113.16	0.49
Reach		4%										
1	658	Future	3598.72	699.89	707.7	704.91	708.4	0.002549	6.79	578.88	132.04	0.45
Reach												
1	635		Bridge									
Reach		4%										
1	612	Future	3598.72	698.25	706.67	704.7	707.59	0.003923	7.78	506.58	143.41	0.55
Reach		4%										
1	548	Future	3598.72	697.44	706.62		707.26	0.002471	6.63	644.52	172.69	0.44
Reach		4%										
1	363	Future	3598.72	696.13	706.59		706.89	0.000923	4.67	1030.97	312.68	0.28
Reach		4%										
1	267	Future	3598.72	695.7	706.46		706.8	0.000964	4.98	1029.45	330.62	0.29
Reach		4%										
1	209	Future	3598.72	691.65	706.52	699.66	706.68	0.000419	3.54	1521.06	383.94	0.19
Reach												
1	188		Culvert									
Reach		4%										
1	167	Future	3598.72	691.65	705.19	701.66	705.67	0.001578	6.39	891.22	310.06	0.35
Reach		4%										
1	118	Future	3598.72	695.06	703.58	703.54	705.18	0.008016	11.32	417.88	121.64	0.79

Appendix 4
ALT 4 – approximate 230-ft Arch Bridge with upstream detention

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	1% Future	2610	797.58	801.75	801.68	802.28	0.011235	8.71	556.59	374.78	0.93
Reach 1	12470	1% Future	2610	794.68	798.47		798.8	0.007989	6.81	601.97	360.88	0.76
Reach 1	12091	1% Future	2610	790.01	795.51	795.42	796.09	0.006978	8.65	578.79	369.89	0.77
Reach 1	11865	1% Future	2610	789.19	793.81	793.71	794.39	0.008466	9.25	546.36	350.57	0.85
Reach 1	11579	1% Future	2610	788.01	792.04		792.48	0.005988	7.02	621.12	398.99	0.7
Reach 1	11385	1% Future	2610	785.68	791.28		791.68	0.003549	7.02	726.89	414.68	0.57
Reach 1	11319	1% Future	2610	785.49	790.67	790.67	791.35	0.006511	8.73	560.26	367.04	0.76
Reach 1	11194	1% Future	2610	784.81	788.99	788.99	789.72	0.006153	9.23	554.96	340.55	0.85
Reach 1	11035	1% Future	2610	783.25	787.74	787.74	788.46	0.005222	9.37	590.9	360.61	0.8
Reach 1	10823	1% Future	2610	781.11	786.14	784.64	786.33	0.001124	4.74	1071.22	520.19	0.38
Reach 1	10529	1% Future	2610	777.6	786.14	782.39	786.17	0.000186	2.68	2406.58	619.73	0.17
Reach 1	10298	1% Future	2610	775.49	786.13	780.24	786.15	0.000064	1.83	2726.25	669.1	0.1
Reach 1	10086	1% Future	2610	774.33	786.12		786.14	0.00003	1.3	2919.27	481.33	0.07
Reach 1	9947	1% Future	3140	771.9	785.94	778.77	786.11	0.000421	4.12	1260.08	204.61	0.2
Reach 1	9898		Culvert									
Reach 1	9851	1% Future	3140	769.28	777.47	774.26	778.25	0.002728	7.1	460.77	89.61	0.45
Reach 1	9757	1% Future	3140	769.16	775.31	775.31	777.62	0.012475	12.33	267.54	116.98	0.95
Reach 1	9717	1% Future	3140	769.1	775.69	775.26	776.63	0.005818	8.59	472.71	259.85	0.66
Reach 1	9668	1% Future	3110	768.63	775.64	774.94	776.31	0.004048	7.63	577.83	290.66	0.56
Reach 1	9559	1% Future	3110	767.86	775.47	774.38	775.89	0.002596	6.4	806.53	420.03	0.45
Reach 1	9303	1% Future	3110	765.59	775.03	771.76	775.41	0.001357	5.48	665.44	629.39	0.34
Reach 1	9269	1% Future	3110	764.89	772.3	772.3	774.7	0.012941	12.52	254.91	88.83	0.96
Reach 1	9180		Culvert									
Reach 1	9055	1% Future	3110	763.5	770.1	770.1	772.46	0.01092	12.34	252.01	379.28	1
Reach 1	8952	1% Future	3110	766.68	768.5	767.66	768.69	0.002984	3.54	881.17	465.66	0.46
Reach 1	8745	1% Future	3110	765.1	768.22	766.47	768.34	0.000996	2.7	1168.3	414.13	0.27
Reach 1	8635	1% Future	3110	764.33	768.14	765.97	768.24	0.000743	2.63	1267.23	415.57	0.23
Reach 1	8489	1% Future	3110	766	767.2	767.2	767.89	0.015596	7.12	492.62	350.25	1.07
Reach 1	8327	1% Future	3110	761.79	765.21	764.36	765.57	0.003774	5.12	682.7	277.59	0.46
Reach 1	8061	1% Future	3570	757	763.89	763.07	764.41	0.004727	6.21	660.91	289.25	0.39
Reach 1	7868	1% Future	3570	755.75	763.06	761.99	763.58	0.004025	6.13	656	318.39	0.38
Reach 1	7700	1% Future	3570	754.6	762.23	760.9	762.87	0.004212	6.52	570.92	290.19	0.41
Reach 1	7531	1% Future	3570	753.86	760.86	760.22	761.91	0.007727	8.23	437.65	297.54	0.55

Reach		1%										
1	7275	Future	3570	752.1	760.56	758.14	760.77	0.002156	4.18	1127.17	453.65	0.32
Reach		1%										
1	7224	Future	3570	750.19	760.27	756.22	760.63	0.001827	5.03	869.71	591.73	0.31
Reach												
1	7196		Bridge									
Reach		1%										
1	7173	Future	3570	750.53	758.23	758.23	760.48	0.02091	12.31	312.13	345.09	0.98
Reach		1%										
1	7100	Future	3570	750.57	757.96	757.5	758.54	0.008366	8.77	829.16	450.82	0.63
Reach		1%										
1	7026	Future	3570	749.79	756.78	756.19	757.75	0.01084	8.51	531.63	252.2	0.7
Reach		1%										
1	6925	Future	3570	748.59	756.82	754.14	757.11	0.002326	4.54	950.22	295.72	0.34
Reach		1%										
1	6723	Future	3570	749.3	755.95	754.84	756.4	0.005928	6.58	801.56	411.28	0.52
Reach		1%										
1	6475	Future	3570	746.76	753.38	753.38	754.28	0.01261	9.18	728.7	402.39	0.75
Reach		1%										
1	6371	Future	3570	745.47	751.65	751.65	752.37	0.016815	9.28	649.61	404	0.83
Reach		1%										
1	6348	Future	3570	744.36	751.58	750.64	751.91	0.005499	6.16	842.55	394.24	0.48
Reach												
1	6325		Culvert									
Reach		1%										
1	6297	Future	3570	740.79	751.58	749.62	751.75	0.00145	4.34	1240.32	404.9	0.27
Reach		1%										
1	6250	Future	3570	741.13	751.44		751.67	0.001914	5.35	1179.87	362.44	0.32
Reach		1%										
1	6193	Future	3570	740.29	750.56		751.35	0.006667	9	850.73	306.66	0.54
Reach		1%										
1	6094	Future	3570	740.2	749.66		750.6	0.007569	9.35	713.15	246.12	0.58
Reach		1%										
1	5856	Future	3570	738.98	746.77	746.54	748.19	0.01367	10.63	505.37	176.96	0.75
Reach		1%										
1	5662	Future	3570	736.06	744.48	744.48	745.65	0.011877	10.71	612.51	239.09	0.71
Reach		1%										
1	5461	Future	3570	734.46	742.67		743.46	0.007485	8.83	650.83	236.79	0.61
Reach		1%										
1	5270	Future	3570	735.05	741.79		742.23	0.004891	6.55	773.14	239.59	0.49
Reach		1%										
1	5037	Future	3570	733.11	741.27		741.46	0.002079	4.97	1186.19	346.42	0.33
Reach		1%										
1	4990	Future	3570	732.27	740.81	739.55	741.26	0.003361	6.64	880.51	289.8	0.42
Reach												
1	4969		Culvert									
Reach		1%										
1	4948	Future	3570	732.27	739.57	739.37	740.82	0.009797	10.19	517.51	193.82	0.7
Reach		1%										
1	4889	Future	3570	730.53	739	738.67	740.22	0.009416	9.8	509.27	186.85	0.68
Reach		1%										
1	4691	Future	3570	729.26	737.85		738.53	0.006715	8.75	710.51	272.03	0.58
Reach		1%										
1	4529	Future	3570	729.11	736.53		737.21	0.008408	8.94	685.25	283.51	0.64
Reach		1%										
1	4486	Future	3570	728.62	736.17	735.82	736.8	0.008333	9.37	728.47	308.51	0.64
Reach												
1	4471		Culvert									
Reach		1%										
1	4456	Future	3570	728.62	736.21	735.44	736.65	0.006092	8.12	835.46	325.25	0.55
Reach		1%										
1	4358	Future	3570	725.74	735.09	734.48	735.97	0.005478	8.43	628.7	283.18	0.58
Reach		1%										
1	4239	Future	3570	724.36	735.12		735.51	0.001512	5.03	759.69	122.75	0.32
Reach		1%										
1	4077	Future	3570	725.28	734.93	730.54	735.26	0.001309	4.65	818.13	157.05	0.29
Reach		1%										
1	3881	Future	3570	724.18	734.97		735.08	0.000343	2.74	1392.48	176.72	0.16
Reach		1%										
1	3767	Future	3570	723.09	734.95		735.04	0.000245	2.53	1558.64	181.93	0.14
Reach		1%										
1	3707	Future	3570	722.9	734.71	730.07	734.97	0.000924	4.6	1207.41	282.64	0.26
Reach												
1	3668		Culvert									

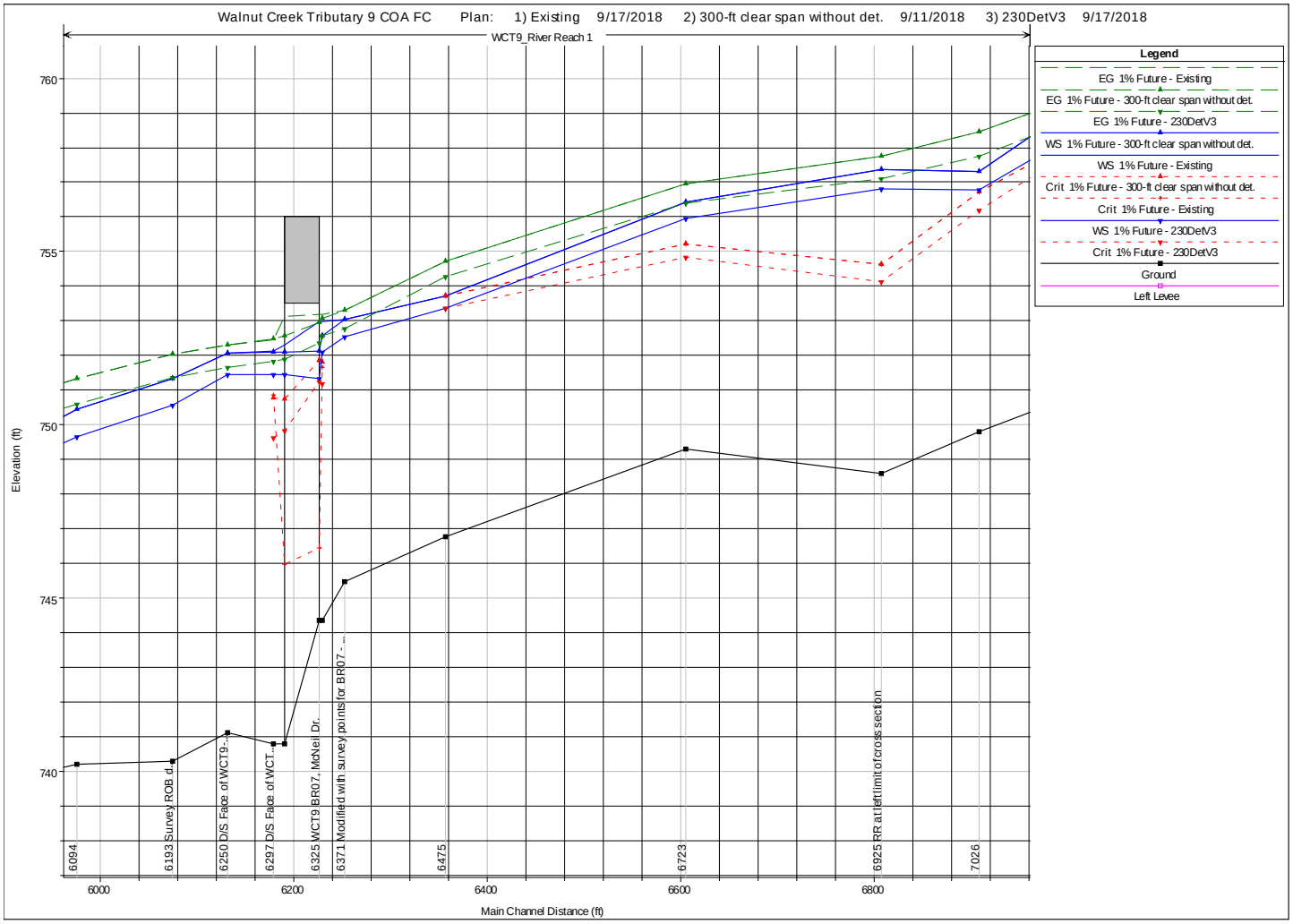
Reach		1%										
1	3628	Future	3570	721.9	730.31	730.31	732.02	0.012233	11.04	441.02	132.45	0.77
Reach		1%										
1	3538	Future	3570	719.92	729.87		730.54	0.004229	6.85	634.63	146.18	0.46
Reach		1%										
1	3423	Future	3940	719.27	729.39		730.05	0.004303	6.85	708.43	155.54	0.47
Reach		1%										
1	3230	Future	3940	717.88	728.42		729.2	0.004345	7.29	637.5	133.24	0.48
Reach		1%										
1	3117	Future	3940	716.04	725.91	725.91	728.2	0.016369	12.77	399.19	107.49	0.89
Reach		1%										
1	2909	Future	3940	716.16	725.61		726.17	0.003284	6.11	729.28	151.62	0.41
Reach		1%										
1	2646	Future	3940	713.01	722.93	722.34	724.61	0.01115	10.84	459.46	131.52	0.74
Reach		1%										
1	2480	Future	3940	710.81	720.8	720.8	722.59	0.01315	11.21	462.4	171.92	0.79
Reach		1%										
1	2200	Future	3940	710.52	719.77		720.26	0.003989	6.47	906.26	323.46	0.45
Reach		1%										
1	1987	Future	3940	708.81	719.1	718.21	719.6	0.003048	7.01	1000.37	375.15	0.44
Reach		1%										
1	1840	Future	3940	706.14	717.91	716.52	719.03	0.005256	9.28	578.61	286.38	0.57
Reach			Lat									
1	1839		Struct									
Reach		1%										
1	1736	Future	3940	706.14	717.56	715.87	718.53	0.003605	8.67	575.2	342.31	0.54
Reach		1%										
1	1683	Future	3940	706.14	717.48	714.74	718.28	0.002444	7.47	570.38	368.21	0.45
Reach												
1	1665		Bridge									
Reach		1%										
1	1646	Future	3940	706.06	715.74	714.81	717.89	0.007584	11.94	346.28	57.3	0.77
Reach			Lat									
1	1645		Struct									
Reach		1%										
1	1609	Future	3940	705.45	715.51	714.63	717.57	0.007217	11.8	360.97	117.09	0.76
Reach		1%										
1	1556	Future	3940	704.61	716.13	712.53	717.02	0.002358	7.7	542.73	168.27	0.45
Reach		1%										
1	1463	Future	3940	704.01	715.91	712.18	716.81	0.002293	7.74	542.42	283.67	0.44
Reach		1%										
1	1370	Future	3940	703.44	714.56	712.93	716.4	0.005525	11.13	380.31	266.34	0.67
Reach		1%										
1	1334	Future	3940	702.62	714.65	711.55	716	0.003438	9.51	439.7	326.88	0.53
Reach												
1	1264		Bridge									
Reach		1%										
1	1194	Future	3940	702.62	711.6	711.6	714.79	0.012595	14.39	280.37	140.83	0.96
Reach		1%										
1	1056	Future	3940	700.98	711.33	708.73	712.31	0.00322	8.01	514.23	181.34	0.51
Reach		1%										
1	908	Future	4740	700.2	709.11	708.69	711.38	0.009355	12.24	405.03	95.71	0.85
Reach		1%										
1	691	Future	4740	699.34	709.15	706.17	709.99	0.002589	7.56	736.33	172.28	0.47
Reach		1%										
1	658	Future	4740	699.89	709.12	705.79	709.86	0.0022	7.13	812.13	194.16	0.43
Reach												
1	635		Bridge									
Reach		1%										
1	612	Future	4740	698.25	707.16	705.55	708.47	0.005115	9.34	581.61	159.33	0.64
Reach		1%										
1	548	Future	4740	697.44	707.12		708.01	0.00321	7.92	736.75	191.22	0.51
Reach		1%										
1	363	Future	4740	696.13	707.14		707.53	0.001172	5.48	1210.08	344.38	0.32
Reach		1%										
1	267	Future	4740	695.7	706.96		707.41	0.001254	5.88	1199.47	350.28	0.33
Reach		1%										
1	209	Future	4740	691.65	707.04	700.78	707.25	0.000562	4.23	1725.14	406.43	0.22
Reach												
1	188		Culvert									
Reach		1%										
1	167	Future	4740	691.65	706.33	704.21	706.71	0.001255	6.11	1272.22	343.68	0.32
Reach		1%										
1	118	Future	4740	695.06	704.37	704.24	706.16	0.008004	12.21	514.99	124.41	0.8

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
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	12840	4% Future	1910	797.58	801.45	801.44	801.93	0.011578	8.17	444.21	364.92	0.92
Reach 1	12470	4% Future	1910	794.68	798.14		798.42	0.007932	6.17	487.15	339.9	0.74
Reach 1	12091	4% Future	1910	790.01	795.17	795.17	795.73	0.00688	8.09	457.84	354.77	0.76
Reach 1	11865	4% Future	1910	789.19	793.49	793.42	794.01	0.008117	8.53	438.14	322.15	0.82
Reach 1	11579	4% Future	1910	788.01	791.65		792.07	0.006414	6.65	472.94	357.14	0.71
Reach 1	11385	4% Future	1910	785.68	790.9		791.27	0.003341	6.43	574.1	380.4	0.55
Reach 1	11319	4% Future	1910	785.49	790.39	790.39	790.96	0.005636	7.74	461.42	340.22	0.7
Reach 1	11194	4% Future	1910	784.81	788.65	788.65	789.29	0.005612	8.28	447.5	326.83	0.8
Reach 1	11035	4% Future	1910	783.25	787.24	787.24	787.97	0.005665	8.98	431.97	295.57	0.82
Reach 1	10823	4% Future	1910	781.11	784.79	784.25	785.21	0.002987	6.23	504.91	298.4	0.59
Reach 1	10529	4% Future	1910	777.6	784.91	782.08	784.94	0.000209	2.54	1746.62	473.12	0.17
Reach 1	10298	4% Future	1910	775.49	784.89	779.81	784.91	0.000063	1.67	2235.29	628.3	0.1
Reach 1	10086	4% Future	1910	774.33	784.89		784.9	0.000025	1.11	2379.45	407.44	0.06
Reach 1	9947	4% Future	2250	771.9	784.77	777.88	784.89	0.00031	3.32	1047.18	163.74	0.17
Reach 1	9898		Culvert									
Reach 1	9851	4% Future	2250	769.28	776.21	773.33	776.79	0.002568	6.12	368.5	57.35	0.42
Reach 1	9757	4% Future	2250	769.16	774.77	774.23	776.28	0.009319	9.92	235.21	59.14	0.81
Reach 1	9717	4% Future	2250	769.1	774.9	774.62	775.78	0.006332	8.05	350.84	192.39	0.67
Reach 1	9668	4% Future	2266.93	768.63	774.71	774.38	775.46	0.0052	7.7	404.78	202.56	0.61
Reach 1	9559	4% Future	2266.93	767.86	773.92	773.63	774.82	0.006489	8.38	376.94	211.56	0.68
Reach 1	9303	4% Future	2266.93	765.59	773.6	770.99	773.94	0.001546	5.13	522.55	558.28	0.35
Reach 1	9269	4% Future	2266.93	764.89	771.3	771.3	773.32	0.014301	11.42	201.21	59.5	0.98
Reach 1	9180		Culvert									
Reach 1	9055	4% Future	2266.93	763.5	769.21	769.21	771.12	0.011599	11.07	204.72	370.43	1
Reach 1	8952	4% Future	2266.93	766.68	768.06	767.42	768.23	0.003606	3.34	679.67	451.31	0.5
Reach 1	8745	4% Future	2266.93	765.1	767.79	766.2	767.88	0.000893	2.31	991.61	408.76	0.25
Reach 1	8635	4% Future	2266.93	764.33	767.72	765.65	767.79	0.000608	2.2	1096.37	406.99	0.21
Reach 1	8489	4% Future	2266.93	766	766.93	766.93	767.49	0.016208	6.43	397.74	346.28	1.1
Reach 1	8327	4% Future	2266.93	761.79	764.66	764.02	764.98	0.004192	4.75	535.36	269.12	0.47
Reach 1	8061	4% Future	2566.93	757	763.22	762.62	763.69	0.005366	5.82	503.22	250.76	0.39
Reach 1	7868	4% Future	2566.93	755.75	762.24	761.48	762.72	0.004778	5.82	494.66	270.54	0.38
Reach 1	7700	4% Future	2566.93	754.6	761.44	760.35	761.95	0.004289	5.82	455.52	263.38	0.39
Reach 1	7531	4% Future	2566.93	753.86	760.11	759.6	760.96	0.00815	7.4	348.34	262.5	0.52
Reach 1	7275	4% Future	2566.93	752.1	759.66	757.71	759.83	0.002226	3.75	900.47	402.82	0.31
Reach 1	7224	4% Future	2566.93	750.19	759.39	755.43	759.7	0.001688	4.47	583.53	507.21	0.29

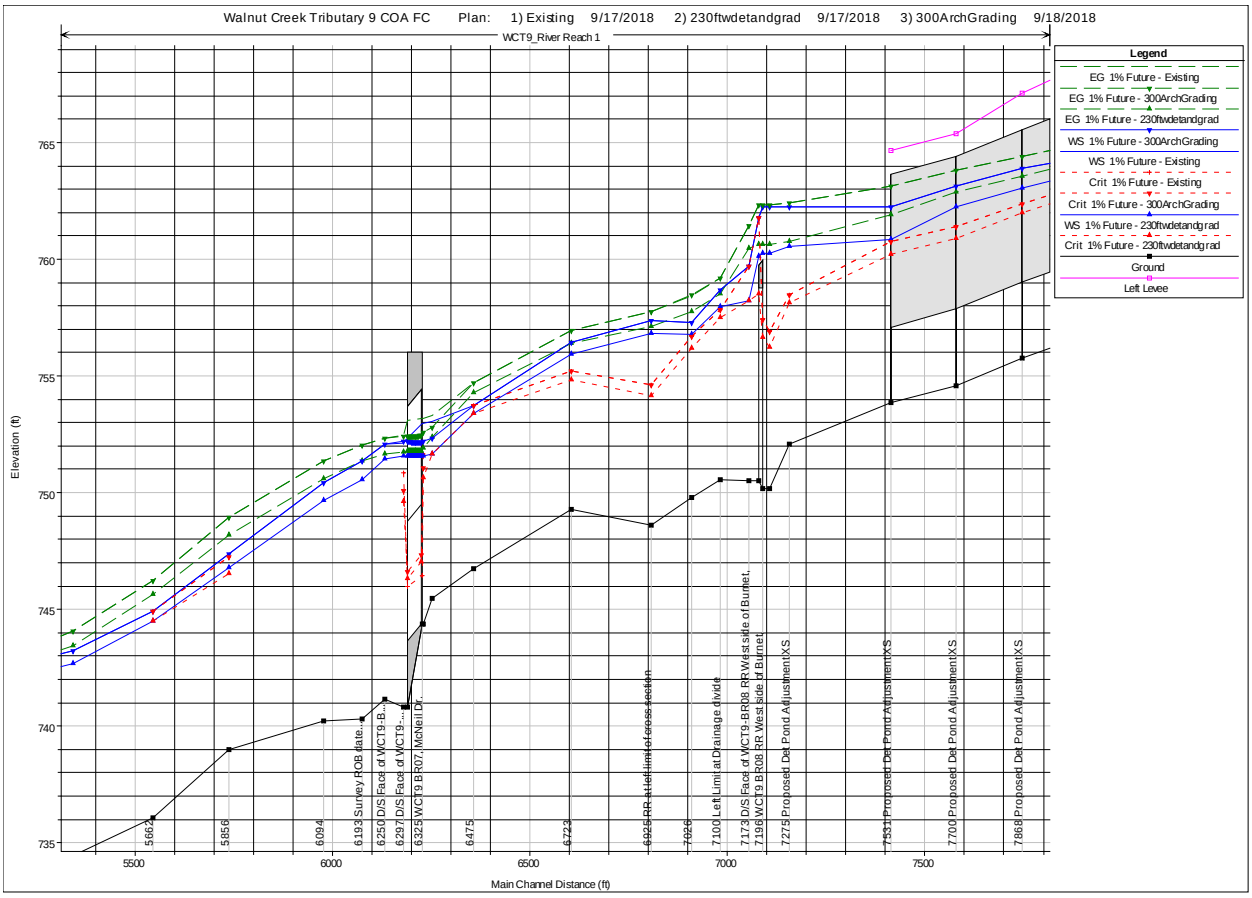
Reach 1	7196		Bridge									
Reach 1	7173	4% Future	2566.93	750.53	757.84	757.32	759.23	0.014361	9.66	284.75	251.93	0.8
Reach 1	7100	4% Future	2566.93	750.57	757.09	757.09	757.86	0.012029	9.46	566.33	406.2	0.74
Reach 1	7026	4% Future	2566.93	749.79	756.14	755.53	756.9	0.010083	7.42	429.99	240.86	0.66
Reach 1	6925	4% Future	2566.93	748.59	756.16	753.56	756.36	0.001909	3.78	798.99	277.88	0.3
Reach 1	6723	4% Future	2566.93	749.3	755.45	754.38	755.78	0.004949	5.59	677.86	373.58	0.47
Reach 1	6475	4% Future	2566.93	746.76	752.77	752.52	753.75	0.014462	8.95	492.12	356.63	0.79
Reach 1	6371	4% Future	2566.93	745.47	751.32	751.32	751.95	0.015517	8.41	520.84	380.95	0.78
Reach 1	6348	4% Future	2566.93	744.36	750.64	750.3	751.06	0.009606	7.11	567.34	356.57	0.61
Reach 1	6325		Culvert									
Reach 1	6297	4% Future	2566.93	740.79	750.78	749.17	750.93	0.001438	4.03	995.34	370.09	0.26
Reach 1	6250	4% Future	2566.93	741.13	750.59		750.83	0.002101	5.24	882.52	341.85	0.33
Reach 1	6193	4% Future	2566.93	740.29	749.43	748.43	750.42	0.008451	9.21	529.96	248.32	0.6
Reach 1	6094	4% Future	2566.93	740.2	748.6	747.32	749.59	0.008372	8.95	478.2	196.41	0.6
Reach 1	5856	4% Future	2566.93	738.98	746.04	745.36	747.19	0.012227	9.26	386.7	149.86	0.69
Reach 1	5662	4% Future	2566.93	736.06	743.87	743.87	744.93	0.010942	9.68	468.41	228.12	0.67
Reach 1	5461	4% Future	2566.93	734.46	741.99	741.71	742.74	0.007542	8.23	495.43	219.56	0.6
Reach 1	5270	4% Future	2566.93	735.05	741.1		741.48	0.00498	6.05	609.64	232.23	0.48
Reach 1	5037	4% Future	2566.93	733.11	740.55		740.72	0.002105	4.66	939.13	333.31	0.33
Reach 1	4990	4% Future	2566.93	732.27	740.16	738.61	740.53	0.002943	5.86	699.28	263.06	0.39
Reach 1	4969		Culvert									
Reach 1	4948	4% Future	2566.93	732.27	738.79	738.48	739.9	0.009456	9.21	381.77	156.63	0.67
Reach 1	4889	4% Future	2566.93	730.53	738.32	737.43	739.31	0.008282	8.53	393.82	154.53	0.63
Reach 1	4691	4% Future	2566.93	729.26	737.18		737.79	0.006368	7.97	541.8	227.92	0.56
Reach 1	4529	4% Future	2566.93	729.11	735.99		736.58	0.007616	7.99	541.68	253.16	0.6
Reach 1	4486	4% Future	2566.93	728.62	735.63	735.34	736.21	0.00798	8.66	568.11	278.68	0.62
Reach 1	4471		Culvert									
Reach 1	4456	4% Future	2566.93	728.62	735.27	734.99	735.86	0.0089	8.89	553.02	272.47	0.65
Reach 1	4358	4% Future	2566.93	725.74	734.05	733.02	735.01	0.006674	8.3	419.98	218.31	0.62
Reach 1	4239	4% Future	2566.93	724.36	734.27		734.53	0.001164	4.09	658.85	114.03	0.27
Reach 1	4077	4% Future	2566.93	725.28	734.12	729.72	734.34	0.000993	3.76	714.18	151.63	0.25
Reach 1	3881	4% Future	2566.93	724.18	734.14		734.21	0.000242	2.16	1249.9	169.24	0.13
Reach 1	3767	4% Future	2566.93	723.09	734.13		734.19	0.000167	1.98	1413.06	173.94	0.11
Reach 1	3707	4% Future	2566.93	722.9	733.95	728.92	734.13	0.000687	3.76	1007.73	246.37	0.22
Reach 1	3668		Culvert									
Reach 1	3628	4% Future	2566.93	721.9	728.97	728.97	731.6	0.020067	13.06	204.41	100.17	0.97
Reach 1	3538	4% Future	2566.93	719.92	728.76		729.3	0.004169	6.04	488.9	120.34	0.45

Reach		4%										
1	3423	Future	2878.91	719.27	728.19		728.77	0.004829	6.37	530.93	139.59	0.48
Reach		4%										
1	3230	Future	2878.91	717.88	727.24		727.88	0.004382	6.52	492.38	113.28	0.46
Reach		4%										
1	3117	Future	2878.91	716.04	724.83	724.83	726.86	0.017697	11.75	292.13	91.04	0.89
Reach		4%										
1	2909	Future	2878.91	716.16	724.46		724.92	0.003363	5.47	566.61	130.58	0.4
Reach		4%										
1	2646	Future	2878.91	713.01	721.99	721.18	723.37	0.010783	9.63	347.98	106.41	0.71
Reach		4%										
1	2480	Future	2878.91	710.81	720.11	719.18	721.51	0.011514	9.7	352.15	146.8	0.73
Reach		4%										
1	2200	Future	2878.91	710.52	719.28		719.67	0.003206	5.51	754.98	305.76	0.4
Reach		4%										
1	1987	Future	2878.91	708.81	717.47	717.01	718.65	0.007357	9.31	457.5	290.36	0.66
Reach		4%										
1	1840	Future	2878.91	706.14	716.51	715.29	717.67	0.006445	9.06	383.44	161.52	0.62
Reach			Lat									
1	1839		Struct									
Reach		4%										
1	1736	Future	2878.91	706.14	715.94	714.75	717.06	0.005162	8.94	375.88	190.07	0.62
Reach		4%										
1	1683	Future	2878.91	706.14	715.93	713.47	716.66	0.002829	7.02	441.4	181.19	0.47
Reach												
1	1665		Bridge									
Reach		4%										
1	1646	Future	2878.91	706.06	714.49	713.56	716.23	0.007695	10.64	278.25	52.22	0.75
Reach			Lat									
1	1645		Struct									
Reach		4%										
1	1609	Future	2878.91	705.45	713.79	713.35	715.83	0.009785	11.57	259	64.85	0.84
Reach		4%										
1	1556	Future	2878.91	704.61	714.45	711.44	715.21	0.002578	7.03	423.96	102.31	0.45
Reach		4%										
1	1463	Future	2878.91	704.01	714.22	711.04	714.97	0.002471	7.05	424.92	109.93	0.44
Reach		4%										
1	1370	Future	2878.91	703.44	712.91	711.61	714.54	0.006365	10.36	290.66	78.39	0.69
Reach		4%										
1	1334	Future	2878.91	702.62	713	710.22	714.11	0.003501	8.5	351.53	278.43	0.52
Reach												
1	1264		Bridge									
Reach		4%										
1	1194	Future	2878.91	702.62	710.24	710.24	712.94	0.014124	13.18	219.95	60.68	0.98
Reach		4%										
1	1056	Future	2878.91	700.98	710.2	707.74	710.95	0.003034	6.98	423.64	117.86	0.48
Reach		4%										
1	908	Future	3598.72	700.2	708	707.67	710.01	0.010527	11.44	322.56	72.1	0.87
Reach		4%										
1	691	Future	3598.72	699.34	707.75	705.3	708.53	0.002997	7.17	534.21	113.16	0.49
Reach		4%										
1	658	Future	3598.72	699.89	707.7	704.91	708.4	0.002549	6.79	578.88	132.04	0.45
Reach												
1	635		Bridge									
Reach		4%										
1	612	Future	3598.72	698.25	706.67	704.7	707.59	0.003923	7.78	506.58	143.41	0.55
Reach		4%										
1	548	Future	3598.72	697.44	706.62		707.26	0.002471	6.63	644.52	172.69	0.44
Reach		4%										
1	363	Future	3598.72	696.13	706.59		706.89	0.000923	4.67	1030.97	312.68	0.28
Reach		4%										
1	267	Future	3598.72	695.7	706.46		706.8	0.000964	4.98	1029.45	330.62	0.29
Reach		4%										
1	209	Future	3598.72	691.65	706.52	699.66	706.68	0.000419	3.54	1521.06	383.94	0.19
Reach												
1	188		Culvert									
Reach		4%										
1	167	Future	3598.72	691.65	705.19	701.66	705.67	0.001578	6.39	891.22	310.06	0.35
Reach		4%										
1	118	Future	3598.72	695.06	703.58	703.54	705.18	0.008016	11.32	417.88	121.64	0.79

Appendix 5
Profile Plot comparing Existing and Alternatives 1, 3

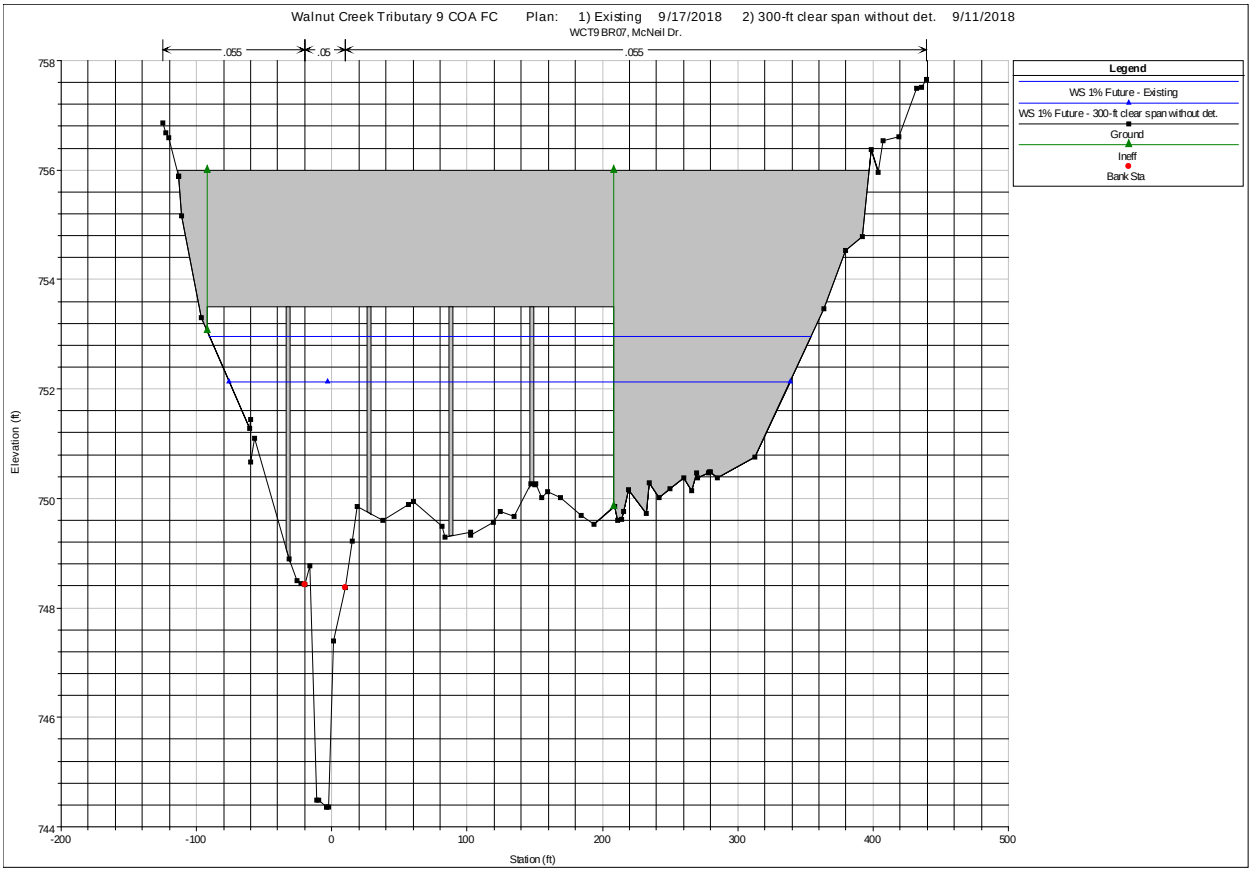


Appendix 6
Profile Plot comparing Existing and Alternatives 2, 4



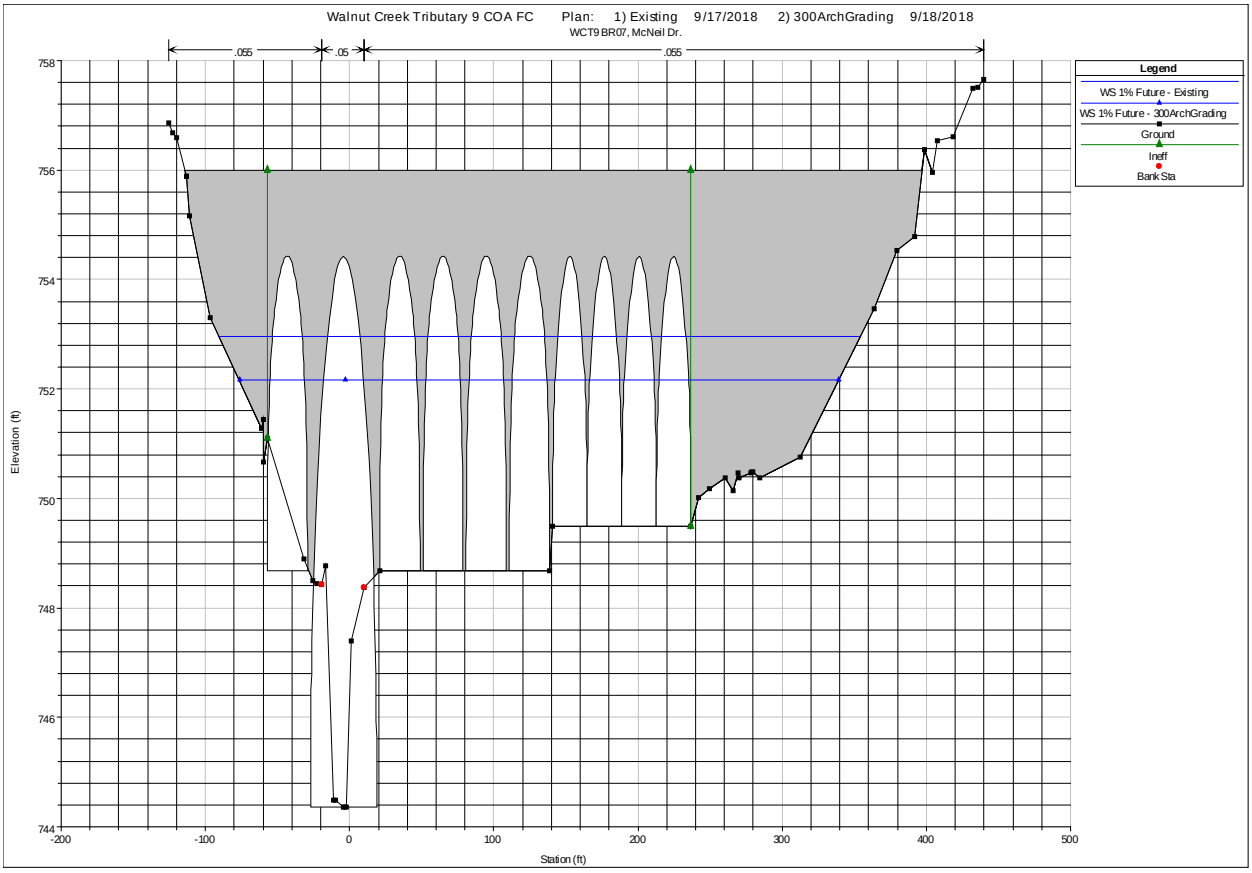
Appendix 7
Cross Section comparing Existing and Alternative 1 Bridge Upstream

XS 6325 BR US



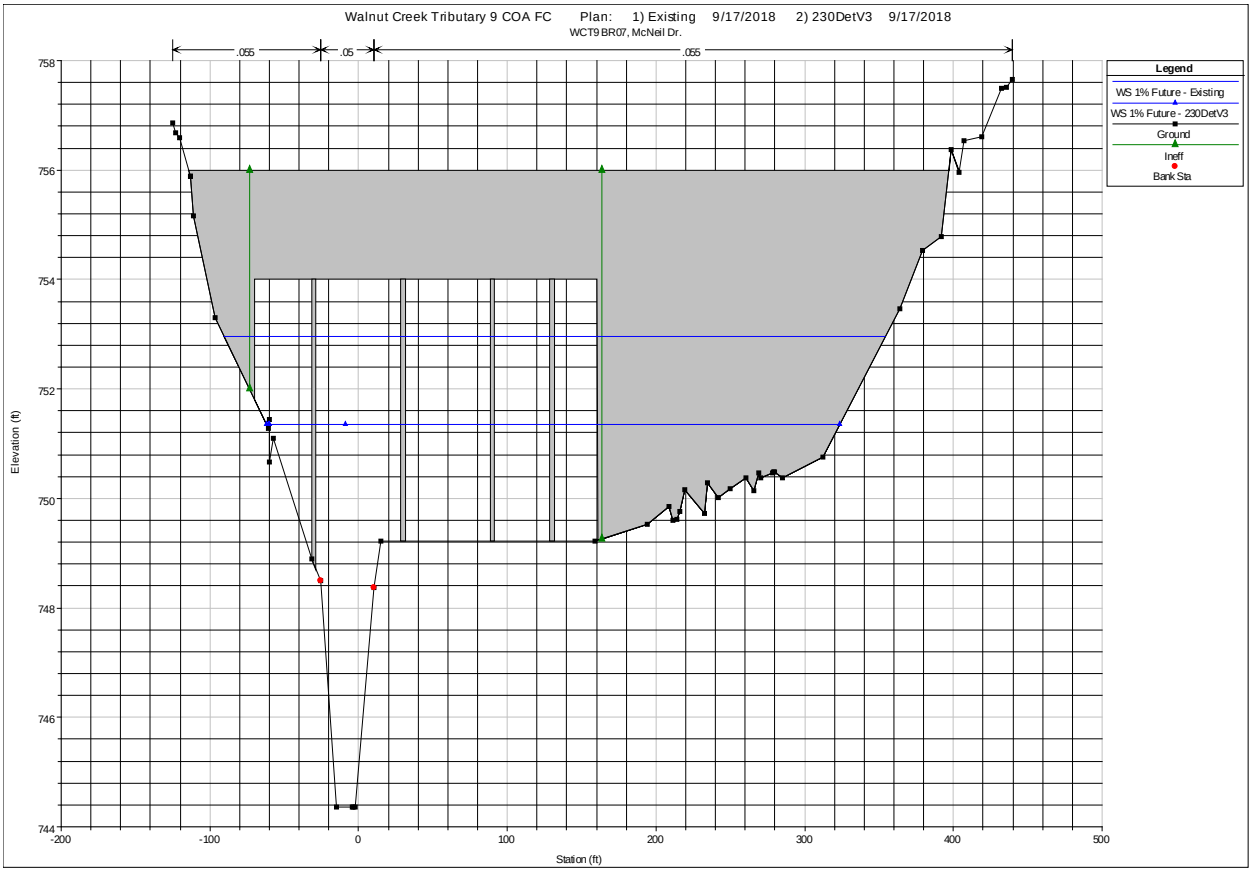
Appendix 8
Cross Section comparing Existing and Alternative 2 Bridge Upstream

XS 6325 BR US



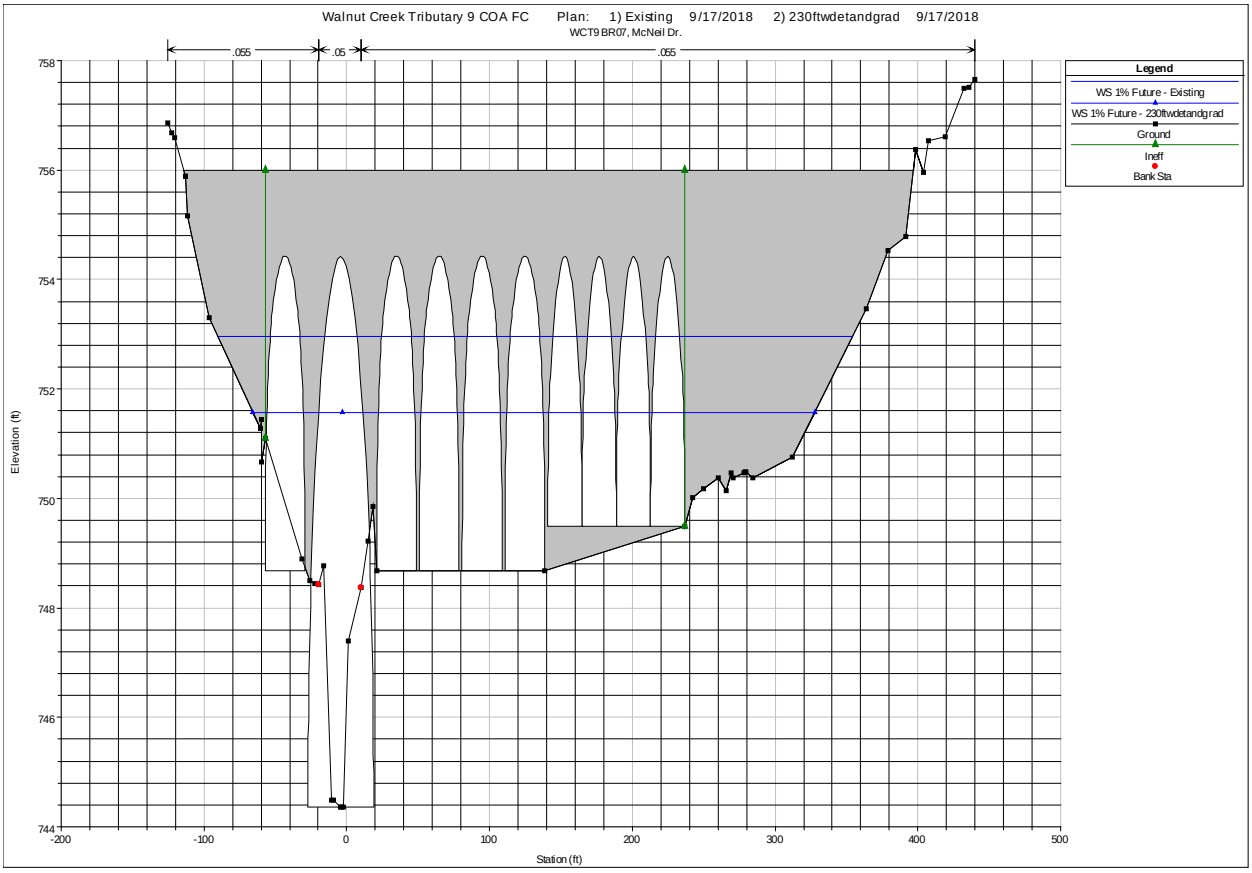
Appendix 9
Cross Section comparing Existing and Alternative 3 Bridge Upstream

XS 6325 BR US



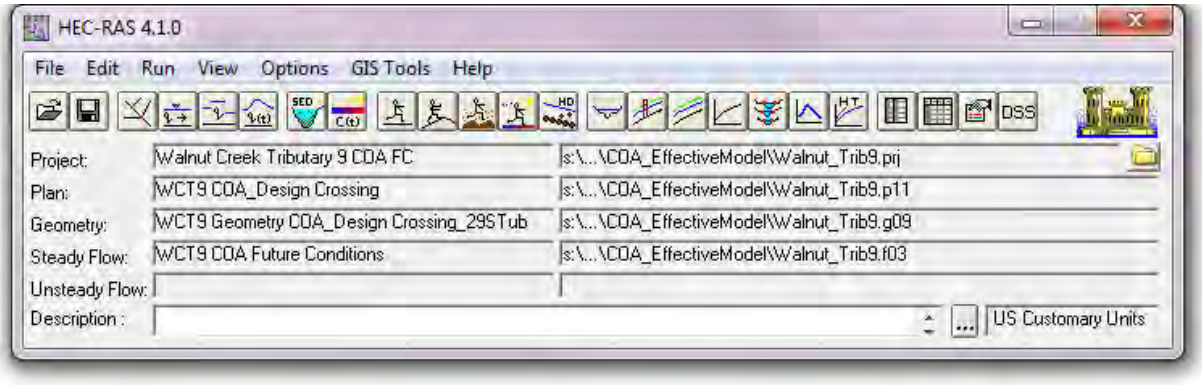
Appendix 10
Cross Section comparing Existing and Alternative 4 Bridge Upstream

XS 6325 BR US

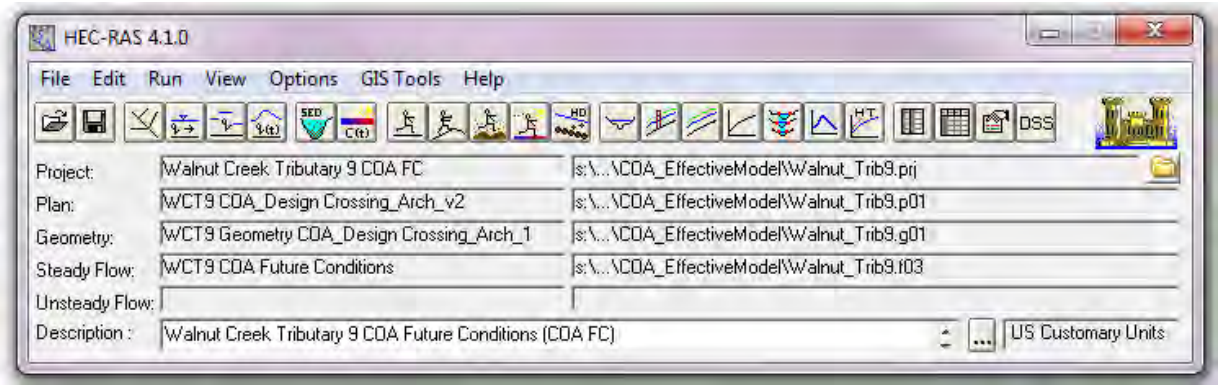


Appendix 11
HEC-RAS Plans

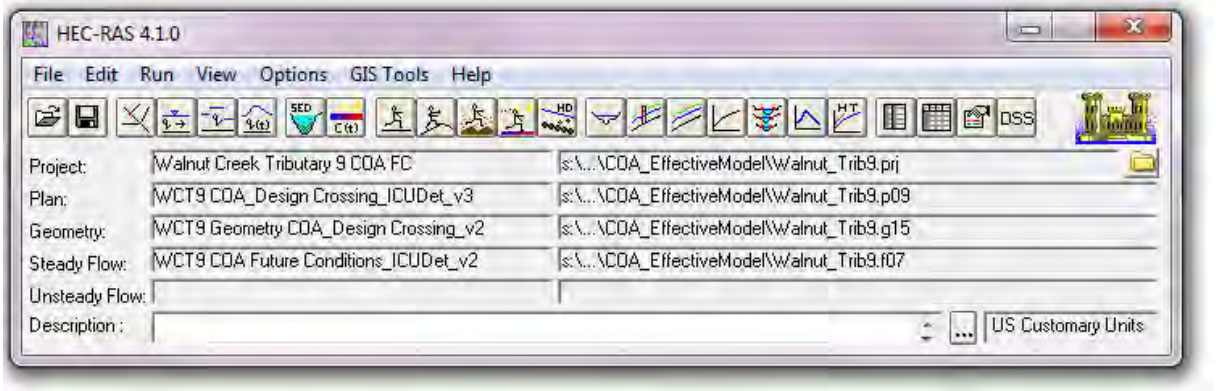
Alternative 1



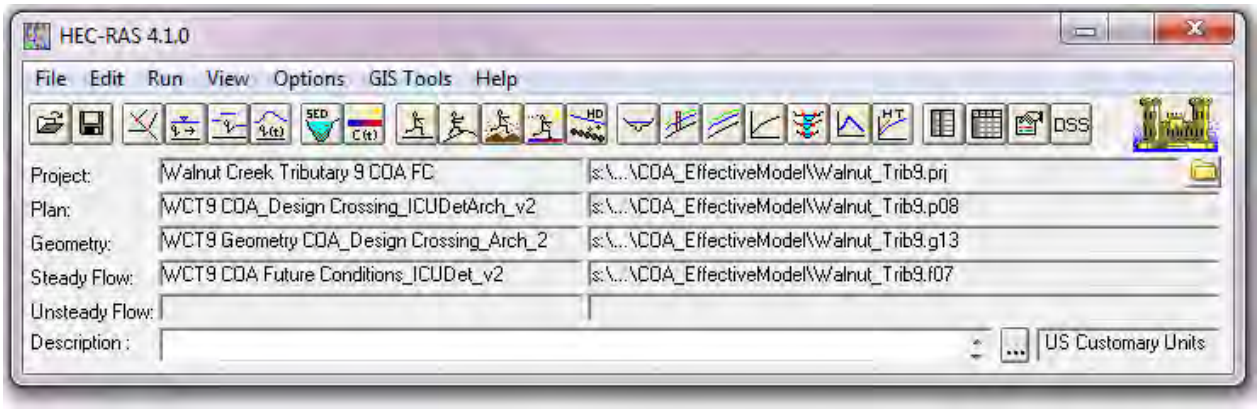
Alternative 2



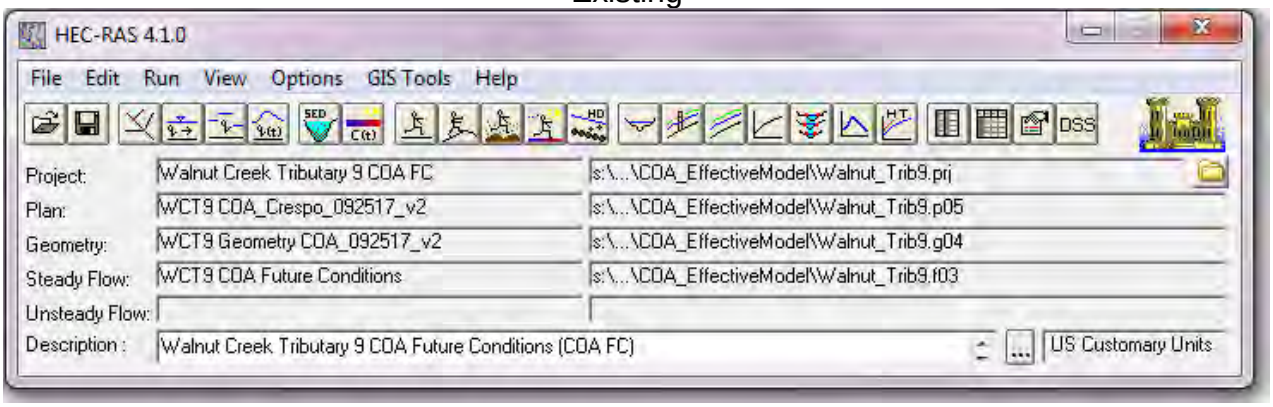
Alternative 3



Alternative 4



Existing



Appendix D

Preliminary Geotechnical Reports

GEOTECHNICAL ENGINEERING
DRILLING & SAMPLING
FOUNDATION DESIGN

HOLT
ENGINEERING, INC.

CONSTRUCTION INSPECTION
LABORATORY TESTING
MATERIALS TESTING

23 August 2017

Doucet + Chan
7401-B Highway 71 West
Suite 160
Austin, Texas 78735

Attn: Mr. John King, P.E.

Re.: Walnut Creek Bridge
McNeil Drive
Austin, Texas

Holt File No: 07-26917

Dear Mr, King:

Enclosed please find one bound copy of our Subsurface Investigation and Geotechnical Data Report (GDR) for the above referenced project.

Should you have any questions concerning our report or if we can be of further service, please do not hesitate to call.

Sincerely,

Steve B. Johnson, P.E.
Geotechnical Division Manager

Holt Engineering, Inc.
TBPE Firm Registration No. F-430

Enc.: Engineering Report
Invoice

2220 Barton Skyway • Austin, Texas • 78704 • Ph. (512) 447-8166 • Fax (512) 447-0852

SUBSURFACE INVESTIGATION

AND

GEOTECHNICAL DATA REPORT

FOR

WALNUT CREEK BRIDGE

MCNEIL DRIVE

AUSTIN, TEXAS

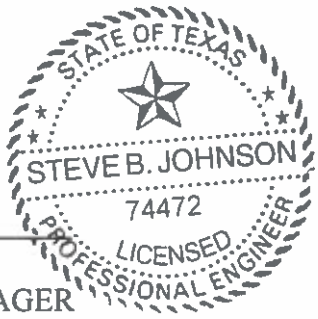
REPORT FOR:

DOUCET + CHAN

7401B HIGHWAY 71 WEST, SUITE 160

AUSTIN, TX 78735

PREPARED BY:



STEVE B. JOHNSON, P.E.
GEOTECHNICAL DIVISION MANAGER

HOLT ENGINEERING, INC.
TBPE FIRM REGISTRATION NO. F-430

FILE NO. 07-26917
23 AUGUST 2017

HOLT ENGINEERING, INC. 2220 Barton Skyway – Austin, Texas – 78704 – Ph. (512) 447-8166 – Fax (512) 447-0852

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SUBSURFACE INVESTIGATION

AND

GEOTECHNICAL DATA REPORT

FOR

WALNUT CREEK BRIDGE

MCNEIL DRIVE

AUSTIN, TEXAS

INTRODUCTION

A subsurface investigation was performed at the site of the proposed Bridge over Walnut Creek at Tributary 9 on McNeil Drive in Austin, Texas. Mr. John King, P.E. of Doucet + Chan Engineering authorized the investigation in accordance with our cost estimate dated 19 December 2017. The purpose of this investigation was to determine subsurface materials and conditions along the proposed bridge alignment in order to provide the engineer with specific characterizations of the subsurface soil and groundwater conditions. This Geotechnical Data Report (GDR) presents only the factual and pertinent field and laboratory data obtained for this project. Interpretive conclusions with respect to ground behavior and design recommendations are intentionally not included.

The project consists of installing a new reinforced concrete bridge clear span or multiple span bridge of approximately 300 feet of total length.

SCOPE

Our scope of services consisted of the following:

- Drilling, logging, and sampling 4 soil borings to a depth of 50 feet below the existing grade.
- Obtaining soil samples of subsurface materials for in-house laboratory analyses.
- Investigating existing in-place conditions of subsurface materials by examination and field tests.

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- Plugging all boreholes with bentonite hole plug. Borings in the roadway were plugged on the surface with a cold patch immediately following the drilling operation.
- Preparing a Geotechnical Data Report (GDR) with specific characterizations of the subsurface soil conditions.

A detailed discussion of each of the above items is presented in the following sections of our report.

LABORATORY TESTS

Samples of subsurface materials were analyzed as necessary in the field and laboratory in general accordance with appropriate ASTM standards.

- Moisture Content (ASTM D2216)
- Atterberg Limits (ASTM D4318)
- Minus 200-Mesh Sieve (ASTM D422)
- Unconfined Compression Tests (ASTM D-2166)

These tests were performed together with visually inspecting and classifying the soil in general accordance with ASTM D2487 and described as recommended in ASTM D2488. Results of these tests are shown in the attached Logs of Borings and Laboratory Test Results found in the Appendix.

SUBSURFACE INVESTIGATION

Subsurface materials along Exposition Boulevard were explored by a total of four soil borings drilled to a depth of 50 feet each below the existing ground surface. Borings were located on each end of the proposed bridge at the abutments and near the proposed interior bents. Locations of the borings are shown in the attached Generalized Boring Location Plans.

All holes were logged in the field by an experienced driller familiar with Austin area geology under the direction of the geotechnical engineer. Grab samples were taken from the auger flights. Undisturbed samples were taken using a thin wall seamless Shelby tube sampler. Standard penetration tests were performed by using a 2-inch O.D. split-spoon

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sampler driven by a 140-pound hammer dropping a distance of 30 inches. The number of blows required to advance the split-spoon 12 inches is recorded on the attached soil-boring logs.

Continuous coring was performed in some of the rock formation using a Christensen NXB wire line system with an outside core diameter of 1-7/8 inches. Core samples were placed in core boxes in the sequence of recovery with the top of the core placed in the upper left hand corner of the box. Core boxes were carefully labeled and transported to the lab for inspection and logging by the geotechnical engineer.

SITE DESCRIPTION

The proposed Bridge Site is located on McNeil Drive at Tributary 9 in Austin, Texas. The site is located just west of the Mopac Frontage Road. The CMTR ROW runs just to the east of the low water crossing. The site currently consists of a concrete paved low water crossing over a shallow creek channel. Concrete culverts exist under the roadway. Large gravel and limestone rock outcrop is visible in the creek. Residential properties border the right of way to the north and south.

SUBSURFACE CONDITIONS

Based on the "Geologic Map of the Austin Area, Texas, Plate VII, published by the Bureau of Economic Geology – The University of Texas at Austin and reprinted in 1992 (Geologic Map), the proposed alignment is located primarily in two geological formations: 1) the Georgetown Limestone Formation (Kgt); and 2) the Edwards Limestone Formation (Ked). A fault line is located just west of the project site and runs from southwest to the northeast. A geologic map with the formations and boring locations is presented in the Appendix.

The soils encountered in our borings generally correspond with the above geological description. A more detailed description of subsurface conditions can be found in the attached soil boring logs.

In general, the subsurface conditions below the existing paving consist of residual clay soils overlying limestone rock that extends to termination of the borings at a depth of 50 feet.

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All borings were drilled through in the existing pavement on McNeil Drive. The pavement structure consists of an asphalt surface course over base-fill material and is summarized in Table 1.

In boring B-01 the pavement overlies the tan limestone rock formation. In borings B-02 and B-03 below the base material, dark brown to brown clay is found to a depth of 3.6 feet and overlies a tan severely weathered limestone that extends to a depth of 7 feet. Below the tan severely weathered limestone, tan limestone is found. In boring B-04 below the base material, unclassified fill is found to a depth 2.5 feet and overlies light brown to tan silty lean clay that extends to 4.5 feet and overlies tan severely weathered limestone that extends to a depth of 6.5 feet. The tan limestone rock formation found under the residual soils or below the severely weathered limestone is considered to be that of the Georgetown Formation and extends to termination of the borings at a depth of 50 feet below the existing grade.

Plasticity indices for the dark brown to brown fat clays range from 34 to 54. Plasticity indices on the tan and light brown lean clays range from 22 to 30.

Rock core sampling was performed on the tan limestone rock. Core recovery for the limestone ranged from 4% to 100%. RQD ranges from 0% to 98%. Unconfined compression tests were run on a total of 13 samples and ranged from 88 TSF to 701 TSF with an average of 213 TSF. The average unit weight is 135.6 PCF. The limestone is medium hard to very hard and contains interbedded silt and clayey silt layers, brown clay layers and some small voids and solution cavities. The rock is massively bedded with some highly fractured layers.

Table 1: Summary of asphalt, and base thickness for all borings

Boring No.	Asphalt (in.)	Base (in.)
B-01	4.0	11.5
B-02	5.5	8.0
B-03	10.5	13.5
B-04	2.5	7.0

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GROUNDWATER

The boreholes were dry prior to coring. The boreholes were not monitored for water levels and all borings were backfilled immediately upon completion of drilling due to safety concerns. Due to 100% water loss encountered at depths of 6 feet to 20 feet we expect that a permanent shallow water table is not present at the site; however, seasonal groundwater migrates through the fractures, seams, and joints in the limestone formations. The amount of groundwater seepage will be highly dependent on rainfall conditions in the weeks and months prior to construction.

LIMITATIONS

This Geotechnical Data Report has been prepared in order to aid in the evaluation of this property and to assist the Engineer in the design of the project. The soil and bedrock conditions described are based on a few widely-spaced soil borings over a relatively large area. Variations are expected to occur between the borings. It is intended for use with regard to specific projects discussed in general herein and any substantial changes in locations or grades should be brought to our attention so that we may determine how this might affect our conclusions. If during the proposed construction the soil strata are found to differ from that reported here, we should be notified immediately.

This report is not intended to be a detailed study of groundwater conditions. The presence or absence of water in our borings may not represent the groundwater conditions under all seasonal conditions.

The procedures, tests and recommendations of this investigation and report have been conducted and furnished in accordance with generally accepted professional engineering practices in the field of foundations, engineering soil mechanics and engineering geology. No other warranty is either expressed or implied.

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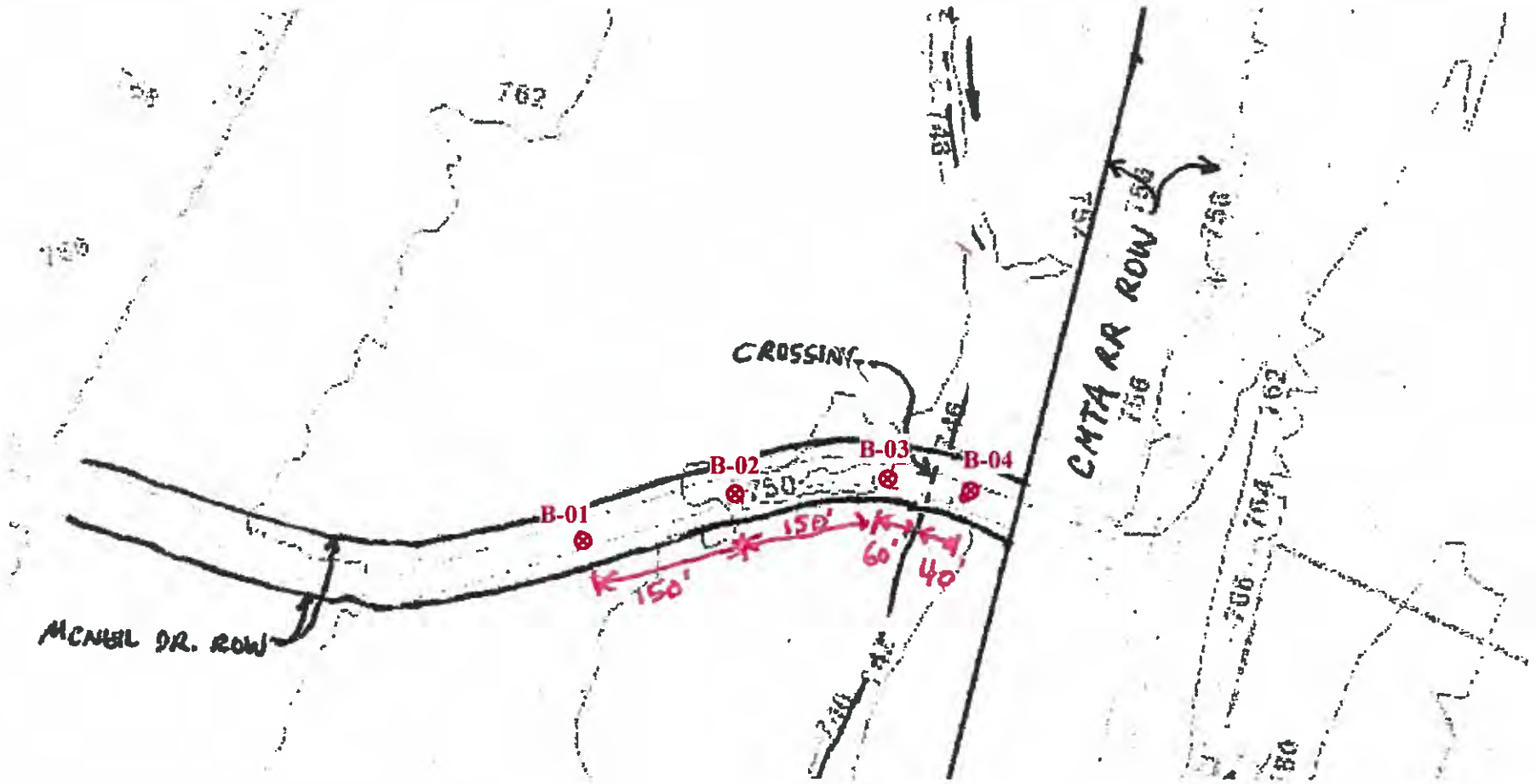
APPENDIX

ITEM I



Not to Scale

GENERALIZED BORING LOCATION PLAN
WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

07-26917

APPENDIX

ITEM 2

WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-01

NOTES : Hole dry prior to coring at 6.3'.

DATE DRILLED : 07-17-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 6.3'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	RQD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			4" Asphalt											
			11 1/2" Base Fill - Unclassified tan silt w/limestone rock											
			LIMESTONE, tan -- 1.5'-5.5' - Hard to very hard w/thin fractured layers & interbedded tan silt layers											
5			-- 4.1'-4.3' - Void, 100% Water loss -- 5.5'-19.2' - Hard w/thin medium hard layers & fractured layers				6.3							
				100	65									
10							11.2							
				100	65									
15							15.8							
				98	83				364.0	2.1	154.3			
20			-- 19.2'-28.2' - Medium hard				21.2							
				100	80									
25							26.2		238.0	10.6	127.5			
			-- 28.2'-31.0' - Void w/red clay & thin hard limestone layers	80	40									
30							31.2							
			-- 31.0'-36.6' - Medium hard w/thin-to-medium hard layers & voids w/clayey silt	74	20									
35														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-01

NOTES : Hole dry prior to coring at 6.3'.

DATE DRILLED : 07-17-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 6.3'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	RQD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
							36.2		238.0	6.5	139.5			
			-- 36.6'-50.0' - Reddish brown clayey silt w/voids w/thin fractured layers	94	28									
40							39.4							
				74	69									
45									231.0	6.8	141.4			
							46.2							
				47	11									
50			Terminated @ 50 feet				50.0							
55														
60														
65														
70														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-02

NOTES : Hole dry prior to coring at 7.0'.

DATE DRILLED : 07-11-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 7.0'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	ROD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			5 1/2" Asphalt											
			Base Fill - Light brown silt w/small gravel											
			FAT CLAY (CH), dark brown, silty					24		24.3		77	54	90.8
			FAT CLAY (CH), brown, w/numerous small to large tan limestone rock					50/2"						
5			LIMESTONE, tan -- 3.7'-4.5' - Very hard, uniform -- 4.5'-8.7' - Very hard, severely fractured w/brown clayey layers, partial water loss				7.0							
				73	50									
10			-- 8.7'-37.0' - Hard w/thin-to-thick medium hard layers, fractued layers, silt layers, red clay layers & voids				10.0							
				88	60				279.0	5.9	138.5			
15														
							18.5							
20			-- 20.0' - 100% Water loss											
				100	77				158.0	5.4	137.0			
25							25.0							
				65	31									
30							33.5							
35														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

Holt Engineering Inc.
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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-02

NOTES : Hole dry prior to coring at 7.0'.

DATE DRILLED : 07-11-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 7.0'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	RQD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			LIMESTONE, tan*(Continued)*	100	79				300.0	2.6	153.7			
			-- 37.0'-46.0' - Medium hard				39.0							
40				100	25		41.0							
				100	70				106.9	9.4	130.3			
45							46.0							
			-- 46.0'-50.0' - Hard w/medium-hard layers & voids	63	18									
50			Terminated @ 50 feet				50.0							
55														
60														
65														
70														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-03

NOTES : Hole dry prior to coring at 11.0'.

DATE DRILLED : 07-12-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 11.0'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	SOIL DESCRIPTION	% CORE RECOVERY	ROD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
	10 1/2" Asphalt											
	13 1/2" Base Fill - Unclassified tan & light brown silt w/small to medium limestone rock					19		15.2		53	34	73.9
	FAT CLAY (CH), brown, w/scattered small to medium limestone rock, stiff											
5	SEVERELY WEATHERED LIMESTONE, tan & light brown, silty, sandy, w/small to large limestone rock, firm					37		4.1		39	22	25.1
	LIMESTONE, tan -- 7.0'-8.0' - Severely fractured w/silt -- 8.0'-10.5' - Hard w/thin fractured layers & interbedded tan silt layers											
10	-- 10.5'-14.0' - Stiff tan silt w/fractured limestone layers	33	0		11.0 14.0							
15	-- 14.0'-16.0' - Medium hard to hard w/thin fractured seams -- 16.0'-21.0' - Firm tan silt w/few thin fractured layers & voids -- 18.0' - 100% Water loss	43	14									
20					21.0							
	-- 23.0'-24.0' - Void	60	30				147.0	3.8	146.7			
25	-- 24.0'-26.0' - Tan silty clay				26.0							
	-- 26.0'-29.0' - Firm to stiff tan silt w/whin hard limestone layers											
	-- 28.0'-29.0' - Void	72	20									
30	-- 29.0'-40.0' - Medium hard w/thin hard layers, clay layers, silt layers & voids				31.0							
		100	91									
35					34.3							

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-03

NOTES : Hole dry prior to coring at 11.0'.

DATE DRILLED : 07-12-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL :

ELEVATION :

DRILLING METHOD : 4" Flight Augers to 11.0'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	RQD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			LIMESTONE, tan	85	34				88.0	15.5	104.9			
40			-- 40.0'-45.0' - Severely fractured	62	0		40.2							
45			-- 45.0'-50.0' - More uniform	94	60		45.0		117.0	10.7	128.6			
50			Terminated @ 50 feet				50.0							
55														
60														
65														
70														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-04

NOTES : Hole dry prior to coring at 8.5'.

DATE DRILLED : 07-14-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 8.5'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	ROD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			2 1/2" Asphalt											
			7" Base Fill - Unclassified tan silt w/limestone fragments											
			Fill - Unclassified tan & light brown clayey sandy silt w/limestone fragments					23		8.2		49	30	41.1
5			LEAN CLAY (CL), light brown & tan, silty, sandy, w/small to large limestone rock, firm to stiff							9.8		39	22	97.2
			SEVERELY WEATHERED LIMESTONE, tan, silty, firm											
			LIMESTONE, tan -- 6.5'-7.3' - Hard, uniform -- 7.3'-8.5' - Firm tan silt w/thin fractured limestone layers -- 8.5'-16.0' - Hard w/thin fractured layers & medium hard layers	90	33		8.5							
10				100	0		11.5							
							13.5							
15			-- 16.0'-36.0' - Hard w/thin to thick medium-hard layers & few thin fractured layers	100	77				701.0	2.0	157.0			
20							21.2							
25				100	77									
							26.8		188.0	7.8	135.6			
30				100	98									
							31.2							
35														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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WALNUT CREEK TRIBUTARY 9
McNEIL DRIVE
AUSTIN, TEXAS

LOG OF BORING B-04

NOTES : Hole dry prior to coring at 8.5'.

DATE DRILLED : 07-14-17 | BORING DEPTH : 50.0 FEET

DRILLER : John Webb | WATER LEVEL : | ELEVATION :

DRILLING METHOD : 4" Flight Augers to 8.5'; NXB Wireline to 50.0'. LAT : LONG. :

DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	RQD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT(%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			LIMESTONE, tan*(Continued)*	100	79									
			-- 36.0' - 100% Water loss				38.5							
40				100	68				153.0	14.6	120.8			
			-- 42.3'-46.0' - Severely fractured w/silt layers				42.3							
45				41	0									
			-- 46.0'-50.0' - Hard w/thin fractured layers & voids				46.0							
50				65	28									
			Terminated @ 50 feet				50.0							
55														
60														
65														
70														

LOG OF BORING 07-26917-WALNUT CREEK TRIBUTARY 9-MCNEIL DR-AUSTIN TX.GPJ HOLT ENGINEERING.GDT 8/18/17

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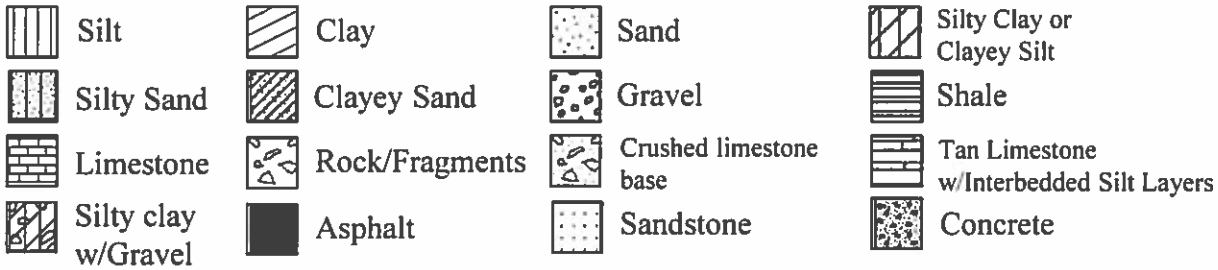
BORING LOGS – TERMS & SYMBOLS

SOIL TYPES



SAMPLER TYPES

PARTICLE SIZE (ASTM D2487)

Boulders	>12 in.	Coarse Sand	5 mm – 2 mm	Silt	0.075 mm – 0.005 mm
Cobbles	12 in. – 3 in.	Medium Sand	2 mm – 0.4 mm	Clay	< 0.005 mm
Gravel	3 in. – 5 mm	Fine Sand	0.4 mm – 0.075 mm		

STRENGTH OF COHESIVE SOILS

CONSISTENCY	COMPRESSIVE STRENGTH (TSF)
Very Soft	< 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	> 4.0

DENSITY OF GRANULAR SOILS

NUMBER OF BLOWS PER FT., N	RELATIVE DENSITY
0 – 4	Very Loose
4 – 10	Loose
10 – 30	Medium Dense
30 – 50	Dense
Over 50	Very Dense

Structure Description (ASTM D2488)

Stratified	Alternating layers of varying material or color with layers at least 6 mm thick
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Homogeneous	Same color and appearance throughout

Percentages of Sand & Gravel (ASTM D2488)

Trace	< 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%
Mostly	50% to 100%

Criteria for Describing Moisture Conditions (ASTM D2488)

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

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APPENDIX

ITEM 3

SUMMARY OF LABORATORY TEST RESULTS

PROJECT: WALNUT CREEK BRIDGE

JOB NO. 07-26917 DATE: 8/23/2017

BORING NO.	DEPTH IN FEET	UNIF. CLASSIF.	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG TEST			COMPRESSION TEST RESULTS		OTHER TESTS: Percent Passing		
						LL	PL	PI	COMPRESSION TSF	STRAIN %	3/4	#4	-200
B-01	17.0-17.5		LIMESTONE, tan	2.1	154.3				364.0				
	26.0-26.5		LIMESTONE, tan	10.6	127.5				238.0				
	35.5-36.0		LIMESTONE, tan	6.5	139.5				238.0				
	45.0-45.5		LIMESTONE, tan	6.8	141.4				231.0				
B-02	2.0-3.7	CH	FAT CLAY, dark brown, silty	24.3		77	23	54					90.8
	15.5-16.0		LIMESTONE, tan	5.9	138.5				279.0				
	24.0-24.5		LIMESTONE, tan	5.4	137.0				158.0				
	36.0-36.5		LIMESTONE, tan	9.4	130.3				106.9				
B-03	2.0-4.0	CH	FAT CLAY, brown, w/scattered limestone rock	15.2		53	19	34					73.9

SUMMARY OF LABORATORY TEST RESULTS

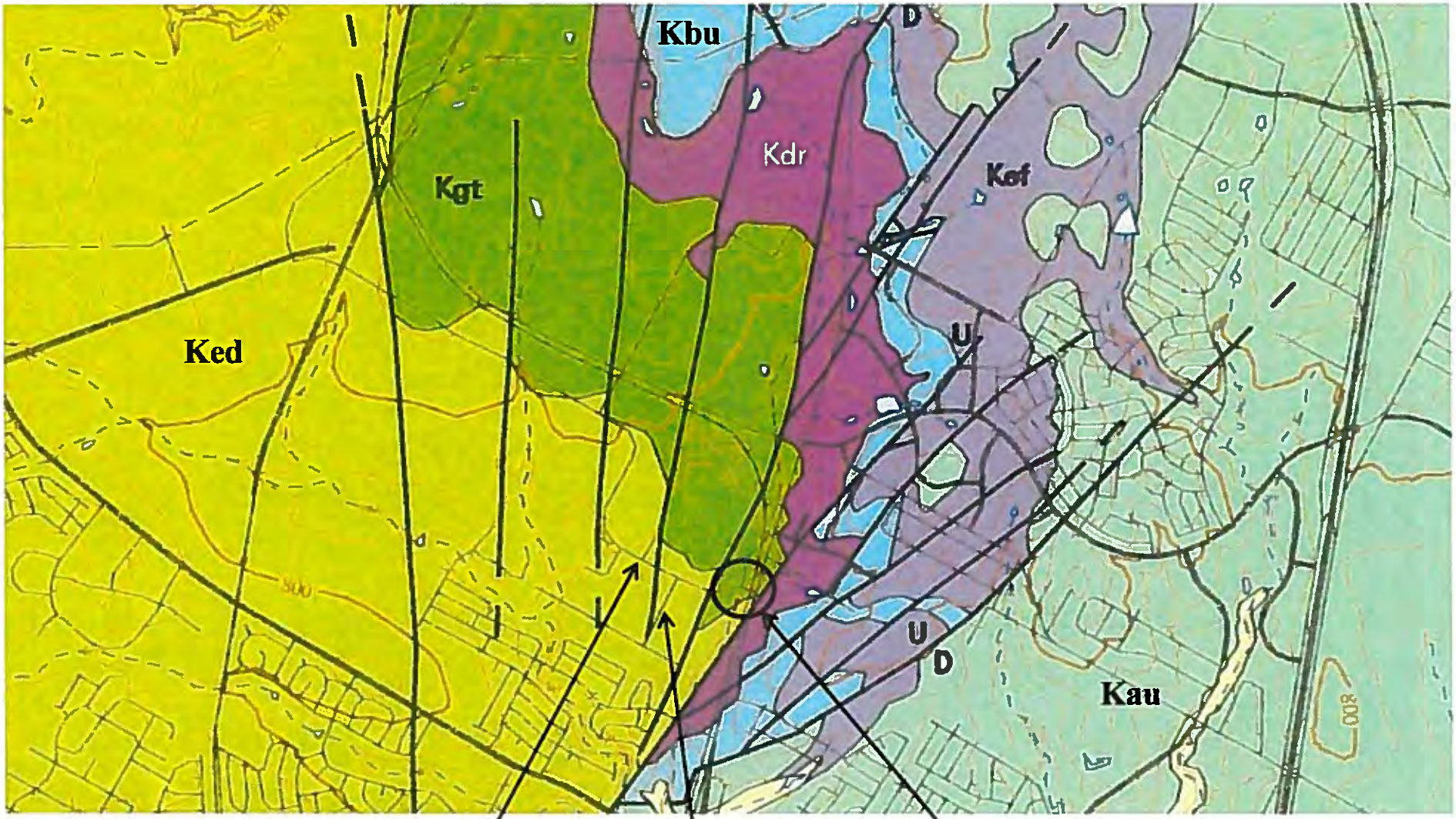
PROJECT: WALNUT CREEK BRIDGE

JOB NO. 07-26917 DATE: 8/23/2017

BORING NO.	DEPTH IN FEET	UNIF. CLASSIF.	TYPE OF MATERIAL	MOISTURE CONTENT %	DRY DENSITY pcf	ATTERBERG TEST LL	ATTERBERG TEST PL	ATTERBERG TEST PI	COMPRESSION TEST RESULTS: COMPRESSION TSF	COMPRESSION TEST RESULTS: STRAIN %	OTHER TESTS: Percent Passing 3/4	OTHER TESTS: Percent Passing #4	OTHER TESTS: Percent Passing -200
B-03	5.0-7.0		SEVERELY WEATHERED LIMESTONE, tan & light brown	4.1		39	17	22					25.1
	23.5-24.0		LIMESTONE, tan	3.8	146.7				147.0				
	36.0-36.5		LIMESTONE, tan	15.5	104.9				88.0				
	44.0-44.5		LIMESTONE, tan	10.7	128.6				117.0				
B-04	2.0-3.6	CL	LEAN CLAY, light brown & tan, silty, sandy, w/limestone rock	8.2		49	19	30					41.1
	5.0-6.5		SEVERELY WEATHERED LIMESTONE, tan	9.8		39	17	22					97.2
	16.0-16.5		LIMESTONE, tan	2.0	157.0				701.0				
	26.5-27.0		LIMESTONE, tan	7.8	135.6				188.0				
	34.5-35.0		LIMESTONE, tan	14.6	120.8				153.0				

APPENDIX

ITEM 4



Not to Scale

GEOLOGIC MAP OF PROJECT AREA
WALNUT CREEK BRIDGE
MCNEIL DRIVE
AUSTIN, TEXAS

07-26917

25 July 2018

Doucet+Chan
7401B Highway 71 West, Suite 160
Austin, Texas 78735

Attn: Mr. John King, P. E.

Re: McNeil Drive Crossing
McNeil Drive
Austin, Texas

File No.: 07-26917

Dear Mr. King,

As per your request we are providing foundation recommendation options for the four bridge designs being proposed for the new stream crossing over McNeil Drive. It is our understanding the four designs being considered are; 1) 300 Ft Clear Span Bridge with retaining walls, 2) 300 Ft Clear Span Bridge with earth side slopes, 3) 300 Ft Arch Type Bridge with retaining walls, and 4) 300 Ft Arch Type Bridge with earth side slopes. We are providing the following preliminary recommendations for drilled piers to support the bridge and under the spread footings supporting the Arch Culverts. We are also providing recommendations for earth embankments and retaining wall recommendations.

DRILLED PIER RECOMMENDATIONS

We recommend all structural loads for the bridge or arched culverts be supported on drilled straight shaft piers seated a minimum of 10 feet into the tan limestone rock and may be sized for an allowable bearing value of 35,000 PSF when seated at a minimum depth of 15 feet below finished grade. It is also important to seat the piers in the creek bottom at least 10 feet below the scour line of the channel bottom. A skin friction of 2,000 PSF may be used for that portion of the pier penetration into either tan or gray limestone rock, but omitting the top 10 feet. All piers should be inspected full time by the geotechnical engineer or qualified technician during the pier drilling operation to verify proper bearing strata, seating depth, reinforcement placement, concrete placement, plumbness and cleanliness of hole.

Groundwater was not encountered in the bridge borings, however, and water migrates through the fractures seams and joints in the rock and pumping of pier holes should be expected. If excessive sloughing occurs, then casing of pier holes will be required. Provisions for pumping and casing of pier holes should be included in the bid documents.

RETAINING WALLS

We expect low height reinforced concrete cantilever type walls will be used to retain the backfill beside the roadway at approaches and at headwalls for arch type culverts. The retaining walls will range in height from approximately 10 feet to 14 feet.

Reinforced concrete spread footings should be seated a minimum of 24 inches into the undisturbed tan limestone rock at a minimum depth of 36 inches below finished grade and sized for an allowable bearing value of 4,000 PSF. The footings should be trenched directly into the excavated the limestone rock and footings should be swept or blown clean with compressed air and concrete placed directly against the rock. No fill should be placed under the bottom of footing, if over excavated. Where needed to resist sliding, a key should be used and seated a minimum of 12 inches below the bottom of the wall footing. A lateral bearing value of 1,000 PSF on the face of the key should be used to resist sliding. A friction factor of 0.4 applied on the bottom of the footing may also be used to resist sliding. The footings should be protected from scour or seated an additional 18 inches into the rock, if no scour protection is used. The walls should be backfilled with uniformly graded crushed rock with a minimum size of ¾-inch with a minimum thickness of 36 inches and extend to within 18 inches of the top of the wall. Walls should have weep holes or drain pies as needed to prevent buildup of hydrostatic pressure. Where landscaping is required, the final 18 inches should be approved top soil. The backfill behind the gravel envelope should consist of a low plasticity (P. I. < 15) well graded granular soil with a maximum rock size of 4 inches meeting City of Austin Class A, *Select Borrow* (see *Item 130S*) or *Flexible Base* (see *Item 210S)* and be compacted in 8-inch loose lifts to a minimum of 95% of the maximum dry density in accordance with TxDOT test method TEX-113-E. Soil moisture content should be within 3% of optimum. Assuming the above recommendations are followed, the walls should be designed for an equivalent fluid pressure of 45 PCF for the active condition. This does not include any surcharge loading for vehicle traffic.

ROADWAY AND EMBANKMENT FILL

Prior to fill placement in the roadway or embankment, the right-of-way area should be cleared of grass, trees, and all organic materials and any soft unstable clay soils. The subgrade should be prepared by scarifying the top 6 inches and compacting to at least 95% of the maximum dry density as determined by TxDOT test method TEX-114-E. The subgrade should be prepared in accordance with the City of Austin *Subgrade Preparation, Item 201S.* All embankment and roadway fill material should consist of a low plasticity (P. I. < 15) well graded granular soil with a maximum rock size of 4 inches meeting City of Austin

Class A, *Select Borrow* (see *Item 130S*) or *Flexible Base* (see *Item 210S*. All fill should be compacted to at least 95% of the maximum dry density as determined by TxDOT test method TEX-113-E. Soil moisture should be within 3% of optimum. Lift thickness should not exceed 8 inches.

PAVEMENT THICKNESS

We are providing the following preliminary asphalt pavement thickness recommendations assuming the roadway will be classified as a Neighborhood Collector with an average daily traffic of approximately 2,000 VPD. We are assuming the subgrade will be low plasticity compacted fill. Under these traffic and subgrade conditions we recommend the following pavement thickness section:

Materials	Thickness
Crushed Limestone Base	14.0 inches
Hot Mix Asphaltic Concrete	2.0 inches

The subgrade, base and asphalt should all be constructed in accordance with the typical City of Austin Standard Specifications for city streets. We can provide additional information on the details of these specifications such as compaction testing, material specifications and asphalt tests in our final report.

If you have any questions or if we can be of further service, please do not hesitate to call.

Sincerely,

Steve B. Johnson, P.E.
Manager Geotechnical Division

STATE OF TEXAS
STEVE B. JOHNSON
74472
LICENSED
PROFESSIONAL ENGINEER

Holt Engineering, Inc.
TBPE Firm Registration No. F-430

Appendix E

Preliminary Environmental Assessment Report

MCNEIL DRIVE LOW WATER CROSSING: TECHNICAL MEMORANDUM

November 2018

Prepared for the City of Austin and Doucet + Chan

COX | McLAIN Environmental Consulting

MCNEIL DRIVE LOW WATER CROSSING: TECHNICAL MEMORANDUM

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INTRODUCTION

The City of Austin (COA) proposes improvements to the McNeil Drive low water crossing at Walnut Creek Tributary 9 in Austin, Travis County, Texas in an effort to improve public safety and access, to comply with the COA Drainage Criteria Manual (DCM), and to reduce flooding. This Technical Memorandum assesses the environmental constraints and summarizes environmental permitting and mitigation commitments associated with four preliminary alternatives for improvements to the McNeil Drive low water crossing.

Site/Project Name: McNeil Drive Low Water Crossing

Address/Location: The McNeil Drive low water crossing is located in the northern part of the city of Austin, to the southwest of the intersection of North Mopac Expressway (Mopac) and Howard Lane. It is slightly west of McNeil Drive's intersection with the Mopac southbound Service Road. **Figure 1** in **Appendix A** illustrates the project location. Photographs of the project area are provided in **Appendix B**.

1.0 Project Description

The McNeil Drive low water crossing at Tributary 9 of Walnut Creek has been identified in the COA Watershed Protection Department Master Plan as a high priority structure for flood control. McNeil Drive is located in the upper portion of the Walnut Creek Watershed. Access to the nearby neighborhoods is provided by McNeil Merriltown Road to the north (at Howard Lane) and McNeil Drive to the east (at North Mopac). The project area is in the 100-year floodplain and during flood events, roadway overtopping often occurs at both the McNeil Drive low water crossing (Walnut Creek Trib 9) and on McNeil Drive near Howard Lane (Walnut Creek Trib 10), which completely cuts off the neighborhood. The McNeil Drive low water crossing currently has two 36-inch circular corrugated metal pipe culverts. The culverts are approximately 36 feet long. The McNeil Drive roadway consists of two lanes of asphalt pavement approximately 25 feet wide. The bridge deck is approximately the same width but has a concrete surface. The roadway is classified as by the City of Austin as a City Collector Street.

Currently, the crossing does not comply with the COA DCM, and the COA Watershed Protection Department has proposed upgrades to the McNeil Drive low water crossing to improve safety and meet the COA DCM requirements. Several alternatives of box culverts and bridge options were considered for the McNeil Drive crossing with the goal of meeting or exceeding the DCM requirements. The COA Watershed Protection Department prepared preliminary hydraulic models and preliminary design of four alternatives to improve the low water crossing, but only one configuration would fully pass the peak discharge of the 100-year storm event in fully developed land use conditions without overtopping the top-of-bridge deck elevation and would result in a reduction in the 100-year and 25-year fully developed land use condition peak discharge water surface elevations at the crossing, as compared to existing conditions.

Given this information, the project engineer (Doucet + Chan) has provided four project alternatives that comply with the COA DCM and would not increase the fully developed 100-year and 25-year maximum water surface elevations. The project alternatives presented contain two primary bridge configurations and two arch culvert bridge configurations, as follows:

- Alternative 1 is a traditional pier and beam clear-span bridge with retaining walls on both sides.
- Alternative 2 is a traditional pier and beam clear-span bridge with 4:1 side slopes on both sides.

- Alternative 3 is an arch culvert pre-cast bridge with retaining walls on both sides.
- Alternative 4 is an arch culvert pre-cast bridge with 4:1 side slopes on both sides.

Each of the two bridge and arch culvert configurations have two alternative roadway approach shoulder configurations: either a retaining wall to confine and minimize the width of the shoulder fill or unconfined sloped shoulder fill, which affects each alternative's ultimate footprint. This document reflects resource assessments that were conducted in a maximum project footprint that would encompass all four alternatives and ancillary work.

This document summarizes the requirements of COA codes and regulations and addresses State and Federal regulations and permitting requirements for the proposed project alternatives. The COA Land Development Code (LDC), Article 3, §25-8-121 establishes the Environmental Resource Inventory (ERI) Requirements. This project would require an ERI because construction (which includes the described activities) would occur within the Critical Water Quality Zone of a tributary to Walnut Creek and because work would occur over the Recharge Zone of the Edwards Aquifer. Sources used to determine potential restrictions to development include Chapters 25 through 28 of the COA LDC; the COA Environmental Criteria Manual (ECM); COA Parks and Recreation Department's Construction in Parks Specifications (CPS); Chapter 26 of the Texas Parks and Wildlife (TPWD) Code; Sections 404 and 401 of the Clean Water Act (CWA); the U.S. Endangered Species Act (ESA), and the Texas Antiquities Code.

As defined by the COA (LDC §25-8-1), Critical Environmental Features (CEFs) include bluffs, canyon rimrocks, caves, faults and fractures, seeps, sinkholes, springs, and wetlands. With some exceptions, the COA requires a development setback distance of 150 feet from CEFs. CEFs are addressed in the sections of this report which address hydrogeology and water resources. This document includes a Hydrogeologic Report including CEF assessment, a Vegetation Report, a Water Resources section including CEF assessment, a Trees and Natural Area Protection section, an Endangered/Threatened and Rare Species section, and an Archeological Resources section.

A 150-foot buffer around the maximum project footprint (described above) was investigated for the occurrence of CEFs. Cox|McLain Environmental Consulting, Inc. (CMEC) performed a vegetation assessment, potential threatened/endangered species habitat analysis, wetlands and waters of the U.S. determinations, and data collection related to the Texas Antiquities Code. A registered geologist prepared a hydrogeologic report and performed associated field assessments. The project engineer is Doucet + Chan.

2.0 Geology

2.1 Introduction

An overview of the hydrogeologic conditions of the project area is presented below. A field assessment was conducted on July 9, 2018. The project is located within the Recharge Zone of the Edwards Aquifer; therefore, the hydrogeologic report was completed by a licensed geologist.

2.2 Site Description

The project area is located in the upper portion of the Walnut Creek Watershed, nearby to residential neighborhoods in north Austin. The Walnut Creek Watershed is classified as a "Suburban Watershed" in the COA LDC.

TOPOGRAPHY

Covering approximately 0.13 mile, the proposed project area crosses Walnut Creek Tributary 9 at a low water crossing approximately 135 feet west of the centerline of the Capitol Metropolitan Transportation Authority's (Cap Metro) Metrorail tracks at the McNeil Drive crossing.

The project area is situated on generally level upland terrain. Slopes in the project area are generally less than 2% and none are 9% or greater. The ground adjacent to the project area has been altered by residential construction.

SOILS

The project would require additional right-of-way. Soils in these areas have likely been previously disturbed as a result of roadway and residential construction. The following soils are mapped within the project area (**Figure 4)** (NRCS, 2018):

- Oakalla soils, 0 to 1 percent slopes, channeled, frequently flooded
- Heiden clay, 5 to 8 percent slopes, eroded
- Tarrant and Speck soils, 0 to 2 percent slopes

HYDROGEOLOGY

The project area is underlain by two geologic formations: the Del Rio Clay and Georgetown Formation and the Edwards Limestone Formation (**Figure 3**). A licensed geologist, James S. Sansom, Jr., performed a field assessment and hydrogeologic report. According to Sansom, "the location where the McNeil Drive low water crossing is planned for modification is almost entirely on the outcrop of the Georgetown formation. The exception is the west end of the project where a fault has been mapped that crosses McNeil Drive... The Edwards formation crops out of the west side of the fault. This fault is one of several faults that occur near it that are part of the Balcones Fault Zone." Sansom also investigated one potential Point Recharge Feature within the boundaries and adjacent to the proposed project. He states, "it is a non-karst closed depression (S-1) located downstream on the west side of the existing low water crossing… [It] occurs in limestone bedrock, and could be a plunge pool due to its location adjacent to and immediately downstream from the existing low water crossing."

Portions of Travis County are located on the Edwards Plateau, a broad flat expanse of Cretaceous age carbonate rock that is characterized by its cave-containing rock units. These units have varying levels of surface exposure, which influence their likelihood of providing suitable habitat for cave-adapted fauna. Based on the geologic restrictions on the distribution of cave fauna and the locations of known caves, George Veni & Associates delineated four karst zones that reflect the relative likelihood of finding any of the federally-listed troglobites (and other rare or endemic karst species) (Veni and Martinez 2007).

These four karst zones are defined as:

- Zone 1: Areas known to contain one or more of the listed karst invertebrates
- Zone 2: Areas having a high probability of suitable habitat for the listed karst invertebrates
- Zone 3: Areas that probably do not contain listed karst invertebrates
- Zone 4: Areas that are not known to contain listed karst invertebrates

The project area is mapped with the western portion in Karst Zone 1 and the eastern portion in Karst Zone 3 (**Figure 3**).

The project area is located over the Recharge Zone of the Edwards Aquifer. The Recharge Zone is the area where the Edwards limestones are highly faulted and fractured, allowing large quantities of water to flow directly to the Edwards Aquifer. In the Recharge Zone, there is no other rock formation that separates the aquifer, so the water table responds directly to rainfall and stormwater runoff.

Minimum groundwater depths recorded at the six nearest wells are in excess of 50 feet below the ground surface (TWDB, 2018). Project excavations are not anticipated to reach these depths; therefore, direct impacts to the Edwards Aquifer are not anticipated. Project excavations may affect the dry karstic formations above the aquifer, which increases the potential for introducing pollutants into recharge pathways.

This project also occurs in a Critical Water Quality Zone (CWQZ), the boundaries of which coincide with the boundaries of the 100-year floodplain calculated under full developed conditions as prescribed by the COA DCM.

2.3 Potentially Significant Recharge Features

The COA has not listed or mapped any hydrogeologic CEFs within this area. However, the contracted licensed geologist has pointed out that a geologic fault (obscured) is mapped near the western terminus. One potential point recharge feature was investigated and found to be a non-karst closed depression that likely resulted from scour associated with stormwater flows over the existing low water crossing. COA regulations require inspection of certain trenches greater than 5 feet in depth, including those intended for the conveyance of stormwater. Trenches of this depth should be coordinated with the City's Watershed Protection Department to determine whether inspection would be required. If voids are discovered during the proposed construction, COA and Texas Commission on Environmental Quality (TCEQ) regulations require work stoppage in the vicinity until the void can be inspected by a licensed geologist and, if appropriate, a void mitigation strategy can be developed and approved. TCEQ and COA regulations would apply to this project.

2.4 Conclusions and Limitations

Because the project is located within the Recharge Zone of the Edwards Aquifer, a geologic assessment and Water Pollution Abatement Plan per the Edwards Aquifer Rules (30 TAC 213) would be required. A registered geologist prepared a hydrogeologic report and performed associated field assessments; however, these do not align with Edwards Aquifer Rules reporting guidelines for geologic assessments. No hydrogeological CEFs (Fault/Point Recharge Feature) were identified in the field review of the project area; therefore, no impacts are anticipated to result from any of the proposed alternatives. The risk of unanticipated impacts could be minimized by selecting an alternative with a relatively smaller impact footprint.

3.0 Vegetation

A general field assessment of project area vegetation and wildlife was performed by CMEC ecologists. A discussion of the field investigation is presented below.

3.1 Vegetation

Vegetation in the project area can be grouped into four general types: juniper woodland, disturbed roadside, riparian, and pasture. At the eastern terminus, juniper woodland paralleled the cleared Mopac and Metrorail right-of-way. In this area, the juniper woodland had a high edge to interior ratio, and the trees were closely spaced with foliage that reached near the ground level. See **Photo 1** for a representative view. Species included Ashe juniper (*Juniperus ashei*), escarpment live oak (*Quercus fusiformis*), red oak (*Quercus shumardii*), mustang grape (*Vitis mustangensis*), and greenbriar (*Smilax bona-nox*). Groundcover was sparse to absent. Adjacent to Walnut Creek Trib 9, additional

woody species typical of lower-lying areas were observed. These included green ash (*Fraxinus pennsylvanica*), rusty blackhaw viburnum (*Viburnum rufidulum*), western soapberry (*Sapindus saponaria var drummondii*), pecan (*Carya illinoinensis*), Roosevelt weed (*Baccharis neglecta*), and chinaberry (*Melia azedarach*). The area appeared to be well drained and few individuals of hydrophytic species were observed. In no locations did hydrophytic (i.e., obligate or facultative wet) vegetation dominate the vegetative community. Groundcover was dense north of McNeil Drive and west of Walnut Creek Trib 9, but it conformed to the disturbed roadside type (discussed below). See **Photos 3-6** for representative views of the areas adjacent to Walnut Creek Trib 9. The disturbed roadside vegetation type was largely devoid of woody species and consisted of grasses and forbs that are typical of regularly maintained areas. Species included johnsongrass (*Sorghum halepense*), silver beardgrass (*Bothriochloa laguroides*), King Ranch bluestem (*Bothriochloa ischaemum* var. *songarica*), Guinea grass (*Panicum maximum*), silver-leaf nightshade (*Solanum elaeagnifolium*), straggler daisy (*Calyptocarpus vialis*), and frog fruit (*Phyla nodiflora*). This species composition extended into adjacent manicured lawns north and south of McNeil Drive, though the relative abundance of each species varied in these shady areas. Trees had apparently been selectively preserved with cedar elm (*Ulmus crassifolia*) dominating the canopy. These grasses and forbs also extended into adjacent pastures south of McNeil Drive, although apparent heavy grazing altered relative abundances as well. Trees were also preserved in the pasture, though more sparsely, with escarpment live oak occurring most often. Mature juniper woodland occurred north of McNeil Road near the western terminus. Ashe juniper and cedar elm were most prevalent with sugar hackberry (*Celtis laevigata* var. *reticulata*) also comprising a substantial component.

3.2 Conclusions and Limitations

These vegetation types are typical of the region and do not represent rare assemblages. Though the juniper woodland is generally consistent with the preferred habitat of the Golden-cheeked warbler (*Setophaga [=Dendroica] chrysoparia*), this particular woodland lacks the extent and connectivity to additional suitable habitat patches to provide adequate habitat for this species (see additional species discussions below).

4.0 Trees and Natural Area Protection

4.1 Tree Survey

The ECM describes the tree and natural area protection regulations, procedures, and mitigation requirements set forth by the COA. A tree survey will be required for the proposed project.

Mitigation is required in the event that some tree removal occurs. Tree removal includes activities that may be reasonably expected to cause a tree to die, including uprooting, severing the main trunk, damaging the root system, or excessive pruning. Typical mitigation measures may include planting of replacement trees, preservation or restoration of natural areas, providing a maintenance program for trees to be retained, requiring special construction techniques, transplanting existing trees, or payment into a tree fund for enhancement of the urban forest (at a general replacement value of $200 per caliper inch removed). The ECM (§3.5.2) states that boring under trees is a mitigation measure that can be incorporated into a project to minimize impacts to roots. Removal of non-native, invasive species listed by the COA does not require mitigation.

4.2 Important Species and Natural Areas (Wildlife Resources)

This section provides a description of the important species, habitats, and sensitive natural areas that may occur in the project area. Information presented in this section was gathered from a background search of recorded information sources such as TPWD's Texas Natural Diversity Database (TXNDD) and from field reconnaissance of the proposed project area.

According to COA LDC, any alterations allowed in the floodplain or CWQZ shall be located, designed and maintained to retain the integrity of protected riparian areas and minimize damage to the physical and biological characteristics of such areas (ECM §1.7.2.A). Revegetation criteria for all disturbed areas are outlined in the guidelines presented in the ECM (§1.4 and §1.5).

Important vegetation includes any rare, threatened, or endangered species and sensitive or unique community types; vegetation that is commercially or recreationally important; any species that if removed or seriously impacted would threaten the fitness of species in the first two categories; or species that are a dominant component or an important biological indicator of an ecological system. Vegetation assemblages are important both as individual units, and as components of the larger ecological system. Riparian and woodland vegetation provides erosion-inhibiting groundcover as habitat for wildlife. Removed trees would be mitigated as appropriate under the COA's Tree Protection Ordinance.

Typical mammal species that are reasonably expected to occur in the vicinity of the project area include: Virginia opossum (*Didelphis virginiana*), fox squirrel (*Sciurus niger*), hispid cotton rat (*Sigmodon hispidus*), eastern cottontail (*Sylvilagus floridanus*), white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), and common raccoon (*Procyon lotor*) (Davis and Schmidly, 1994).

Common amphibian and reptile species in the vicinity include the cricket frog (*Acris crepitans*), Gulf Coast toad (*Bufo valliceps*), red-eared slider (*Trachemys scripta elegans*), green anole (*Anolis carolinensis*), Texas spiny lizard (*Sceloporus olivaceous*), coachwhip (*Masticophis flagellum*), eastern gartersnake (*Thamnophis sirtalis sirtalis*), and western diamondback rattlesnake (*Crotalus atrox*) (TCWC, 2009).

Over 400 species of birds have been noted to occur within Central Texas (Lockwood, 2001). Some common bird species include the Red-tailed Hawk (*Buteo jamaicensis*), Red-shouldered Hawk (*B. lineatus*), Black Vulture (*Coragyps atratus*), Turkey Vulture (*Cathartes aura*), Killdeer (*Charadrius vociferous*), White-winged Dove (*Zenaida asiatica*), Mourning Dove (*Z. macroura*), Eastern Screech-Owl (*Megascops asio*), Golden-fronted Woodpecker (*Melanerpes aurifrons*), Blue Jay (*Cyanocitta cristata*), Carolina Chickadee (*Poecile carolinensis*), Black-crested Tufted Titmouse (*Baeolophus bicolor*), Carolina Wren (*Thryothorus ludovicianus*), Bewick's Wren (*Thryomanes bewickii*), Northern Mockingbird (*Mimus polyglottos*), Northern Cardinal (*Cardinalis cardinalis*), Red-winged Blackbird (*Agelaius phoeniceus*), Great-tailed Grackle (*Quiscalus mexicanus*), House Finch (*Carpodacus mexicanus*), and House Sparrow (*Passer domesticus*).

4.3 Parklands and Greenbelts

No parklands or dedicated greenbelts are located within or adjacent to the proposed project limits.

4.4 Conclusions and Limitations

Through field investigations and reviews of published resources, project ecologists have determined that no rare or protected vegetation types would be disturbed by any of the proposed alternatives. COA tree preservation ordinances would apply to this project and required tree mitigation would be commensurate with disturbed area. Final tree impacts can not be determined until the design is finalized but minimizing the project footprint would minimize the mitigation requirements.

5.0 Water Resources and Critical Environmental Features

5.1 Introduction

Water resources evaluated include wetlands and other waters of the U.S. (WOUS). Water quality is regulated under Section 401 of the CWA and by the COA. CMEC performed an investigation of the

project area for the presence of water-related CEFs, primarily wetlands and WOUS. This investigation involved both background records search and field reconnaissance.

5.2 Wetland CEFs and Waters of the U.S. Investigation

WATERS OF THE U.S.

The term "waters of the U.S." is defined in 33 Code of Federal Regulations (CFR) §328.3(a) and encompasses a variety of water bodies, including interstate and intrastate waters, the use, degradation, or destruction of which could affect interstate or foreign commerce, impoundments or tributaries of such waters, and the territorial seas. A significant nexus with traditionally navigable water must exist for a water body, including wetlands, to qualify as a water of the U.S. For potential linear waters of the U.S., the presence of an ordinary high water mark (OHWM) is determined by assessing a combination of factors and abiding by the definition of an OHWM provided in §328.3(e) of the CWA. Under Section 404 of the CWA, activities that involve discharges of dredged or fill materials into waters of the U.S. and adjacent wetlands are subject to permitting, under the jurisdiction of the U.S. Army Corps of Engineers (USACE). One feature was determined to constitute waters of the U.S.: Walnut Creek Trib 9, was delineated within the proposed project footprint (additional discussion below).

WETLANDS

According to the COA LDC, §25-8-1, wetlands are defined as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. An area is classified as a wetland if it meets the USACE three parameter (hydrophytic vegetation, hydric soil formation, and presence of adequate hydrology) technical criteria as outlined in the *Corps of Engineers 1987 Wetlands Delineation Manual*.

According to the COA ECM, wetland hydrology and hydric soils can be assumed if an area under examination is dominated (over 50% vegetative cover) by facultative-wet and/or obligate plant species as listed in the *National List of Plant Species That Occur in Wetlands*, Region 6, and an abrupt boundary is evident between the facultative-wet plant communities and the upland plant communities.

The standard setback is 150 feet around the outside edge of the wetland area, according to LDC §25-8-281. An administratively approved modified setback is the same square footage as the standard setback applied to the natural drainage patterns above and below the wetland. This is appropriate for fringe wetlands along streams or ponds in-line with streams. The Director may grant an administrative variance to further reduce setbacks for CEFs; however, the variance request must demonstrate that the proposed measures used in place of setbacks preserve all the characteristics of the CEF (LDC §25-8-281 (D)).

Qualified wetland ecologists reviewed several published data resources prior to the field visit to identify potentially jurisdictional crossings. Sources consulted included National Wetland Inventory (NWI) maps, the National Hydrography Dataset, the Natural Resources Conservation Service (NRCS) Soil Surveys for Travis County, U.S. Geological Survey (USGS) 7.5-minute quadrangle sheets (*Austin West, Texas*), Geologic Atlas of Texas maps (Austin sheet), Federal Emergency Management Agency (FEMA) floodplain maps, and recent aerial photography (NWI, 2018; NHD, 2018; NRCS, 2017; FEMA, 2016).

SECTION 404 OF THE CLEAN WATER ACT

Under Section 404 of the CWA, activities that involve discharges of dredged or fill materials into waters of the U.S. and adjacent wetlands are subject to permitting, under the jurisdiction of the USACE.

5.3 Water Quality

The COA has established a Critical Water Quality Zone (CWQZ) along each waterway classified under LDC §25-8-91 (*Waterway Classifications)*. The boundaries of a CWQZ may coincide with the boundaries of the 100-year floodplain, except:

- For a minor waterway, the boundaries of the critical water quality zone are located not less than 50 feet and not more than 100 feet from the centerline of the waterway;
- For an intermediate waterway, the boundaries of the critical water quality zone are located not less than 100 feet and not more than 200 feet from the centerline of the waterway;
- For a major waterway, the boundaries of the critical water quality zone are located not less than 200 feet and not more than 400 feet from the centerline of the waterway; and
- For the main channel of Barton Creek, the boundaries of the critical water quality zone are located 400 feet from the centerline of the creek.

The proposed improvements would cross the CWQZ associated with Walnut Creek Trib 9. No reasonable alternative exists to the impacts associated with the low water crossing improvements; however, impacts should be minimized to the extent practicable. Development within the CWQZ shall be designed to protect the natural hydrologic function, long-term channel stability, and ecological function of the floodplain. Disturbed areas would comply with the COA's vegetative stabilization requirements.

Construction related activities have the potential to indirectly affect local groundwater through stormwater runoff. The project area is located within the Edwards Aquifer Recharge Zone, as mapped by the TCEQ (**Figure 6)**; therefore, a Water Pollution Abatement Plan would be required.

According to the Texas Water Development Board, there no water wells within the proposed project area (**Figure 6**). The nearest registered well is west of the project area across the Mopac and Metrorail right-of-way.

In compliance with Section 402 of the CWA, temporary erosion and sedimentation control BMPs would be installed before any work begins. BMPs to be used include erosion controls, sedimentation controls, and/or post-construction total suspended solids controls. These controls should be inspected periodically, and if monitoring indicates that the project's controls are not adequately protecting water quality, installation of additional protection would be required.

The TCEQ has primary responsibility for implementing the Texas Pollutant Discharge Elimination System (TPDES) program. The proposed project would likely disturb more than one acre but less than five acres. For construction projects that disturb more than one acre but less than five, and that are not part of a larger common plan of development, the requirements are:

1. Develop and implement a storm water pollution prevention plan (SWP3);
2. Complete and post a site notice; and
3. Submit a copy of the site notice to Municipal Separate Storm Sewer (MS4) operator

5.4 Conclusions and Limitations

During field investigation, one WOUS (Walnut Creek Trib 9) was identified within the project area (**Figure 5)**. Whether the project would result in permanent impacts to this feature depends on final design. Regardless of final design, temporary (and potentially permanent) impacts would result from removing the existing structure. These impacts would require authorization of the USACE under the

Section 404 permitting process. Anticipated impacts would likely be authorized under Nationwide Permit (NWP) #14, Linear Transportation Projects. Regardless of the final design, impacts to Walnut Creek Trib 9 are unlikely to trigger the need for a Pre-Construction Notification (PCN) to the USACE. However, General Condition 18 may require a PCN if final design would result in a potential to affect federally protected species (see **Section 6.4** for additional discussion).

Field investigations did not identify wetlands per current USACE or COA guidelines; therefore, the project would not result in impacts to wetlands and no wetland mitigation would be required.

The project would occur within the Edwards Aquifer Recharge Zone. A Water Pollution Abatement Plan would be required regardless of final design.

The project would be unlikely to disturb more than five acres; however, it would likely disturb more than one acre. Therefore, the project would be required to comply with the TPDES commitments for small construction sites, as discussed above.

6.0 Endangered, Threatened and Rare Species

This section provides a brief overview of the federally listed and state listed endangered and threatened species of potential occurrence in the project area.

6.1 Federal – U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) has legislative authority to list and monitor the status of species whose populations are considered to be imperiled. This federal legislative authority for the protection of threatened and endangered species issues from the ESA (1973), and its subsequent amendments. Regulations supporting this act are codified and regularly updated in 50 CFR §17.11 and §17.12. The federal process stratifies potential candidates based upon the species' biological vulnerability. The vulnerability decision is based upon many factors affecting the species within its range and is always linked to the best current scientific data available to the USFWS. Species listed as endangered or threatened by the USFWS are provided full protection. This protection includes a prohibition of indirect take such as destruction of critical habitat. The ESA and accompanying regulations provide the necessary authority and incentive for the individual states to establish their own regulatory vehicle for the management and protection of threatened and endangered species.

6.2 State – Texas Parks and Wildlife Department

TPWD oversees endangered resources through the Wildlife Division. The Wildlife Division is further divided into branches, with the Endangered Resources Branch consisting of the Endangered Species Program and the TXNDD. The Endangered Species Program lists, regulates and plans for recovery of threatened and endangered species. The TXNDD catalogs, monitors, and provides information on rare species and communities of concern.

6.3 Listed Threatened and Endangered Species of Travis County

The following section addresses the ecological requirements and known occurrences of threatened or endangered species of potential occurrence in the project region. **Table 1** lists and describes the threatened, endangered, and rare species of potential occurrence in Travis County, the listing status of each, a determination of whether appropriate habitat occurs in the project area, and expected project impacts.

U.S. Geologic Survey (USGS) based maps from the report entitled "Revision of Karst Species Zones for the Austin, Texas Area" (Veni and Martinez, 2007) were consulted to determine whether karst species are likely to be found in or near the project area. Approximately half of the project area is in Karst Zone 1(Areas known to contain endangered cave fauna) and the remainder is in Karst Zone 3

(Areas that probably do not contain endangered cave fauna). The disturbance of karstic formations introduces a potential for impacting habitat and protected species. The project area is not in the Balcones Canyonlands Conservation Plan participation area.

6.3 Texas Natural Diversity Database Search Results

A search of TPWD's TXNDD was conducted on August 30, 2018. TXNDD lists 31 element of occurrence (EO) records within a 5-mile buffer of the project site. This includes 18 EOs for the Bone Cave harvestman (*Texella reyesi*), 9 EOs for the Jollyville Plateau salamander (*Eurycea tonkawae*), 3 EOs for the Black-capped Vireo Black-capped Vireo (*Vireo atricapilla*), and 1 EO for the Golden-cheeked Warbler. These EOs generally occur west of the project area; however, they illustrate the potential for encountering the habitat of subsurface species, especially the bone cave harvestman and the Jollyville Plateau Salamander. Note that TXNDD data cannot be interpreted as presence/absence data. See **Figure 9**.

Table 1: Threatened and Endangered Species of Potential Occurrence in Travis County, Texas						
Species	**Federal Status**	**State Status**	**Species/Habitat Description**	**Habitat Present?**	**Species Effects***	**Pertinent Information**
Plants						
Bracted twistflower *Streptanthus bracteatus*	C	SGCN	Endemic; prefers clay soils over limestone, rocky slopes, openings in juniper-oak woodlands; flowers April-May	Yes	No effect	Oak-juniper woodlands are located within the proposed project area. Flowering season surveys could determine the presence of this species in the final project footprint to avoid impacts.
Mollusks						
False spike mussel *Fusconia (=Quadrula) mitchelli*	NL	T	Little known; substrates of cobble and mud; water lilies may be present	No	No impact	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Golden orb *Quadrula aurea*	C**	T	Sand and gravel in some locations and mud at others; intolerant of impoundment in most instances; Guadalupe, San Antonio, and Nueces River basins	No	No effect	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Smooth pimpleback *Quadrula houstonensis*	C	T	Small to moderate streams and rivers, as well as moderate size reservoirs; mixed mud, sand, and fine gravel; does not tolerate dramatic water level fluctuations	No	No effect	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Texas fatmucket *Lampsilis bracteata*	C	T	Streams and rivers on sand, mud, gravel, or broken bedrock in moderately flowing water	No	No effect	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Texas fawnsfoot *Truncilla macrodon*	C**	T	Little known; possibly rivers and larger streams; intolerant of impoundment; prefers sand, gravel, and sandy-mud in moderate flows	No	No effect	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.
Texas pimpleback *Quadrula petrina*	C	T	Mud, gravel, and sand substrates in areas with low flow rates	No	No effect	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in receiving streams.

Table 1: Threatened and Endangered Species of Potential Occurrence in Travis County, Texas						
Species	**Federal Status**	**State Status**	**Species/Habitat Description**	**Habitat Present?**	**Species Effects***	**Pertinent Information**
Insects						
Kretschmarr Cave mold beetle *Texamaurops reddelli*	LE	SGCN	Small, cave-adapted beetle found under rocks buried in silt in small Edwards Limestone caves of the Edwards Plateau	No	No effect	No areas of potential habitat (i.e., caves) are known to occur within project area, and no karst features were discovered during geologic investigations. Ground disturbance could reveal potential habitat and should be minimized to the extent practicable. The disturbance of karstic formations introduces a potential for impacting habitat and protected species.
Tooth Cave ground beetle *Rhadine persephone*	LE	SGCN	Resident, small, cave-adapted; small Edwards Limestone caves in Travis and Williamson Counties	No	No effect	No areas of potential habitat (i.e., caves) are known to occur within project area, and no karst features were discovered during geologic investigations. Ground disturbance could reveal potential habitat and should be minimized to the extent practicable. The disturbance of karstic formations introduces a potential for impacting habitat and protected species.
Arachnids						
Bee Creek Cave harvestman *Texella reddelli*	LE	SGCN	Small, blind, cave-adapted; endemic to a few caves in Travis and Williamson Counties	No	No effect	No areas of potential habitat (i.e., caves) are known to occur within project area, and no karst features were discovered during geologic investigations. Ground disturbance could reveal potential habitat and should be minimized to the extent practicable. The disturbance of karstic formations introduces a potential for impacting habitat and protected species.

Table 1: Threatened and Endangered Species of Potential Occurrence in Travis County, Texas						
Species	**Federal Status**	**State Status**	**Species/Habitat Description**	**Habitat Present?**	**Species Effects***	**Pertinent Information**
Bone Cave harvestman *Texella reyesi*	LE	SGCN	Small, blind, cave-adapted; endemic to a few caves in Travis and Williamson Counties	No	No effect	No areas of potential habitat (i.e., caves) are known to occur within project area, and no karst features were discovered during geologic investigations. Ground disturbance could reveal potential habitat and should be minimized to the extent practicable. The disturbance of karstic formations introduces a potential for impacting habitat and protected species.
Tooth Cave pseudoscorpion *Tartarocreagris texana*	LE	SGCN	Small, cave-adapted; small limestone caves of the Edwards Plateau	No	No effect	No areas of potential habitat (i.e., caves) are known to occur within project area, and no karst features were discovered during geologic investigations. Ground disturbance could reveal potential habitat and should be minimized to the extent practicable. The disturbance of karstic formations introduces a potential for impacting habitat and protected species.
Tooth Cave spider *Neoleptoneta myopica*	LE	SGCN	Very small, cave-adapted, sedentary	No	No effect	No areas of potential habitat (i.e., caves) are known to occur within project area, and no karst features were discovered during geologic investigations. Ground disturbance could reveal potential habitat and should be minimized to the extent practicable. The disturbance of karstic formations introduces a potential for impacting habitat and protected species.
Fishes						
Smalleye shiner *Notropis buccula*	LE	SGCN**	Medium to large prairie streams with sandy substrate and turbid to clear warm water	No	No effect	No perennial streams occur within the project area. Stormwater pollution control BMPs would be in place to protect water quality in any receiving streams.

Table 1: Threatened and Endangered Species of Potential Occurrence in Travis County, Texas						
Species	**Federal Status**	**State Status**	**Species/Habitat Description**	**Habitat Present?**	**Species Effects***	**Pertinent Information**
Amphibians						
Austin blind salamander *Eurycea waterlooensis*	LE	SGCN	Subterranean cavities of the Edwards Aquifer; known from outlets of Barton Springs and dependent upon water flow/quality from Barton Springs segment of Edwards Aquifer	No	No effect	This species is only known from areas south of the Colorado River. The project area is located north of the Colorado River. No caves or springs are known to occur within project area.
Barton Springs salamander *Eurycea sosorum*	LE	E	Spring dweller, ranges into water-filled subterranean caverns; found under rocks, in gravel, or among plants and algae; known from outlets of Barton Springs and dependent upon water flow/quality from Barton Springs segment of Edwards Aquifer	No	No effect	This species is only known from areas south of the Colorado River. The project area is located north of the Colorado River. No caves or springs are known to occur within project area.
Jollyville Plateau salamander *Eurycea tonkawae*	LT	SGCN	Known from springs and waters of some caves north of the Colorado River	No	No effect	No springs or recharge features are known to occur in the project area. If the final design requires subsurface activities that intercept the Edwards Aquifer or significant recharge features, protective measures to minimize the potential for impacts to this species would be appropriate.
Reptiles						
Texas horned lizard *Phrynosoma cornutum*	NL	T	Open, arid, and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush, and scrubby trees; soils may vary from sandy to rocky; burrows into soil; breeds March-September	No	No impact	No open, arid, or semi-arid regions occur within the project area.
Birds						
American Peregrine Falcon *Falco peregrinus anatum*	DL	T	Potential migrant; occupies wide range of habitats during migration, including urban, with concentrations along coast and barrier islands; stopovers at leading landscape edges	No	No impact	Potential migrant; any use of project area would be incidental.

Table 1: Threatened and Endangered Species of Potential Occurrence in Travis County, Texas						
Species	**Federal Status**	**State Status**	**Species/Habitat Description**	**Habitat Present?**	**Species Effects***	**Pertinent Information**
Bald Eagle *Haliaeetus leucocephalus*	DL	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water	No	No impact	No nesting habitat occurs within project area. Potential migrant; any use of project area would be incidental. The provision of the Bald and Golden Eagle Protection Act would be followed.
Black-capped Vireo *Vireo atricapilla*	DL	E	Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; deciduous broad-leaved shrubs and trees provide insects for feeding; nests March-late summer	No	No impact	No oak-juniper woodlands with a distinctive patchy, two-layered aspect occur in the project area. The species is a potential migrant; any use of project area would be incidental.
Golden-cheeked Warbler *Setophaga (=Dendroica) chrysoparia*	LE	E	Juniper-oak woodlands; long fine bark strips from mature Ashe juniper used in nest construction; nests are placed in trees other than Ashe juniper; forage for insects in broad-leaved trees and shrubs; nests late March-early summer	No	No effect	No mature juniper-oak woodlands lacking edge occur within the project area. The species is a potential migrant; any use of project area would be incidental.
Interior Least Tern *Sterna antillarum athalassos*	LE	E	Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony	No	No effect	No suitable habitat is present within the proposed project area.

Table 1: Threatened and Endangered Species of Potential Occurrence in Travis County, Texas						
Species	**Federal Status**	**State Status**	**Species/Habitat Description**	**Habitat Present?**	**Species Effects***	**Pertinent Information**
Red Knot *Calidris canutus rufa*	LT	T	Red knots migrate long distances in flocks northward through the contiguous United States mainly April-June, southward July-October. The Red Knot prefers the shoreline of coast and bays and also uses mudflats during rare inland encounters. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore.	No	No effect	No suitable habitat is present within the proposed project area.
Whooping Crane *Grus americana*	LE	E	Potential migrant via plains throughout most of the state to the coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties	No	No effect	No suitable habitat is present within the proposed project area.
Mammals						
Red wolf *Canis rufus*	LE	E**	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas and coastal prairie	No	No effect	The species is extirpated and would not be reasonably expected to occur within Travis County.

Status
E = State-Listed Endangered
T = State-Listed Threatened
LE = Federally-Listed Endangered
LT = Federally-Listed Threatened
C = Candidate for listing
NL = Not listed
DL = Delisted
SGCN = Species of Greatest Conservation Need
* = Determinations assume USACE authorization and the potential for coordination as prescribed by NWP General Conditions
** = Species' potential to occur in the project area is recognized by the indicated agency but not by the other.

Sources: TPWD, 2018; USFWS, 2018

6.4 Conclusions and Limitations

Potential habitat exists for the bracted twist flower (*Streptanthus bracteatus*), which is a candidate for federal listing. No individuals of this species were observed during field investigations, and potential habitat in the area is sub-optimal. Minimization of the project footprint and bloom-season surveys before construction could lessen the risk of species impacts.

Potential subsurface habitat exists for the Jollyville Plateau salamander, which is listed as Threatened by the USFWS. Risk of impacts to this species increases with increased subsurface impacts, especially in cases were the Edwards Aquifer is directly intercepted or where significant recharge features are encountered. Excavations to depth that would intercept the Edwards Aquifer are unlikely; however, recharge features may be intercepted. Significant recharge features introduce a possibility for the transmission of pollutants to the aquifer. Should the final design require subsurface activities (e.g., bridge pier installation) with a potential to intercept the aquifer or recharge features may, the project may warrant a "May Affect Not Likely to Adversely Affect" determination regarding this species. In that case, coordination with the USACE per NWP General Conditions may be appropriate, which would include USFWS review of the project findings. This scenario would likely require the incorporation of various voluntary conservation measures (e.g., encased piers, potential pollutant management plans).

Potential subsurface habitat exists for several karst-associated invertebrates, especially the Bone Cave harvestman. Preliminary geologic evaluations did not indicate the presence of geologic formations that are consistent with habitat for this species. Excavations and other ground disturbance could reveal potential habitat. COA and TCEQ require notification in certain instances of karst void discovery during construction. These notification procedures should be followed and, if warranted, the USFWS should be notified of the discovery of potential habitat.

Though TXNDD EOs for the Golden-cheeked Warbler and the Black-capped vireo are reported within a 5-mile buffer of the project area, suitable habitat for these species does not occur in the project area.

In order to minimize risk associated with species impacts, project footprint and subsurface investigations should be minimized to the extent practicable.

7.0 Cultural Resources

As a political subdivision of the State of Texas, the City of Austin is subject to the Antiquities Code of Texas (9 Texas Natural Resources Code [TNRC] 191). A data search of the Texas Archeological Sites Atlas (Atlas) maintained by the Texas Historical Commission (THC) and the Texas Archeological Research Laboratory (TARL) was conducted in order to identify any previously recorded cemeteries, historical markers, National Register of Historic Places (NRHP) properties or districts, State Antiquities Landmarks (SALs), archeological sites, and previous surveys in and near the project area. According to survey coverage data available in the THC Atlas, it does not appear that the project area has been surveyed previously, and no notations for previously documented archeological sites or other cultural resources are located within the project area.

The nearest survey to the project area is a 1983 Veterans Administration/Environmental Protection Agency survey for the Scofield Farms residential development just across MoPac (Loop 1) from McNeil Drive. The closest previously documented cultural resource is 41TV859, a surficial prehistoric site of unknown age and affiliation recorded approximately 0.35 miles south of the project area, along the northbound MoPac frontage road (THC 2018). Although its formal NRHP/SAL determination is unavailable, the site is a typical Central Texas upland lithic scatter unlikely to be deemed significant.

The closest previously documented cultural resource on the west (southbound) side of MoPac is site 41TV1943, the remnants of a circa 1920s residence approximately 0.40 miles north of McNeil Drive. The site was determined ineligible for NRHP/SAL listing in 2001 (THC 2018).

7.1 Conclusions and Limitations

Due to the lack of consistent soil cover, the project area has a low probability of containing buried archeological deposits. Archeological sites in this part of Austin tend to consist of surface artifacts and structural remains, as illustrated at nearby sites 41TV1943 and 41TV859. Given the apparent lack of previous surface disturbance, it is possible that as-yet-unknown sites similar to these known sites may be located within the project area, and the THC may require survey even though the project falls below the 5-acre Antiquities Code coordination threshold. The fill-based build option may cause a survey to be required, as it would disturb a larger area of the surface, which in this case is archeologically relevant (in contrast to other project areas with deeply buried archeological deposits more amenable to additional fill cover). However, if the City chose the bridge build option, in which piers would be drilled into the limestone bedrock and cumulatively would have a smaller footprint than the fill option, the fractional surface acreage occupied by the piers may reduce the likelihood of an archeological survey requirement prior to construction.

Recent guidance from the Regulatory Archaeologist at the USACE Fort Worth District requires informal notification of all projects assuming authorization under any NWP. USACE involvement may trigger survey and reporting per Section 106 of the National Historic Preservation Act. If this were to be the case, a historic resource survey would likely be required, especially in the event of impacts to the historic-age residence south of McNeil Drive.

8.0 Hazardous Materials

CMEC hazardous materials specialists reviewed regulatory database records resulting from a query per American Society of Testing and Materials E1527-13 standards. The database query returned three sites where contamination resulted from leaking petroleum storage tanks. Each of these sites is across the Mopac and Metrorail right-of-way and none are closer than one-third of a mile from the project site. Records indicate that no groundwater contamination resulted from these releases. Given the distance from the project site and the media impacted, we have determined that it is highly unlikely for these releases to have resulted in contamination of the project site. See **Appendix C** for additional information.

Field investigations for potential hazardous materials and/or petroleum product contamination included determining the presence or absence of indicators including stained soil, sheens on water, dumping, unlabeled pails or drums, stressed vegetation, and pungent odors. No signs of contamination were observed.

9.0 Summary and Recommendations

Research and field investigations identified one known regulated resource; Walnut Creek Trib 9. USACE permitting per Section 404 of the Clean Water act regulates temporary or permanent fill (i.e., impacts) to this resource. NWP 14 would authorize these impacts on the condition that the project adheres to the permit's regional and general conditions. Impacts to Walnut Creek Trib 9 are unlikely to require a PCN; however, a potential for protected species impacts may.

Additional permitting and agency coordination will be required. The City of Austin Land Development Code requires the preparation of an ERI and tree mitigation is likely. Coordination with the local floodplain administrator is also required. Edwards Aquifer Rules require the preparation of a WPAP. TPDES regulations require the preparation of a SWP3 and notification to the local MS4 Operator

before construction. Cultural resource surveys may be required, as described above. Coordination with the Texas Historical Commission is advised.

Despite investigations to date, risk of impacts remains. In general, risk can be reduced by minimizing the footprint (e.g., the risk to cultural resources and potential karst habitat) and by avoiding impacts to karst features and the Edwards Aquifer.

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APPENDIX A – FIGURES

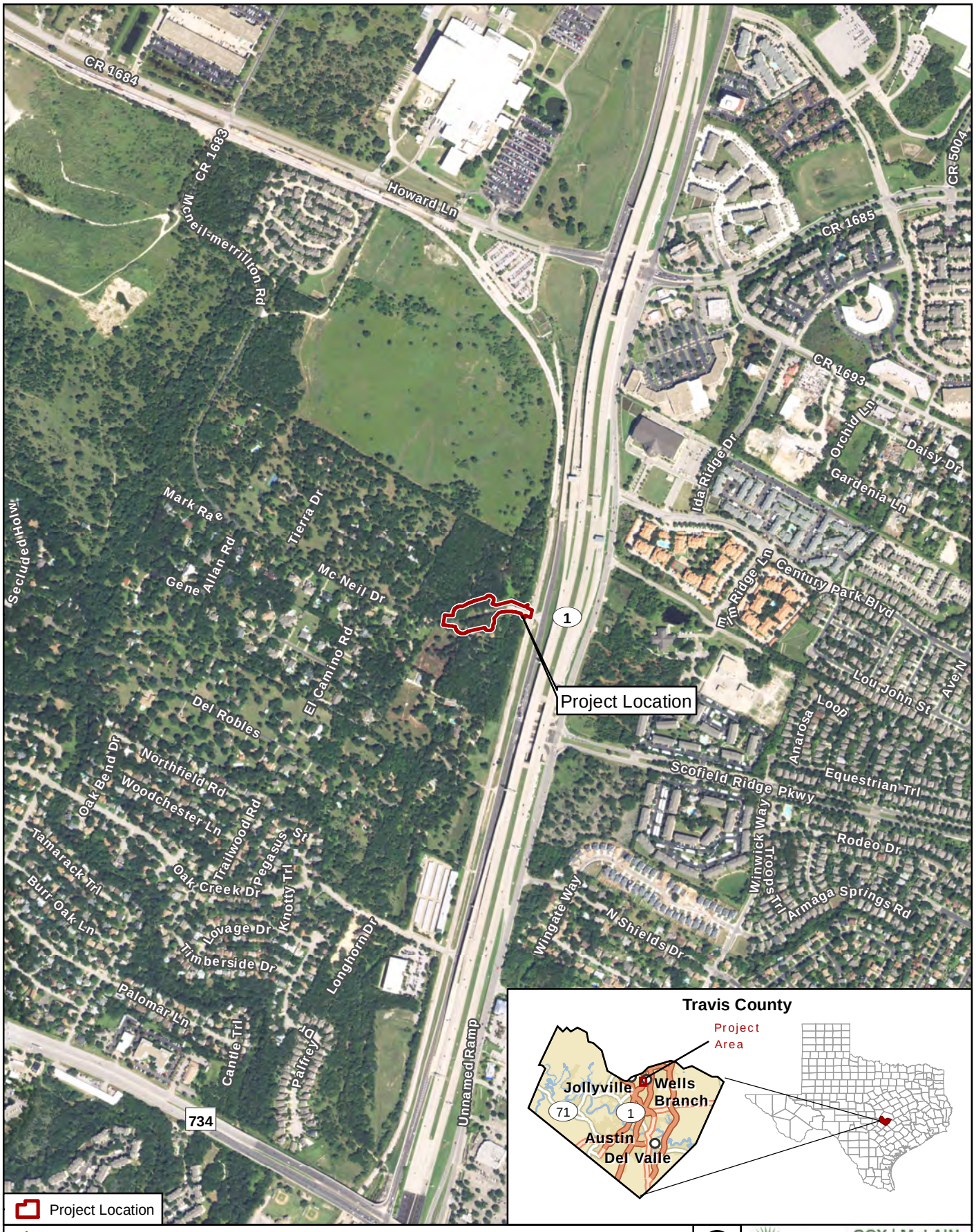

Figure 1

Project Location (Aerial Base)

McNeil Dr Low Water Crossing

Aerial Source: NAIP (2016)

COX | McLAIN Environmental Consulting

0 1,000 Feet

0 300 Meters

1 in = 1,000 feet

Scale: 1:12,000

Date: 8/24/2018

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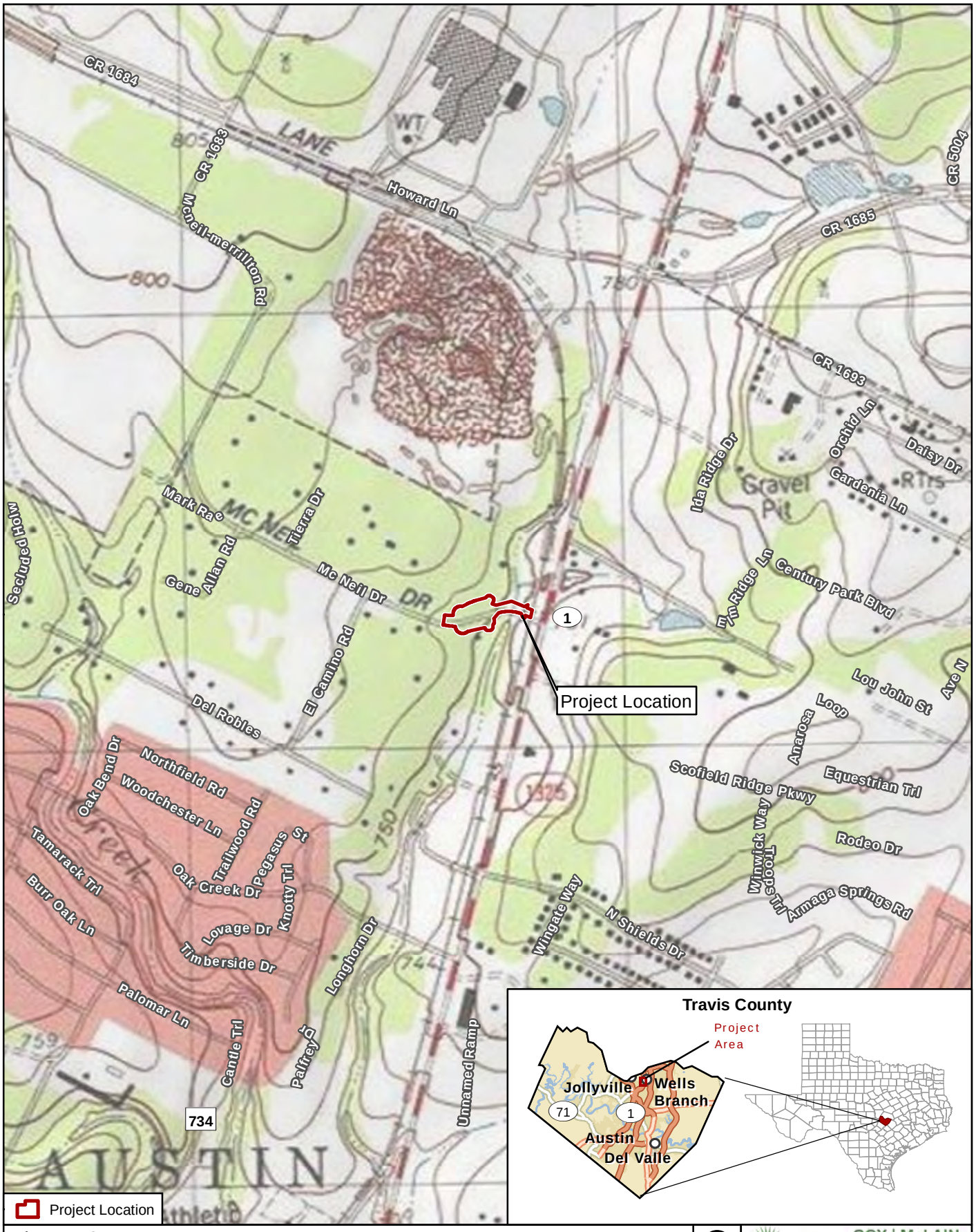

Figure 2

Project Location (Topographic Base)

McNeil Dr Low Water Crossing

Base Map Source: USGS Pflugerville West 7.5' Quadrangle (1987)

COX | McLAIN Environmental Consulting

0 1,000 Feet

0 300 Meters

1 in = 1,000 feet

Scale: 1:12,000

Date: 8/24/2018

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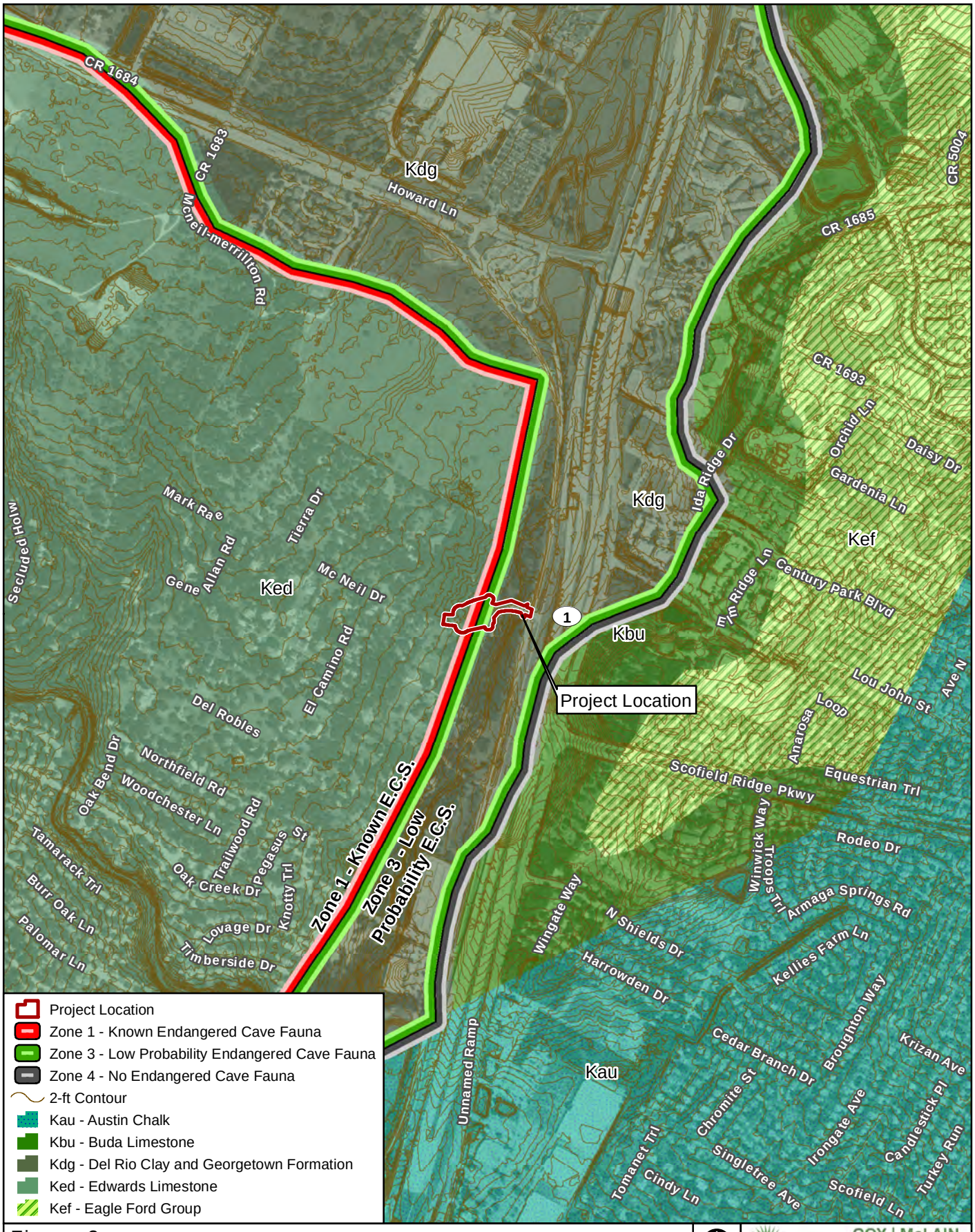


Figure 3

Project Area Geology

McNeil Dr Low Water Crossing

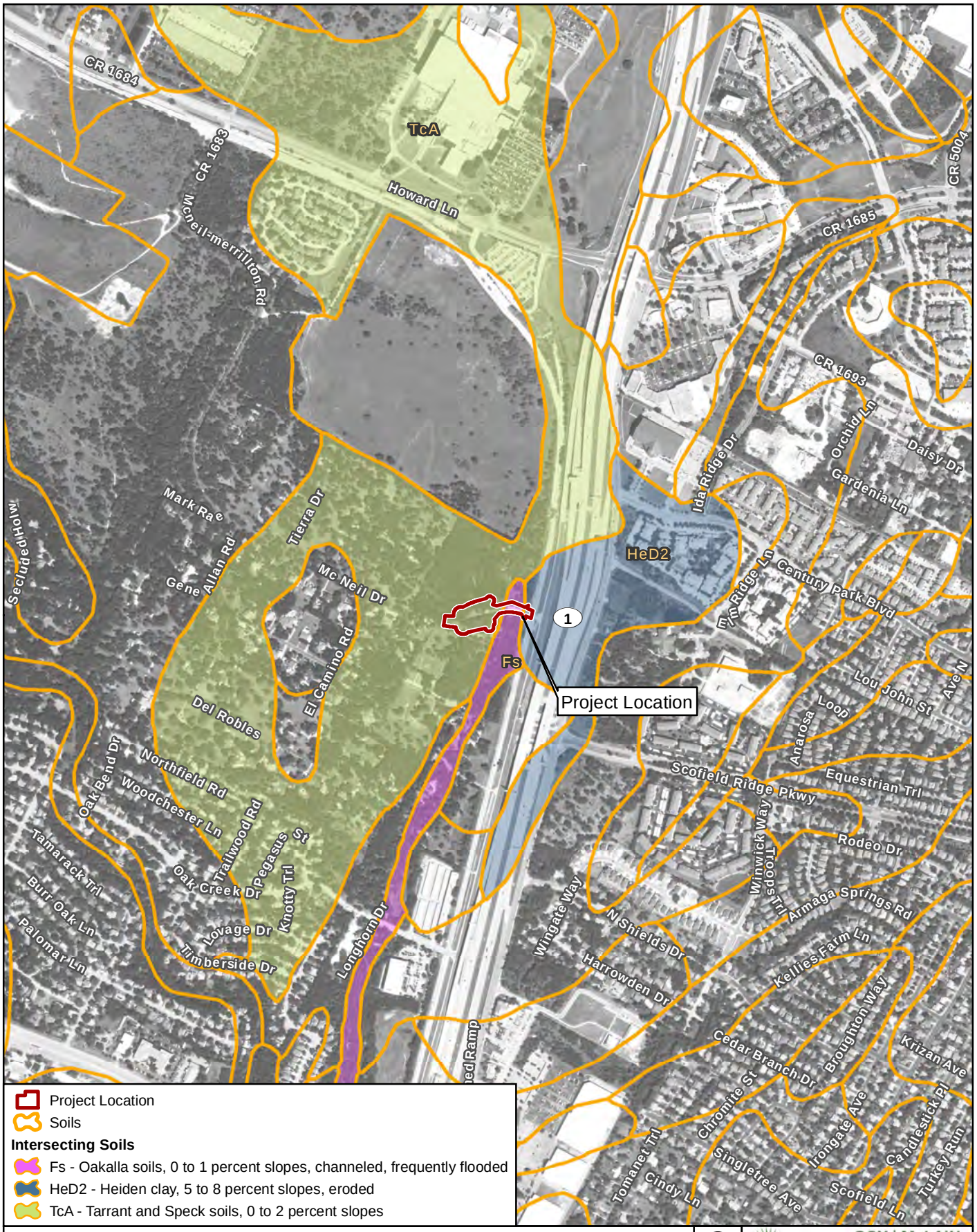
Data Sources: Geologic Database of Texas (2007)/Geologic Atlas of Texas Austin Sheet (1981), City of Austin (2012), Veni (2007)
Aerial Source: NAIP (2016)

COX | McLAIN Environmental Consulting

0 1,000 Feet
0 300 Meters

1 in = 1,000 feet
Scale: 1:12,000
Date: 8/24/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 3_Geology_20180823.mxd



Project Location
Soils

Intersecting Soils

Fs - Oakalla soils, 0 to 1 percent slopes, channeled, frequently flooded
HeD2 - Heiden clay, 5 to 8 percent slopes, eroded
TcA - Tarrant and Speck soils, 0 to 2 percent slopes

Figure 4

Project Area Soils

McNeil Dr Low Water Crossing

Data Source: NRCS (2017)
Aerial Source: NAIP (2016)

COX | McLAIN Environmental Consulting

0 1,000 Feet
0 300 Meters

1 in = 1,000 feet
Scale: 1:12,000
Date: 8/24/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 4_Soils_20180823.mxd

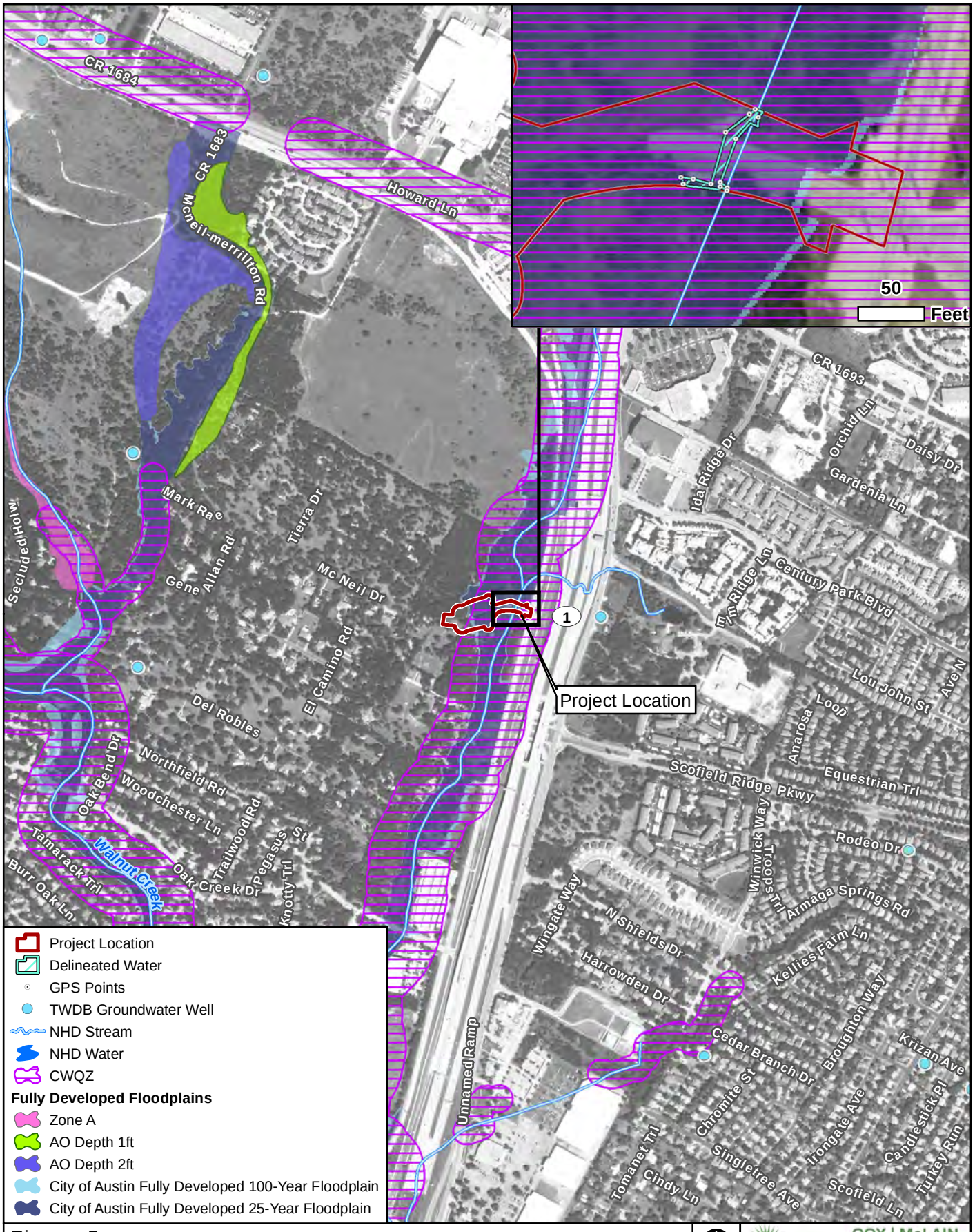


Figure 5

Water Resources

McNeil Dr Low Water Crossing

Data Sources: NHD (2018), TWDB (2018), City of Austin (2012, 2015), CMEC (2018)
Aerial Source: NAIP (2016)

COX | McLAIN Environmental Consulting

0 1,000 Feet
0 300 Meters

1 in = 1,000 feet
Scale: 1:12,000
Date: 8/24/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 5_WaterResources_20180823.mxd

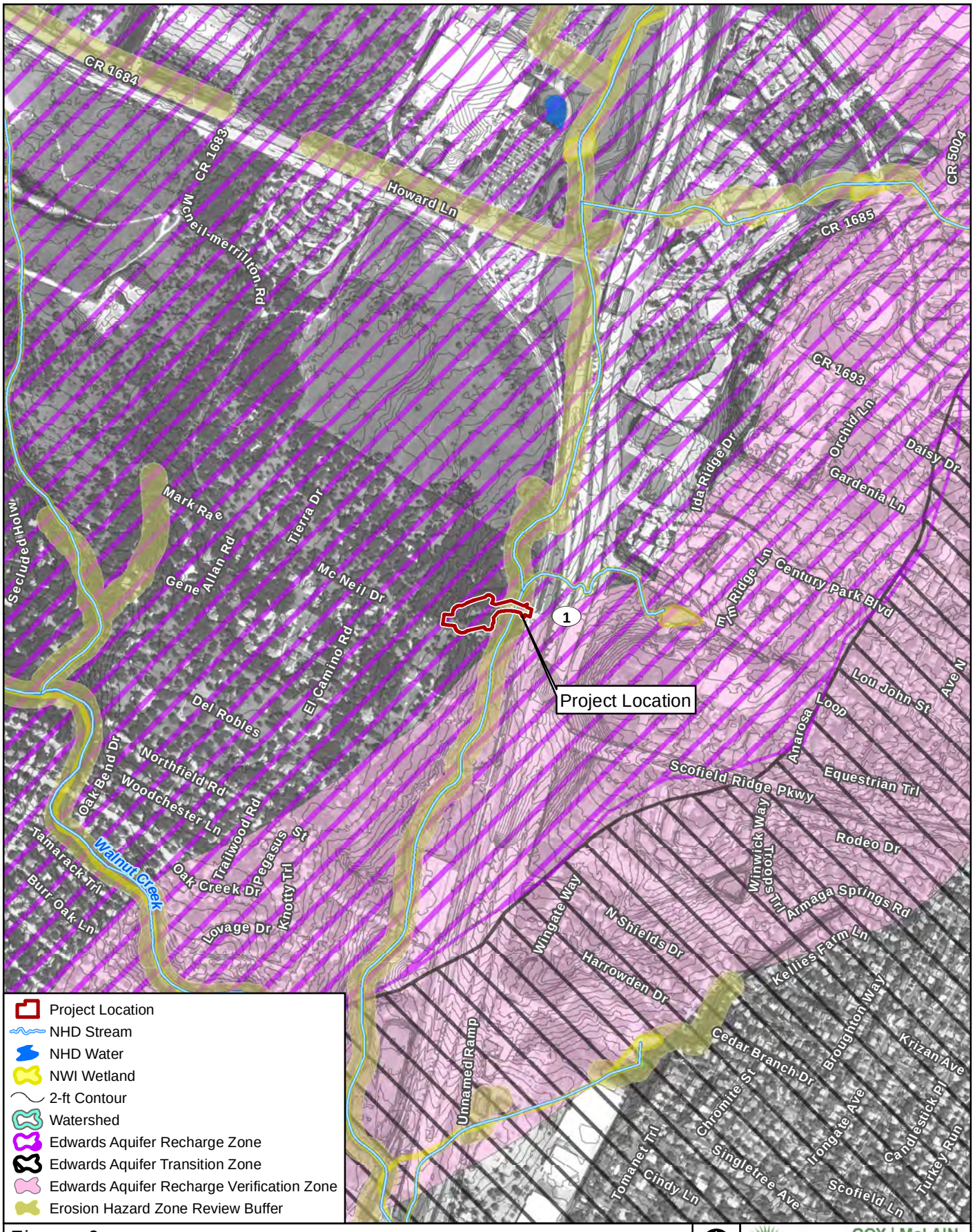


Figure 6

Watershed Resources

McNeil Dr Low Water Crossing

Data Source: NWI (2018), NHD (2018), City of Austin (2012, 2015, 2017), TCEQ (2005)
Aerial Source: NAIP (2016)

COX | McLAIN Environmental Consulting

0 1,000 Feet
0 300 Meters

1 in = 1,000 feet
Scale: 1:12,000
Date: 8/24/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 6_Watershed_20180823.mxd

Figure 7

Vegetation Types of Texas

McNeil Dr Low Water Crossing

Data Sources: TPWD (2003)/McMahan, et. al (1984), NHD (2018)
Aerial Source: NAIP (2016)

COX | McLAIN Environmental Consulting

0 1,000 Feet
0 300 Meters

1 in = 1,000 feet
Scale: 1:12,000
Date: 8/24/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 7_VegetationTypes_20180823.mxd

Figure 8

1974 Aerial

McNeil Dr Low Water Crossing

Aerial Source: USGS (1974)

COX | McLAIN Environmental Consulting

0 500 Feet

0 150 Meters

1 in = 500 feet

Scale: 1:6,000

Date: 8/24/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 8_1974Aerial_20180823.mxd

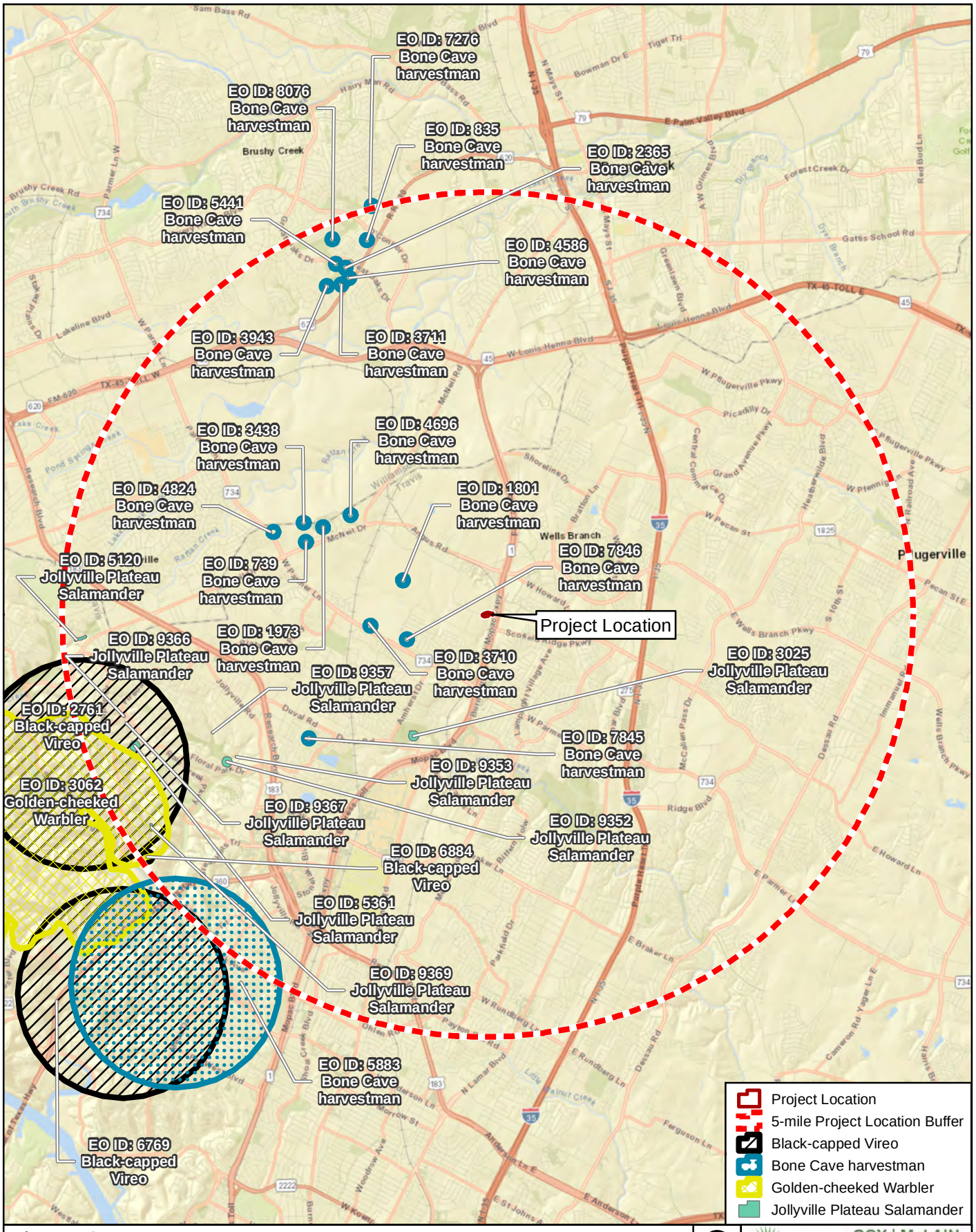


Figure 9

TXNDD Elements of Occurrence

McNeil Dr Low Water Crossing

Data Source: TPWD (8/20/2018)
Basemap Source: ESRI (2018)

COX | McLAIN Environmental Consulting

0 1.5 Miles
0 2 Kilometers

1 in = 8,333.33 feet
Scale1:100,000
Date: 8/30/2018

G:\Projects\CityofAustin\McNeilDriveCrossing\Figure 9_TXNDD_20180830.mxd

APPENDIX B – PROJECT AREA PHOTOGRAPHS

Photo 1: View westward along McNeil Drive from near the eastern terminus toward the existing culvert and low water crossing.

Photo 2: View eastward along McNeil Drive from near the western terminus. The existing culvert and low water crossing are just beyond the pictured vehicle.

Photo 3: View northward along Walnut Trib 9 from the deck of the existing low water crossing. A rain storm passed over the area during field investigations. Walnut Creek Trib 9 was dry before the rain. Flow is toward the photo point. Note the extensive concrete riprap that extends to near the boundary of the project area.

Photo 4: View northward from the bed of Walnut Creek Trib 9 toward the existing culvert and low water crossing. Flow is toward the photo point.

Photo 5: View southward from the bed of Walnut Creek Trib 9 away from the project area. Flow is away from the photo point.

Photo 6: Alternate view of Walnut Creek Trib 9 from north of McNeil Drive, viewing northeast. Flow is left to right.

Photo 7: View east along the northern boundary of the project location. McNeil Drive is pictured (right of frame), Walnut Creek Trib 9 is just beyond the manicured grass.

Photo 8: View west along the northern boundary of the project location. McNeil Drive is pictured (left of frame), Walnut Creek Trib 9 is behind the photo point. This area is apparently routinely mowed including much of the areas under the mature trees in the distance.

Photo 9: View west along the northern boundary of the project location showing a representative view of the juniper woodland north of McNeil Drive.

Photo 10: View south from McNeil Drive across a pasture adjacent to the eastern terminus.

Photo 11: View east along the southern boundary of the project location. McNeil Drive is pictured (left of frame). This area is apparently routinely mowed.

Photo 12: View north from near the southern boundary of the project location. McNeil Drive can be seen in the distance, and Walnut Creek Trib 9 is out-of-frame to the right. The exposed bedrock (center frame) is associated scour that results when McNeil Drive is overtopped by high water and the stream comes out of its banks.

APPENDIX C – HAZARDOUS MATERIALS DATABASE REPORT

Prepared for:

COX MCLAIN ENVIRONMENTAL CONSULTING INC - Austin
8401 Shoal Creek Blvd, STE 100
Austin, TX 78757

BANKS ENVIRONMENTAL DATA
A DIVISION OF THE BANKS GROUP

Regulatory Database Report

ASTM E1527-13/AAI Compliant

McNeil LWC

TX

PO #: 019-009-001

ES-128276

Thursday, June 07, 2018

Banks Environmental Data, Inc. - 1601 Rio Grande, Ste. 331 - Austin, TX 78701 - 800.531.5255 P - 512.478.1433 F
www.banksenvdata.com

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Geographic Summary

Location
TX

Coordinates	
Longitude & Latitude in Degrees Minutes Seconds	-97° 42' 4", 30° 26' 0"
Longitude & Latitude in Decimal Degrees	-97.701243°, 30.433283°
X and Y in UTM	624719.62, 3367514.24 (Zone 14)

Elevation
Target Property lies 743.11 feet above sea level.

Zip Codes Searched	
Search Distance	**Zip Codes (historical zip codes included)**
Target Property	78727
0.25 miles	78727
0.5 miles	78727, 78759
1 mile	78727, 78728, 78758, 78759

Topos Searched	
Search Distance	**Topo Name**
Target Property	Pflugerville West (1975)
0.25 miles	Pflugerville West (1975)
0.5 miles	Pflugerville West (1975)
1 mile	Pflugerville West (1975)

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Database Summary

Databases Searched	Distance Searched	# Mapped	# Not Mapped	Total
Federal - ASTM 1527-13/AAI Required				
National Priority List (NPL)	1	0	0	0
Delisted National Priority List (DNPL)	0.5	0	0	0
SEMS (CER SEMS)	0.5	0	0	0
SEMS NFRAP (CER SEMS NFRAP)	0.5	0	0	0
RCRA CORRACTS (RCRA COR)	1	0	0	0
RCRA non-CORRACTS TSD (RCRA TSD)	0.5	0	0	0
RCRA Generators (RCRA GEN)	0.25	0	0	0
Federal Brownfields (FED BWN)	0.5	0	0	0
Federal Institutional Control (FED IC)	0.5	0	0	0
Federal Engineering Control (FED EC)	0.5	0	0	0
ERNS List (ERNS)	0.25	0	0	0
State - ASTM 1527-13/AAI Required				
State/Tribal Equivalent NPL (ST NPL)	1	0	0	0
State/Tribal Equivalent CERCLIS (ST CER)	0.5	0	0	0
State/Tribal Disposal or Landfill (SWLF)	0.5	0	1	1
State/Tribal Leaking Storage Tank (LPST)	0.5	3	0	3
State/Tribal Storage Tank (PST)	0.25	0	0	0
State/Tribal Institutional Control (ST IC)	0.25	0	0	0
State/Tribal Engineering Control (ST EC)	0.5	0	0	0
State/Tribal Voluntary Cleanup (VCP)	0.5	0	0	0
State/Tribal Brownfield (ST BWN)	0.5	0	0	0
State/Tribal Hazardous Waste (HW)	0.25	0	0	0
Non-ASTM/AAI Required Databases				
RCRA (RCRA)	0.25	0	0	0
Dry Cleaners (DRYC)	0.25	0	0	0
State/Tribal Municipal Settings Designation (MS)	0.25	0	0	0
Total Sites Found		**3**	**1**	**4**

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Summary Map - 0.25 Mile Radius

McNeil LWC

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract
RCRA COR, RCRA TSD, CER, LPST, NPL, ST NPL, SWLF

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract
RCRA GEN, ST & FED BWN, ST & FED EC, ST & FED IC, DNPL, CER NFRAP, PST, VCP, ST CER

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract
ERNS, HW, RCRA, DRYC

Target Property

Search Buffer

0' 250' 500'

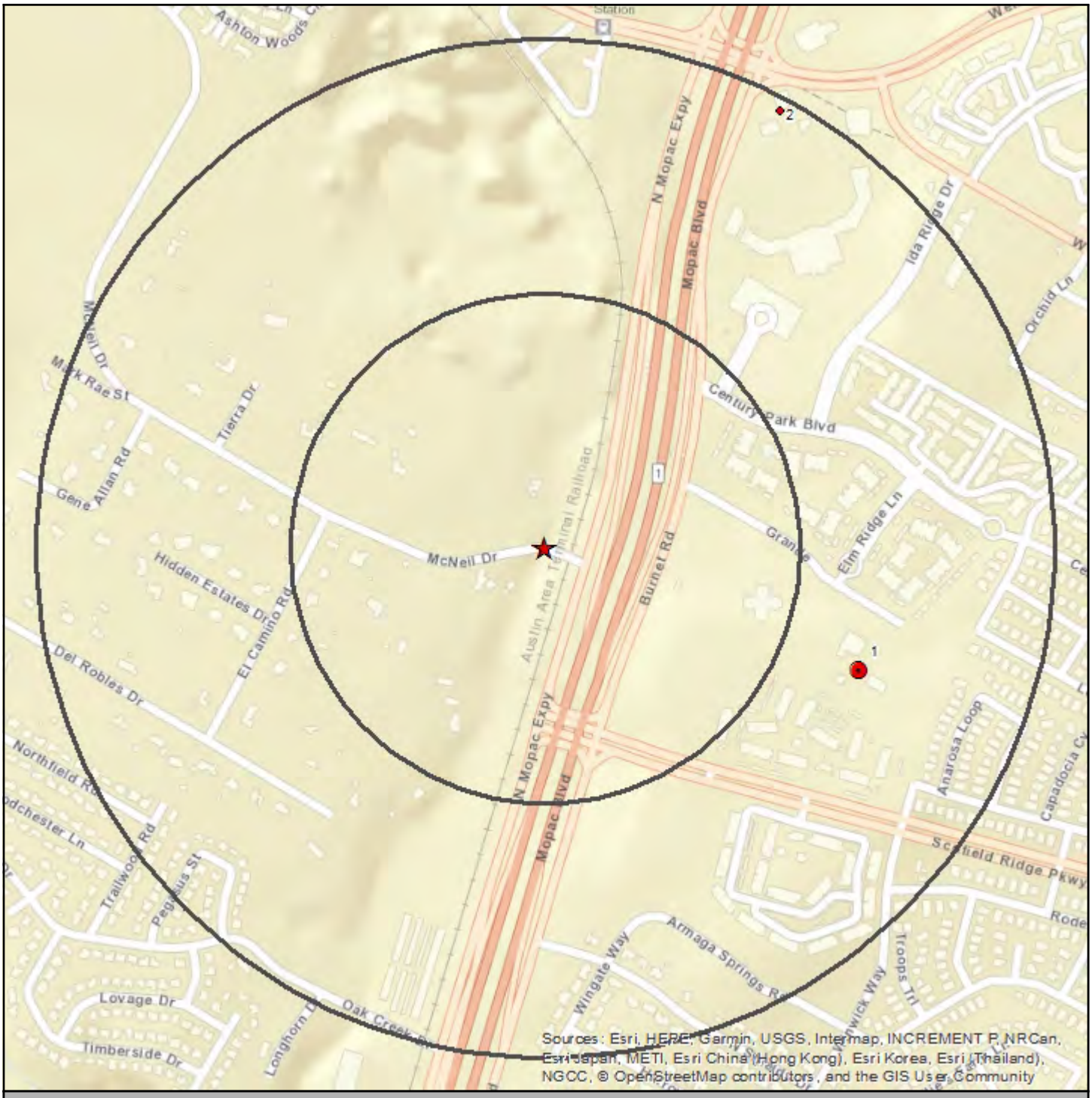
1 : 4,500

1 inch = 0.071 miles
1 inch = 375 feet
1 centimeter = 0.045 kilometers
1 centimeter = 45 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Summary Map - 0.5 Mile Radius



McNeil LWC

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

RCRA COR, RCRA TSD, CER, LPST, NPL, ST NPL, SWLF

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

RCRA GEN, ST & FED BWN, ST & FED EC, ST & FED IC, DNPL, CER NFRAP, PST, VCP, ST CER

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

ERNS, HW, RCRA, DRYC

Target Property

Search Buffer

0' 500' 1000'

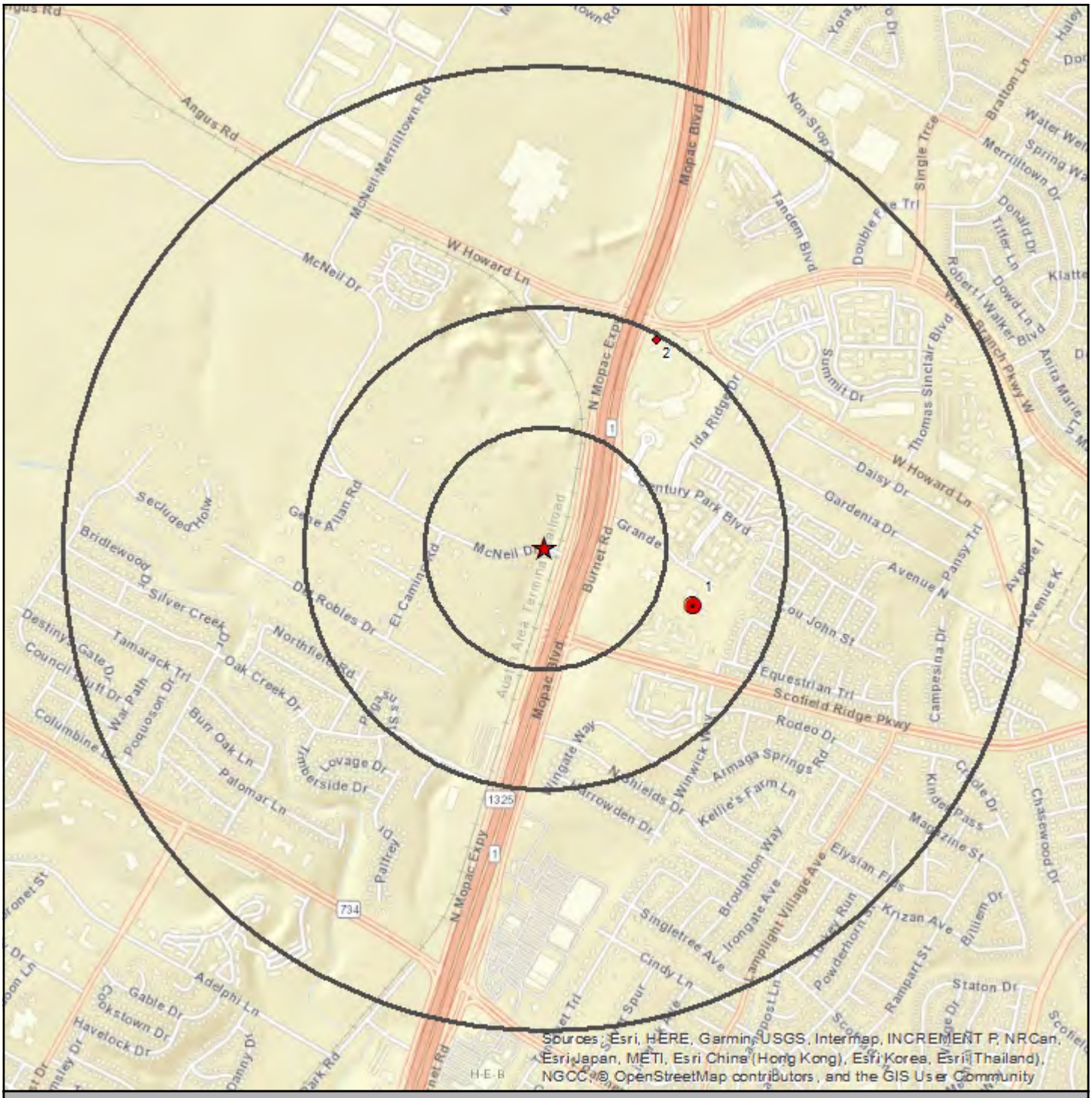
N

1 : 9,000

1 inch = 0.142 miles
1 inch = 750 feet
1 centimeter = 0.090 kilometers
1 centimeter = 90 meters

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Summary Map - 1 Mile Radius



McNeil LWC

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

RCRA COR, RCRA TSD, CER, LPST, NPL, ST NPL, SWLF

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

RCRA GEN, ST & FED BWN, ST & FED EC, ST & FED IC, DNPL, CER NFRAP, PST, VCP, ST CER

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

ERNS, HW, RCRA, DRYC

Target Property

Search Buffer

0' 1000' 2000'

1 : 19,000

1 inch = 0.300 miles
1 inch = 1583 feet
1 centimeter = 0.190 kilometers
1 centimeter = 190 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Topographic Overlay Map - 1 Mile Radius

McNeil LWC

Target Property

Search Buffer

Target Property Quad Name(s)
Pflugerville West (1975)

0' 1000' 2000'

1 : 19,000

1 inch = 0.300 miles
1 inch = 1583 feet

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

N

Current Imagery Overlay Map - 0.5 Mile Radius

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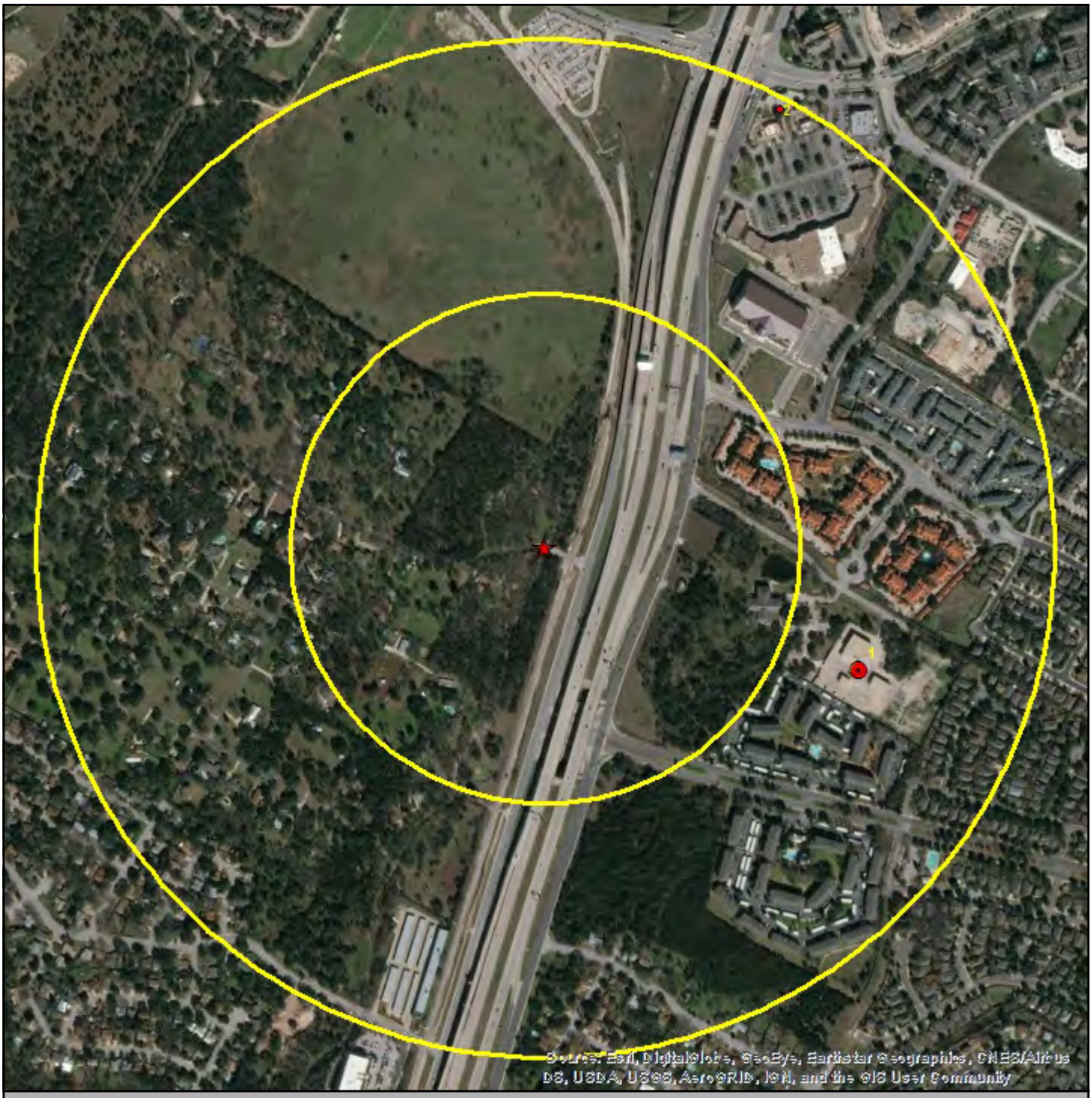
A DIVISION OF THE BANKS GROUP



McNeil LWC

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract
RCRA COR, RCRA TSD, CER, LPST, NPL, ST NPL, SWLF

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract
RCRA GEN, ST & FED BWN, ST & FED EC, ST & FED IC, DNPL, CER NFRAP, PST, VCP, ST CER

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract
ERNS, HW, RCRA, DRYC

Target Property

Search Buffer

0' 500' 1000'

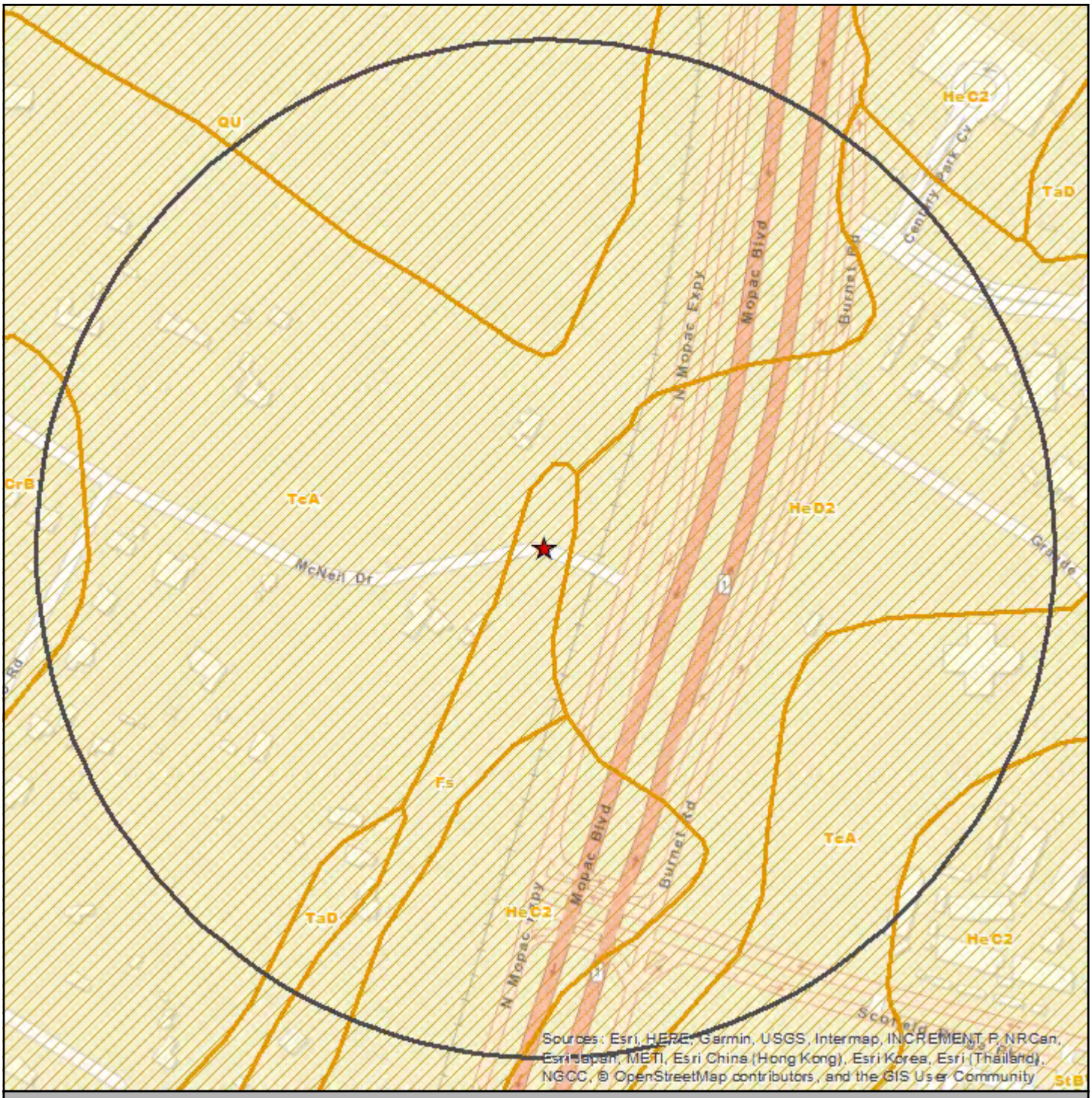
N

1 : 9,000

1 inch = 0.142 miles
1 inch = 750 feet
1 centimeter = 0.090 kilometers
1 centimeter = 90 meters

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Soil Survey Map - 0.25 Mile Radius



McNeil LWC

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

RCRA COR, RCRA TSD, CER, LPST, NPL, ST NPL, SWLF

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

RCRA GEN, ST & FED BWN, ST & FED EC, ST & FED IC, DNPL, CER NFRAP, PST, VCP, ST CER

Single Site | Cluster Site | Large Tract | Cluster Site with Large Tract

ERNS, HW, RCRA, DRYC

Target Property

Search Buffer

Soils Boundary

0' 250' 500'

1 : 4,500

1 inch = 0.071 miles
1 inch = 375 feet
1 centimeter = 0.045 kilometers
1 centimeter = 45 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Soils

Soils Types Found	
Target Property	Fs
Within 0.25 miles of Target Property	TcA, HeC2, HeD2, TaD, HeC2, Fs, TcA, CrB, QU

Soil Type Descriptions

CrB - Crawford clay, 1 to 3 percent slopes	
Percent Hydric	0
Minimum Depth to Bedrock	69 cm

Crawford (85 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	51 to 102 cm to Lithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
A	Clay	0 cm	15 cm	A-7-6	CH
Bss	Clay	15 cm	69 cm	A-7-6	CH
R	Bedrock	69 cm	76 cm		

Denton (4 percent)	
Hydrologic Group	Moderately high runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	Moderate
Depth to Restrictive Feature	102 to 152 cm to Lithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
2Bk	Silt loam	52 cm	91 cm	A-6, A-7-6	CL
2CBk	Silt loam	91 cm	132 cm	A-4, A-6	CL, CL-ML, GC, GC-GM
2R	Bedrock	132 cm	178 cm		
A	Silty clay	0 cm	33 cm	A-7-5, A-7-6	CH
Bw	Silty clay	33 cm	52 cm	A-7-5, A-7-6	CH

Fairlie (4 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Moderately well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	102 to 152 cm to Paralithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
A	Clay	0 cm	20 cm	A-7	CH
Bss	Clay	20 cm	117 cm	A-7	CH
Cr	Bedrock	117 cm	137 cm		

Georgetown (4 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	51 to 102 cm to Lithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
A	Clay loam	0 cm	18 cm	A-6, A-7-6	CL
Bt	Cobbly clay	18 cm	89 cm	A-7-6	CH
R	Bedrock	89 cm	119 cm		

Purves (2 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	20 to 51 cm to Lithic bedrock

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Soils

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
A	Silty clay	0 cm	28 cm	A-7-5, A-7-6	CH
Bk	Very gravelly silty clay	28 cm	36 cm	A-2-7, A-7-6	CH, GC, GP-GC
R	Bedrock	36 cm	61 cm		

Unnamed (1 percent)

Fs - Oakalla soils, 0 to 1 percent slopes, channeled, frequently flooded

Percent Hydric	1
Minimum Depth to Bedrock	

Oakalla, channeled (90 percent)

Hydrologic Group	Moderately low runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	Moderate
Depth to Restrictive Feature	

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
Ak	Silty clay loam	20 cm	58 cm	A-4, A-6, A-7-6	CH, CL
Ap	Silty clay loam	0 cm	20 cm	A-6, A-7-6	CH, CL
Bk1	Silty clay loam	58 cm	135 cm	A-4, A-6, A-7-6	CH, CL
Bk2	Silty clay loam	135 cm	203 cm	A-4, A-6, A-7-6	CH, CL, CL-ML, ML

Rock outcrop (5 percent)

Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	
Depth to Restrictive Feature	0 to 5 cm to Lithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
R	Bedrock	0 cm	203 cm		

Dev (4 percent)

Hydrologic Group	
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	
Depth to Restrictive Feature	

Unnamed, hydric (1 percent)

Hydrologic Group	
Soil Drainage Class	Somewhat poorly drained
Corrosion Potential - Uncoated Steel	
Depth to Restrictive Feature	

HeC2 - Heiden clay, 3 to 5 percent slopes, eroded

Percent Hydric	0
Minimum Depth to Bedrock	

Heiden, moderately eroded (85 percent)

Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	102 to 165 cm to Densic material

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
A	Clay	0 cm	33 cm	A-7-6	CH
Bkss	Clay	56 cm	147 cm	A-7-6	CH
Bss	Clay	33 cm	56 cm	A-7-6	CH
CBdk	Clay	147 cm	203 cm	A-7-6	CH

Soils

Houston Black (10 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Moderately well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	

Ferris, severely eroded (5 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	100 to 152 cm to Densic bedrock

HeD2 - Heiden clay, 5 to 8 percent slopes, eroded	
Percent Hydric	0
Minimum Depth to Bedrock	

Heiden, moderately eroded (85 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	102 to 165 cm to Densic material

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
A1	Clay	0 cm	20 cm	A-7-6	CH
A2	Clay	20 cm	56 cm	A-7-6	CH
Bss	Clay	56 cm	112 cm	A-7-6	CH
CBd	Clay	112 cm	203 cm	A-7-6	CH

Ferris, moderately eroded (10 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	100 to 152 cm to Densic bedrock

Heiden, severely eroded (5 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	102 to 165 cm to Densic material

QU - Quarry, 1 to 40 percent slopes	
Percent Hydric	0
Minimum Depth to Bedrock	

Pits, quarry (95 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	
Corrosion Potential - Uncoated Steel	
Depth to Restrictive Feature	

Unnamed (5 percent)

TaD - Tarrant soils, 5 to 18 percent slopes	
Percent Hydric	0
Minimum Depth to Bedrock	20 cm

Tarrant, PE >44 (95 percent)	
Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	15 to 51 cm to Lithic bedrock

Soils

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
H1	Very stony clay	0 cm	20 cm	A-7-5, A-7-6	CH, GC, SC
H2	Bedrock	20 cm	30 cm		GP

Unnamed (5 percent)

TcA - Tarrant and Speck soils, 0 to 2 percent slopes

Percent Hydric	0
Minimum Depth to Bedrock	25 cm

Tarrant, PE >44 (63 percent)

Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	High
Depth to Restrictive Feature	15 to 51 cm to Lithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
H1	Very stony clay	0 cm	25 cm	A-7-5, A-7-6	CH, GC, SC
H2	Bedrock	25 cm	30 cm		GP

Speck (32 percent)

Hydrologic Group	High runoff potential
Soil Drainage Class	Well drained
Corrosion Potential - Uncoated Steel	Moderate
Depth to Restrictive Feature	36 to 51 cm to Lithic bedrock

Horizon	Soil Texture	Upper Boundary	Lower Boundary	AASHTO	Unified
H1	Clay loam	0 cm	36 cm	A-6, A-7-6	CL
H2	Gravelly clay	36 cm	46 cm	A-7-6	CH, CL
H3	Bedrock	46 cm	51 cm		

Unnamed (5 percent)

Soils Descriptions

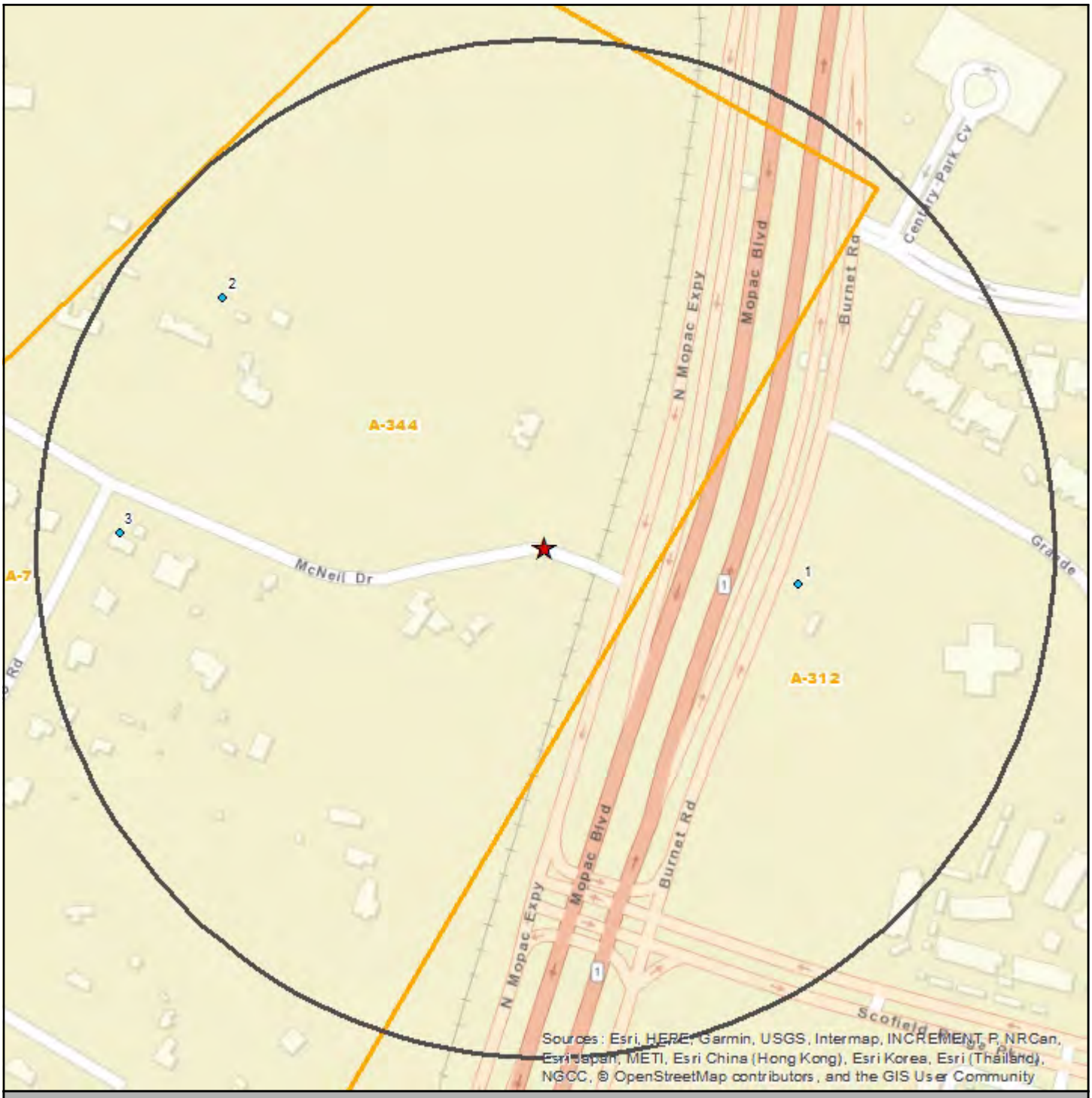
AASHTO Classification Definitions	
A-1, A-1-a, A-1-b	Granular materials (35% or less passing No. 200 sieve), sonte fragments, gravel and sand
A-2, A-2-4, A-2-5, A-2-6, A-2-7	Granular materials (35% or less passing No. 200 sieve), silty or clayey gravel and sand
A-3	Granular materials (35% or less passing No. 200 sieve), fine sand
A-4	Silt-Clay materials (more than 35% passing No. 200 sieve), silty soils
A-5	Silt-Clay materials (more than 35% passing No. 200 sieve), silty soils
A-6	Silt-Clay materials (more than 35% passing No. 200 sieve), clayey soils
A-7, A-7-5, A-7-6	Silt-Clay materials (more than 35% passing No. 200 sieve), clayey soils
A-8	Silt-Clay materials (more than 35% passing No. 200 sieve), clayey soils

Unified Classification Definitions	
CH	Fine-grained soils, silts and clays (liquid limit is 50% or more), Fat Clay
CL, CL-A (proposed), CL-K (proposed), CL-ML, CL-O (proposed), CL-T (proposed)	Fine-grained soils, silts and clays (liquid limit is less than 50%), Lean Clay
GC, GC-GM	Coarse-grained soils, Gravels, gravel with fines, Clayey Gravel
GM	Coarse-grained soils, Gravels, gravel with fines, Silty Gravel
GP, GP-GC, GP-GM	Coarse-grained soils, Gravels, clean gravels, Poorly Graded Gravel
GW, GW-GC, GW-GM	Coarse-grained soils, Gravels, clean gravels, Well-Graded Gravel
MH, MH-A, MH-K, MH-O, MH-T	Fine-grained soils, silts and clays (liquid limit is 50% or more), Elastic Silt
ML, ML-A (proposed), ML-K (proposed), ML-O (proposed), ML-T (proposed)	Fine-grained soils, silts and clays (liquid limit is less than 50%), Silt
OH, OH-T (proposed)	Fine-grained soils, silts and clays (liquid limit is 50% or more), Organic Clay or Organic Silt
OL	Fine-grained soils, silts and clays (liquid limit is less than 50%), Organic Clay or Organic Silt
PT	Highly organic soils, Peat
SC, SC-SM	Coarse-grained soils, Sands, sands with fines, Clayey Sand
SM	Coarse-grained soils, Sands, sands with fines, Silty Sand
SP, SP-SC, SP-SM	Coarse-grained soils, Sands, clean sands, Poorly Graded Sand
SW, SW-SC, SW-SM	Coarse-grained soils, Sands, clean sands, Well-Graded Sand

Source
Natural Resources Conservation Service, Soil Survey Geographic (SSURGO) Database.

Disclaimer
This Soils Survey from Banks Environmental Data, Inc. has searched Natural Resources Conservation Service (NRCS) and the Soil Survey Geographic Database (SSURGO). All soil data presented on the map and in the details section are based on information obtained from NRCS. Although Banks performs quality assurance and quality control on all data, inaccuracies of the data and mapped locations could possibly be traced to the source. Banks Environmental Data, Inc. cannot fully guarantee the accuracy of the SSURGO database maintained by NRCS.

Water & Oil/Gas Wells Map - 0.25 Mile Radius



McNeil LWC

- Single Water Well
- Water Well Cluster
- Single Oil/Gas/Other Well
- Oil/Gas/Other Well Cluster
- Water/Oil/Gas/Other Well Cluster
- Target Property
- Search Buffer
- Texas Land Survey

0' 250' 500'

N

1 : 4,500

1 inch = 0.071 miles
1 inch = 375 feet
1 centimeter = 0.045 kilometers
1 centimeter = 45 meters

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

Water & Oil/Gas Wells

Map ID	Well ID	Owner	Well Type	Elevation
1	58-35-505	J.B. Ray	Water: Domestic	769 ft (+26)
2	465620	Bill Dudley	Water: Irrigation	773 ft (+30)
3	25714	Brian Robinson	Water: Domestic	768 ft (+25)

Source

U.S. Geological Survey, Texas Water Development Board (GW and Submitted Driller's Report), Texas Commission of Environmental Quality (PWS), Railroad Commission of Texas (Production Data)

Disclaimer

This well scan from Banks Environmental Data, Inc. has included a digital search of state and federal wells currently digitized in our geospatial database. Since this scan includes only well data that is currently mapped in our geospatial database, more wells could exist within the search area. For a complete well search or to locate more details, please contact Banks to obtain a full Water Well Report or Oil & Gas Well/Pipeline Search Report. More detailed individual well records can also be obtained from Banks for an additional cost, please reference a Well ID # from this well scan.

All well locations are based on information obtained from state and federal sources. Although Banks performs quality assurance and quality control on all data, inaccuracies of the records and mapped locations could possibly be traced to the specific regulatory authority or individual well driller. Banks Environmental Data, Inc. cannot fully guarantee the accuracy of the data or well location(s) of the maps and records maintained by the state and federal agencies.

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Mapped Sites Summary

Database	Distance from Target Property	Map ID	Facility Site Name	Facility Site Address	Site Details Page #
*Sites are sorted by database tier, database, and distance from the target site.					
LPST	0.33 miles E	1	J C EVANS CONSTRUCTION CO INC	13505 BURNET RD, AUSTIN, TX 78758	21
LPST	0.33 miles E	1	GRANDE COMMUNICATIONS	13505 BURNET RD, AUSTIN, TX 78727	22
LPST	0.49 miles NE	2	EXXON CO USA 6 9912	3505 WELLS BRANCH PKWY, AUSTIN, TX 78728	23

End of Mapped Sites Summary Section

Unmapped Sites Summary

Database	Facility Site Name	Facility Site Address	Site Details Page #

*Sites are sorted by database tier and database.

SWLF	CITY OF AUSTIN COMPOSTING FACILITY	AUSTIN, TX	24

End of Unmapped Sites Summary Section

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Zip Code Map - 1 Mile Radius

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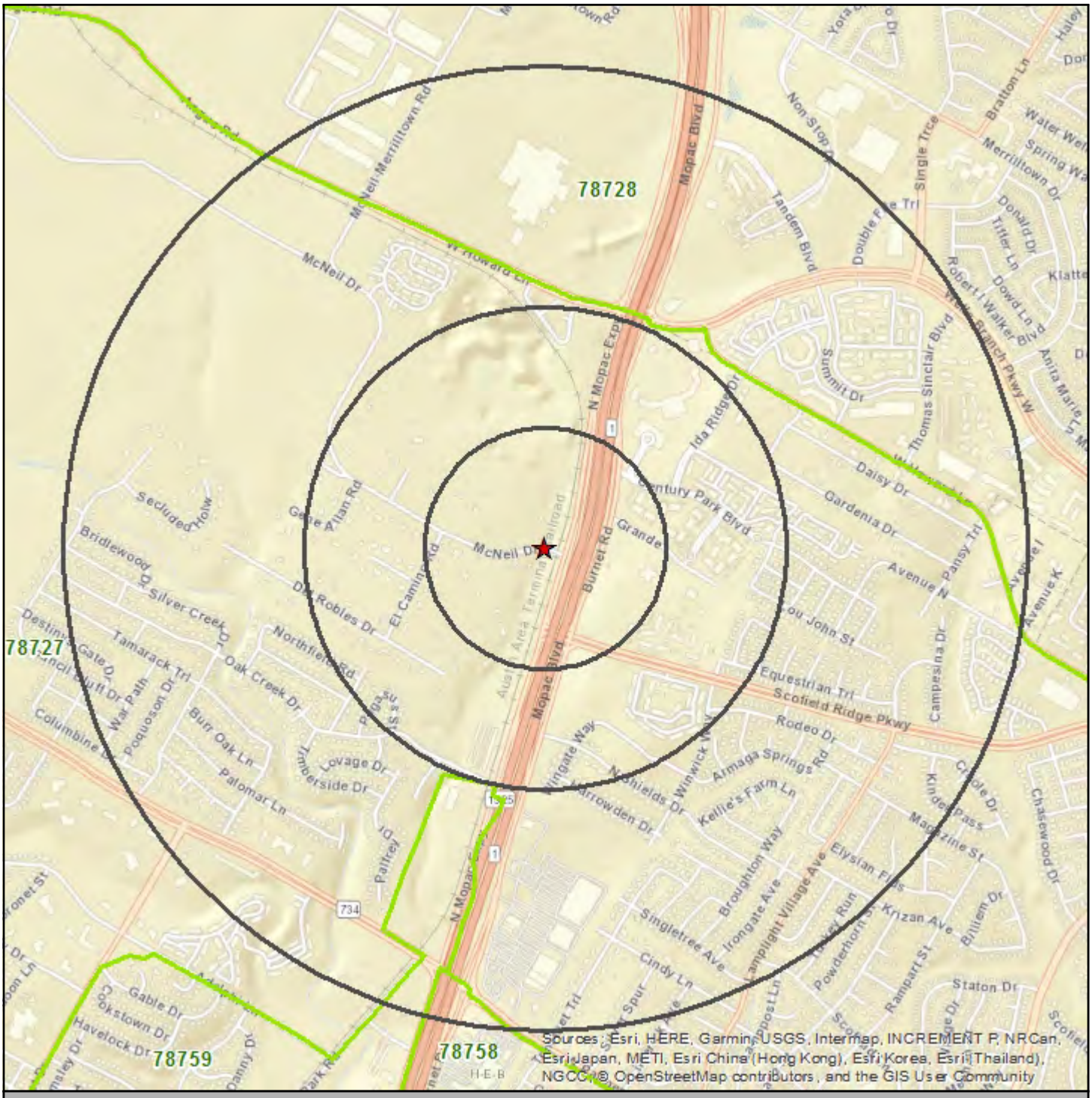

McNeil LWC

Target Property

Search Buffer

Zip Code Boundary

0' 1000' 2000'

1 : 19,000

1 inch = 0.300 miles
1 inch = 1583 feet
1 centimeter = 0.190 kilometers
1 centimeter = 190 meters

N

Lambert Conformal Conic Projection
1983 North American Datum
First Standard Parallel: 33 0' 00" North
Second Standard Parallel: 45 0' 00" North
Central Meridian: 96 0' 00" West
Latitude of Origin: 39 0' 00" North

MapID 1: LPST - 13505 BURNET RD

LPST - State/Tribal Leaking Storage Tank

Map ID #1	LPST - State/Tribal Leaking Storage Tank	Source: TCEQ
LPST ID: 107984	Facility ID: 0012873	Banks ID: 107984
J C EVANS CONSTRUCTION CO INC		Rel. Loc.: 0.33 miles E
13505 BURNET RD, AUSTIN, TX 78758		Elevation: 795.87 feet (+52.76)

Status:	6A-Final concurrence issued, case close		
Leak Discovery Date:	3/14/1994		
Damage Description:	soil contamination only, requires full site assessment & rap		
Leak Closure Date:	7/14/1997		
Owner Contact Name:	J C EVANS CONSTRUCTION		
Facility Information from Related UST			
Facility Contact Name:	TOM IVEY		
Facility Contact Phone:	5122203280		
Facility Status:	ACTIVE		
Facility Type:	FLEET REFUELING		
Number of ASTs:	1		
Number of USTs:	0		
Tank #:	**#1**	**#2**	**#3**
Status:	REMOVED FROM GROUND	REMOVED FROM GROUND	REMOVED FROM GROUND
Status Date:	9/17/2008	9/17/2008	9/17/2008
Capacity:	6000	6000	6000
Install Date:	1/1/1983	1/1/1983	1/1/1983
Above or Below Ground Tank:	below	below	below
Unit ID:			
Construction Material:			
Piping Type:	Suction	Suction	Suction
Piping Material:	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)
Tank Contents:			
Tank Release Vapor Monitor Status Stage 1:			
Corrosion Protection:	Cathodic_Protection_Field_Installation	Cathodic_Protection_Field_Installation	Cathodic_Protection_Field_Installation
Piping Corrosion Protection:	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible
Tank #:	**#4**	**#A**	
Status:	REMOVED FROM GROUND		
Status Date:	3/3/1994	1/1/1982	
Capacity:	500	10000	
Install Date:	1/1/1982	1/1/1982	
Above or Below Ground Tank:	below	above	
Unit ID:		151619	
Construction Material:		Steel	
Piping Type:			
Piping Material:	Steel		
Tank Contents:		DIESEL	
Tank Release Vapor Monitor Status Stage 1:			
Corrosion Protection:			
Piping Corrosion Protection:			

MapID 1: LPST - 13505 BURNET RD

Map ID #1	LPST - State/Tribal Leaking Storage Tank	Source: TCEQ
LPST ID: 117962	Facility ID: 0012873	Banks ID: 117962
GRANDE COMMUNICATIONS		Rel. Loc.: 0.33 miles E
13505 BURNET RD, AUSTIN, TX 78727		Elevation: 795.87 feet (+52.76)

Status:	6P-Final concurrence pending documentation of well plugging		
Leak Discovery Date:	12/1/2008		
Damage Description:	assessment incomplete, no apparent receptors impacted		
Leak Closure Date:	2/12/2009		
Owner Contact Name:	GRANDE COMMUNICATIONS		
Facility Information from Related UST			
Facility Contact Name:	TOM IVEY		
Facility Contact Phone:	5122203280		
Facility Status:	ACTIVE		
Facility Type:	FLEET REFUELING		
Number of ASTs:	1		
Number of USTs:	0		
Tank #:	**#1**	**#2**	**#3**
Status:	REMOVED FROM GROUND	REMOVED FROM GROUND	REMOVED FROM GROUND
Status Date:	9/17/2008	9/17/2008	9/17/2008
Capacity:	6000	6000	6000
Install Date:	1/1/1983	1/1/1983	1/1/1983
Above or Below Ground Tank:	below	below	below
Unit ID:			
Construction Material:			
Piping Type:	Suction	Suction	Suction
Piping Material:	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)
Tank Contents:			
Tank Release Vapor Monitor Status Stage 1:			
Corrosion Protection:	Cathodic_Protection_Field_Installation	Cathodic_Protection_Field_Installation	Cathodic_Protection_Field_Installation
Piping Corrosion Protection:	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible
Tank #:	**#4**	**#A**	
Status:	REMOVED FROM GROUND		
Status Date:	3/3/1994	1/1/1982	
Capacity:	500	10000	
Install Date:	1/1/1982	1/1/1982	
Above or Below Ground Tank:	below	above	
Unit ID:		151619	
Construction Material:		Steel	
Piping Type:			
Piping Material:	Steel		
Tank Contents:		DIESEL	
Tank Release Vapor Monitor Status Stage 1:			
Corrosion Protection:			
Piping Corrosion Protection:			

MapID 2: LPST - 3505 WELLS BRANCH PKWY

Map ID #2	LPST - State/Tribal Leaking Storage Tank	Source: TCEQ
LPST ID: 096988	Facility ID: 0056877	Banks ID: 096988
EXXON CO USA 6 9912		Rel. Loc.: 0.49 miles NE
3505 WELLS BRANCH PKWY, AUSTIN, TX 78728		Elevation: 780.46 feet (+37.35)

Status:	6A-Final concurrence issued, case close		
Leak Discovery Date:	8/28/1990		
Damage Description:	soil contamination only, requires full site assessment & rap		
Leak Closure Date:	4/15/1992		
Owner Contact Name:	EXXON COMPANY USA		
Facility Information from Related UST			
Facility Contact Name:			
Facility Contact Phone:			
Facility Status:	ACTIVE		
Facility Type:	RETAIL		
Number of ASTs:	0		
Number of USTs:	2		
Tank #:	**#1**	**#2**	**#3**
Status:	REMOVED FROM GROUND	REMOVED FROM GROUND	REMOVED FROM GROUND
Status Date:	7/13/2001	7/13/2001	7/13/2001
Capacity:	10000	10000	10000
Install Date:	1/1/1987	1/1/1987	1/1/1987
Above or Below Ground Tank:	below	below	below
Unit ID:			
Construction Material:			
Piping Type:	Pressurized	Pressurized	Pressurized
Piping Material:	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)
Tank Contents:			
Tank Release Vapor Monitor Status Stage 1:			
Corrosion Protection:	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible
Piping Corrosion Protection:	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible
Tank #:	**#4**	**#5**	**#6**
Status:	REMOVED FROM GROUND	IN USE	IN USE
Status Date:	7/13/2001	11/10/2015	11/10/2015
Capacity:	10000	14000	10000
Install Date:	1/1/1987	11/10/2015	11/10/2015
Above or Below Ground Tank:	below	below	below
Unit ID:			
Construction Material:			
Piping Type:	Pressurized	Pressurized	Pressurized
Piping Material:	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)	FRP (fiberglass-reinforced plastic)
Tank Contents:			
Tank Release Vapor Monitor Status Stage 1:			
Corrosion Protection:	FRP_tank_or_piping_noncorrodible	External_Dielectric_Coating_Laminate_Tape_Wrap Composite_Tank_steel_w_FRP_external_laminate	External_Dielectric_Coating_Laminate_Tape_Wrap Composite_Tank_steel_w_FRP_external_laminate
Piping Corrosion Protection:	FRP_tank_or_piping_noncorrodible	FRP_tank_or_piping_noncorrodible Isolated_in_Open_Area_2nd_Containment	FRP_tank_or_piping_noncorrodible Isolated_in_Open_Area_2nd_Containment

End of LPST Sites Section

Unmapped Sites Details: SWLF (42004)

SWLF - State/Tribal Disposal or Landfill

SWLF - State/Tribal Disposal or Landfill		Source: TCEQ
MSW ID: 42004	Regulated Entity#: RN101491231	Banks ID: 42004
CITY OF AUSTIN COMPOSTING FACILITY AUSTIN, TX		

Detail #1	
Facility Type:	Resource Recovery/Composting Facility
Facility Status:	NOT CONSTRUCTED
Permit Status:	WITHDRAWN

End of SWLF Sites Section

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Dataset Descriptions and Sources

Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
NPL -- National Priority List	EPA	NPL is the list of high priority hazardous waste sites in the United States eligible for long-term remedial action financed under the federal Superfund program or SEMS database (formerly known as the CERCLIS database). The EPA will only add sites to the NPL list based upon completion of the Hazard Ranking System (HRS) screening, public solicitation of comments about the proposed site, and after all comments have been addressed.	Quarterly	05/14/2018	05/14/2018	05/18/2018	04/11/2018
DNPL -- Delisted National Priority List	EPA	DNPL is a list of all sites that have been deleted from the EPA NPL list (SEMS database). These sites are taken off the NPL list usually due to no further response or remedial action being required on them. Notices to delete NPL sites are published in the Federal Register and become effective unless the EPA receives significant adverse or critical comments during the 30-day public comment period.	Quarterly	05/14/2018	05/14/2018	05/18/2018	04/11/2018
CER SEMS -- SEMS	EPA	The EPA maintains the SEMS database to track sites under the Comprehensive Environmental Response, Compensation, and Liability Act, a federal law designed to clean up abandoned hazardous waste sites. These sites are either proposed, listed or under review currently to be a part of the National Priority List.	Quarterly	05/14/2018	05/14/2018	05/18/2018	04/11/2018
CER SEMS NFRAP -- SEMS NFRAP	EPA	From the Superfund Enterprise Management System (SEMS) database No Further Remedial Action Planned or NFRAP have been removed from the listing. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the site being placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration.	Quarterly	05/14/2018	05/14/2018	05/18/2018	04/11/2018
RCRA COR -- RCRA CORRACTS	EPA	These sites are registered hazardous waste generators or handlers that fall under the Resource Conservation and Recovery Act (RCRA) and subject to corrective action activity.	Quarterly	05/24/2018	05/24/2018	05/25/2018	04/14/2018
RCRA TSD -- RCRA non-CORRACTS TSD	EPA	This database lists all treatment, storage and disposal of hazardous material sites that fall under the Resource Conservation and Recovery Act (RCRA). All hazardous waste TSD facilities are required to notify EPA of their existence.	Quarterly	05/24/2018	05/24/2018	05/24/2018	04/14/2018
RCRA GEN -- RCRA Generators	EPA	The EPA regulates all Hazardous Waste Generators subject to the Resource Conservation and Recovery Act (RCRA). They are classified by the quantity of hazardous waste generated. A Small Quantity Generator (SQG) generates between 100kg and 1,000 kg of waste per month. A Large Quantity Generator (LQG) generates over 1,000 kg of waste per month. A Conditionally Exempt SQG (CEG) generates less than 100 kg of waste per month.	Quarterly	05/24/2018	05/24/2018	05/24/2018	04/14/2018
FED BWN -- Federal Brownfields	EPA	A listing of sites that assist the EPA in collecting, tracking, and updating information of sites in relation to the Small Business Liability Relief and Brownfields Revitalization Act. These sites are real property that is either abandoned or underutilized where redevelopment or expansion is complicated by real or perceived environmental contamination.	Quarterly	05/14/2018	05/14/2018	05/22/2018	05/01/2018
FED IC -- Federal Institutional Control	EPA	This is a listing of Brownfield Management System (BMS) sites that have had Institutional Controls (ICs) placed on them. ICs are administrative restrictions, such as legal controls, that help minimize the potential for human exposure to known contamination by ensuring appropriate land or resource use. ICs are meant to supplement Engineering Controls and will rarely be the sole remedy at a site. ICs are a type of Activity and Use Limitation (AUL).	Quarterly	05/14/2018	05/14/2018	05/22/2018	05/01/2018
FED EC -- Federal Engineering Control	EPA	This is a listing of Brownfield Management System (BMS) sites that have had Engineering Controls (ECs) placed on them. ECs are physical methods or modifications put into place on a site to reduce or eliminate the possibility of human exposure to known contamination. ECs are a type of Activity and Use Limitation (AUL).	Quarterly	05/14/2018	05/14/2018	05/22/2018	05/01/2018

Dataset Descriptions and Sources

Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
ERNS -- ERNS List	EPA/National Response Center	ERNS is a national database used to store information on unauthorized releases of oil and hazardous substances that have been reported to the National Response Center since 2001. The NRC is the sole federal point of contact for reporting oil and chemical spills. Prior to 2001 this information was maintained by the EPA.	Annually	01/02/2018	01/05/2018	01/23/2018	01/05/2018
ST NPL -- State/Tribal Equivalent NPL (TX)	TCEQ	This database contains sites determined by the TCEQ that may constitute an imminent and substantial endangerment to public health and safety or to the environment due to a release or threatened release of hazardous substances into the environment.	Quarterly	05/02/2018	05/15/2018	05/23/2018	05/15/2018
ST CER -- State/Tribal Equivalent CERCLIS (TX)	NA	This database is not currently available from this state. If this state does make this database available in the future, Banks Environmental Data will obtain it for reporting purposes.	N/A	N/A	N/A	N/A	N/A
SWLF -- State/Tribal Disposal or Landfill (TX)	TCEQ	The SWLF database contains records of municipal solid waste facilities that may accept various types of municipal solid waste for processing or disposal, depending on the type of facility. A Municipal Solid Waste facility may also accept certain special wastes and non-hazardous industrial solid wastes if approved by the TCEQ executive director.	Quarterly	04/30/2018	04/30/2018	05/03/2018	04/17/2018
SWLF -- State/Tribal Disposal or Landfill (TX)	TCEQ	This database is a listing of closed and abandoned municipal solid waste landfills. The sites included are either unauthorized (UNUM_) or permitted (PERMAPP_).	N/A	N/A	N/A	N/A	N/A
LPST -- State/Tribal Leaking Storage Tank (TX)	TCEQ	This database contains information on leaking storage tanks, equipment failures, compliance, and releases in the state.	Quarterly	04/30/2018	05/02/2018	05/07/2018	04/04/2018
LPST -- State/Tribal Leaking Storage Tank (TX)	EPA	The Tribal LUST database (maintained by EPA Region 6) provides information on leaking underground storage tank on tribal lands in Louisiana, Arkansas, Oklahoma, New Mexico and Tribal Nations.	Quarterly	04/27/2018	04/27/2018	04/27/2018	10/06/2017
PST -- State/Tribal Storage Tank (TX)	TCEQ	This database contains information on above and underground storage tanks, compliance, and releases in the state.	Quarterly	04/30/2018	04/30/2018	05/03/2018	04/10/2018
PST -- State/Tribal Storage Tank (TX)	EPA	The Tribal UST database (maintained by EPA Region 6) provides underground storage tank information on tribal lands in Louisiana, Arkansas, Oklahoma, New Mexico and Tribal Nations.	Quarterly	04/27/2018	04/27/2018	04/27/2018	10/06/2017
ST IC -- State/Tribal Institutional Control (TX)	TCEQ	This database includes Voluntary Cleanup Program (VCP) or Innocent Operator Program (IOP) sites that have been remediated and have had Institutional Controls (ICs) placed on them. ICs are administrative restrictions, such as legal controls, that help minimize the potential for human exposure to known contamination by ensuring appropriate land or resource use.	Quarterly	04/04/2018	04/04/2018	05/03/2018	04/02/2018
ST IC -- State/Tribal Institutional Control (TX)	RRC	The Railroad Commission of Texas Voluntary Cleanup Program provides an incentive to remediate Oil & Gas related pollution by participants as long as they did not cause or contribute to the contamination.	Quarterly	04/04/2018	04/04/2018	05/03/2018	04/02/2018
ST EC -- State/Tribal Engineering Control (TX)	TCEQ	This database includes Voluntary Cleanup Program (VCP) or Innocent Operator Program (IOP) sites that have been remediated and have had Engineering Controls (ECs) placed on them. ECs are physical methods or modifications put into place on a site to reduce or eliminate the possibility of human exposure to known contamination.	Quarterly	04/04/2018	04/02/2018	05/03/2018	04/02/2018

Dataset Descriptions and Sources

Dataset	Source	Dataset Description	Update Schedule	Data Requested	Data Obtained	Data Updated	Source Updated
VCP -- State/Tribal Voluntary Cleanup (TX)	TCEQ	This database contains sites from both the Voluntary Cleanup Program (VCP) and the Innocent Operator Program (IOP). The VCP records contain information on contaminated sites that private parties have cleaned up through assistance from the State in the form of administrative, technical, and legal incentives. The IOP records are sites that have received certificates from the State acknowledging that their property is contaminated as a result of a release or migration of contaminants from a source or sources not located on the property, and they did not cause or contribute to the source or sources of contamination.	Quarterly	04/04/2018	04/04/2018	05/03/2018	04/02/2018
VCP -- State/Tribal Voluntary Cleanup (TX)	RRC	The Railroad Commission of Texas Voluntary Cleanup Program provides an incentive to remediate Oil & Gas related pollution by participants as long as they did not cause or contribute to the contamination.	Quarterly	04/30/2018	05/04/2018	05/07/2018	05/04/2018
ST BWN -- State/Tribal Brownfield (TX)	TCEQ	Brownfield sites are former industrial properties that lie dormant or underutilized due to liability associated with real or perceived contamination. In Texas, the TCEQ, in close partnership with the EPA and other federal, state, and local redevelopment agencies, and stakeholders, is facilitating cleanup, transferability, and revitalization of Brownfield's through the development of regulatory, tax, and technical assistance tools.	Quarterly	04/30/2018	02/15/2018	03/12/2018	02/15/2018
ST BWN -- State/Tribal Brownfield (TX)	RRC	The Railroad Commission of Texas' Voluntary Cleanup Program (RRC-VCP) provides an incentive to remediate Oil & Gas related pollution by participants as long as they did not cause or contribute to the contamination. Applicants to the program receive a release of liability to the state in exchange for a successful cleanup.	Quarterly	04/30/2018	05/04/2018	05/07/2018	05/04/2018
HW -- State/Tribal Hazardous Waste (TX)	TCEQ	This database contains information on facilities which store, process, or dispose of hazardous waste as maintained by the Industrial and Hazardous Waste Permits section of the TCEQ.	Quarterly	05/14/2018	05/14/2018	05/22/2018	05/01/2018
RCRA -- RCRA	EPA	This database lists all sites that fall under the Resource Conservation and Recovery Act (RCRA) and are not classifiable as treatment, storage, disposers of hazardous material, hazardous waste generator or subject to corrective action activity.	Quarterly	05/24/2018	05/24/2018	05/25/2018	04/14/2018
DRYC -- Dry Cleaners (TX)	TCEQ	Dry Cleaner data houses both the DCRP Program information and PERC information released by the TCEQ. The DCRP database contains records funded for state-lead clean up of dry cleaner related contaminated sites. The DCRP administers the Dry Cleaning Facility Release Fund to assist with remediation of contamination caused by dry cleaning solvents. There are two listings from this program: LIST#1 - A historic listing of any facility that registered with the DCRP indicating whether or not the facility has used Perchloroethylene (PERC) in the past. LIST#2 - A Prioritization list of dry cleaner sites Facilities on this list will be investigated in order to determine the existence and or extent of possible contamination. Facilities which are not current on their DCRP payments get dropped from the program. Banks Environmental Data DOES NOT REMOVE these listings from our database so that we may present a more complete historical listing of facilities that may or may not have used PERC in the past.	Quarterly	05/14/2018	01/24/2018	03/06/2018	01/25/2018
MS -- State/Tribal Municipal Settings Designation (TX)	TCEQ	TCEQ defines a Municipal Settings Designation (MSD) as an official state designation given to a property within a municipality or its extraterritorial jurisdiction that certifies that designated groundwater at the property is not used as potable water, and is prohibited from future use as potable water because that groundwater is contaminated in excess of the applicable potable-water protective concentration level. The prohibition must be in the form of a city ordinance, or a restrictive covenant that is enforceable by the city and filed in the property records.	Quarterly	04/19/2018	04/19/2018	04/25/2018	04/01/2018

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Appendix F

Bridge and Roadway Alternatives Plans, Profiles, and Sections

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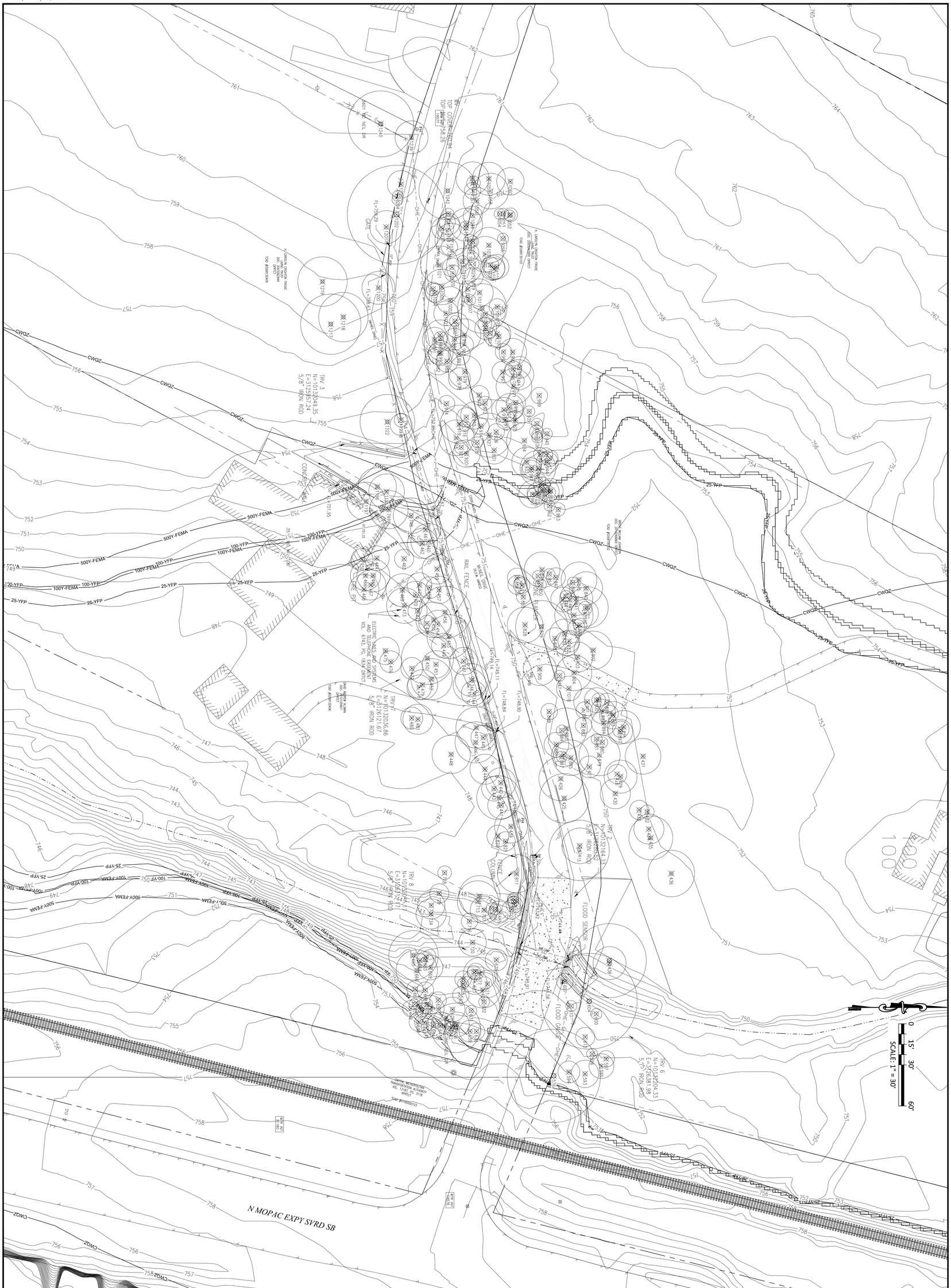

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MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

EXISITNG CONDITIONS

Scale: 1"=
Designed: JK
Drawn: SD
Reviewed: JK
Date: 9/25/2018

SHEET
FIGURE F-1
OF -

Project No.: 1570-022

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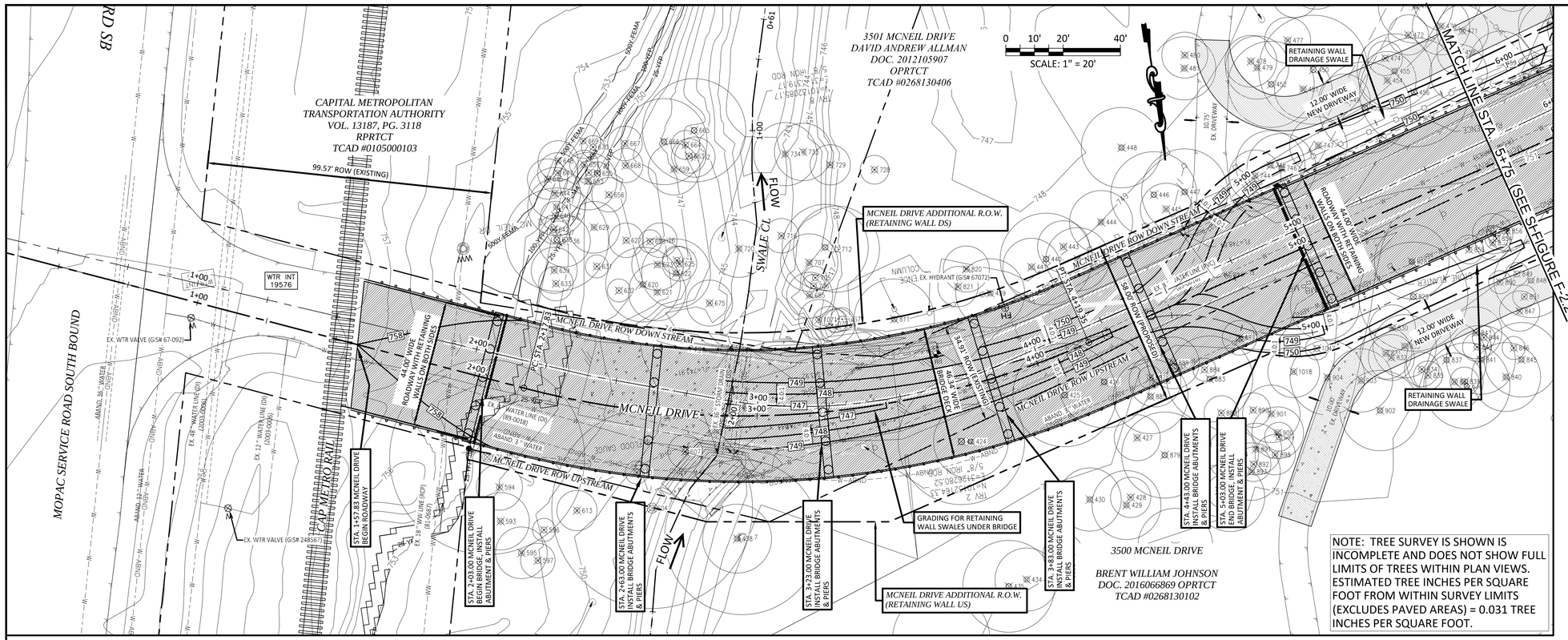

MCNEIL DRIVE 300-FT. CLEAR-SPAN BRIDGE PROFILE

1" = 20' HORZ. - 1" = 4' VERT.

CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

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NOTE: TREE SURVEY IS SHOWN IS INCOMPLETE AND DOES NOT SHOW FULL LIMITS OF TREES WITHIN PLAN VIEWS. ESTIMATED TREE INCHES PER SQUARE FOOT FROM WITHIN SURVEY LIMITS (EXCLUDES PAVED AREAS) = 0.031 TREE INCHES PER SQUARE FOOT.

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FULL LENGTH SPAN ALT. 1U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE
WITH RETAINING WALL SHEET 1

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Designed: JK
Drawn: SD
Reviewed: JK
Date: 9/25/2018

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FIGURE F-2.1

OF .

Project No.: 1570-022

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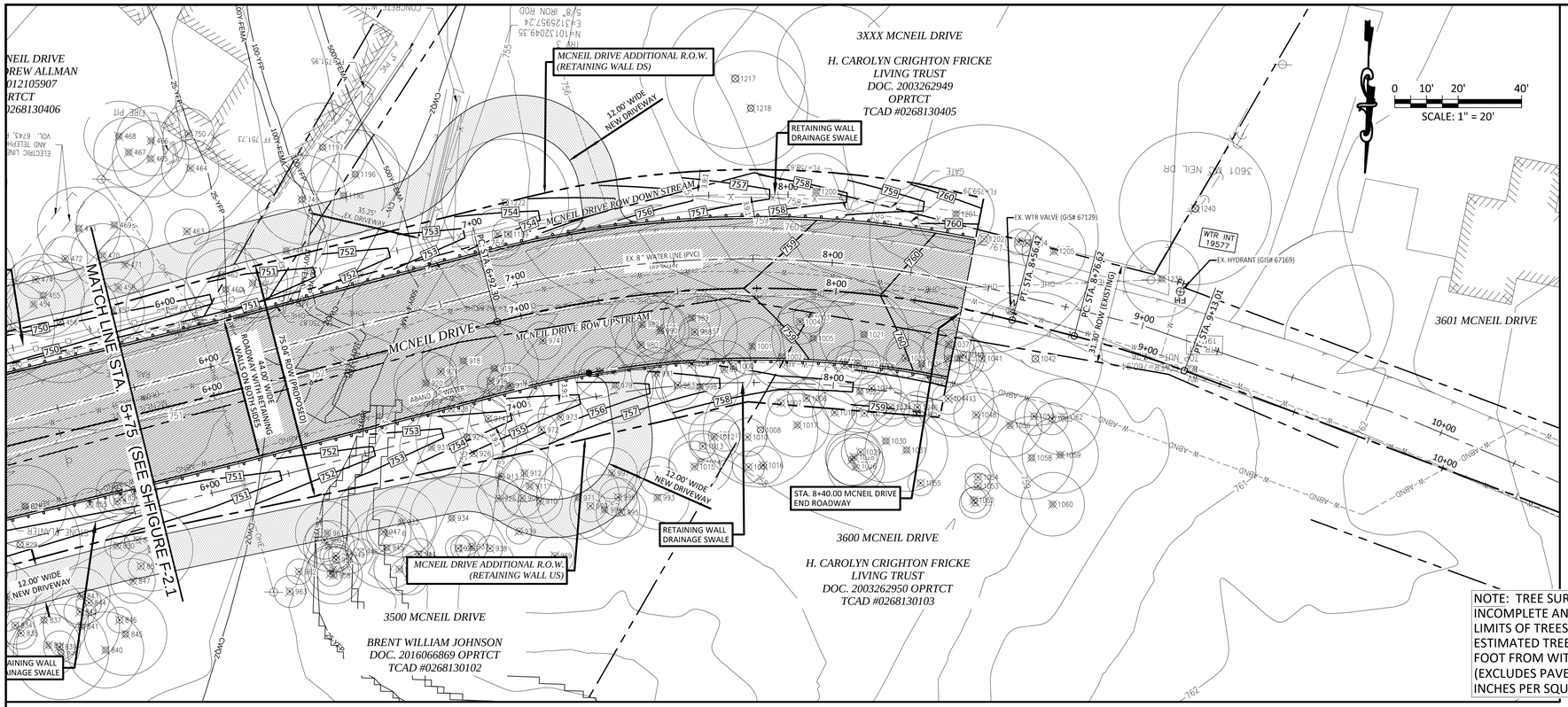

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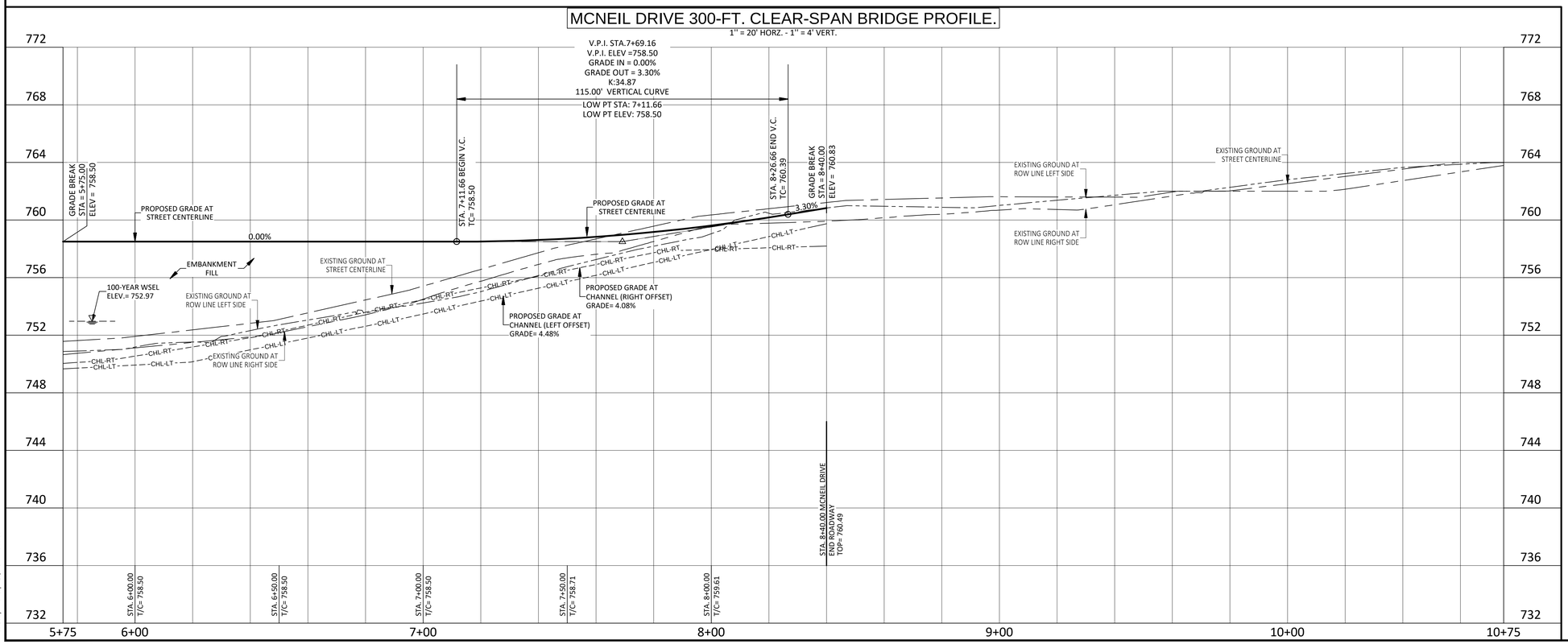
MCNEIL DRIVE 300-FT. CLEAR-SPAN BRIDGE PROFILE.

1" = 20' HORZ. - 1" = 4' VERT.



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FULL LENGTH SPAN ALT. 1U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE
WITH RETAINING WALL SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Scale: 1"=
Designed: JK
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Reviewed: JK
Date: 9/25/2018

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FIGURE F-2.2

OF .

Project No.: 1570-022

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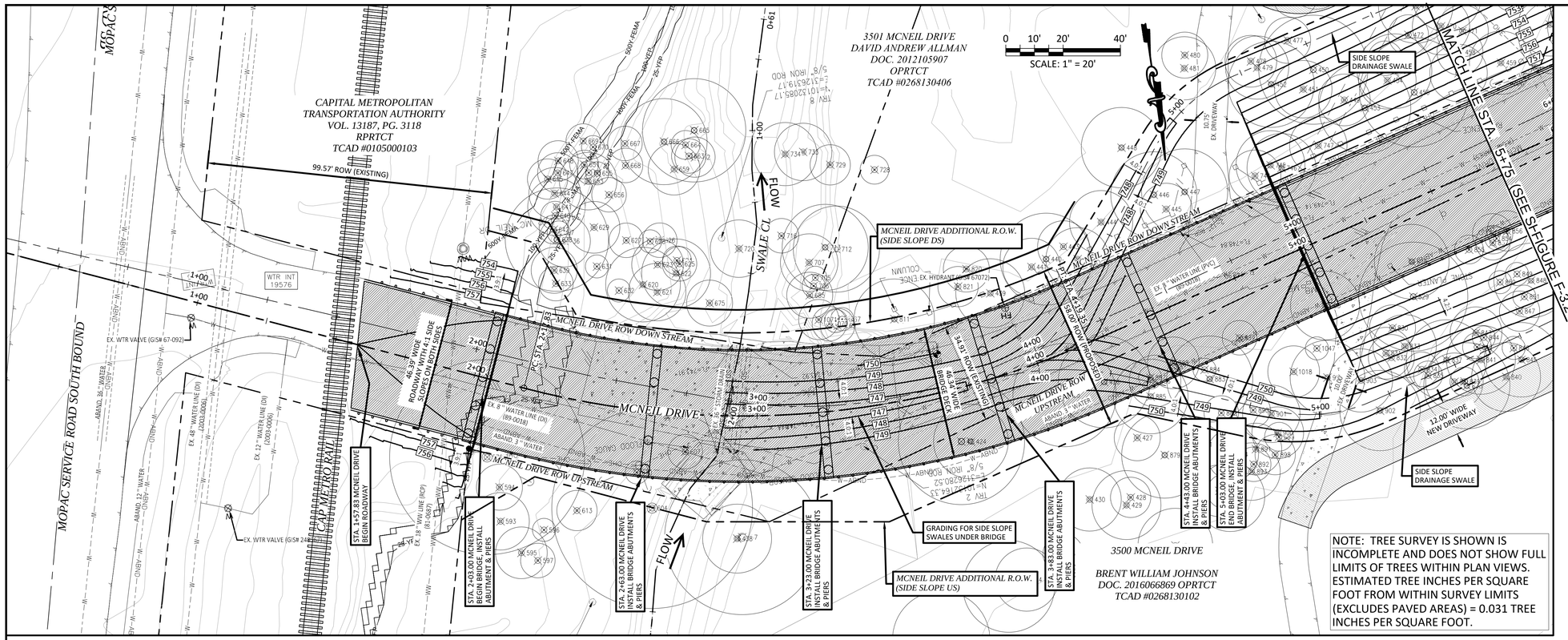

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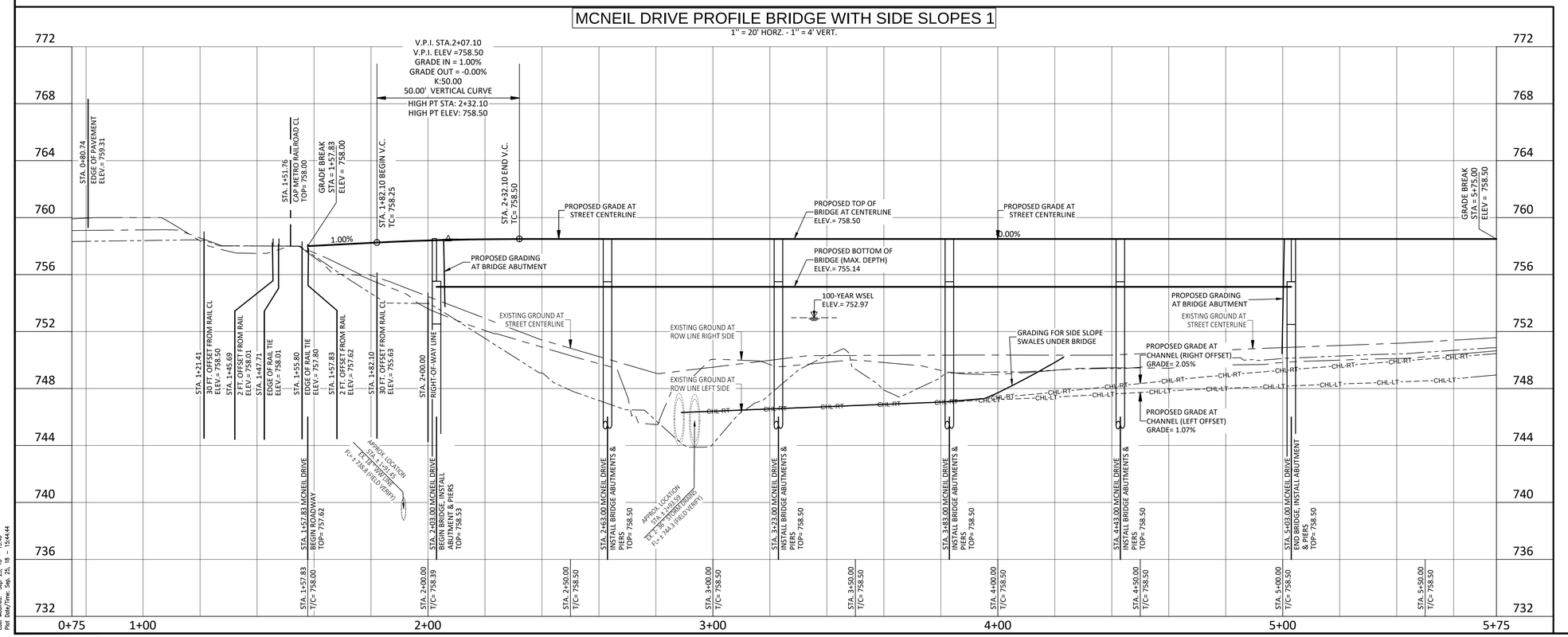
MCNEIL DRIVE PROFILE BRIDGE WITH SIDE SLOPES 1

1" = 20' HORZ. - 1" = 4' VERT.



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FULL LENGTH SPAN ALT. 1U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE
WITH SIDE SLOPES SHEET 1

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Scale:	1"=
Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

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FIGURE F-3.1

OF .

Project No.: 1570-022

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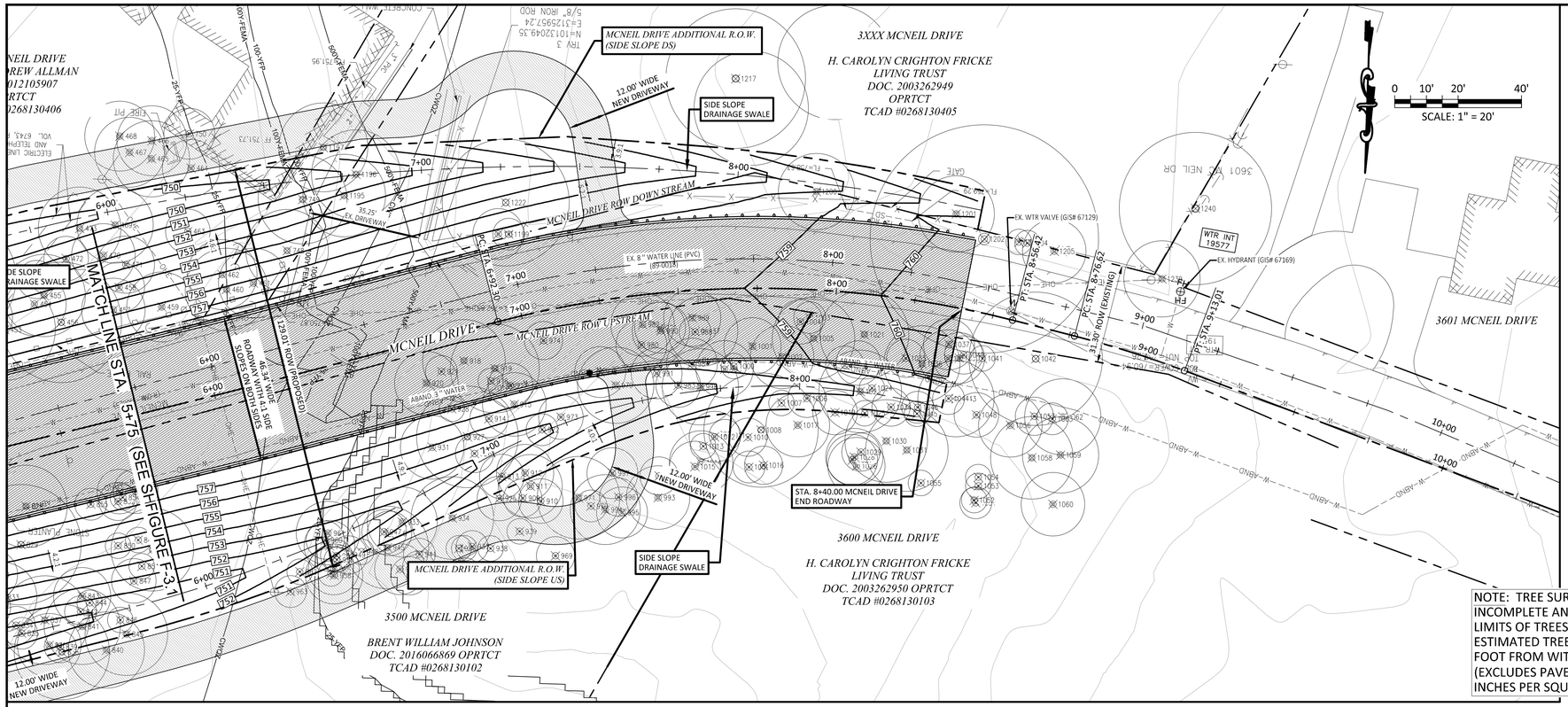

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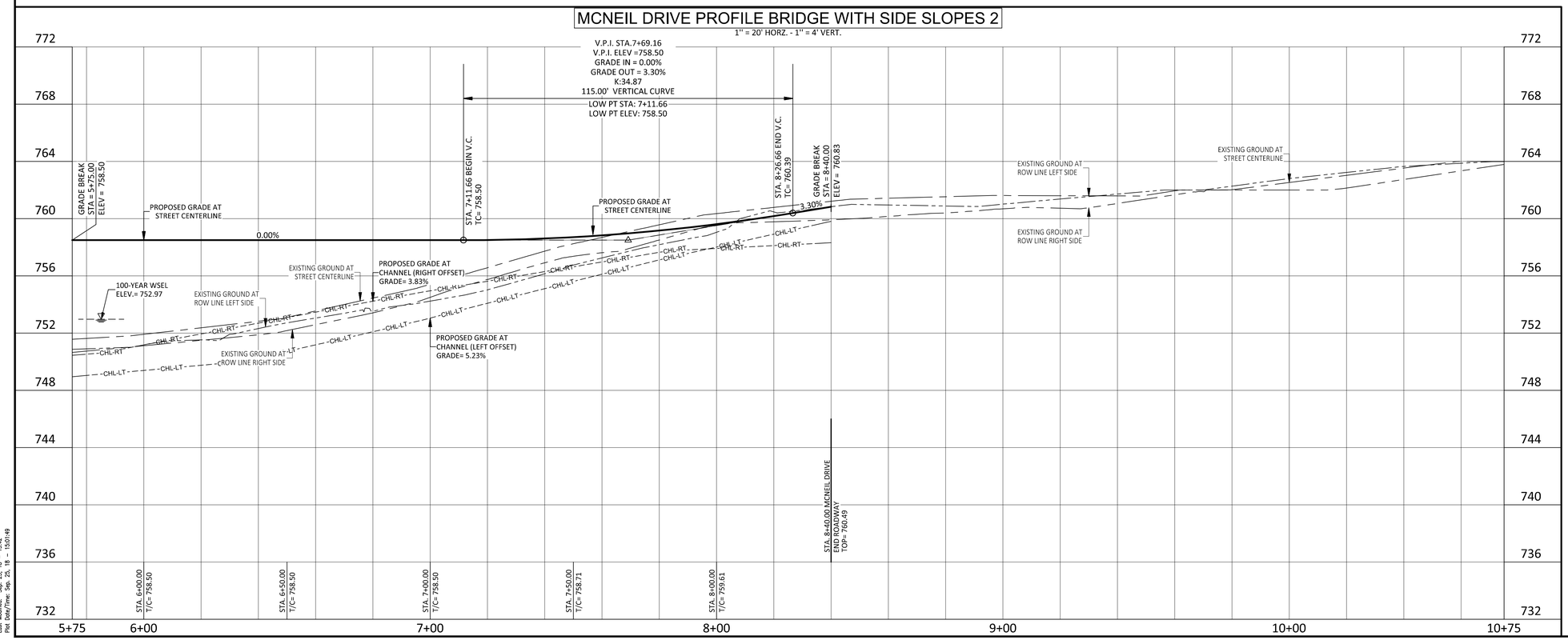
MCNEIL DRIVE PROFILE BRIDGE WITH SIDE SLOPES 2

1" = 20' HORZ. - 1" = 4' VERT.



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FULL LENGTH SPAN ALT. 1U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE WITH SIDE SLOPES SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Scale:	1"=
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Reviewed:	JK
Date:	9/25/2018

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FIGURE F-3.2

OF .

Project No.: 1570-022

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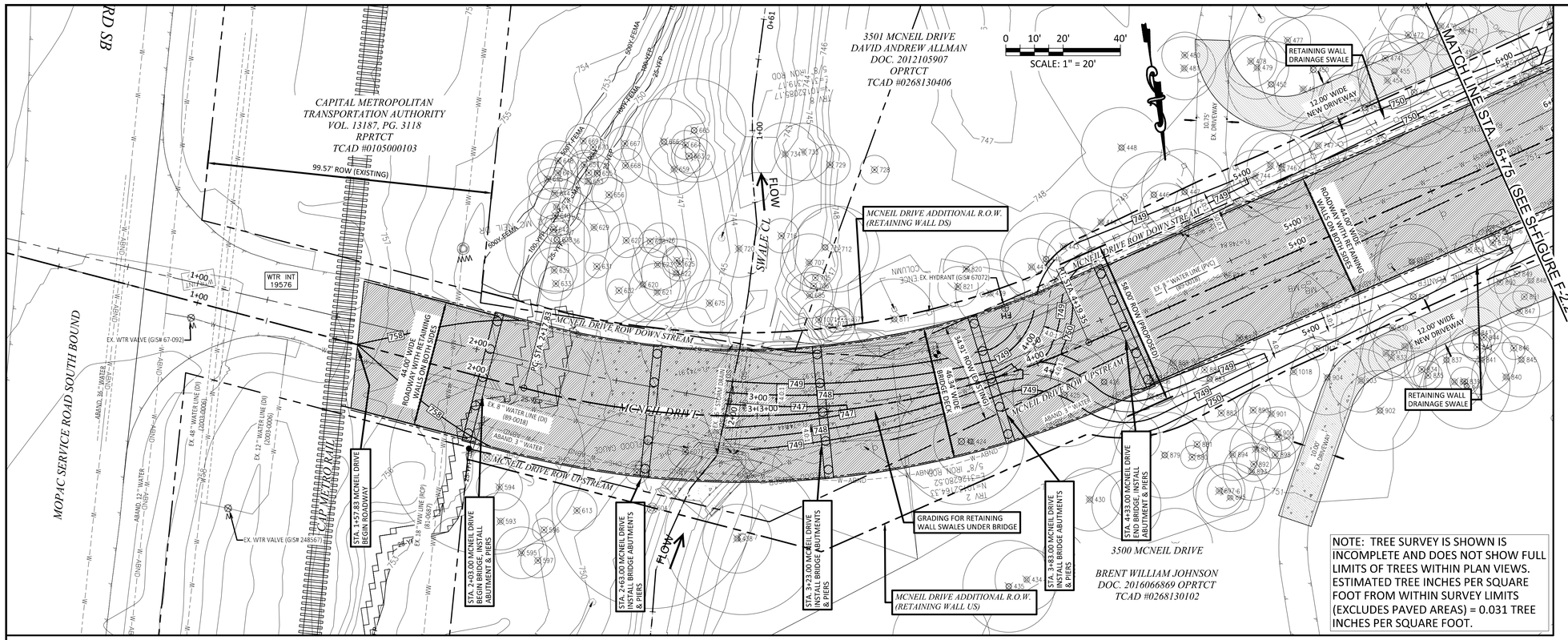

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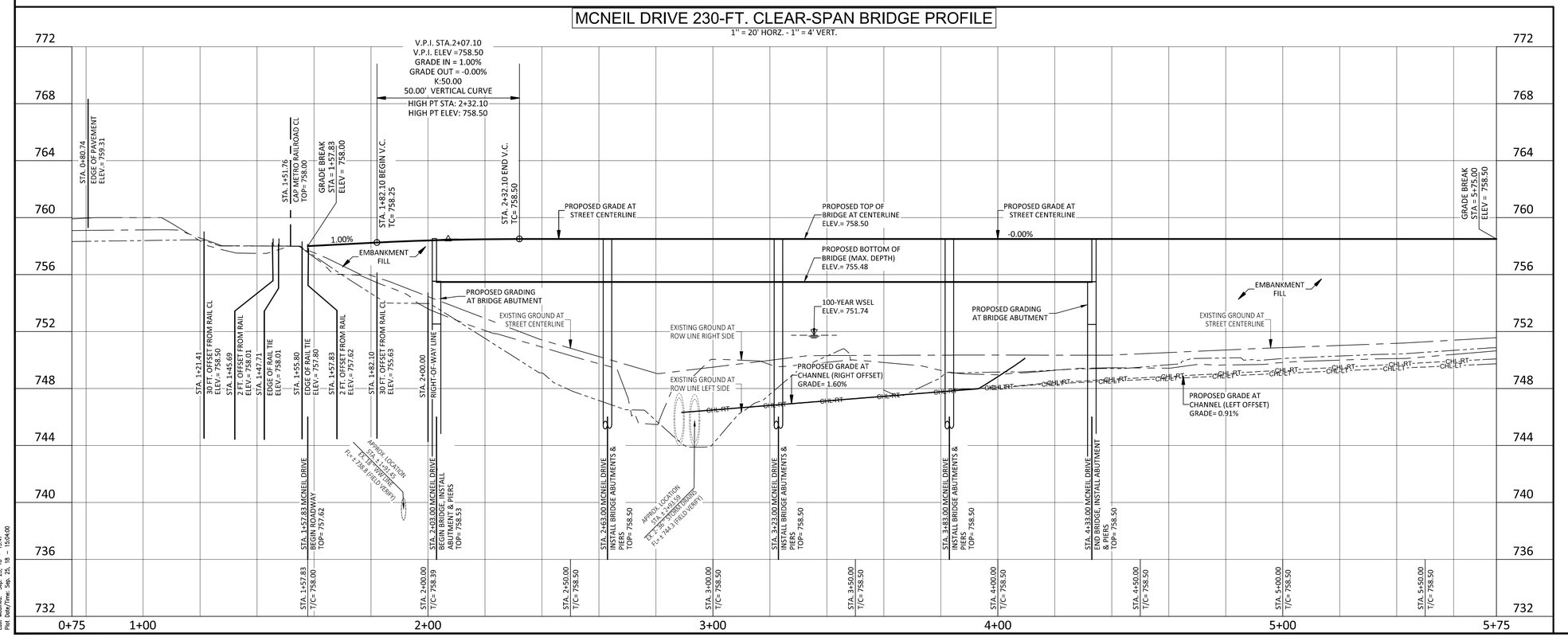

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REDUCED SPAN ALT. 1D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE WITH RETAINING WALL SHEET 1

MCNEIL DRIVE CROSSING
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Scale: 1"=
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Date: 9/25/2018

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FIGURE F-4.1

OF .

Project No.: 1570-022

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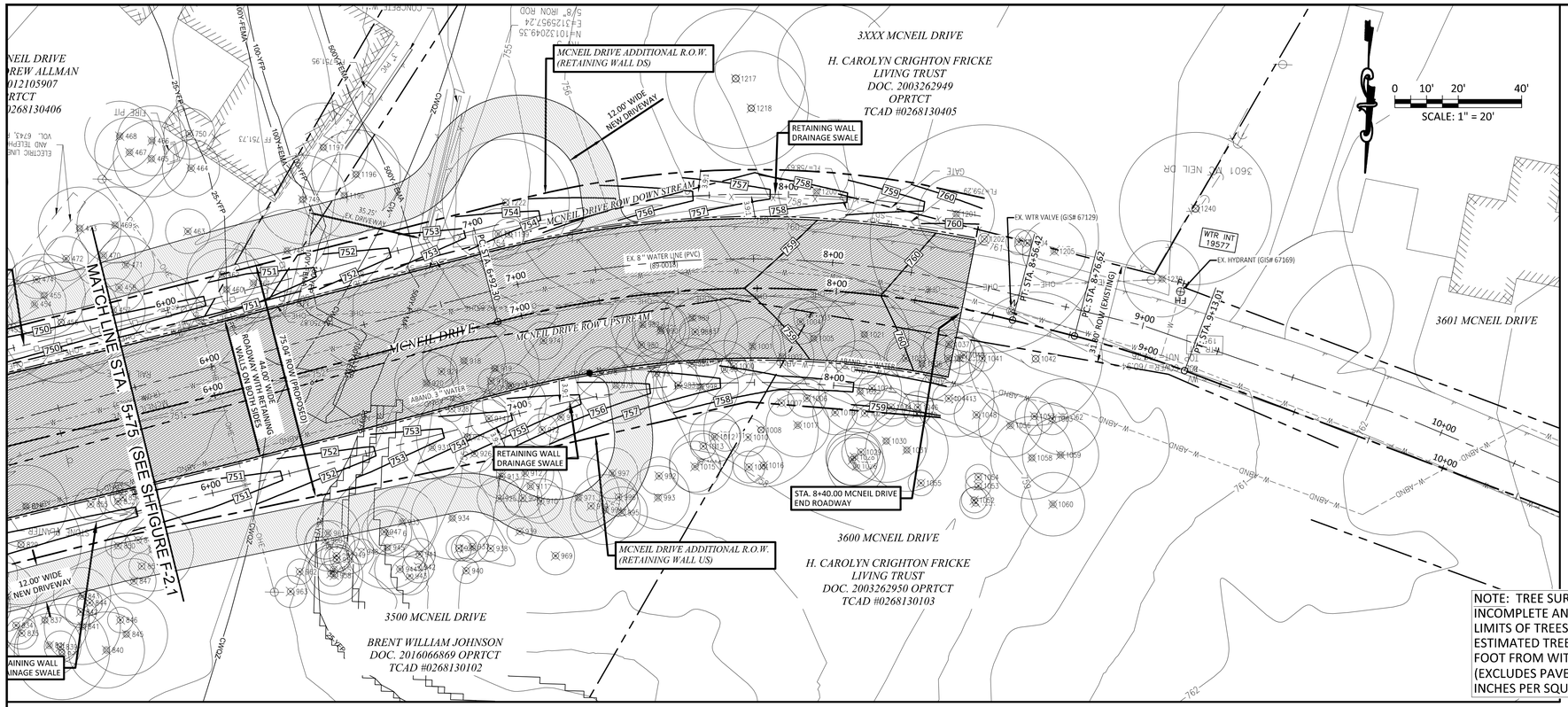

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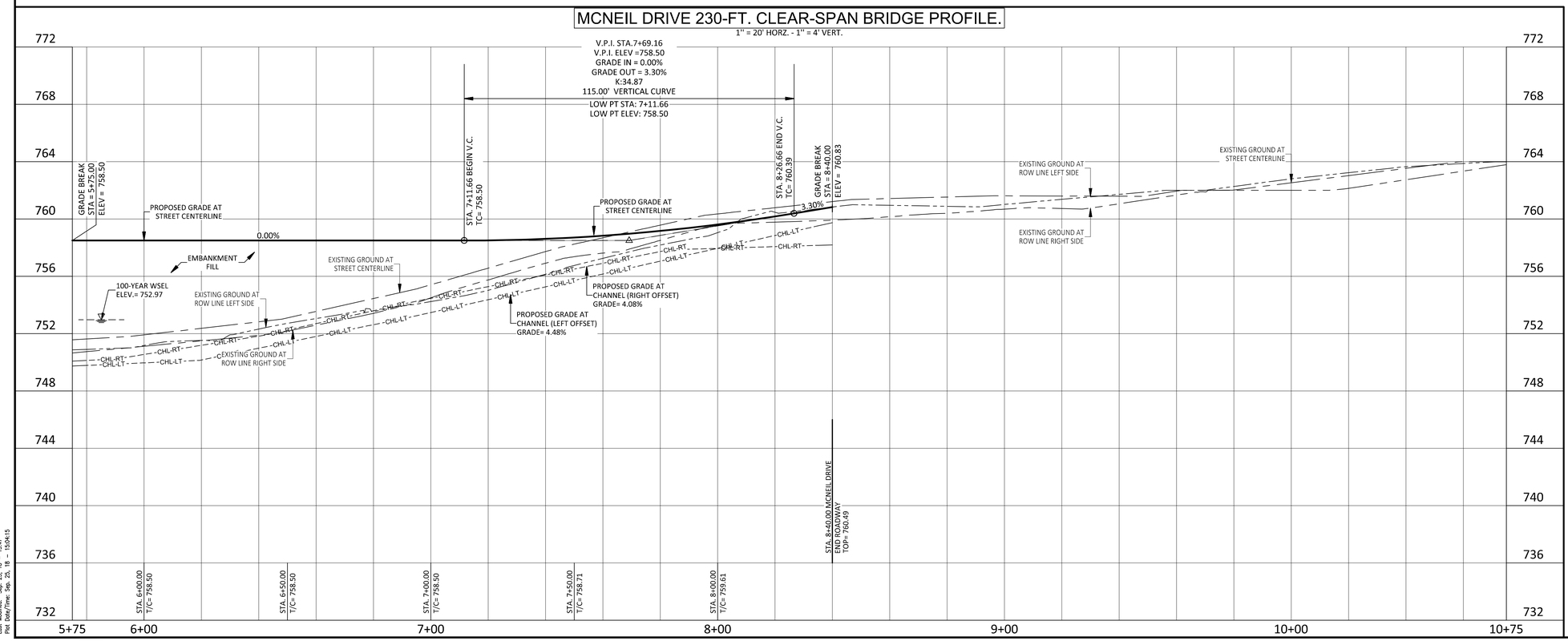
MCNEIL DRIVE 230-FT. CLEAR-SPAN BRIDGE PROFILE.

1" = 20' HORZ. - 1" = 4' VERT.



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REDUCED SPAN ALT. 1D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE
WITH RETAINING WALL SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Reviewed: JK
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FIGURE F-4.2

OF .

Project No.: 1570-022

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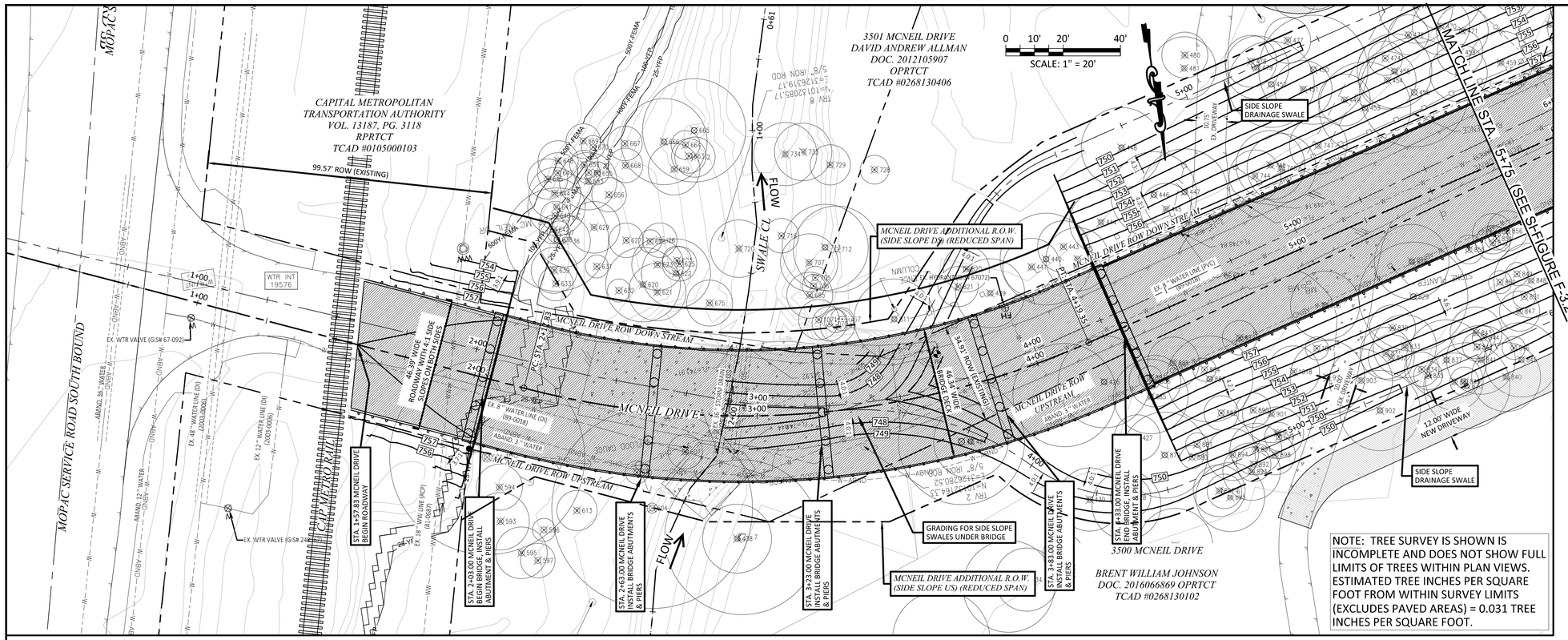

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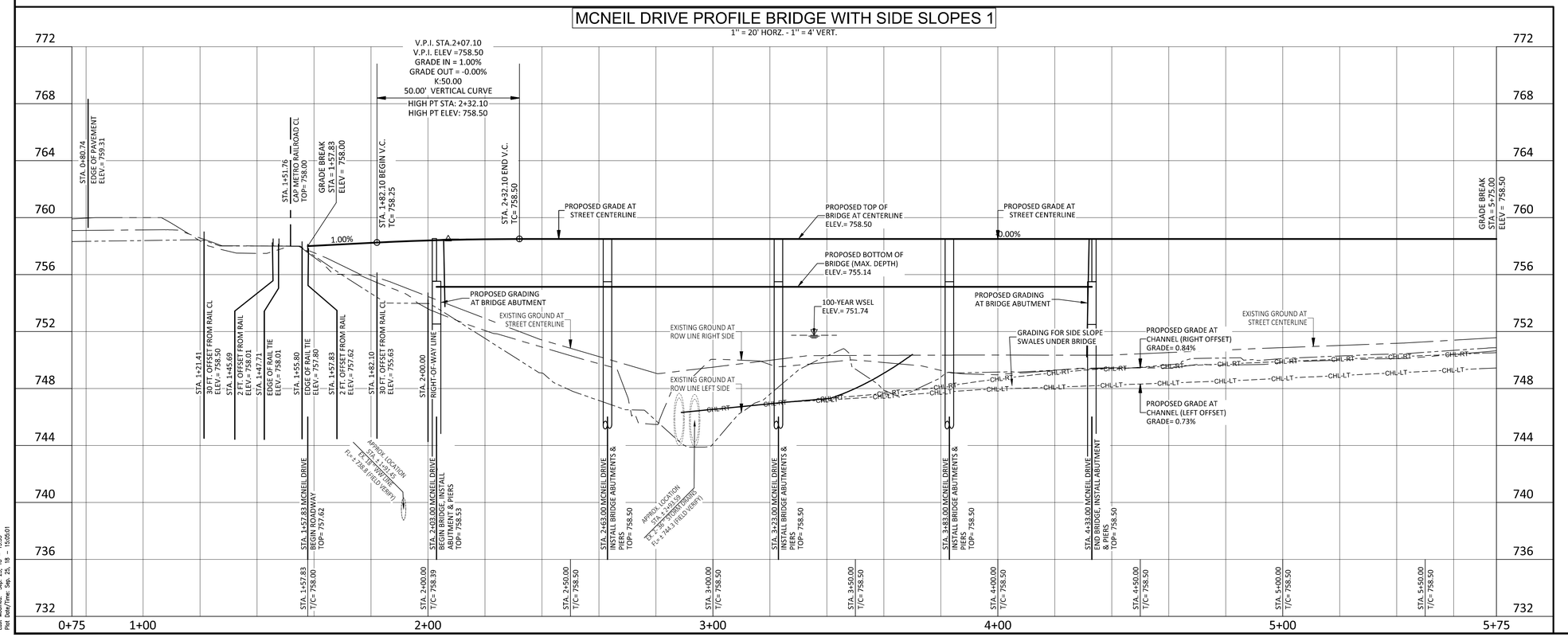

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REDUCED SPAN ALT. 1D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE WITH SIDE SLOPES SHEET 1

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Reviewed:	JK
Date:	9/25/2018

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FIGURE F-5.1

OF .

Project No.: 1570-022

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User: COOLLERY
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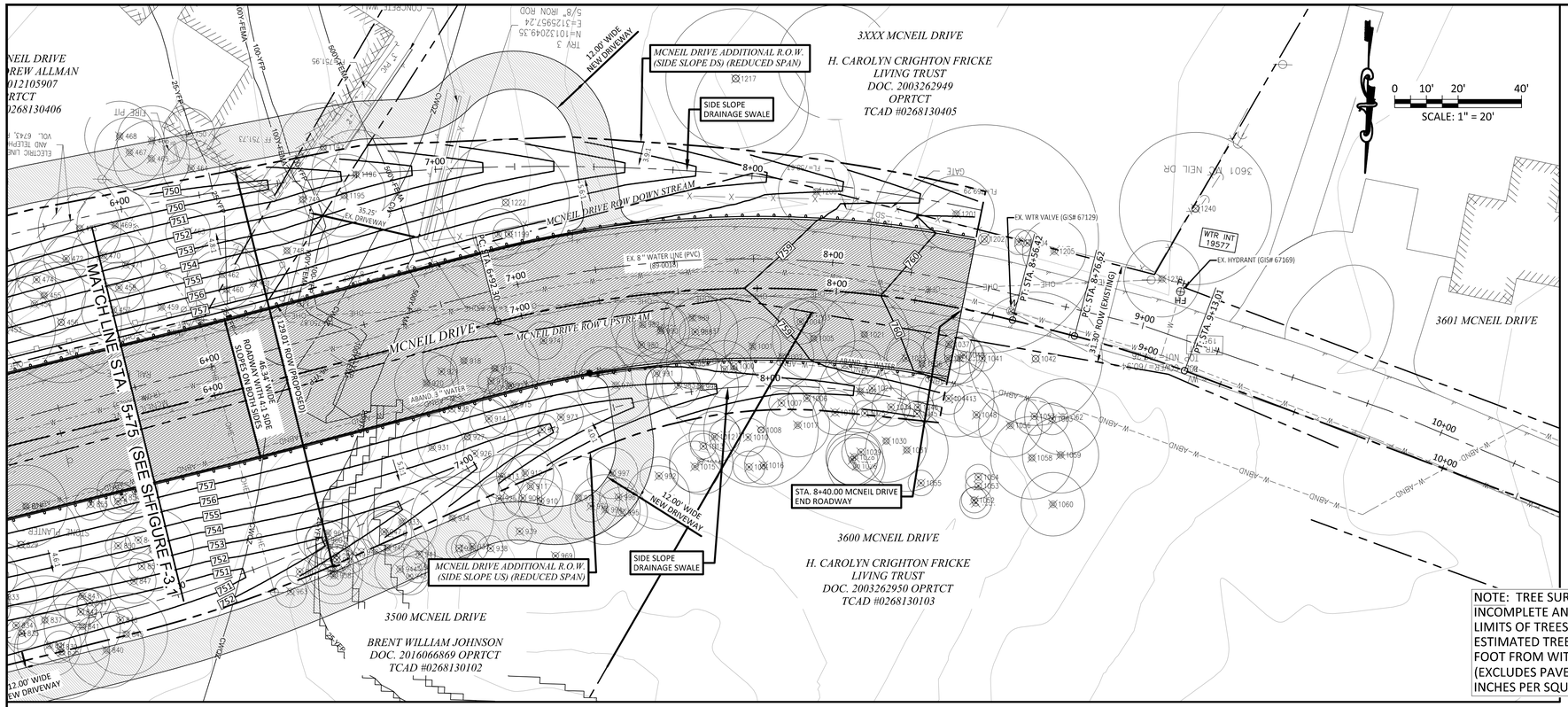

NOTE: TREE SURVEY IS SHOWN IS INCOMPLETE AND DOES NOT SHOW FULL LIMITS OF TREES WITHIN PLAN VIEWS. ESTIMATED TREE INCHES PER SQUARE FOOT FROM WITHIN SURVEY LIMITS (EXCLUDES PAVED AREAS) = 0.031 TREE INCHES PER SQUARE FOOT.

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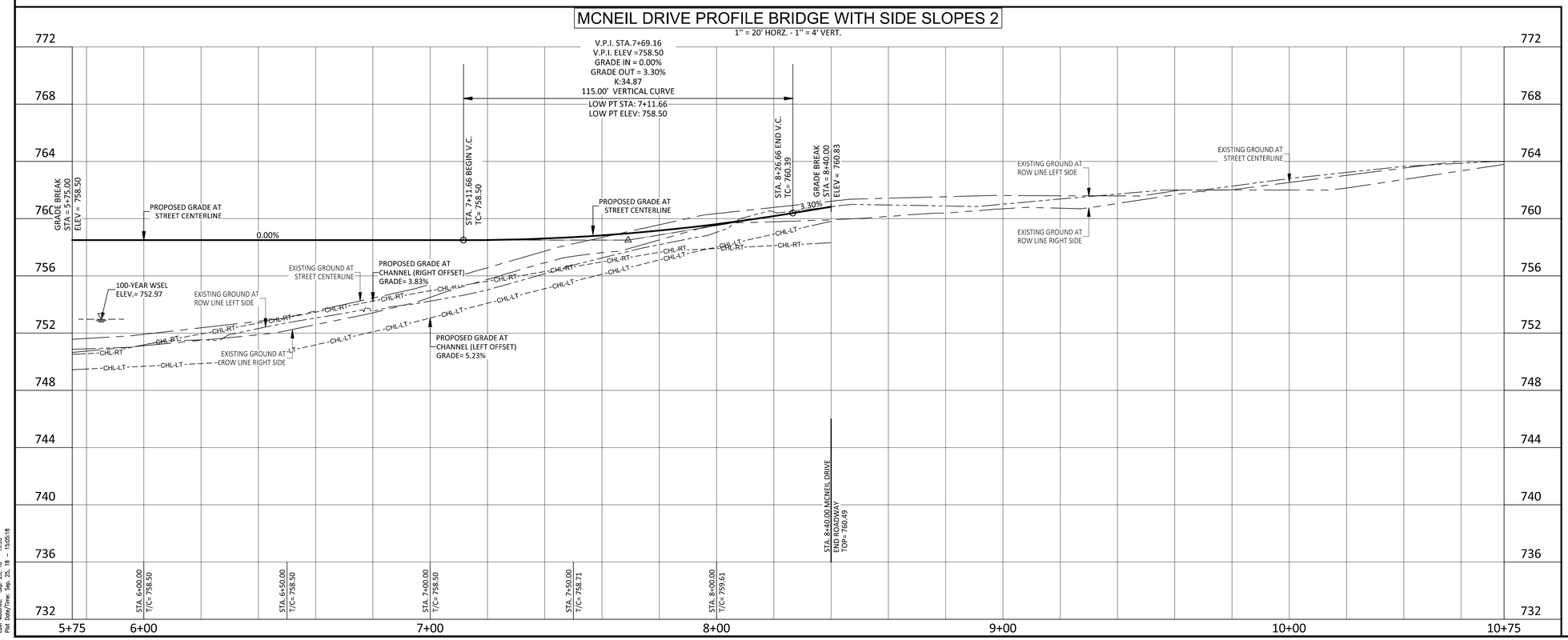
MCNEIL DRIVE PROFILE BRIDGE WITH SIDE SLOPES 2

1" = 20' HORZ. - 1" = 4' VERT.



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REDUCED SPAN ALT. 1D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED BRIDGE WITH SIDE SLOPES SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Scale:	1"=
Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

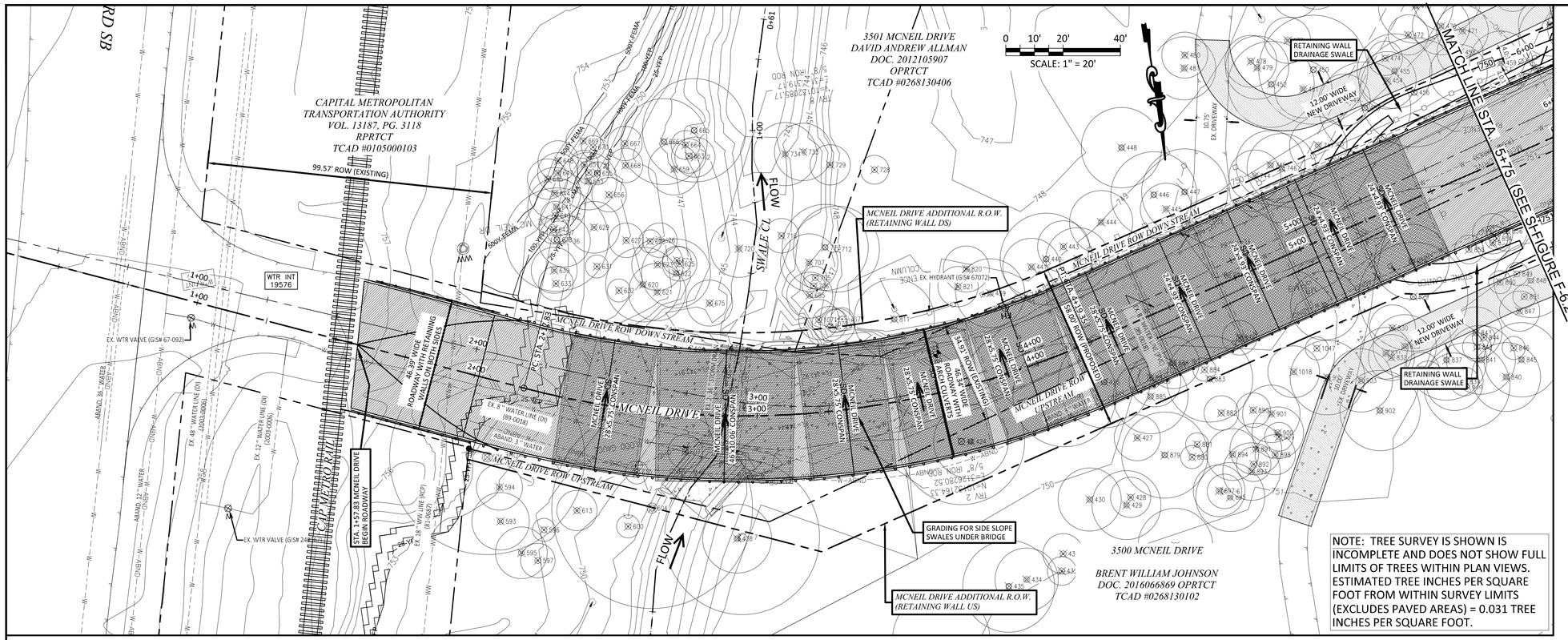
SHEET

FIGURE F-5.2

OF .

Project No.: 1570-022

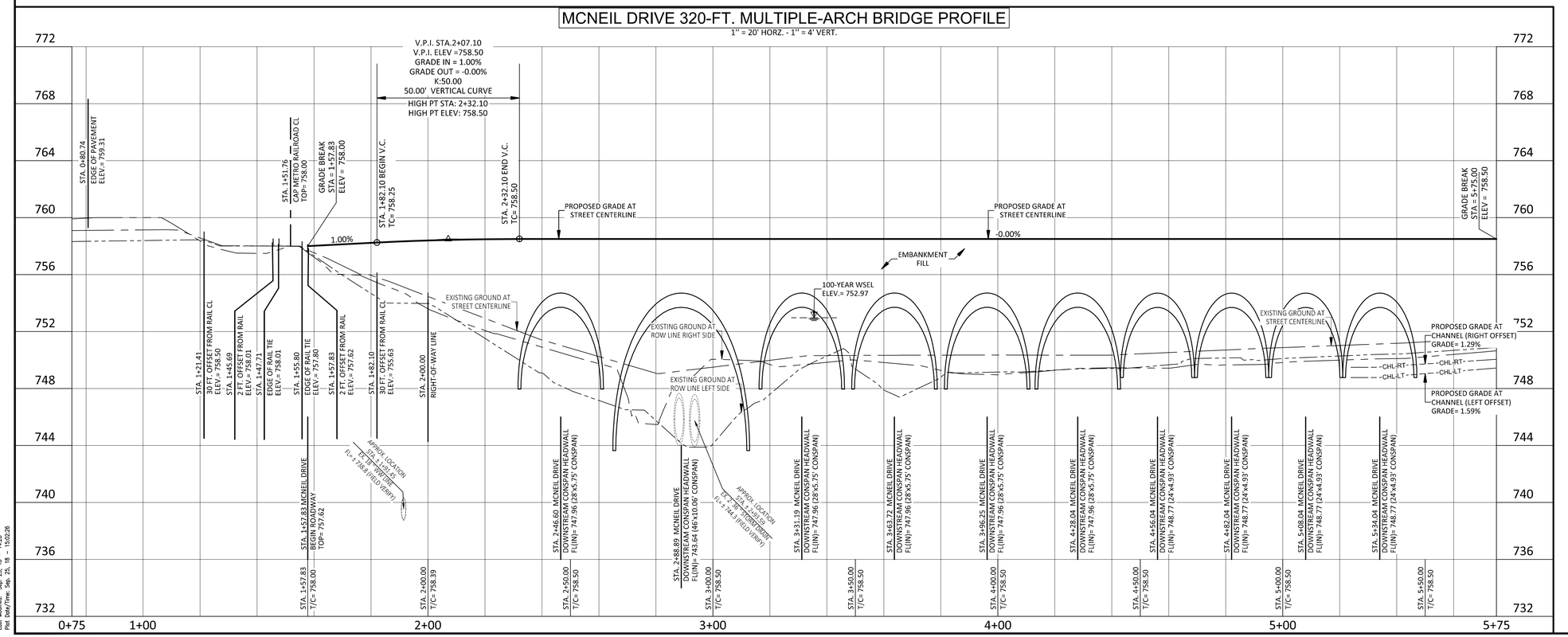
Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\Aws\working_drawings\submitted_files\1570-022-Ab-BRIDGE-SIDE-SLOPE - REDUCED.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 13:55
Plot Date/Time: Sep. 25, 18 - 10:55:18



CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.



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MULTIPLE ARCHES ALT. 2U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & RETAINING WALL SHEET 1

MCNEIL DRIVE CROSSING
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Reviewed:	JK
Date:	9/25/2018

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FIGURE F-6.1

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-RD-ARCH-RET-WALL.dwg
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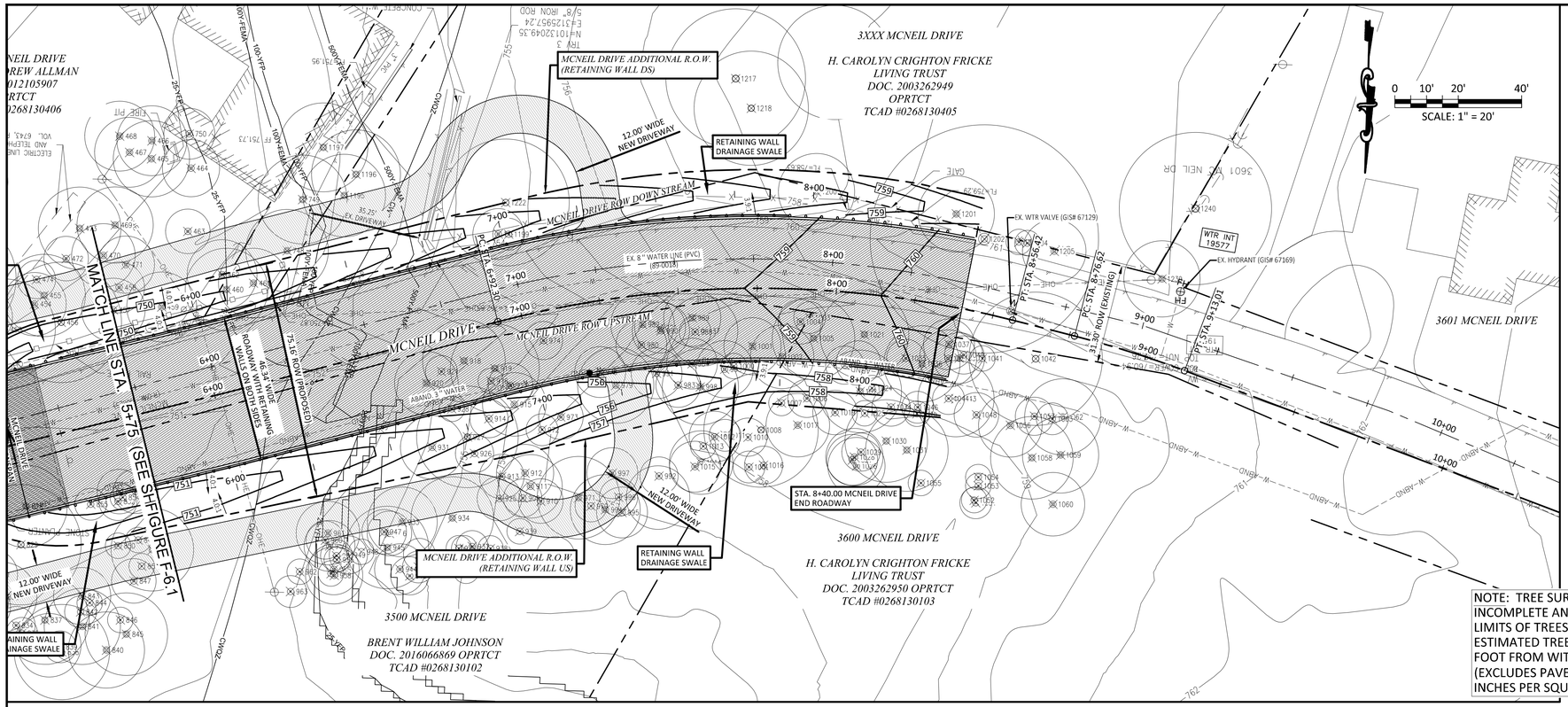

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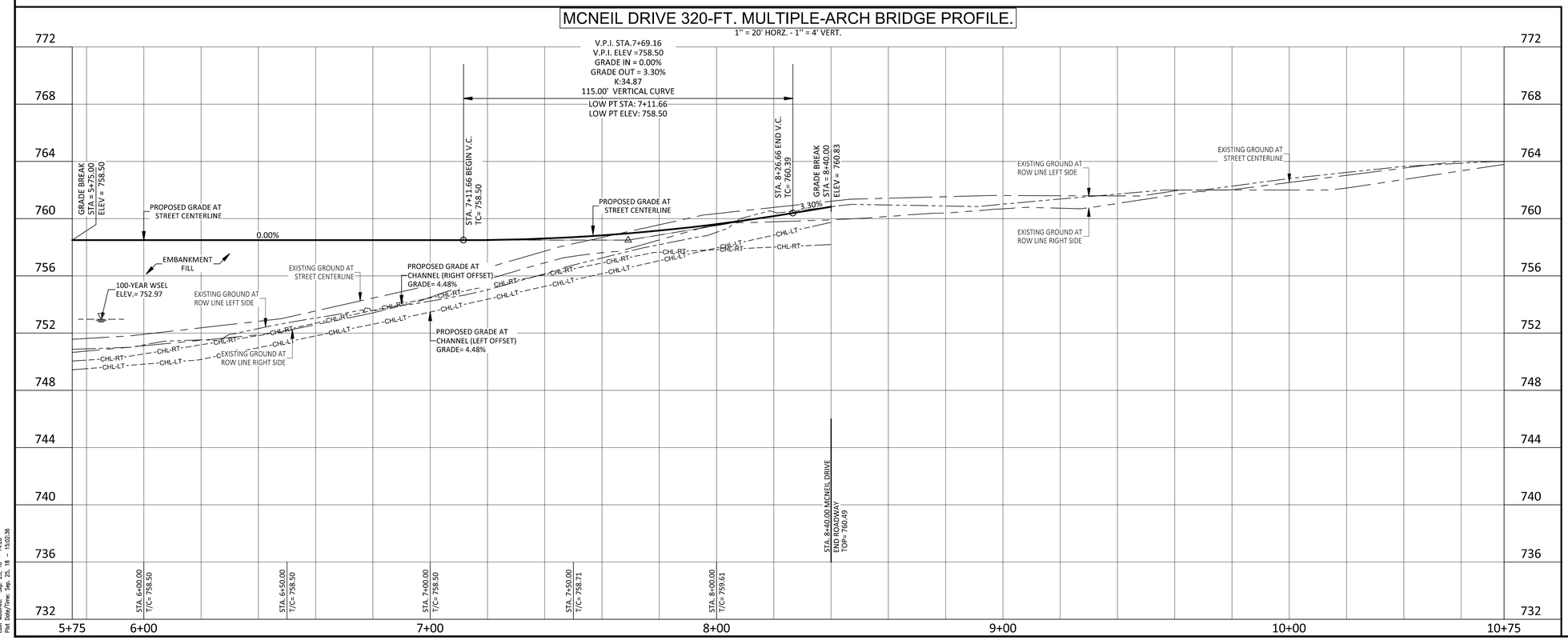
MCNEIL DRIVE 320-FT. MULTIPLE-ARCH BRIDGE PROFILE.

1" = 20' HORZ. - 1" = 4' VERT.



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MULTIPLE ARCHES ALT. 2U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & RETAINING WALL SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

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FIGURE F-6.2

OF .

Project No.: 1570-022

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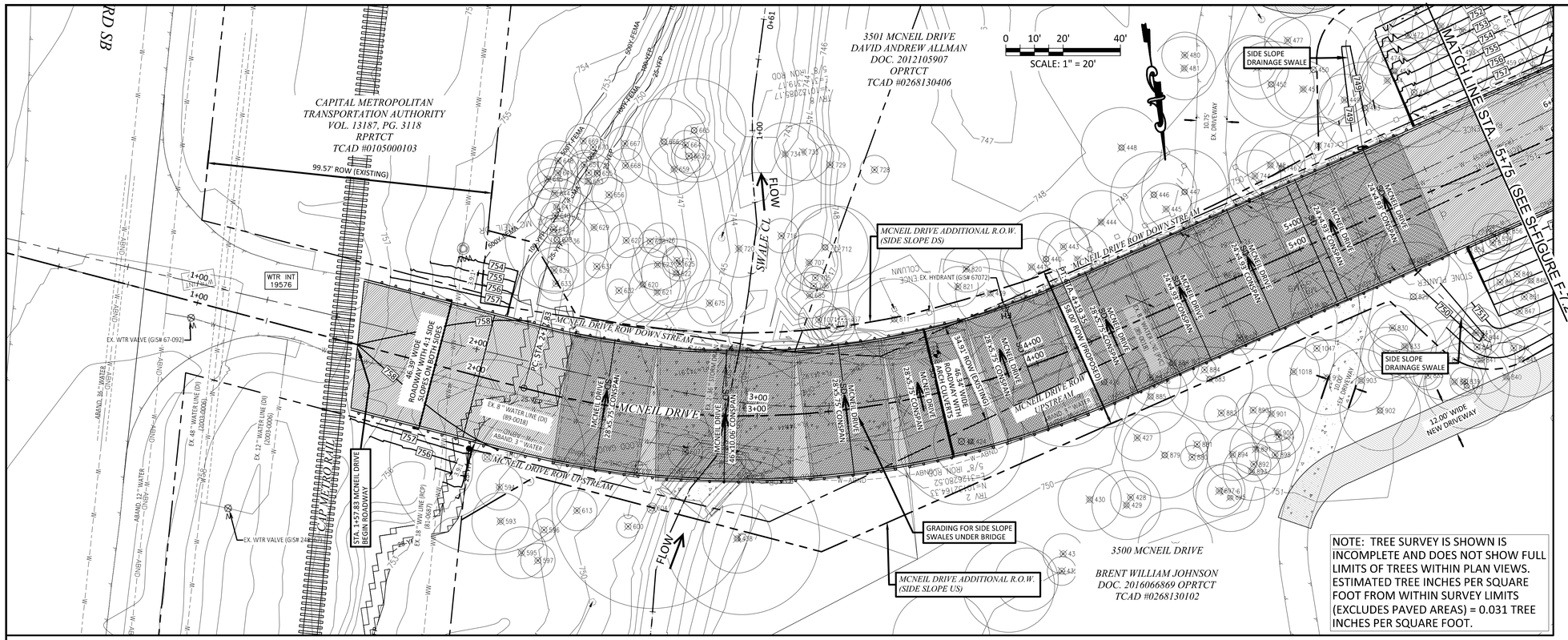
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:28
Plot Date/Time: Sep 25, 18 - 10:02:36



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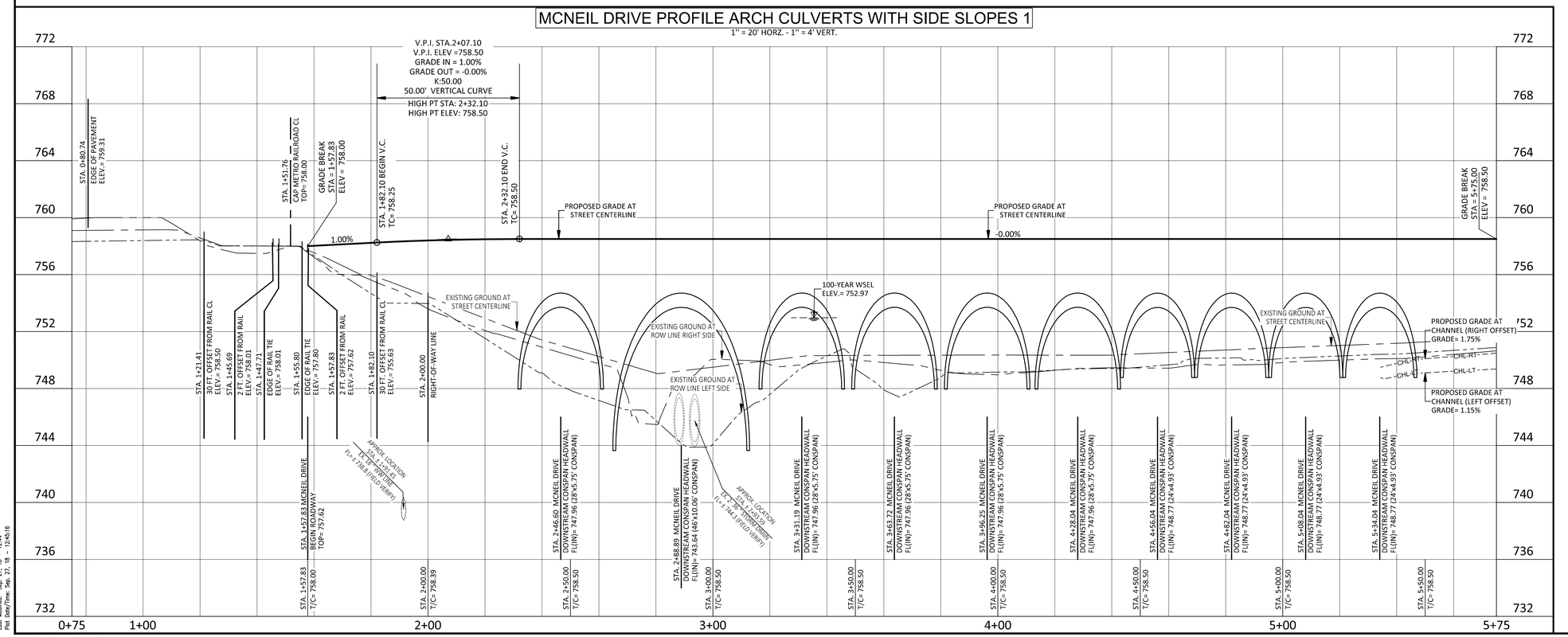
MCNEIL DRIVE PROFILE ARCH CULVERTS WITH SIDE SLOPES 1

1" = 20' HORZ. - 1" = 4' VERT.



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MULTIPLE ARCHES ALT. 2U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & SIDE SLOPES SHEET 1

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Reviewed:	JK
Date:	9/27/2018

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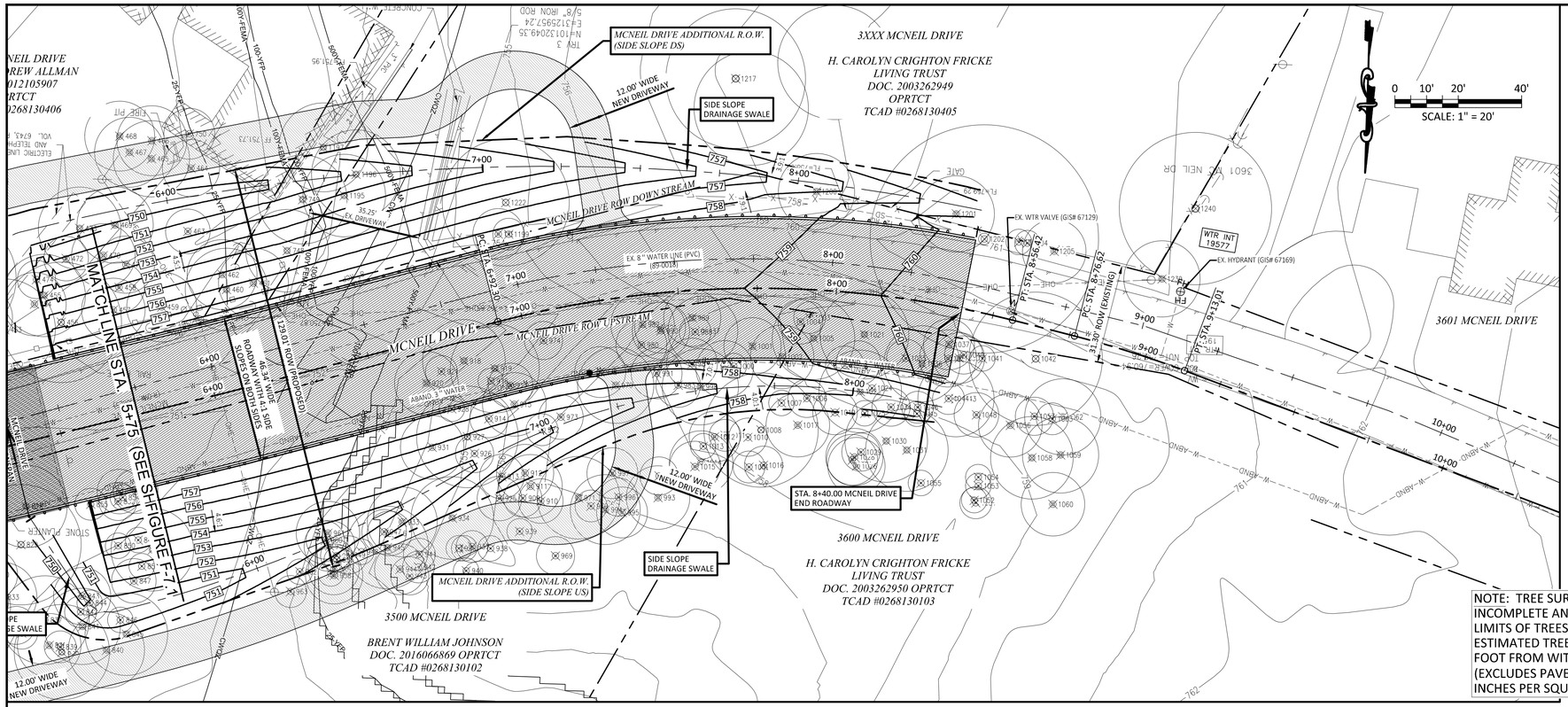
FIGURE F-7.1

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-RD-ARCH-SIDE-SLOPE.dwg
User: CDOLLERY
Last Modified: Sep. 27, 18 - 12:44
Plot Date/Time: Sep. 27, 18 - 12:45:16



CONTRACTOR NOTES:

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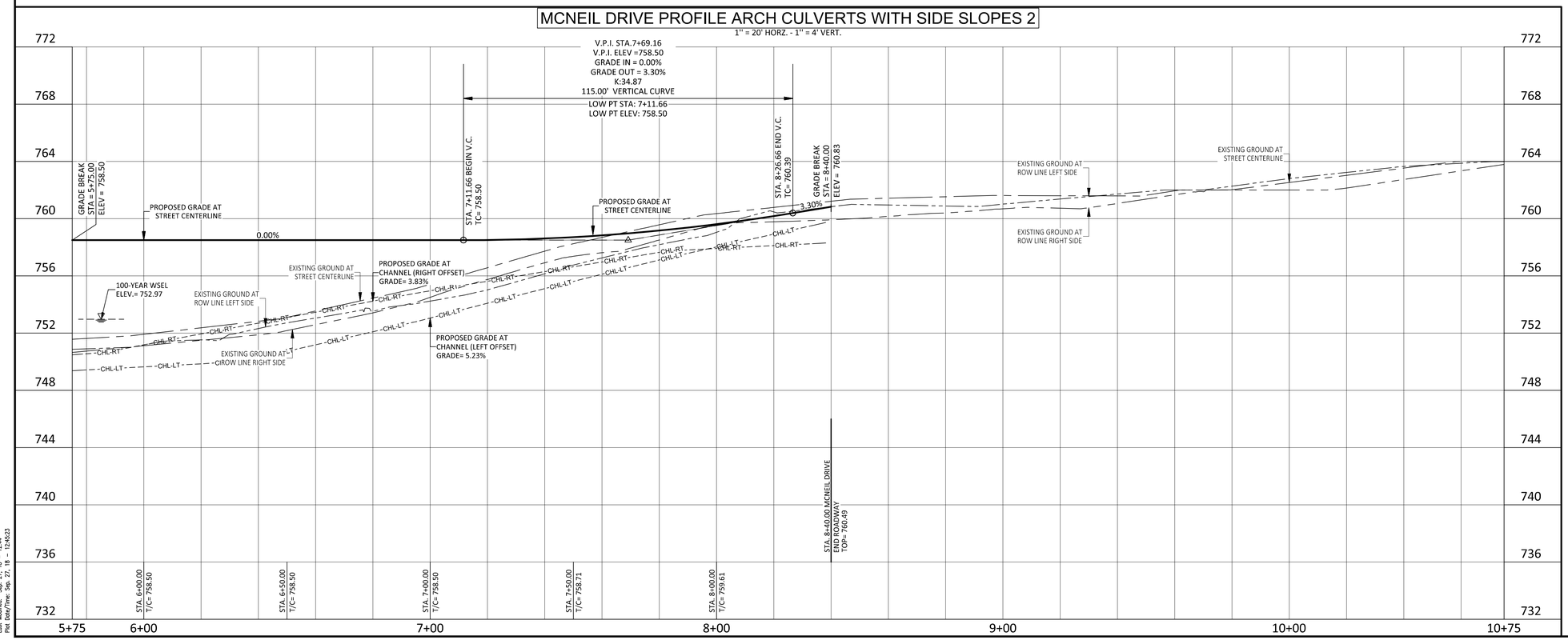
MCNEIL DRIVE PROFILE ARCH CULVERTS WITH SIDE SLOPES 2

1" = 20' HORZ. - 1" = 4' VERT.



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MULTIPLE ARCHES ALT. 2U
UNDETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & SIDE SLOPES SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Drawn:	SD
Reviewed:	JK
Date:	9/27/2018

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FIGURE F-7.2

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-RD-MCNEIL-SIDE-SLOPE.dwg
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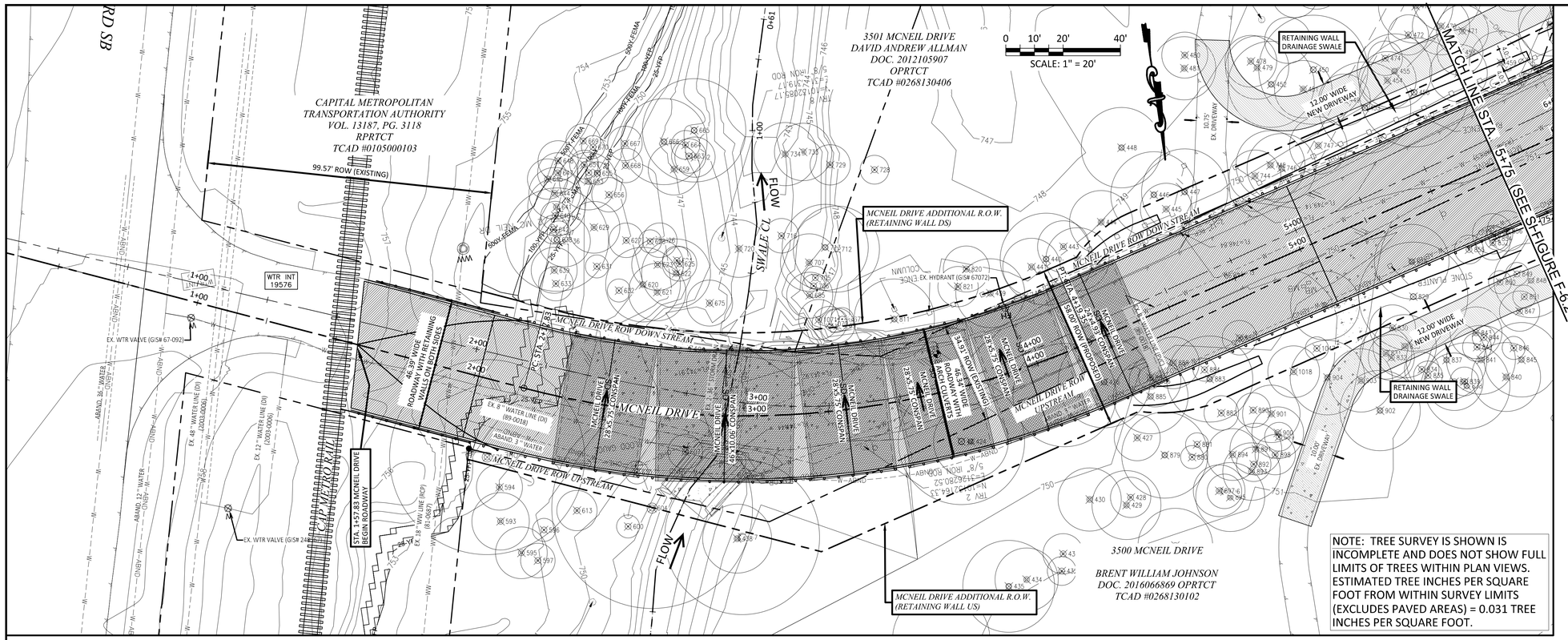

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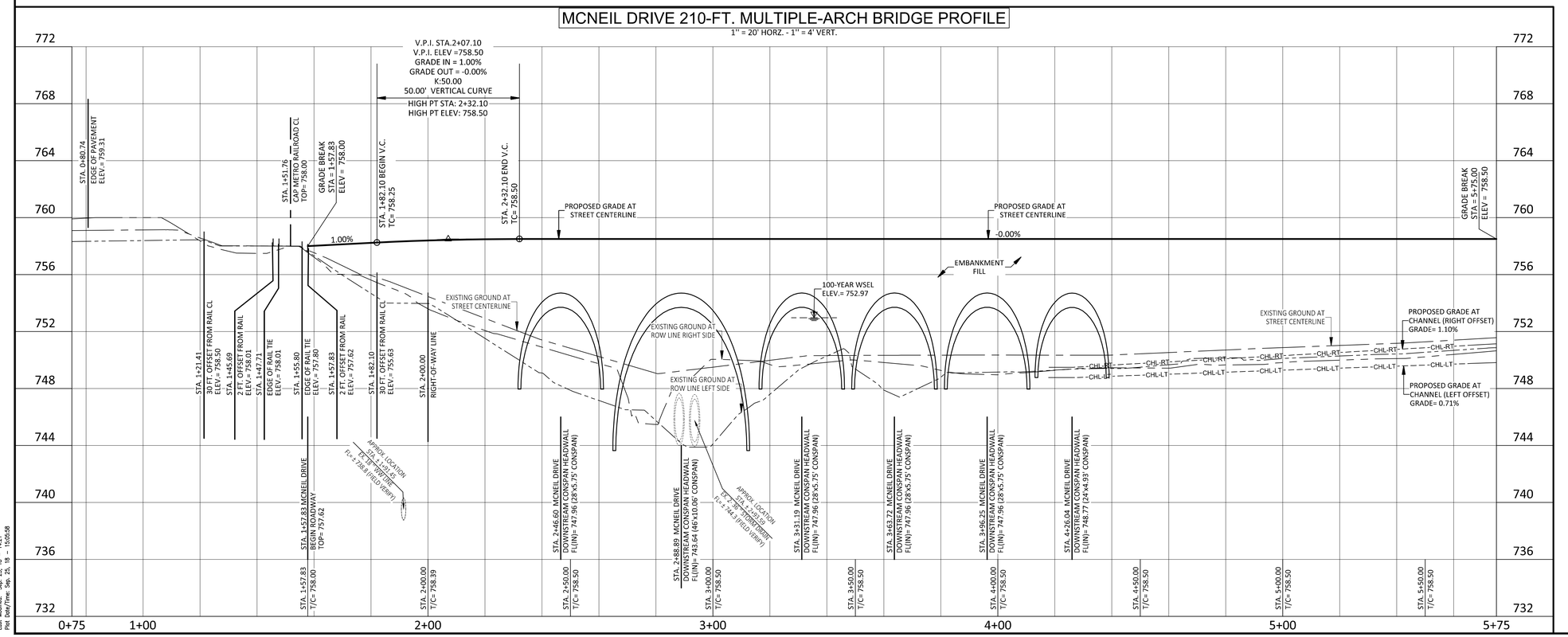

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MULTIPLE ARCHES ALT. 2D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & RETAINING WALL SHEET 1

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Reviewed:	JK
Date:	9/25/2018

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FIGURE F-8.1

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-RD-ARCH-RET-WALL - REDUCED.dwg
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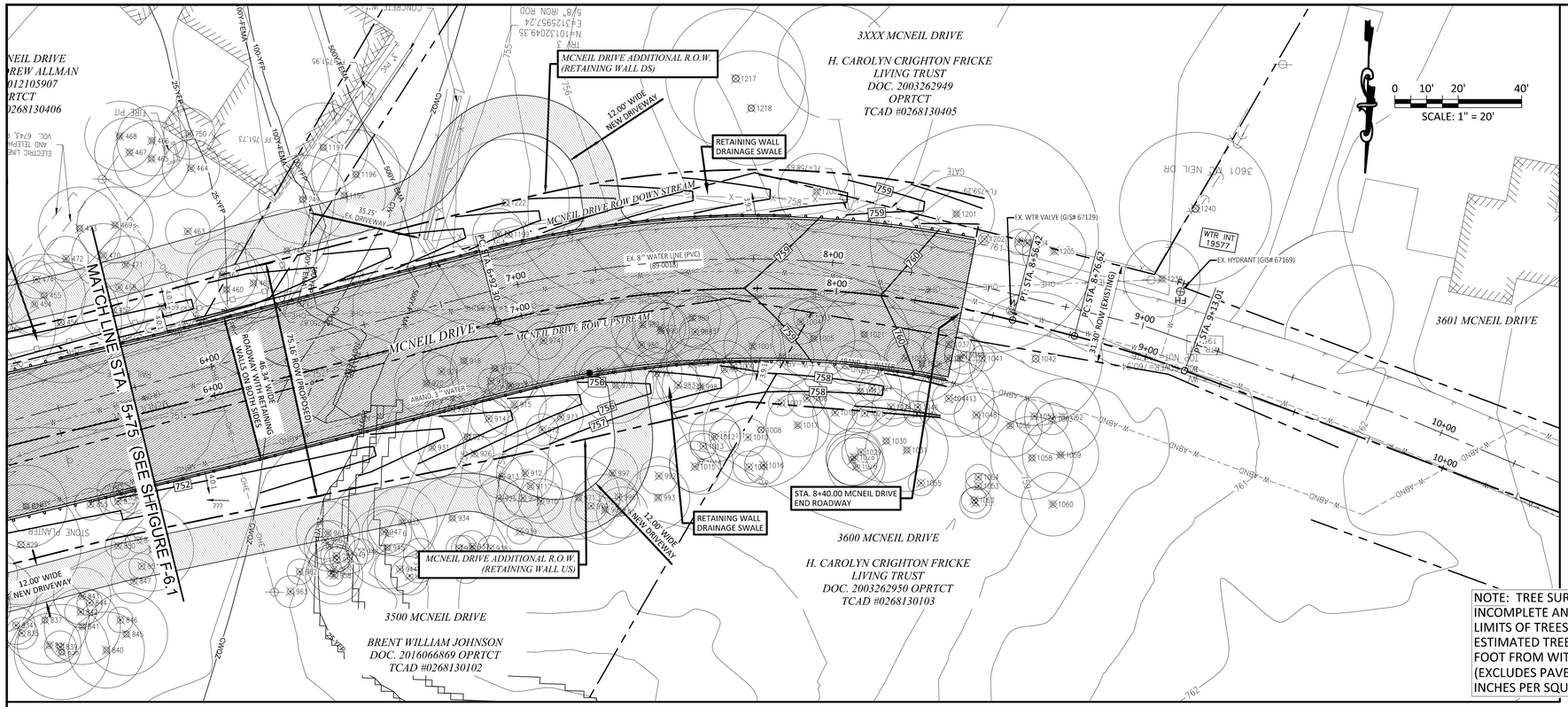
Plot Date/Time: Sep 25, 18 - 1:55:58



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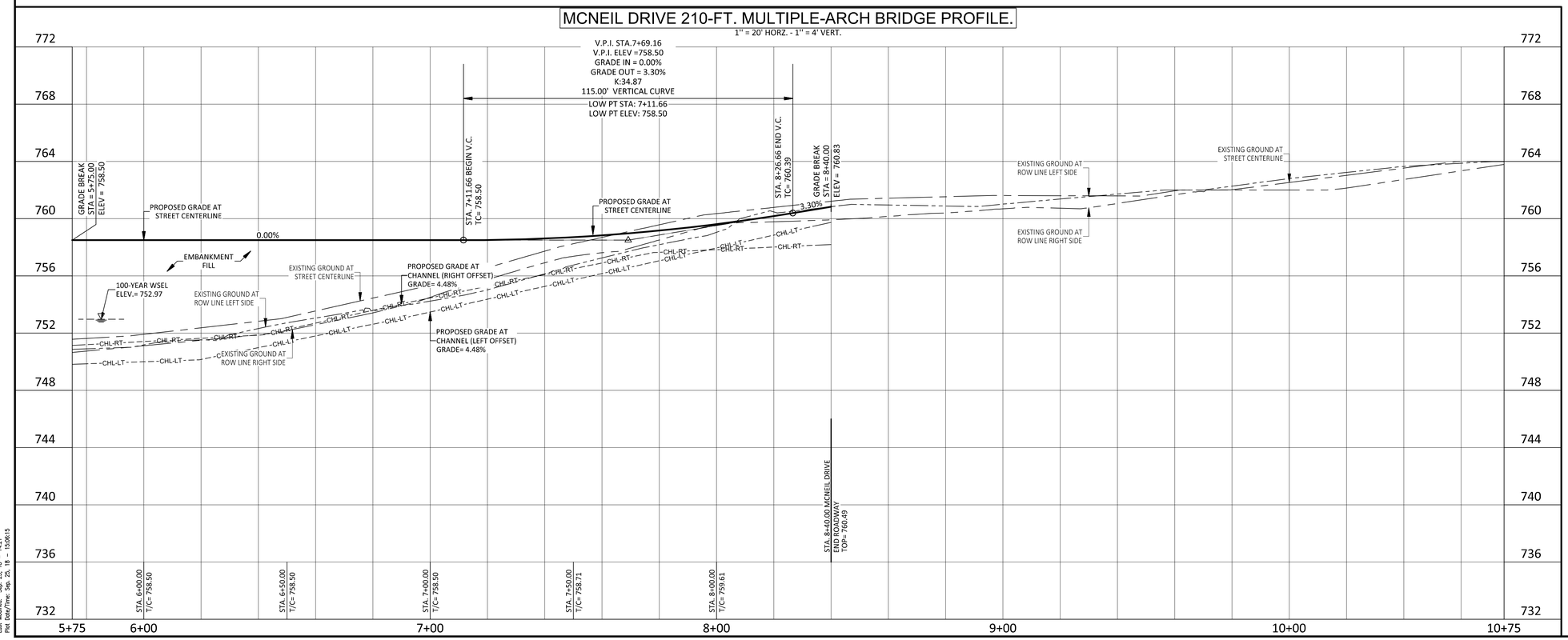
MCNEIL DRIVE 210-FT. MULTIPLE-ARCH BRIDGE PROFILE.

1" = 20' HORZ. - 1" = 4' VERT.



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MULTIPLE ARCHES ALT. 2D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & RETAINING WALL SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Scale:	1"=
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Reviewed:	JK
Date:	9/25/2018

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FIGURE F-8.2

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-RD-ARCH-RET-WALL - REDUCED.dwg
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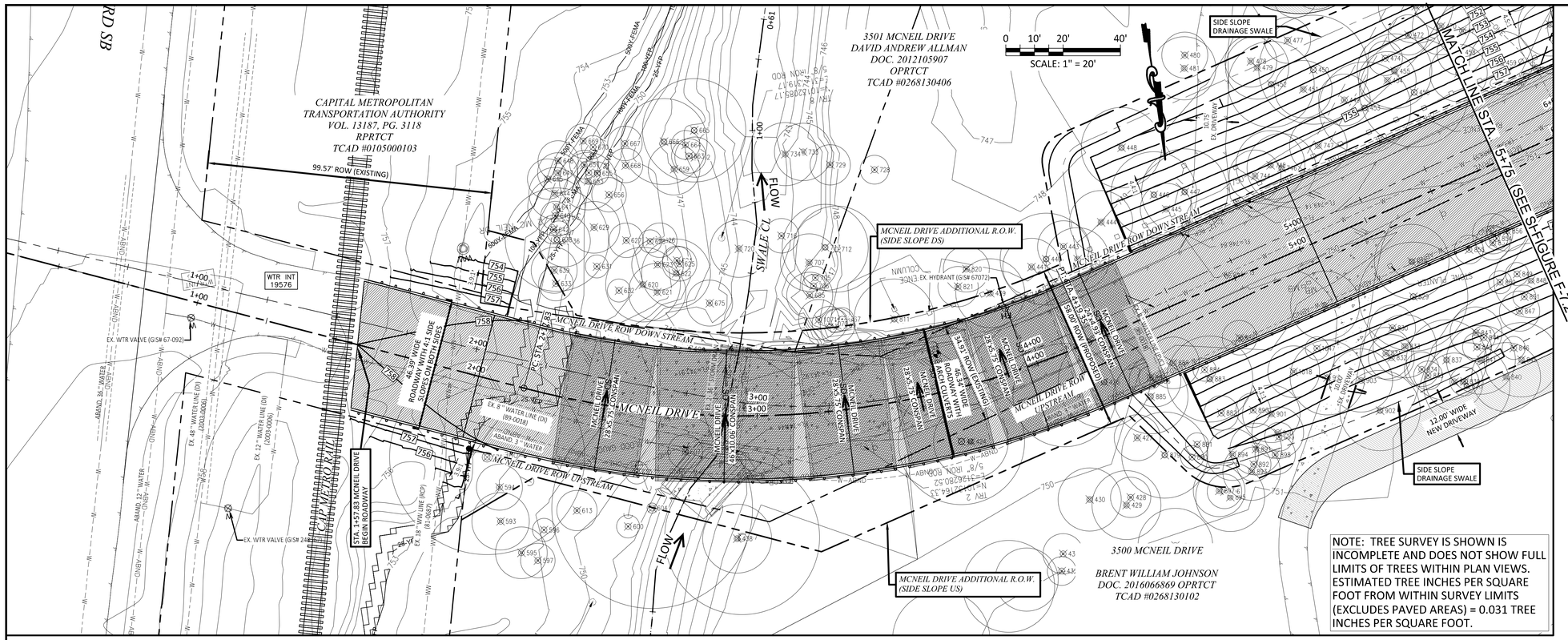
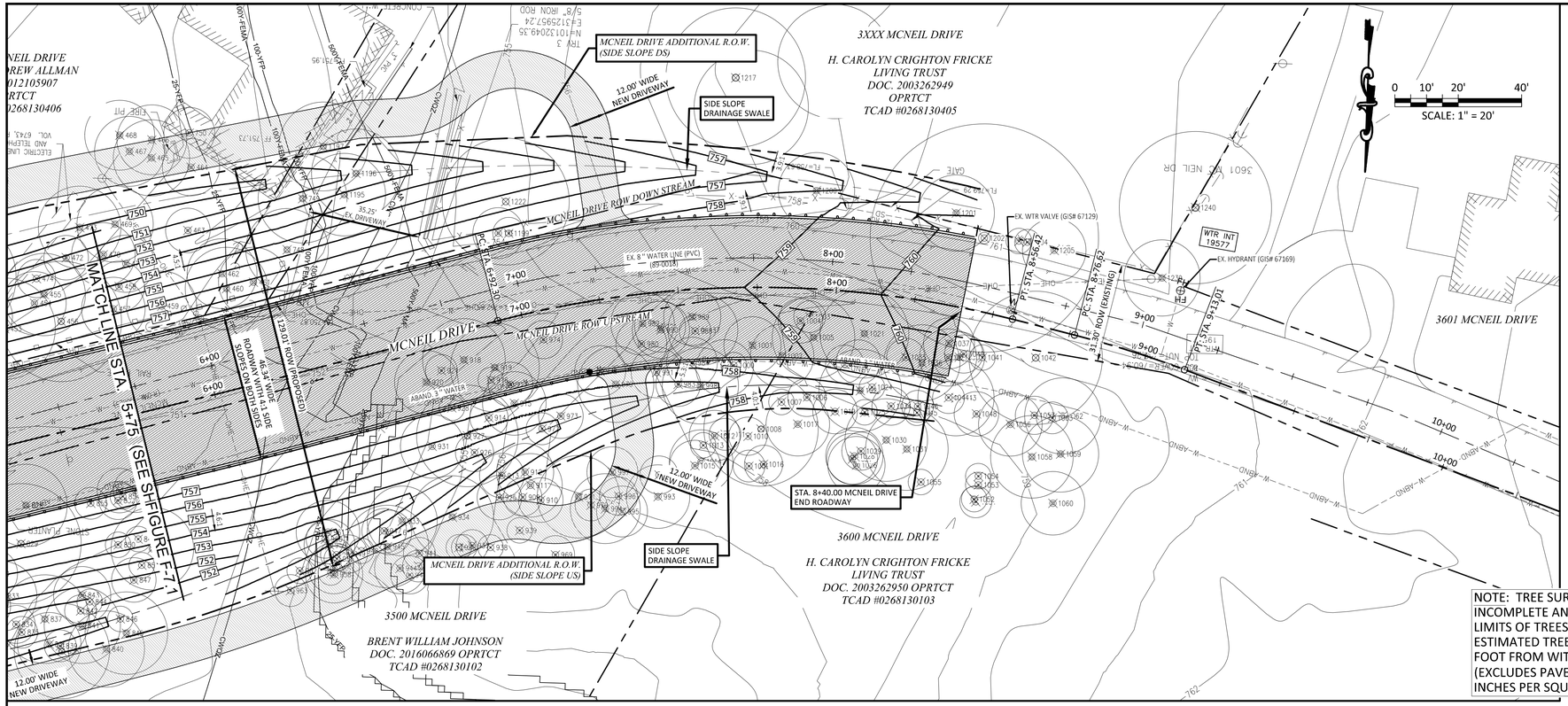

CAPITAL METROPOLITAN TRANSPORTATION AUTHORITY
VOL. 13187, PG. 3118
RPRTCT
TCAD #0105000103
99.57' ROW (EXISTING)
CAP METRO RAILROAD
3501 MCNEIL DRIVE
DAVID ANDREW ALLMAN
DOC. 2012105907
OPRTCT
TCAD #0268130406
MCNEIL DRIVE ADDITIONAL R.O.W. (SIDE SLOPE DS)
MCNEIL DRIVE ROW DOWNSTREAM
MCNEIL DRIVE ROW UPSTREAM
MCNEIL DRIVE
SIDE SLOPE DRAINAGE SWALE
MATCH LINE STA. 5+15 (SEE SHEET FIGURE F-7.2)
12.00' WIDE NEW DRIVEWAY
SIDE SLOPE DRAINAGE SWALE
3500 MCNEIL DRIVE
BRENT WILLIAM JOHNSON
DOC. 2016066869 OPRTCT
TCAD #0268130102
MCNEIL DRIVE ADDITIONAL R.O.W. (SIDE SLOPE US)
SCALE: 1" = 20'
WTR INT 19576
EX. WTR VALVE (GIS# 67-092)
EX. WTR VALVE (GIS# 248)
ABAND. 36" WATER
ABAND. 12" WATER
EX. 48" WATER LINE (DI) (2003-0006)
EX. 17" WATER LINE (DI) (2003-0006)
EX. 8" WATER LINE (DI) (89-0018)
ABAND. 3" WATER
EX. 18" WW LINE (RCP) (81-0587)
STA. 1+57.83 MCNEIL DRIVE BEGIN ROADWAY
46.39' WIDE ROADWAY WITH 4:1 SIDE SLOPES ON BOTH SIDES
MCNEIL DRIVE 28'x5.75' CONSPAN
MCNEIL DRIVE 46'x10.06' CONSPAN
34'x9.1' ROW CONSPAN
46.39' WIDE ROADWAY WITH SIDE SLOPES AND CULVERTS
24'x5.33' CONSPAN
SWALE CL
FLOW
EX. DRIVEWAY
EX. HYDRANT (GIS# 67072)
EX. 6" WATER LINE
EX. 12" WATER LINE
EX. 8" WW LINE
EX. 6" WW LINE
EX. 30" FERMA
EX. 24" RCP
EX. 18" RCP
EX. 8" WW LINE
EX. 6" WW LINE
EX. 4" WW LINE
EX. 2" WW LINE
EX. 1" WW LINE
EX. 3" WW LINE
EX. 4" WW LINE
EX. 6" WW LINE
EX. 8" WW LINE
EX. 10" WW LINE
EX. 12" WW LINE
EX. 15" WW LINE
EX. 18" WW LINE
EX. 21" WW LINE
EX. 24" WW LINE
EX. 30" WW LINE
EX. 36" WW LINE
EX. 42" WW LINE
EX. 48" WW LINE
EX. 54" WW LINE
EX. 60" WW LINE
EX. 66" WW LINE
EX. 72" WW LINE
EX. 78" WW LINE
EX.



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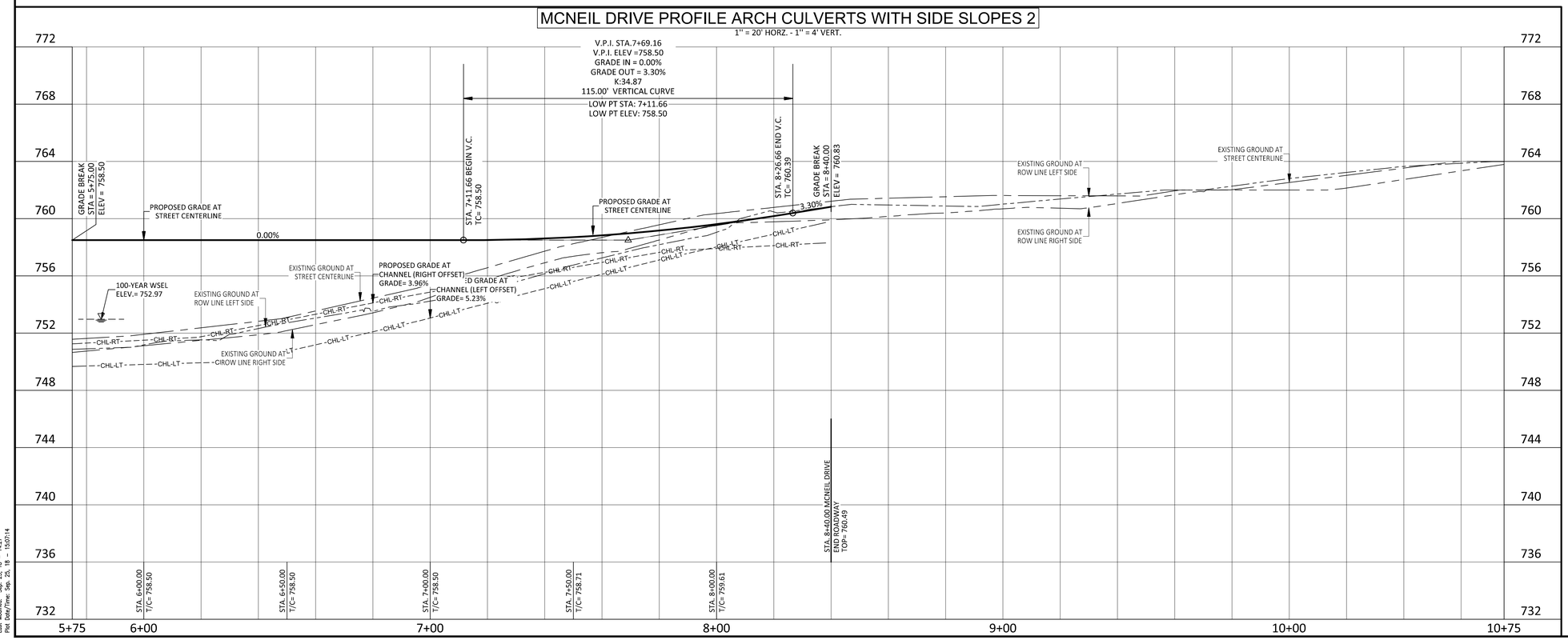
MCNEIL DRIVE PROFILE ARCH CULVERTS WITH SIDE SLOPES 2

1" = 20' HORZ. - 1" = 4' VERT.



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MULTIPLE ARCHES ALT. 2D
DETAINED FLOWS

MCNEIL DRIVE PROPOSED MULTIPLE ARCHES & SIDE SLOPES SHEET 2

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Reviewed:	JK
Date:	9/25/2018

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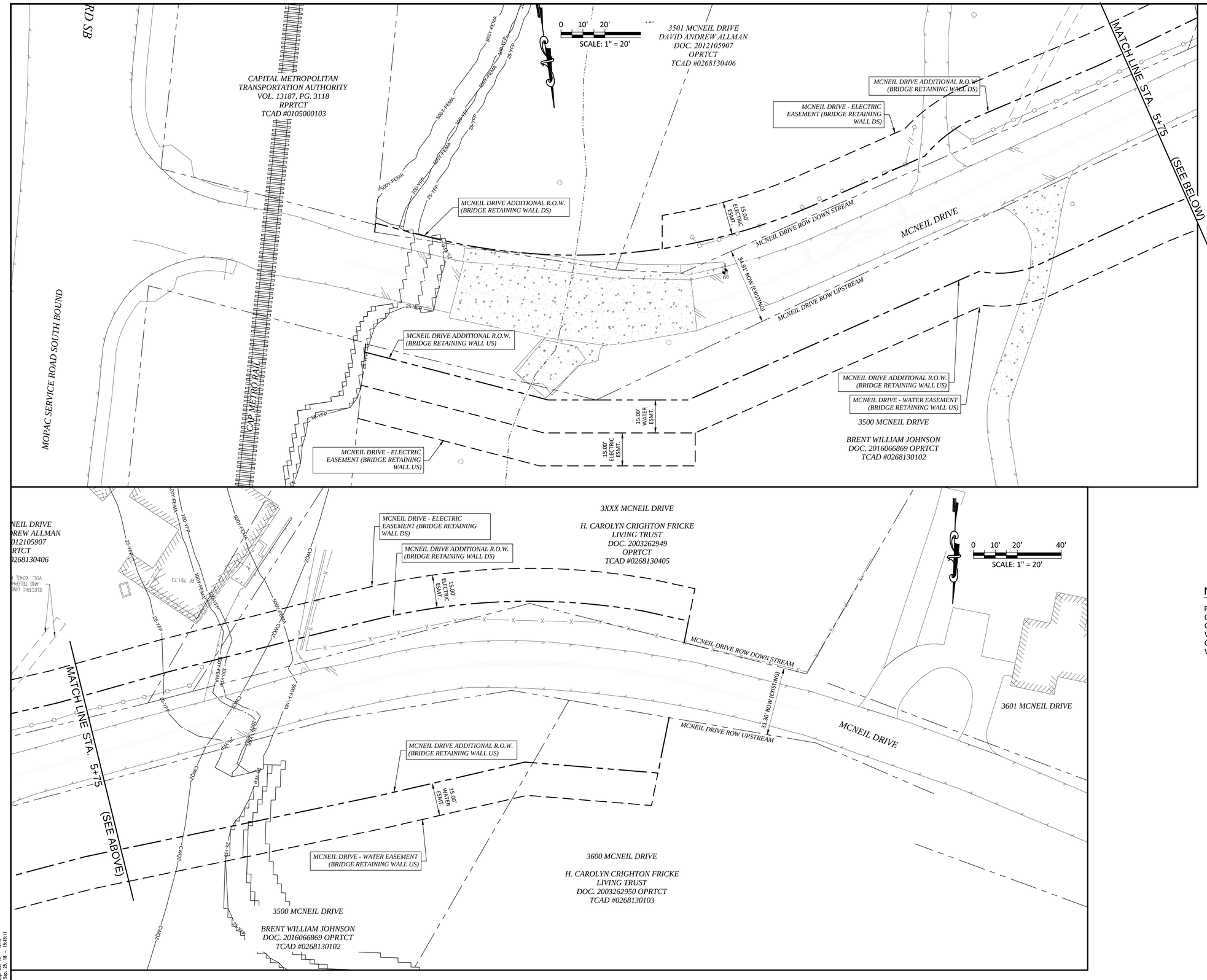
FIGURE F-9.2

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-RD-ARCH-SIDE-SLOPE - REDUCED.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:27
Plot Date/Time: Sep 25, 18 - 1:03:14



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NOTE:

PROPOSED 15-FOOT WIDE WATER EASEMENT IS ONLY FOR RELOCATION OF WATER MAIN OUTSIDE OF FOOTPRINT OF PROPOSED CROSSING. EASEMENT WILL BE WIDER IF AUSTIN WATER DESIRES TO CONSTRUCT FUTURE WASTEWATER COLLECTOR WITHIN EASEMENT AS WELL.

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R.O.W. & EASEMENT ACQUISITION PLAN FOR FULL SPAN WITH RETAINING WALLS UNDETAINED FLOWS

MCNEIL DRIVE CROSSING AUSTIN, TEXAS

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Reviewed:	JK
Date:	9/25/2018

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FIGURE F-10

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-ROW-FULL SPAN.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 15:45
Plot Date/Time: Sep. 25, 18 - 15:45:11

CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.

MOPAC SERVICE ROAD SOUTH BOUND

CAP METRO RAIL

CAPITAL METROPOLITAN TRANSPORTATION AUTHORITY
VOL. 13187, PG. 3118
RPRTCT
TCAD #0105000103

3501 MCNEIL DRIVE
DAVID ANDREW ALLMAN
DOC. 2012105907
OPRTCT
TCAD #0268130406

0 10' 20' 40'
SCALE: 1" = 20'

MATCH LINE STA. 5+75 (SEE BELOW)

MCNEIL DRIVE ADDITIONAL R.O.W. (BRIDGE SIDE SLOPE DS)

MCNEIL DRIVE - ELECTRIC EASEMENT (BRIDGE SIDE SLOPE DS)

15.00' ELECTRIC ESMT.

MCNEIL DRIVE ROW DOWN STREAM

MCNEIL DRIVE

34.91' ROW (EXISTING)

MCNEIL DRIVE ROW UPSTREAM

MCNEIL DRIVE ADDITIONAL R.O.W. (BRIDGE SIDE SLOPE US)

MCNEIL DRIVE ADDITIONAL R.O.W. (BRIDGE SIDE SLOPE US)

15.00' WATER ESMT.

MCNEIL DRIVE - WATER EASEMENT (BRIDGE SIDE SLOPE DS)

3500 MCNEIL DRIVE

BRENT WILLIAM JOHNSON
DOC. 2016066869 OPRTCT
TCAD #0268130102

15.00' ELECTRIC ESMT.

MCNEIL DRIVE - ELECTRIC EASEMENT (BRIDGE SIDE SLOPE US)

3XXX MCNEIL DRIVE

H. CAROLYN CRIGHTON FRICKE
LIVING TRUST
DOC. 2003262949
OPRTCT
TCAD #0268130405

MCNEIL DRIVE ADDITIONAL R.O.W. (BRIDGE SIDE SLOPE DS)

MCNEIL DRIVE - ELECTRIC EASEMENT (BRIDGE SIDE SLOPE DS)

15.00' ELECTRIC ESMT.

MCNEIL DRIVE ROW DOWN STREAM

MCNEIL DRIVE

31.30' ROW (EXISTING)

MCNEIL DRIVE ROW UPSTREAM

MCNEIL DRIVE ADDITIONAL R.O.W. (BRIDGE SIDE SLOPE US)

15.00' WATER ESMT.

MCNEIL DRIVE - WATER EASEMENT (BRIDGE SIDE SLOPE DS)

3500 MCNEIL DRIVE

BRENT WILLIAM JOHNSON
DOC. 2016066869 OPRTCT
TCAD #0268130102

3600 MCNEIL DRIVE

H. CAROLYN CRIGHTON FRICKE
LIVING TRUST
DOC. 2003262950 OPRTCT
TCAD #0268130103

3601 MCNEIL DRIVE

MATCH LINE STA. 5+75 (SEE ABOVE)

0 10' 20' 40'
SCALE: 1" = 20'

NOTE:

PROPOSED 15-FOOT WIDE WATER EASEMENT IS ONLY FOR RELOCATION OF WATER MAIN OUTSIDE OF FOOTPRINT OF PROPOSED CROSSING. EASEMENT WILL BE WIDER IF AUSTIN WATER DESIRES TO CONSTRUCT FUTURE WASTEWATER COLLECTOR WITHIN EASEMENT AS WELL.

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www.doucetengineers.com
Firm Registration Number: 3937

R.O.W. & EASEMENT ACQUISITION PLAN FOR FULL SPAN WITH SIDE SLOPES UNDETAINED FLOWS

MCNEIL DRIVE CROSSING AUSTIN, TEXAS

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Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

SHEET

FIGURE F-11

OF .

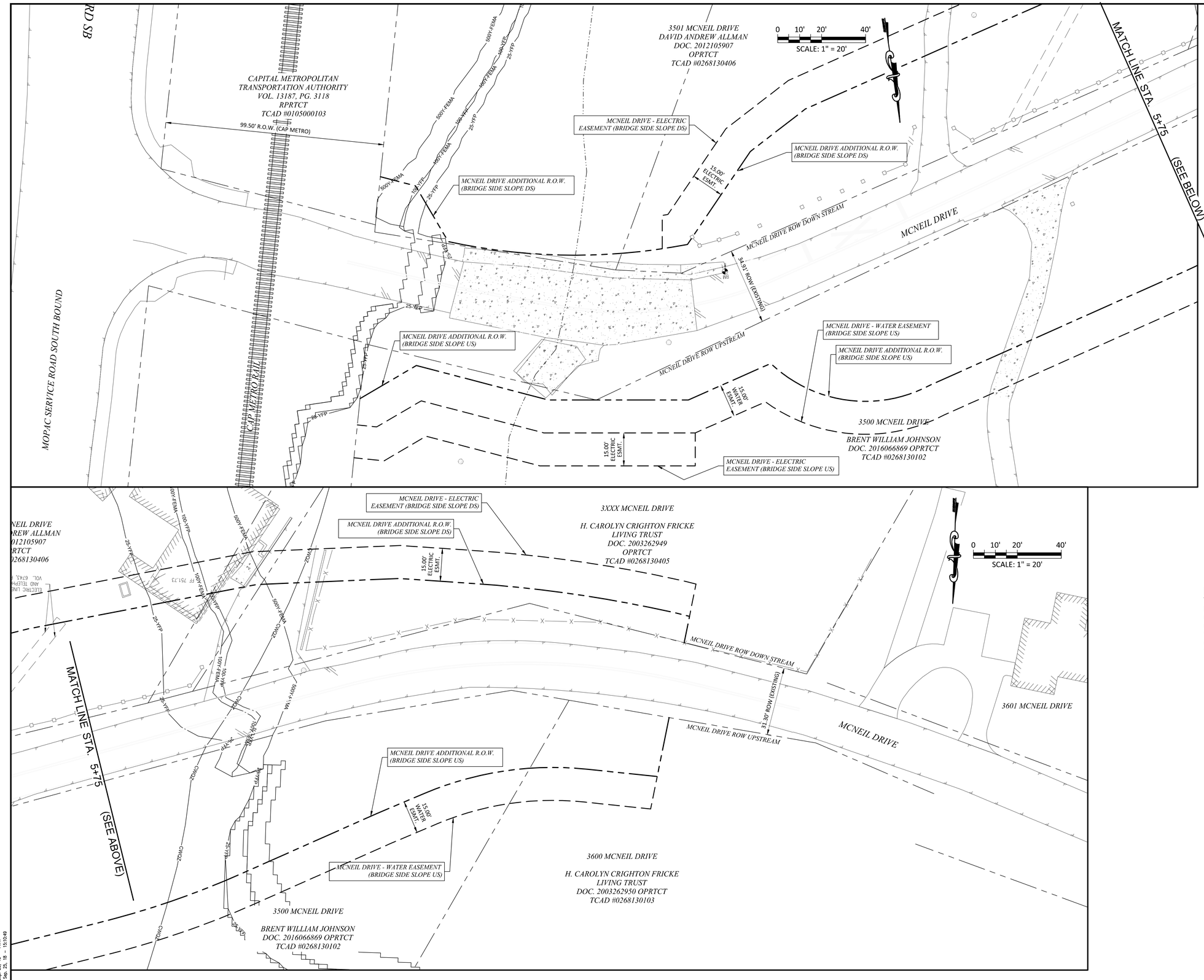
Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive (MM's dwg)\working_drawings\submitted_files\1570-022-ROW-FULL SPAN-SS.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 15:38
Plot Date/Time: Sep. 25, 18 - 15:42:41

CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.



NOTE:

PROPOSED 15-FOOT WIDE WATER EASEMENT IS ONLY FOR RELOCATION OF WATER MAIN OUTSIDE OF FOOTPRINT OF PROPOSED CROSSING. EASEMENT WILL BE WIDER IF AUSTIN WATER DESIRES TO CONSTRUCT FUTURE WASTEWATER COLLECTOR WITHIN EASEMENT AS WELL.

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Firm Registration Number: 3937

R.O.W. & EASEMENT ACQUISITION PLAN FOR REDUCED SPAN WITH SIDE SLOPES DETAINED FLOWS

MCNEIL DRIVE CROSSING AUSTIN, TEXAS

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Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

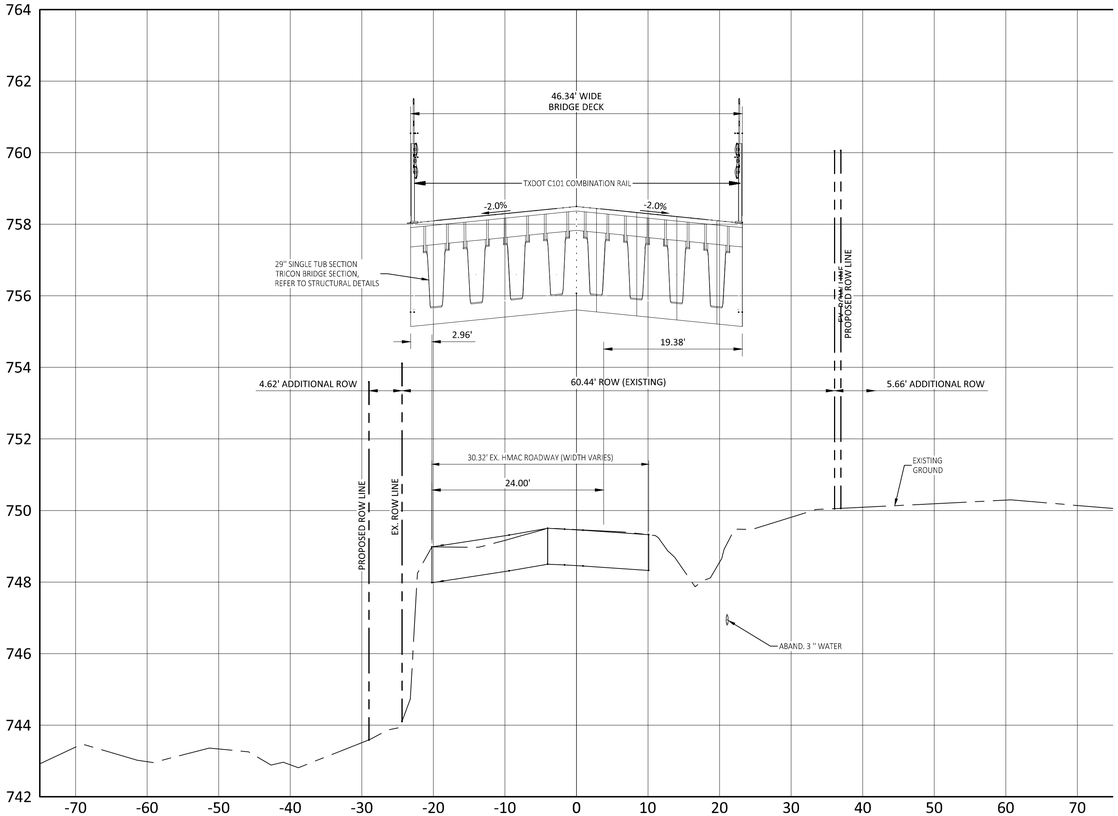
SHEET

FIGURE F-12

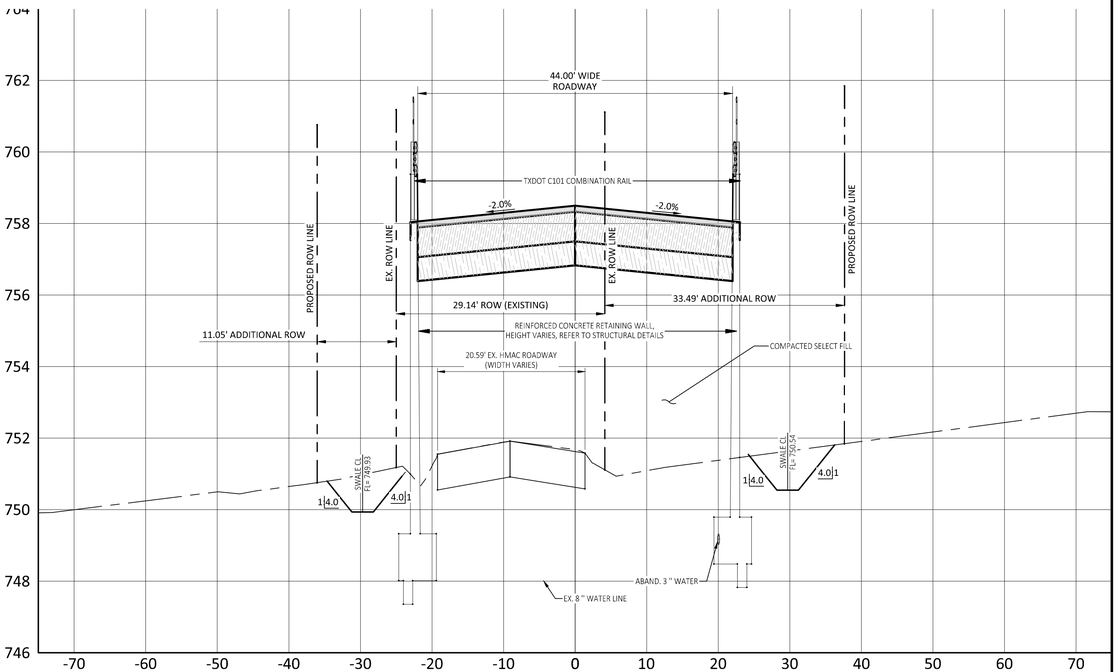
OF .

Project No.: 1570-022

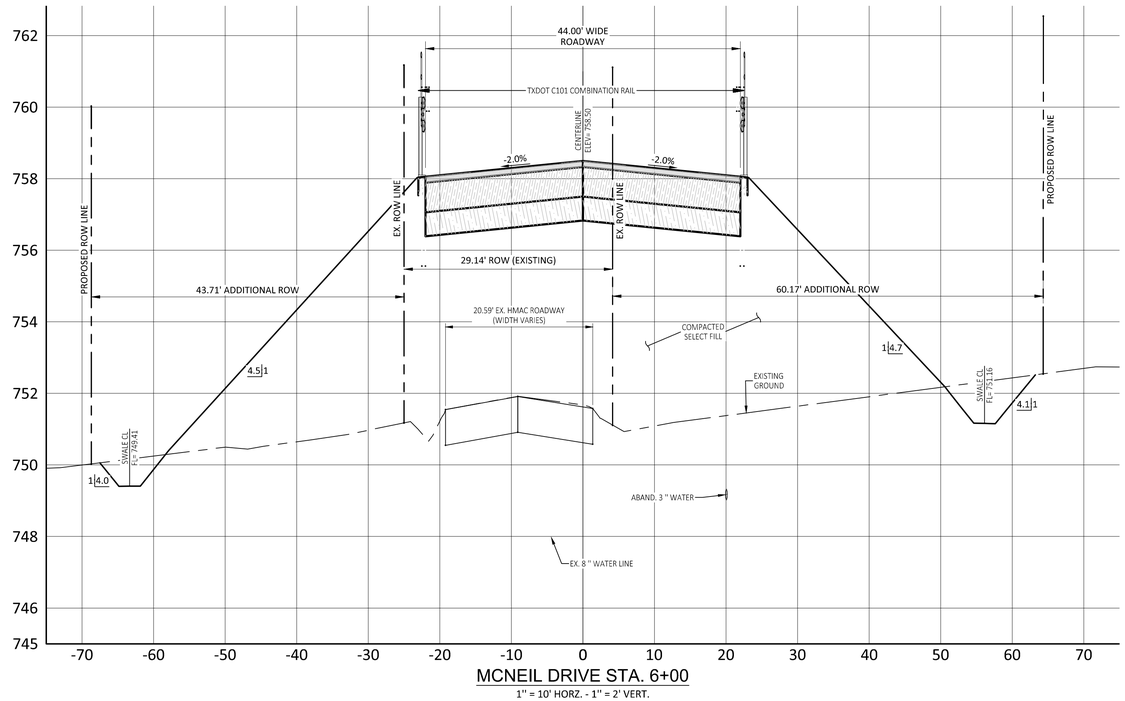
Drawing: D:\01--JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-ROW-REDUCED SPAN.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:47
Plot Date/Time: Sep. 25, 18 - 15:02:49



DETAILED SECTION VIEW FOR ROADWAY WITH TRICON BRIDGE SPAN



DETAILED SECTION VIEW FOR ROADWAY WITH RETAINING WALLS ON BOTH SIDES



DETAILED SECTION VIEW FOR ROADWAY WITH SIDE SLOPES ON BOTH SIDES

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TYPICAL ROADWAY SECTIONS

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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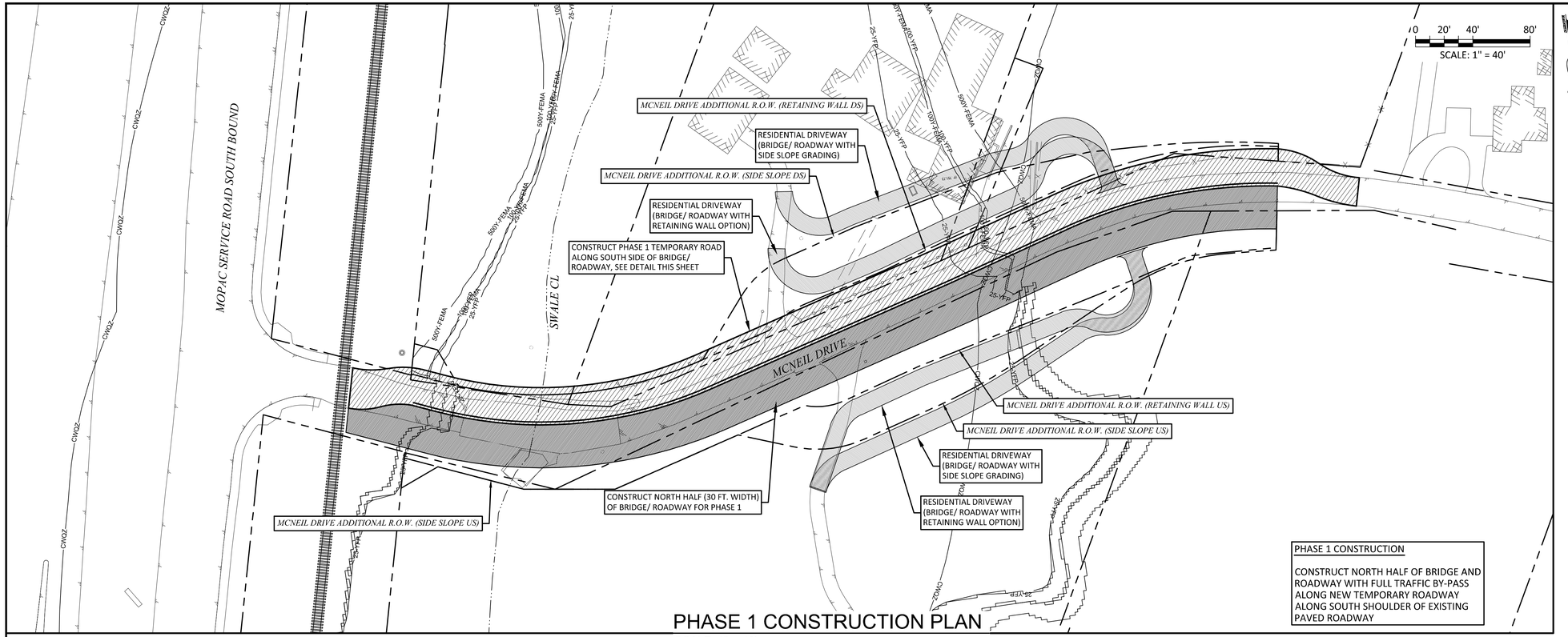
Scale: 1"=
Designed: JK
Drawn: SD
Reviewed: JK
Date: 9/25/2018

SHEET
FIGURE F-13
OF .

Project No.: 1570-022

Drawing: D:\01--JOBS\1570-022 McNeil Drive LMC\Arw\working_drawings\submitted_files\1570-022-07.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:51
Plot Date/Time: Sep. 25, 18 - 15:16:41

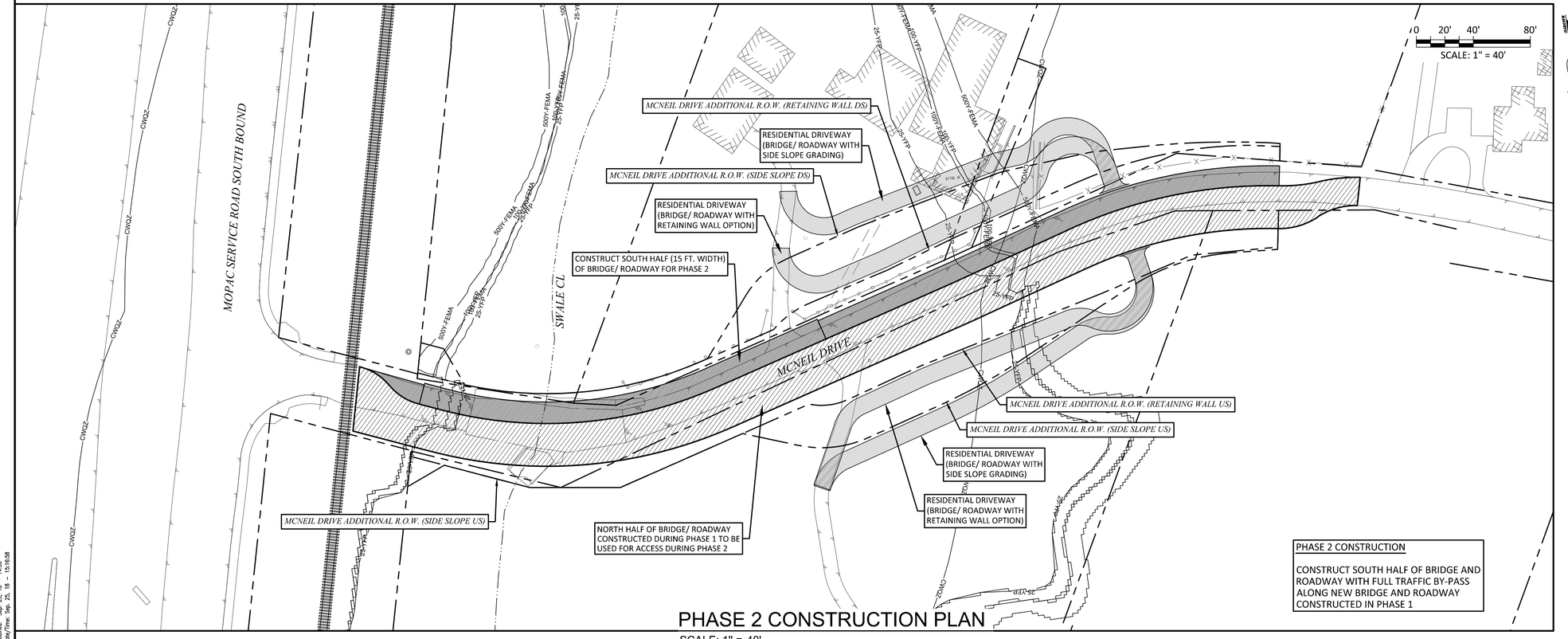


PHASE 1 CONSTRUCTION

CONSTRUCT NORTH HALF OF BRIDGE AND ROADWAY WITH FULL TRAFFIC BY-PASS ALONG NEW TEMPORARY ROADWAY ALONG SOUTH SHOULDER OF EXISTING PAVED ROADWAY

PHASE 1 CONSTRUCTION PLAN

SCALE: 1" = 40'



PHASE 2 CONSTRUCTION

CONSTRUCT SOUTH HALF OF BRIDGE AND ROADWAY WITH FULL TRAFFIC BY-PASS ALONG NEW BRIDGE AND ROADWAY CONSTRUCTED IN PHASE 1

PHASE 2 CONSTRUCTION PLAN

SCALE: 1" = 40'

CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

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PHASED CONSTRUCTION OF BRIDGE AND ROADWAY PLAN

MCNEIL DRIVE CROSSING AUSTIN, TEXAS

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Scale:	1"=
Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

SHEET

FIGURE F-14

OF .

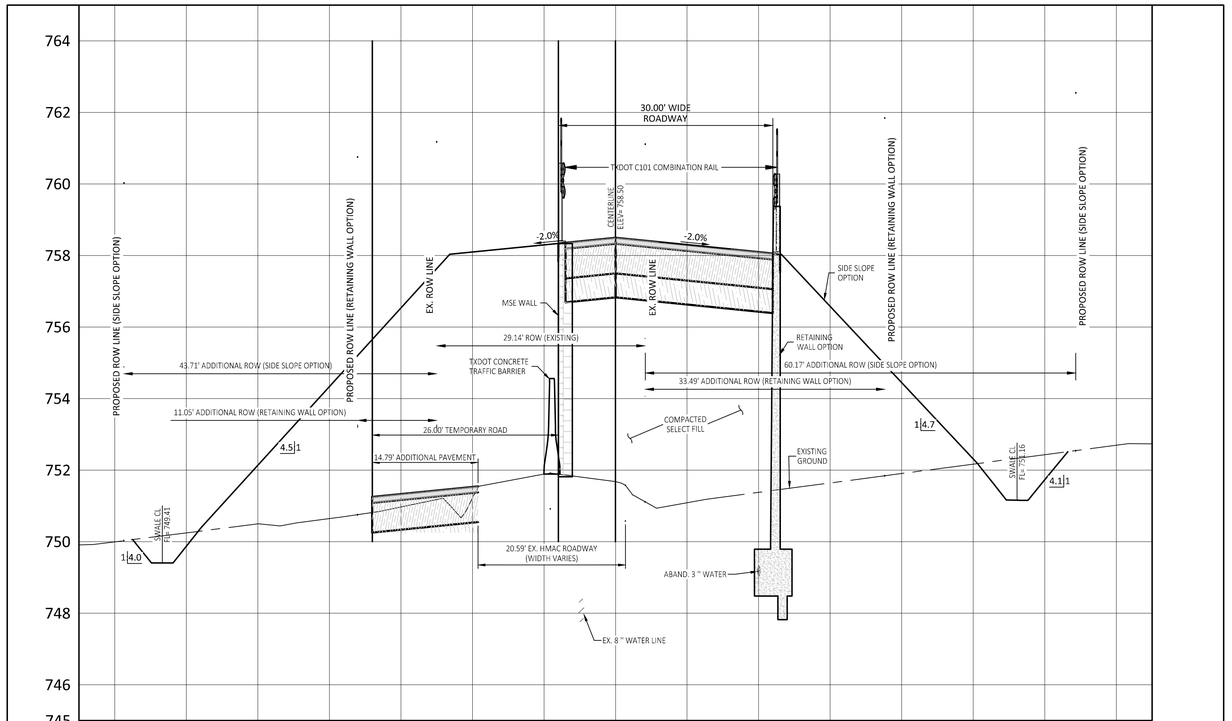
Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LMC\dwg\working_drawings\submittal_files\1570-022-Ph-BRIDGE-SIDE-SLOPE-PHASING.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:56
Plot Date/Time: Sep. 25, 18 - 15:16:58

CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.



MCNEIL DRIVE STA. 6+00

1" = 10' HORZ. - 1" = 2' VERT.

ROADWAY SECTION FOR PHASE 1

DOUCET + CHAN

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Firm Registration Number: 3937

PHASED CONSTRUCTION TYPICAL SECTION

MCNEIL DRIVE CROSSING AUSTIN, TEXAS

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Scale:	1"=
Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

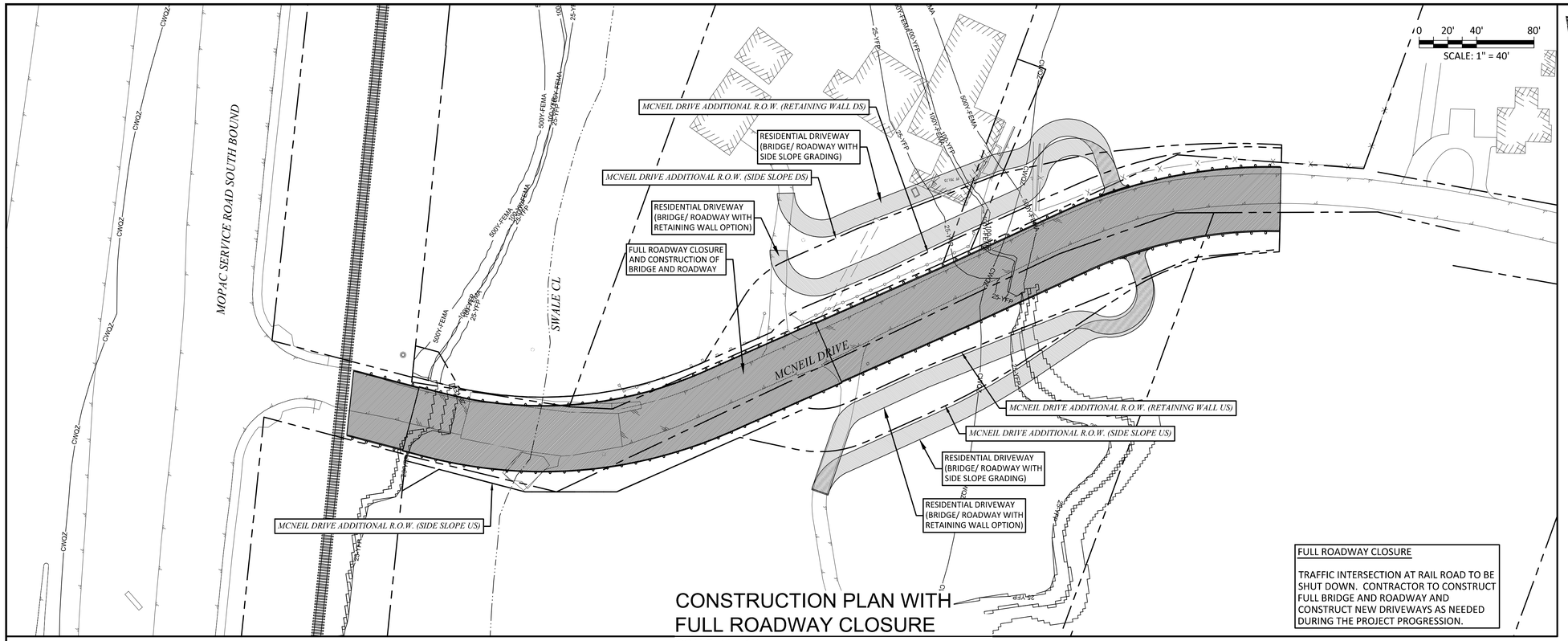
SHEET

FIGURE F-15

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWR\dwg\working_drawings\submitted_files\1570-022-RD-BRIDGE-SIDE-SLOPE-PHASING.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:56
Plot Date/Time: Sep. 25, 18 - 15:17:03



CONSTRUCTION PLAN WITH FULL ROADWAY CLOSURE

SCALE: 1" = 40'

FULL ROADWAY CLOSURE

TRAFFIC INTERSECTION AT RAIL ROAD TO BE SHUT DOWN. CONTRACTOR TO CONSTRUCT FULL BRIDGE AND ROADWAY AND CONSTRUCT NEW DRIVEWAYS AS NEEDED DURING THE PROJECT PROGRESSION.

CONTRACTOR NOTES:

EXISTING UNDERGROUND & OVERHEAD UTILITIES IN VICINITY. CONTRACTOR TO CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR TO CALL 811 FOR UTILITY LOCATES PRIOR TO EXCAVATION. CONTRACTOR TO FIELD VERIFY EXISTING UTILITY LOCATIONS & DEPTH PRIOR TO BEGINNING CONSTRUCTION.

CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.

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FULL BRIDGE AND ROADWAY CONSTRUCTION PLAN

MCNEIL DRIVE CROSSING
AUSTIN, TEXAS

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Scale:	1"=
Designed:	JK
Drawn:	SD
Reviewed:	JK
Date:	9/25/2018

SHEET

FIGURE F-16

OF .

Project No.: 1570-022

Drawing: D:\01-JOBS\1570-022 McNeil Drive LWC\dwg\working_drawings\submitted_files\1570-022-Ro-BRIDGE-SIDE_SLOPE-PHASING.dwg
User: CDOLLERY
Last Modified: Sep. 25, 18 - 14:56
Plot Date/Time: Sep. 25, 18 - 18:17:07

Appendix G

Preliminary Opinions of Probable Project Cost Information

Property Profile

Legend

- Easement Annotation
- Easement Lines
  - UNKNOWN
  - DEDICATED
  - PROPOSED
  - RELEASED
- ☐ TCAD Parcels
- TCAD Parcel ID's

Notes

0.1 0 0.04 0.1 Miles

NAD_1983_StatePlane_Texas_Central_FIPS_4203_Feet

Date Printed:

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Travis CAD

Property Search Results > 379057 JOHNSON BRENT WILLIAM for Year 2018

Tax Year: 2018

Property

Account

Property ID:	379057	Legal Description:	ABS 344 SUR 22 HORNSBY W ABS 312 SUR 60 GARCIA F ACR 5.449
Geographic ID:	0268130102	Zoning:	RR
Type:	Real	Agent Code:	
Property Use Code:			
Property Use Description:			

Protest

Protest Status:	
Informal Date:	
Formal Date:	

Location

Address:	3500 MC NEIL DR TX	Mapsco:	
Neighborhood:	VT540	Map ID:	026711
Neighborhood CD:	VT540		

Owner

Name:	JOHNSON BRENT WILLIAM	Owner ID:	1684490
Mailing Address:	3500 MCNEIL DR AUSTIN , TX 78727-1103	% Ownership:	100.0000000000%
		Exemptions:	HS

Values

(+) Improvement Homesite Value:	+	$186,835	
(+) Improvement Non-Homesite Value:	+	$0	
(+) Land Homesite Value:	+	$463,165	
(+) Land Non-Homesite Value:	+	$0	Ag / Timber Use Value
(+) Agricultural Market Valuation:	+	$0	$0
(+) Timber Market Valuation:	+	$0	$0

(=) Market Value:	=	$650,000	
(–) Ag or Timber Use Value Reduction:	–	$0	

(=) Appraised Value:	=	$650,000	
(–) HS Cap:	–	$0	

(=) Assessed Value:	=	$650,000	

Taxing Jurisdiction

Owner: JOHNSON BRENT WILLIAM
% Ownership: 100.0000000000%
Total Value: $650,000

Entity	Description	Tax Rate	Appraised Value	Taxable Value	Estimated Tax
01	AUSTIN ISD	1.192000	$650,000	$625,000	$7,450.00
02	CITY OF AUSTIN	0.444800	$650,000	$585,000	$2,602.09
03	TRAVIS COUNTY	0.369000	$650,000	$520,000	$1,918.80
0A	TRAVIS CENTRAL APP DIST	0.000000	$650,000	$650,000	$0.00

2J	TRAVIS COUNTY HEALTHCARE DISTRICT	0.107385	$650,000	$520,000	$558.40
68	AUSTIN COMM COLL DIST	0.100800	$650,000	$643,500	$648.65
	Total Tax Rate:	2.213985			
				Taxes w/Current Exemptions:	$13,177.94
				Taxes w/o Exemptions:	$14,390.90

Improvement / Building

Improvement #1: 1 FAM DWELLING **State Code:** A1 **Living Area:** 2646.0 sqft **Value:** $186,835

Type	Description	Class CD	Exterior Wall	Year Built	SQFT
1ST	1st Floor	WW - 5-		1981	2646.0
011	PORCH OPEN 1ST F	* - 5-		1981	65.0
031	GARAGE DET 1ST F	WW - 5-		1981	714.0
095	HVAC RESIDENTIAL	* - *		1981	2646.0
251	BATHROOM	* - *		1981	4.0
512	DECK UNCOVRED	* - 5-		1981	425.0
513	DECK COVERED	* - 5-		1981	216.0
522	FIREPLACE	* - 5-		1981	1.0
591	MASONRY TRIM SF	AVG - *		1981	1550.0

Land

#	Type	Description	Acres	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
1	LAND	Land	5.4490	237358.44	0.00	0.00	$463,165	$0

Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap	Assessed
2019	N/A	N/A	N/A	N/A	N/A	N/A
2018	$186,835	$463,165	0	650,000	$0	$650,000
2017	$186,835	$463,165	0	650,000	$0	$650,000
2016	$278,284	$463,165	0	741,449	$0	$741,449
2015	$263,526	$446,250	0	709,776	$0	$709,776
2014	$259,310	$446,250	0	705,560	$0	$705,560

Deed History - (Last 3 Deed Transactions)

#	Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Deed Number
1	4/28/2016	WD	WARRANTY DEED	MOON CHARLES D & EMMA C LIVING	JOHNSON BRENT WILLIAM			2016066869
2	6/22/1999	SW	SPECIAL WARRANTY DEED	MOON CHAS D & EMMA C	MOON CHARLES D & EMMA C LIVING	00000	00000	1999057489TR
3	1/8/1981				MOON CHAS D & EMMA C	07264	00091	

Questions Please Call (512) 834-9317

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Travis CAD

Property Search Results > 379058 FRICKE HELEN CAROLYN CRIGHTON for Year 2018

Tax Year: 2018

Property

Account

Property ID:	379058	Legal Description:	ABS 344 SUR 22 HORNSBY W ABS 312 SUR 60 GARCIA F ACR 5.45 *TOTAL
Geographic ID:	0268130103	Zoning:	RR
Type:	Real	Agent Code:	
Property Use Code:			
Property Use Description:			

Protest

Protest Status:	
Informal Date:	
Formal Date:	

Location

Address:	MCNEIL RD TX 78727	Mapsco:	
Neighborhood:	FORMERLY VTACR NBHD CODE	Map ID:	026711
Neighborhood CD:	_VTACR		

Owner

Name:	FRICKE HELEN CAROLYN CRIGHTON	Owner ID:	337936
Mailing Address:	TRUSTEE OF THE CAROLYN 13106 BURNET RD AUSTIN , TX 78727	% Ownership:	100.0000000000%
		Exemptions:	

Values

(+) Improvement Homesite Value:	+	$0	
(+) Improvement Non-Homesite Value:	+	$0	
(+) Land Homesite Value:	+	$0	
(+) Land Non-Homesite Value:	+	$299,750	Ag / Timber Use Value
(+) Agricultural Market Valuation:	+	$0	$0
(+) Timber Market Valuation:	+	$0	$0

(=) Market Value:	=	$299,750	
(–) Ag or Timber Use Value Reduction:	–	$0	

(=) Appraised Value:	=	$299,750	
(–) HS Cap:	–	$0	

(=) Assessed Value:	=	$299,750	

Taxing Jurisdiction

Owner: FRICKE HELEN CAROLYN CRIGHTON
% Ownership: 100.0000000000%
Total Value: $299,750

Entity	Description	Tax Rate	Appraised Value	Taxable Value	Estimated Tax
01	AUSTIN ISD	1.192000	$245,795	$245,795	$2,929.88
02	CITY OF AUSTIN	0.444800	$299,750	$299,750	$1,333.29
03	TRAVIS COUNTY	0.369000	$299,750	$299,750	$1,106.07

0A	TRAVIS CENTRAL APP DIST	0.000000	$299,750	$299,750	$0.00	
2J	TRAVIS COUNTY HEALTHCARE DISTRICT	0.107385	$299,750	$299,750	$321.88	
5A	ROUND ROCK ISD	1.304800	$53,955	$53,955	$704.00	
68	AUSTIN COMM COLL DIST	0.100800	$299,750	$299,750	$302.15	
	Total Tax Rate:	3.518785				
				Taxes w/Current Exemptions:	$6,697.27	
				Taxes w/o Exemptions:	$6,697.28	

Improvement / Building

No improvements exist for this property.

Land

#	Type	Description	Acres	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
1	LAND	Land	5.4500	237402.00	0.00	0.00	$299,750	$0

Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap	Assessed
2019	N/A	N/A	N/A	N/A	N/A	N/A
2018	$0	$299,750	0	299,750	$0	$299,750
2017	$0	$299,750	0	299,750	$0	$299,750
2016	$0	$299,750	0	299,750	$0	$299,750
2015	$0	$299,750	0	299,750	$0	$299,750
2014	$0	$299,750	0	299,750	$0	$299,750

Deed History - (Last 3 Deed Transactions)

#	Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Deed Number
1	10/1/2003	WD	WARRANTY DEED	FRICKE HELEN C	FRICKE HELEN CAROLYN CRIGHTON	00000	00000	2003262950TR
2	2/23/1988	PD	PARTITION DEED	FRICKE JAMES R JR	FRICKE HELEN C	10601	00444	
3					FRICKE JAMES R JR	00000	00000	

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Property Search Results > 379085 FRICKE HELEN CAROLYN CRIGHTON for Year 2018

Tax Year: 2018

Property

Account

Property ID:	379085	Legal Description:	ABS 344 SUR 22 HORNSBY W ACR 5.832
Geographic ID:	0268130405	Zoning:	RR
Type:	Real	Agent Code:	
Property Use Code:			
Property Use Description:			

Protest

Protest Status:	
Informal Date:	
Formal Date:	

Location

Address:	MC NEIL DR TX	Mapsco:	
Neighborhood:	FORMERLY VTACR NBHD CODE	Map ID:	026711
Neighborhood CD:	_VTACR		

Owner

Name:	FRICKE HELEN CAROLYN CRIGHTON	Owner ID:	337763
Mailing Address:	TRUSTEE OF THE H CAROLYN 13106 N MOPAC EXPRESSWAY AUSTIN , TX 78727-1901	% Ownership:	100.0000000000%
		Exemptions:	

Values

(+) Improvement Homesite Value:	+	$0	
(+) Improvement Non-Homesite Value:	+	$68,494	
(+) Land Homesite Value:	+	$0	
(+) Land Non-Homesite Value:	+	$320,760	Ag / Timber Use Value
(+) Agricultural Market Valuation:	+	$0	$0
(+) Timber Market Valuation:	+	$0	$0
(=) Market Value:	=	$389,254	
(–) Ag or Timber Use Value Reduction:	–	$0	
(=) Appraised Value:	=	$389,254	
(–) HS Cap:	–	$0	
(=) Assessed Value:	=	$389,254	

Taxing Jurisdiction

Owner: FRICKE HELEN CAROLYN CRIGHTON
% Ownership: 100.0000000000%
Total Value: $389,254

Entity	Description	Tax Rate	Appraised Value	Taxable Value	Estimated Tax
01	AUSTIN ISD	1.192000	$389,254	$389,254	$4,639.91
02	CITY OF AUSTIN	0.444800	$389,254	$389,254	$1,731.40
03	TRAVIS COUNTY	0.369000	$389,254	$389,254	$1,436.35
0A	TRAVIS CENTRAL APP DIST	0.000000	$389,254	$389,254	$0.00
2J	TRAVIS COUNTY HEALTHCARE DISTRICT	0.107385	$389,254	$389,254	$418.00

68	AUSTIN COMM COLL DIST	0.100800	$389,254		$389,254	$392.37
	Total Tax Rate:	2.213985				
				Taxes w/Current Exemptions:		$8,618.03
				Taxes w/o Exemptions:		$8,618.03

Improvement / Building

Improvement #1: Detail Only **State Code:** A1 **Living Area:** 377.0 sqft **Value:** $56,151

Type	Description	Class CD	Exterior Wall	Year Built	SQFT
031	GARAGE DET 1ST F	M - 6		1977	960.0
061	CARPORT ATT 1ST	* - 2		1977	432.0
251	BATHROOM	* - *		1977	1.0
1ST	1st Floor	WW - 4-		1977	377.0
531	OBS FENCE	WAL - *		1977	1.0
541	FENCE COMM LF	C4 - *		1977	3615.0
551	PAVED AREA	AI - *		1977	16265.0
581	STORAGE ATT	WM - 1		1977	2370.0

Improvement #2: Detail Only **State Code:** A1 **Living Area:** sqft **Value:** $12,343

Type	Description	Class CD	Exterior Wall	Year Built	SQFT
021	PORCH CLOS 1ST F	CUC - 2+		1972	720.0
021	PORCH CLOS 1ST F	CUC - 2+		1972	1053.0
051	CARPORT DET 1ST	* - 2		1972	90.0

Land

#	Type	Description	Acres	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
1	LAND	Land	5.8320	254041.92	0.00	0.00	$320,760	$0

Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap	Assessed
2019	N/A	N/A	N/A	N/A	N/A	N/A
2018	$68,494	$320,760	0	389,254	$0	$389,254
2017	$68,494	$320,760	0	389,254	$0	$389,254
2016	$68,494	$320,760	0	389,254	$0	$389,254
2015	$68,494	$320,760	0	389,254	$0	$389,254
2014	$68,494	$320,760	0	389,254	$0	$389,254

Deed History - (Last 3 Deed Transactions)

#	Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Deed Number
1	10/1/2003	WD	WARRANTY DEED	FRICKE HELEN C	FRICKE HELEN CAROLYN CRIGHTON	00000	00000	2003262949TR
2	2/23/1988	PD	PARTITION DEED	FRICKE JAMES R	FRICKE HELEN C	10601	00444	
3		WD	WARRANTY DEED		FRICKE JAMES R	04653	01503	

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Property Search Results > 379087 ALLMAN DAVID ANDREW for Year 2018

Tax Year: 2018

Property

Account

Property ID:	379087	Legal Description:	ABS 312 SUR 60 GARCIA F ABS 344 SUR 22 HORNSBY W ACR 7.5406
Geographic ID:	0268130406	Zoning:	RR
Type:	Real	Agent Code:	
Property Use Code:			
Property Use Description:			

Protest

Protest Status:	
Informal Date:	
Formal Date:	

Location

Address:	3501 MC NEIL DR TX 78727	Mapsco:	
Neighborhood:	FORMERLY VTACR NBHD CODE	Map ID:	026711
Neighborhood CD:	_VTACR		

Owner

Name:	ALLMAN DAVID ANDREW	Owner ID:	1546068
Mailing Address:	3501 MCNEIL DR	% Ownership:	100.0000000000%
	AUSTIN , TX 78727-1104		
		Exemptions:	HS

Values

(+) Improvement Homesite Value:	+	$303,871	
(+) Improvement Non-Homesite Value:	+	$0	
(+) Land Homesite Value:	+	$153,742	
(+) Land Non-Homesite Value:	+	$0	Ag / Timber Use Value
(+) Agricultural Market Valuation:	+	$0	$0
(+) Timber Market Valuation:	+	$0	$0
(=) Market Value:	=	$457,613	
(–) Ag or Timber Use Value Reduction:	–	$0	
(=) Appraised Value:	=	$457,613	
(–) HS Cap:	–	$0	
(=) Assessed Value:	=	$457,613	

Taxing Jurisdiction

Owner: ALLMAN DAVID ANDREW
% Ownership: 100.0000000000%
Total Value: $457,613

Entity	Description	Tax Rate	Appraised Value	Taxable Value	Estimated Tax
01	AUSTIN ISD	1.192000	$457,613	$432,613	$5,156.74
02	CITY OF AUSTIN	0.444800	$457,613	$411,852	$1,831.91
03	TRAVIS COUNTY	0.369000	$457,613	$366,090	$1,350.87
0A	TRAVIS CENTRAL APP DIST	0.000000	$457,613	$457,613	$0.00

2J	TRAVIS COUNTY HEALTHCARE DISTRICT	0.107385	$457,613	$366,090	$393.13
68	AUSTIN COMM COLL DIST	0.100800	$457,613	$452,613	$456.23
	Total Tax Rate:	2.213985			
				Taxes w/Current Exemptions:	$9,188.88
				Taxes w/o Exemptions:	$10,131.48

Improvement / Building

Improvement #1: 1 FAM DWELLING **State Code:** A1 **Living Area:** 1452.0 sqft **Value:** $183,776

Type	Description	Class CD	Exterior Wall	Year Built	SQFT
1ST	1st Floor	WV - 4+		1956	276.0
011	PORCH OPEN 1ST F	* - 4+		1956	250.0
031	GARAGE DET 1ST F	WV - 4+		1956	900.0
054	CARPORT DET CLAS	* - 4+		1956	600.0
251	BATHROOM	* - *		1956	1.5
436	FENCE MASON SF	AVG - *		1956	400.0
522	FIREPLACE	* - 4+		1956	1.0
1ST	1st Floor	WV - 4+		1956	1176.0
SO	Sketch Only	SO - *			460.0

Improvement #2: WAREHOUSE <20000 **State Code:** E1 **Living Area:** 5952.0 sqft **Value:** $120,095

Type	Description	Class CD	Exterior Wall	Year Built	SQFT
1ST	1st Floor	C - 3		1972	4302.0
MEZZ	Mezzanine	C - 3		1972	1650.0
091	HVAC COMMRCL TON	* - *		1972	2.0
413	STAIRWAY EXT	G - *		1972	1.0
551	PAVED AREA	AI - *		1972	1800.0
SO	Sketch Only	SO - *			1650.0

Land

#	Type	Description	Acres	Sqft	Eff Front	Eff Depth	Market Value	Prod. Value
1	LAND	Land	3.6406	158584.54	0.00	0.00	$100,117	$0
2	LAND	Land	3.9000	169884.00	0.00	0.00	$53,625	$0

Roll Value History

Year	Improvements	Land Market	Ag Valuation	Appraised	HS Cap	Assessed
2019	N/A	N/A	N/A	N/A	N/A	N/A
2018	$303,871	$153,742	0	457,613	$0	$457,613
2017	$303,871	$153,742	0	457,613	$0	$457,613
2016	$303,871	$153,742	0	457,613	$0	$457,613
2015	$303,871	$153,742	0	457,613	$0	$457,613
2014	$303,871	$153,742	0	457,613	$0	$457,613

Deed History - (Last 3 Deed Transactions)

#	Deed Date	Type	Description	Grantor	Grantee	Volume	Page	Deed Number
1	7/2/2012	GF	GIFT DEED	ALLMAN DAVID ANDREW	ALLMAN DAVID ANDREW			2012105907TR
2	7/2/2012	MS	MISCELLANEOUS	ALLMAN ANNA MERLENE	ALLMAN ANNA MERLENE			2012105906TR
3	2/2/2012	GF	GIFT DEED	ALLMAN ANNA MERLENE	ALLMAN DAVID ANDREW			2012017714TR

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Table G-1

Summary of Preliminary Opinion of Probable Project Costs

Bridge Type	Detention (Yes/No)	Fill Retaining Wall	Fill Slopes	Closed to Thru Road	Open to Traffic	Construction Subtotal	30% Contengencies	Total Construction Cost	Tree Mitigation	Land Acquisition	Engineering Cost (18%)	City Administrative Cost (12%)	Total Cost
Clear Span	No	X		X		$3,059,899	$917,970	$3,977,869	$140,470	$319,348	$716,016	$477,344	**$5,631,047**
Clear Span	No	X			X	$3,766,076	$1,129,823	$4,895,899	$140,470	$319,348	$881,262	$587,508	**$6,824,486**
Clear Span	No		X	X		$3,023,753	$907,126	$3,930,878	$186,255	$414,135	$707,558	$471,705	**$5,710,532**
Clear Span	No		X		X	$3,926,800	$1,178,040	$5,104,840	$186,255	$414,135	$918,871	$612,581	**$7,236,682**
Clear Span	Yes	X		X		$2,922,842	$876,853	$3,799,695	$140,470	$319,348	$683,945	$455,963	**$5,399,421**
Clear Span	Yes	X			X	$3,678,588	$1,103,576	$4,782,164	$140,470	$319,348	$860,790	$573,860	**$6,676,632**
Clear Span	Yes		X	X		$2,929,860	$878,958	$3,808,817	$202,205	$433,683	$685,587	$457,058	**$5,587,351**
Clear Span	Yes		X		X	$3,753,846	$1,126,154	$4,880,000	$202,205	$433,683	$878,400	$585,600	**$6,979,888**
Multiple Arch	No	X		X		$5,052,382	$1,515,715	$6,568,097	$140,470	$319,348	$1,182,257	$788,172	**$8,998,344**

Table G-2
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
110S-B	353.86	360	CY	Street Excavation, Plan Quantity	$ 38.00	$ 13,680.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR			CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ -
130S-A	1,468.55	1,480	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 59,200.00
130S-T		480	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 14,880.00
132S-A	2,165.76	2,170	CY	Embankment	$ 24.00	$ 52,080.00
201S-A	2,123.17	2,130	SY	Subgrade Preparation	$ 6.00	$ 12,780.00
210S-A	1,058.27	1,070	CY	Flexible Base	$ 50.00	$ 53,500.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	744.44	750	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 20,250.00
340S-B-C3	1,868.39	1,870	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 61,710.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	30	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 24,900.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	19.92	22	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 19,140.00
403S-CY-S-BENT	42.91	45	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 41,400.00
403S-SY-DKSLAB	13,902.00	13,910	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 904,150.00
SP414S-W	5,450.81	5,460	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 327,600.00
SP414S-SF	1,499.79	1,500	SF	Reinforcement	$ 50.00	$ 75,000.00
420S-A-36IN	480.00	480	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 136,800.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		60	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 2,580.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	915.00	915	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 1,830.00
510-AW2C		75	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 6,975.00
510-AW-6-350		60	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 6,960.00
510-AW-8-350		720	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 108,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	1.95	1.95	TON	Ductile Iron Fittings	$ 9,500.00	$ 18,525.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	983.18	990	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 57,420.00

Table G-2
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-2
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
591S-B	527.91	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	175.97	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	5.56	6	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 2,580.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 2,325.00
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE			SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ -
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		2	EA	Stabilized Construction Entrance	$ 1,700.00	$ 3,400.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 146,000.00	$ 146,000.00
700S-TM2			LS	Total Mobilization Payment, Second Mobilization/Demobilization		$ -
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	764.34	770	LF	Metal Beam Guard Railing	$ 68.00	$ 52,360.00
704-T		4	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 3,760.00
705			LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ -
706S	600.00	600	LF	Bridge and Culvert Railing, Guardrail Type TxDOT C101	$ 122.00	$ 73,200.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD	182.50	190	CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ 26,220.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ -
824S		6	EA	Traffic Signs	$ 410.00	$ 2,460.00
831S-1C		7	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 40,600.00
839S		7	EA	Power Pole	$ 11,000.00	$ 77,000.00
863S	266.65	270	EA	Reflectorized Pavement Marker	$ 17.00	$ 4,590.00
870S			LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ -
871S-A4SW	1,972.51	1,980	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,752.00
871S-A24SW		25	LF	Thickness, Solid White in Color	$ 19.00	$ 475.00
871S-D		1	EA	in Thickness, _ in Color	$ 950.00	$ 950.00

SUBTOTAL	**$ 3,059,899.00**
30% CONTINGENCIES	$ 917,969.70
TOTAL CONSTRUCTION	**$ 3,977,868.70**

Table G-2
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-3
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
110S-B	985.50	990	CY	Street Excavation, Plan Quantity	$ 38.00	$ 37,620.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR	106.67	110	CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ 8,140.00
130S-A	836.91	840	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 33,600.00
130S-T		480	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 14,880.00
132S-A	2,165.76	2,170	CY	Embankment	$ 24.00	$ 52,080.00
201S-A	5,913.00	5,920	SY	Subgrade Preparation	$ 6.00	$ 35,520.00
210S-A	2,195.22	2,200	CY	Flexible Base	$ 50.00	$ 110,000.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	411.11	420	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 11,340.00
340S-B-C3	3,839.10	3,850	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 127,050.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	30	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 24,900.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	19.92	22	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 19,140.00
403S-CY-S-BENT	42.91	45	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 41,400.00
403S-SY-DKSLAB	13,902.00	13,910	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 904,150.00
SP414S-W	5,674.81	5,680	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 340,800.00
SP414S-SF	1,576.79	1,580	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 79,000.00
420S-A-36IN	480.00	480	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 136,800.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		65	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 2,795.00
505S-B24		25	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	915.00	915	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 1,830.00
510-AW2C		70	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 6,510.00
510-AW-6-350		65	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 7,540.00
510-AW-8-350		720	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 108,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	1.96	1.96	TON	Ductile Iron Fittings	$ 9,500.00	$ 18,620.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	1,365.35	1,370	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 79,460.00
559S-4x4	100.00	100	LF	Precast Concrete Box Culverts, 4 Ft. x 4 Ft.	$ 606.00	$ 60,600.00
591S-B	527.91	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	175.97	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	9.26	10	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 4,300.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 2,325.00

Table G-3
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Open Roadway
Preliminary Opinion of Probable Construction Cost

Table G-3
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE	2,354.69	2,360	SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ 94,400.00
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		4	EA	Stabilized Construction Entrance	$ 1,700.00	$ 6,800.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 176,000.00	$ 176,000.00
700S-TM2		1	LS	Total Mobilization Payment, Second Mobilization/Demobilization	$ 88,000.00	$ 88,000.00
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	1,146.51	1,150	LF	Metal Beam Guard Railing	$ 68.00	$ 78,200.00
704-T		6	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 5,640.00
705	682.17	690	LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ 11,040.00
706S	960.00	960	LF	Bridge and Culvert Railing, Guardrail Type TxDOT C101	$ 122.00	$ 117,120.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ -
803S-CD	273.75	280	CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ 170,800.00
SP803S-CTB	300.00	300	LF	Barricades, Portable Safety Barrier, TxDOT Precast Barrier (Type 1)(F-Shape)	$ 30.00	$ 9,000.00
824S		12	EA	Traffic Signs	$ 410.00	$ 4,920.00
831S-1C		7	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 40,600.00
839S		7	EA	Power Pole	$ 11,000.00	$ 77,000.00
863S	471.30	480	EA	Reflectorized Pavement Marker	$ 17.00	$ 8,160.00
870S	1,327.34	1,330	LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ 2,527.00
871S-A4SW	1,972.51	1,980	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,752.00
871S-A24SW	50.00	50	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 950.00
871S-D		2	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 1,900.00

SUBTOTAL	**$**	**3,766,076.00**
30% CONTINGENCIES	$	1,129,822.80
TOTAL CONSTRUCTION	**$**	**4,895,898.80**

Table G-3
Clear Span Bridge Option - Undetained Flows, Embankment Retaining Wall, Open Roadway
Preliminary Opinion of Probable Construction Cost

Table G-4
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
SP102S		5,284	SF	Remove Residential Structure	$ 2.00	$ 10,568.00
110S-B	634.50	640	CY	Street Excavation, Plan Quantity	$ 38.00	$ 24,320.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR			CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ -
130S-A	4,072.15	4,080	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 163,200.00
130S-T	624.89	630	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 19,530.00
132S-A	5,050.00	5,050	CY	Embankment	$ 24.00	$ 121,200.00
201S-A	3,807.00	3,810	SY	Subgrade Preparation	$ 6.00	$ 22,860.00
210S-A	1,061.97	1,070	CY	Flexible Base	$ 50.00	$ 53,500.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	766.67	770	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 20,790.00
340S-B-C3	1,868.39	1,880	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 62,040.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	30	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 24,900.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	19.92	22	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 19,140.00
403S-CY-S-BENT	42.91	44	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 40,480.00
403S-SY-DKSLAB	13,902.00	13,910	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 904,150.00
SP414S-W	1,731.31	1,740	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 104,400.00
SP414S-SF	439.29	440	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 22,000.00
420S-A-36IN	480.00	480	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 136,800.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		132	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 5,676.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	1,000.00	1,000	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 2,000.00
510-AW2C		140	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 13,020.00
510-AW-6-350		60	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 6,960.00
510-AW-8-350		740	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 111,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	2.00	2.00	TON	Ductile Iron Fittings	$ 9,500.00	$ 19,000.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	381.86	390	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 22,620.00
591S-B	527.91	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	175.97	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	5.56	6	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 2,580.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A	1,048.33	1,050	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 1,627.50

Table G-4
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probably Construction Cost

Table G-4
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
604S-G6	136.85	140	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 1,750.00
604S-I	3,367.22	3,370	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 17,187.00
605S-A1	1,818.89	1,820	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 9,100.00
605S-A2	1,305.33	1,310	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,480.00
607S-C-MSE			SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ -
609S-C	2,318.89	2,320	SY	Native Grassland Seeding and Planting	$ 2.50	$ 5,800.00
610S-A		400	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 1,880.00
610S-R2-9		70	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 26,600.00
610S-R10-18		34	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 20,400.00
610S-R19-23		8	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 5,680.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		2	EA	Stabilized Construction Entrance	$ 1,700.00	$ 3,400.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 144,000.00	$ 144,000.00
700S-TM2			LS	Total Mobilization Payment, Second Mobilization/Demobilization		$ -
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	764.34	770	LF	Metal Beam Guard Railing	$ 68.00	$ 52,360.00
704-T		4	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 3,760.00
705			LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ -
706S	600.00	600	LF	Bridge and Culvert Railing, Guardrail Type TxDOT C101	$ 122.00	$ 73,200.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD	182.50	190	CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ 26,220.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ -
824S		6	EA	Traffic Signs	$ 410.00	$ 2,460.00
831S-1C		9	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 52,200.00
839S		9	EA	Power Pole	$ 11,000.00	$ 99,000.00
863S	266.65	270	EA	Reflectorized Pavement Marker	$ 17.00	$ 4,590.00
870S			LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ -
871S-A4SW	1,972.51	1,980	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,752.00
871S-A24SW		25	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 475.00
871S-D		1	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 950.00

SUBTOTAL	**$ 3,023,752.50**
30% CONTINGENCIES	$ 907,125.75
TOTAL CONSTRUCTION	**$ 3,930,878.25**

Table G-4
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probably Construction Cost

Table G-5
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
SP102S		5284	SF	Remove Residential Structure	$ 2.00	$ 10,568.00
110S-B	946.54	950	CY	Street Excavation, Plan Quantity	$ 38.00	$ 36,100.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR	106.67	110	CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ 8,140.00
130S-A	5,750.91	5,760	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 230,400.00
130S-T	624.89	630	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 19,530.00
132S-A	7,040.80	7,050	CY	Embankment	$ 24.00	$ 169,200.00
201S-A	5,679.22	5,690	SY	Subgrade Preparation	$ 6.00	$ 34,140.00
210S-A	2,198.92	2,200	CY	Flexible Base	$ 50.00	$ 110,000.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	411.11	420	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 11,340.00
340S-B-C3	3,839.10	3,850	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 127,050.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	30	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 24,900.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	19.92	22	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 19,140.00
403S-CY-S-BENT	42.91	44	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 40,480.00
403S-SY-DKSLAB	13,902.00	13,910	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 904,150.00
SP414S-W	1,955.31	1,960	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 117,600.00
SP414S-SF	1,576.79	1,580	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 79,000.00
420S-A-36IN	480.00	480	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 136,800.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		132	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 5,676.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	1,010.00	1,010	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 2,020.00
510-AW2C		140	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 13,020.00
510-AW-6-350		70	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 8,120.00
510-AW-8-350		740	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 111,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	2.03	2.03	TON	Ductile Iron Fittings	$ 9,500.00	$ 19,285.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00

Table G-5
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Table G-5
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
551	1,365.35	1,370	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 79,460.00
559S-4x4	100.00	100	LF	Precast Concrete Box Culverts, 4 Ft. x 4 Ft.	$ 606.00	$ 60,600.00
591S-B	527.91	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	175.97	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	9.26	10	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 4,300.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 2,325.00
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE	2,354.69	2,360	SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ 94,400.00
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		4	EA	Stabilized Construction Entrance	$ 1,700.00	$ 6,800.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 183,000.00	$ 183,000.00
700S-TM2		1	LS	Total Mobilization Payment, Second Mobilization/Demobilization	$ 91,500.00	$ 91,500.00
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	1,146.51	1,160	LF	Metal Beam Guard Railing	$ 68.00	$ 78,880.00
704-T		6	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 5,640.00
705	682.17	690	LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ 11,040.00
706S	960.00	960	LF	Bridge and Culvert Railing, Guardrail Type TxDOT C101	$ 122.00	$ 117,120.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ -
803S-CD	273.75	280	CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ 170,800.00
SP803S-CTB	300.00	300	LF	Barricades, Portable Safety Barrier, TxDOT Precast Barrier (Type 1)(F-Shape)	$ 30.00	$ 9,000.00
824S		12	EA	Traffic Signs	$ 410.00	$ 4,920.00
831S-1C		9	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 52,200.00
839S		9	EA	Power Pole	$ 11,000.00	$ 99,000.00
863S	471.30	480	EA	Reflectorized Pavement Marker	$ 17.00	$ 8,160.00
870S	1,327.34	1,330	LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ 2,527.00
871S-A4SW	1,972.51	1,980	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,752.00
871S-A24SW	50.00	50	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 950.00
871S-D		2	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 1,900.00

SUBTOTAL	**$**	**3,926,800.00**
30% CONTINGENCIES	$	1,178,040.00
TOTAL CONSTRUCTION	**$**	**5,104,840.00**

Table G-5
Clear Span Bridge Option - Undetained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Table G-6
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
110S-B	418.68	420	CY	Street Excavation, Plan Quantity	$ 38.00	$ 15,960.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR			CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ -
130S-A	1,817.25	1,820	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 72,800.00
130S-T		480	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 14,880.00
132S-A	2,579.28	2,590	CY	Embankment	$ 24.00	$ 62,160.00
201S-A	2,512.06	2,520	SY	Subgrade Preparation	$ 6.00	$ 15,120.00
210S-A	1,229.38	1,240	CY	Flexible Base	$ 50.00	$ 62,000.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	744.44	750	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 20,250.00
340S-B-C3	2,210.61	2,220	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 73,260.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	32	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 26,560.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	14.94	17	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 14,790.00
403S-CY-S-BENT	32.18	35	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 32,200.00
403S-SY-DKSLAB	10,658.20	10,670	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 693,550.00
SP414S-W	6,325.81	6,330	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 379,800.00
SP414S-SF	1,744.79	1,750	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 87,500.00
420S-A-36IN	400.00	400	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 114,000.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		60	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 2,580.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	925.00	925	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 1,850.00
510-AW2C		75	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 6,975.00
510-AW-6-350		70	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 8,120.00
510-AW-8-350		720	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 108,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	1.98	1.98	TON	Ductile Iron Fittings	$ 9,500.00	$ 18,810.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	1,123.18	1,130	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 65,540.00

Table G-6
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-6
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
591S-B	523.55	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	174.52	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	5.56	6	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 2,580.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, Mulch	$ 1.55	$ 2,325.00
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE			SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ -
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		2	EA	Stabilized Construction Entrance	$ 1,700.00	$ 3,400.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 140,000.00	$ 140,000.00
700S-TM2			LS	Total Mobilization Payment, Second Mobilization/Demobilization		$ -
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	904.34	910	LF	Metal Beam Guard Railing	$ 68.00	$ 61,880.00
704-T		4	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 3,760.00
705			LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ -
706S	460.00	460	LF	Bridge and Culvert Railing, Type Combination Guardrail Type TxDOT C101	$ 122.00	$ 56,120.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD	182.50	190	CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ 26,220.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ -
824S		6	EA	Traffic Signs	$ 410.00	$ 2,460.00
831S-1C		7	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 40,600.00
839S		7	EA	Power Pole	$ 11,000.00	$ 77,000.00
863S	252.65	260	EA	Reflectorized Pavement Marker	$ 17.00	$ 4,420.00
870S			LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ -
871S-A4SW	1,692.51	1,700	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,080.00
871S-A24SW		25	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 475.00
871S-D		1	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 950.00

SUBTOTAL	**$ 2,922,842.00**
30% CONTINGENCIES	$ 876,852.60
TOTAL CONSTRUCTION	**$ 3,799,694.60**

Table G-6
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-7
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
110S-B	1,050.31	1,060	CY	Street Excavation, Plan Quantity	$ 38.00	$ 40,280.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR	106.67	110	CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ 8,140.00
130S-A	1,185.62	1,190	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 47,600.00
130S-T		480	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 14,880.00
132S-A	2,579.28	2,590	CY	Embankment	$ 24.00	$ 62,160.00
201S-A	6,301.89	6,310	SY	Subgrade Preparation	$ 6.00	$ 37,860.00
210S-A	2,366.33	2,370	CY	Flexible Base	$ 50.00	$ 118,500.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	411.11	420	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 11,340.00
340S-B-C3	4,181.32	4,190	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 138,270.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	32	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 26,560.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	14.94	17	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 14,790.00
403S-CY-S-BENT	32.18	35	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 32,200.00
403S-SY-DKSLAB	10,658.20	10,670	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 693,550.00
SP414S-W	6,549.81	6,560	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 393,600.00
SP414S-SF	1,821.79	1,830	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 91,500.00
420S-A-36IN	400.00	400	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 114,000.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		60	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 2,580.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	925.00	925	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 1,850.00
510-AW2C		75	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 6,975.00
510-AW-6-350		70	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 8,120.00
510-AW-8-350		720	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 108,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	1.98	1.98	TON	Ductile Iron Fittings	$ 9,500.00	$ 18,810.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	1,575.35	1,580	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 91,640.00
559S-4x4	100.00	100	LF	Precast Concrete Box Culverts, 4 Ft. x 4 Ft.	$ 606.00	$ 60,600.00

Table G-7
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
591S-B	523.55	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	174.52	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	9.26	10	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 4,300.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 2,325.00
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE	2,792.19	2,800	SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ 112,000.00
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		4	EA	Stabilized Construction Entrance	$ 1,700.00	$ 6,800.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 172,000.00	$ 172,000.00
700S-TM2		1	LS	Total Mobilization Payment, Second Mobilization/Demobilization	$ 86,000.00	$ 86,000.00
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	1,356.51	1,360	LF	Metal Beam Guard Railing	$ 68.00	$ 92,480.00
704-T		6	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 5,640.00
705	682.17	690	LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ 11,040.00
706S	750.00	750	LF	Bridge and Culvert Railing, Type Combination Guardrail Type TxDOT C101	$ 122.00	$ 91,500.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ -
803S-CD	273.75	280	CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ 170,800.00
SP803S-CTB	230.00	230	LF	Barricades, Portable Safety Barrier, TxDOT Precast Barrier (Type 1)(F-Shape)	$ 30.00	$ 6,900.00
824S		12	EA	Traffic Signs	$ 410.00	$ 4,920.00
831S-1C		9	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 52,200.00
839S		9	EA	Power Pole	$ 11,000.00	$ 99,000.00
863S	457.30	460	EA	Reflectorized Pavement Marker	$ 17.00	$ 7,820.00
870S	1,187.34	1,190	LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ 2,261.00
871S-A4SW	1,692.51	1,700	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,080.00
871S-A24SW	50.00	50	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 950.00
871S-D		2	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 1,900.00

SUBTOTAL	**$ 3,678,588.00**
30% CONTINGENCIES	$ 1,103,576.40
TOTAL CONSTRUCTION	**$ 4,782,164.40**

Table G-7
Clear Span Bridge Option - Detained Flows, Embankment Retaining Wall, Open Road
Preliminary Opinion of Probable Construction Cost

Table G-8
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
SP102S		5,284	SF	Remove Residential Structure	$ 2.00	$ 10,568.00
110S-B	792.26	800	CY	Street Excavation, Plan Quantity	$ 38.00	$ 30,400.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR			CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ -
130S-A	5,933.70	6,000	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 240,000.00
130S-T	745.45	750	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 23,250.00
132S-A	7,069.31	7,100	CY	Embankment	$ 24.00	$ 170,400.00
201S-A	4,753.55	4,760	SY	Subgrade Preparation	$ 6.00	$ 28,560.00
210S-A	1,233.08	1,240	CY	Flexible Base	$ 50.00	$ 62,000.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	766.67	770	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 20,790.00
340S-B-C3	2,210.61	2,220	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 73,260.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	32	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 26,560.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	14.94	17	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 14,790.00
403S-CY-S-BENT	32.18	35	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 32,200.00
403S-SY-DKSLAB	10,658.20	10,660	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 692,900.00
SP414S-W	1,731.31	1,740	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 104,400.00
SP414S-SF	439.29	450	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 22,500.00
420S-A-36IN	400.00	400	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 114,000.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		140	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 6,020.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	1,010.00	1,010	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 2,020.00
510-AW2C		140	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 13,020.00
510-AW-6-350		70	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 8,120.00
510-AW-8-350		740	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 111,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	2.03	2.03	TON	Ductile Iron Fittings	$ 9,500.00	$ 19,285.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	381.86	390	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 22,620.00
591S-B	523.55	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	174.52	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	5.56	6	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 2,580.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00

Table G-8
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-8
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
604S-A	1,048.33	1,050	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 1,627.50
604S-G6	136.85	140	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 1,750.00
604S-I	3,367.22	3,370	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 17,187.00
605S-A1	1,818.89	1,820	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 9,100.00
605S-A2	1,305.33	1,310	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,480.00
607S-C-MSE			SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ -
609S-C	2,318.89	2,320	SY	Native Grassland Seeding and Planting	$ 2.50	$ 5,800.00
610S-A		400	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 1,880.00
610S-R2-9		70	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 26,600.00
610S-R10-18		34	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 20,400.00
610S-R19-23		8	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 5,680.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		2	EA	Stabilized Construction Entrance	$ 1,700.00	$ 3,400.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 140,000.00	$ 140,000.00
700S-TM2			LS	Total Mobilization Payment, Second Mobilization/Demobilization		$ -
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	904.34	910	LF	Metal Beam Guard Railing	$ 68.00	$ 61,880.00
704-T		4	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 3,760.00
705			LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ -
706S	460.00	460	LF	Bridge and Culvert Railing, Type Combination Guardrail Type TxDOT C101	$ 122.00	$ 56,120.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD	182.50	190	CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ 26,220.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ -
824S		6	EA	Traffic Signs	$ 410.00	$ 2,460.00
831S-1C		9	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 52,200.00
839S		9	EA	Power Pole	$ 11,000.00	$ 99,000.00
863S	252.65	260	EA	Reflectorized Pavement Marker	$ 17.00	$ 4,420.00
870S			LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ -
871S-A4SW	1,692.51	1,700	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,080.00
871S-A24SW		25	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 475.00
871S-D		1	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 950.00

SUBTOTAL	**$**	**2,929,859.50**
30% CONTINGENCIES	$	878,957.85
TOTAL CONSTRUCTION	**$**	**3,808,817.35**

Table G-8
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-9
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
SP102S		5,284	SF	Remove Residential Structure	$ 2.00	$ 10,568.00
110S-B	1,169.11	1,170	CY	Street Excavation, Plan Quantity	$ 38.00	$ 44,460.00
SP120S-BS	343.35	350	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 13,650.00
SP120S-BR	106.67	110	CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ 8,140.00
130S-A	5,941.86	5,950	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 238,000.00
130S-T	745.45	750	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 23,250.00
132S-A	7,454.31	7,460	CY	Embankment	$ 24.00	$ 179,040.00
201S-A	7,014.66	7,020	SY	Subgrade Preparation	$ 6.00	$ 42,120.00
210S-A	2,370.03	2,370	CY	Flexible Base	$ 50.00	$ 118,500.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	411.11	420	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 11,340.00
340S-B-C3	4,181.32	4,190	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 138,270.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT	27.96	32	CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ 26,560.00
403S-CY-C-APSLAB	74.15	76	CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ 34,960.00
403S-CY-S-COLUMN	14.94	17	CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ 14,790.00
403S-CY-S-BENT	32.18	35	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 32,200.00
403S-SY-DKSLAB	10,658.20	10,660	SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ 692,900.00
SP414S-W	1,955.31	1,960	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 117,600.00
SP414S-SF	1,821.79	1,830	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 91,500.00
420S-A-36IN	400.00	400	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 114,000.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		140	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 6,020.00
505S-B24		25	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 3,750.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
509S-1	1,010.00	1,010	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 2,020.00
510-AW2C		140	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 13,020.00
510-AW-6-350		70	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 8,120.00
510-AW-8-350		740	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 111,000.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	2.03	2.03	TON	Ductile Iron Fittings	$ 9,500.00	$ 19,285.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		2	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 3,600.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	1,575.35	1,580	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 91,640.00
559S-4x4	100.00	100	LF	Precast Concrete Box Culverts, 4 Ft. x 4 Ft.	$ 606.00	$ 60,600.00
591S-B	523.55	530	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 83,740.00
SP591S-BED	174.52	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	9.26	10	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 4,300.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00

Table G-9
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Table G-9
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 2,325.00
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE	2,792.19	2,800	SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ 112,000.00
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	110	LF	Rock Berm	$ 38.00	$ 4,180.00
641S		4	EA	Stabilized Construction Entrance	$ 1,700.00	$ 6,800.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 175,000.00	$ 175,000.00
700S-TM2		1	LS	Total Mobilization Payment, Second Mobilization/Demobilization	$ 87,500.00	$ 87,500.00
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	1,356.51	1,360	LF	Metal Beam Guard Railing	$ 68.00	$ 92,480.00
704-T		6	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 5,640.00
705	682.17	690	LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ 11,040.00
706S	750.00	750	LF	Bridge and Culvert Railing, Guardrail Type TxDOT C101	$ 122.00	$ 91,500.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ -
803S-CD	273.75	280	CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ 170,800.00
SP803S-CTB	230.00	230	LF	Barricades, Portable Safety Barrier, TxDOT Precast Barrier (Type 1)(F-Shape)	$ 30.00	$ 6,900.00
824S		12	EA	Traffic Signs	$ 410.00	$ 4,920.00
831S-1C		9	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 52,200.00
839S		9	EA	Power Pole	$ 11,000.00	$ 99,000.00
863S	457.30	460	EA	Reflectorized Pavement Marker	$ 17.00	$ 7,820.00
870S	1,187.34	1,190	LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ 2,261.00
871S-A4SW	1,692.51	1,700	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,080.00
871S-A24SW	50.00	50	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 950.00
871S-D		2	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 1,900.00

SUBTOTAL	**$**	**3,753,846.00**
30% CONTINGENCIES	$	1,126,153.80
TOTAL CONSTRUCTION	**$**	**4,879,999.80**

Table G-9
Clear Span Bridge Option - Detained Flows, Embankment Fill Slopes, Open Roadway
Preliminary Opinion of Probable Construction Cost

Table G-10
Multiple Arch Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
101S-B	6.82	7	100 FT STA	Preparing Right of Way	$ 2,600.00	$ 18,200.00
102S-A		3.122	AC	Clearing and Grubbing	$ 6,000.00	$ 18,732.00
110S-B	631.64	640	CY	Street Excavation, Plan Quantity	$ 38.00	$ 24,320.00
SP120S-BS	2,134.33	2,140	CY	Channel Excavation, Plan Quantity, Soil	$ 39.00	$ 83,460.00
SP120S-BR	2,112.82	2,120	CY	Channel Excavation, Plan Quantity, Rock	$ 74.00	$ 156,880.00
130S-A	2,540.54	2,550	CY	Class A (Select Borrow), Plan Quantity	$ 40.00	$ 102,000.00
130S-T		480	CY	Class C (Topsoil), Plan Quantity	$ 31.00	$ 14,880.00
132S-A	5,306.50	5,310	CY	Embankment	$ 24.00	$ 127,440.00
201S-A	3,789.83	3,800	SY	Subgrade Preparation	$ 6.00	$ 22,800.00
210S-A	1,791.60	1,800	CY	Flexible Base	$ 50.00	$ 90,000.00
315S-A	55.56	60	SY	Surface Milling	$ 42.00	$ 2,520.00
340S-B-C2	744.44	750	SY	Hot Mix Asphaltic Concrete Pavement, 2 Inches, Type C	$ 27.00	$ 20,250.00
340S-B-C3	3,335.05	3,340	SY	Hot Mix Asphaltic Concrete Pavement, 3 Inches, Type C	$ 33.00	$ 110,220.00
SP401S-I		1	LS	Cofferdams and Site Dewatering	$ 43,000.00	$ 43,000.00
403S-CY-C-ABUT			CY	Class "C" Concrete (Bridge Abutment)	$ 830.00	$ -
403S-CY-C-APSLAB			CY	Class "C" Concrete (Bridge Approach Slab)	$ 460.00	$ -
403S-CY-S-COLUMN			CY	Class "S" Concrete (Bridge Column, 30" Dia.)	$ 870.00	$ -
403S-CY-S-BENT	203.70	210	CY	Class "S" Concrete (Bridge Bent Cap)	$ 920.00	$ 193,200.00
403S-SY-DKSLAB			SF	Single Tub Deck System, Tricon Con-Struct or Approved Equal	$ 65.00	$ -
SP414S-W	4,416.14	4,420	SF	Cast in Place Portland Cement Concrete Retaining Wall, Including Reinforcement	$ 60.00	$ 265,200.00
SP414S-SF	2,387.60	2,400	SF	Cast in Place Portland Cement Concrete Retaining Wall Spread Footing, Including Reinforcement	$ 50.00	$ 120,000.00
420S-A-36IN	1,600.00	1,600	LF	Drilled Shaft, 30 In. Dia.	$ 285.00	$ 456,000.00
433S-A		210	SF	Type 1 P.C. Concrete Driveway	$ 21.00	$ 4,410.00
504S-1RM		3	EA	Repositioning & Adjusting Water Meters	$ 650.00	$ 1,950.00
504S-3W		8	EA	Adjusting Water Valve Boxes to Grade	$ 600.00	$ 4,800.00
505S-B6		70	LF	Encasement Pipe, 6-In. Dia., Type Steel	$ 43.00	$ 3,010.00
505S-B24	110.00	110	LF	Encasement Pipe, 24-In. Dia., Type Steel	$ 150.00	$ 16,500.00
505S-B36S		25	LF	Encasement Pipe, 36-In. Dia., Type Steel, Split	$ 566.00	$ 14,150.00
508S-HSETPD18		6	EA	Headwalls, Type TxDOT SET Type II, 18 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 610.00	$ 3,660.00
508S-HSETPD24			EA	Headwalls, Type TxDOT SET Type II, 24 In. Dia. RCP Pipe, 6H to 1V, Parallel	$ 1,080.00	$ -
508S-I		4	EA	Inlet, Biofiltration Water Quality Treatment	$ 2,600.00	$ 10,400.00
SP508S-ARCH48		2	EA	Precast Headwall, 48 Ft. Arch Bridge System	$ 17,000.00	$ 34,000.00
SP508S-ARCH28		10	EA	Precast Headwall, 28 Ft. Arch Bridge System	$ 17,000.00	$ 170,000.00
SP508S-ARCH24		8	EA	Precast Headwall, 24 Ft. Arch Bridge System	$ 17,000.00	$ 136,000.00
509S-1	960.00	960	LF	Trench Excavation Safety Protective Systems (all depths)	$ 2.00	$ 1,920.00
510-AW2C		80	LF	Pipe, 2 In. Dia. Copper Type K (all depths), including Excavation and Backfill	$ 93.00	$ 7,440.00
510-AW-6-350		90	LF	Pipe, 6 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 116.00	$ 10,440.00
510-AW-8-350	724.00	730	LF	Pipe, 8 In. Dia. Class 350 Ductile Iron (all depths), including Excavation and Backfill	$ 150.00	$ 109,500.00
510-ASW18		60	LF	Pipe, 18 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 135.00	$ 8,100.00
510-ASW24			LF	Pipe, 24 In. R.C.P. Storm Drain (all depths), including Excavation and Backfill	$ 170.00	$ -
510-BW		3	EA	Connecting New Water Service, 2 in. x 8 in.	$ 2,700.00	$ 8,100.00
510-JW2X8		3	EA	Wet Connections, 2 In. Dia. x 8 In. Dia.	$ 1,600.00	$ 4,800.00
510-JW6x8		1	EA	Wet Connections, 6 In. Dia. x 8 In. Dia.	$ 2,300.00	$ 2,300.00
510-JW8x8		2	EA	Wet Connections, 8 in. x 8 in. Dia.	$ 2,600.00	$ 5,200.00
510-KW	2.05	2.05	TON	Ductile Iron Fittings	$ 9,500.00	$ 19,475.00
511S-A2		3	EA	Valves, Ball Type, 2 In. Dia.	$ 970.00	$ 2,910.00
511S-A6		1	EA	Valves, Gate Type, 6 In. Dia.	$ 1,800.00	$ 1,800.00
511S-A8		4	EA	Valves, Gate Type, 8 In. Dia.	$ 2,200.00	$ 8,800.00
511S-B		2	EA	Fire Hydrant (see Detail No. 511S-17)	$ 4,800.00	$ 9,600.00
SP511S-BR		1	EA	Fire Hydrant Removal and Salvage	$ 2,800.00	$ 2,800.00

Table G-10
Multiple Arch Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-10
Multiple Arch Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Item No.	Quantity Calculations	Quantity	Unit	Item Description	Unit Price	Amount
511S-C2		3	EA	Pressure or Flow Control Valve Assemblies (2 In.)	$ 1,200.00	$ 3,600.00
551	1,495.18	1,500	LF	Pipe Underdrains, 6 In. Dia.	$ 58.00	$ 87,000.00
SP559-ARCH48	44.00	44	LF	Precast Arch Bridge System, 48 Ft. x 10 Ft. Arch Section	$ 6,020.00	$ 264,880.00
SP559-ARCH28	220.00	220	LF	Precast Arch Bridge System, 28 Ft. x 5.75 Ft. Arch Section	$ 3,030.00	$ 666,600.00
SP559-ARCH24	176.00	176	LF	Precast Arch Bridge System, 24 Ft. x 5 Ft. Arch Section	$ 3,290.00	$ 579,040.00
591S-B	510.46	520	CY	Dry Rock Riprap, D50 = 6 In.	$ 158.00	$ 82,160.00
SP591S-BED	170.15	180	CY	Bedding Material for Dry Rock Riprap, 6 in. Thickness, D50 = 2 In.	$ 142.00	$ 25,560.00
591S-G6	123.70	130	CY	Concrete Riprap, 6 In. Thickness	$ 430.00	$ 55,900.00
602S-A	70.14	72	SY	Bermuda Block Sodding (Celebration Bermuda)	$ 10.00	$ 720.00
604S-A		1,500	SY	Non-Native Seeding for Erosion Control Method, _ Mulch	$ 1.55	$ 2,325.00
604S-G6		1,000	SY	Mulch, Hardwood (6 in. Thickness)	$ 12.50	$ 12,500.00
604S-I		1,200	SY	Topsoil and Seedbed Preparation	$ 5.10	$ 6,120.00
605S-A1		1,100	SY	Soil Retention Blanket Class 1, Type A or B	$ 5.00	$ 5,500.00
605S-A2		1,330	SY	Soil Retention Blanket Class 2, Type G or H	$ 8.00	$ 10,640.00
607S-C-MSE			SF	Earth Reinforcement System, Temporary Earth Retaining Wall	$ 40.00	$ -
609S-C		1,100	SY	Native Grassland Seeding and Planting	$ 2.50	$ 2,750.00
610S-A		1,800	LF	Tree Protective Fencing Type A Chain Link Fence	$ 4.70	$ 8,460.00
610S-R2-9		40	EA	Removal of Existing Trees, 2 In. to 9 In. Caliper Size	$ 380.00	$ 15,200.00
610S-R10-18		20	EA	Removal of Existing Trees, 10 In. to 18 In. Caliper Size	$ 600.00	$ 12,000.00
610S-R19-23		5	EA	Removal of Existing Trees, 19 In. to 23 In. Caliper Size	$ 710.00	$ 3,550.00
610S-R24			EA	Removal of Existing Trees, 24 In. and Larger Caliper Size	$ 1,380.00	$ -
639S	103.00	120	LF	Rock Berm	$ 38.00	$ 4,560.00
641S		2	EA	Stabilized Construction Entrance	$ 1,700.00	$ 3,400.00
642S		3,000	LF	Silt Fence for Erosion Control	$ 2.70	$ 8,100.00
660S		790	CY	Biofiltration Medium	$ 78.00	$ 61,620.00
661S		1,070	SY	Compacted Surface Soil: Tilling	$ 64.00	$ 68,480.00
700S-TM1		1	LS	Total Mobilization Payment, First Mobilization/Demobilization	$ 241,000.00	$ 241,000.00
700S-TM2			LS	Total Mobilization Payment, Second Mobilization/Demobilization		$ -
702S-G	1,064.34	1,070	LF	Remove and Relocate Existing Barbed Wire Fence	$ 32.50	$ 34,775.00
704	1,364.34	1,370	LF	Metal Beam Guard Railing	$ 68.00	$ 93,160.00
704-T		4	EA	Metal Beam Guard Railing, Terminal Anchor Sections	$ 940.00	$ 3,760.00
705			LF	Remove and Relocate Existing Metal Beam Guard Railing	$ 16.00	$ -
706S		630	LF	Bridge and Culvert Railing, Guardrail Type TxDOT C101	$ 122.00	$ 76,860.00
802S-BC.I.P.		2	EA	C.I.P. Project Sign	$ 800.00	$ 1,600.00
803S-CD	182.50	190	CD	Barricades, Signs, and Traffic Handling (Road Closed to Through Traffic)	$ 138.00	$ 26,220.00
803S-CD			CD	Barricades, Signs, and Traffic Handling (Maintain Through Traffic)	$ 610.00	$ -
824S		6	EA	Traffic Signs	$ 410.00	$ 2,460.00
831S-1C		6	EA	Power Pole Foundation, 30-In. Dia. Drilled Shaft	$ 5,800.00	$ 34,800.00
839S		6	EA	Power Pole	$ 11,000.00	$ 66,000.00
863S	206.65	210	EA	Reflectorized Pavement Marker	$ 17.00	$ 3,570.00
870S			LF	Work Zone Pavement Markings (Removable) (4 In.)	$ 1.90	$ -
871S-A4SW	2,046.51	2,050	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 4 Inches in Width, 100 Mils in Thickness, _ in Color	$ 2.40	$ 4,920.00
871S-A24SW		25	LF	Reflectorized Type 1 Thermoplastic Pavement Markings, 24 Inches in Width, 100 Mils in Thickness, Solid White in Color	$ 19.00	$ 475.00
871S-D		1	EA	Reflectorized Type 1 Thermoplastic Pavement Markings, Symbol RR Crossing, 100 Mils in Thickness, _ in Color	$ 950.00	$ 950.00

SUBTOTAL	**$**	**5,052,382.00**
30% CONTINGENCIES	$	1,515,714.60
TOTAL CONSTRUCTION	**$**	**6,568,096.60**

Table G-10
Multiple Arch Bridge Option - Undetained Flows, Embankment Retaining Wall, Full Road Closure
Preliminary Opinion of Probable Construction Cost

Table G-11
Tree Classification and Size for Mitigation

Tree #	Tree Description	Surveyed Caliper Size (in.)	Footprint of Measured Tree Removal in Survey Area (sf)	Fill Retaining Wall Condition Area (sf)	Prorated Caliper Size for Fill Retaining Wall Condition (in.)	Fill Slope with Undetained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Undetained Flow Condition (in.)	Fill Slope with Detained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Detained Flow Condition (in.)	Mitigation not Required (1)	Protected Tree (2)	Heritage	Appendix F > 19"	Appendix F 8" - 18.9"	Appendix F < 8"	Non-Appendix F > 19"	Non-Appendix F 8" - 18.9"	Non-Appendix F < 8"
423	Chinaberry (17"/9")	22	26,786	45,441	37.3	60,255	49.5	65,414	53.7	X								
424	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
425	Hackberry	18	26,786	45,441	30.5	60,255	40.5	65,414	44.0					18				
426	Hackberry	16	26,786	45,441	27.1	60,255	36.0	65,414	39.1					16				
439	Cedar Elm	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3								12	
440	Cedar Elm	16	26,786	45,441	27.1	60,255	36.0	65,414	39.1								16	
441	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
443	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
445	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
446	Cedar Elm	15	26,786	45,441	25.4	60,255	33.7	65,414	36.6								15	
447	Cedar Elm (10"/9")	15	26,786	45,441	25.4	60,255	33.7	65,414	36.6								15	
449	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
450	Cedar Elm	19	26,786	45,441	32.2	60,255	42.7	65,414	46.4		X					19		
451	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
452	Cedar Elm (11"/7")	15	26,786	45,441	25.4	60,255	33.7	65,414	36.6								15	
453	Cedar Elm (12"/9")	16	26,786	45,441	27.1	60,255	36.0	65,414	39.1								16	
454	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
455	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
456	Cedar Elm	19	26,786	45,441	32.2	60,255	42.7	65,414	46.4		X					19		
457	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
458	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
459	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
460	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
461	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
462	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
463	Cedar Elm	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
470	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
471	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
472	Cedar Elm	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
474	Cedar Elm	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
478	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
479	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
480	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
481	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
604	Siberian Elm (2-15"/2-12")	35	26,786	45,441	59.4	60,255	78.7	65,414	85.5	X								
607	Pecan	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7						6			
610	Cedar Elm	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
811	Cedar Elm (2-6"/2-5")	14	26,786	45,441	23.8	60,255	31.5	65,414	34.2								14	
828	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
829	Cedar Elm	19	26,786	45,441	32.2	60,255	42.7	65,414	46.4		X					19		
830	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
831	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
832	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
833	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
834	Cedar Elm	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
835	Cedar Elm	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
837	Cedar Elm (10"/7")	14	26,786	45,441	23.8	60,255	31.5	65,414	34.2								14	
842	Cedar Elm	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
843	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
844	Cedar Elm	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
847	Cedar Elm	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7

Notes:
(1) Tree removal mitigation not required per ECM 3.5.4
(2) Protected tree has a diameter of 19" or more

Table G-11
Tree Classification and Size for Mitigation

Tree #	Tree Description	Surveyed Caliper Size (in.)	Footprint of Measured Tree Removal in Survey Area (sf)	Fill Retaining Wall Condition Area (sf)	Prorated Caliper Size for Fill Retaining Wall Condition (in.)	Fill Slope with Undetained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Undetained Flow Condition (in.)	Fill Slope with Detained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Detained Flow Condition (in.)	Mitigation not Required (1)	Protected Tree (2)	Heritage	Appendix F > 19"	Appendix F 8" - 18.9"	Appendix F < 8"	Non-Appendix F > 19"	Non-Appendix F 8" - 18.9"	Non-Appendix F < 8"
848	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
849	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
850	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
851	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
852	Red Oak	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7						6			
853	Red Oak	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1						7			
854	Red Oak	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
855	Live Oak	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2						5			
856	Hackberry	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1						7			
883	Cedar Elm	15	26,786	45,441	25.4	60,255	33.7	65,414	36.6								15	
884	Hackberry	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
885	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
886	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
887	Cedar Elm	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
888	Hackberry	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0					9				
889	Hackberry	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7						6			
903	Cedar Elm	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
904	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
905	Cedar Elm	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3								12	
914	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
915	Juniper (8"/3")	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
916	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
917	Cedar Elm	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
918	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
919	Cedar Elm	14	26,786	45,441	23.8	60,255	31.5	65,414	34.2								14	
920	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
921	Juniper	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
926	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
927	Cedar Elm	16	26,786	45,441	27.1	60,255	36.0	65,414	39.1								16	
928	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
931	Juniper	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
933	Juniper	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9								11	
946	Juniper	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
947	Juniper	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
948	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
949	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
955	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
956	Juniper	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
958	Juniper	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
959	Juniper	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
960	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
961	Juniper	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	
962	Cedar Elm	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
963	Cedar Elm	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
972	Juniper	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
973	Juniper	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
978	Juniper	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
979	Juniper	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3								12	
980	Juniper (6"/4")	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
981	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
982	Cedar Elm	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4								10	

Notes:
(1) Tree removal mitigation not required per ECM 3.5.4
(2) Protected tree has a diameter of 19" or more

Table G-11
Tree Classification and Size for Mitigation

Tree #	Tree Description	Surveyed Caliper Size (in.)	Footprint of Measured Tree Removal in Survey Area (sf)	Fill Retaining Wall Condition Area (sf)	Prorated Caliper Size for Fill Retaining Wall Condition (in.)	Fill Slope with Undetained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Undetained Flow Condition (in.)	Fill Slope with Detained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Detained Flow Condition (in.)	Mitigation not Required (1)	Protected Tree (2)	Heritage	Appendix F > 19"	Appendix F 8" - 18.9"	Appendix F < 8"	Non-Appendix F > 19"	Non-Appendix F 8" - 18.9"	Non-Appendix F < 8"
983	Cedar Elm	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
984	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
987	Live Oak	11	26,786	45,441	18.7	60,255	24.7	65,414	26.9					11				
988	Juniper	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
989	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
990	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
991	Cedar Elm	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
998	Juniper (8"/2-4")	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3								12	
999	Cedar Elm	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
1000	Live Oak	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
1001	Live Oak	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0					9				
1002	Live Oak	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4					10				
1003	Live Oak	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2						5			
1004	Live Oak	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1						7			
1005	Juniper (8"/5"/4")	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
1006	Live Oak	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7						6			
1007	Live Oak	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
1018	Live Oak	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0					9				
1019	Red Oak	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1						7			
1020	Live Oak	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7						6			
1021	Red Oak (10"/9")	14	26,786	45,441	23.8	60,255	31.5	65,414	34.2					14				
1022	Juniper (5"/4")	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
1023	Cedar Elm (9"/8")	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
1024	Red Oak	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
1025	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
1034	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
1035	Live Oak	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7						6			
1036	Cedar Elm	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3								12	
1037	Red Oak	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5					8				
1038	Juniper	9	26,786	45,441	15.3	60,255	20.2	65,414	22.0								9	
1039	Juniper	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5								8	
1040	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
1041	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
1042	Juniper	21	26,786	45,441	35.6	60,255	47.2	65,414	51.3	X								
1043	Cedar Elm	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3								12	
1044	Juniper	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
1045	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
1046	Juniper	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2									5
1047	Live Oak	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
1067	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
1068	Juniper	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8									4
1069	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
1070	Juniper	6	26,786	45,441	10.2	60,255	13.5	65,414	14.7									6
1071	Cedar Elm	7	26,786	45,441	11.9	60,255	15.7	65,414	17.1									7
1195	Cedar Elm	13	26,786	45,441	22.1	60,255	29.2	65,414	31.7								13	
1196	Cedar Elm	14	26,786	45,441	23.8	60,255	31.5	65,414	34.2								14	
1197	Cedar Elm	14	26,786	45,441	23.8	60,255	31.5	65,414	34.2								14	
1198	Hackberry	8	26,786	45,441	13.6	60,255	18.0	65,414	19.5					8				
1199	Hackberry 6	5	26,786	45,441	8.5	60,255	11.2	65,414	12.2						5			
1200	Live Oak	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3					12				
1201	Texas Redbud	12	26,786	45,441	20.4	60,255	27.0	65,414	29.3					12				

Notes:
(1) Tree removal mitigation not required per ECM 3.5.4
(2) Protected tree has a diameter of 19" or more

Table G-11
Tree Classification and Size for Mitigation

Tree #	Tree Description	Surveyed Caliper Size (in.)	Footprint of Measured Tree Removal in Survey Area (sf)	Fill Retaining Wall Condition Area (sf)	Prorated Caliper Size for Fill Retaining Wall Condition (in.)	Fill Slope with Undetained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Undetained Flow Condition (in.)	Fill Slope with Detained Flow Condition Area (sf)	Prorated Caliper Size for Fill Slope with Detained Flow Condition (in.)	Mitigation not Required (1)	Protected Tree (2)	Heritage	Appendix F > 19"	Appendix F 8" - 18.9"	Appendix F < 8"	Non-Appendix F > 19"	Non-Appendix F 8" - 18.9"	Non-Appendix F < 8"
1203	Texas Redbud	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
1204	Texas Redbud	4	26,786	45,441	6.8	60,255	9.0	65,414	9.8						4			
1205	Texas Redbud	10	26,786	45,441	17.0	60,255	22.5	65,414	24.4					10				
1222	Cedar Elm	20	26,786	45,441	33.9	60,255	45.0	65,414	48.8	X								
	Totals											0	0	146	111	57	794	234

Notes:
(1) Tree removal mitigation not required per ECM 3.5.4
(2) Protected tree has a diameter of 19" or more

Table G-11
Tree Classification and Size for Mitigation

Table G-12
Tree Removal Mitigation Cost

Tree Size Classification	% Caliper Inch to Mitigate	Retaining Wall		Fill Slope with Undetained Flow		Fill Slope with Detained Flow	
		Total Caliper Inches to be Removed	Caliper Inches to be Mitigated	Total Caliper Inches to be Removed	Caliper Inches to be Mitigated	Total Caliper Inches to be Removed	Caliper Inches to be Mitigated
Heritage	300%	0.0	0.0	0.0	0.0	0.0	0.0
Appendix F > 19"	100%	0.0	0.0	0.0	0.0	0.0	0.0
Appendix F 8" - 18.9"	50%	247.7	123.9	328.4	164.2	356.5	178.3
Appendix F < 8"	50%	188.3	94.2	249.7	124.9	271.1	135.6
Non-Appendix F > 19"	50%	96.7	48.4	128.2	64.1	139.2	69.6
Non-Appendix F 8" - 18.9"	25%	1,347.0	336.8	1,786.1	446.5	1,939.0	484.8
Non-Appendix F < 8"	25%	397.0	99.3	526.4	131.6	571.5	142.9
	Total Inches	2,276.7	702.4	3,018.8	931.3	3,277.3	1,011.0
	Unit Cost/In.		$200		$200		$200
	Total Cost		$140,470		$186,255		$202,205

Table G-13
Right-of-Way and Utility Easement Acquisition Costs

Condition	ROW Area (SF)	Electric Easement Area (SF)	Water Easement Area (SF)	Total Land Acquisition (SF)	Land Acquisition Unit Cost ($/SF)(1)	Land Acquisition Cost	Improvement Acquisition Cost (2)	Survey Cost (3)	City Real Estate Cost (4)	Total Land Acquisition Cost
Creek Crossing with Fill Retaining Wall	19,972	9,994	9,683	39,649	$2.00	$79,298	$60,050	$100,000	$80,000	$319,348
Full Span Creek Crossing with Fill Side Slopes	36,827	10,303	9,890	57,020	$2.00	$114,040	$120,095	$100,000	$80,000	$414,135
Reduced Span Creek Crossing with Fill Side Slopes	42,093	10,247	9,954	62,294	$2.00	$124,588	$129,095	$100,000	$80,000	$433,683

Notes:
(1) See TCAD property evaluations.
(2) On David Allman tract assumes: 50% reduction in dwelling value for fill retaining wall condition and complete dwelling removal for fill slopes condition.
(3) Deed search and development of survey metes/bounds description and exhibit at $10k per tract per ROW/easement acquisition type.
(4) City Real Estate Department cost assumed = $20k per tract

Table G-13
Right-of-Way and Utility Easement Acquisition Costs