PASSPORT PARK

DRAINAGE MASTER PLAN

IRVING, TARRANT COUNTY, TEXAS

PREPARED BY:

Pacheco Koch

October 18, 2017

TX REG. ENGINEERING FIRM F-14439
TX REG. SURVEYING FIRM 10193805

7557 RAMBLER ROAD
SUITE 1400
DALLAS, TX 75231-2388

PASSPORT PARK

DRAINAGE MASTER PLAN

BIG BEAR CREEK
CITY OF IRVING, DALLAS COUNTY, TEXAS

PREPARED FOR:

F.A. PEINADO, LLC

STATE OF TEXAS
RYAN MORTENSEN
102274
LICENSED
PROFESSIONAL ENGINEER
10/18/2017

PREPARED BY:

Pacheco Koch

TX REG. ENGINEERING FIRM F-14439
TX REG. SURVEYING FIRM LS-10193805
PK NO: 1469-17.026

7557 Ramber Road, Suite 1400
Dallas, Texas 75231-2388

EXECUTIVE SUMMARY

Pacheco Koch was retained by F.A. Peinado, LLC. on behalf of Bandera Ventures to prepare a site development drainage master plan associated with Passport Park which is an industrial development within the DFW Airport. The project is located northeast of the intersection of International Parkway and State Highway 183 in the City of Irving, Texas.

The purpose of this analysis is to develop a drainage master plan for the proposed Passport Park industrial development. This master plan defines detention requirements for the proposed development area. The detention requirements were developed by comparing pre- and post-project conditions for the 1-year, 25-year and 100-year storm events as outlined in the ISWM Criteria Manual, 2015. Existing 100-year floodplain inundation limits for three minor tributaries within the proposed development were defined. It is anticipated that a detailed floodplain reclamation plan and detailed detention configuration will be provided for each site as they are developed.

Existing infrastructure in Valley View Lane, located to the east, was designed to accommodate light industrial development. On-site detention will be used to offset the increases in flow associated with the planned heavy industrial development to maintain existing peak discharges. Detention is proposed for the future mixed-use development (industrial and commercial) located on the western half of the site. It is anticipated that detention will be phased as individual sites are developed. This report provides approximate detention volumes for maintaining pre-project flow rates as runoff leaves the development.

Existing 100-year floodplain inundation limits were established for Big Bear Creek Tributary, Channel BD-1and Estelle Creek Tributary. The City of Irving has not conducted a Development Study of Estelle Creek and has no drainage study for Estelle Creek. Future development within the established Passport Park floodplains will require detailed hydraulic analysis to compare existing and proposed conditions. These streams have also been identified as Jurisdictional Features of the US and will require permitting through the USACE construction activities resulting in fill. However, an environmental assessment and permitting through Section 404 of the Clean Water Act was not a part of this drainage master plan. A separate report and study was prepared by DFW Environmental Affairs Department.

Reclamation of Bear Creek floodplain may be required for commercial sites located adjacent to International Parkway. Modifications including fill within the Bear Creek will require permitting through FEMA and the City of Irving. Permitting will also be required from DFW. Typically, hydraulic analysis is necessary to prove proposed fill will not negatively impact (increase flood level and velocities) adjacent properties. FEMA requires a Conditional Letter of Map Revision (CLOMR) prior to construction if proposed floodplain modifications within a Zone AE floodplain cause any increase in Base Flood Elevations (BFE).

CONTACT INFORMATION

Description	Name	Company	Email
Client Representative	Bruce Barclay	F.A. Peinado, LLC	bruce@peinado.com
Project Manager	Clayton Strolle, PE	Pacheco Koch	cstrolle@pkce.com
Drainage Master Plan	Ryan Mortensen, PE, CFM	Pacheco Koch	rmortensen@pkce.com

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1.0 INTRODUCTION

1.1 Authorization

Pacheco Koch was retained by F.A. Peinado, LLC. on behalf of Bandera Ventures to prepare a site development drainage master plan associated with Passport Park which is an industrial development within the DFW Airport. The project is located northeast of the intersection of International Parkway and State Highway 183 in the City of Irving, Texas. This report documents the procedures and findings of the drainage analysis. Technical supporting documentation is provided in the accompanying Appendices.

1.2 Purpose

The purpose of this analysis is to develop a drainage master plan for the proposed Passport Park industrial development. This master plan defines detention requirements for the proposed development area. The detention requirements were developed by comparing pre- and post-project conditions for the 1-year, 25-year and 100-year storm events as outlined in the ISWM Criteria Manual, 2015. Existing 100-year floodplain inundation limits for three minor tributaries within the proposed development were defined. It is anticipated that a detailed floodplain reclamation plan and detailed detention configuration will be provided for each site as they are developed.

1.3 Background

Passport Park is located along the Dallas-Tarrant County line with portions of the site located in each county. Bear Creek is located to the southwest and Estelle Creek is located to the east of Passport Park. Both streams are designated as Zone AE floodplains with floodways. The Bear Creek and Estelle Creek floodplains in Dallas County are defined by the Flood Insurance Study (FIS) and the effective Flood Insurance Rate Map (FIRM) Number 48113C0285K, dated July 7, 2014. Portions of Bear Creek located to the west are within Tarrant County and are defined by the effective Flood Insurance Rate Map (FIRM) Number 48439C0235K, dated September 25, 2009. Bear Creek floodplain (100-year) within the Tarrant County portion of the site overtops International Parkway and inundates the site along the roadway. The City of Irving has not conducted a Development Study of Estelle Creek and has no drainage study for Estelle Creek.

An environmental assessment and permitting through Section 404 of the Clean Water Act was not a part of this drainage master plan. A separate report and study was prepared by DFW Environmental Affairs Department.

1.4 Project Location

The project site is located south of DFW Airport, northeast of the intersection of International Parkway and State Highway 183. A drainage divide approximately bisects the site with runoff crossing Valley View Lane to the east and International Parkway to the southwest. Figure 1 shows the approximate boundaries of Passport Park and the overall drainage divides relative to floodplain of Bear Creek and Estelle Creek.

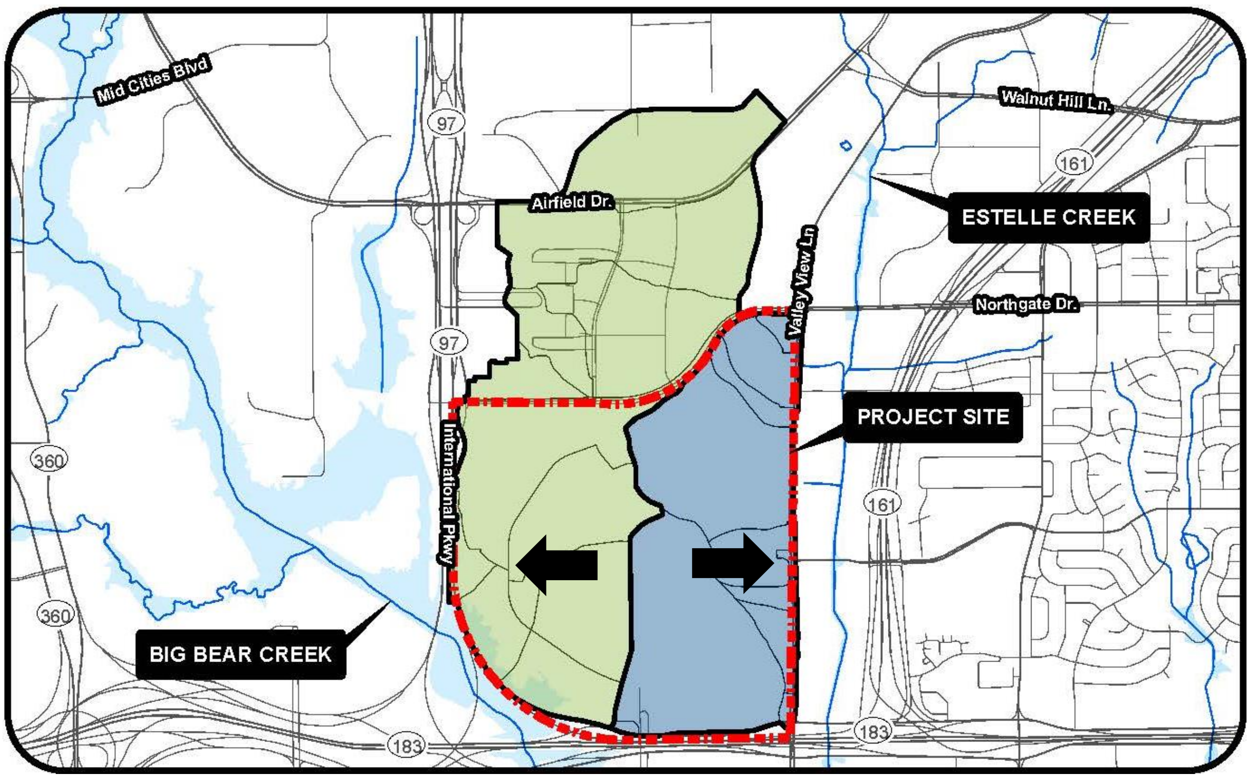

Figure 1: Location Map

1.5 Site Assessment

All storm drainage from the site leaves through culverts beneath the surrounding roadways. Eight (8) culverts cross Valley View Lane east of the site, two (2) culverts run beneath SH 183 south of the site, two (2) culverts discharge southwest of the site from under the highway interchange and two (2) culverts cross International Parkway on the west side of the site. Figure 2 shows the location of each culvert outfall.

Three (3) minor tributaries exist within the project site that are classified as Waters of the U.S. These minor tributaries do not have FEMA SFHA designation. The largest (Channel BD-1) is approximately 9550 ft long, and flows into the project site from the north and exits to the west through culvert W1 beneath International Parkway. The Big Bear Creek Tributary is approximately 3200 ft long, and flows southwest from Mt Marvin and leaves the site on the southern edge through culvert W4 beneath the International Parkway/SH 183 interchange. The Estelle Creek Tributary is approximately 2400 ft long and exits the site through culvert E4 under Valley View Lane. Figure 2 shows the location of these three tributaries.

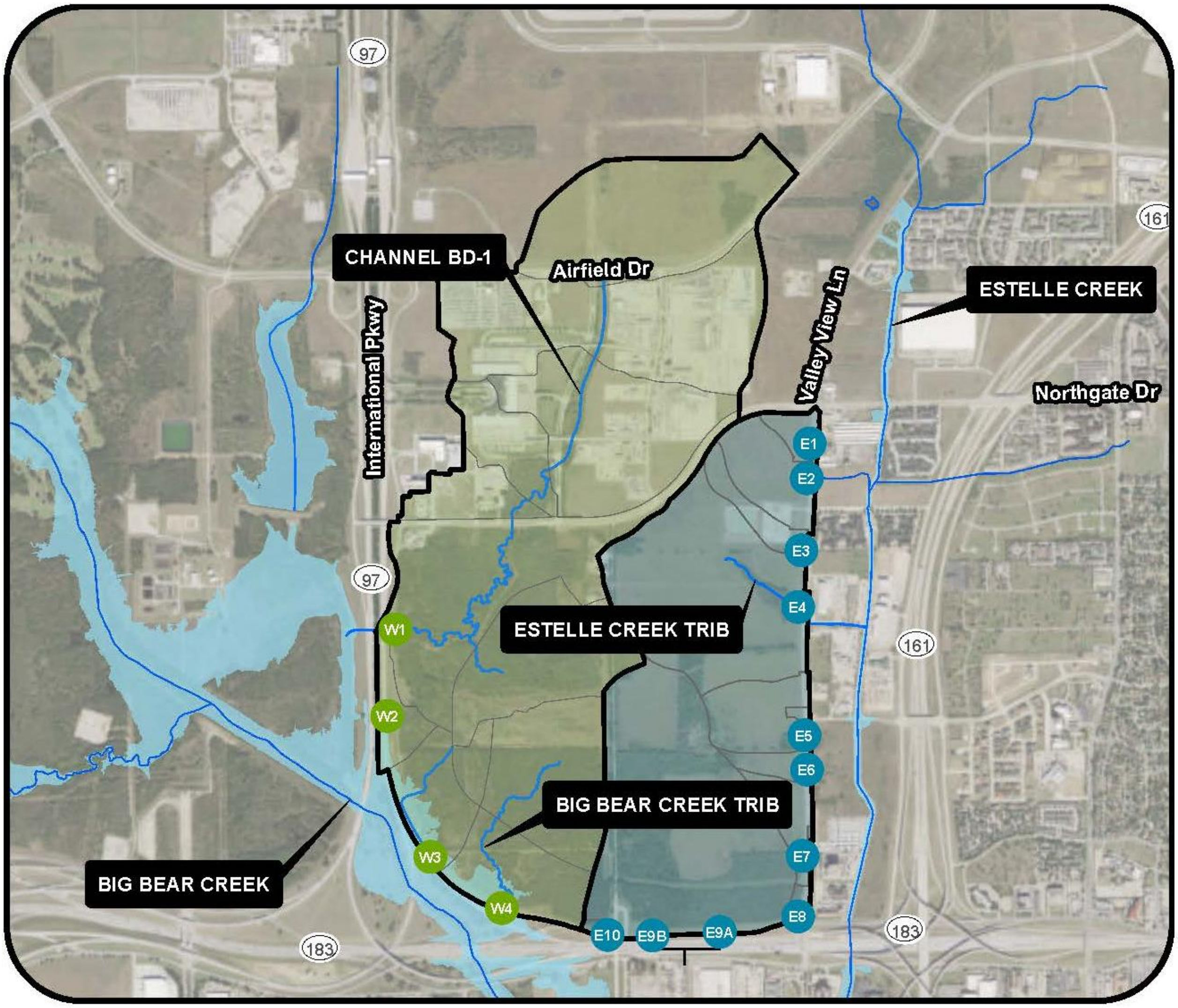

Figure 2: Culvert & Tributary Locations Map

1.6 Design Criteria

The post development design criteria is based on the NCTCOG iSWM Criteria Manual. The manual requires that all detention maintain pre-development peak discharges for 1-, 25- and 100-year 24-hour storm events. The criteria is also based on the DFW Design Criteria Manual Section 334 – Storm Drainage Utilities.

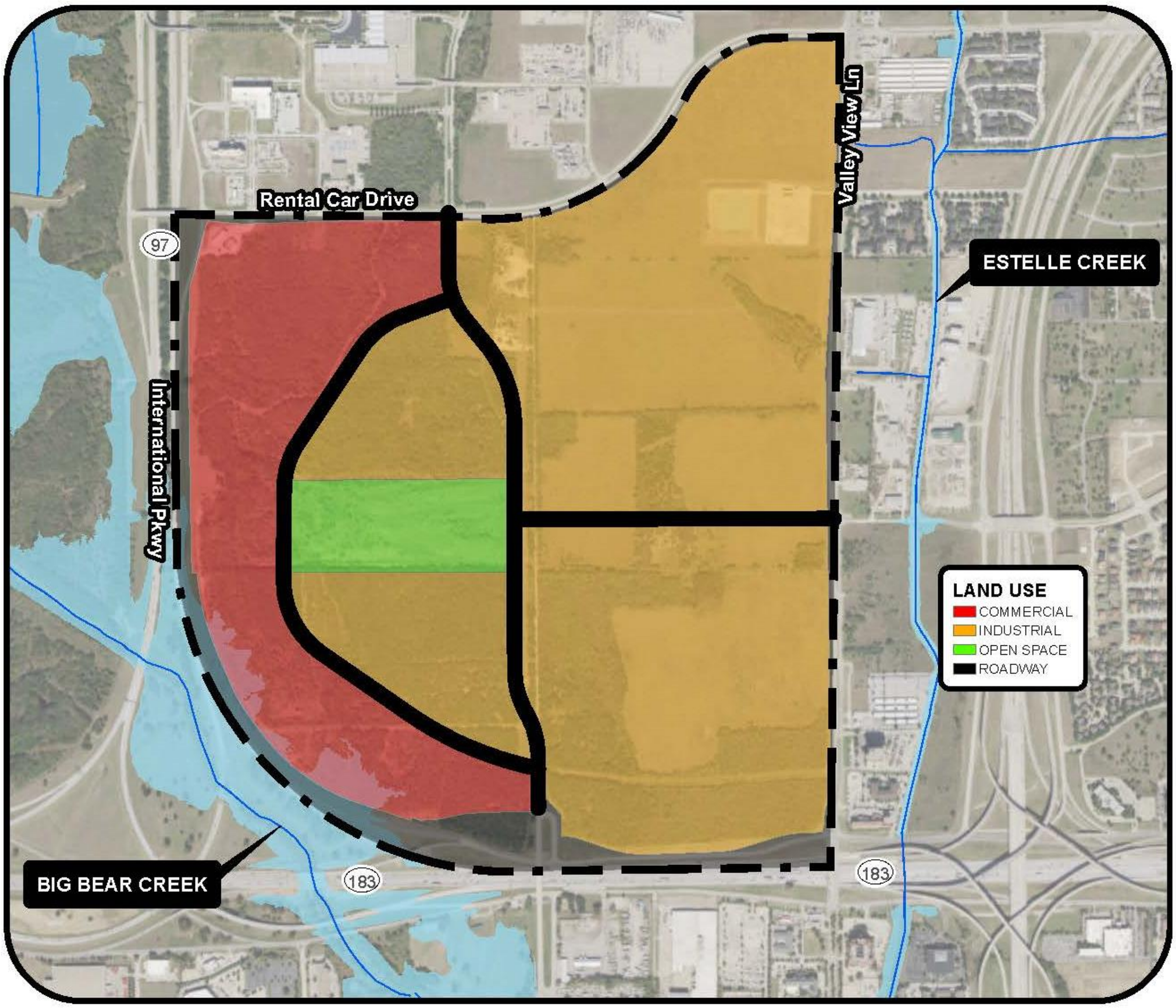

Figure 3: Proposed Improvements

1.7 Proposed Improvements

Passport Park will include a mix of industrial and commercial development. The first phase of the project includes developing plans for supporting infrastructure such as roadways and utilities as well as land development for two (2) industrial sites with multiple buildings. Figure 3 shows the proposed improvements outlined in this master plan.

2.0 SURVEY AND MAPPING

2.1 Field Survey Data

Pacheco Koch conducted an on-the-ground survey in March 2016. The survey data was then used to generate topographic information for design of the Passport Park infrastructure. Table 1 contains survey benchmarks.

BM ID	ELEVATION	DESCRIPTION
BM#1254	540.941’	BRASS DISK FOUND IN THE WEST NOSE OF A MEDIAN INTERSECTION OF RENTAL CAR DRIVE AND SOUTH 26TH AVENUE ±1.1 FEET FROM BACK EDGE OF CONCRETE. POINT ALSO BEING ±26.1 FEET SOUTHEAST OF A STORM DRAINAGE MANHOLE AND 70 FEET EAST OF A LIGHT STANDARD.
BM#1255	535.562’	BRASS DISK FOUND IN THE EAST NOSE OF A MEDIAN INTERSECTION OF RENTAL CAR DRIVE AND PASSPORT AVENUE. POINT ALSO BEING ±47 FEET NORTHWEST OF A TRAFFIC SIGNAL LIGHT POLE AND ±121 FEET WEST OF LIGHT STANDARD.
BM#1256	523.405’	BRASS DISK FOUND IN THE WEST NOSE OF MEDIAN INTERSECTION OF RENTAL CAR DRIVE AND THE ENTRANCE DRIVE INTO A SHUTTLE BUS MAINTENANCE CENTER ADDRESSED AS 2425 RENTAL CAR DRIVE. POINT ALSO BEING ±47.5 FEET NORTH THE CENTER OF A CURB INLET LID AND ±74.9 FEET WEST OF A LIGHT STANDARD ON THE MEDIAN TO THE EAST.
BM#1257	527.728’	BRASS DISK FOUND IN THE NORTHEAST CORNER OF A 6-FOOT CURB INLET ON THE NORTH SIDE OF RENTAL CAR DRIVE ±280 FEET WEST OF THE CENTERLINE OF SOUTH 24TH AVENUE. POINT ALSO BEING ±39 FEET EAST OF A LIGHT STANDARD AND 11.5 FEET WEST OF A FIRE HYDRANT.
BM#8	493.356’	BOX WITH AN “X” CUT SET ON THE NORTH SIDE OF A CONCRETE BASE OF A LIGHT STANDARD ON THE EAST SIDE OF INTERNATIONAL PARKWAY ±1750 FEET SOUTH OF RENTAL CAR DRIVE.

Table 1: Survey Benchmarks

2.2 Project Datum

Horizontal control for the site survey data and mapping is based on the 1983 North American Datum (NAD83), Texas State Plane, North Central Zone, FIPS 4202. Vertical control is based on the 1988 North American Vertical Datum (NAVD88).

2.3 Mapping

LiDAR point cloud data and aerial photography were used to supplement the site survey data and development of watershed topography. The LiDAR data was obtained through the Texas Natural Resources Information System[1] (TNRIS) for Tarrant County (2009) and aerial photography (2010) was obtained through ArcGIS online.

[1] TNRIS: http://www.tnris.org

3.0 HYDROLOGY

3.1 Methodology

Hydrology for the site was reviewed using two (2) different methodologies (Rational Method for drainage to the east and Synthetic Unit Hydrographs for drainage to the southwest). In order to maintain consistency with existing plans, Rational Method was used for the east half of the site. On-site detention is anticipated to be provided for the eastern half of Passport Park as industrial sites are developed. Hydrology for the west side of the development was analyzed in this study using the computer program HEC-HMS[2], Hydrologic Modeling System, developed by the Hydrologic Engineering Center of the USACE (Version 4.1). Hydrology along the west side of the development compares pre-project to post-project conditions to define future detention volumes needed as pad sites are developed within Passport Park.

3.2 East (Rational Method)

The individual drainage areas for the east half of the site were analyzed using Rational Method. Both pre- and post-project conditions were examined for the 1-, 25- and 100-year storm events. The expected increase in peak discharges will be addressed separately with on-site detention using the Modified Ration Method for volume attenuation calculations. It is anticipated that each site will detain to the pre-project peak discharges determined for each outfall as defined in this report.

[2] HEC-HMS, USACE: http://www.hec.usace.army.mil/software/hec-hms/

Drainage Area

Drainage areas of available as-built plans of adjacent roads surrounding the project site (see Appendix A) were reviewed in conjunction with topographic data to establish pre-project drainage areas divides for the eastern half of the site. Outfall drainage areas were developed by combining relevant sub-basins identified in the as-built plans. Figure 4 shows the drainage area delineation of the eastern side of Passport Park.

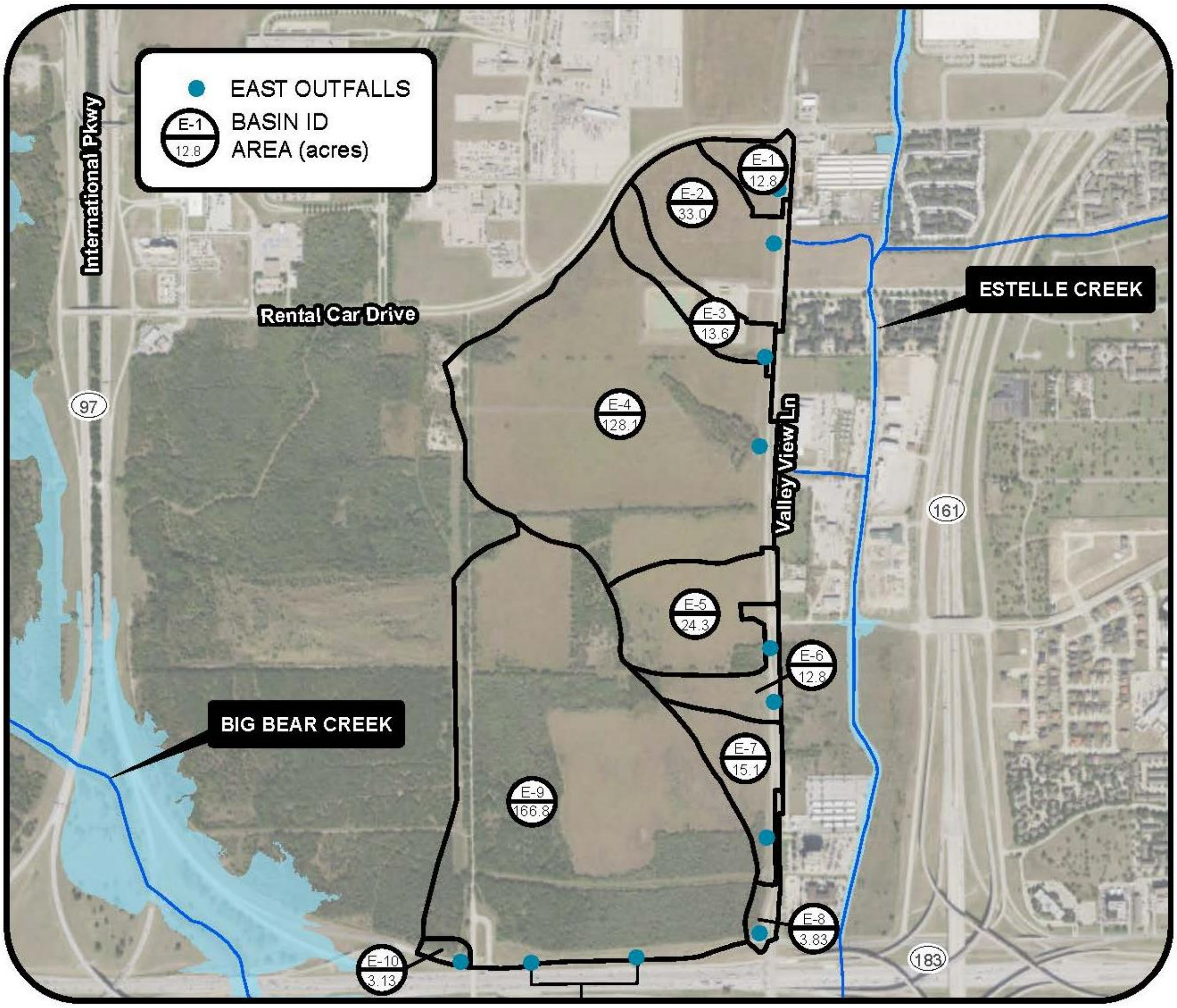

Figure 4: Eastern Drainage Delineation

Design Storm Intensities

Design storm intensities were determined from the NCTCOG, ISWM Technical Manual, 2015[3]. Times of concentration were calculated for each individual sub-basin to calculate the design storm intensity for each respective basin. Times of concentration for post-development conditions were assumed to be 10 minutes (minimum). Calculations for the times of concentration are provided in Appendix A.

C-Factors

An area-weighted average of C-factors for existing conditions was determined for each outfall location based on combined sub-basins identified in the as-built plans. Figure 5 shows the existing C-factors used to compute the weighted C-factor for each basin.

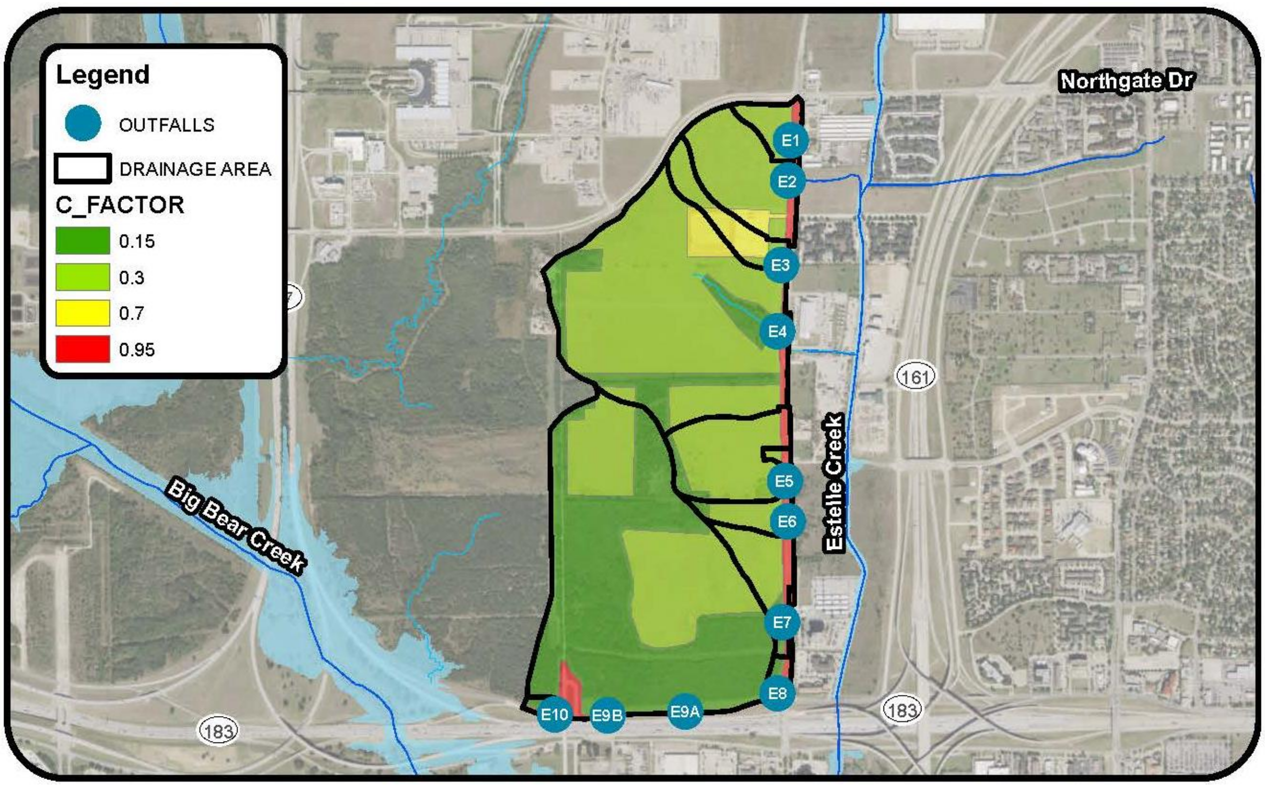

Figure 5: C Factor Map

3 NCTCOG, ISWM Technical Manual: http://iswm.nctcog.org/Documents/technical_manual/Hydrology_9-2014.pdf

3.3 West (Synthetic Unit Hydrograph Method)

As-built plans for the International Parkway were limited and information related to culvert capacity was not verifiable. New hydrology was developed and pre-project peak discharges and approximate detention volumes for the western half of Passport Park were established based on the SCS Curve Number Method. It is anticipated that detention will be provided during future phases of development as pad sites are constructed. Additional detention volumes will be required throughout the developed drainage areas to reduce peak discharges to back to pre-project conditions. This study does not define the location of required detention areas within each drainage sub-basin.

Drainage Area

Drainage areas of available as-built plans of adjacent roads surrounding the project site (see Appendix A) were reviewed in conjunction with topographic data to establish pre-project drainage areas divides for the western half of the site. Approximately 420 acres of off-site drainage is conveyed through the site to Bear Creek. Figure 6 shows the drainage area delineation of the western side of Passport Park.

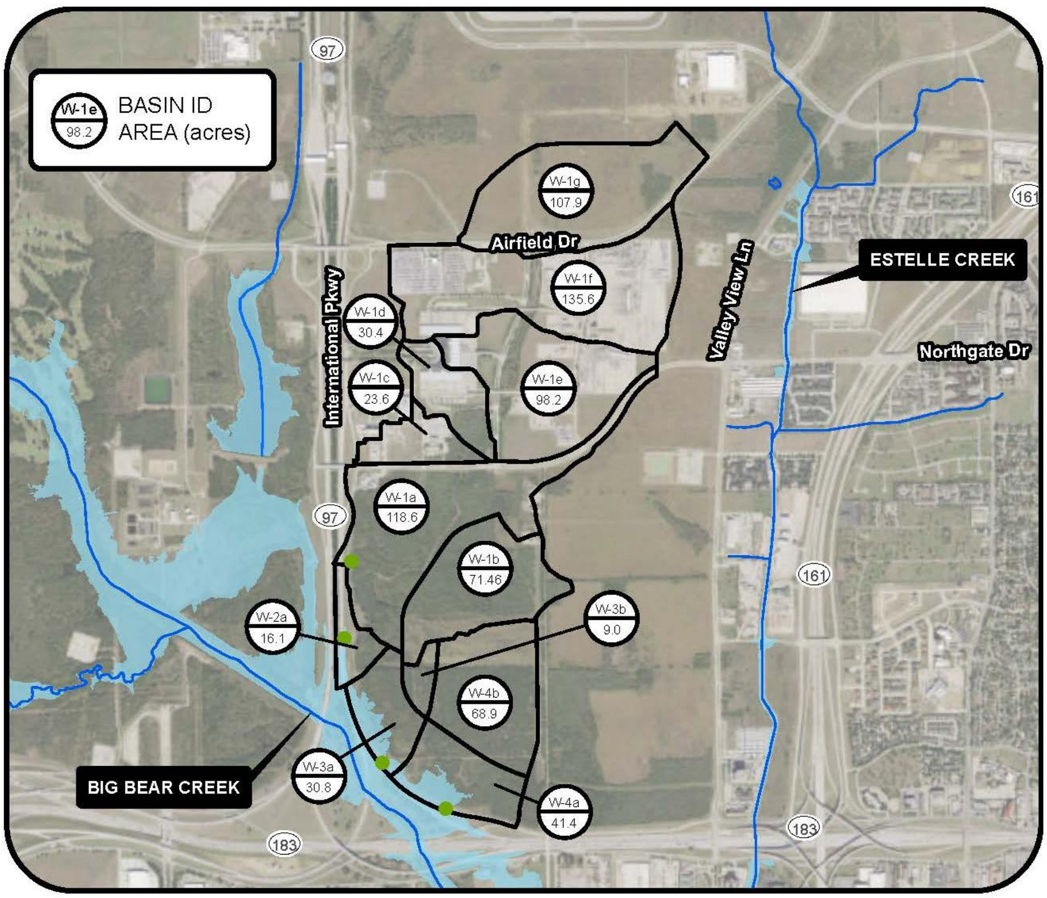

Figure 6: Western Drainage Delineation

Synthetic Storm

The hydrologic model is based 24-hour duration storm event using the SCS Type III Rainfall Distribution Method. The depths used to develop the rainfall distribution were obtained from the iSWM Technical Manual Tarrant County Rainfall Data. Table 2 shows the 1-, 25- and 100-year rainfall depths used in the rainfall distribution.

Duration	1-Year Depth (in)	25-Year Depth (in)	100-Year Depth (in)
24 hours	2.64	6.72	9.12

Table 2: Frequency Storm Depths

Loss Rates

Loss rates and initial abstractions were determined from the Curve Number method outlined in US Department of Agriculture, Technical Release No. 55, *Urban Hydrology for Small Watersheds*[4]. Composite Curve Numbers for the sub-basin containing the proposed development were updated based on the hydrologic soil types and the existing land use for the City of Irving. The study area consists primarily of hydrologic soil type D, with a few isolated areas of types B. Hydrologic soil types were determined from the USDA-NRCS Soil Survey Geographic[5] (SSURGO) database for Dallas and Tarrant Counties, Texas dated 2009. Curve Numbers were used in calculating existing and proposed peak discharges. Land Use and Soil Maps along with Curve Number computations are provided in Appendix A.

Lag Time

Times of Concentration were determined for each sub-basin from the method outlined in Chapter 3 of Technical Release No. 55. Overland flow distances were limited to 100-feet. The shallow concentrated flow components use a K-factor of 16.1 and 20.3 for unpaved and paved conditions, respectively. Times of Concentration for the project site under post-project conditions were assumed to be the minimum (10 min) as defined by iSWM. Basin lag times were developed by multiplying the time of concentration by 0.6. Lag Time calculations are provided in Appendix A.

Unit Hydrographs and Routing

The Soil Conservation Service Dimensionless Unit Hydrograph Method was used to produce a synthetic hydrograph for the given 24-hour storms. The hydrograph parameters used for each sub-basin were based on the sub-basin Lag Time and the composite Curve Numbers (discussed above). Hydrographs from each sub-basin were routed to combination points using the Muskingum-Cunge. Level Pool Routing was used to determined proposed detention volumes. A computational interval of 2 minutes was used in HEC-HMS to develop hydrographs for each sub-basin.

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[4] TR-55, NRCS: http://www.wsi.nrcs.usda.gov/products/w2q/H&H/docs/other/TR55_documentation.pdf
[5] USDA-NRCS: http://soildatamart.nrcs.usda.gov

4.0 HYDRAULICS

4.1 Methodology

Three separate streams (Big Bear Creek Tributary, Channel BD-1and Estelle Creek Tributary) located in Passport Park were analyzed using the computer program HEC-RAS[6], River Analysis System, developed by the Hydrologic Engineering Center of the USACE (Version 5.0.3, October 2016). The existing conditions hydrology determined in the Passport Park Drainage Master plan was used to establish 100-year (1% annual chance) peak discharges for each model. The hydraulic model includes all three streams. Separate geometry and plans were developed for each stream. The procedures used in developing the hydraulic models are further explained below.

4.2 Existing Conditions (ECM)

The existing Conditions models for Big Bear Creek Tributary, Channel BD-1and Estelle Creek Tributary were developed to map existing inundation limits for the 100-year floodplain. Supporting data, results and mapping for each of the three (3) streams are provided in Appendix C.

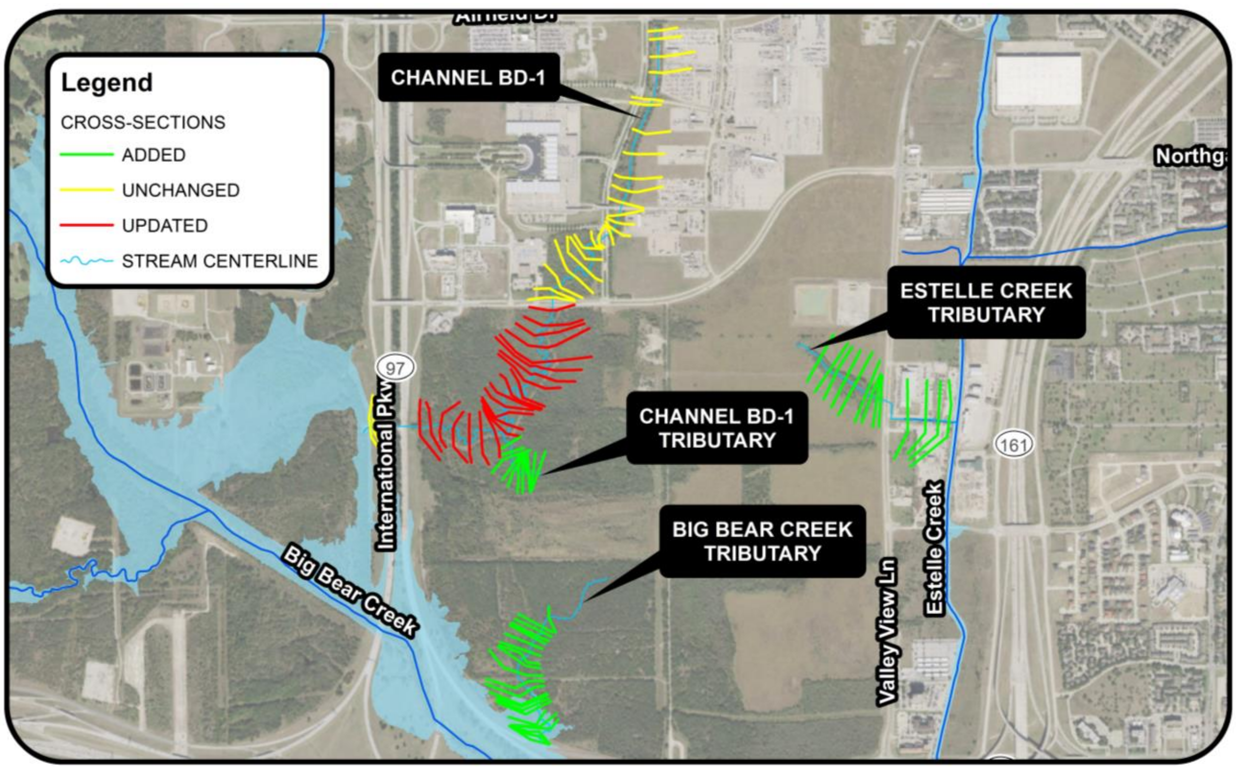


Figure 7: Cross-Section Layout

[6] HEC-RAS, USACE: http://www.hec.usace.army.mil/software/hec-ras/

Channel BD-1

DFW Airport provided the existing conditions hydraulic model for Channel BD-1, prepared by Jacob's, dated 2014. The existing model contains 48 cross-sections. Cross sectional geometry was updated for the 22 sections located within Passport Park. The model was revised to include 11 sections for a minor tributary located upstream of Section 2032 of the main reach. The downstream boundary condition was unrevised from the original model. Roughness coefficients for cross-sections within Passport Park were range from 0.075 for the channel and 0.12 for the heavily wooded overbanks. These values were unrevised from the original model. Normal contraction and expansion coefficients were used for all sections of 0.1 and 0.3, respectively.

Big Bear Creek Tributary

An existing hydraulic model for Big Bear Creek Tributary was not available. A new model was created for existing conditions extending northward from West Airport Freeway approximately 2,000 linear-feet. The geometry for the hydraulic model was developed by adding 22 new cross-sections from the site survey data within Passport Park. A normal depth slope of 0.001 was used for the starting boundary condition. Roughness coefficients for this tributary range from were range from 0.075 for the channel and 0.12 for the heavily wooded overbanks. Normal contraction and expansion coefficients of 0.1 and 0.3, were used for all cross sections, respectively.

Estelle Creek Tributary

An existing hydraulic model for Estelle Creek Tributary was not available. A new model was created for existing conditions extending westward from Estelle Creek and Valley View Lane, approximately 2,000 linear-feet. The geometry for the hydraulic model was developed by adding 13 new cross-sections and the Valley View Lane culvert. from the site survey data within Passport Park and as-built plans. A known water-surface elevation (499.1) was used for the starting boundary conditions of the hydraulic model. The known WSEL is based on Estelle Creek Base Flood Elevation as defined by FEMA's FIS for Dallas, County Texas Volume 4 of 9. Roughness coefficients for this tributary range from 0.018 for the downstream concrete channel to 0.075 for the moderately wooded overbanks. Contraction/expansion coefficients were set to 0.3 and 0.5 for cross-sections located up and downstream of the culvert sections, respectively. Normal contraction and expansion coefficients of 0.1 and 0.3, were used for all remaining cross sections.

5.0 RESULTS

5.1 Hydrologic Results

This master drainage plan provides peak discharges for the eastern and western portions of Passport Park. On-site detention will be provided on a site by site basis for the eastern half of the development. The western half also includes proposed detention volumes required to maintain pre-project peak discharges.

East Results

Figure 8 and Table 4 show the outfall locations and peak discharges for pre- and post-project conditions, respectively. Culverts 9A and 9B have a common outfall for the given drainage area. It is anticipated that the total flow will be divided and distributed equally to each inlet.

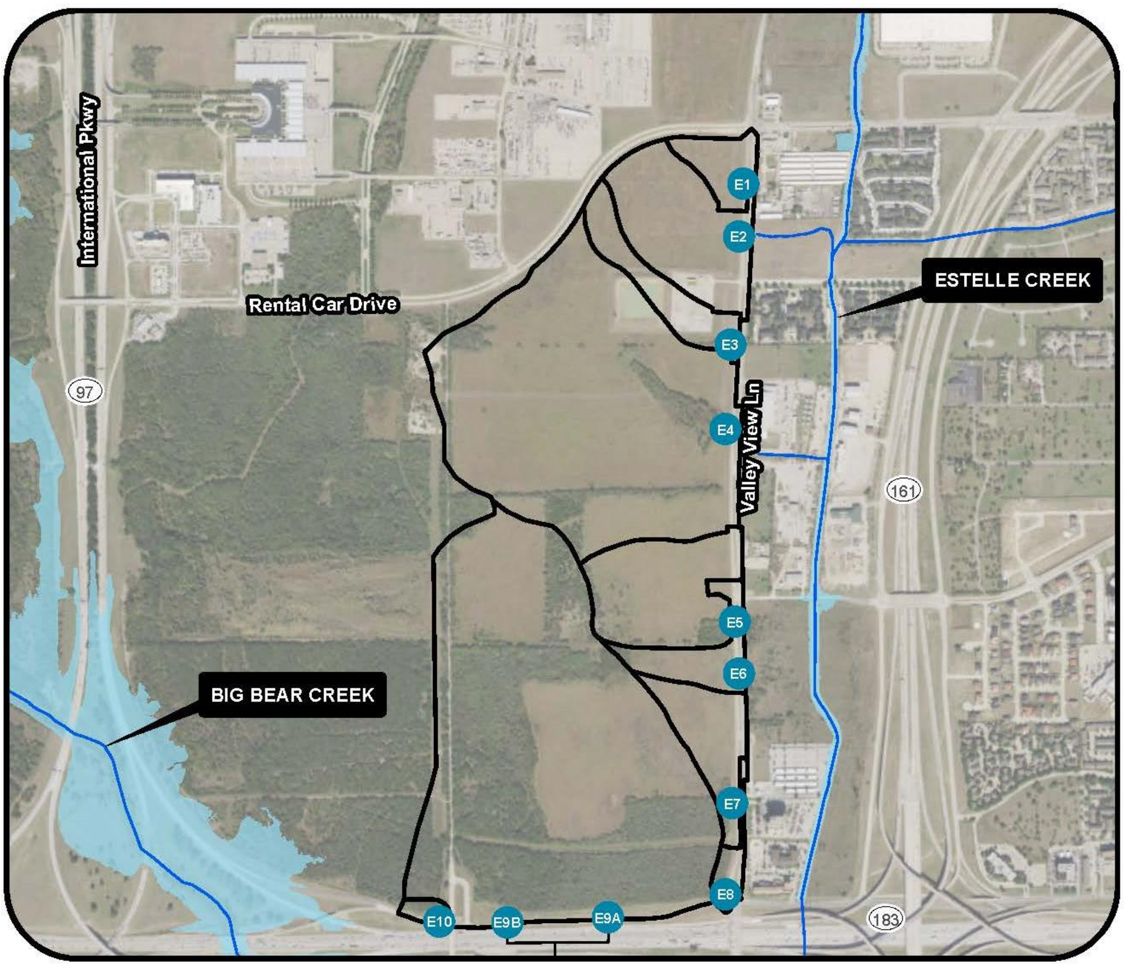


Figure 8: Eastern Drainage Area Outfall Locations

Table 3 shows the calculated Rational Method pre-project and post-project peak discharges for the 100-year storm event. On-site detention for each industrial site is required to maintain pre-project peak discharges.

Culvert/Drainage Area	**100-Year Pre-Project Peak Discharge** (cfs)	**100-Year Post-Project Peak Discharge** (cfs)
E1	24.9	77.2
E2	73.5	274.2
E3	38.0	121.8
E4	242.9	1188.2
E5	74.5	261.9
E6	39.9	103.5
E7	51.7	144.4
E8	23.6	39.9
E9A/E9B	244.2	1547.1*
E10	9.2	18.9

Table 3: Rational Method Peak Discharges

* The 100-year post-project peak for Drainage Areas E9A and E9B is the undetained release rate. Based on input from the City of Irving, the downstream channel on the south side of SH 183 does not have capacity for the undetained release rate. Development within subbasins E9A and E9B will be required to detain the 100-year post-project peak discharges to the pre-project peak discharge shown in the table above. It should be noted, the design plans for the Gateway Business Park Passport South Industrial development show the100-year post-project peak discharge is approximately 227.6 cfs, which is 16.6 cfs below the pre-project conditions.

West Results

Figure 9 show the outfall locations and potential detention footprints for the western half of the development. Detention footprint areas were approximated based establishing a volume to maintaining pre-project peak discharges for the 1-, 25- and 100-year storm events as required in the iSWM Manual. Detailed calculations will be required as specific sites are developed during later phases of the project. The location and size of detention footprints shown in Figure 9 are for site planning purposes only. Detailed detention calculations and grading plans will be required for each site.

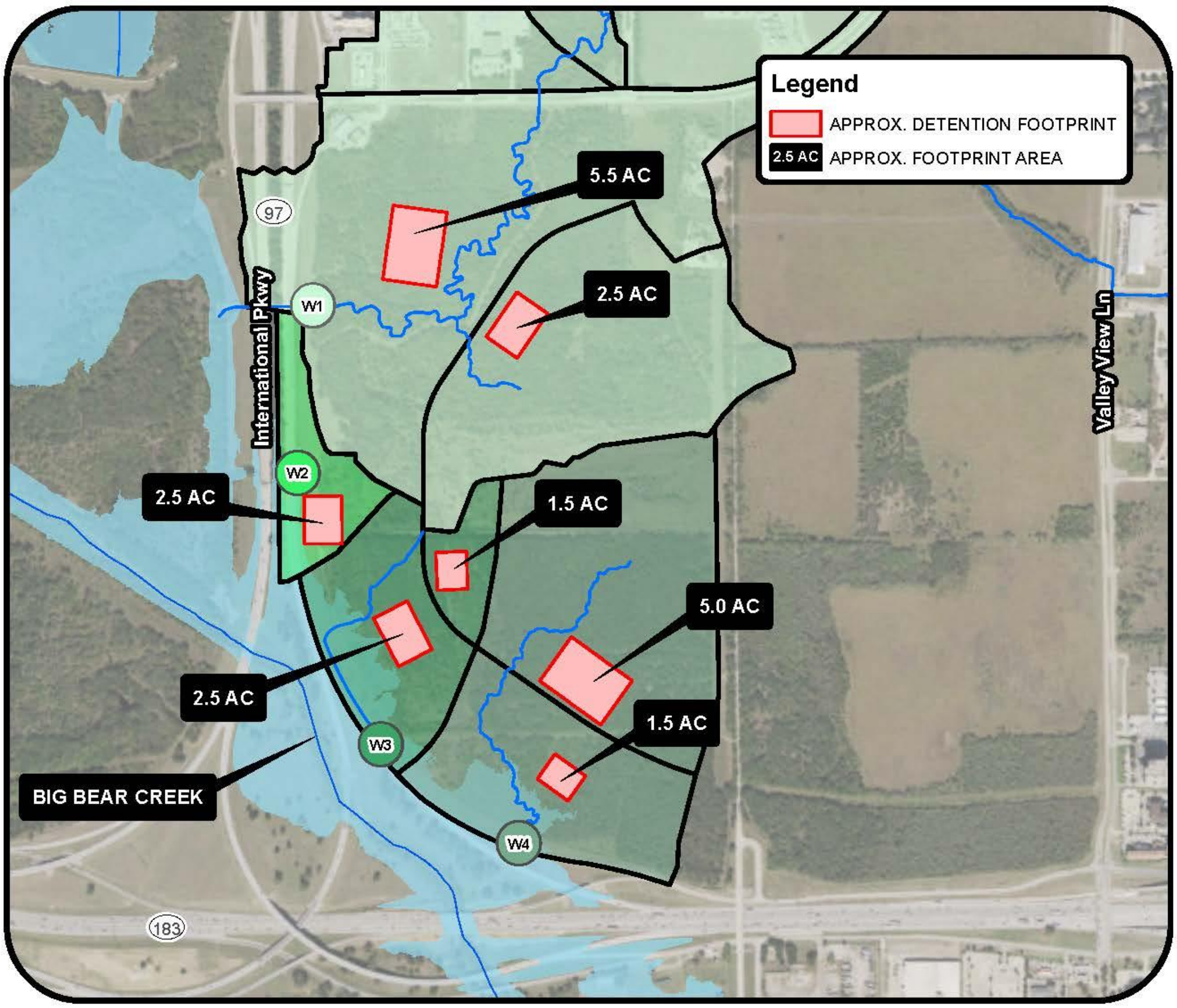


Figure 9: Western Drainage Area Outfall Locations

Figure 10 shows the overall watershed for the western half of Passport Park. The area located between Rental Car Drive and Airfield Drive was assumed to be developed. The area north of Airfield Drive is currently undeveloped and may need to provide detention.

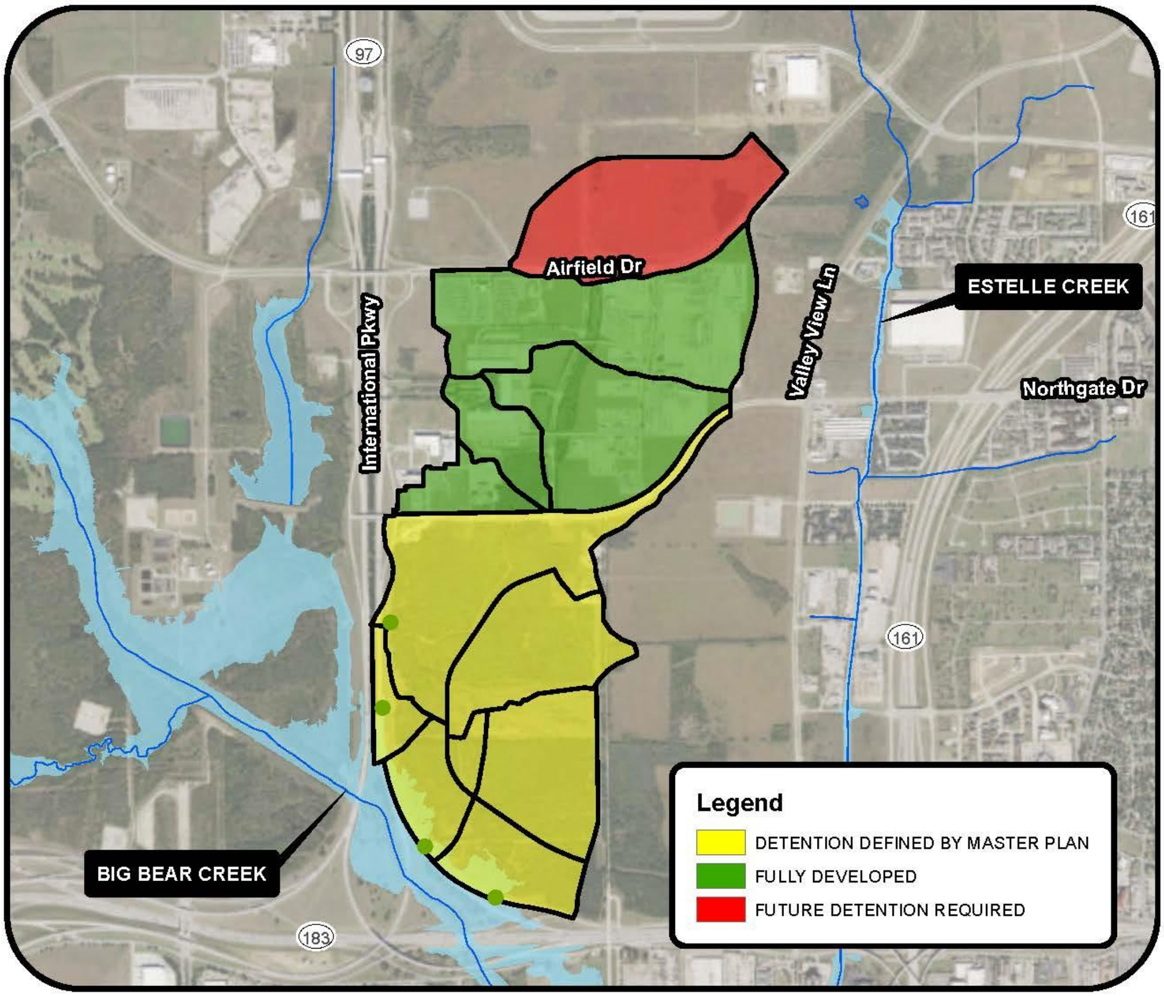


Figure 10: Future Detention Requirements

Table 4 shows the 100-year peak discharges for pre- and post-project conditions for each sub-basin on the west half of the site. Peak discharges for sub-basins upstream of the site are unchanged. On-site, peak discharges increase from pre- to post-project conditions, as expected.

Sub-basin	100-Yr Pre-Project Peak Discharge (cfs)	100-Yr Post-Project Peak Discharge (cfs)
W-1a	507	868
W-1b	331	511
W-1c	125	125
W-1d	180	180
W-1e	515	515
W-1f	603	603
W-1g	481	481
W-2a	74	118
W-3a	118	223
W-3b	56	64
W-4a	157	301
W-4b	318	490

Table 4: 100-Year Peak Discharge Comparison

Table 5 shows the computed pre-project discharge rates at each outfall location. Post-project rates must not exceed the values indicated in Table 5. The table also provides the total estimated detention volume necessary to reduce developed peak discharges to pre-project peak discharges.

Culvert	1-Yr Pre-Project Peak Discharge (cfs)	25-Yr Pre-Project Peak Discharge (cfs)	100-Yr Pre-Project Peak Discharge (cfs)	Required volume (ac-ft)
W1	502	1750	2500	32.0
W2	8	50	74	5.0
W3	16	113	180	9.0
W4	58	310	474	20.0

Table 5: Detention Requirements

5.2 Hydraulic Results

Figure 11 shows the existing 100-year floodplain inundation limits for the three streams within Passport Park. Detailed floodplain mapping and water-surface elevations are provided in Appendix B. Hydraulic model output is provided in Appendix C.

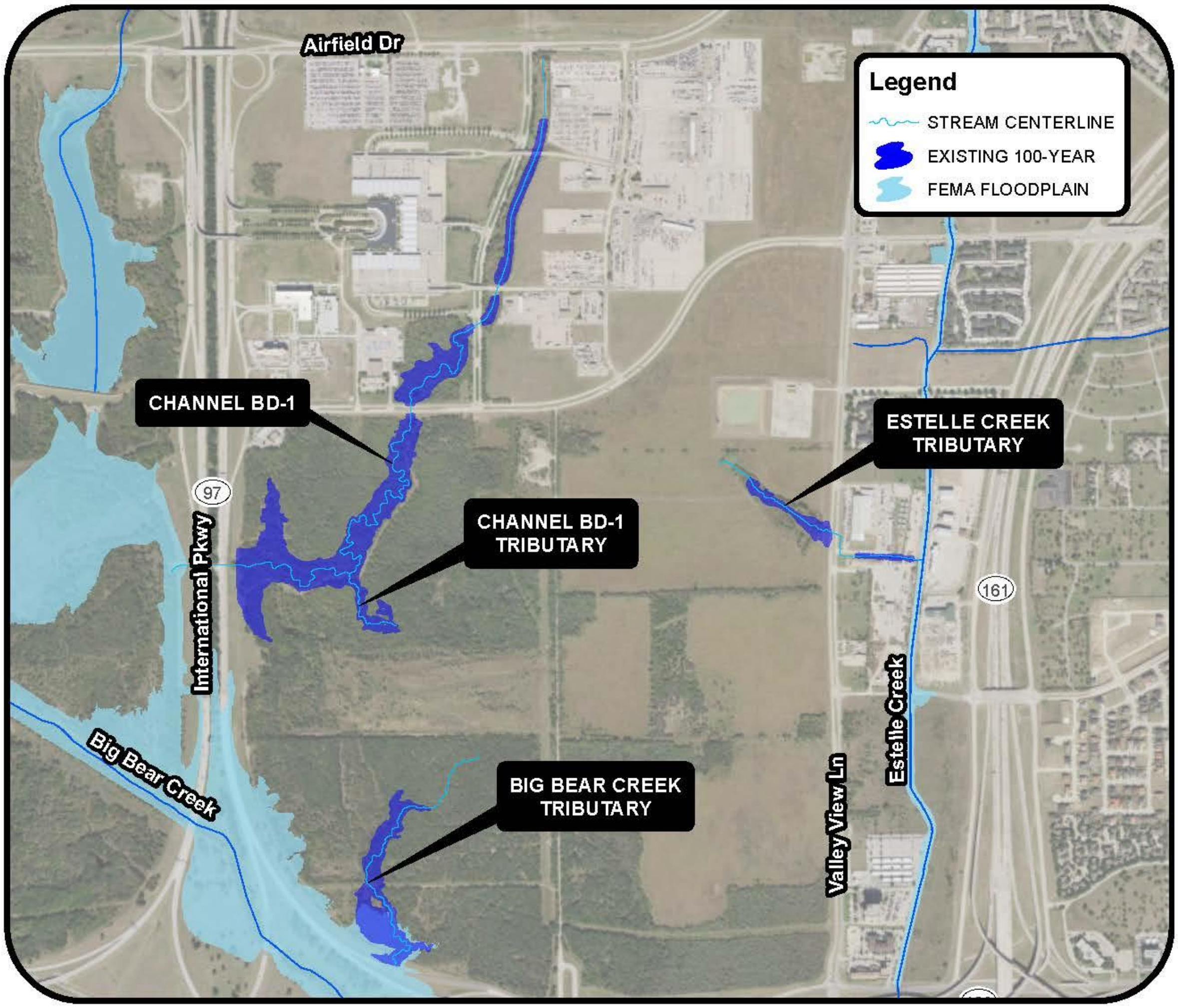


Figure 11: Existing Conditions Floodplain

6.0 CONCLUSION & RECOMMENDATIONS

This study develops a master drainage plan for the proposed Passport Park industrial development. Pre-project peak discharges are established for the eastern side of the development based on as-built plans of existing downstream storm water infrastructure using Rational Method calculations. On-site detention will be required to reduce developed flows and maintain pre-project peak discharges for individual industrial sites. The western half of the development was analyzed using a 24-hour frequency storm and the unit hydrograph methodology. Pre-project peak discharges for the 1-, 25-, and 100-year storm events were established base on pre-project watershed conditions. Estimated detention volumes and footprint areas are provided for Passport Park planning purposes. Detailed detention calculations will be required as development occurs. This study does not define the location of required detention areas within each drainage sub-basin.

Existing 100-year floodplain inundation limits were established for Big Bear Creek Tributary, Channel BD-1and Estelle Creek Tributary. These minor tributaries are not currently shown on the FEMA Flood Insurance Rate Maps. However, future development including modifications to the established floodplains within Passport Park will require detailed hydraulic analysis to compare existing and proposed conditions. These streams have also been identified as Jurisdictional Features of the US and will require permitting through the USACE construction activities resulting in fill.

Reclamation of Bear Creek floodplain may be required for commercial sites located adjacent to International Parkway. Modifications including fill within the Bear Creek will require permitting through FEMA and the City of Irving. Permitting will also be required from DFW. Typically, hydraulic analysis is necessary to prove proposed fill will not negatively impact (increase flood level and velocities) adjacent properties. FEMA requires a Conditional Letter of Map Revision (CLOMR) prior to construction if proposed floodplain modifications within a Zone AE floodplain cause any increase in Base Flood Elevations (BFE).

7.0 DEFINITIONS & ACRONYMS

100-Year Flood. The flood event that has a 1-percent chance of being equaled or exceeded each year, also referred to as the 1-percent annual chance flood.

Base Flood Elevation (BFE). Typically refers to the water-surface elevations during the 100-year flood event.

Basin Lag Time. The time difference between the peak of the storm event and the peak discharge. Typically calculated by multiplying the time of concentration by 0.6.

Curve Number (CN). A hydrologic parameter used to characterize the runoff properties for a particular soil type and land use.

FPS. Feet Per Second

HEC-HMS. The Hydrologic Engineering Center – Hydrologic Modeling System software developed by the US Army Corps of Engineers to simulate the precipitation-runoff processes of dendritic watershed systems.

NAD83. 1983 North American Datum

NAVD88. 1988 North American Vertical Datum

PK. Pacheco Koch

Time of Concentration (Tc). The time needed for water to flow from the most hydraulically remote point in a watershed to the watershed outlet. It is a function of the topography, geology, and land use within the watershed.

USACE. United States Army Corps of Engineers

WSEL. Water-Surface Elevation

8.0 REFERENCES

Department of Agriculture. Natural Resources Conservation Service. *Technical Release 55, Urban Hydrology for Small Watersheds.* Washington, DC: GPO, 1986.

Department of Agriculture. Soil Conservation Service: *Soil Survey of Dallas County, Texas,* 1981.

Department of Agriculture. Soil Conservation Service: *Soil Survey of Tarrant County, Texas,* 1981.

Ernest F. Brater, Horace Williams King: *Handbook of Hydraulics*, Sixth Edition, Michigan, 1976.

NTCOG, *iSWM Criteria Manual, 2015.*

NTCOG, *iSWM Technical Manual, 2014*.

United States Army Corps of Engineers. Hydrologic Engineering Center: *HEC-HMS Hydrologic Modeling System: [Computer Software, User's Manual, Technical Reference Manual, Application Guide], Version 4.1*. Washington, DC: GPO, August 2010.

United States. Federal Emergency Management Agency. *Flood Insurance Rate Map, No. 48113C0285K, Dallas County, Texas and Incorporated Areas.* Washington, DC: GPO, July 7, 2014.

United States. Federal Emergency Management Agency. *Flood Insurance Rate Map, No. 48439C0235K, Tarrant County, Texas and Incorporated Areas.* Washington, DC: GPO, September 25, 2009.

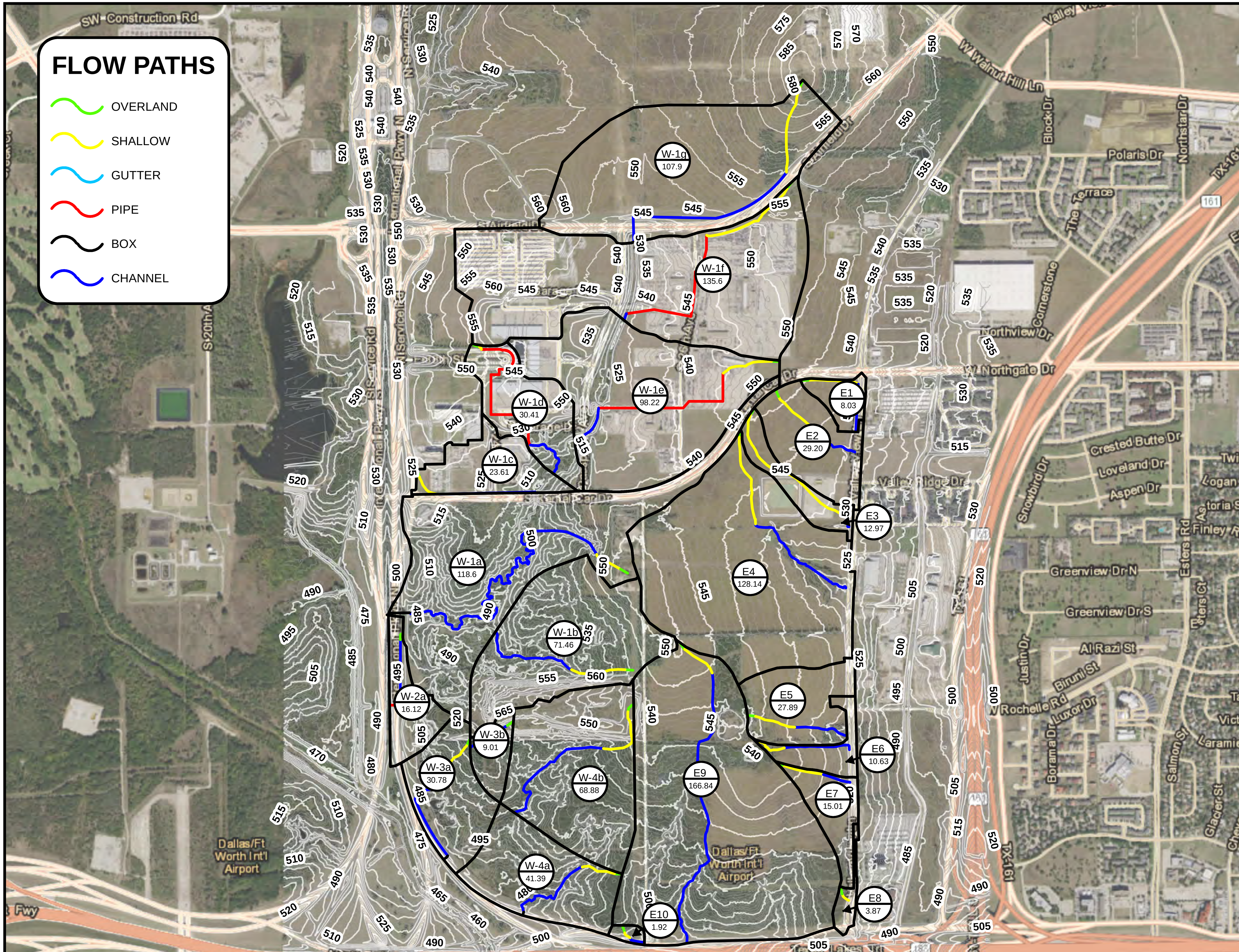
Ven Te Chow, PhD: *Open-Channel Hydraulics*, Illinois, 1959.

Appendix A

Hydrology

- Drainage Area Map
- Hydrologic Soil Groups Map
- Existing Land Use Map
- Proposed Land Use Map
- Existing C Factor Map
- Proposed C Factor Map
- Curve Number Calculations
- Lag Time Calculations
- SCS Hydrologic Parameters
- Weighted C Factor Calculations

Drainage Area Map



DRAINAGE AREA MAP

PASSPORT PARK

IRVING, TEXAS

KEY TO FEATURES

DRAINAGE AREA

E8 3.87 — BASIN ID / AREA (acres)

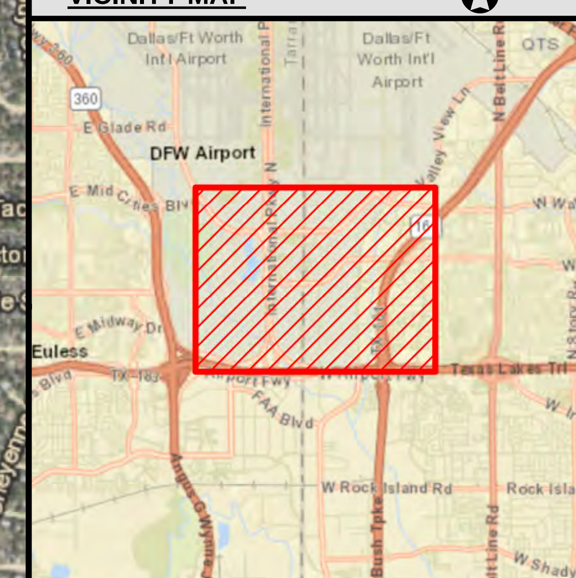
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 600 1,200 Feet

1 inch = 1,200 feet

VICINITY MAP



October 3, 2017 MAP 1 OF 1

Pacheco Koch

TX REG. ENGINEERING FIRM F-469

TX REG. SURVEYING FIRM LS-10008000

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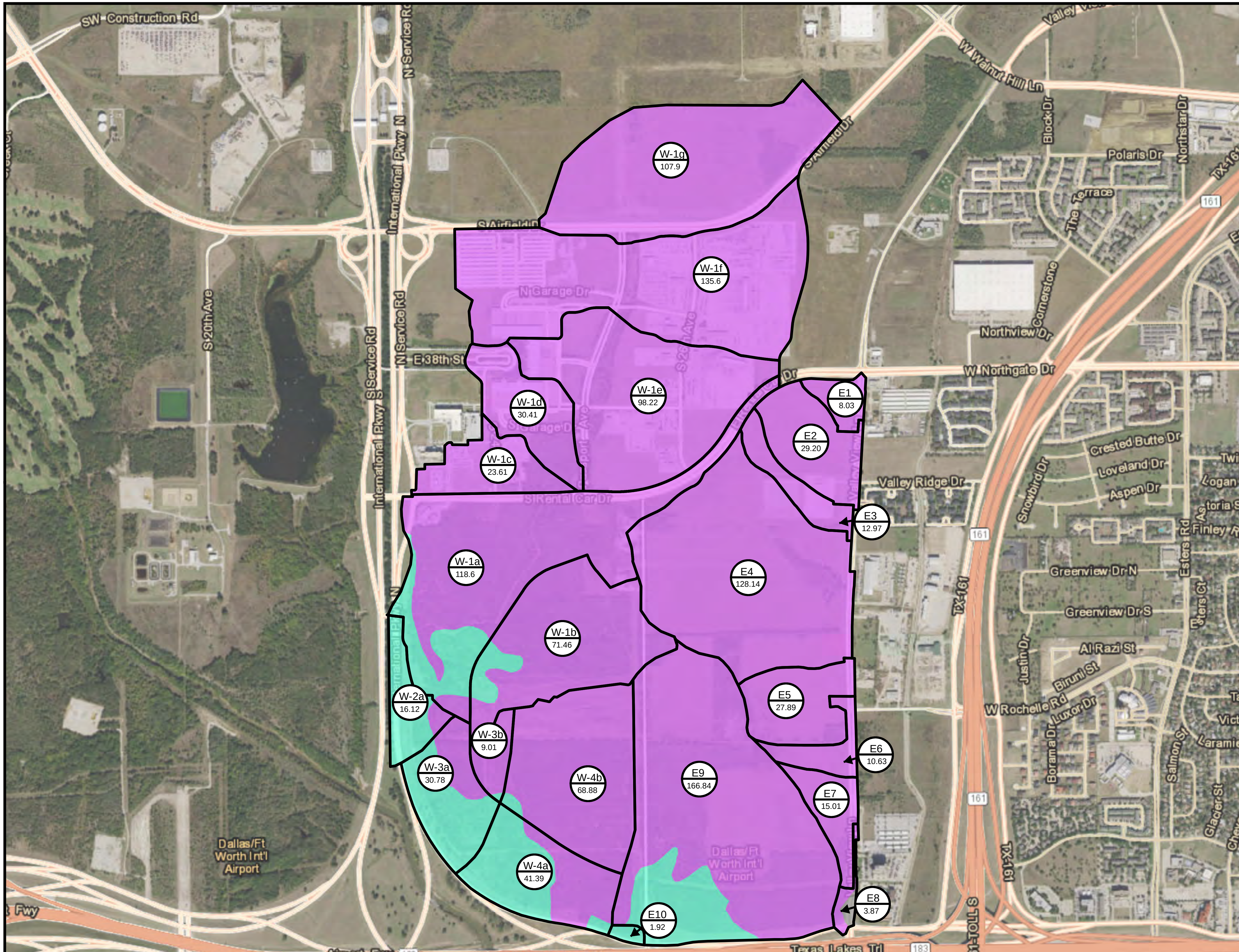
Hydrologic Soil Groups Map

SOILS MAP

PASSPORT PARK

IRVING, TEXAS



KEY TO FEATURES

HYDROLOGIC SOILS GROUP

- B
- C
- D
- DRAINAGE AREA
- BASIN ID / AREA (acres) (E8, 3.87)

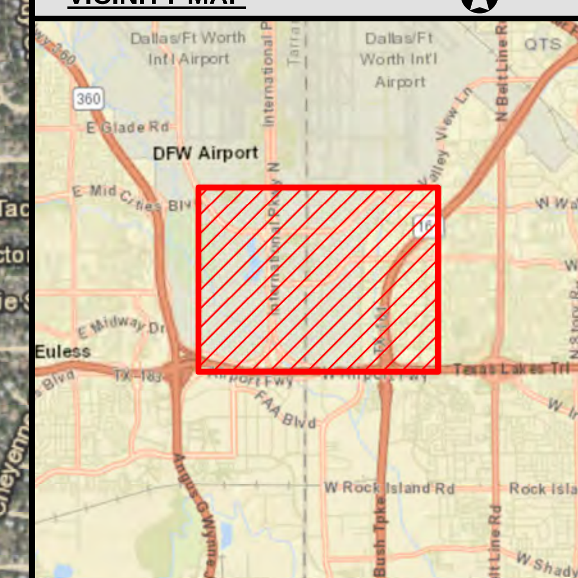
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 600 1,200 Feet

1 inch = 1,200 feet

VICINITY MAP



October 3, 2017 MAP 1 OF 3

Pacheco Koch

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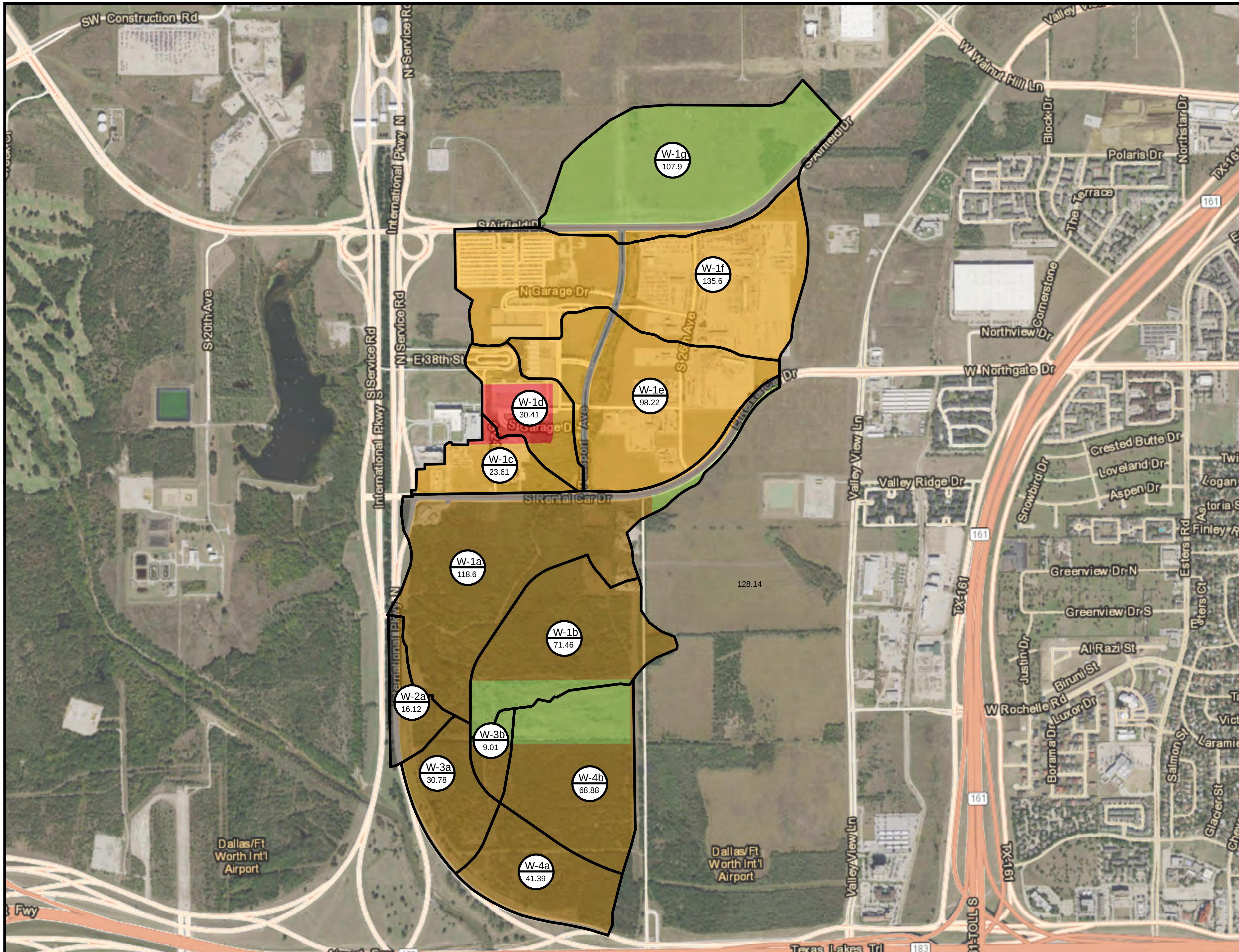
TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469

Existing Land Use Map



EXISTING LANDUSE MAP

PASSPORT PARK

IRVING, TEXAS

KEY TO FEATURES

DRAINAGE AREA

LAND USE

WOODS

ROADWAY

COMMERCIAL

INDUSTRIAL

OPEN SPACE

E8 3.87 BASIN ID AREA (acres)

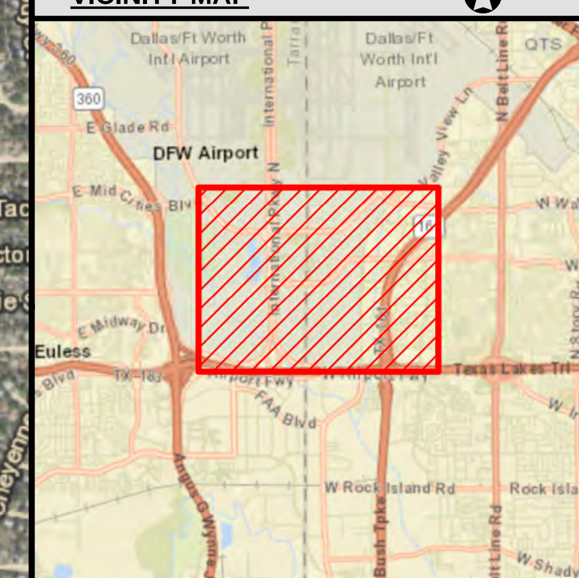
DATUM

NAD 1983 Texas State Plane North Central Zone FIPS 4202

0 600 1,200 Feet

1 inch = 1,200 feet

VICINITY MAP



October 3, 2017 MAP 1 OF 3

Pacheco Koch

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TX REG. SURVEYING FIRM LS-10008000

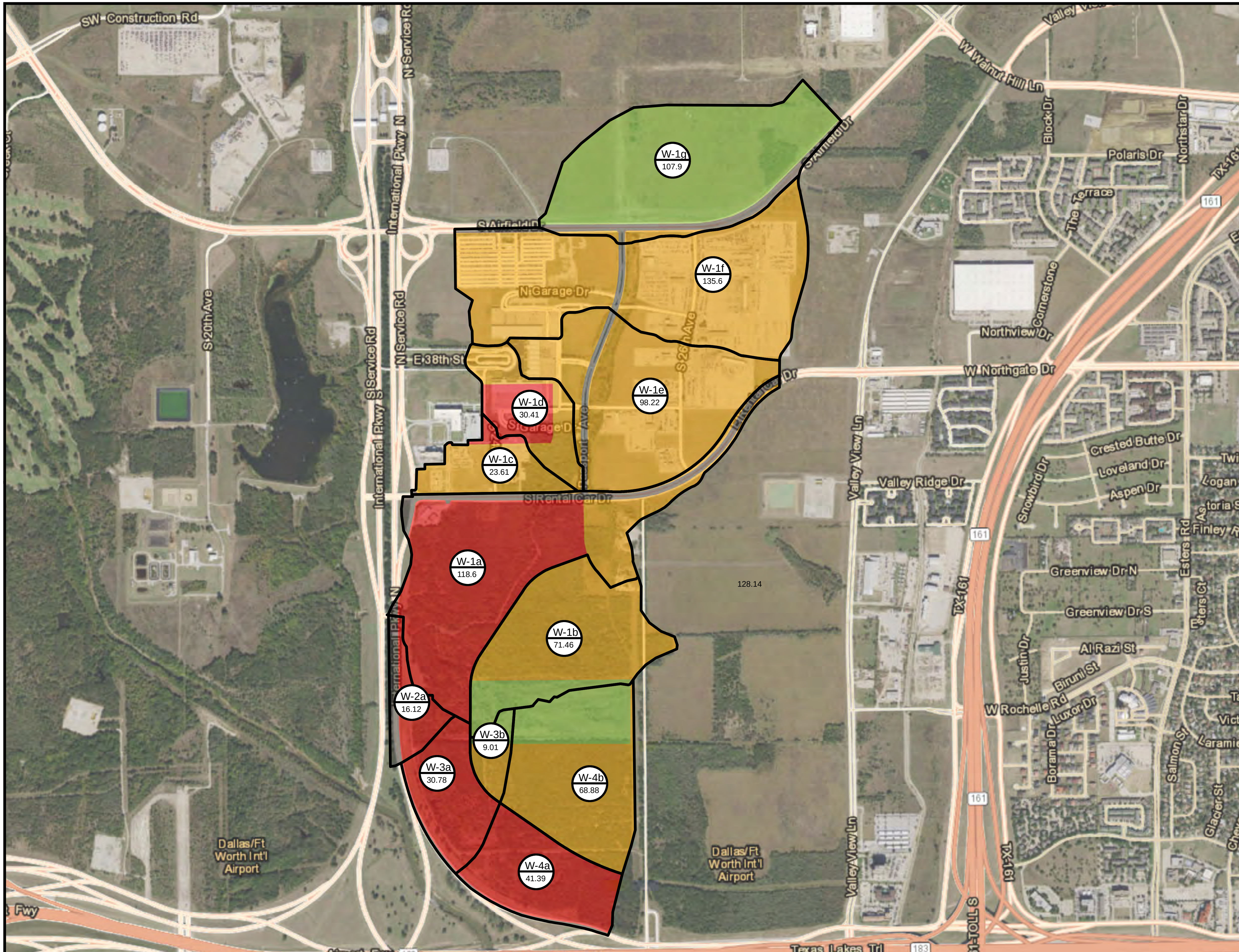
TX REG. ENGINEERING FIRM F-469

Proposed Land Use Map

PROPOSED LAND USE MAP

PASSPORT PARK

IRVING, TEXAS



KEY TO FEATURES

DRAINAGE AREA

LAND USE

- WOODS
- ROADWAY
- COMMERCIAL
- INDUSTRIAL
- OPEN SPACE

E8 3.87 — BASIN ID / AREA (acres)

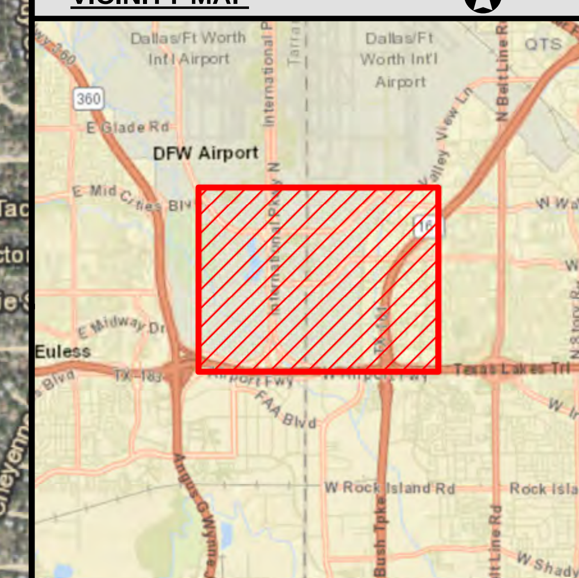
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 600 1,200 Feet

1 inch = 1,200 feet

VICINITY MAP



October 3, 2017 MAP 1 OF 1

Pacheco Koch

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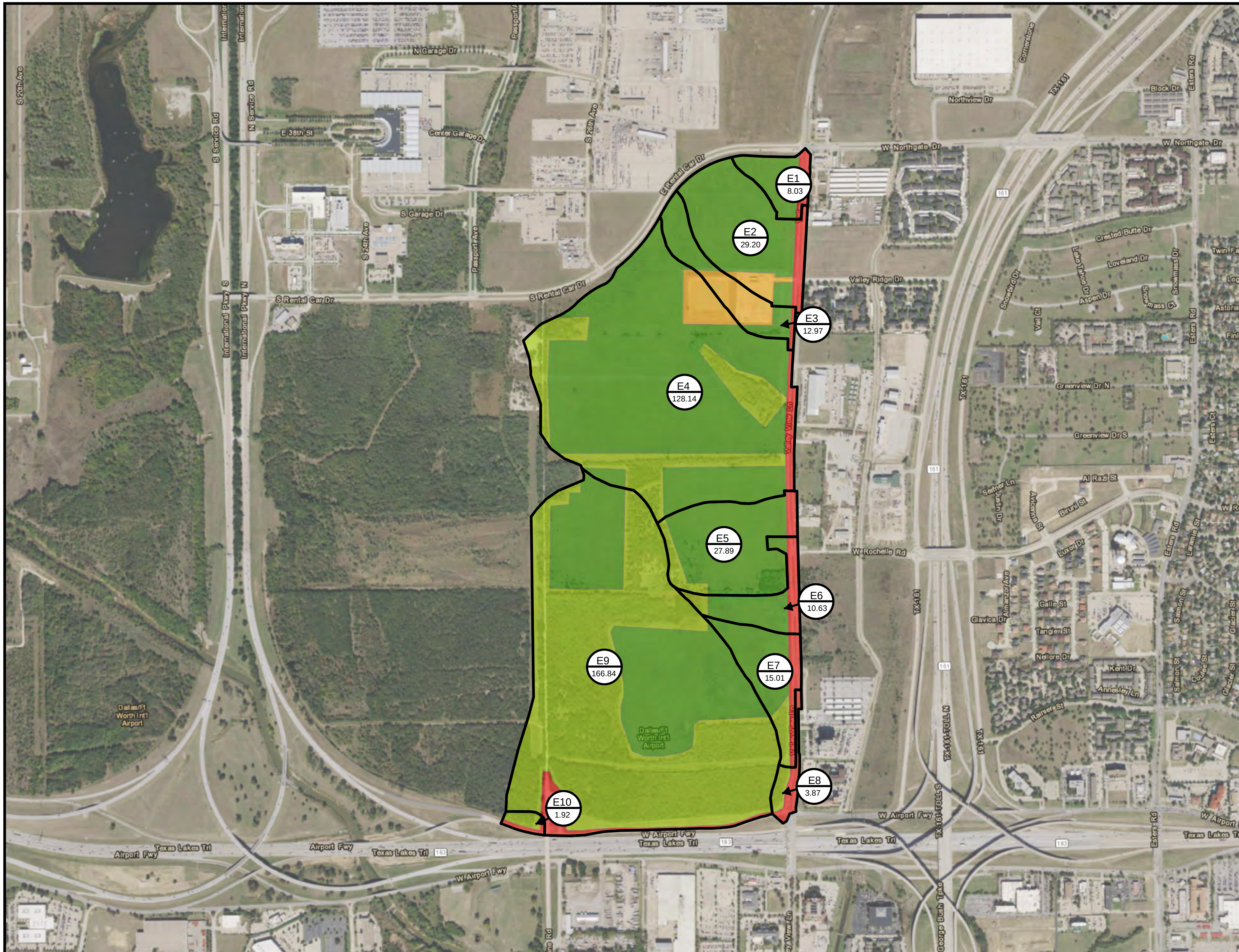
TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469

Existing C Factor Map



EXISTING C-FACTOR MAP

PASSPORT PARK

IRVING, TEXAS

KEY TO FEATURES

C-FACTOR

- 0.15
- 0.3
- 0.7
- 0.95
- DRAINAGE AREA
- E8 / 3.87: BASIN ID / AREA (acres)

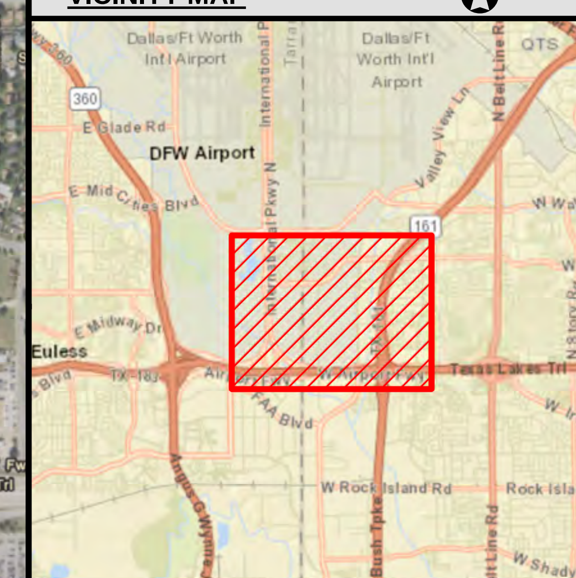
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 500 1,000 Feet

1 inch = 1,000 feet

VICINITY MAP



September 18, 2017 MAP 2 OF 2

Pacheco Koch

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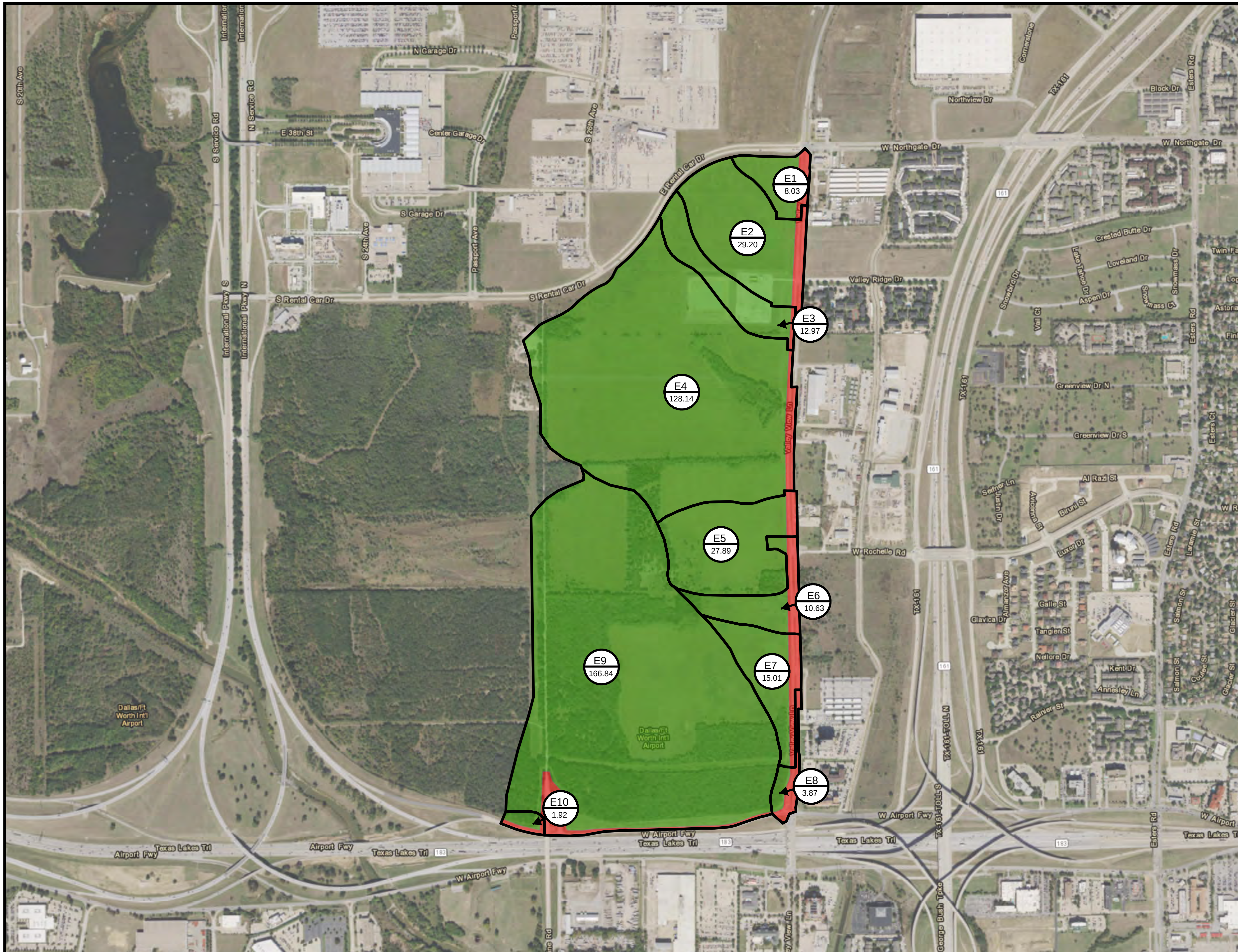
TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469

Proposed C Factor Map



PROPOSED C-FACTOR MAP

PASSPORT PARK

IRVING, TEXAS

KEY TO FEATURES

C-FACTOR

- 0.8
- 0.95
- DRAINAGE AREA

E8 / 3.87 — BASIN ID / AREA (acres)

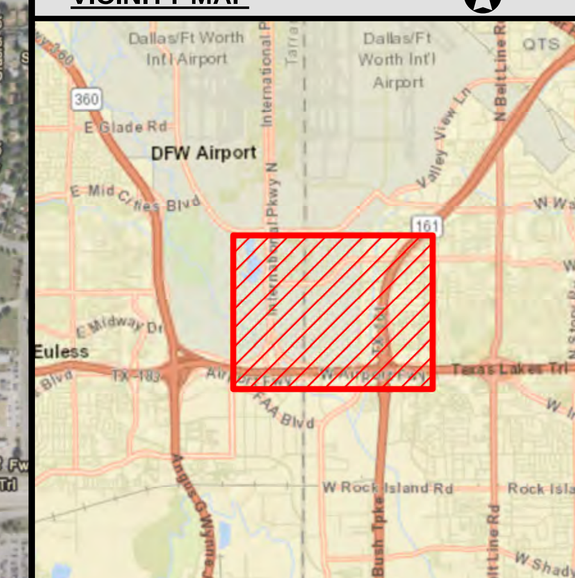
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 500 1,000 Feet

1 inch = 1,000 feet

VICINITY MAP



September 18, 2017

MAP 2 OF 2

Pacheco Koch

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TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469

Curve Number Calculations

PRE-PROJECT CURVE NUMBER REPORT

W-1a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
INDUSTRIAL	D	93	117,040	2.1
OPEN SPACE (FAIR CONDITION)	B	69	11	0.0
OPEN SPACE (FAIR CONDITION)	D	84	139,669	2.3
ROADWAY	B	98	18,758	0.4
ROADWAY	D	98	473,308	9.0
WOODS	B	60	771,517	9.0
WOODS	D	79	3,646,439	55.8
			5,166,742	78.4

W-1b

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
OPEN SPACE (FAIR CONDITION)	B	69	83,324	1.8
OPEN SPACE (FAIR CONDITION)	D	84	469,922	12.7
WOODS	B	60	164,142	3.2
WOODS	D	79	2,395,561	60.8
			3,112,950	78.5

W-1c

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
COMMERCIAL & BUSINESS	D	95	99,342	9.2
INDUSTRIAL	D	93	925,686	83.7
ROADWAY	D	98	3,557	0.3
			1,028,585	93.2

W-1d

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
COMMERCIAL & BUSINESS	D	95	573,955	41.2
INDUSTRIAL	D	93	742,308	52.1
ROADWAY	D	98	8,472	0.6
			1,324,735	93.9

W-1e

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
INDUSTRIAL	D	93	4,097,721	89.1
ROADWAY	D	98	180,527	4.1
			4,278,249	93.2

W-1f

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
INDUSTRIAL	D	93	5,770,046	90.8
ROADWAY	D	98	137,033	2.3
			5,907,079	93.1

W-1g

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
INDUSTRIAL	D	93	147,896	2.9
OPEN SPACE (FAIR CONDITION)	D	84	4,180,872	74.7
ROADWAY	D	98	370,277	7.7
			4,699,045	85.4

W-2a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
ROADWAY	B	98	223,370	31.2
WOODS	B	60	401,710	34.3
WOODS	D	79	77,164	8.7
			702,244	74.2

W-3a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
OPEN SPACE (FAIR CONDITION)	D	84	26	0.0
ROADWAY	B	98	36,416	2.7
WOODS	B	60	923,577	41.3
WOODS	D	79	380,828	22.4
			1,340,847	66.4

W-3b

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
OPEN SPACE (FAIR CONDITION)	D	84	125,397	26.8
WOODS	B	60	11,141	1.7
WOODS	D	79	256,072	51.5
			392,610	80.1

W-4a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
ROADWAY	B	98	41,992	2.3
ROADWAY	D	98	14,630	0.8
WOODS	B	60	1,031,658	34.3
WOODS	D	79	714,481	31.3
			1,802,761	68.7

W-4b

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	WEIGHTED CN
OPEN SPACE (FAIR CONDITION)	D	84	929,036	26.0
WOODS	B	60	46,276	0.9
WOODS	D	79	2,024,931	53.3
			3,000,242	80.3

POST-PROJECT CURVE NUMBER REPORT

W-1a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	B	92	771,343	13.7
COMMERCIAL & BUSINESS	D	95	2,996,618	55.1
INDUSTRIAL	B	88	174	0.0
INDUSTRIAL	D	93	906,483	16.3
OPEN SPACE (FAIR CONDITION)	B	69	11	0.0
OPEN SPACE (FAIR CONDITION)	D	84	48	0.0
ROADWAY	B	98	1,565	0.0
ROADWAY	B	98	17,192	0.3
ROADWAY	D	98	473,308	9.0
			5,166,742	94.5

W-1b

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	B	92	61	0.0
COMMERCIAL & BUSINESS	D	95	291	0.0
INDUSTRIAL	B	88	164,081	4.6
INDUSTRIAL	D	93	2,395,271	71.6
OPEN SPACE (FAIR CONDITION)	B	69	83,324	1.8
OPEN SPACE (FAIR CONDITION)	D	84	469,922	12.7
			3,112,950	90.7

W-1c

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	D	95	99,342	9.2
INDUSTRIAL	D	93	925,686	83.7
ROADWAY	D	98	3,557	0.3
			1,028,585	93.2

W-1d

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	D	95	573,955	41.2
INDUSTRIAL	D	93	742,308	52.1
ROADWAY	D	98	8,472	0.6
			1,324,735	93.9

W-1e

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
INDUSTRIAL	D	93	4,097,721	89.1
ROADWAY	D	98	180,527	4.1
			4,278,249	93.2

W-1f

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
INDUSTRIAL	D	93	5,770,046	90.8
ROADWAY	D	98	137,033	2.3
			5,907,079	93.1

W-1g

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
INDUSTRIAL	D	93	147,896	2.9
OPEN SPACE (FAIR CONDITION)	D	84	4,180,872	74.7
ROADWAY	D	98	370,277	7.7
			4,699,045	85.4

W-2a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	B	92	401,710	52.6
COMMERCIAL & BUSINESS	D	95	77,164	10.4
ROADWAY	B	98	223,370	31.2
			702,244	94.2

W-3a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	B	92	923,577	63.4
COMMERCIAL & BUSINESS	D	95	380,614	27.0
INDUSTRIAL	D	93	214	0.0
OPEN SPACE (FAIR CONDITION)	D	84	26	0.0
ROADWAY	B	98	36,416	2.7
			1,340,847	93.0

W-3b

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	B	92	18	0.0
COMMERCIAL & BUSINESS	D	95	115	0.0
INDUSTRIAL	B	88	11,123	2.5
INDUSTRIAL	D	93	255,957	60.6
OPEN SPACE (FAIR CONDITION)	D	84	125,397	26.8
			392,610	90.0

W-4a

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	B	92	1,031,658	52.6
COMMERCIAL & BUSINESS	D	95	714,163	37.6
INDUSTRIAL	D	93	318	0.0
ROADWAY	B	98	41,992	2.3
ROADWAY	D	98	14,630	0.8
			1,802,761	93.4

W-4b

LAND USE	SOIL TYPE	CURVE NUMBER	SHAPE AREA	AREA WEIGHTED CN
COMMERCIAL & BUSINESS	D	95	217	0.0
INDUSTRIAL	B	88	46,276	1.4
INDUSTRIAL	D	93	2,024,714	62.8
OPEN SPACE (FAIR CONDITION)	D	84	929,036	26.0
			3,000,242	90.1

Lag Time Calculations

EAST DRAINAGE TIME OF CONCENTRATION REPORT

EQUATIONS:

$$T_{overland} = \frac{0.42(n \cdot L)^{0.8}}{(P_{2YR})^{0.5} S^{0.4}} \qquad T_{channel} = \frac{L}{60 \cdot K \cdot S^{0.5}}$$

P-2YR = 4 INCH MNIMUM SLOPE USED - 0.5%

E-01

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.60	0.240	0.00	0.1	22.57
SHALLOW	UNPAVED	638	1.33	0.000	16.10	1.9	5.72
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	600	1.27	0.050	28.69	3.2	3.09
		1,338					31.38

E-02

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.42	0.240	0.00	0.1	25.97
SHALLOW	UNPAVED	896	0.97	0.000	16.10	1.6	9.41
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	337	2.03	0.050	28.69	4.1	1.37
		1,333					36.75

E-03

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.50	0.240	0.00	0.1	24.25
SHALLOW	PAVED	975	2.57	0.000	20.30	3.3	4.99
SHALLOW	UNPAVED	924	0.60	0.000	16.10	1.2	12.38
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	171	6.56	0.050	28.69	7.3	0.39
		2,170					42.01

E-04

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.83	0.240	0.00	0.1	19.76
SHALLOW	UNPAVED	1,143	0.67	0.000	16.10	1.3	14.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,525	4.95	0.050	28.69	6.4	3.98
		2,768					38.17

E-05

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.47	0.240	0.00	0.1	15.75
SHALLOW	UNPAVED	516	1.55	0.000	16.10	2.0	4.28
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	685	2.72	0.050	28.69	4.7	2.41
		1,301					22.45

E-06

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.26	0.240	0.00	0.1	16.76
SHALLOW	UNPAVED	367	1.14	0.000	16.10	1.7	3.55
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	866	2.43	0.050	28.69	4.5	3.23
		1,333					23.54

E-07

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.44	0.240	0.00	0.1	25.62
SHALLOW	UNPAVED	527	1.34	0.000	16.10	1.9	4.71
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	351	3.06	0.050	28.69	5.0	1.17
		978					31.50

E-08

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.27	0.240	0.00	0.1	16.71
SHALLOW	UNPAVED	121	3.31	0.000	16.10	2.9	0.69
		221					17.39

E-09

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.66	0.240	0.00	0.1	21.71
SHALLOW	UNPAVED	467	1.22	0.000	16.10	1.8	4.39
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	3,715	2.83	0.050	42.29	7.1	8.71
		4,282					34.81

E-10

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	4.14	0.240	0.00	0.2	10.41
SHALLOW	UNPAVED	98	5.48	0.000	16.10	3.8	0.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	202	6.89	0.050	28.69	7.5	0.45
		401					11.29

TIME OF CONCENTRATION REPORT

EQUATIONS:

$$T_{overland}=\frac{0.42(n\cdot L)^{0.8}}{(P_{2YR})^{0.5}S^{0.4}} \qquad T_{channel}=\frac{L}{60\cdot K\cdot S^{0.5}}$$

P-2YR = 3.36 INCH MNIMUM SLOPE USED - 0.5%

W-1a

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.16	0.240	0.00	0.1	17.32
SHALLOW	UNPAVED	360	3.18	0.000	16.10	2.9	2.09
CHANNEL	NATRL TRAP (B=10,Y=6,SS=3:1)	4,961	1.26	0.050	68.56	7.7	10.72
BOX	7X5 RCB	263	0.81	0.014	136.50	12.3	0.36
		5,684					30.49
						TIME LAG (min):	18.29

W-1b

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	4.10	0.240	0.00	0.2	10.45
SHALLOW	UNPAVED	694	2.93	0.000	16.10	2.8	4.20
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,287	2.20	0.050	42.29	6.3	3.42
		2,082					18.07
						TIME LAG (min):	10.84

W-1c

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.50	0.240	0.00	0.1	24.25
SHALLOW	UNPAVED	333	0.61	0.000	16.10	1.3	4.43
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,239	1.74	0.050	28.69	3.8	5.45
		1,671					34.12
						TIME LAG (min):	20.47

W-1d

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.40	0.240	0.00	0.1	16.05
SHALLOW	UNPAVED	42	0.50	0.000	16.10	1.1	0.62
PIPE	42" RCP	2,244	1.09	0.014	97.10	10.2	3.68
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	673	2.65	0.050	42.29	6.9	1.63
		3,059					21.98
						TIME LAG (min):	13.19

W-1e

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.50	0.240	0.00	0.1	24.25
SHALLOW	PAVED	423	0.63	0.000	20.30	1.6	4.39
SHALLOW	UNPAVED	223	0.50	0.000	16.10	1.1	3.26
PIPE	36" RCP	1,952	0.50	0.014	87.62	6.2	5.25
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	546	3.53	0.050	42.29	7.9	1.14
		3,243					38.30
						TIME LAG (min):	22.98

W-1f

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	0.50	0.240	0.00	0.1	24.25
SHALLOW	UNPAVED	1,253	0.83	0.000	16.10	1.5	14.28
PIPE	42" RCP	1,900	1.04	0.014	97.10	9.9	3.20
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	88	2.24	0.050	42.29	6.3	0.23
		3,341					41.96
						TIME LAG (min):	25.18

W-1g

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.43	0.240	0.00	0.1	15.93
SHALLOW	UNPAVED	1,099	2.61	0.000	16.10	2.6	7.04
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	2,432	1.22	0.050	28.69	3.2	12.80
		3,631					35.77
						TIME LAG (min):	21.46

W-2a

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.43	0.240	0.00	0.1	15.91
PIPE	30" RCP	132	0.50	0.014	77.59	5.5	0.40
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	821	0.81	0.050	28.69	2.6	5.29
		1,053					21.60
						TIME LAG (min):	12.96

W-3a

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	6.10	0.240	0.00	0.1	13.68
SHALLOW	UNPAVED	434	4.03	0.000	16.10	3.2	2.24
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	1,430	1.62	0.050	28.69	3.7	6.52
BOX	5X5 RCB	72	0.99	0.014	123.17	12.3	0.10
		2,036					22.54
						TIME LAG (min):	13.52

W-3b

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	5.39	0.240	0.00	0.2	9.69
CHANNEL	NATRL TRAP (B=0,Y=2,SS=3:1)	565	5.50	0.050	28.69	6.7	1.40
		665					11.09
						TIME LAG (min):	6.65

W-4a

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	1.99	0.240	0.00	0.1	21.43
SHALLOW	UNPAVED	429	3.90	0.000	16.10	3.2	2.25
CHANNEL	NATRL TRAP (B=6,Y=4,SS=3:1)	1,150	1.65	0.050	51.79	6.6	2.88
BOX	7X5 RCB	46	1.72	0.014	136.50	17.9	0.04
		1,726					26.60
						TIME LAG (min):	15.96

W-4b

FLOW TYPE	SURFACE	LENGTH (ft)	SLOPE (%)	ROUGHNESS	K VALUE	VELOCITY (fps)	Tc (min)
OVERLAND	GRS-DENSE	100	2.22	0.240	0.00	0.1	20.52
SHALLOW	UNPAVED	777	3.94	0.000	16.10	3.2	4.05
CHANNEL	NATRL TRAP (B=4,Y=3,SS=3:1)	1,714	3.73	0.050	42.29	8.2	3.50
		2,591					28.07
						TIME LAG (min):	16.84

SCS Hydrologic Parameters

PRE PROJECT HYDROLOGIC PARAMETERS REPORT

BASIN ID	BASIN AREA (acres)	Tc (minutes)	TL (minutes)	COMPOSITE CN
W-1a	118.6	30.5	18.3	78.4
W-1b	71.5	18.1	10.8	78.5
W-1c	23.6	34.1	20.5	93.2
W-1d	30.4	22.0	13.2	93.9
W-1e	98.2	38.3	23.0	93.2
W-1f	135.6	42.0	25.2	93.1
W-1g	107.9	35.8	21.5	85.4
W-2a	16.1	21.6	13.0	74.2
W-3a	30.8	22.5	13.5	66.4
W-3b	9.0	11.1	6.7	80.1
W-4a	41.4	26.6	16.0	68.7
W-4b	68.9	16.8	10.1	80.3

POST PROJECT HYDROLOGIC PARAMETERS REPORT

BASIN ID	BASIN AREA (acres)	Tc (minutes)	TL (minutes)	COMPOSITE CN
W-1a	118.6	10.0	6.0	94.5
W-1b	71.5	10.0	6.0	90.7
W-1c	23.6	34.1	20.5	93.2
W-1d	30.4	22.0	13.2	93.9
W-1e	98.2	38.3	23.0	93.2
W-1f	135.6	42.0	25.2	93.1
W-1g	107.9	35.8	21.5	85.4
W-2a	16.1	10.0	6.0	94.2
W-3a	30.8	10.0	6.0	93.0
W-3b	9.0	10.0	6.0	90.0
W-4a	41.4	10.0	6.0	93.4
W-4b	68.9	10.0	6.0	90.1

Weighted C Factor Calculations

EXISTING WEIGHTED C FACTOR CALCULATIONS

BASIN ID	C FACTOR	AREA (acres)	% AREA	WEIGHTED C FACTOR
E-01	0.95	1.7	21.4%	0.44
	0.30	6.3	78.6%	
E-02	0.95	2.7	9.2%	0.39
	0.70	2.4	8.2%	
	0.30	24.1	82.6%	
E-03	0.95	0.5	3.7%	0.49
	0.70	5.2	40.3%	
	0.30	7.3	56.0%	
E-04	0.95	2.8	2.2%	0.30
	0.70	4.8	3.7%	
	0.15	23.7	18.5%	
	0.30	96.9	75.6%	
E-05	0.95	1.3	4.5%	0.32
	0.15	2.6	9.2%	
	0.30	24.0	86.2%	
E-06	0.95	2.8	26.4%	0.46
	0.15	0.9	8.9%	
	0.30	6.9	64.7%	
E-07	0.95	2.9	19.5%	0.45
	0.15	2.1	13.7%	
	0.30	12.1	80.5%	
E-08	0.95	2.4	62.8%	0.65
	0.15	1.4	37.2%	
E-09	0.95	4.7	2.8%	0.22
	0.15	109.6	65.7%	
	0.30	52.5	31.5%	
E-10	0.95	0.7	35.0%	0.43
	0.15	1.2	65.0%	

PROPOSED WEIGHTED C FACTOR CALCULATIONS

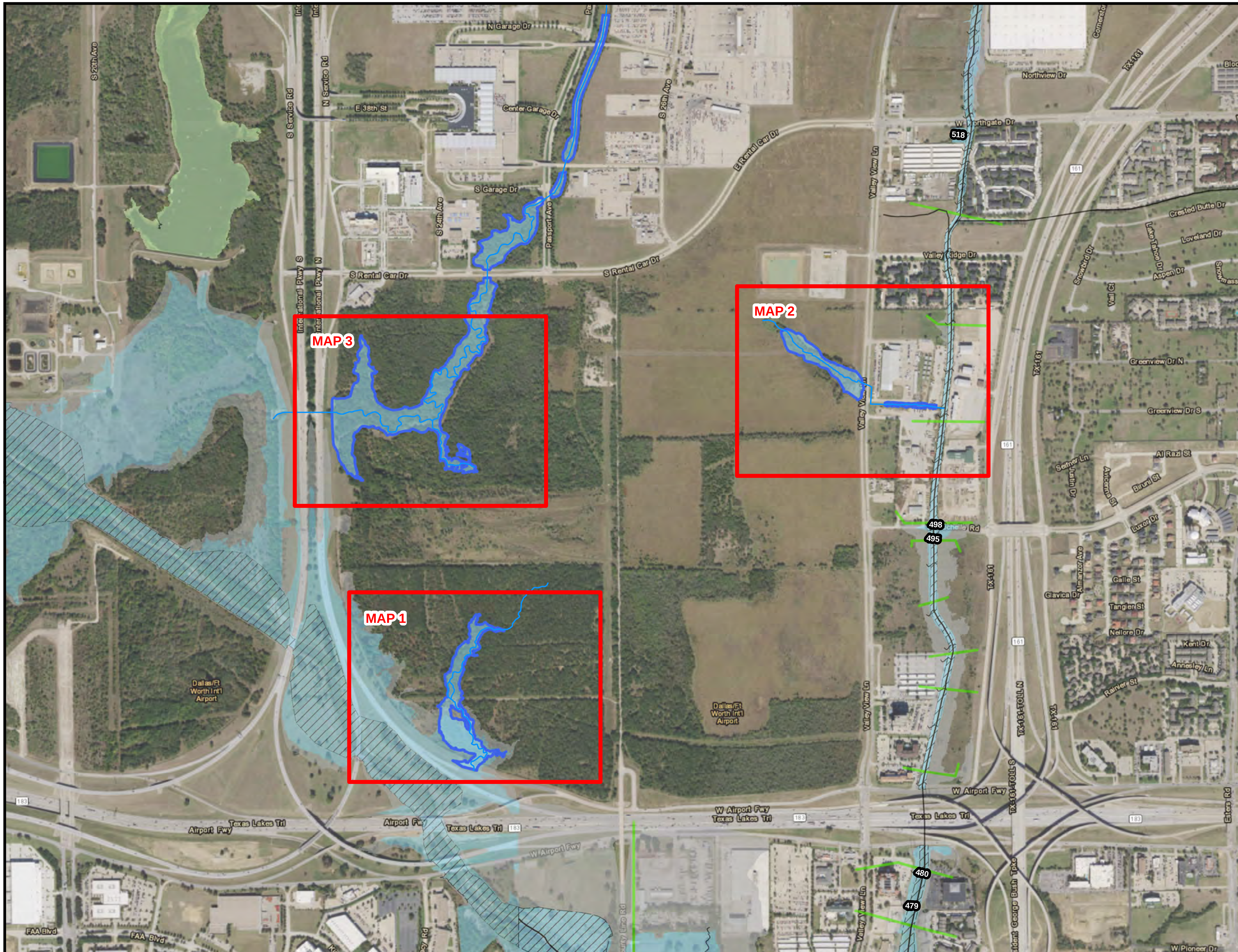
BASIN ID	C FACTOR	AREA (acres)	% AREA	WEIGHTED C FACTOR
E-01	0.95	1.7	21.4%	0.83
	0.80	6.3	78.6%	
E-02	0.95	2.7	9.2%	0.81
	0.80	26.5	90.7%	
E-03	0.95	0.5	3.7%	0.81
	0.80	12.5	96.4%	
E-04	0.95	2.8	2.2%	0.80
	0.80	125.3	97.8%	
E-05	0.95	1.3	4.5%	0.81
	0.80	26.6	95.5%	
E-06	0.95	2.8	26.4%	0.84
	0.80	7.8	73.6%	
E-07	0.95	2.9	19.5%	0.83
	0.80	12.1	80.5%	
E-08	0.95	2.4	62.8%	0.89
	0.80	1.4	37.2%	
E-09	0.95	4.7	2.8%	0.80
	0.80	162.2	97.2%	
E-10	0.95	0.7	35.0%	0.85
	0.80	1.2	65.0%	

Appendix B

Hydraulics

- Floodplain Key Map
- Floodplain Work Maps
- Cross-Section Plots
- Flood Profile
- Existing Conditions Model Output

Floodplain Key Map



FLOODPLAIN KEY MAP

PASSPORT PARK

DFW AIRPORT, TEXAS

KEY TO FEATURES

- FLOODPLAIN KEY
- STREAM CENTERLINE
- EXISTING 100-YR FLOODPLAIN

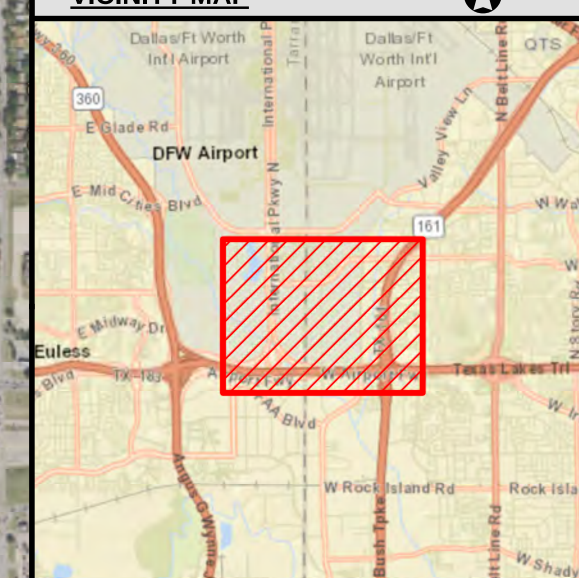
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 500 1,000 Feet

1 inch = 1,000 feet

VICINITY MAP



September 18, 2017 MAP 1 OF 1

Pacheco Koch

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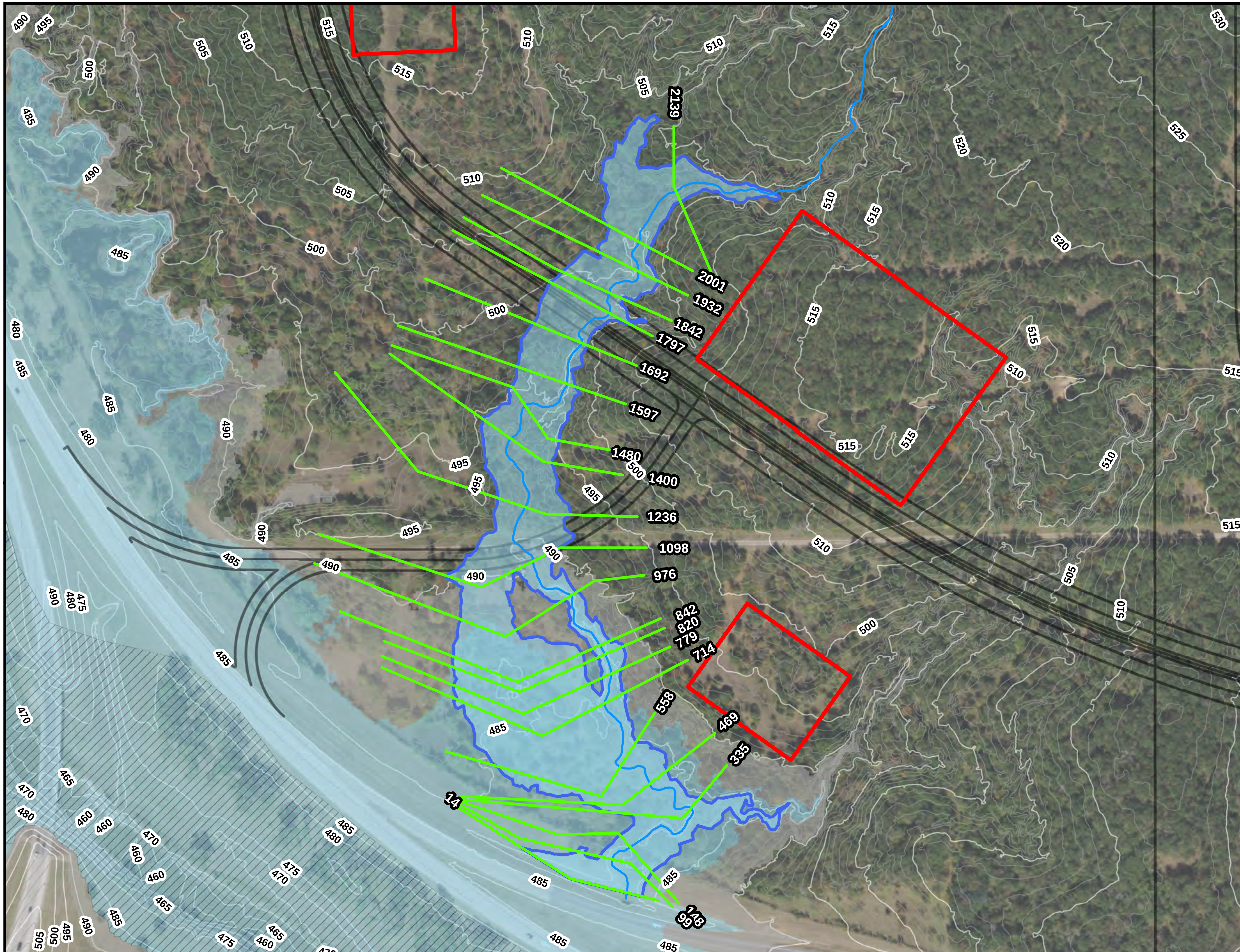
TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469

Floodplain Work Maps



BASE MAP 1

PASSPORT PARK

DFW AIRPORT, TEXAS

KEY TO FEATURES

- DETENTION PONDS
- EXISTING 100-YR FLOODPLAIN
- CROSS SECTIONS
- BIG BEAR CREEK
- LOT LAYOUT

LiDAR CONTOURS

- MINOR
- MAJOR

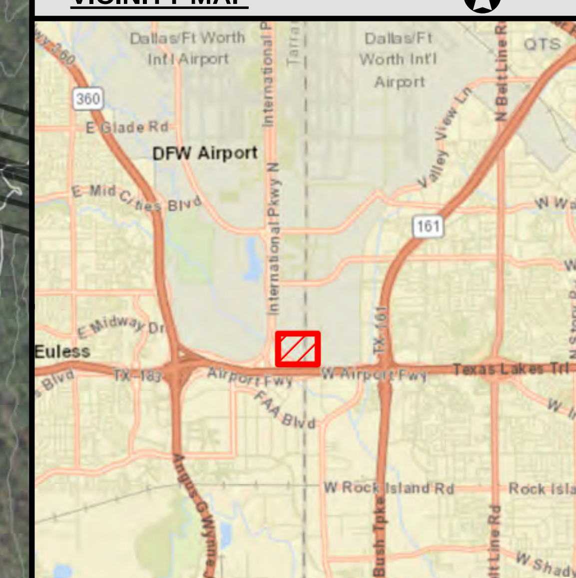
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 100 200 Feet

1 inch = 200 feet

VICINITY MAP



September 18, 2017

MAP 1 OF 3

Pacheco Koch

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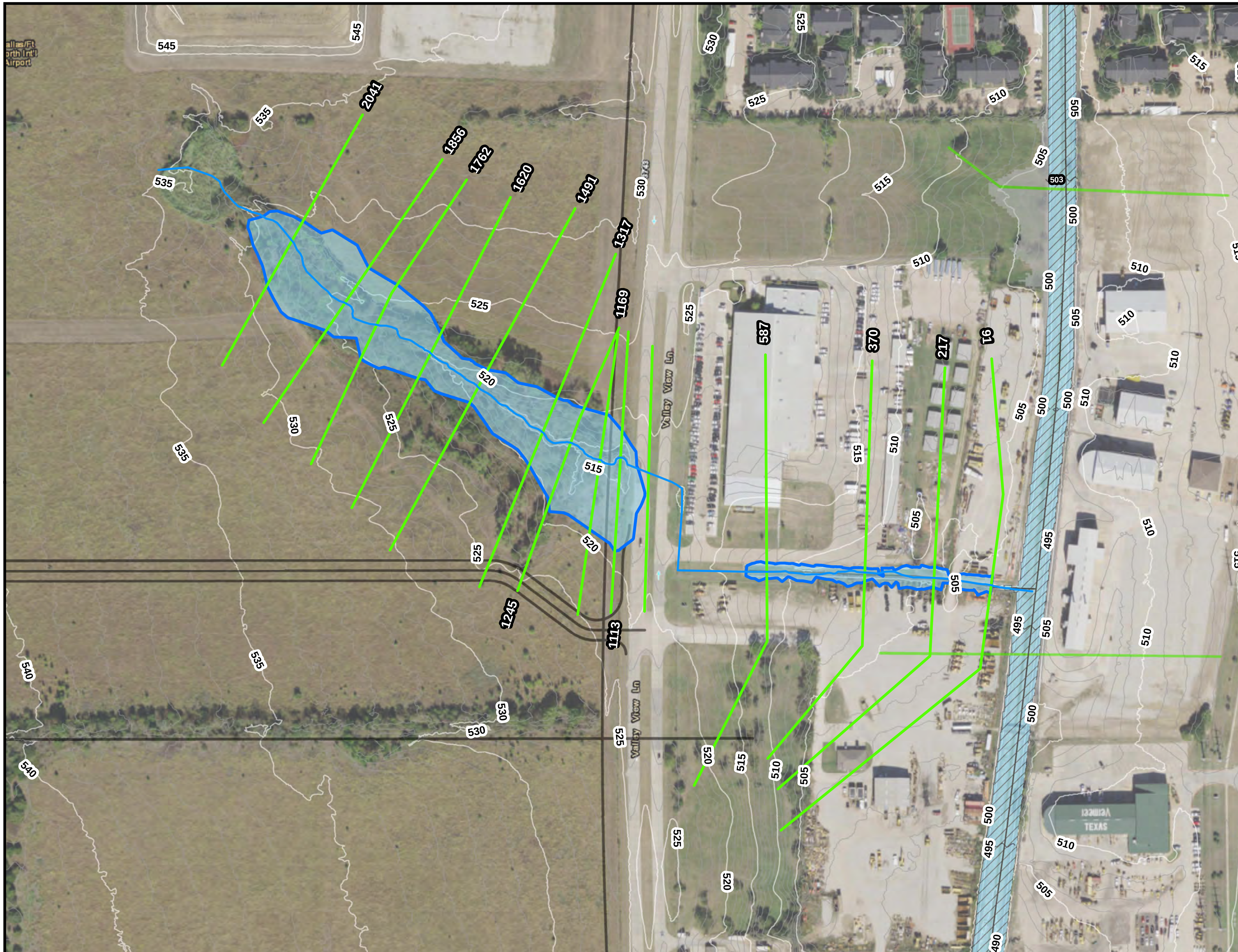
TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469



BASE MAP 2

PASSPORT PARK

DFW AIRPORT, TEXAS

KEY TO FEATURES

- ESTELLE CREEK TRIBUTARY
- CROSS SECTIONS
- EXISTING 100-YR FLOODPLAIN
- LOT LAYOUT

LiDAR CONTOURS

- MINOR
- MAJOR

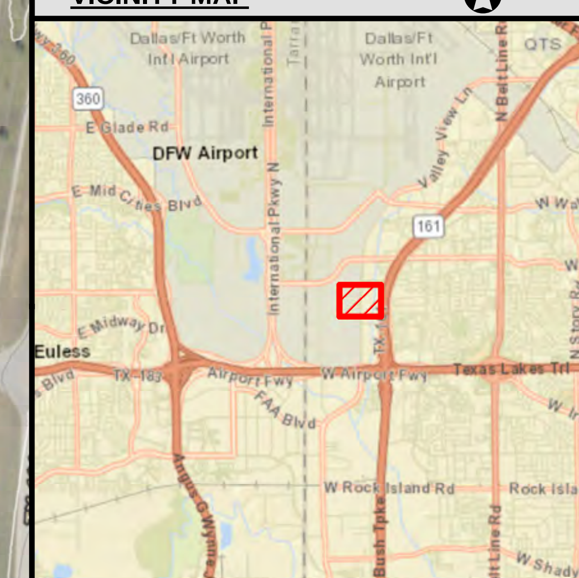
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 100 200 Feet

1 inch = 208 feet

VICINITY MAP



September 18, 2017 MAP 2 OF 3

Pacheco Koch

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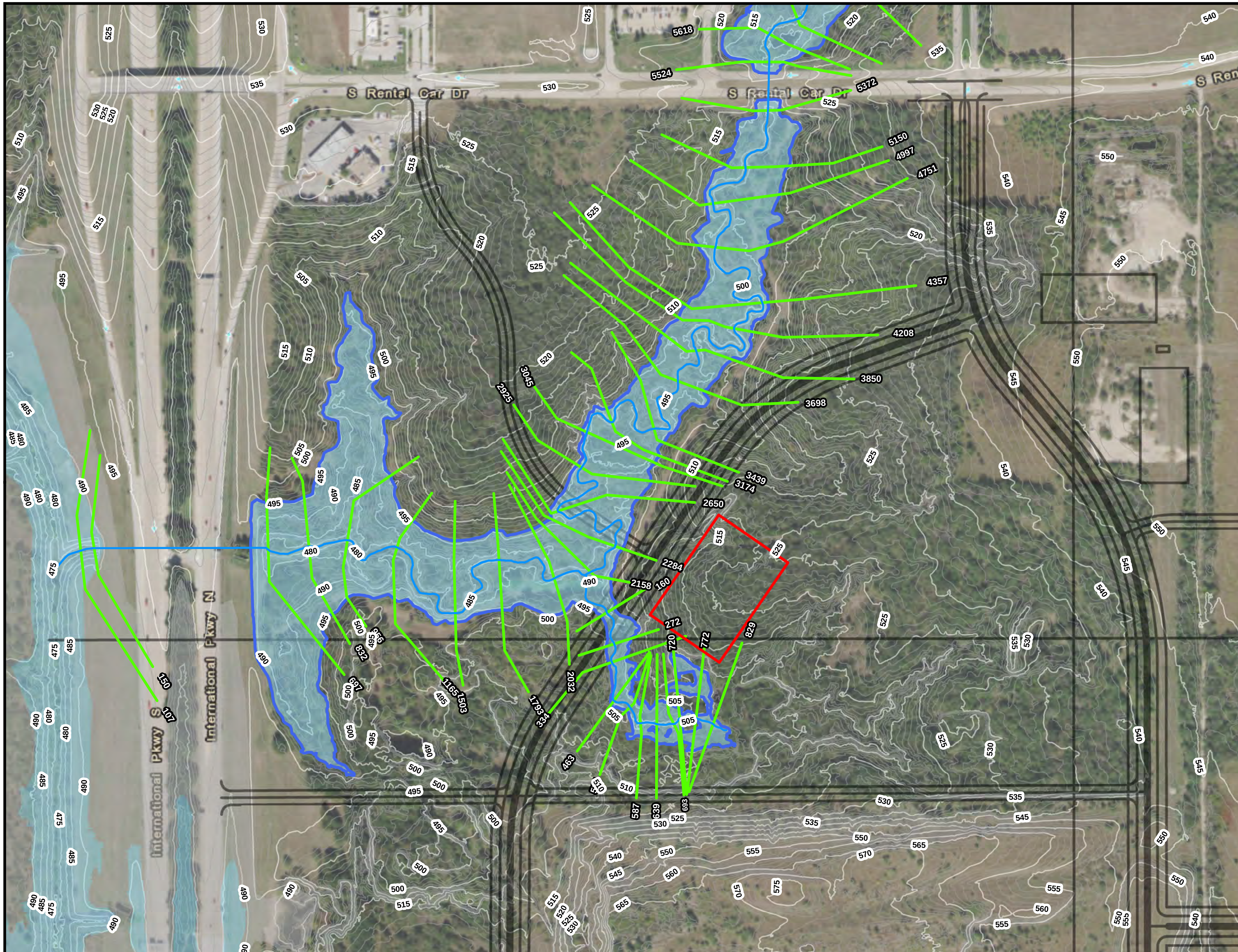
TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469



BASE MAP 3

PASSPORT PARK

DFW AIRPORT, TEXAS

KEY TO FEATURES

- DETENTION POND
- CROSS SECTIONS
- CHANNEL BD-1
- EXISTING 100-YR FLOODPLAIN
- LOT LAYOUT

LiDAR CONTOURS

- MINOR
- MAJOR

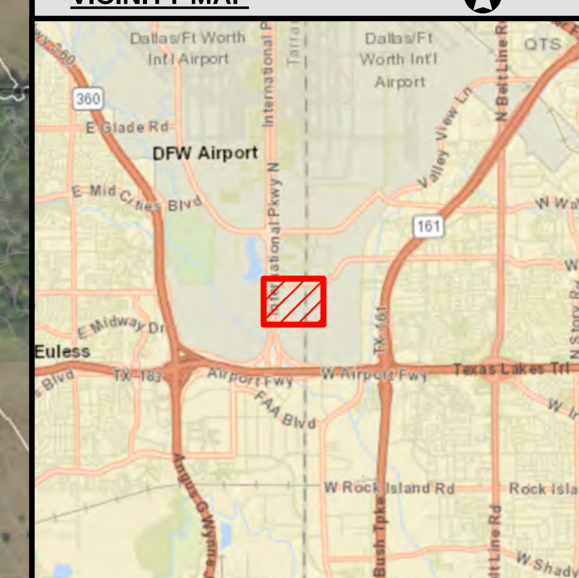
DATUM

NAD 1983 Texas State Plane
North Central Zone FIPS 4202

0 150 300 Feet

1 inch = 300 feet

VICINITY MAP



September 18, 2017 MAP 3 OF 3

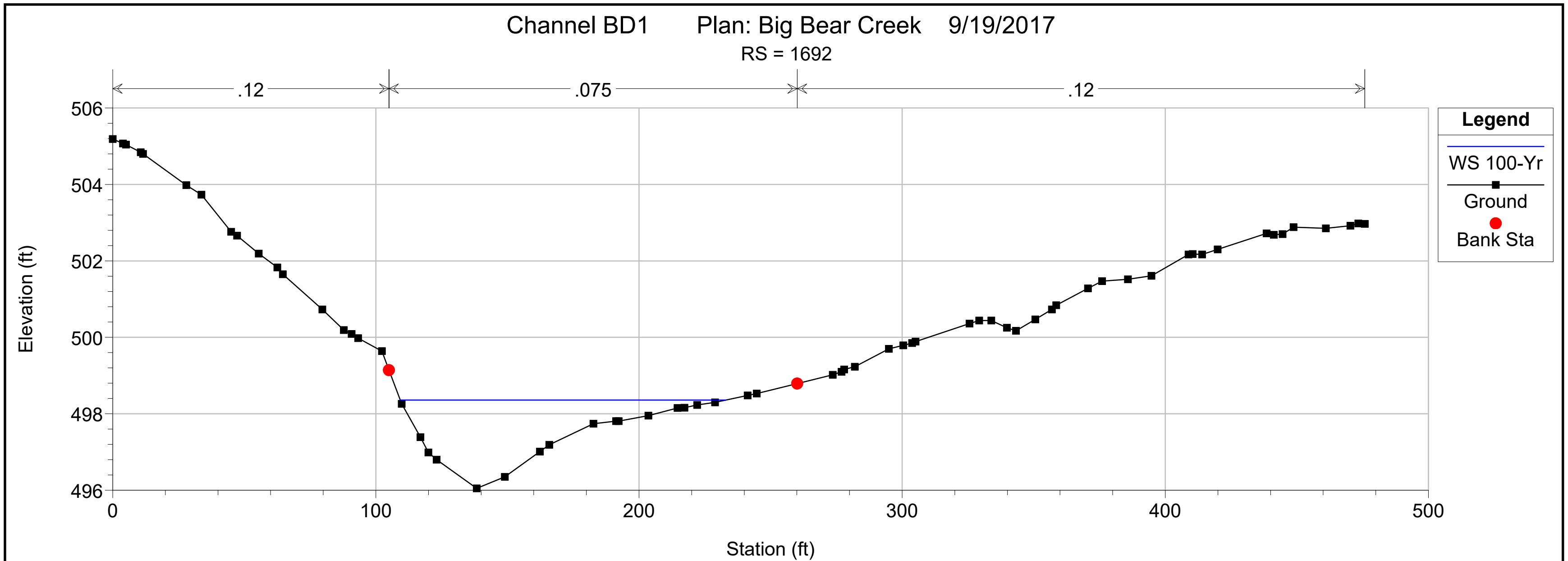
Pacheco Koch

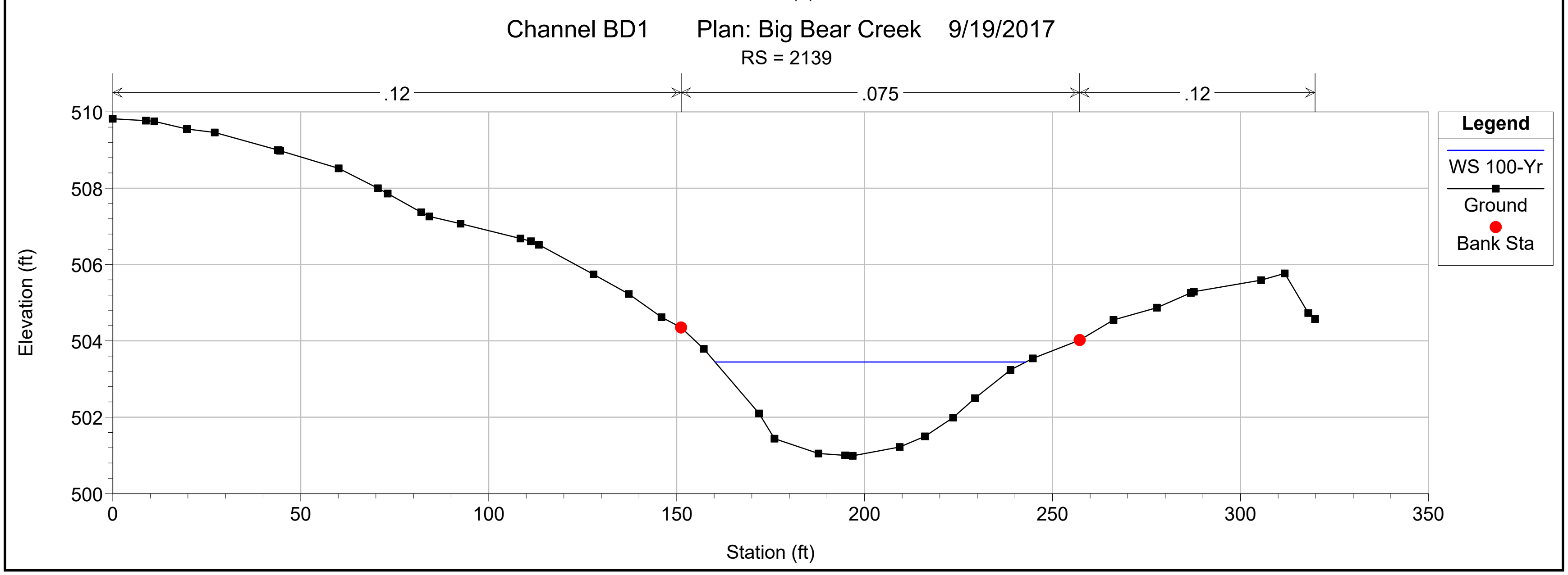
Path: M:\DWG-141469-17.026\Design\GIS\Maps\Base Map3.mxd

TX REG. SURVEYING FIRM LS-10008000

TX REG. ENGINEERING FIRM F-469

Cross-Section Plots


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1692
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 2139
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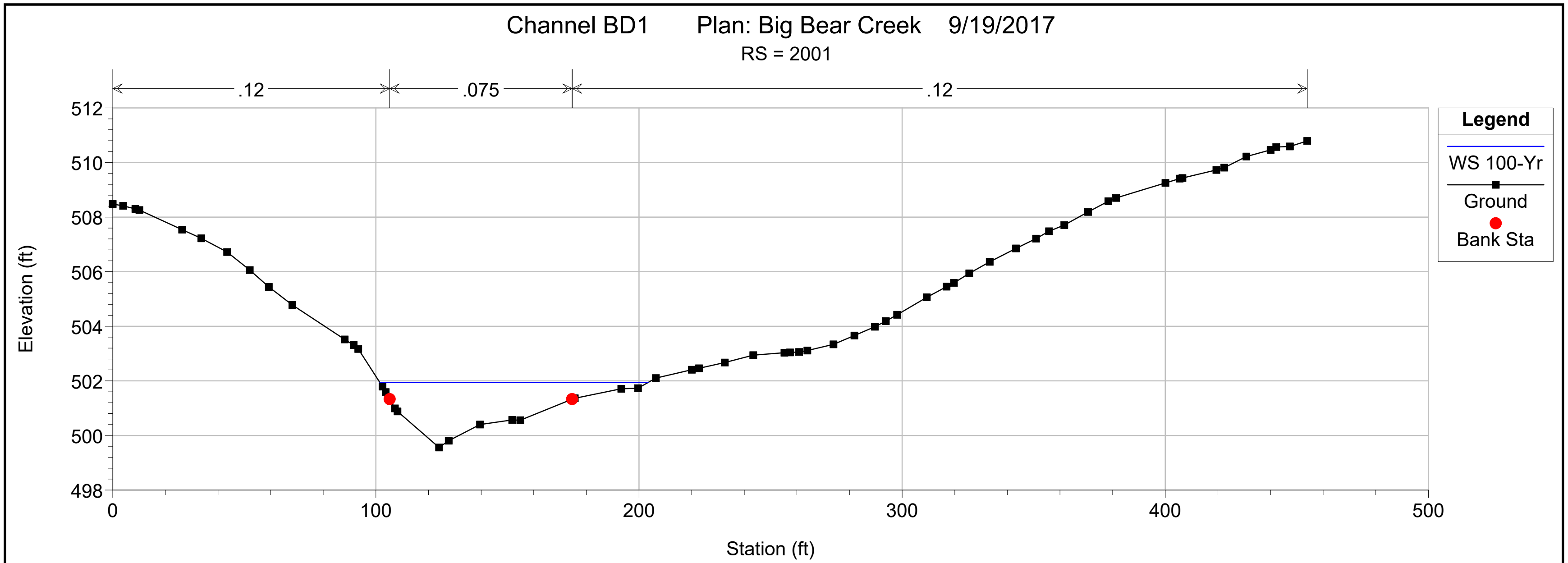
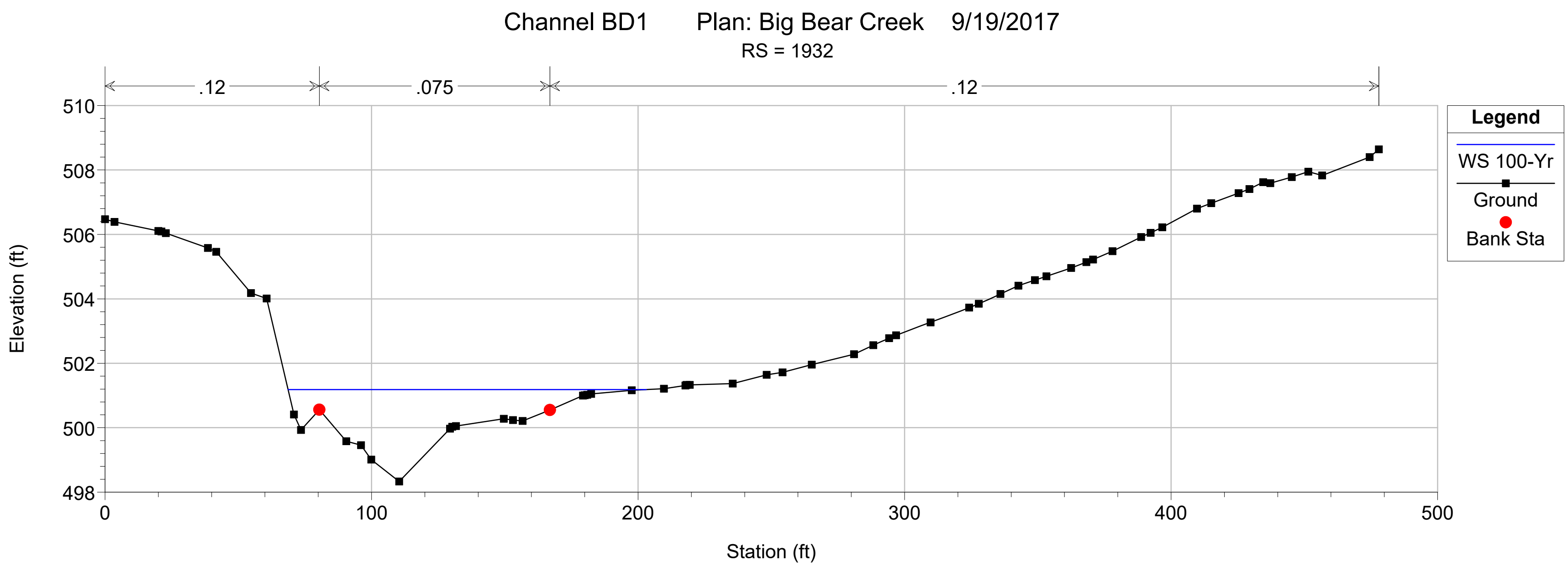
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta



Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 2001
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta



Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1932
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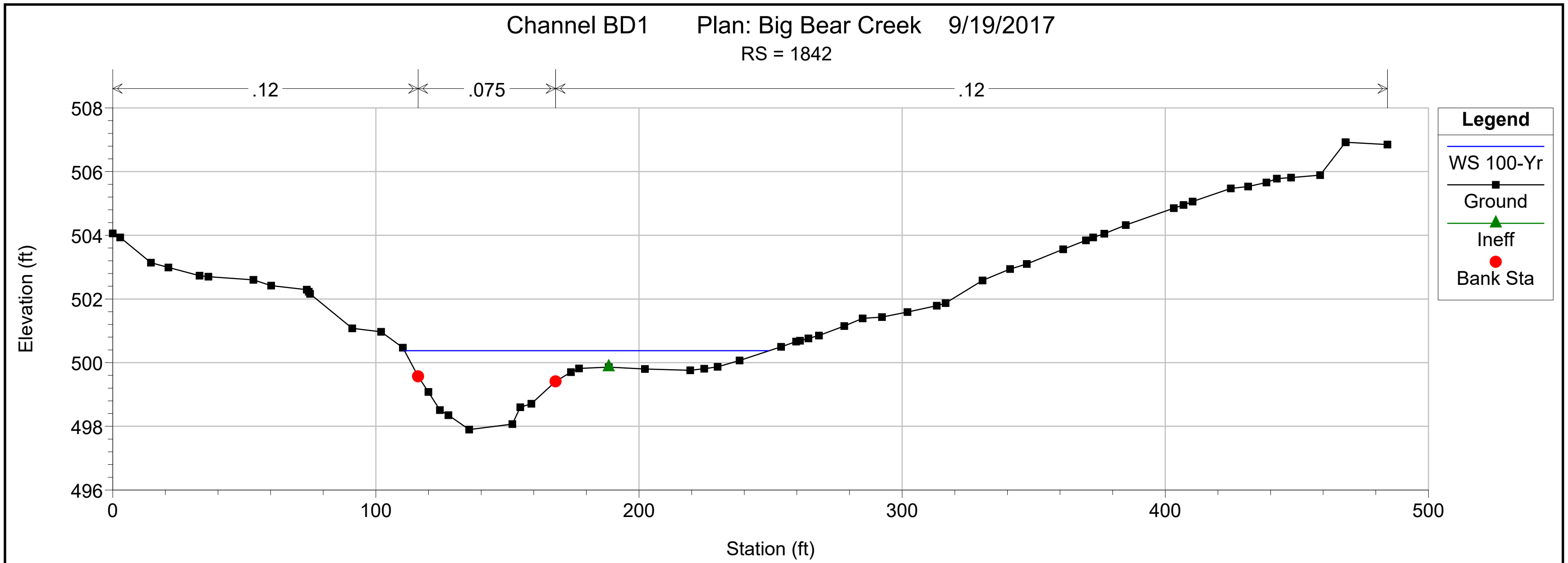
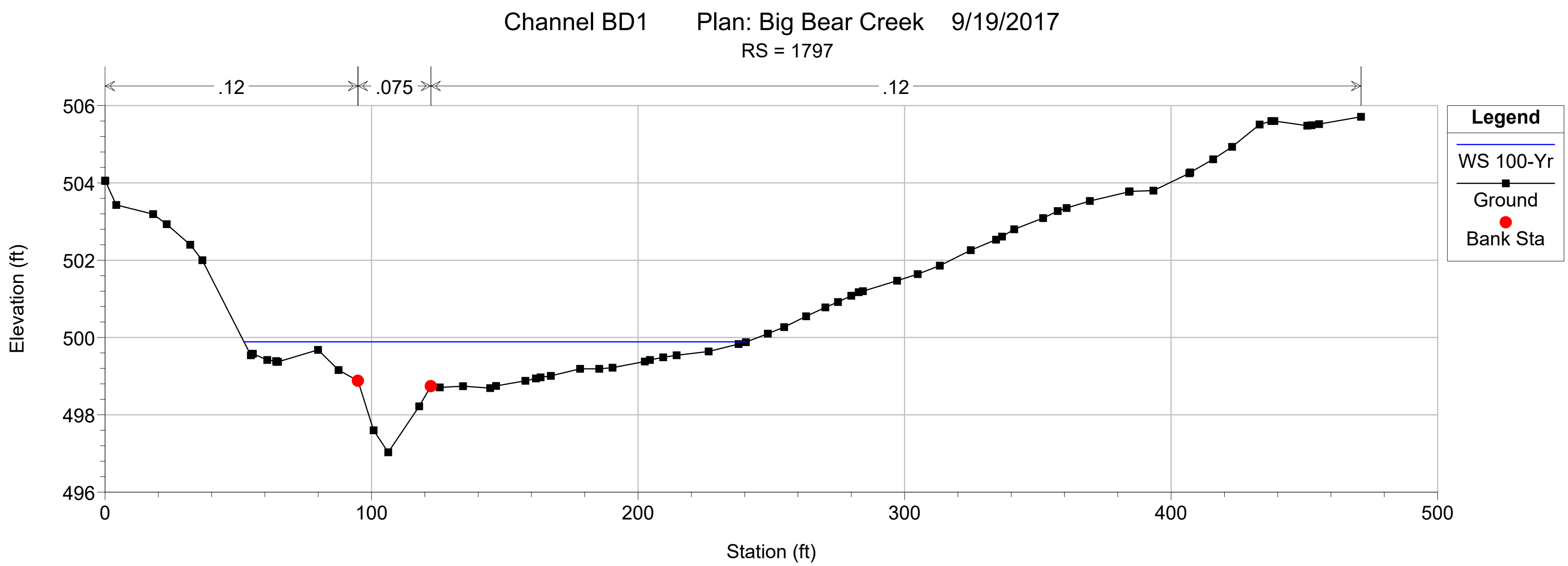
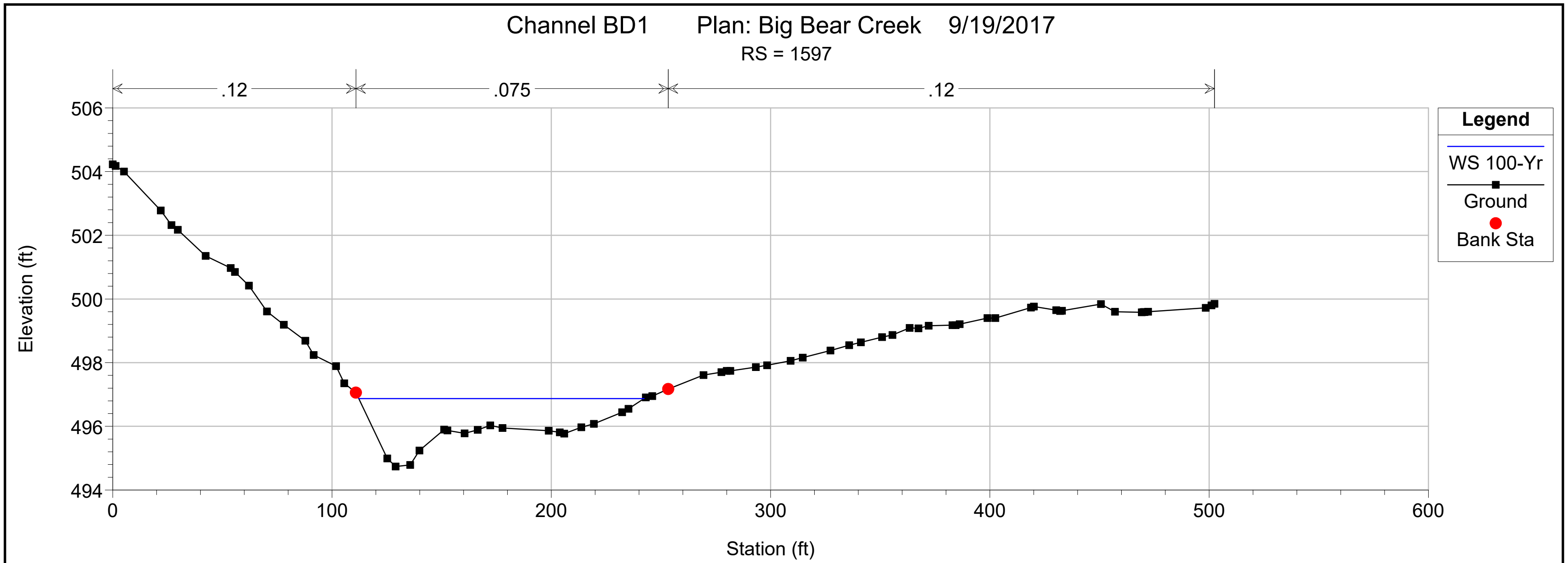
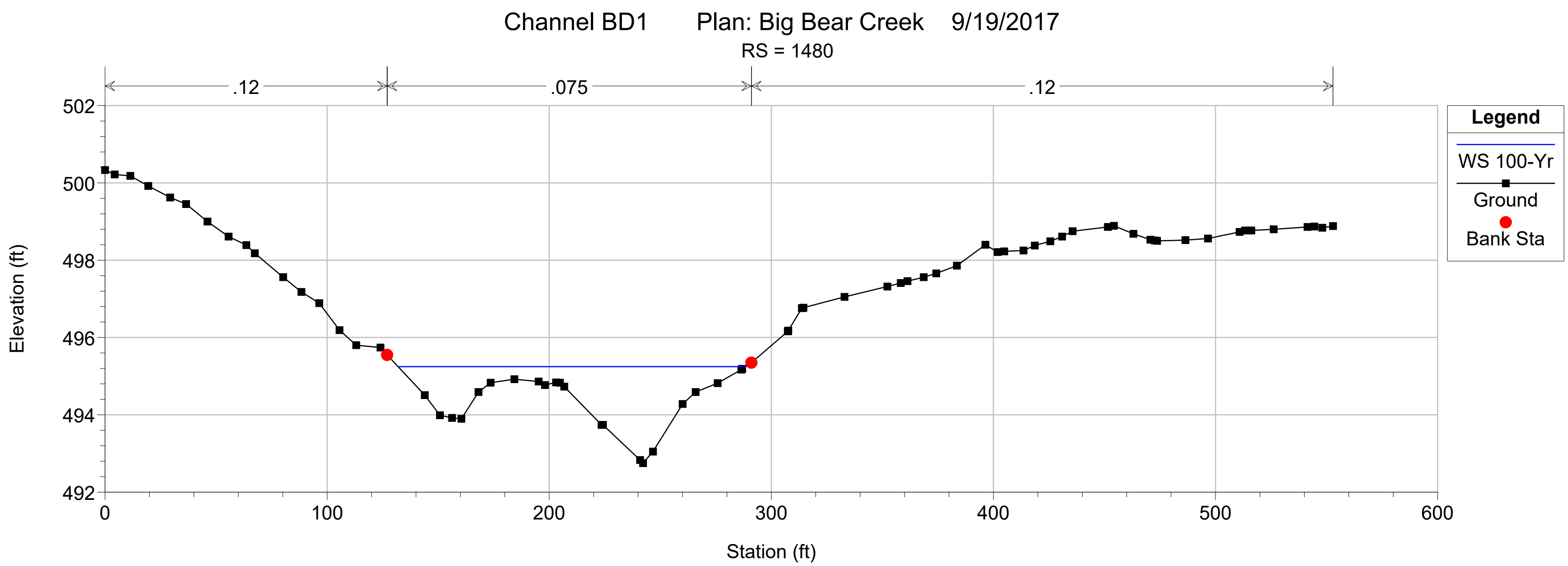
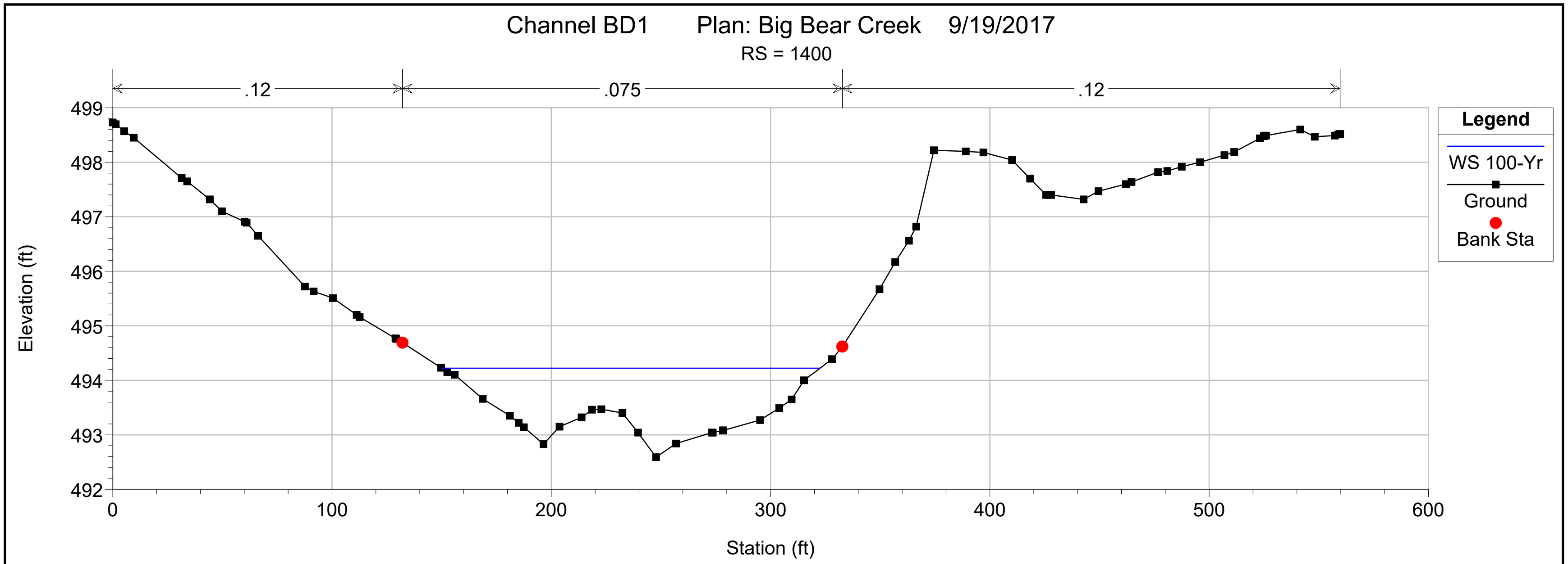
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

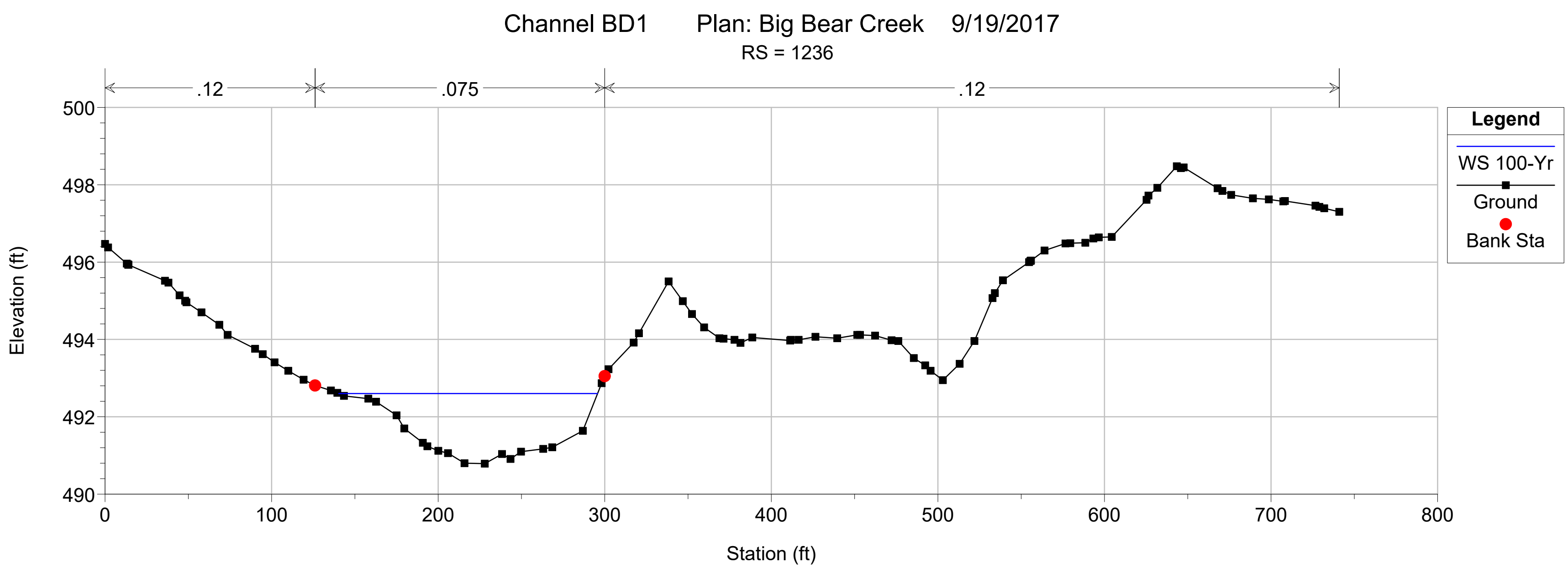

Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1842
.12
.075
.12
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
508
506
504
502
500
498
496
0
100
200
300
400
500


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1797
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
506
504
502
500
498
496
0
100
200
300
400
500


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1597
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
506
504
502
500
498
496
494
0
100
200
300
400
500
600


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1480
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
502
500
498
496
494
492
0
100
200
300
400
500
600


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1400
.12
.075
.12
Elevation (ft)
499
498
497
496
495
494
493
492
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1236
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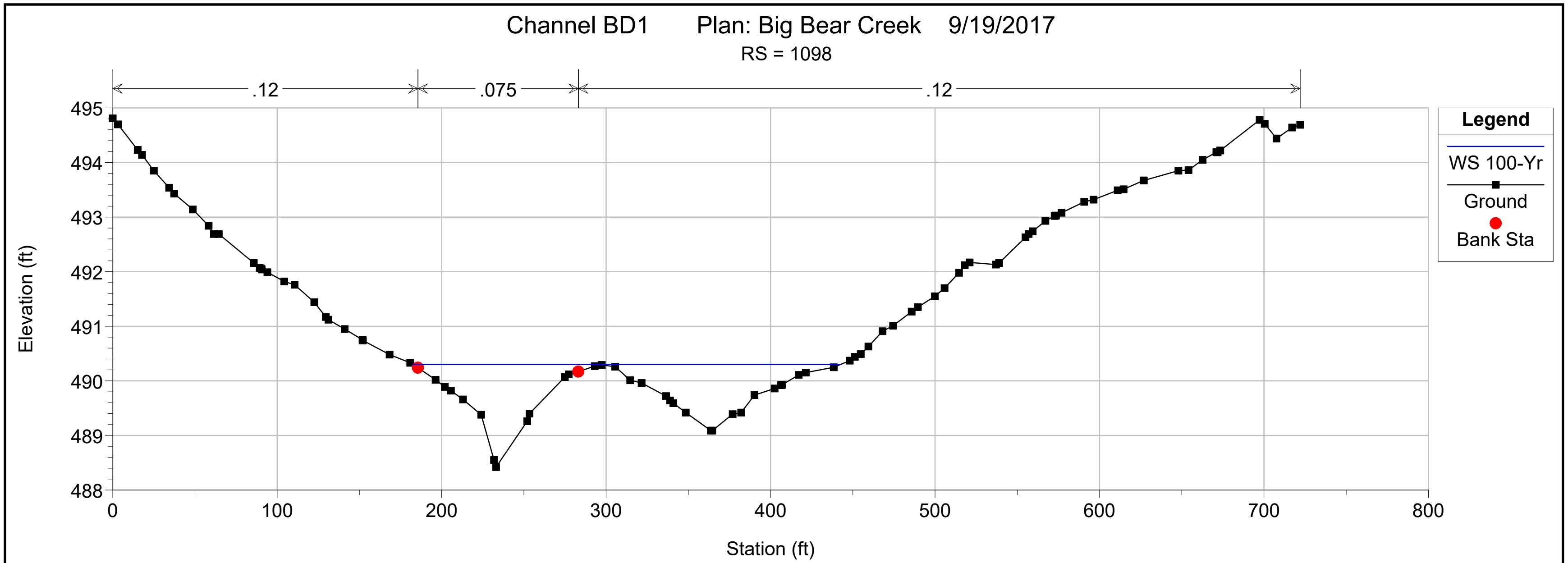
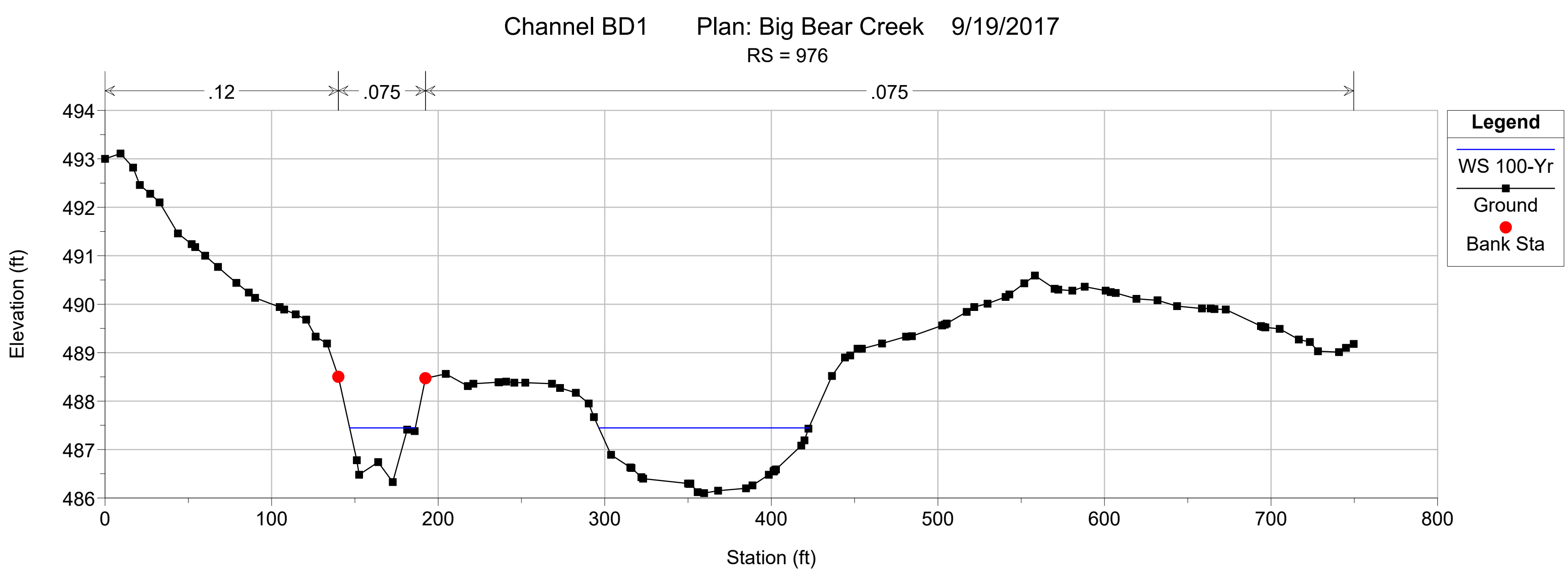
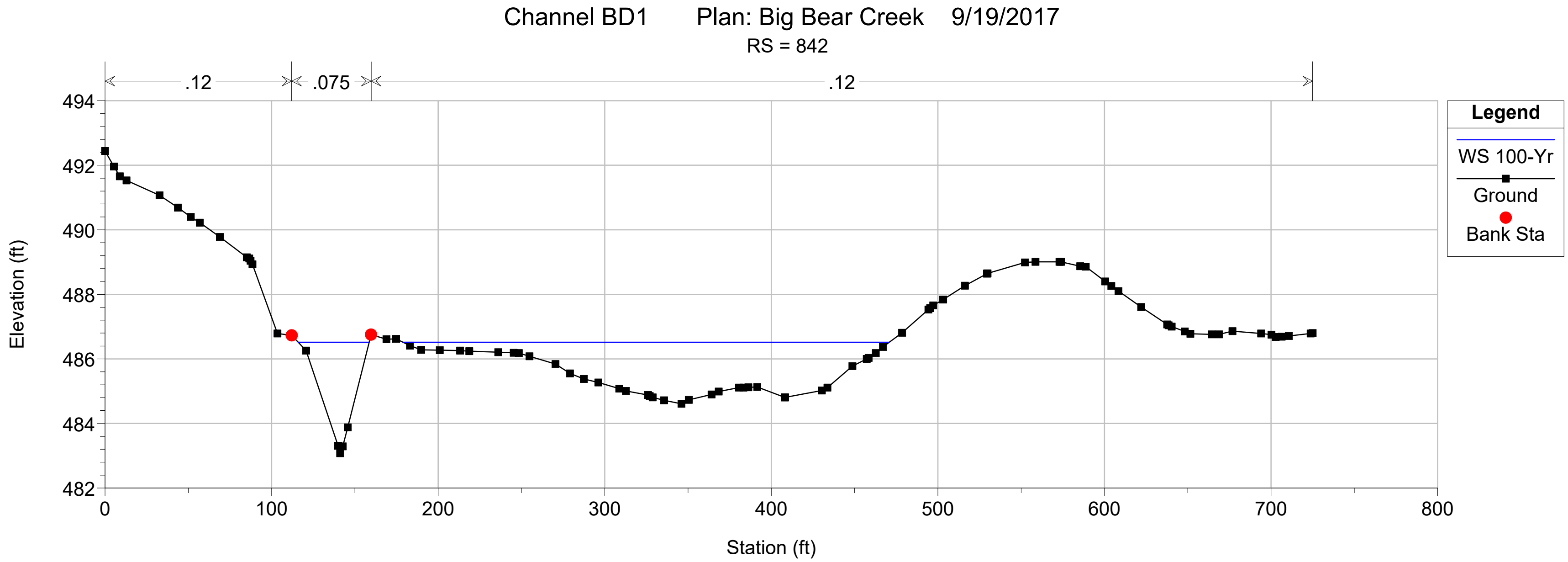
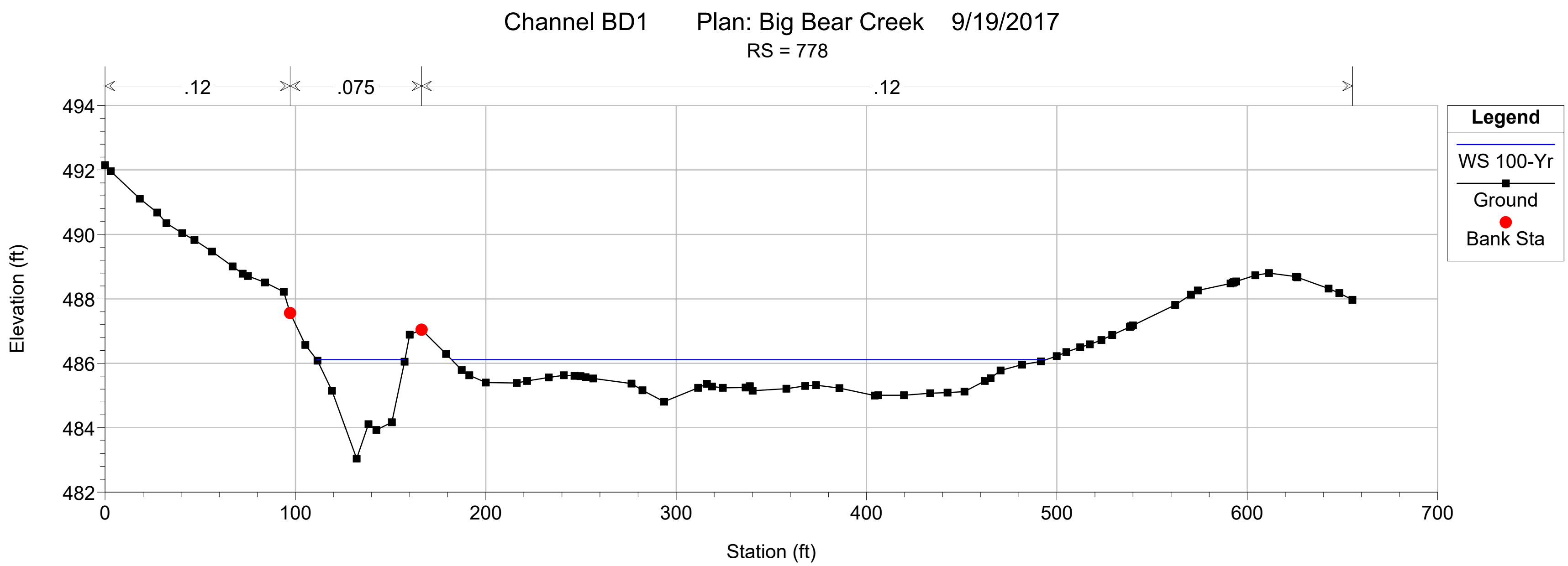
.075
.12
Elevation (ft)
500
498
496
494
492
490
0
100
200
300
400
500
600
700
800
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 1098
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

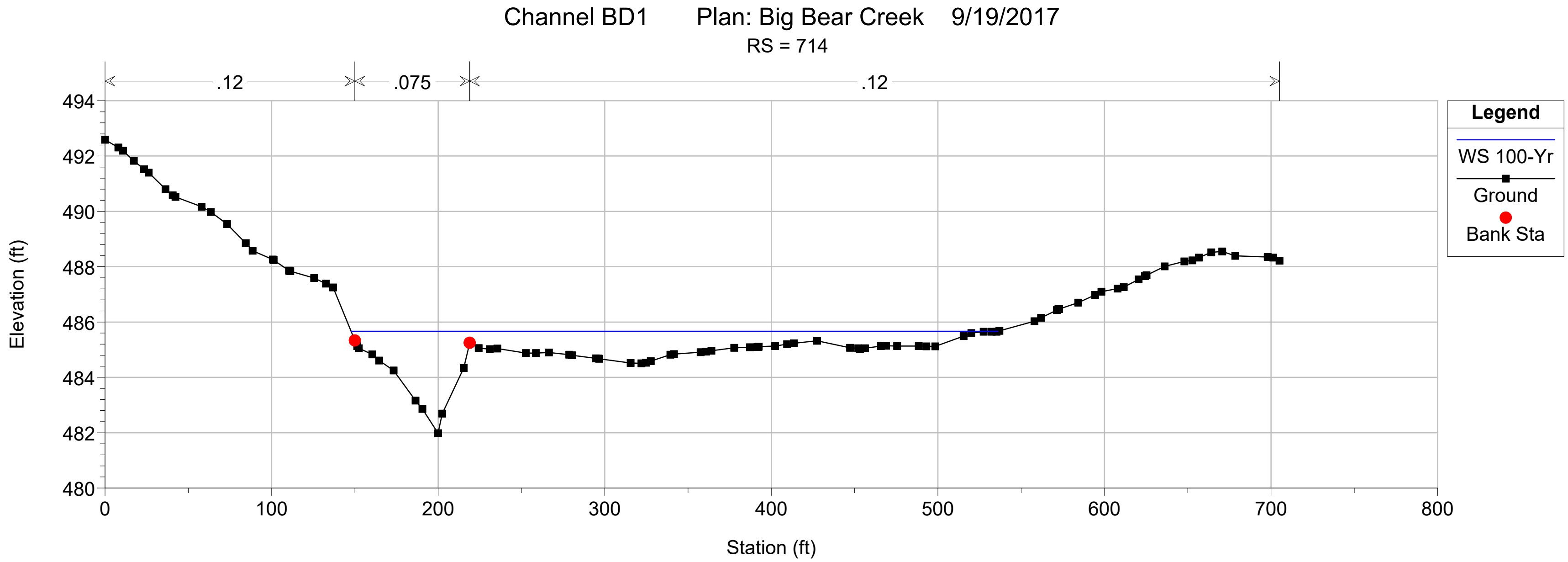

Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 976
.12
.075
.075
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)



Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 842
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
494
492
490
488
486
484
482
0
100
200
300
400
500
600
700
800



Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 778
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
494
492
490
488
486
484
482
0
100
200
300
400
500
600
700



Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 714
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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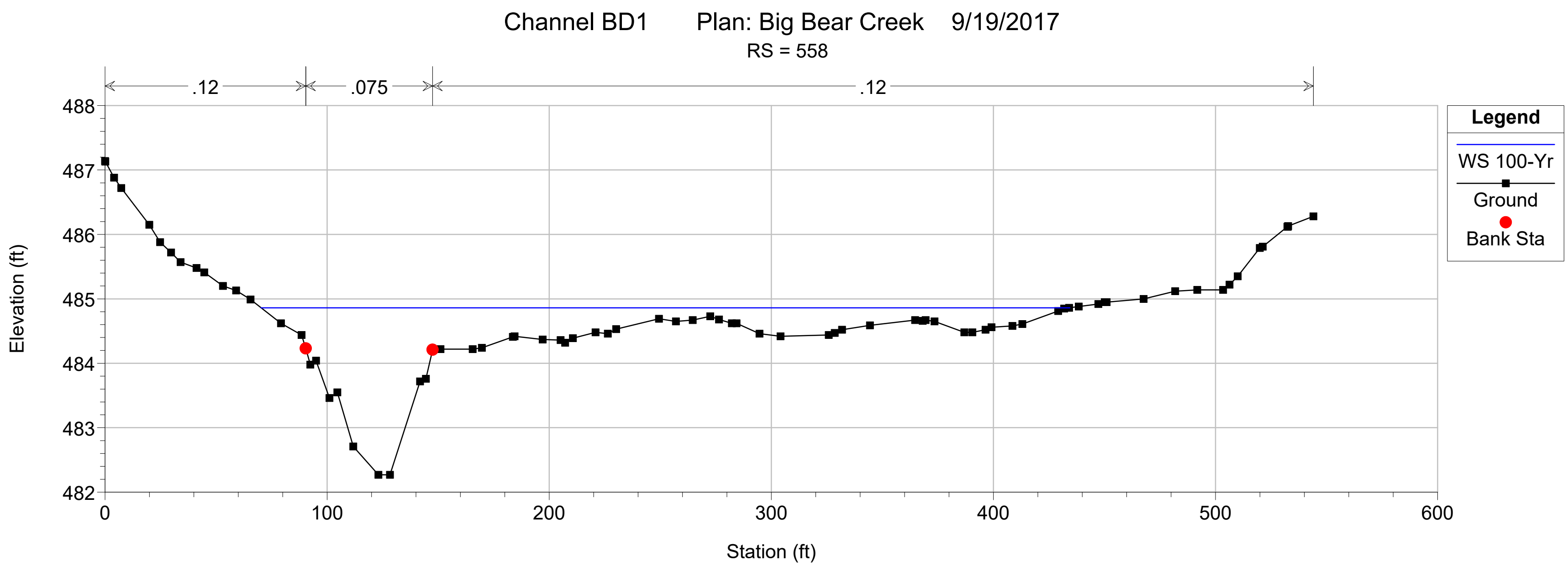
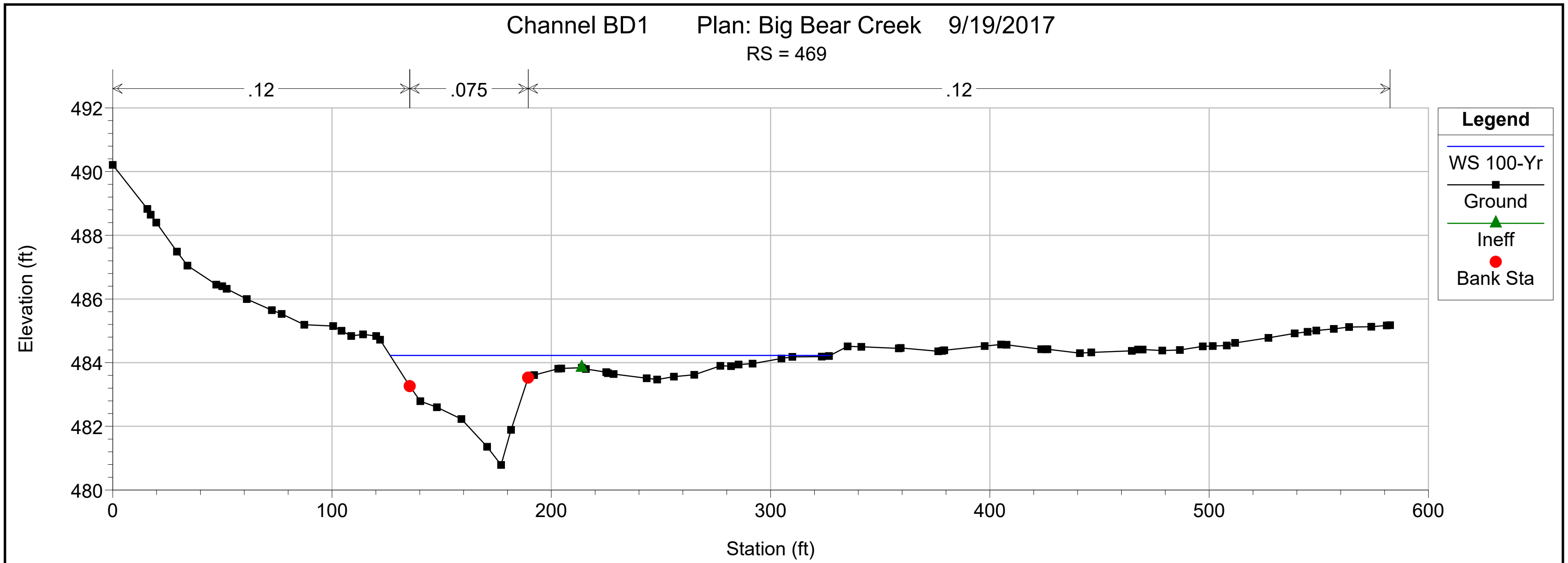
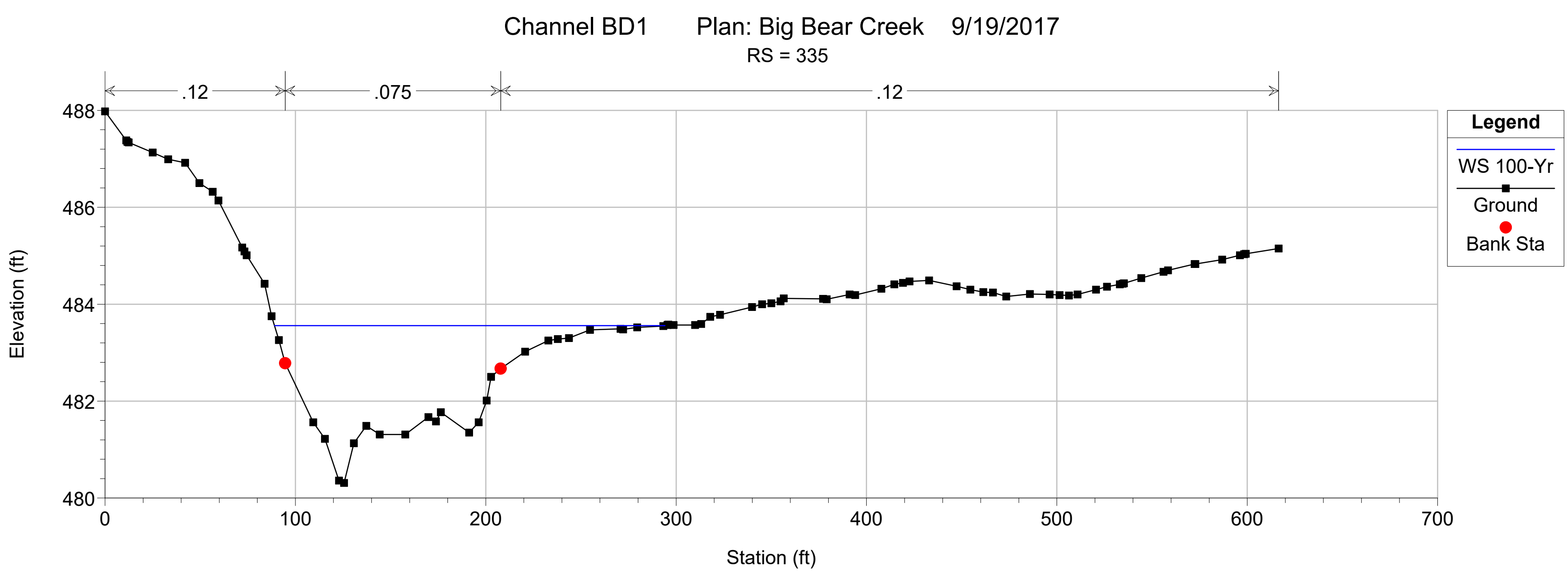
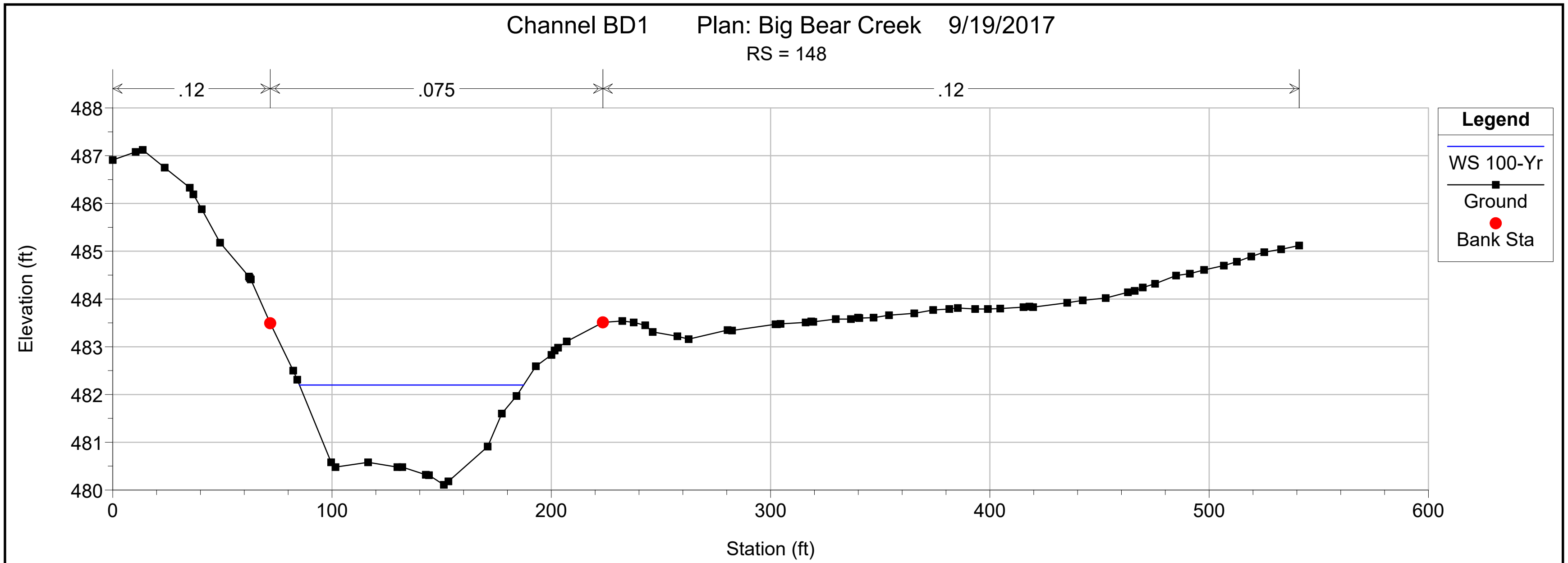
492
490
488
486
484
482
480
0
100
200
300
400
500
600
700
800

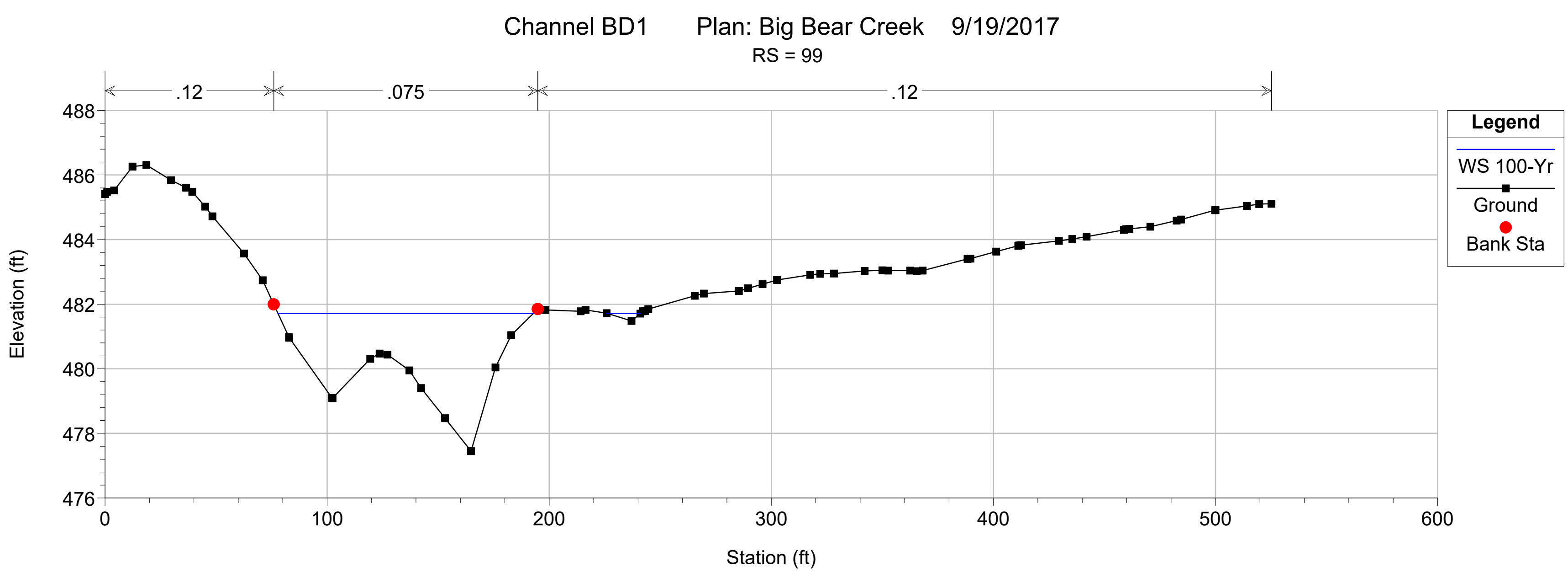


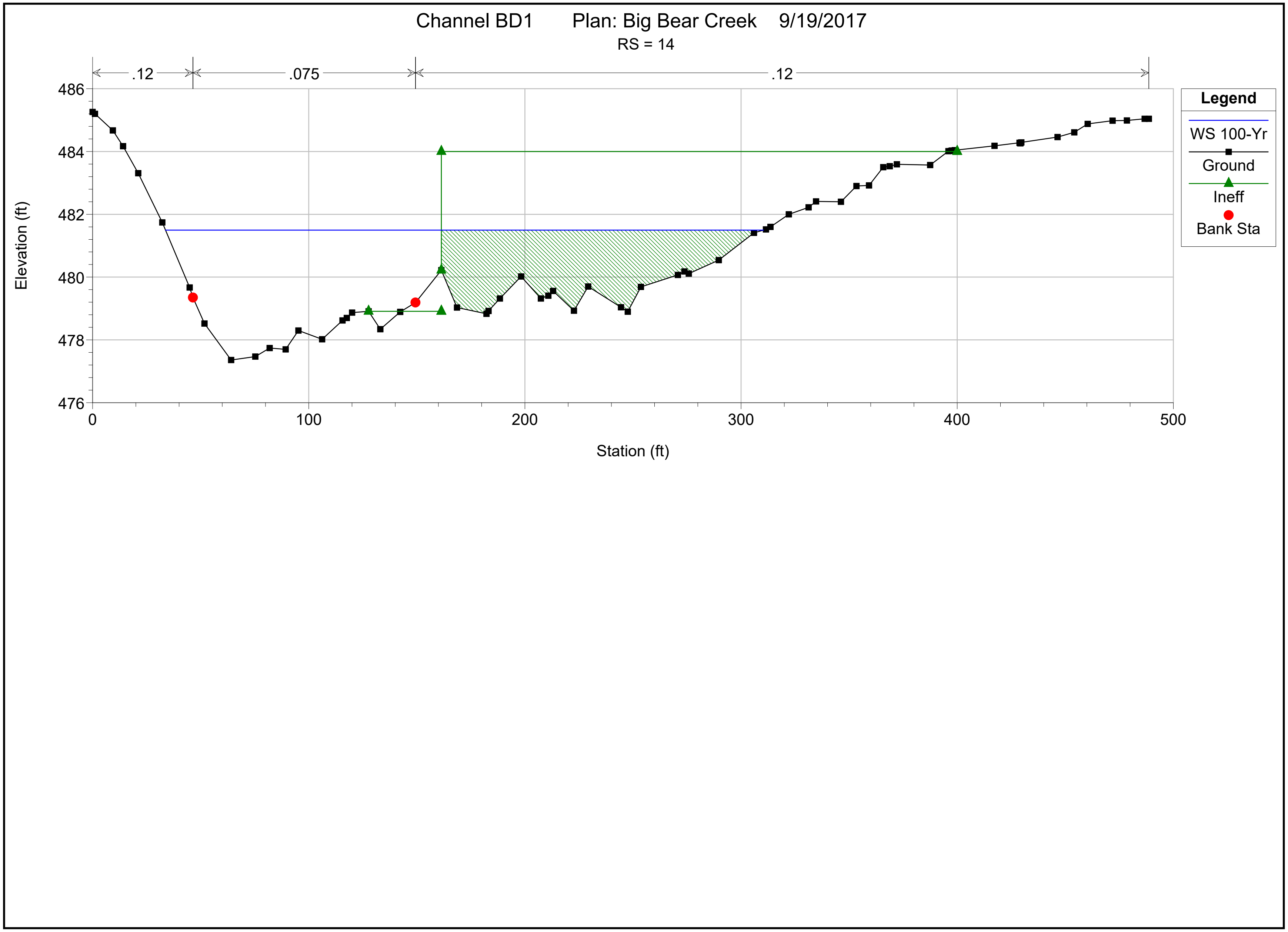
Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 558
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
488
487
486
485
484
483
482
0
100
200
300
400
500
600


Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 469
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

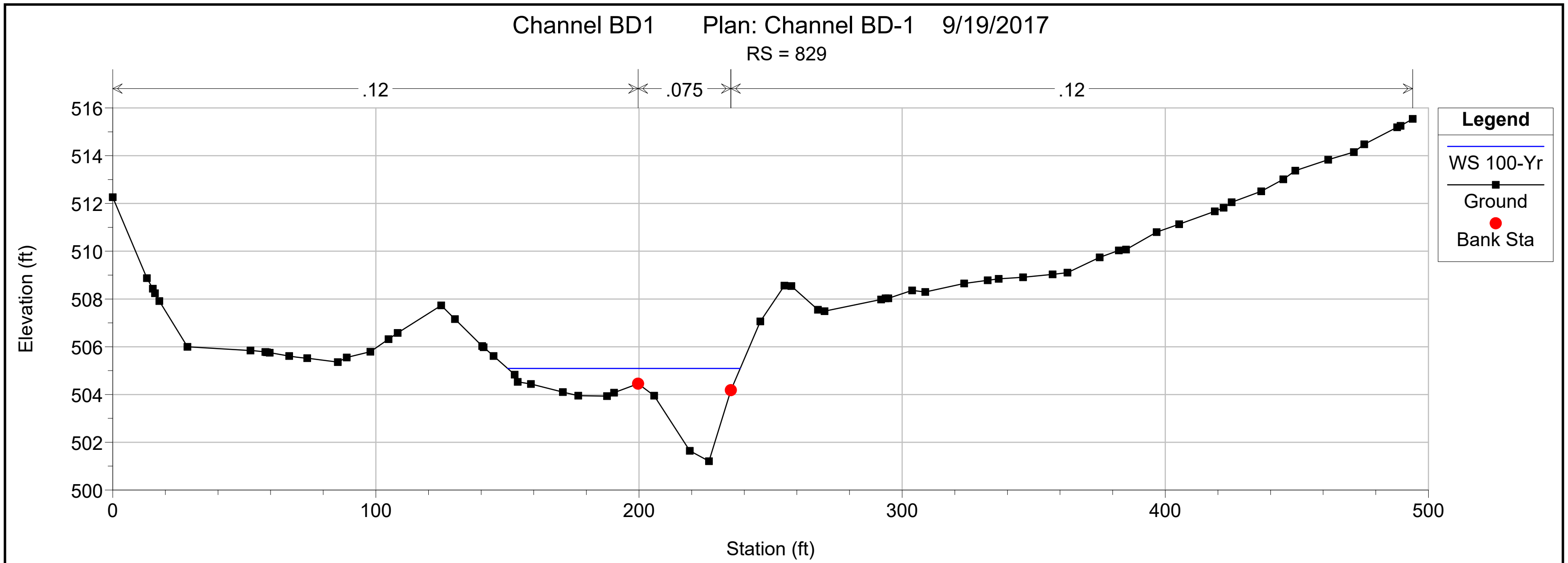

Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 335
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

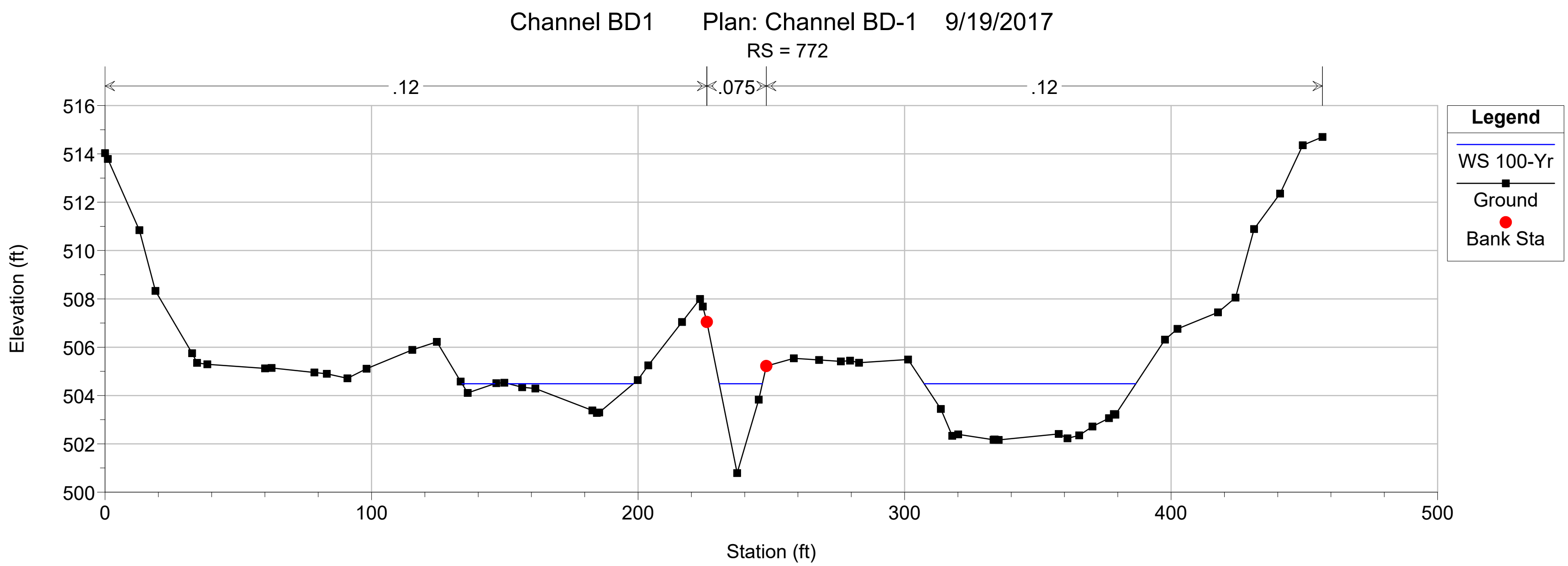

Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 148
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
488
487
486
485
484
483
482
481
480
0
100
200
300
400
500
600

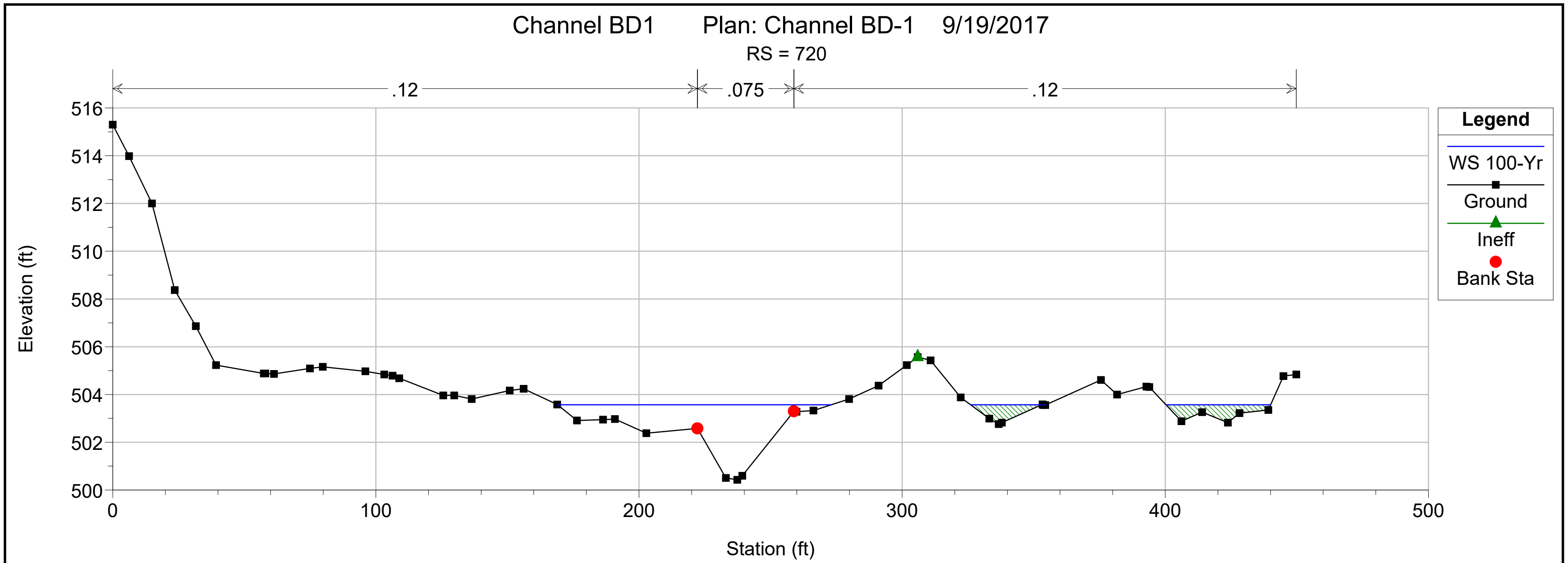

Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 99
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
488
486
484
482
480
478
476
0
100
200
300
400
500
600

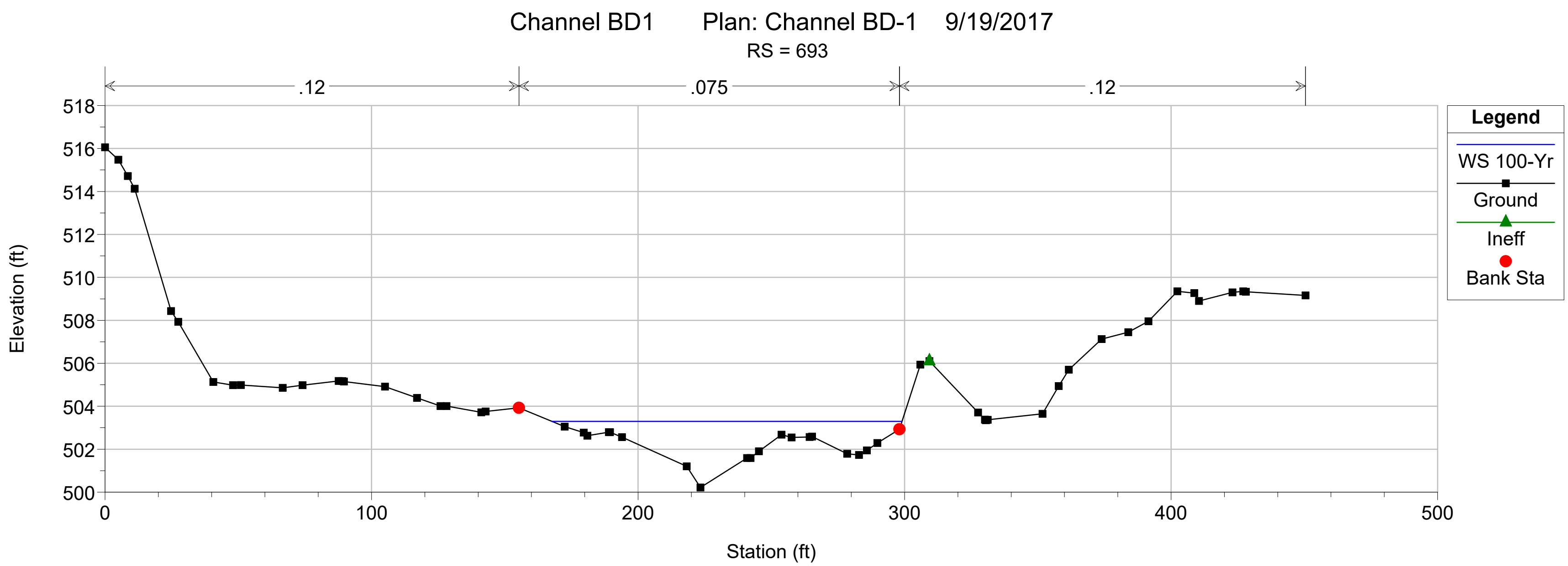


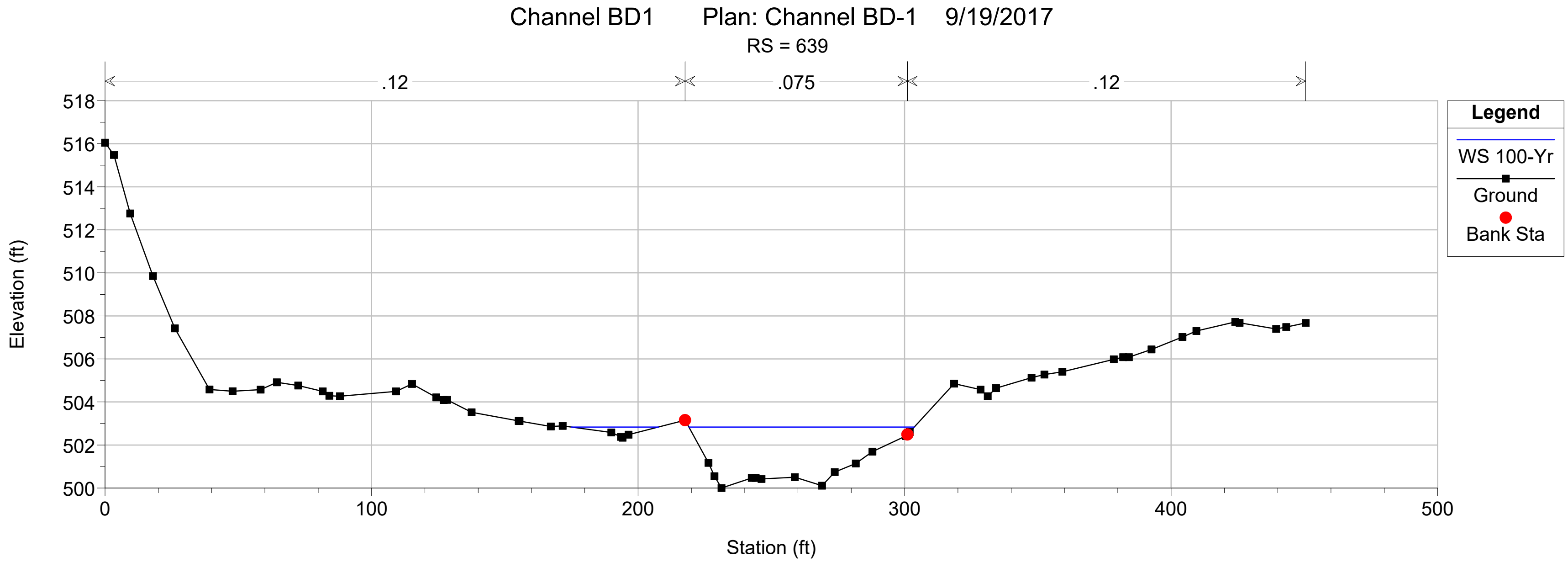
Channel BD1 Plan: Big Bear Creek 9/19/2017
RS = 14
.12
.075
.12
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
486
484
482
480
478
476
0
100
200
300
400
500
Station (ft)

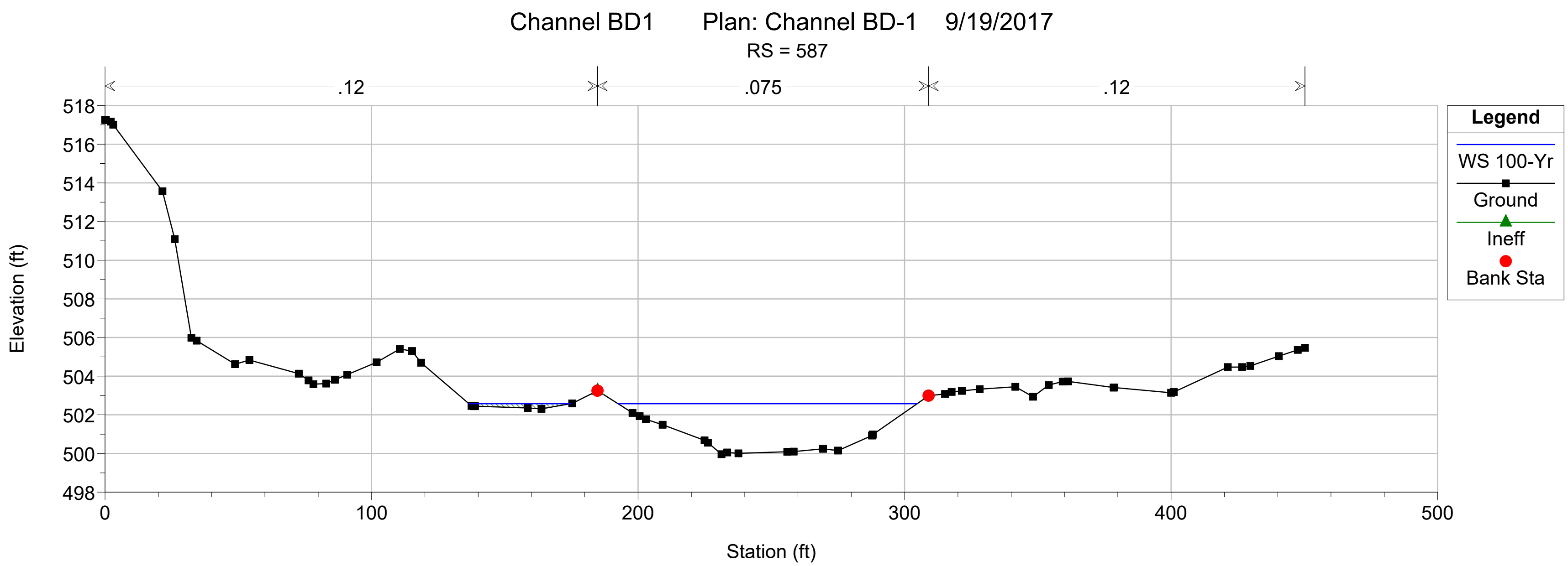

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 829
.12
.075
.12
Elevation (ft)
Station (ft)
516
514
512
510
508
506
504
502
500
0
100
200
300
400
500
Legend
WS 100-Yr
Ground
Bank Sta

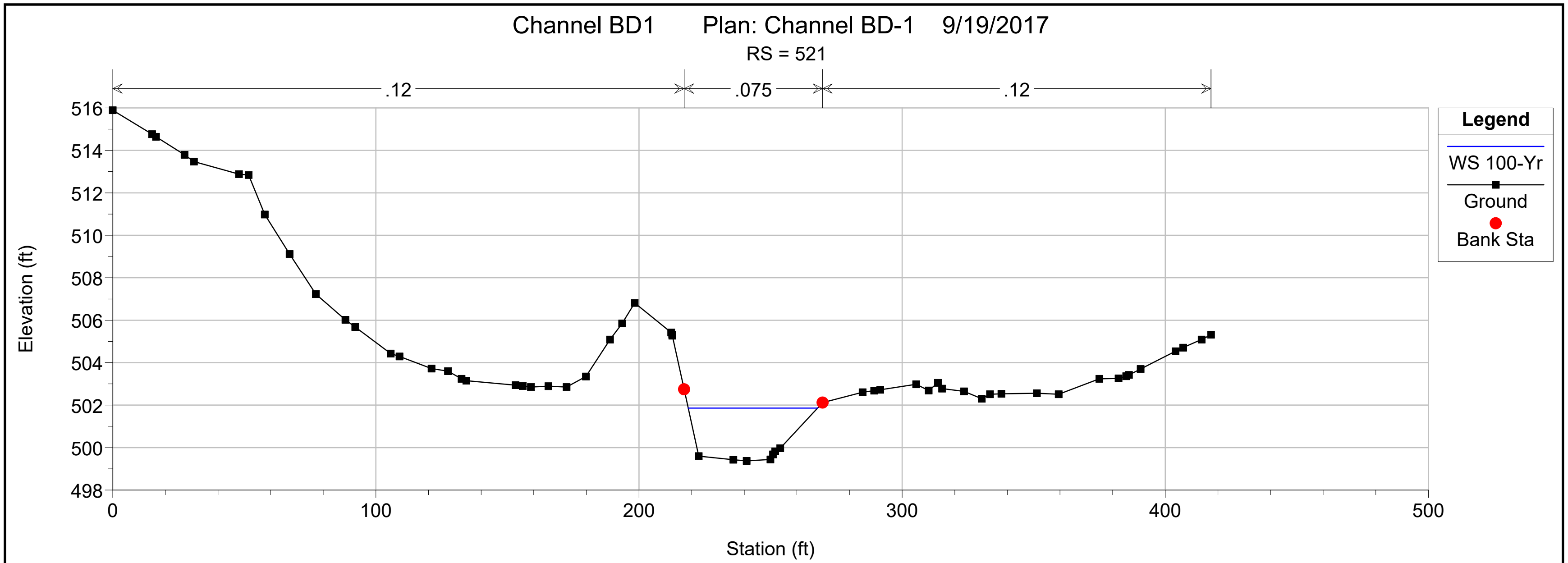

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 772
.12
.075
.12
Elevation (ft)
Station (ft)
516
514
512
510
508
506
504
502
500
0
100
200
300
400
500
Legend
WS 100-Yr
Ground
Bank Sta

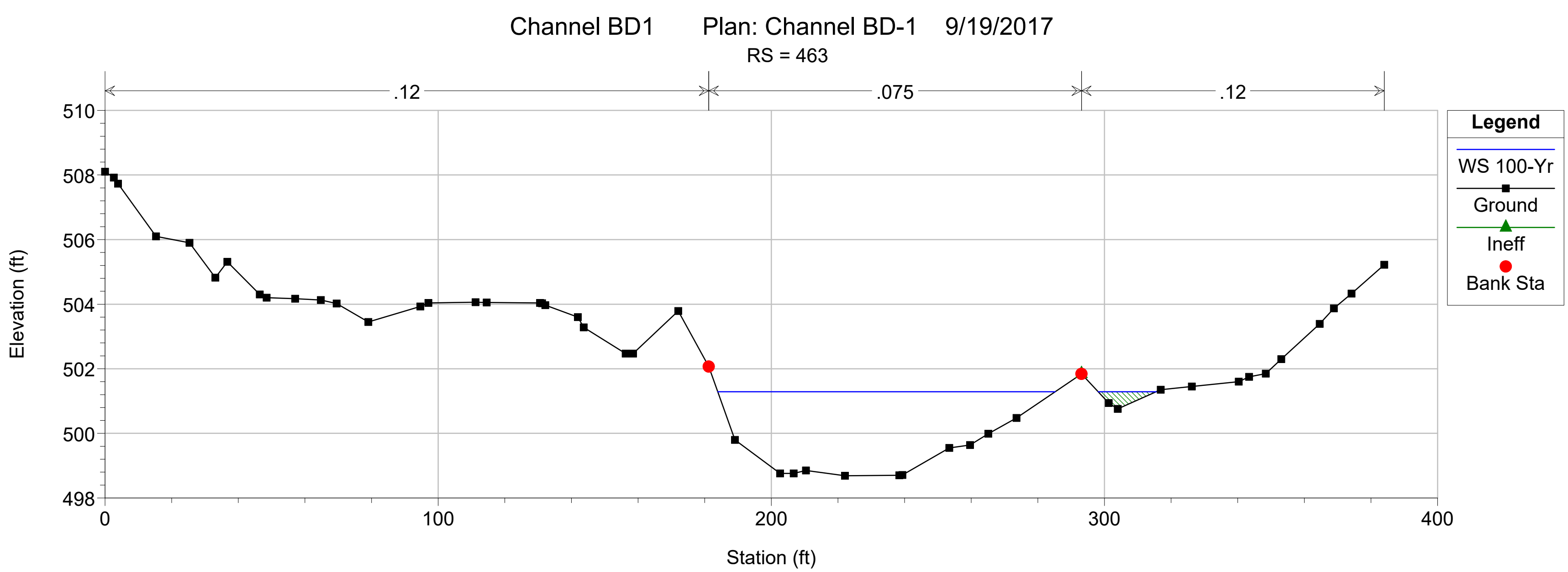

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 720
.12
.075
.12
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
516
514
512
510
508
506
504
502
500
0
100
200
300
400
500

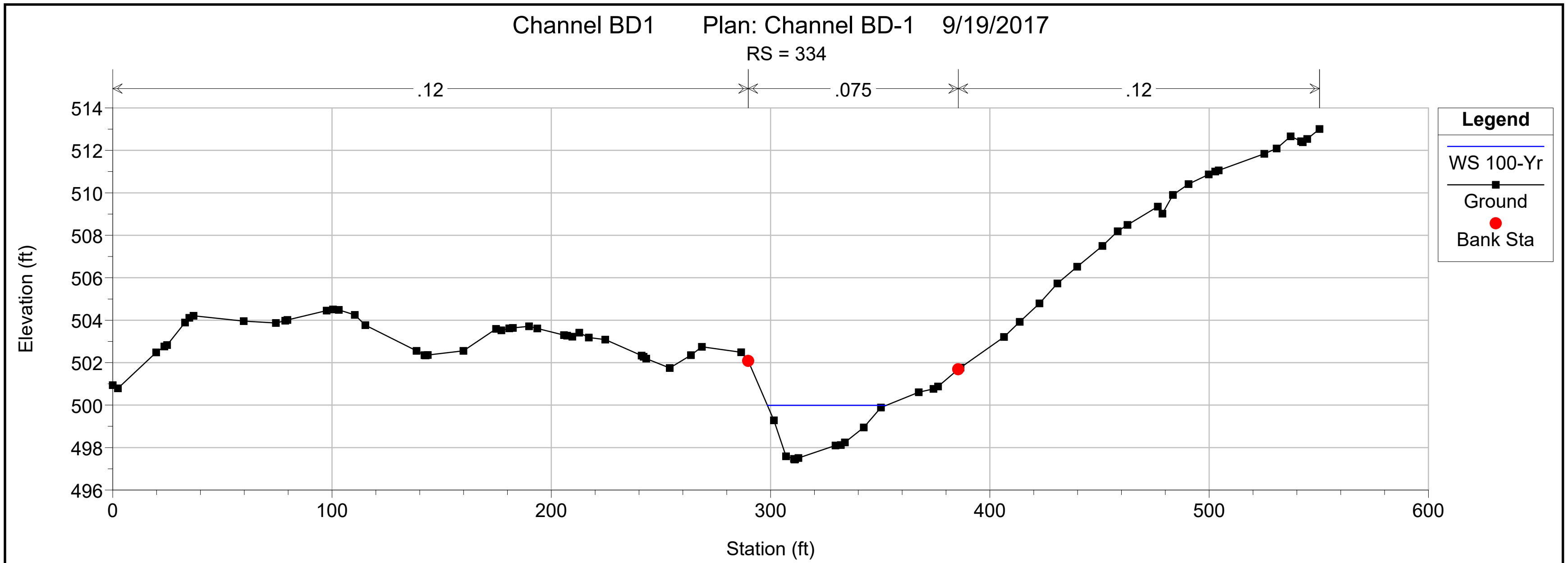

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 693
.12
.075
.12
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
518
516
514
512
510
508
506
504
502
500
0
100
200
300
400
500

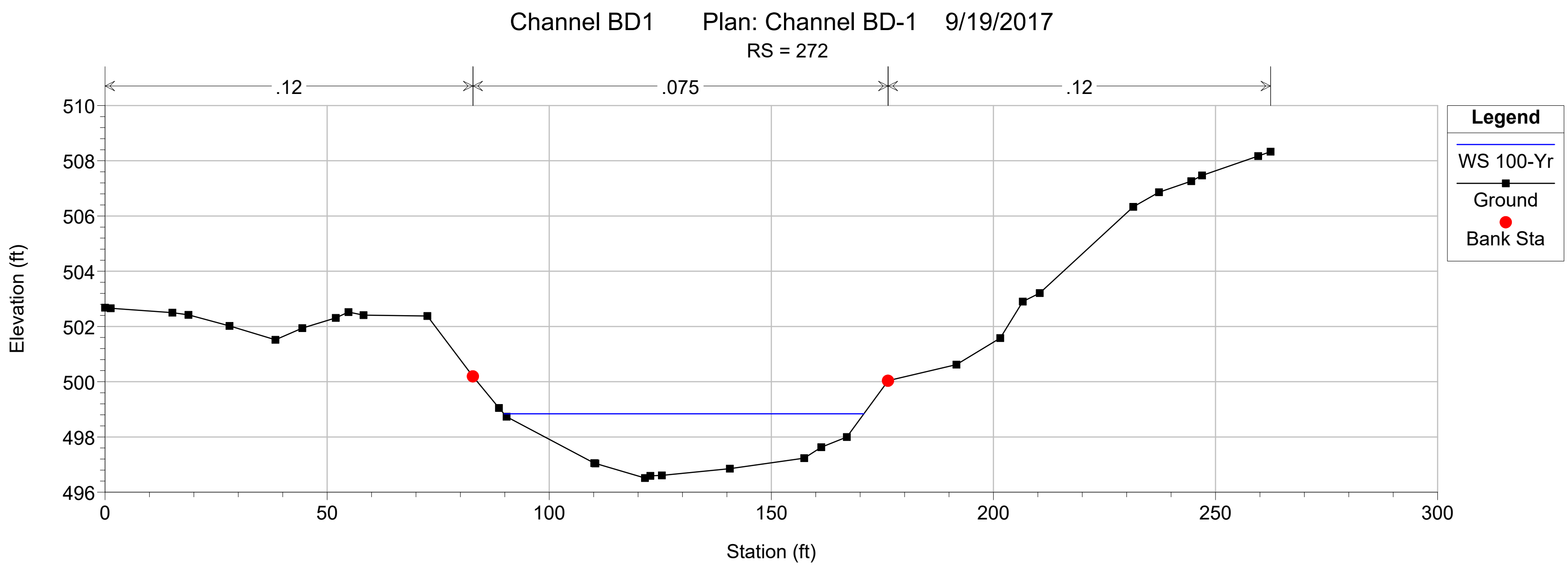

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 639
.12
.075
.12
518
516
514
512
510
508
506
504
502
500
Elevation (ft)
0
100
200
300
400
500
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

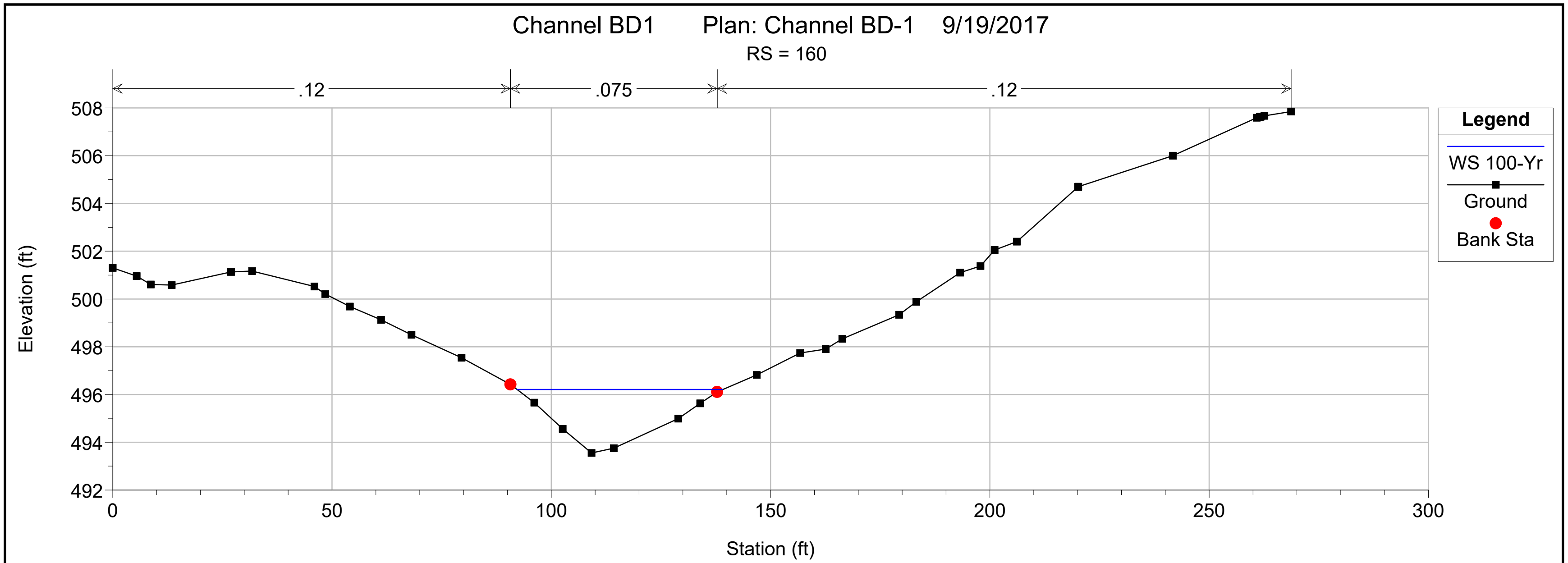

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 587
.12
.075
.12
518
516
514
512
510
508
506
504
502
500
498
Elevation (ft)
0
100
200
300
400
500
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 521
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

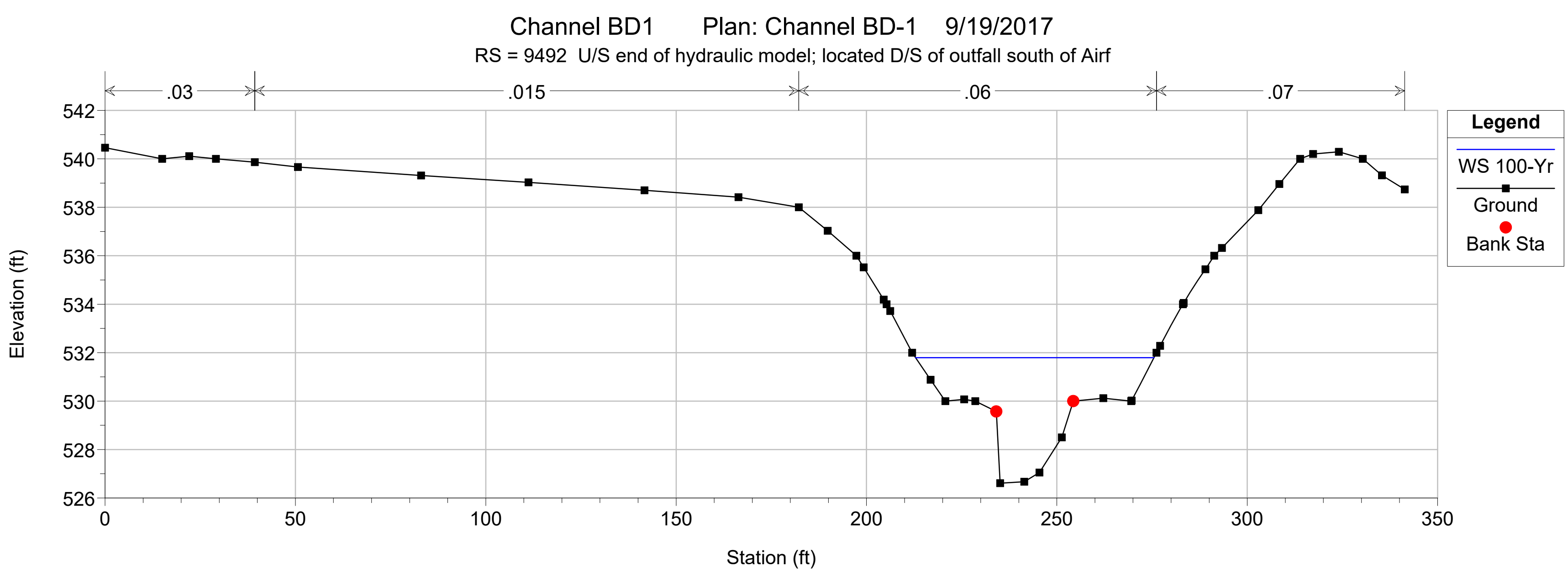

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 463
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 334
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

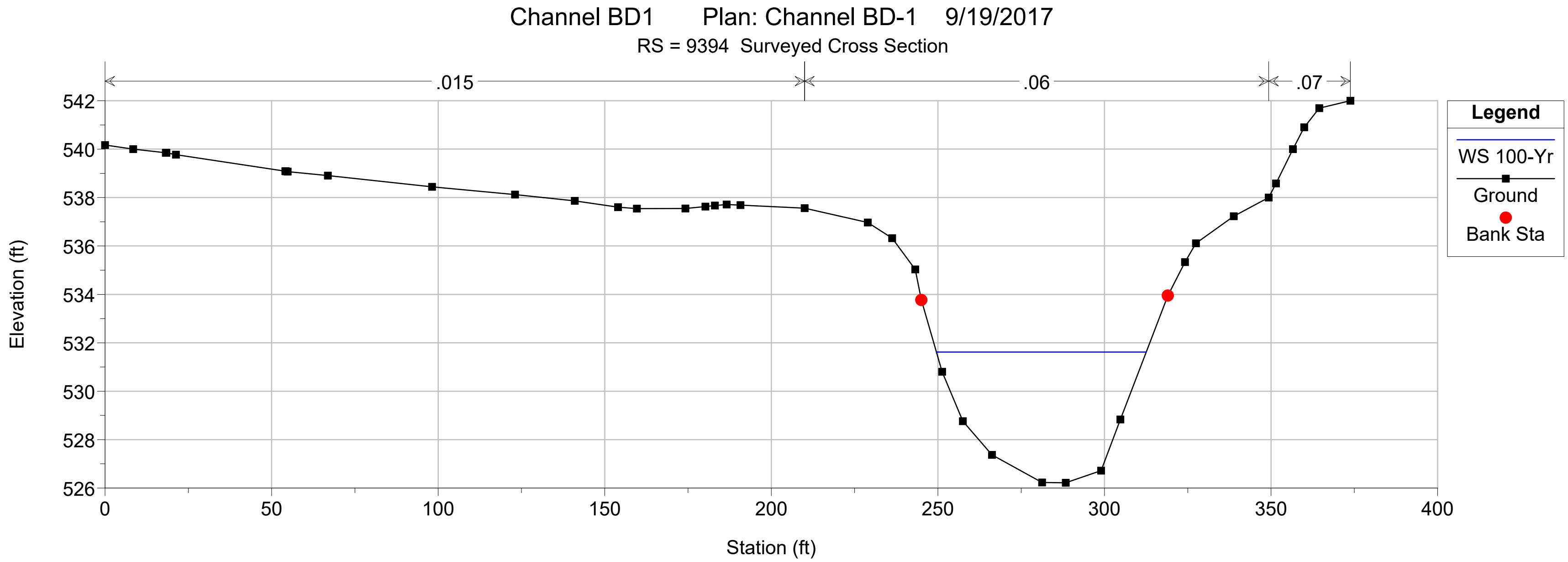

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 272
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

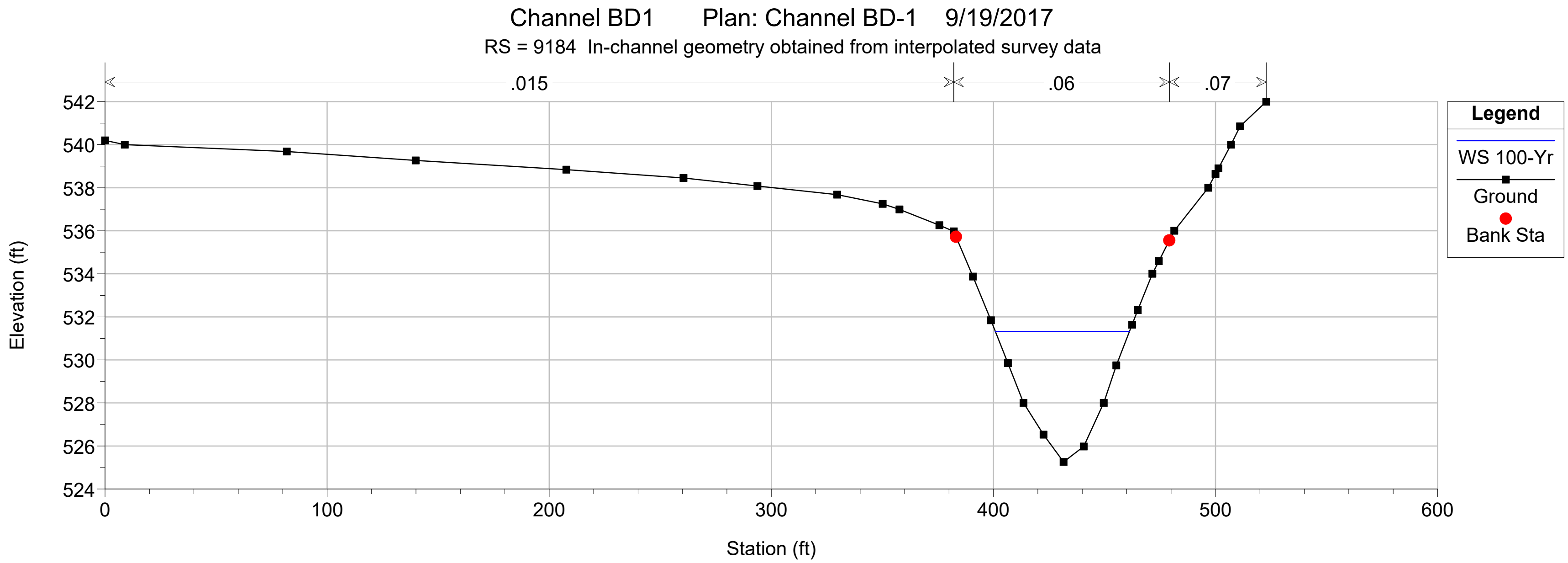


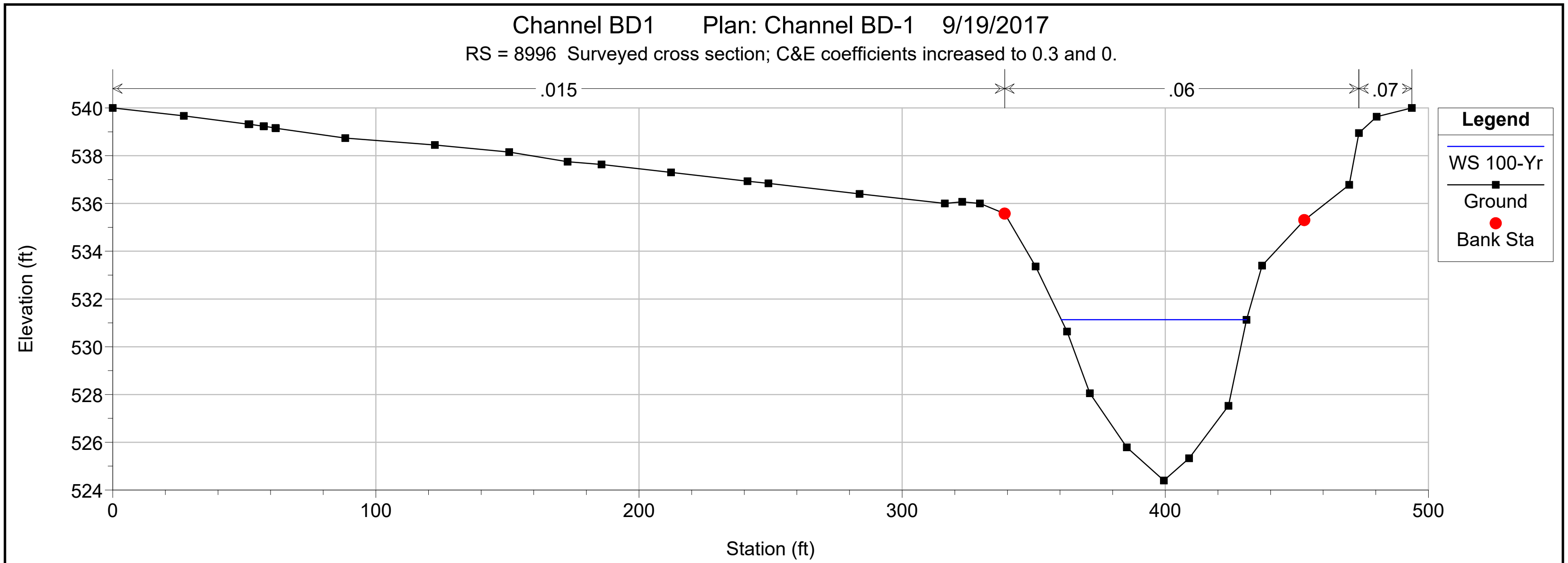
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 160
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta



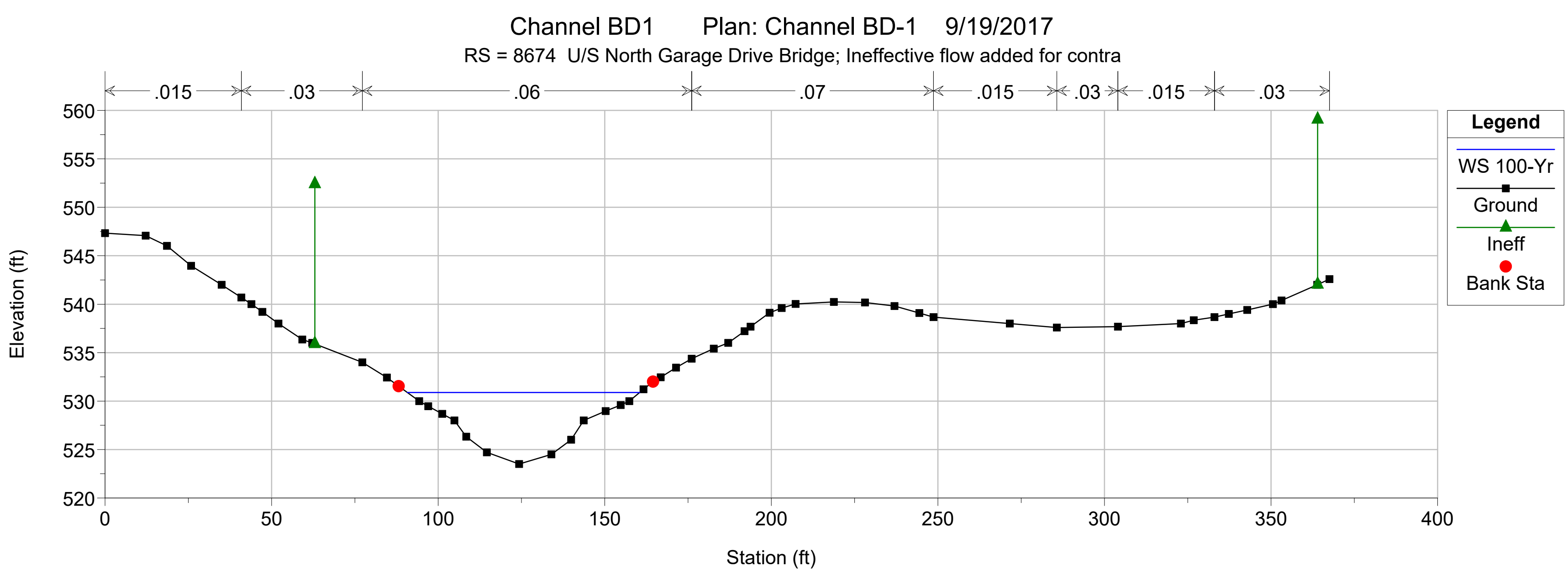
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 9492 U/S end of hydraulic model; located D/S of outfall south of Airf
.03
.015
.06
.07
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 9394 Surveyed Cross Section
.015
.06
.07
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

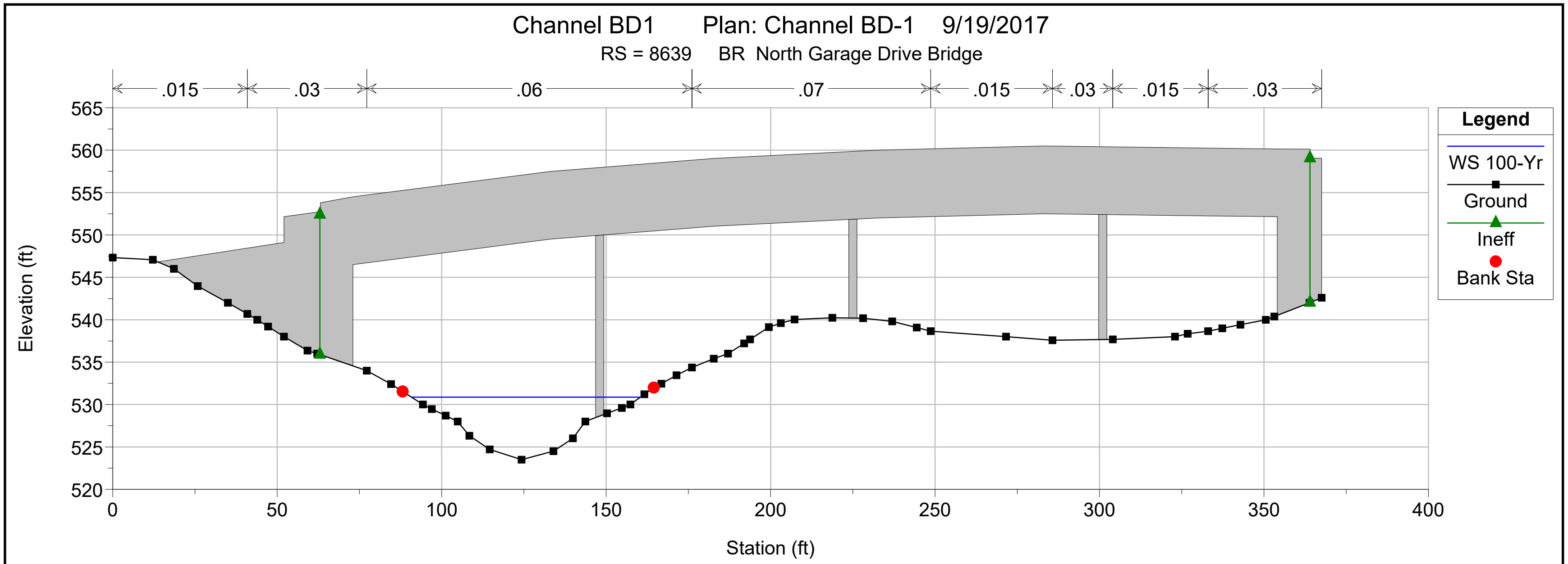

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 9184 In-channel geometry obtained from interpolated survey data
.015
.06
.07
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta



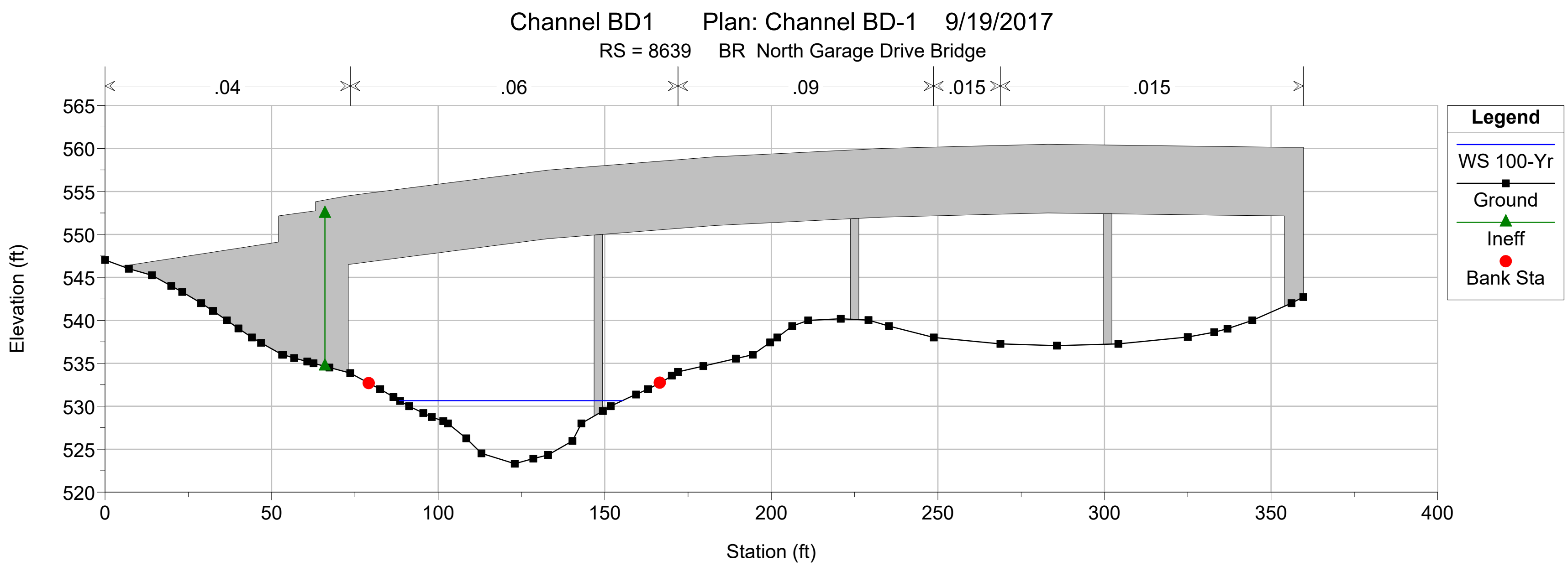
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 8996 Surveyed cross section; C&E coefficients increased to 0.3 and 0.
.015
.06
.07
Elevation (ft)
540
538
536
534
532
530
528
526
524
0
100
200
300
400
500
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta



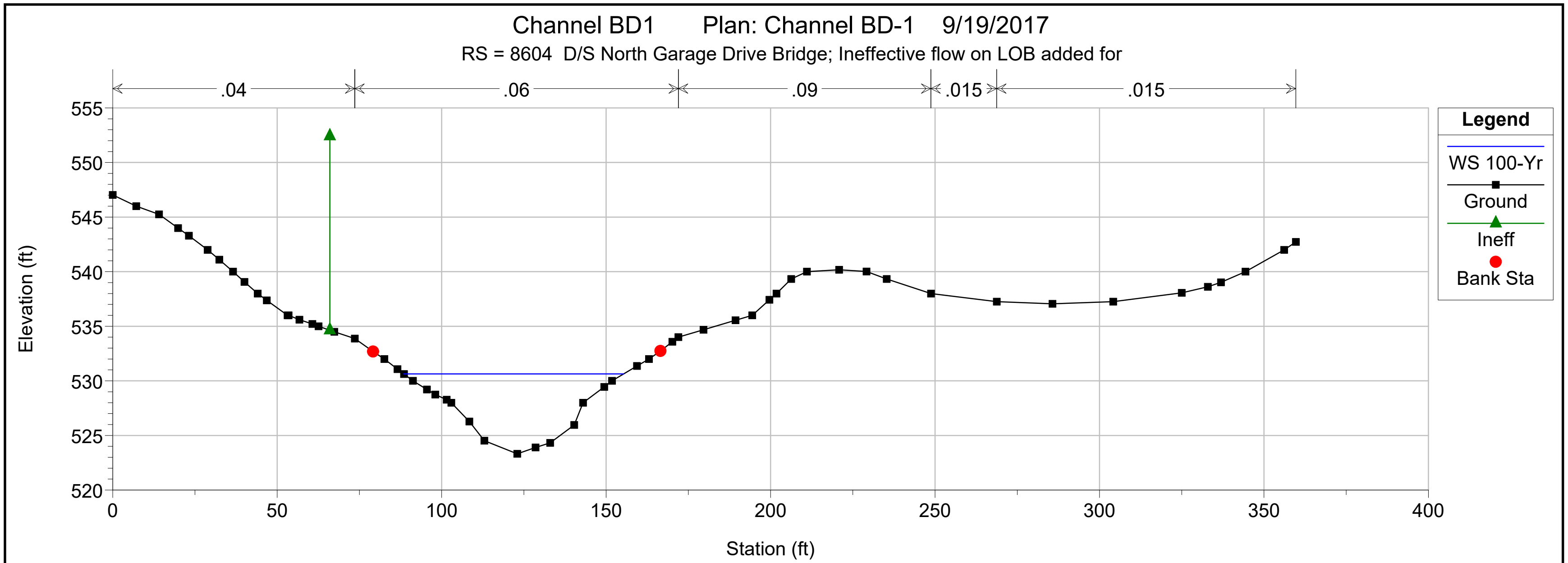
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 8674 U/S North Garage Drive Bridge; Ineffective flow added for contra
.015
.03
.06
.07
.015
.03
.015
.03
Elevation (ft)
560
555
550
545
540
535
530
525
520
0
50
100
150
200
250
300
350
400
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

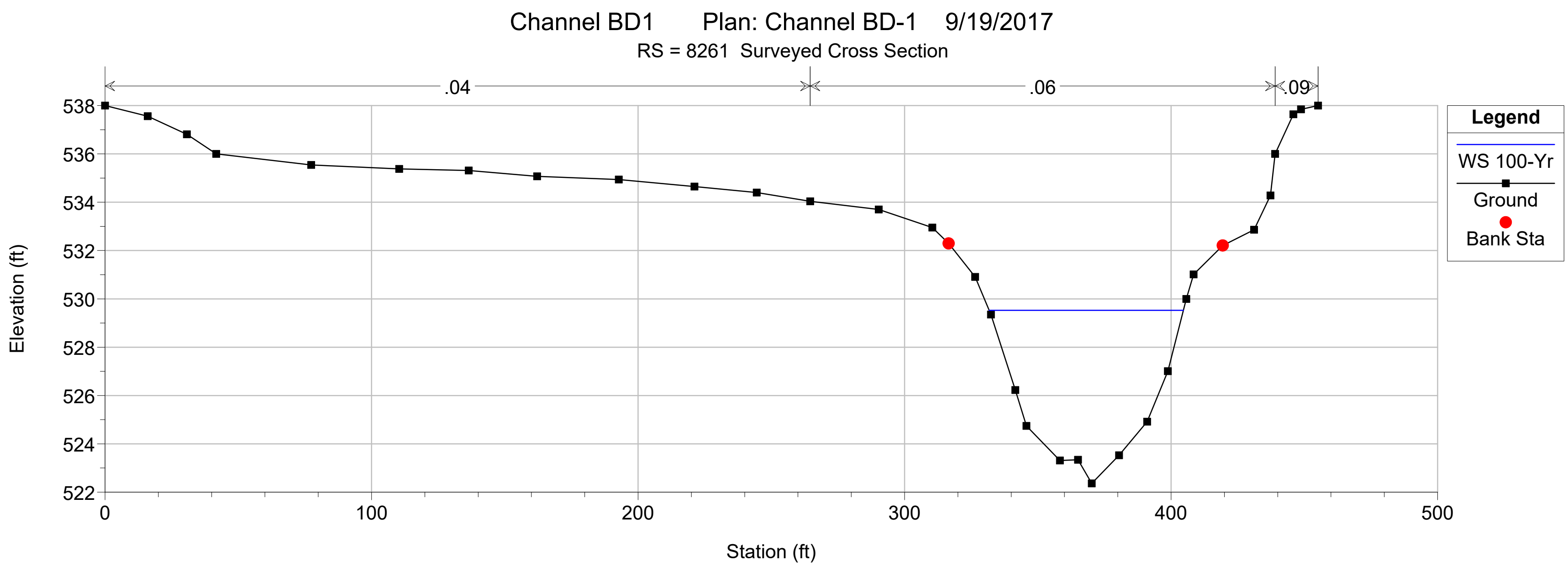


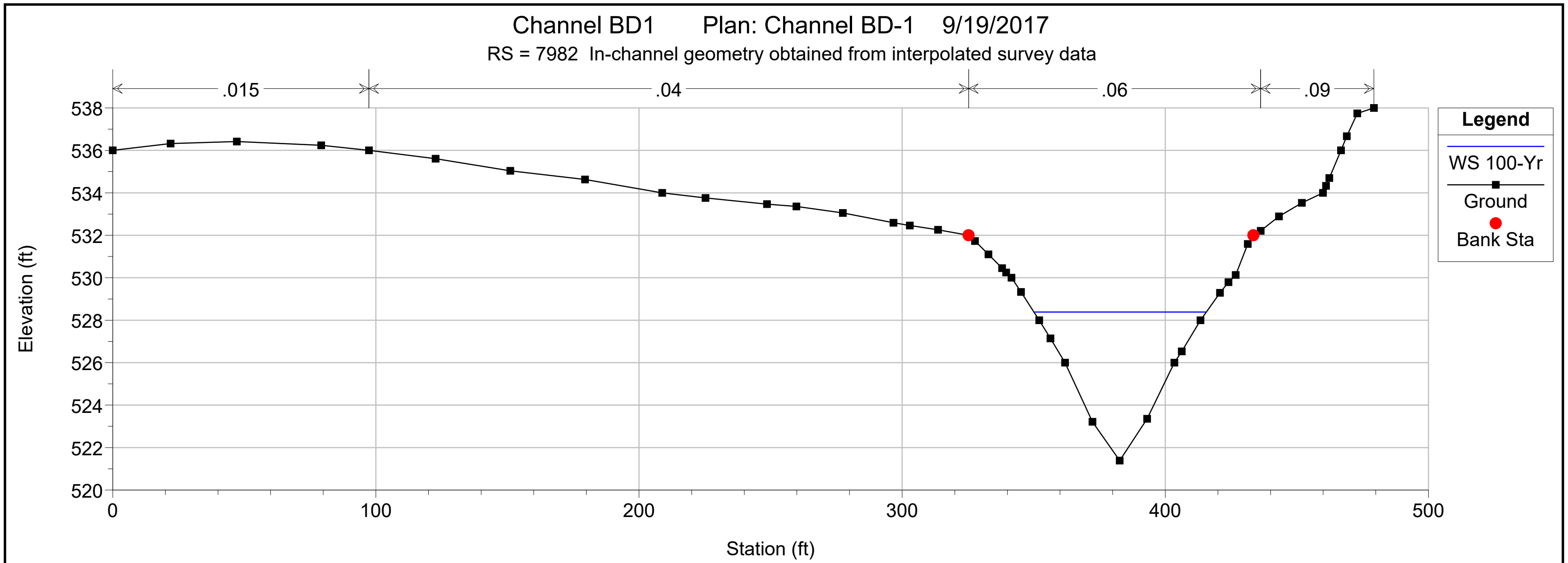
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 8639 BR North Garage Drive Bridge
.015
.03
.06
.07
.015
.03
.015
.03
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

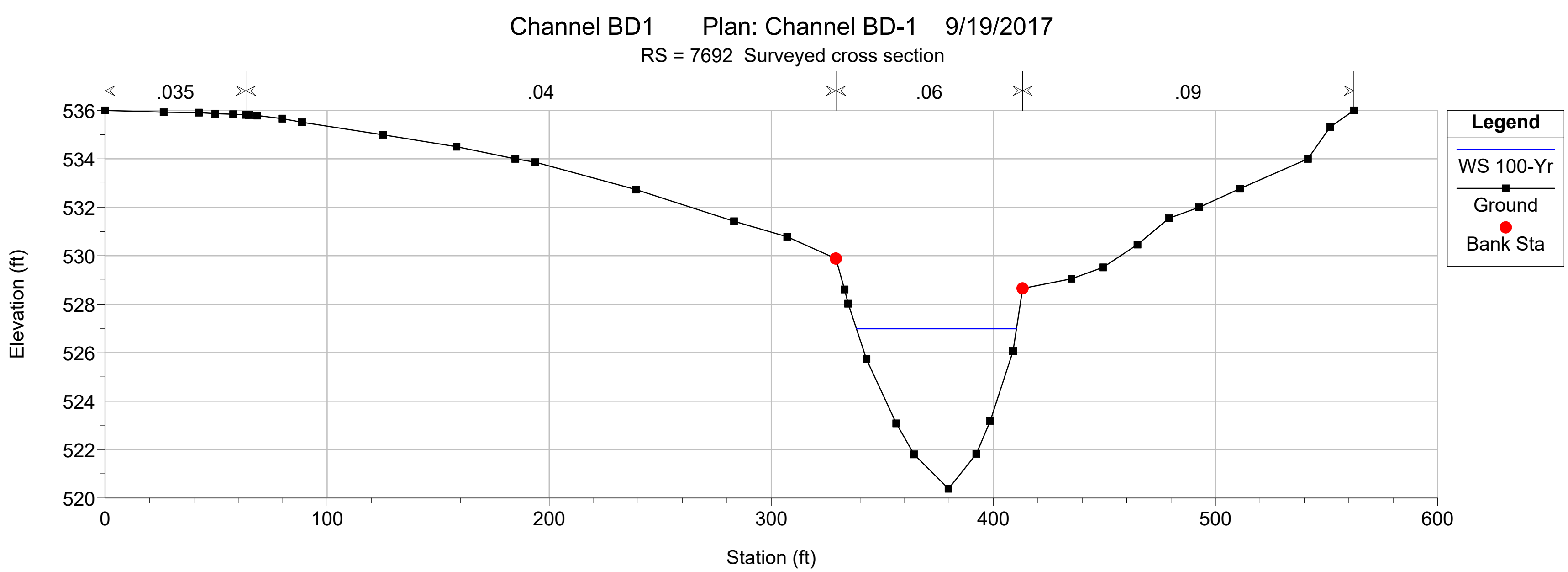


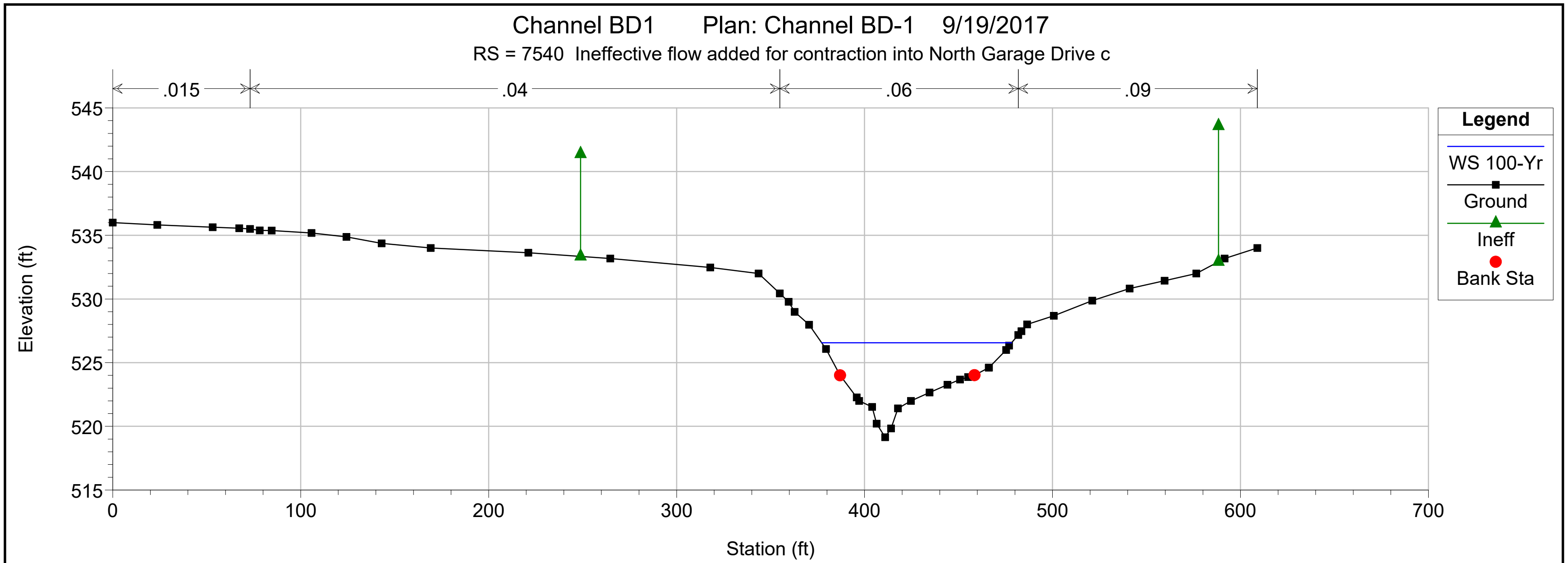
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 8639 BR North Garage Drive Bridge
.04
.06
.09
.015
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 8604 D/S North Garage Drive Bridge; Ineffective flow on LOB added for
.04
.06
.09
.015
.015
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
555
550
545
540
535
530
525
520
0
50
100
150
200
250
300
350
400

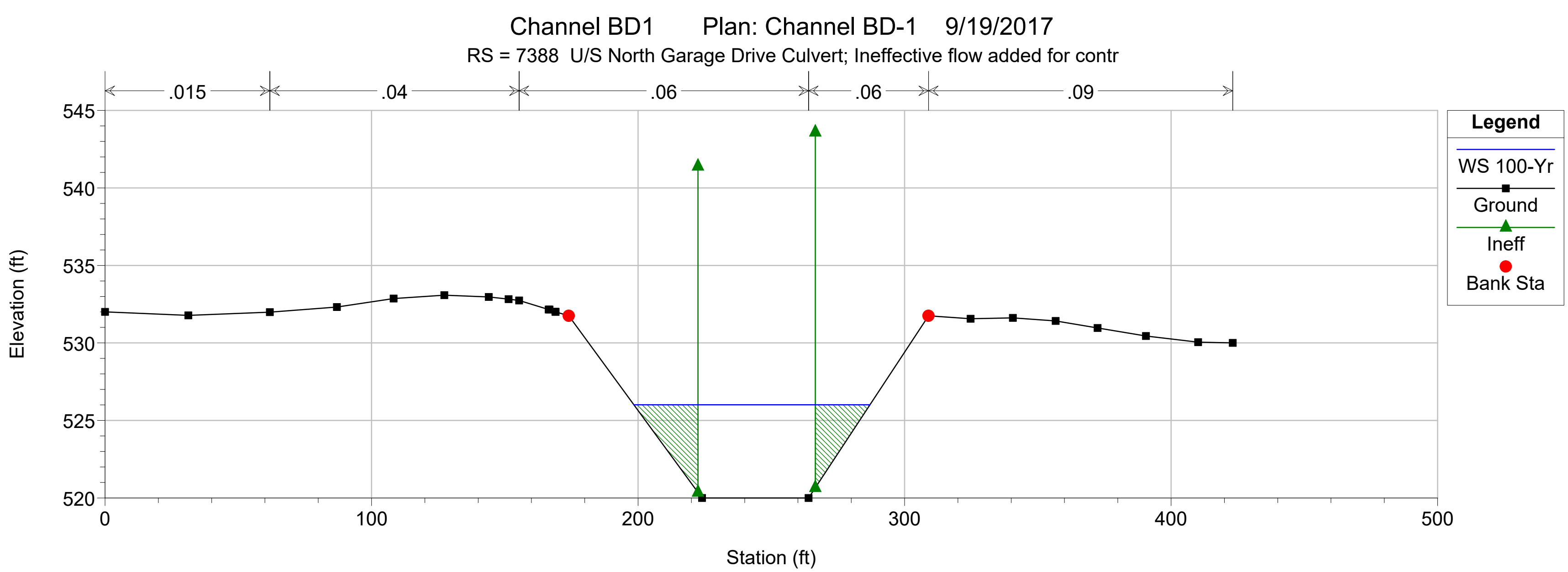

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 8261 Surveyed Cross Section
.04
.06
.09
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
538
536
534
532
530
528
526
524
522
0
100
200
300
400
500


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7982 In-channel geometry obtained from interpolated survey data
.015
.04
.06
.09
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

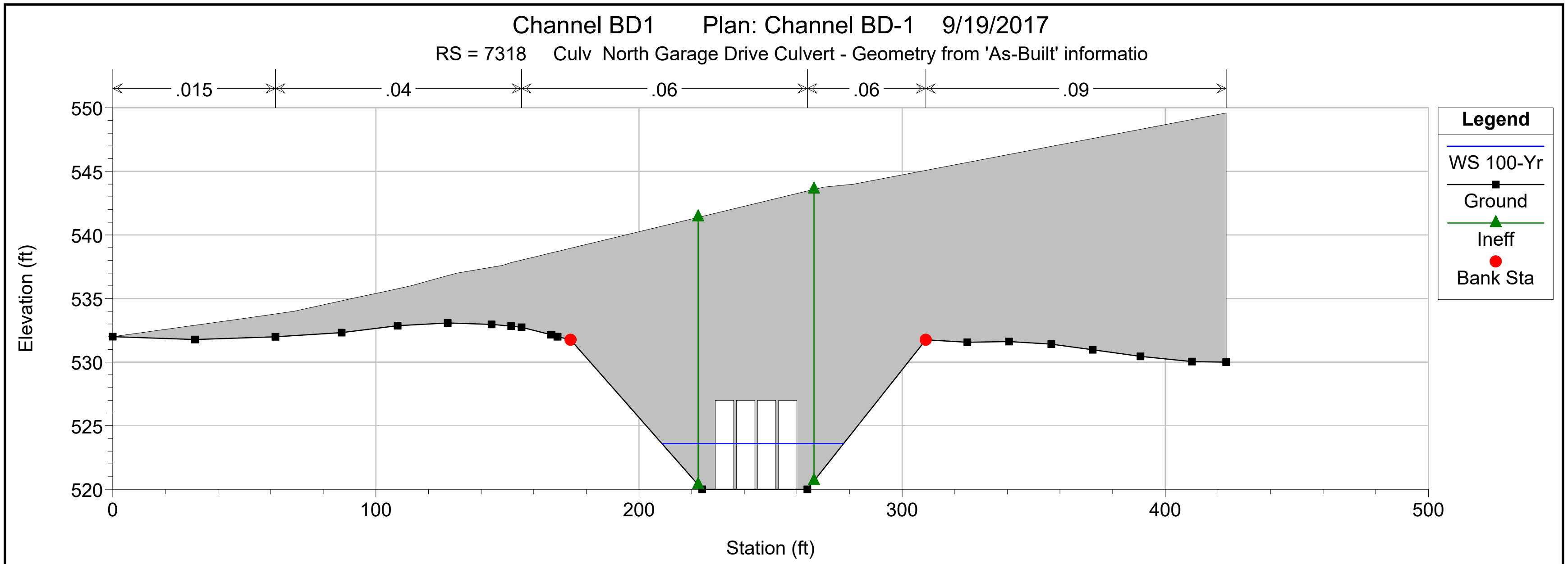

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7692 Surveyed cross section
.035
.04
.06
.09
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

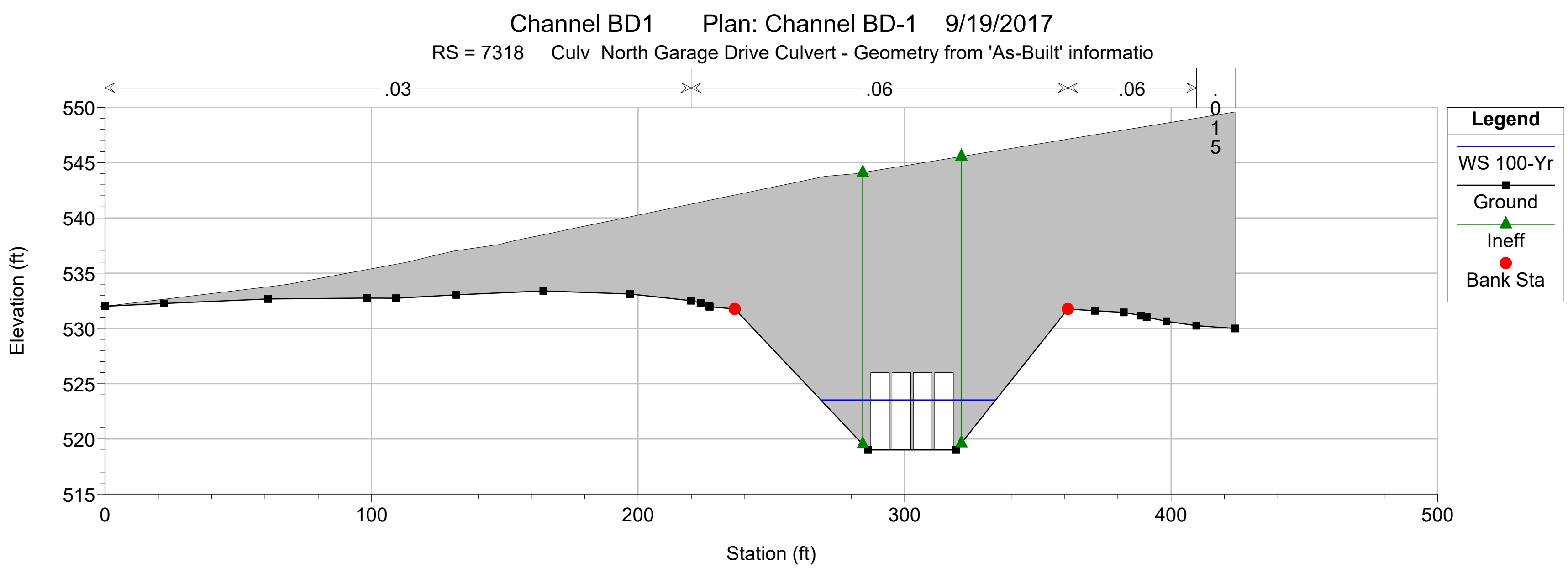


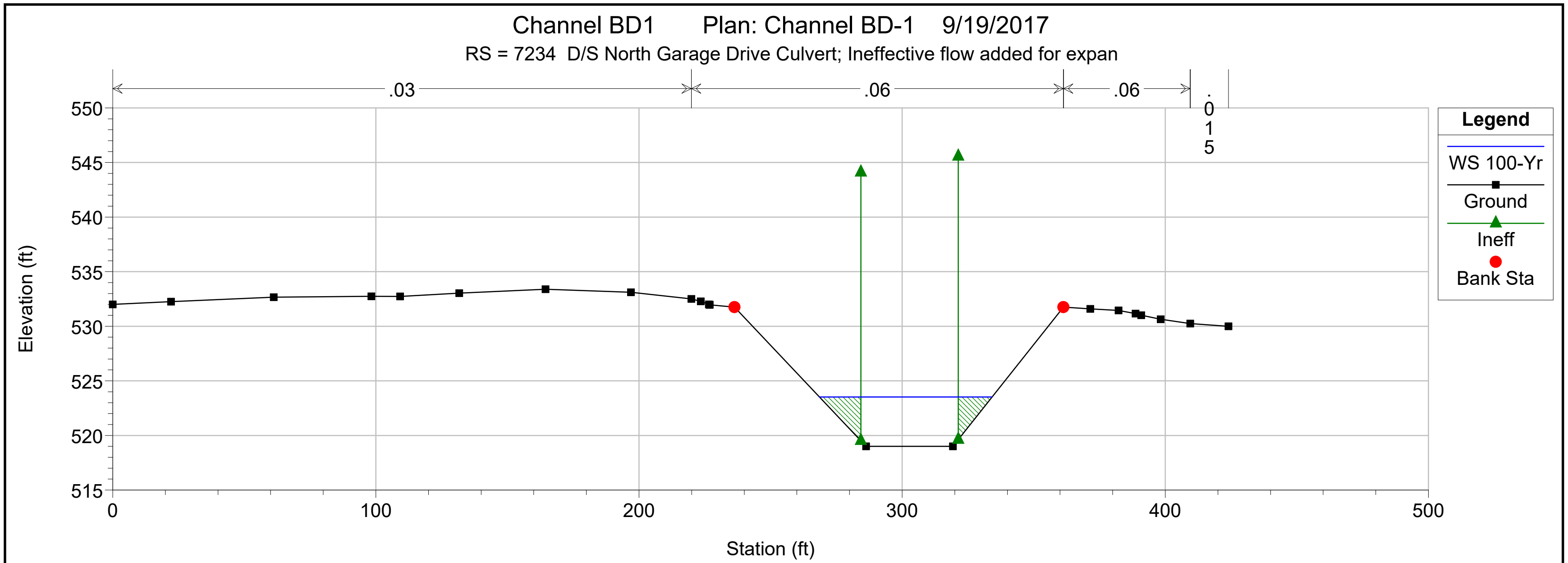
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7540 Ineffective flow added for contraction into North Garage Drive c
.015
.04
.06
.09
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



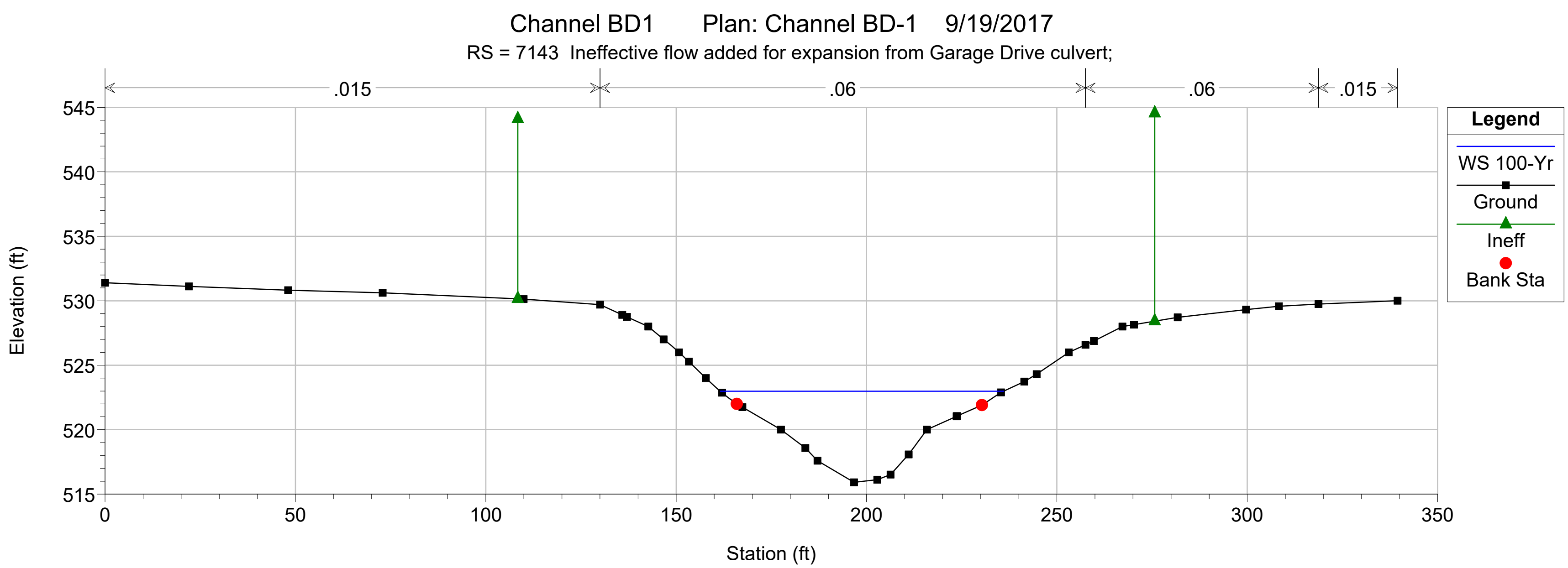
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7388 U/S North Garage Drive Culvert; Ineffective flow added for contr
.015
.04
.06
.06
.09
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7318 Culv North Garage Drive Culvert - Geometry from 'As-Built' informatio
.015
.04
.06
.06
.09
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

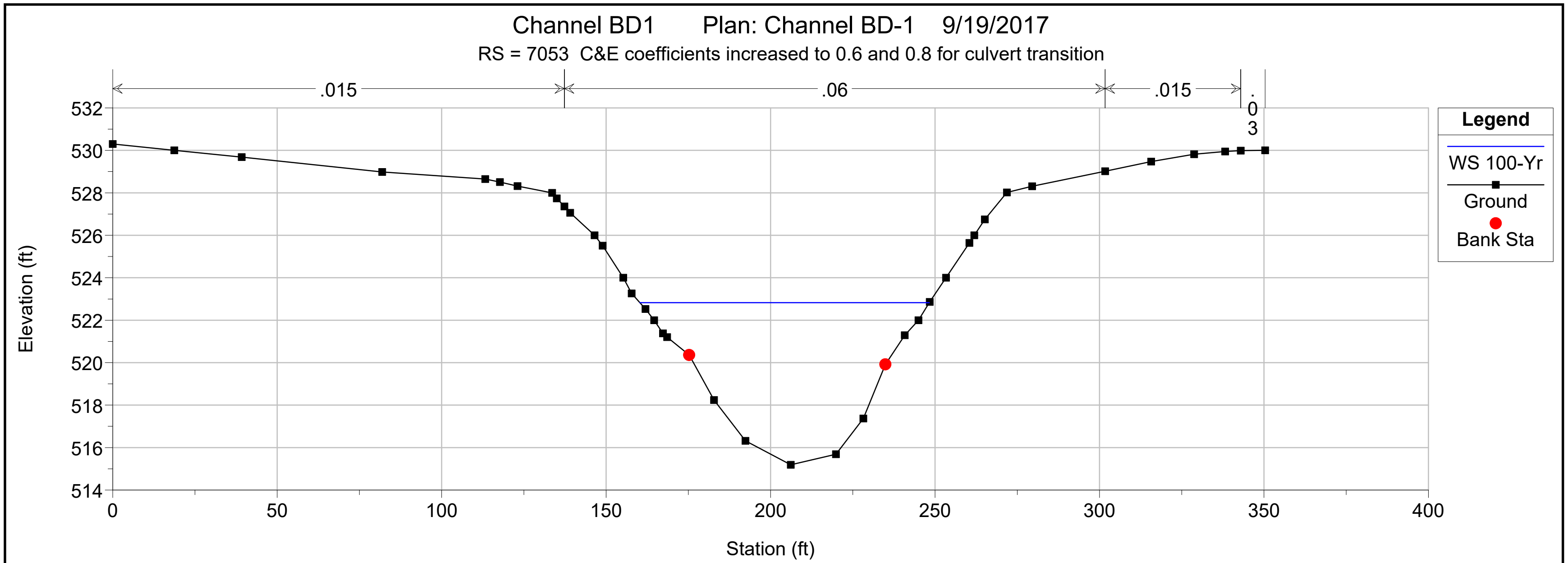

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7318 Culv North Garage Drive Culvert - Geometry from 'As-Built' informatio
.03
.06
.06
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta



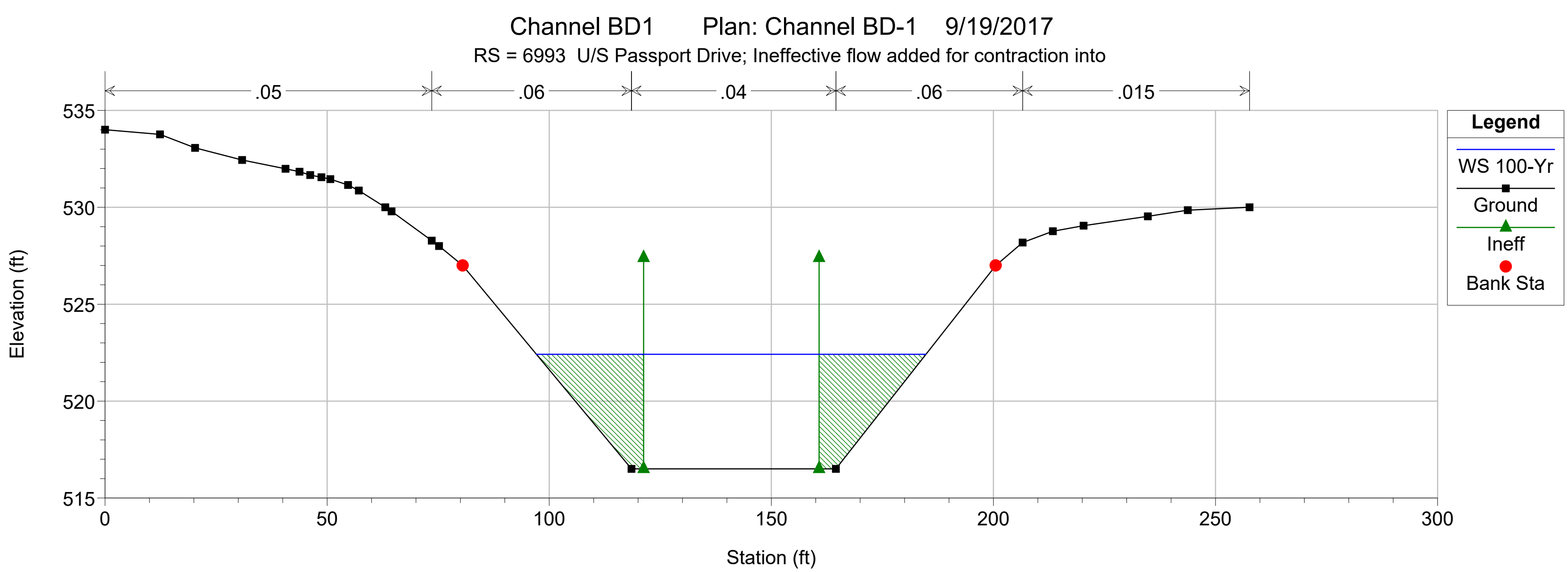
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7234 D/S North Garage Drive Culvert; Ineffective flow added for expan
.03
.06
.06
.015
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
550
545
540
535
530
525
520
515
0
100
200
300
400
500



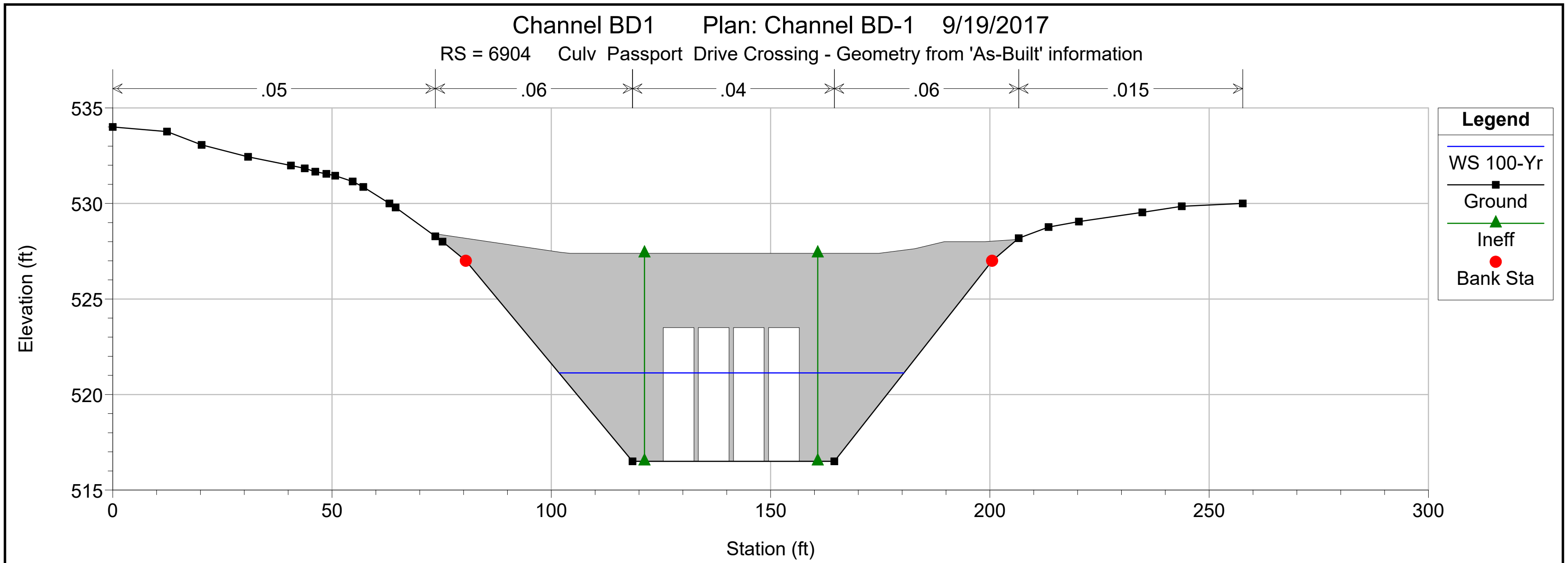
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7143 Ineffective flow added for expansion from Garage Drive culvert;
.015
.06
.06
.015
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
545
540
535
530
525
520
515
0
50
100
150
200
250
300
350

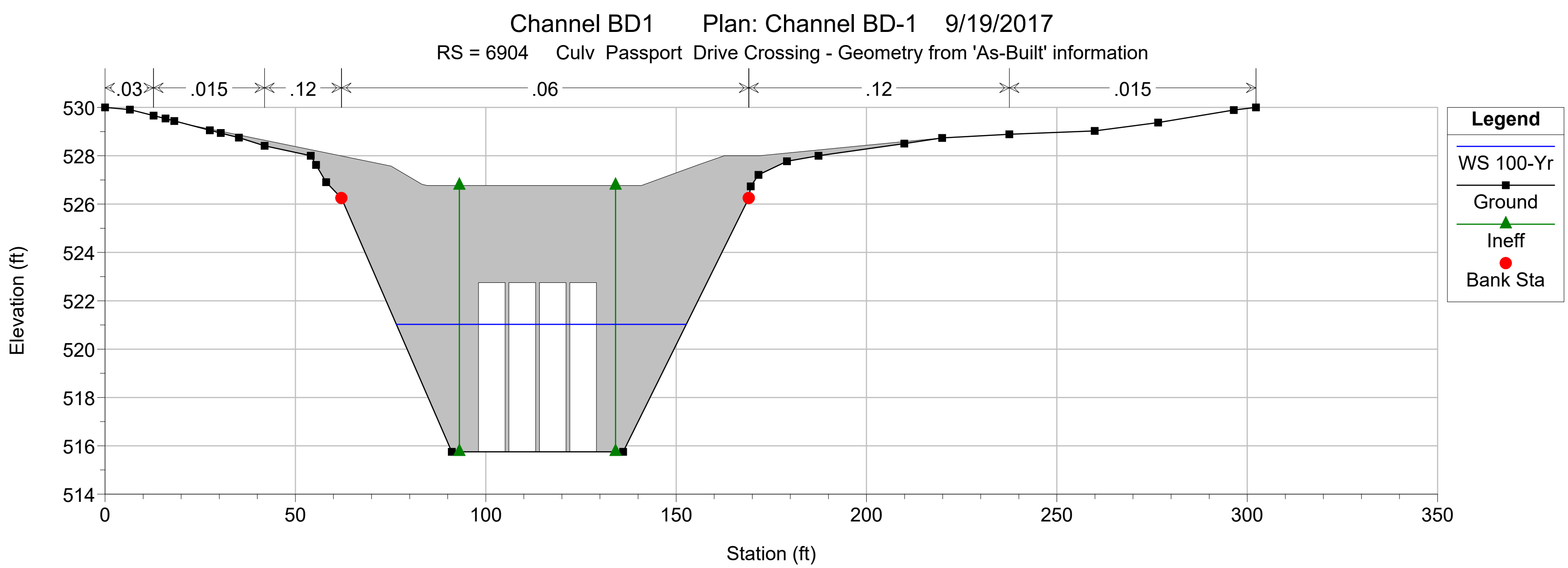


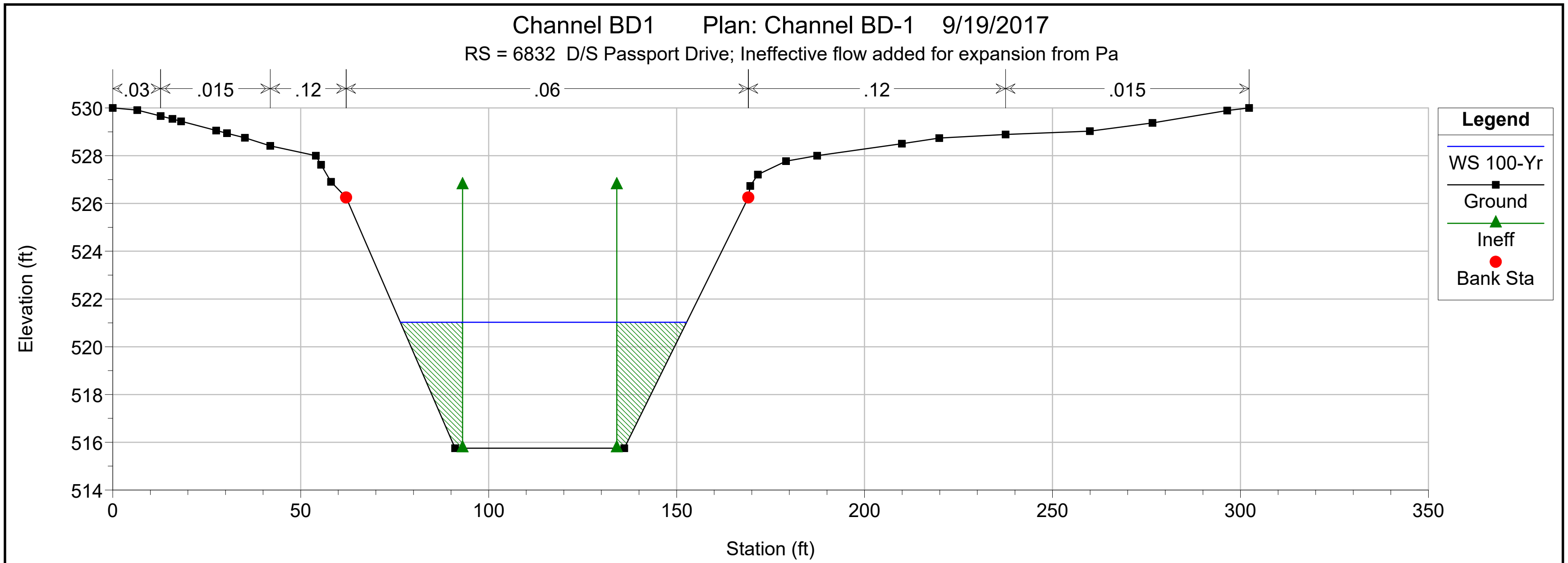
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 7053 C&E coefficients increased to 0.6 and 0.8 for culvert transition
.015
.06
.015
.03
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

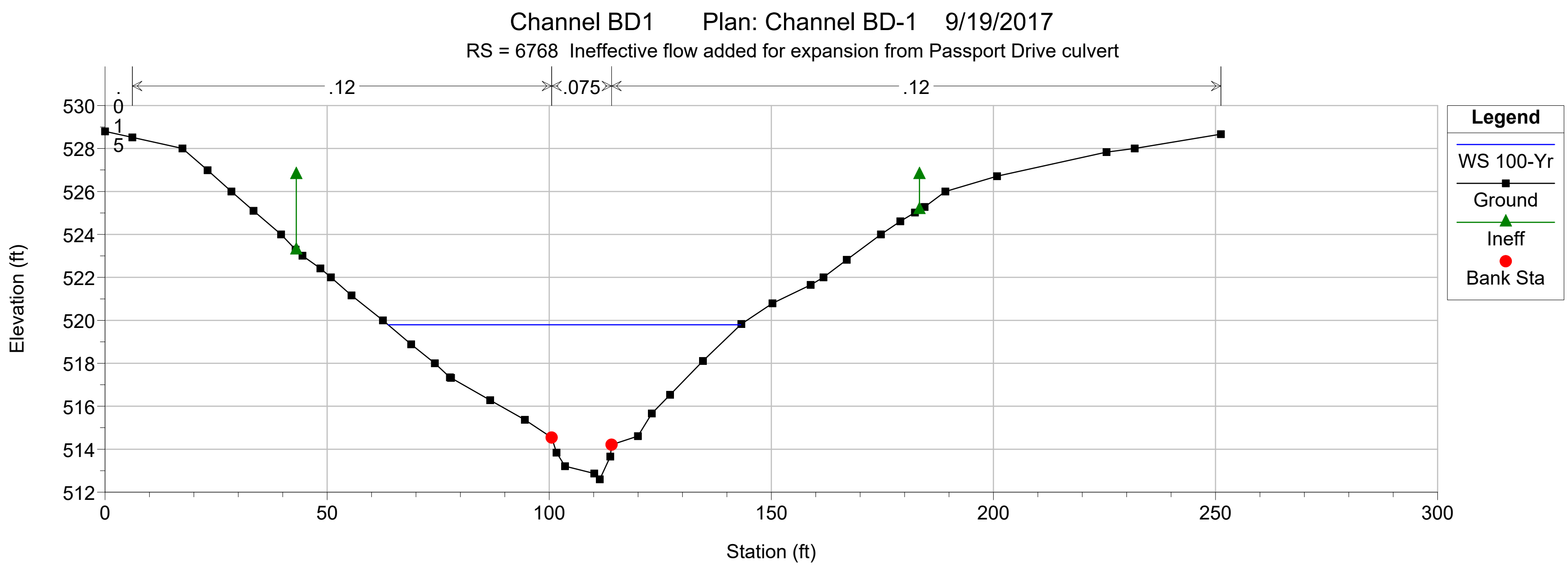


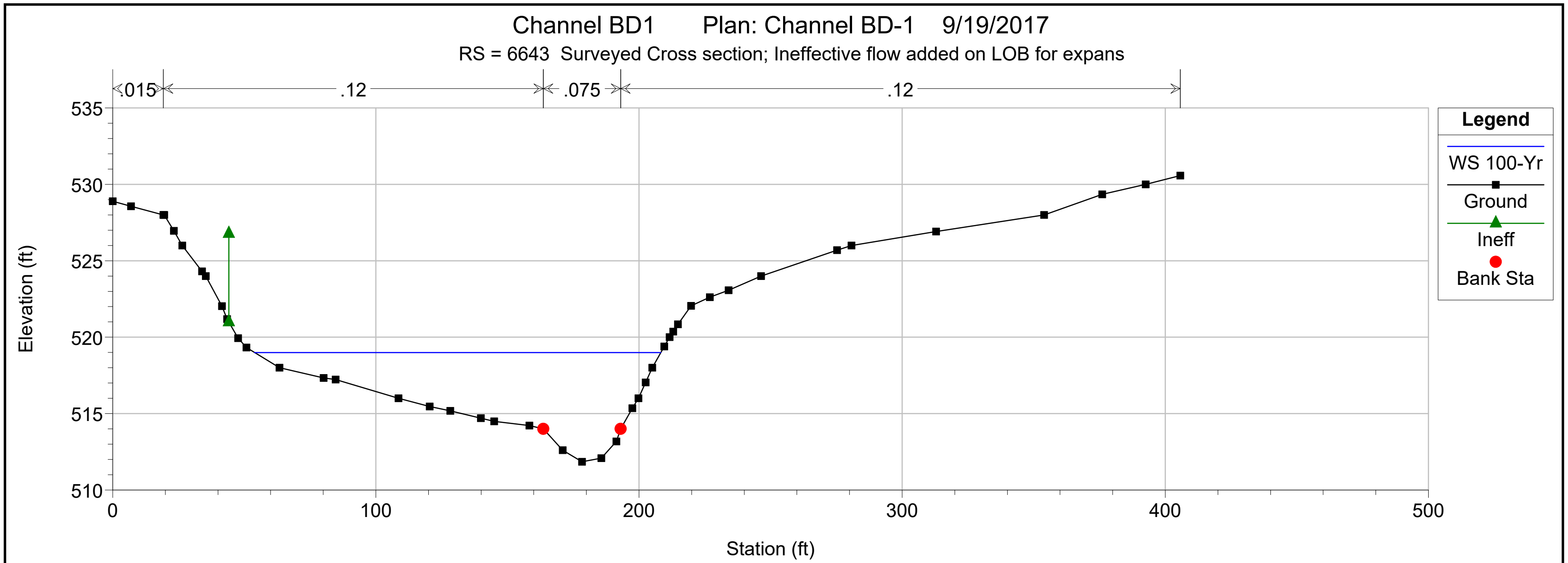
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6993 U/S Passport Drive; Ineffective flow added for contraction into
.05
.06
.04
.06
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

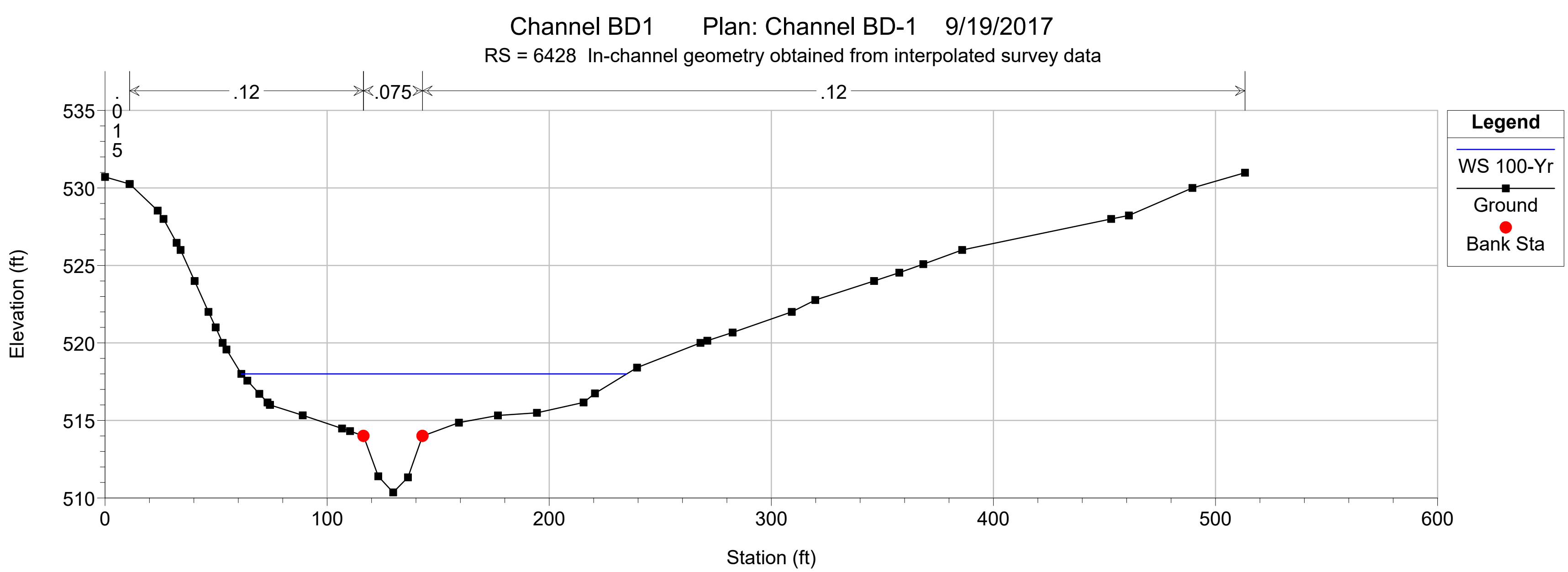

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6904 Culv Passport Drive Crossing - Geometry from 'As-Built' information
.05
.06
.04
.06
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

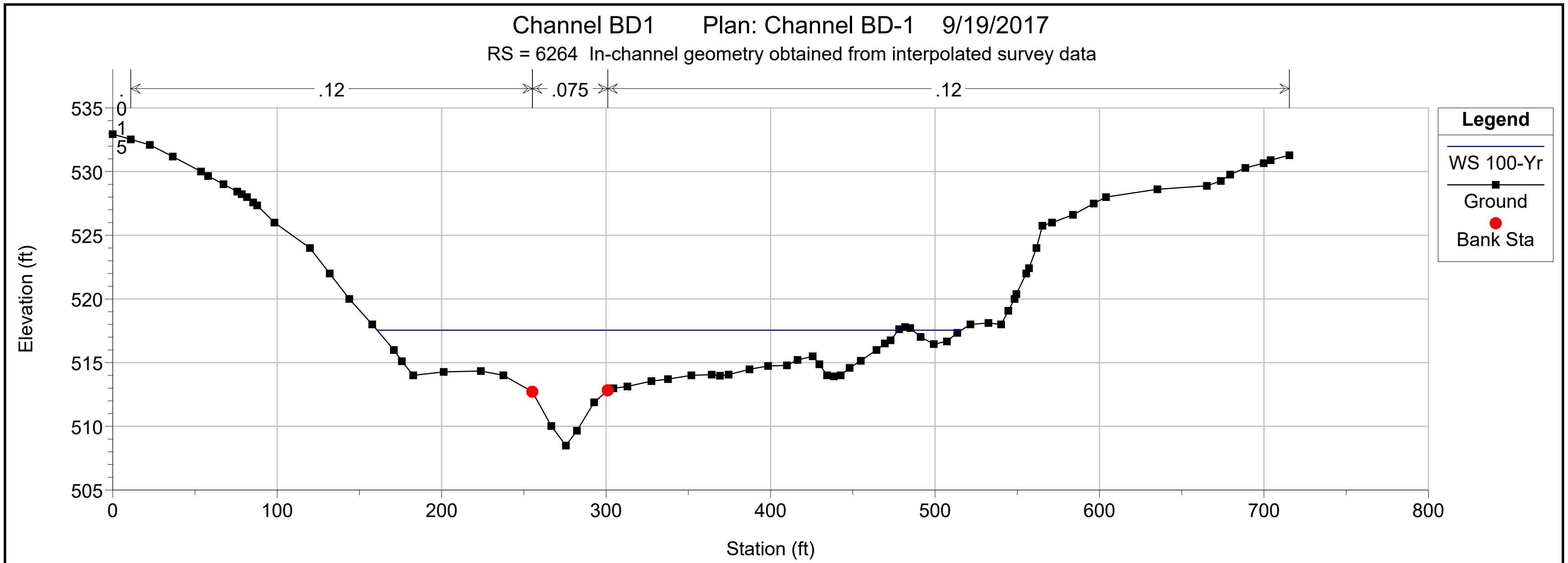

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6904 Culv Passport Drive Crossing - Geometry from 'As-Built' information
.03
.015
.12
.06
.12
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

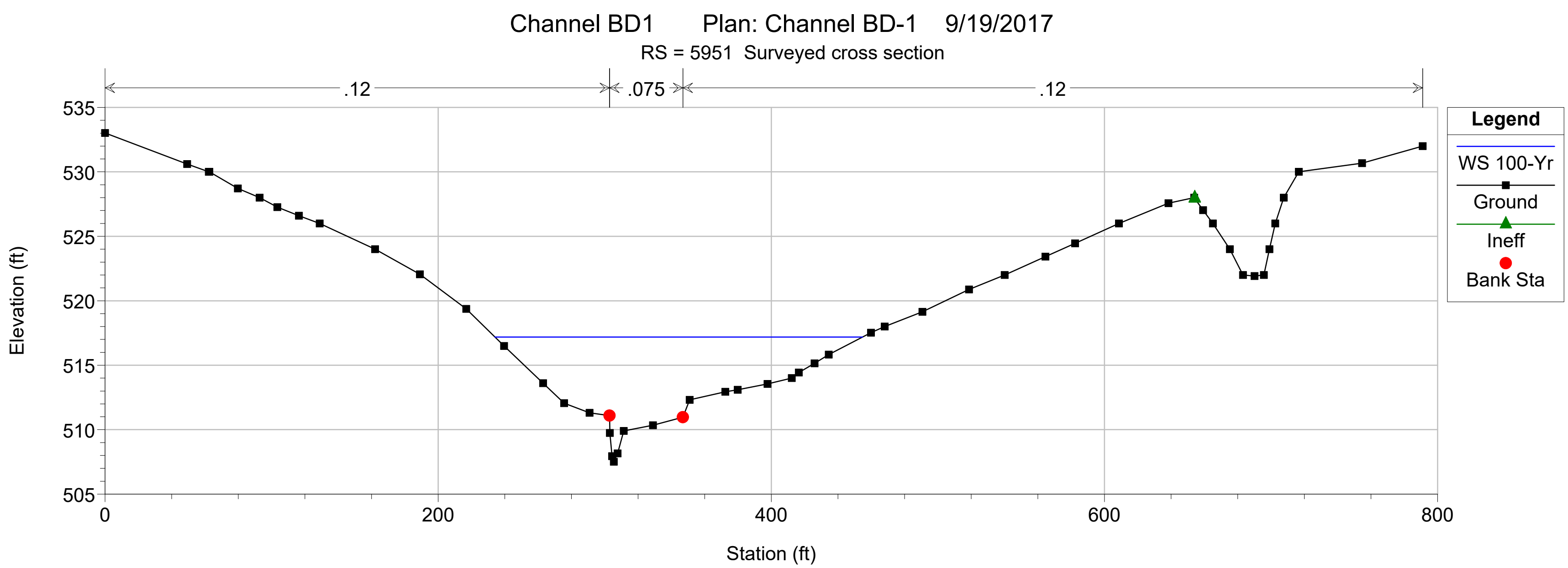

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6832 D/S Passport Drive; Ineffective flow added for expansion from Pa
.03
.015
.12
.06
.12
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

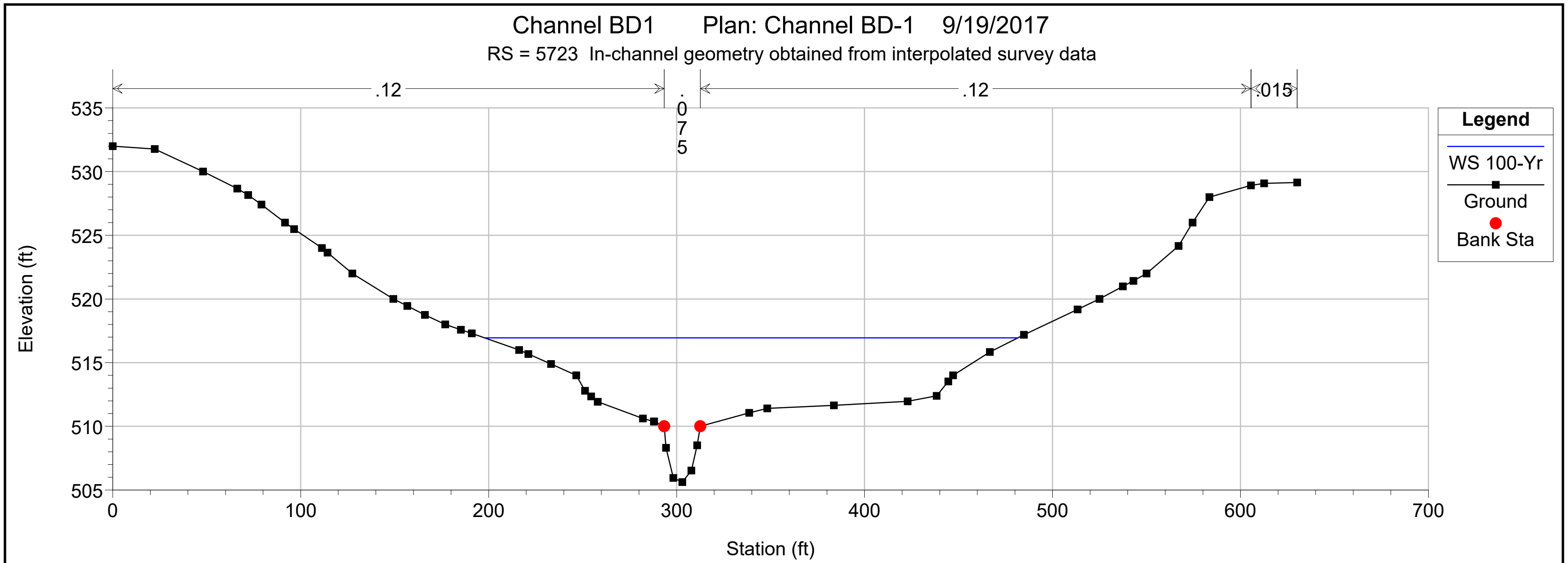

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6768 Ineffective flow added for expansion from Passport Drive culvert
.015
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6643 Surveyed Cross section; Ineffective flow added on LOB for expans
.015
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

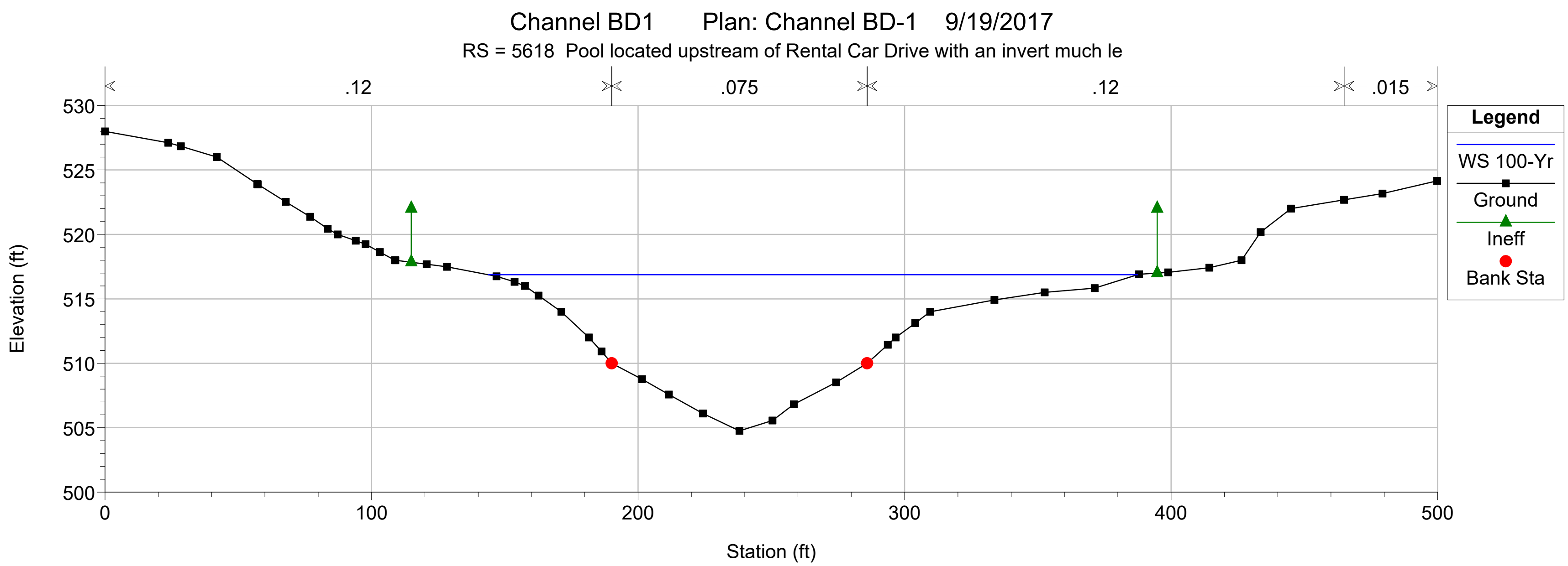

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6428 In-channel geometry obtained from interpolated survey data
.015
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 6264 In-channel geometry obtained from interpolated survey data
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

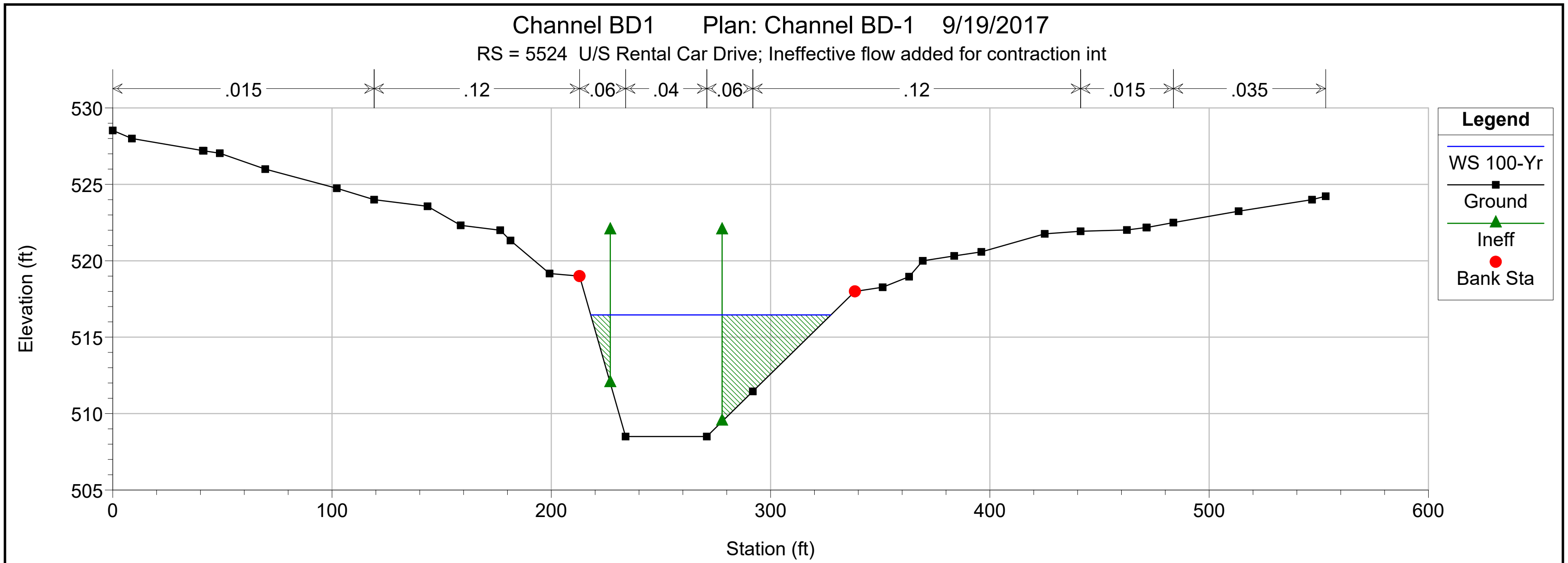

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5951 Surveyed cross section
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

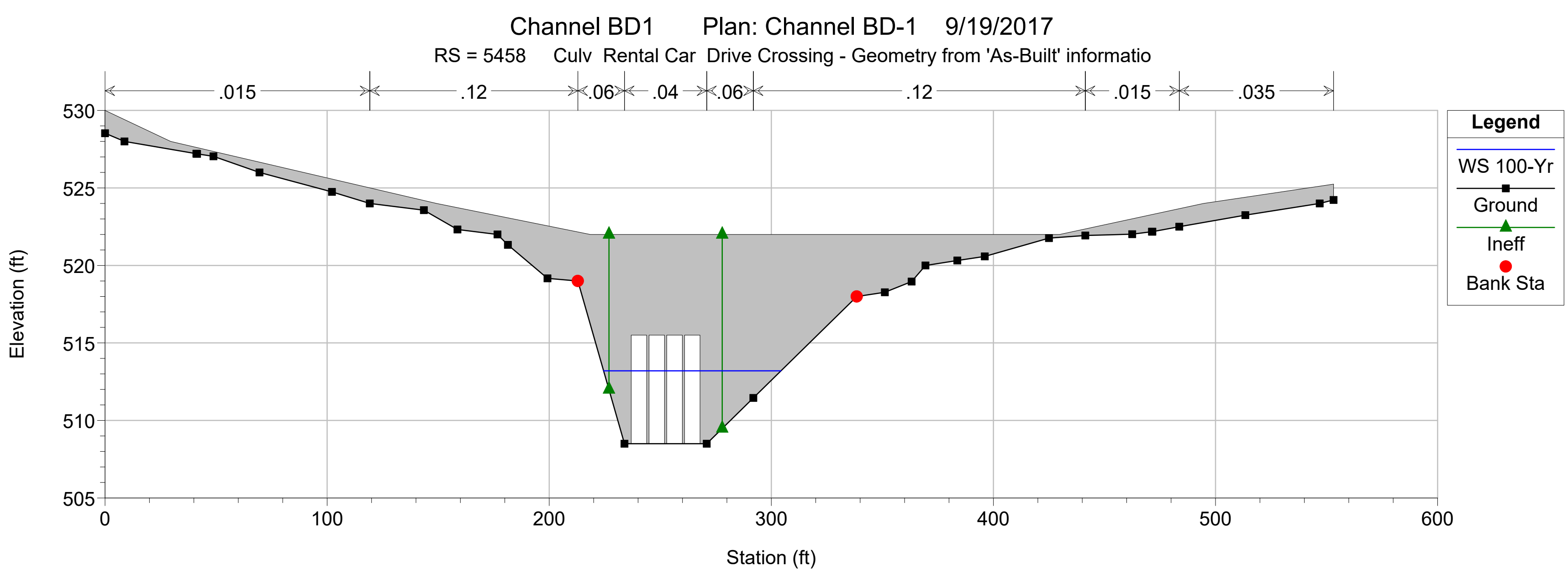


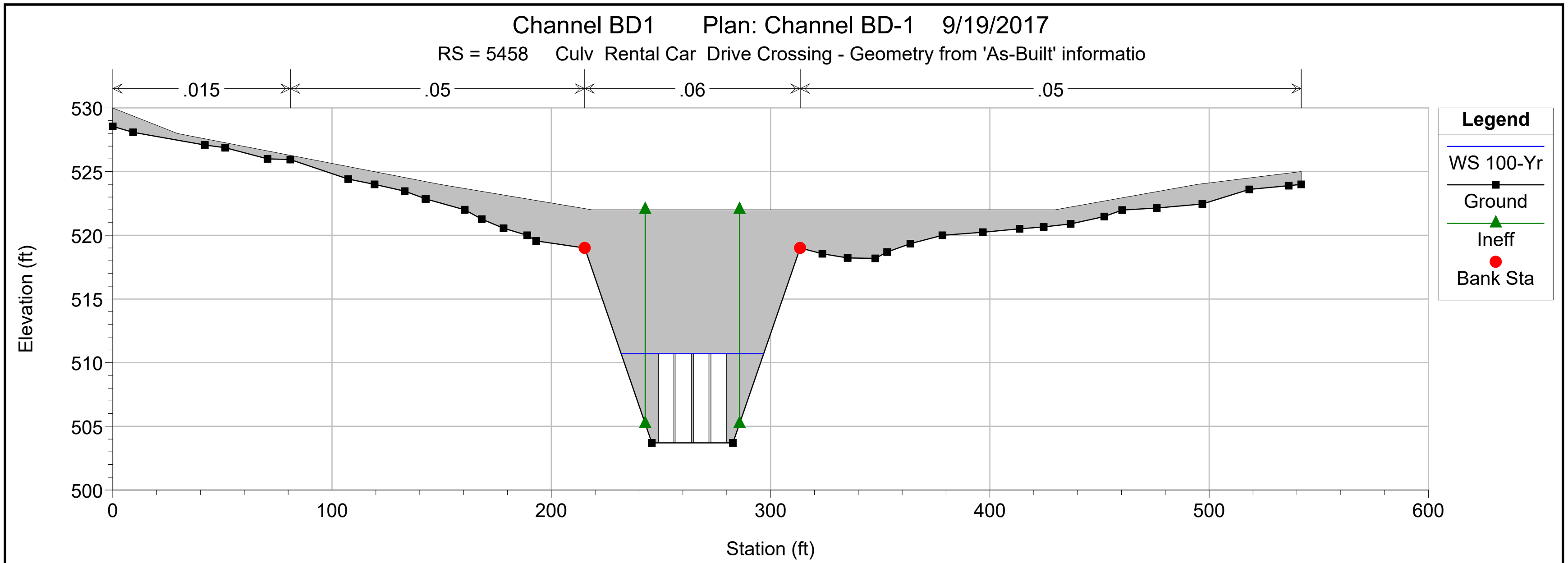
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5723 In-channel geometry obtained from interpolated survey data
.12
.075
.12
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

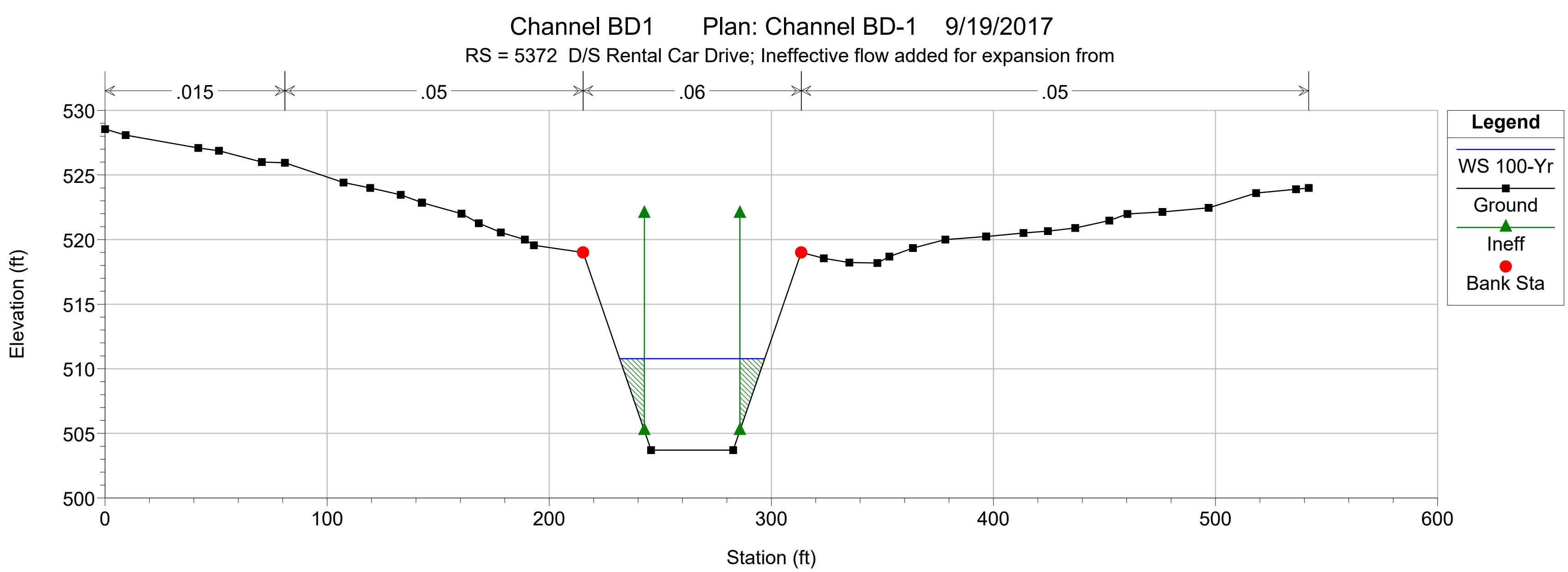


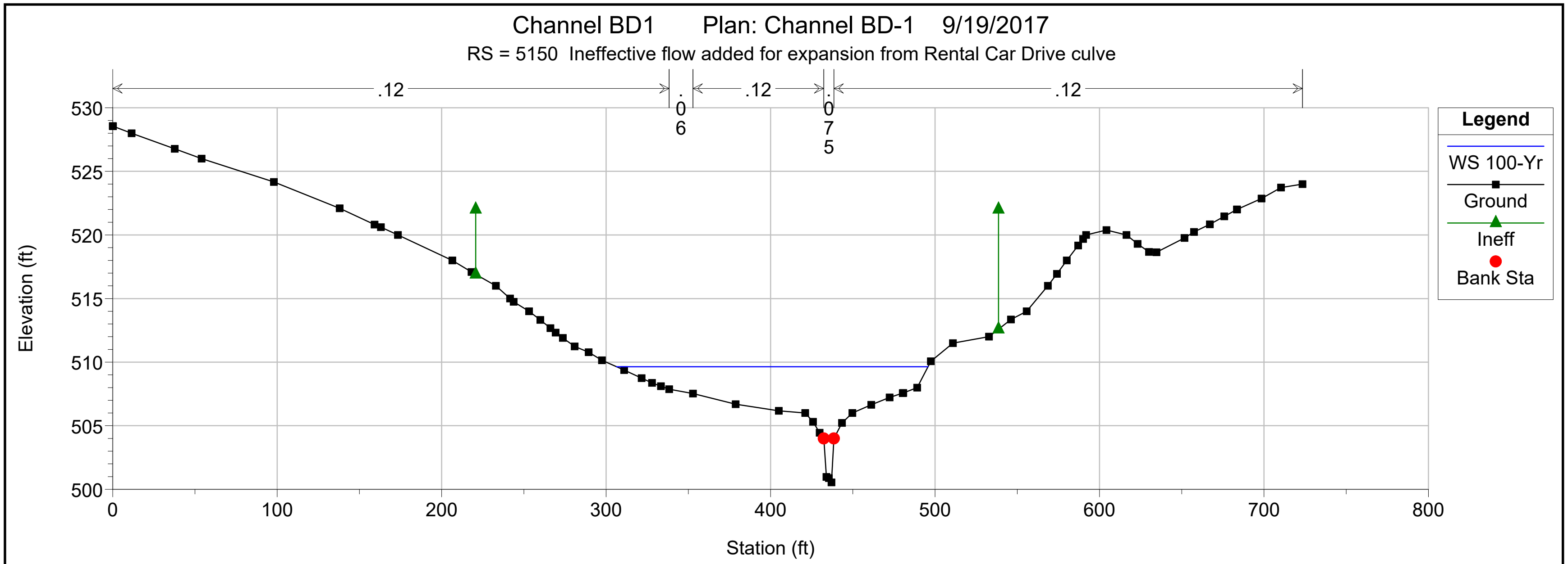
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5618 Pool located upstream of Rental Car Drive with an invert much le
.12
.075
.12
.015
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

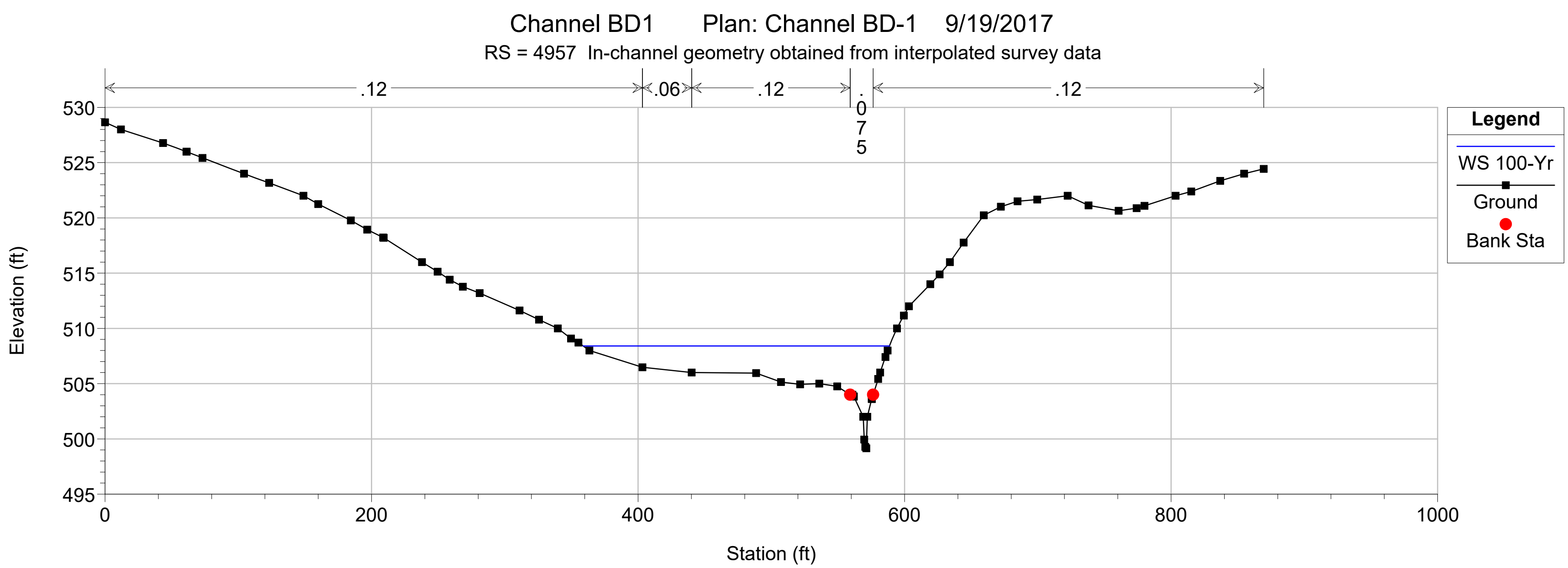

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5524 U/S Rental Car Drive; Ineffective flow added for contraction int
.015
.12
.06
.04
.06
.12
.015
.035
Elevation (ft)
530
525
520
515
510
505
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

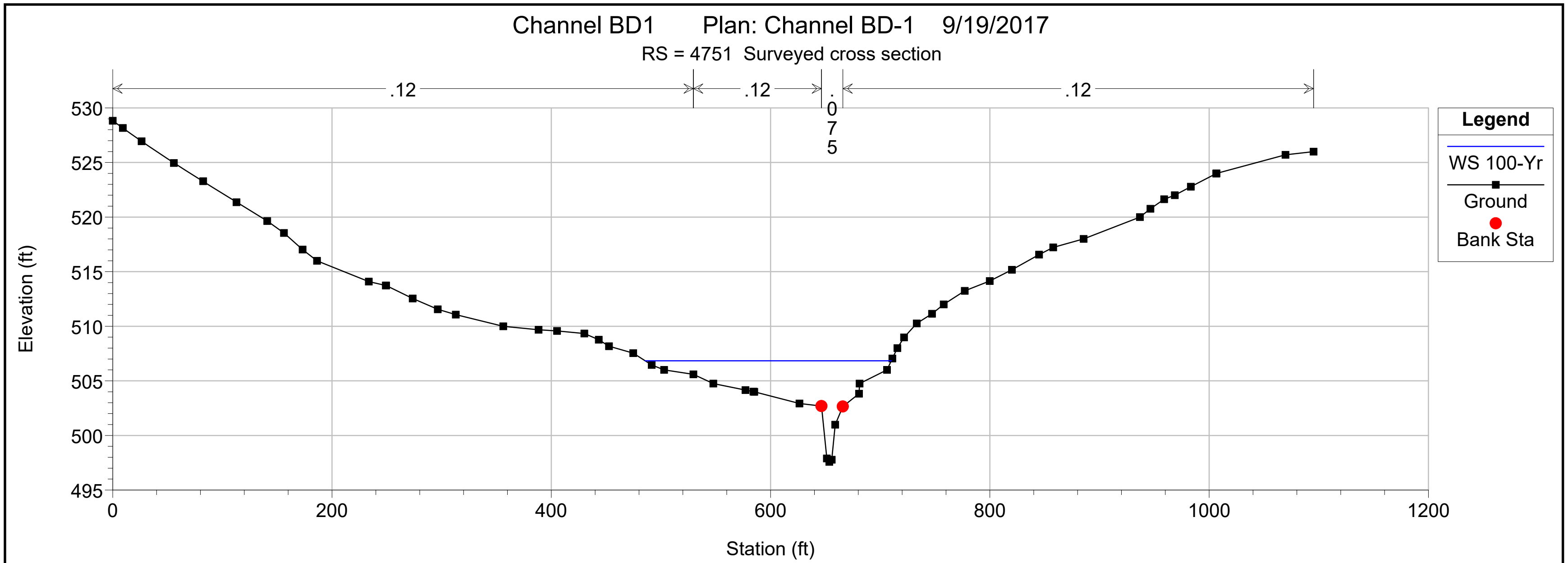

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5458 Culv Rental Car Drive Crossing - Geometry from 'As-Built' informatio
.015
.12
.06
.04
.06
.12
.015
.035
Elevation (ft)
530
525
520
515
510
505
0
100
200
300
400
500
600
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

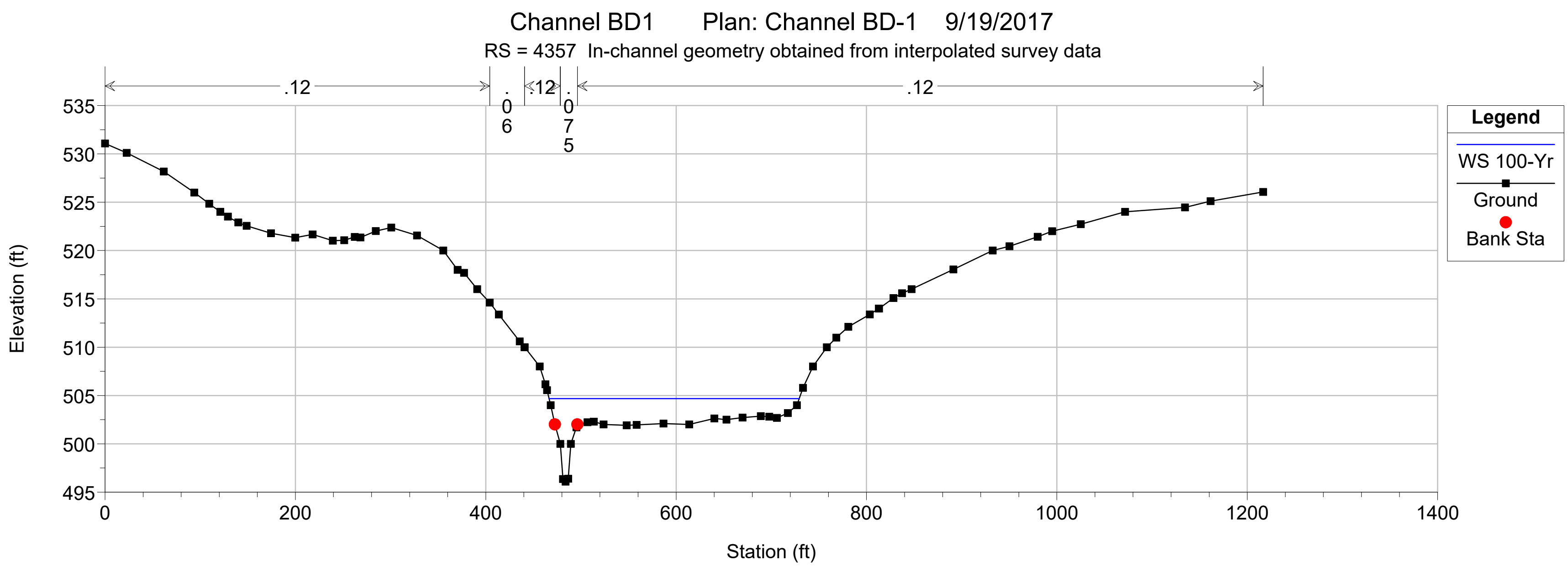

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5458 Culv Rental Car Drive Crossing - Geometry from 'As-Built' informatio
.015
.05
.06
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

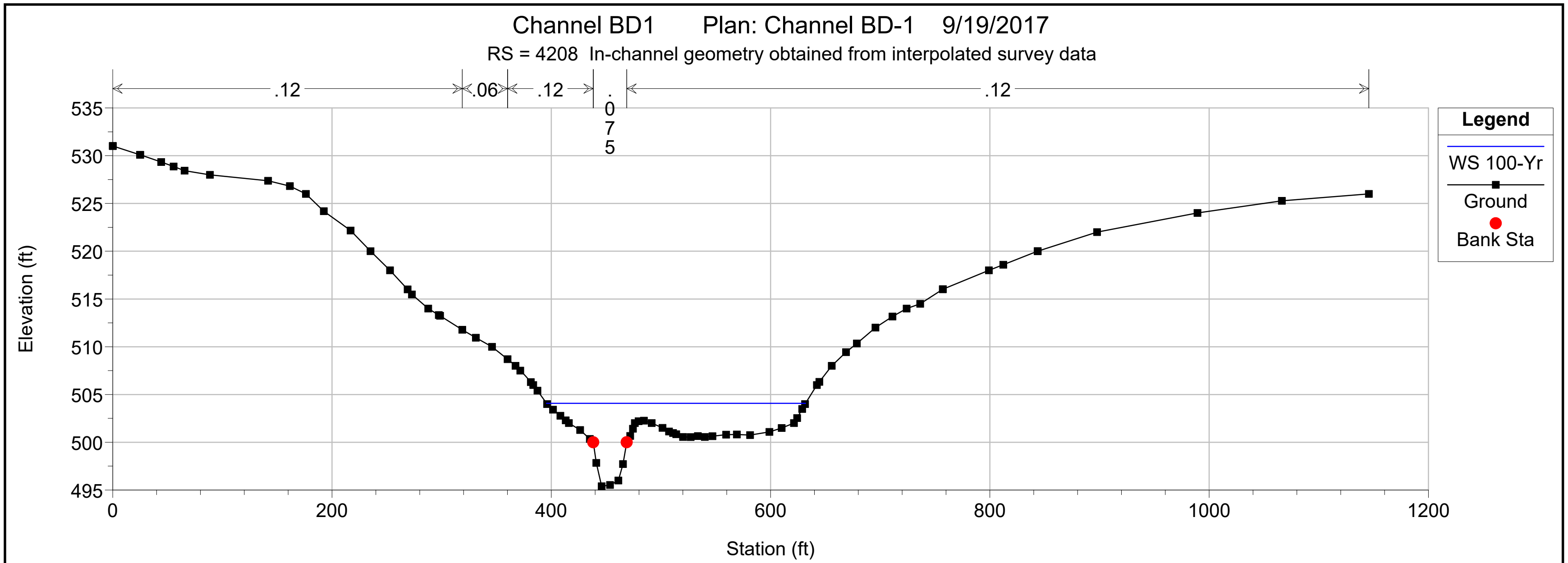

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5372 D/S Rental Car Drive; Ineffective flow added for expansion from
.015
.05
.06
.05
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 5150 Ineffective flow added for expansion from Rental Car Drive culve
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

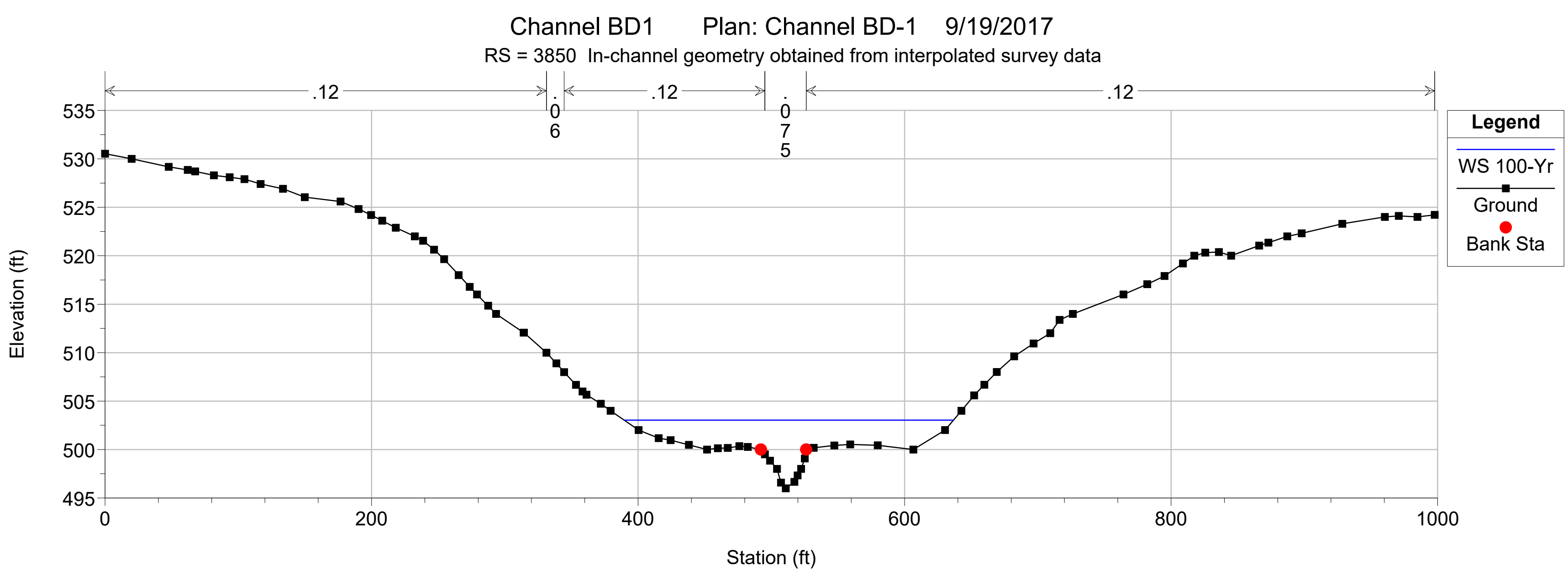

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 4957 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 4751 Surveyed cross section
.12
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

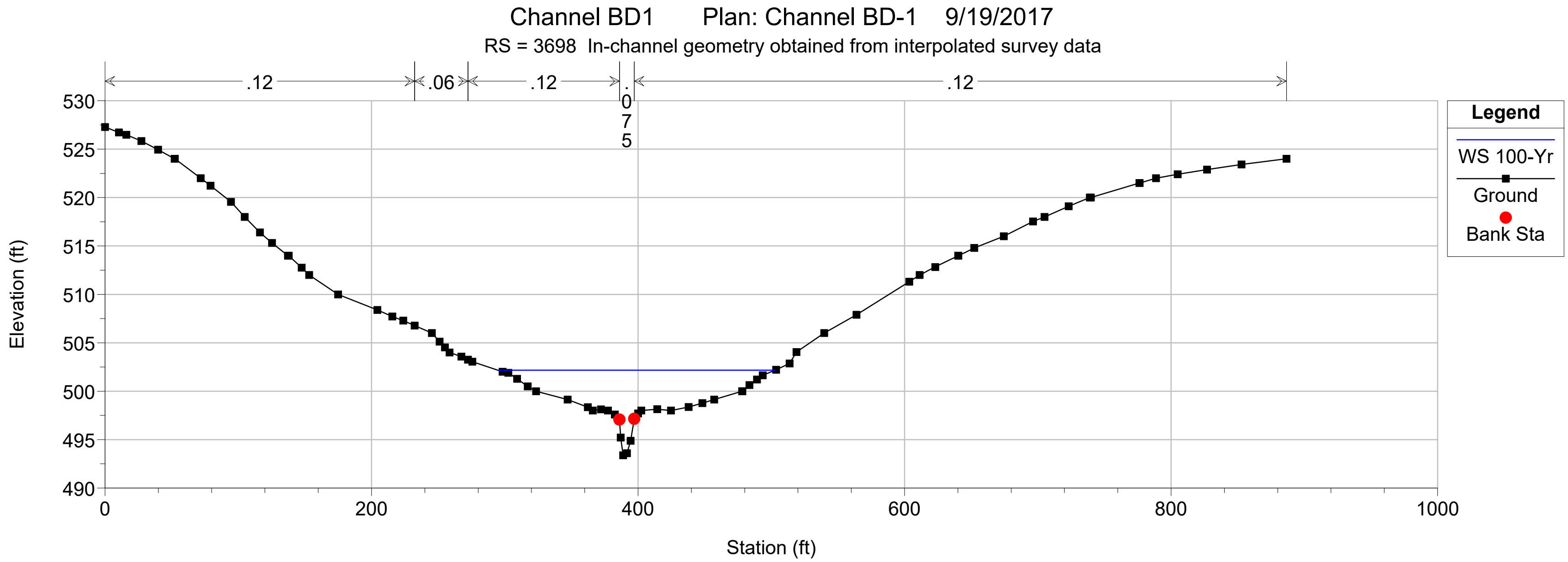

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 4357 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

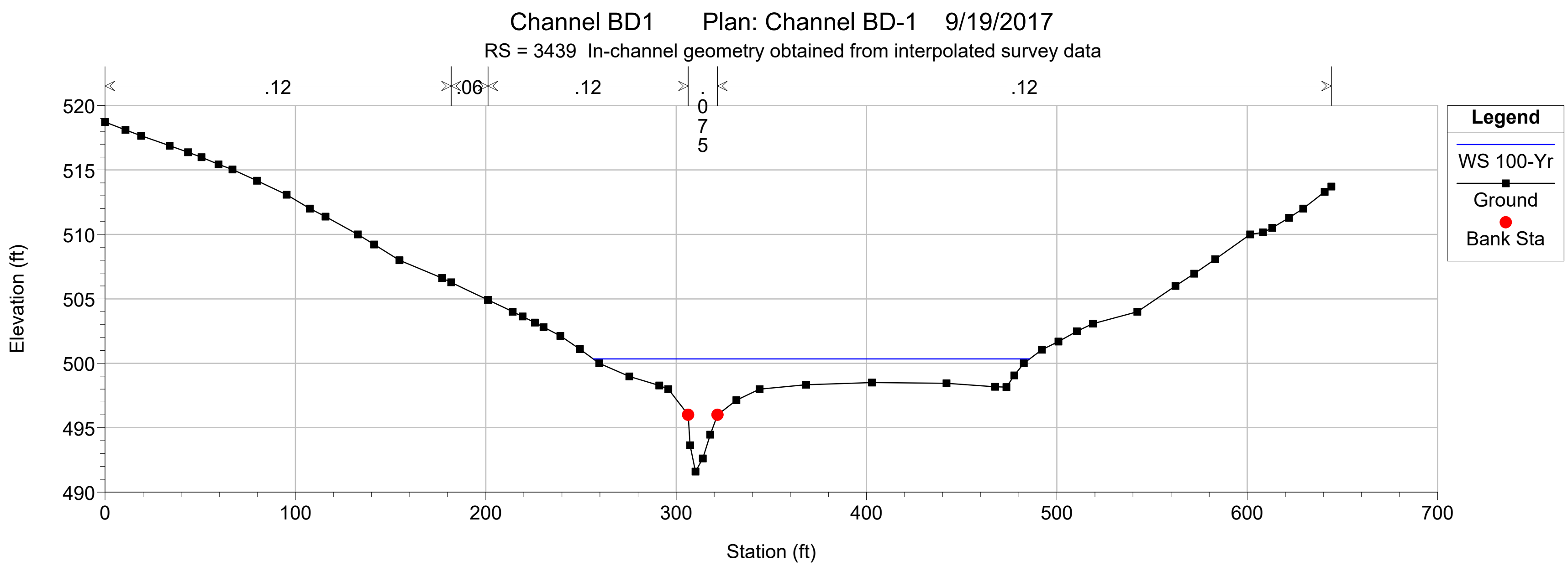


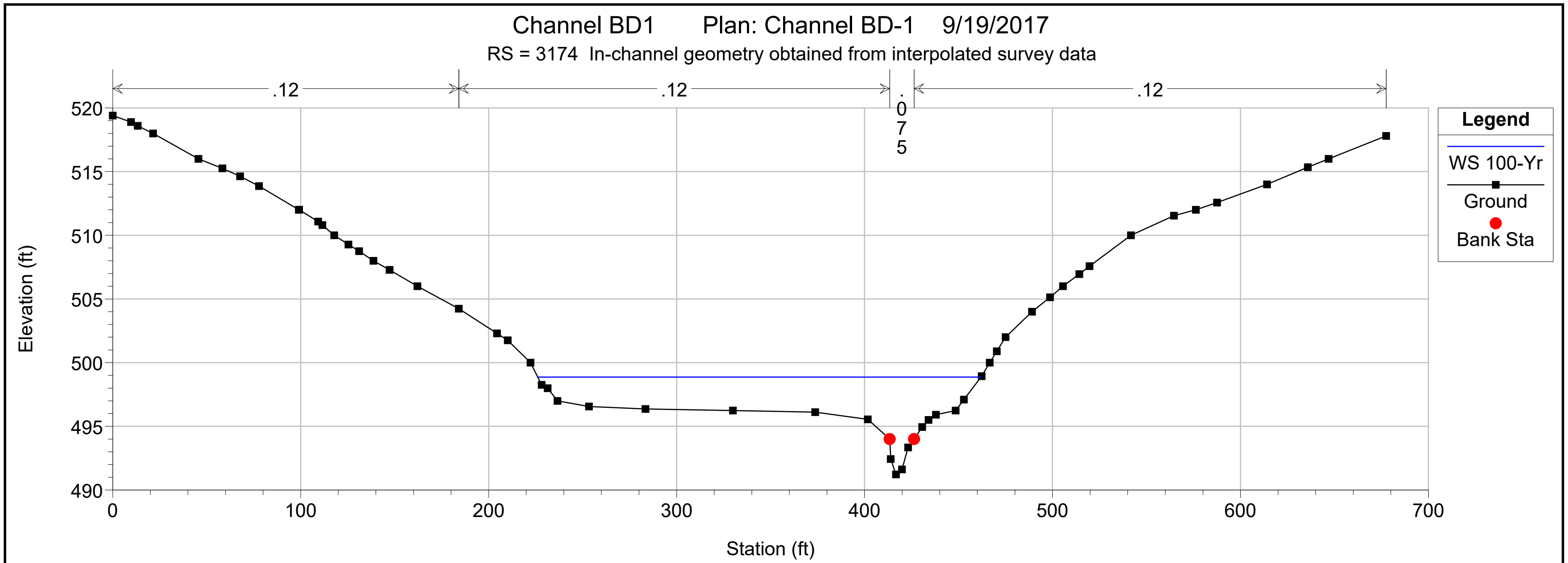
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 4208 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
535
530
525
520
515
510
505
500
495
0
200
400
600
800
1000
1200

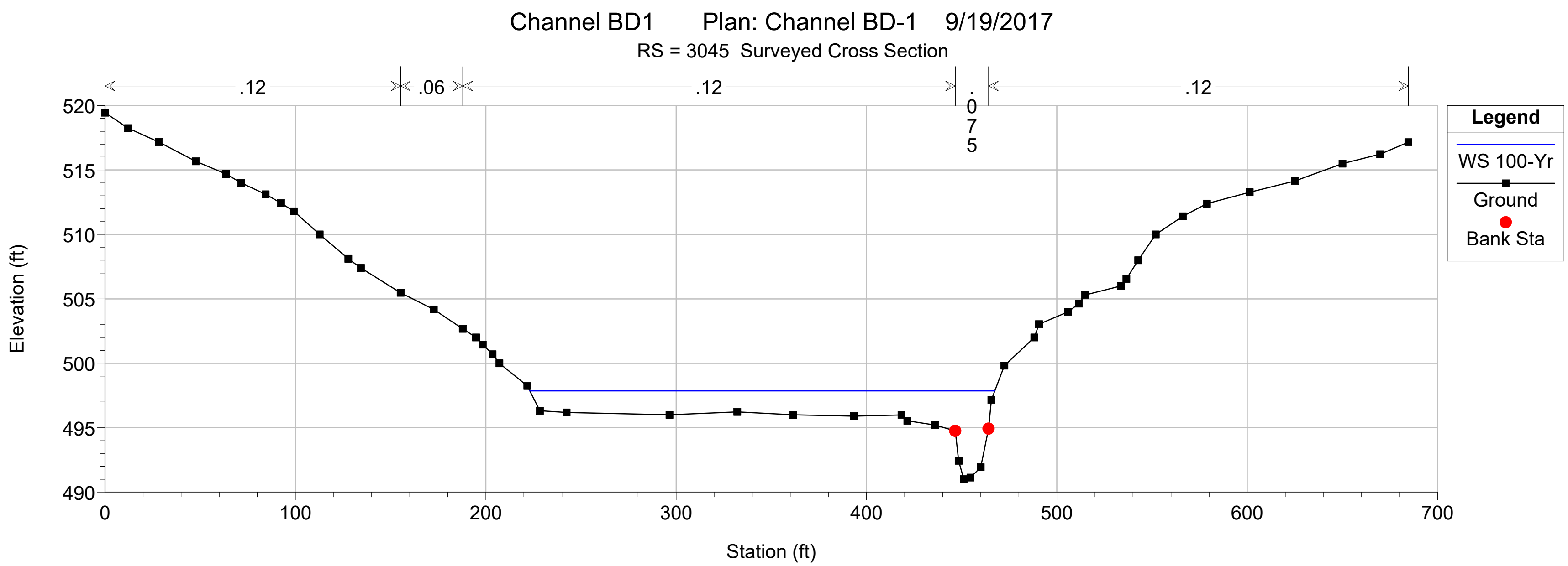


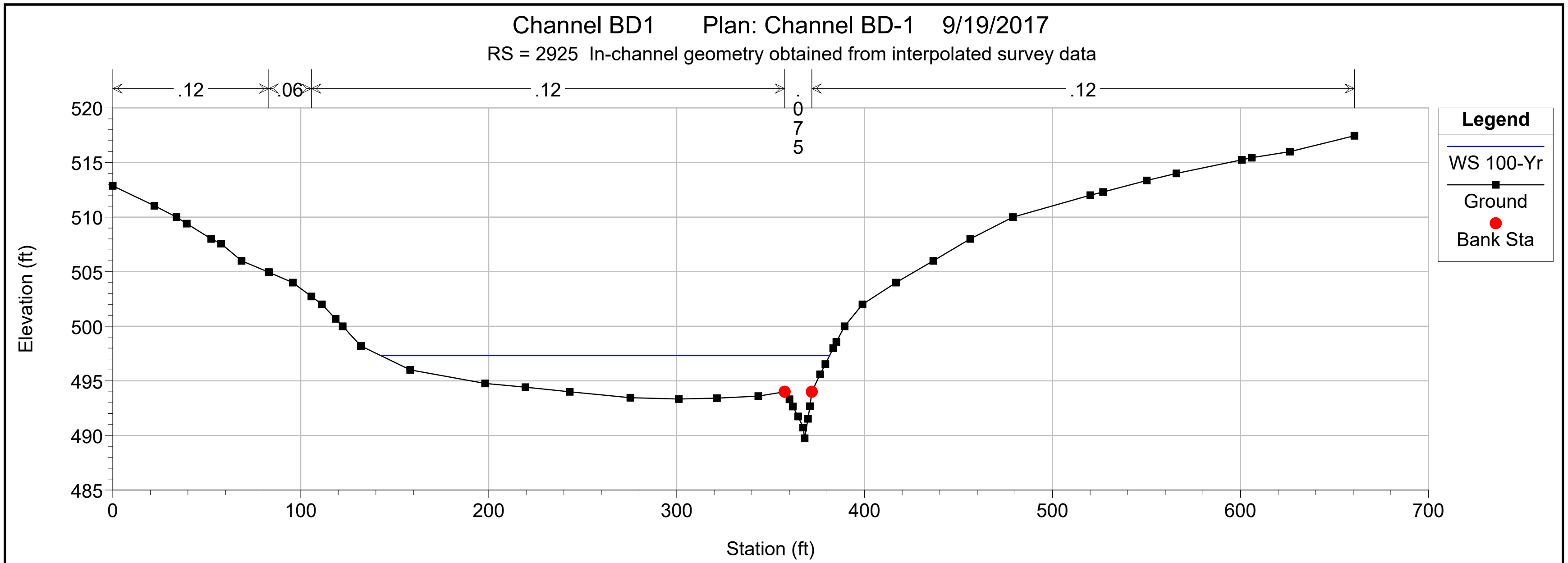
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 3850 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
535
530
525
520
515
510
505
500
495
0
200
400
600
800
1000

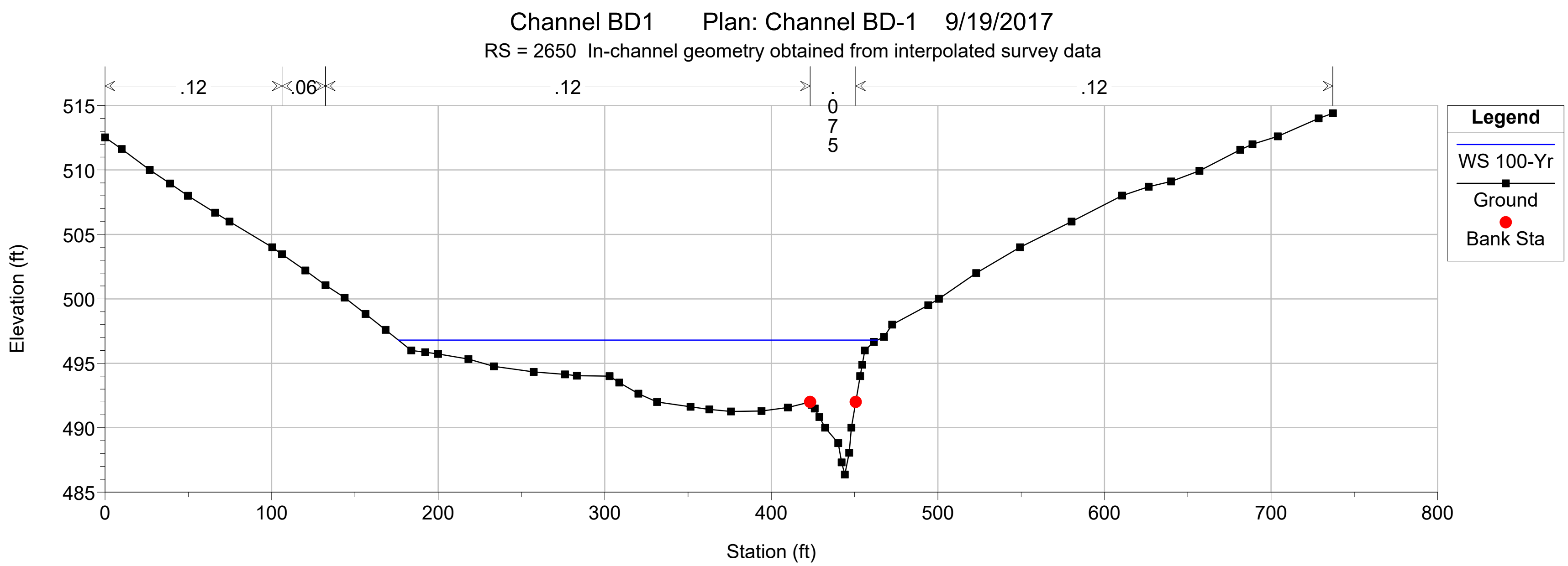

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 3698 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

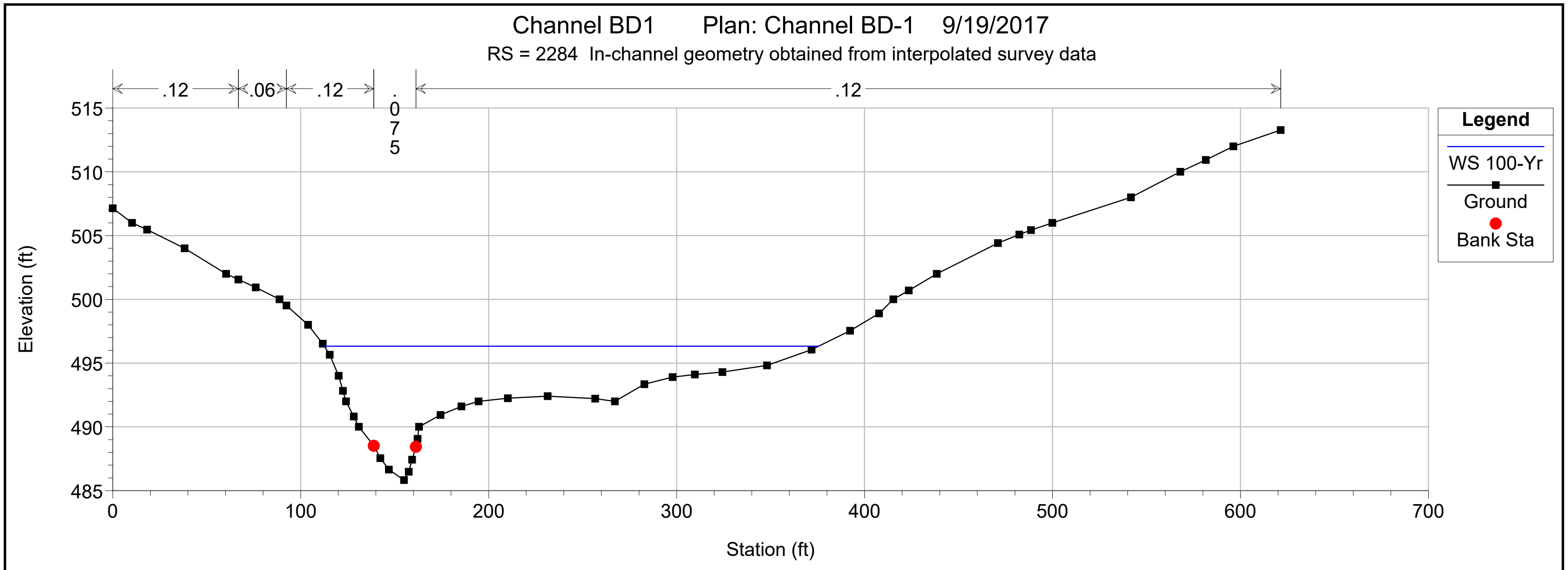

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 3439 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

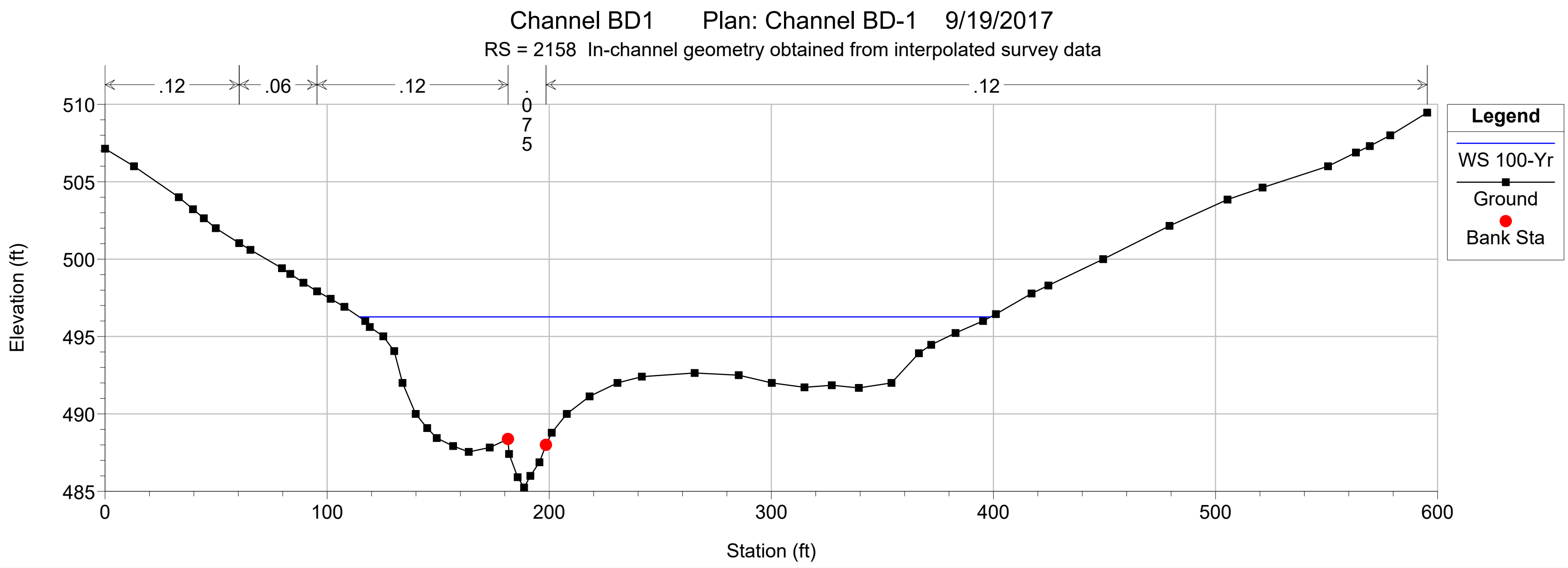

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 3174 In-channel geometry obtained from interpolated survey data
.12
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

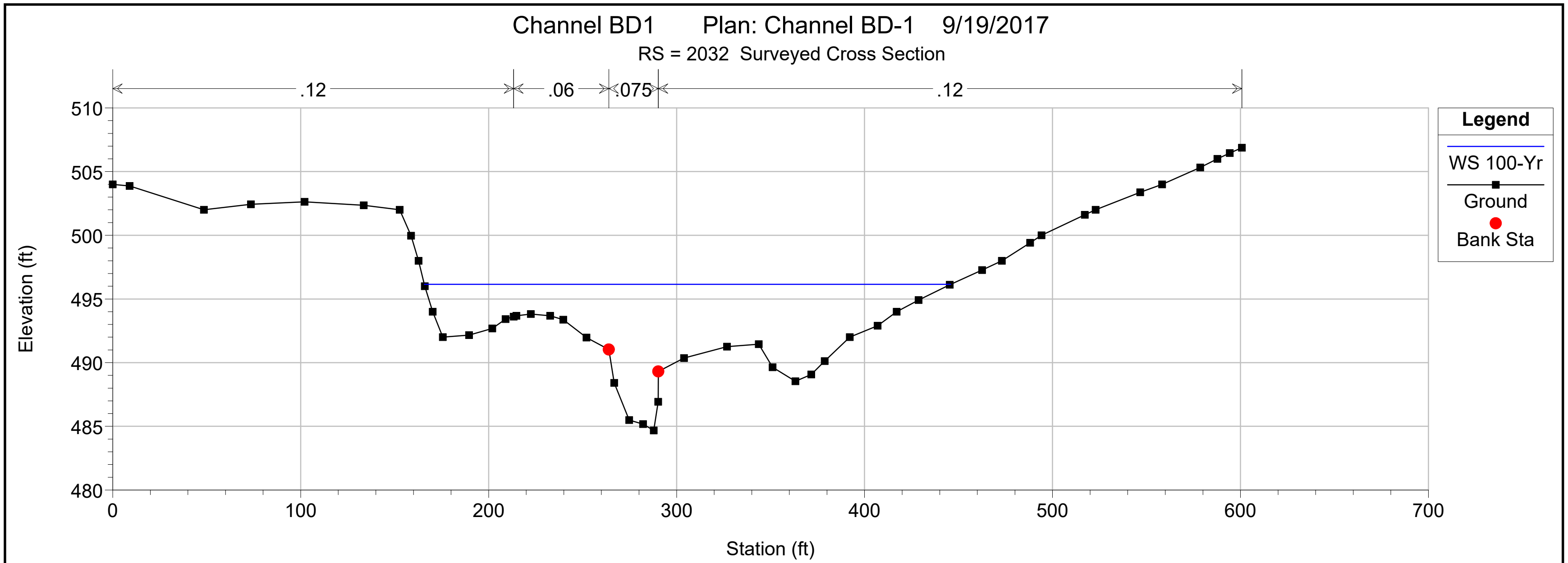

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 3045 Surveyed Cross Section
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

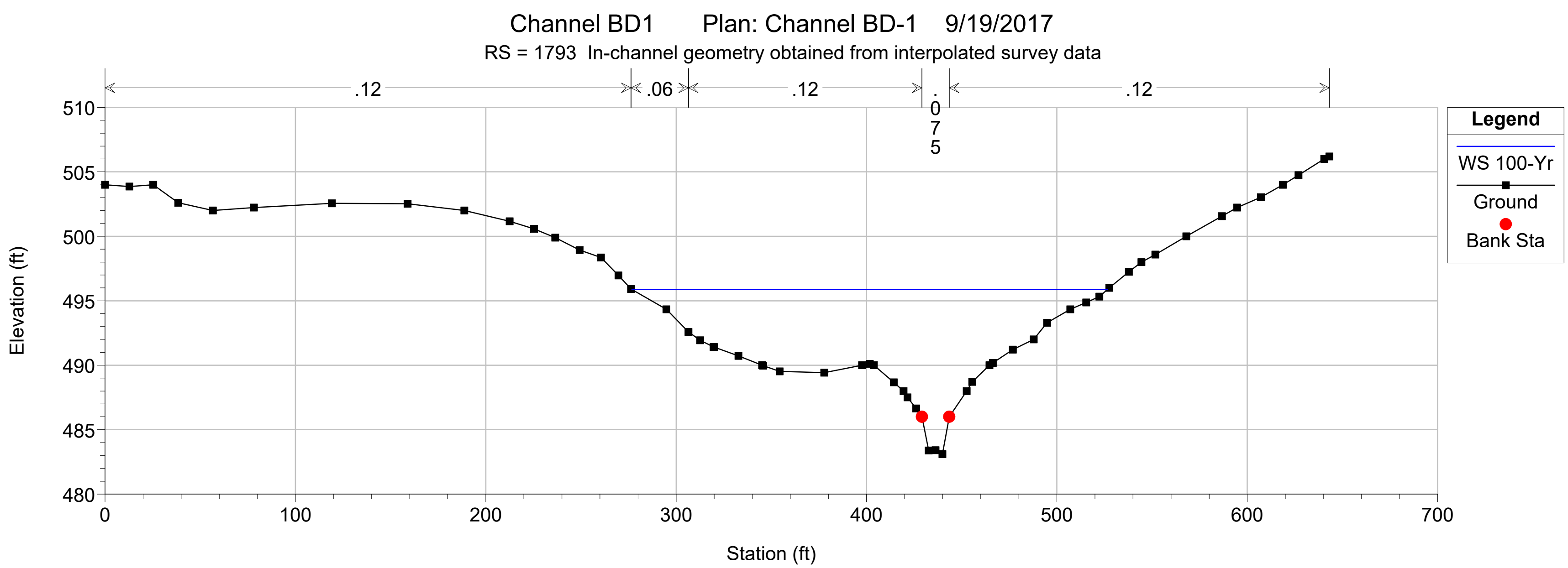

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 2925 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
520
515
510
505
500
495
490
485
0
100
200
300
400
500
600
700

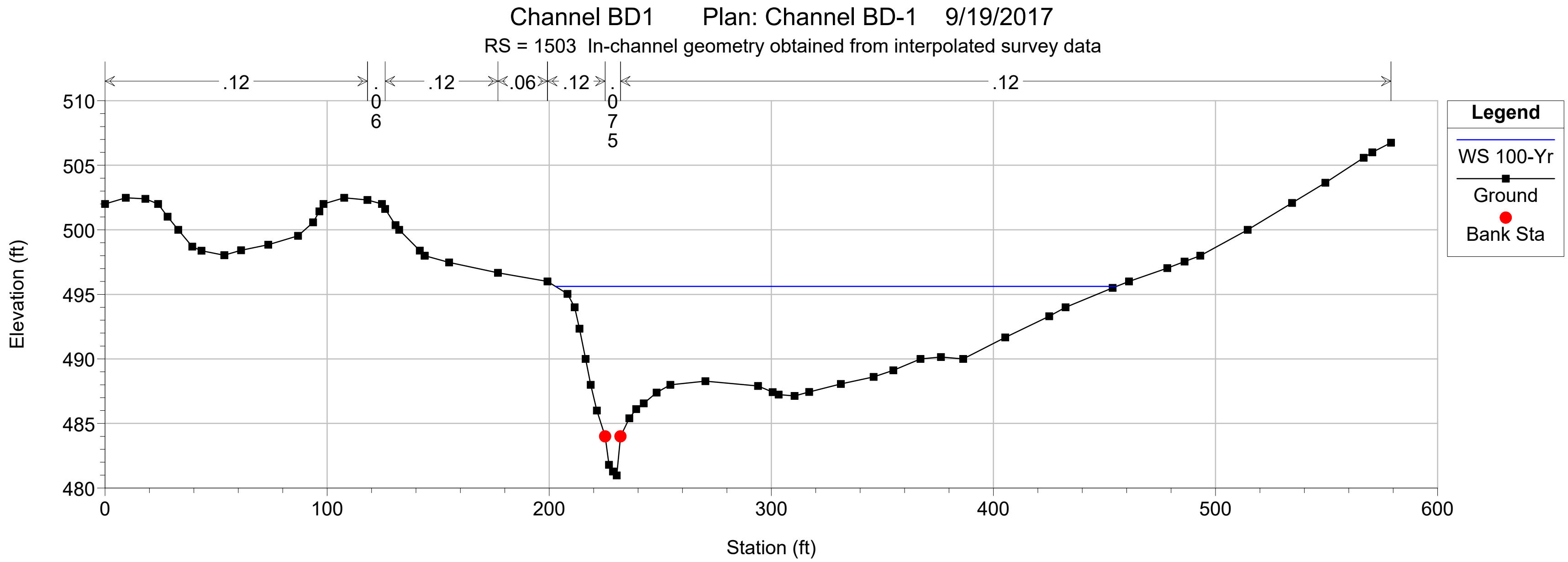

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 2650 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
515
510
505
500
495
490
485
0
100
200
300
400
500
600
700
800

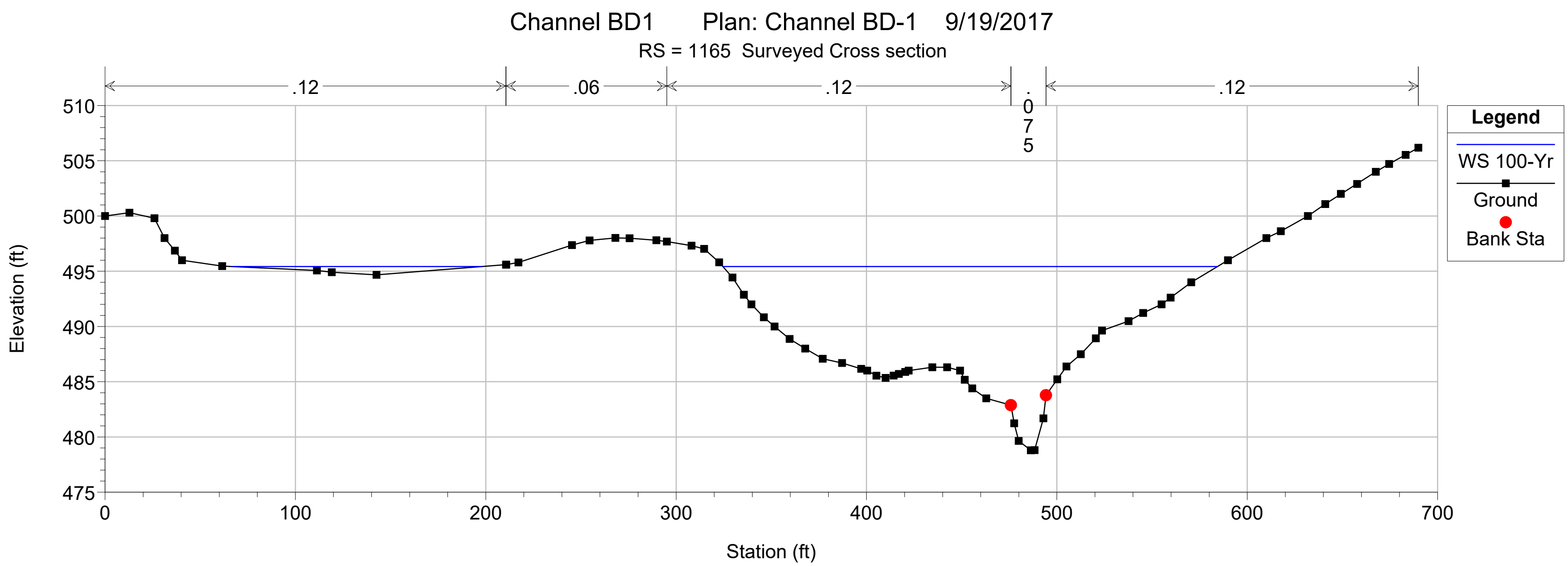

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 2284 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

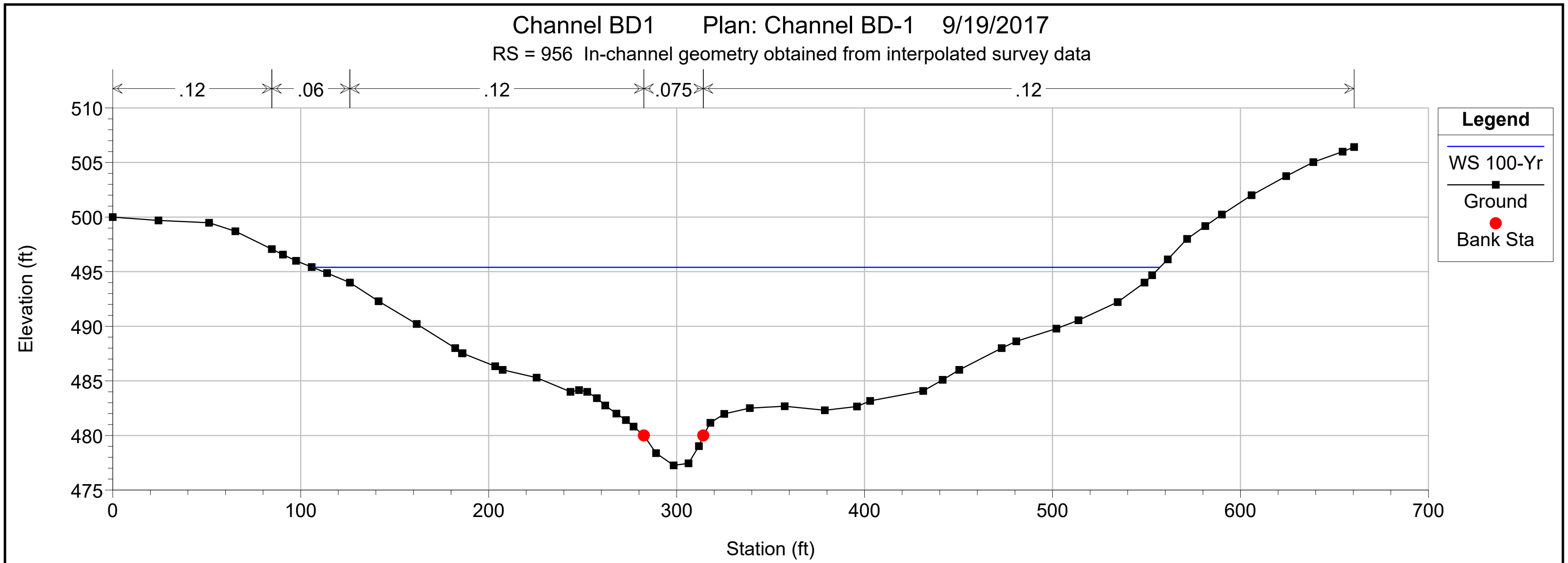

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 2158 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

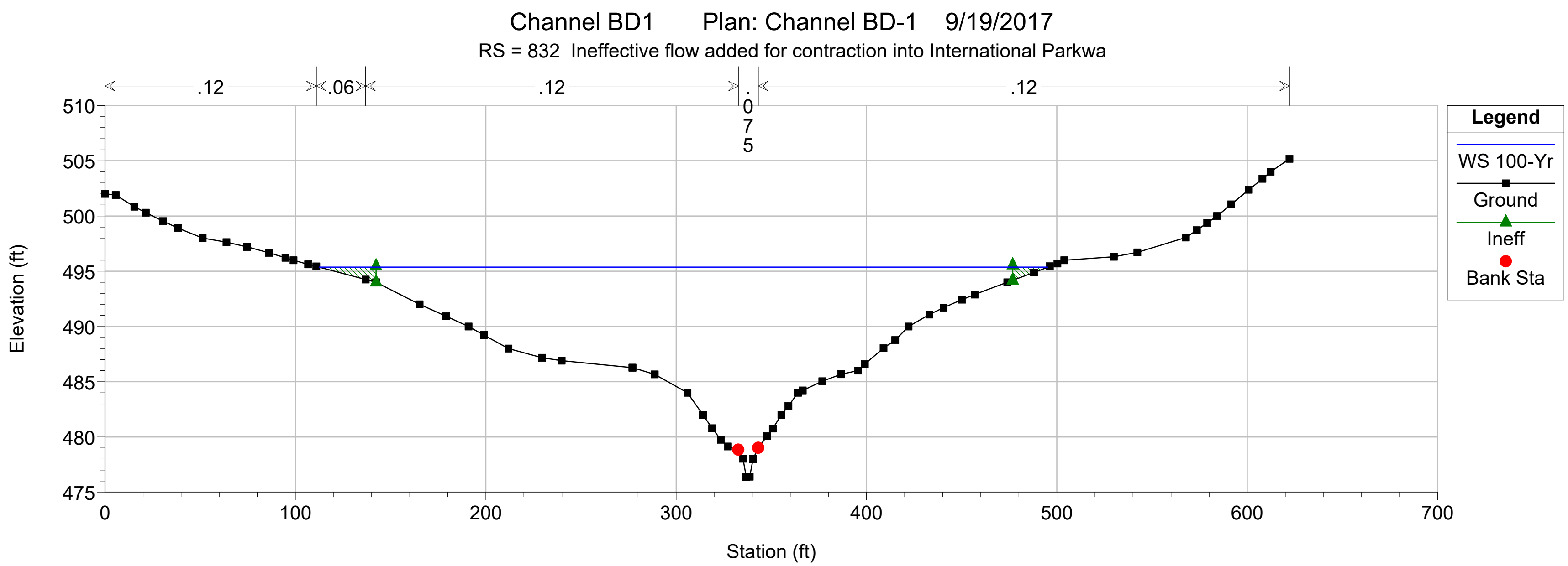

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 2032 Surveyed Cross Section
.12
.06
.075
.12
Elevation (ft)
510
505
500
495
490
485
480
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

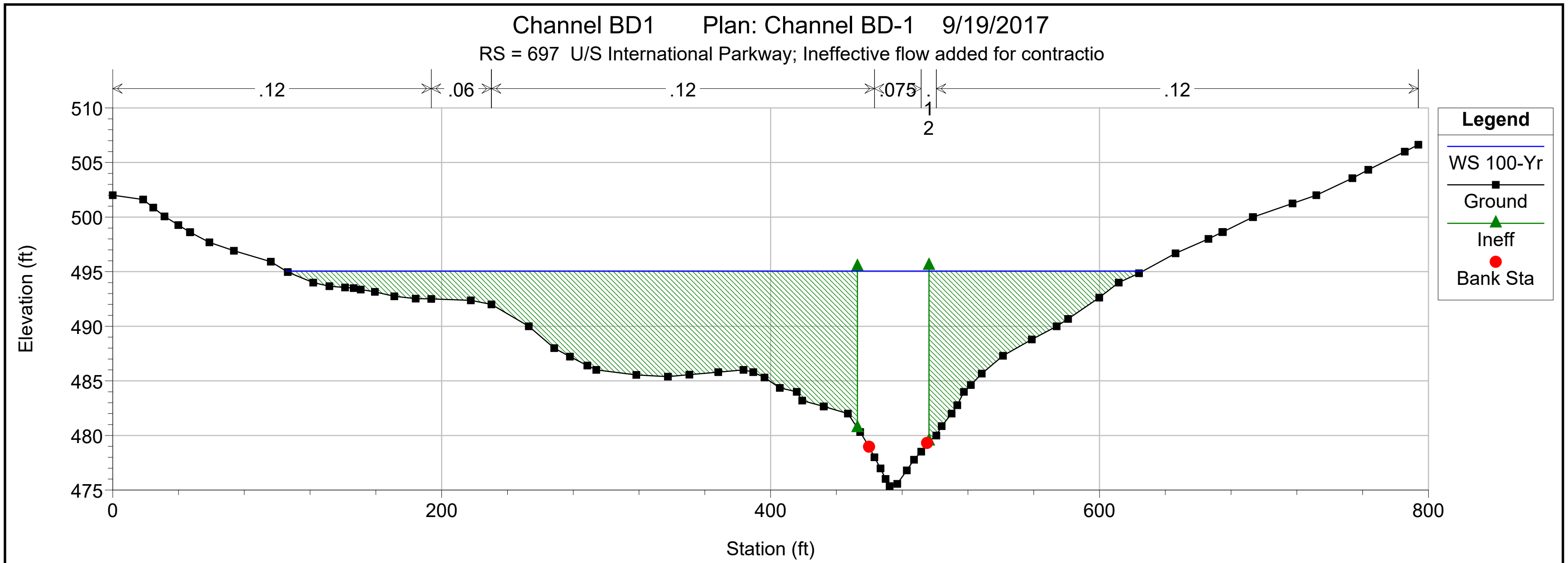

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 1793 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
510
505
500
495
490
485
480
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 1503 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.06
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
510
505
500
495
490
485
480
0
100
200
300
400
500
600

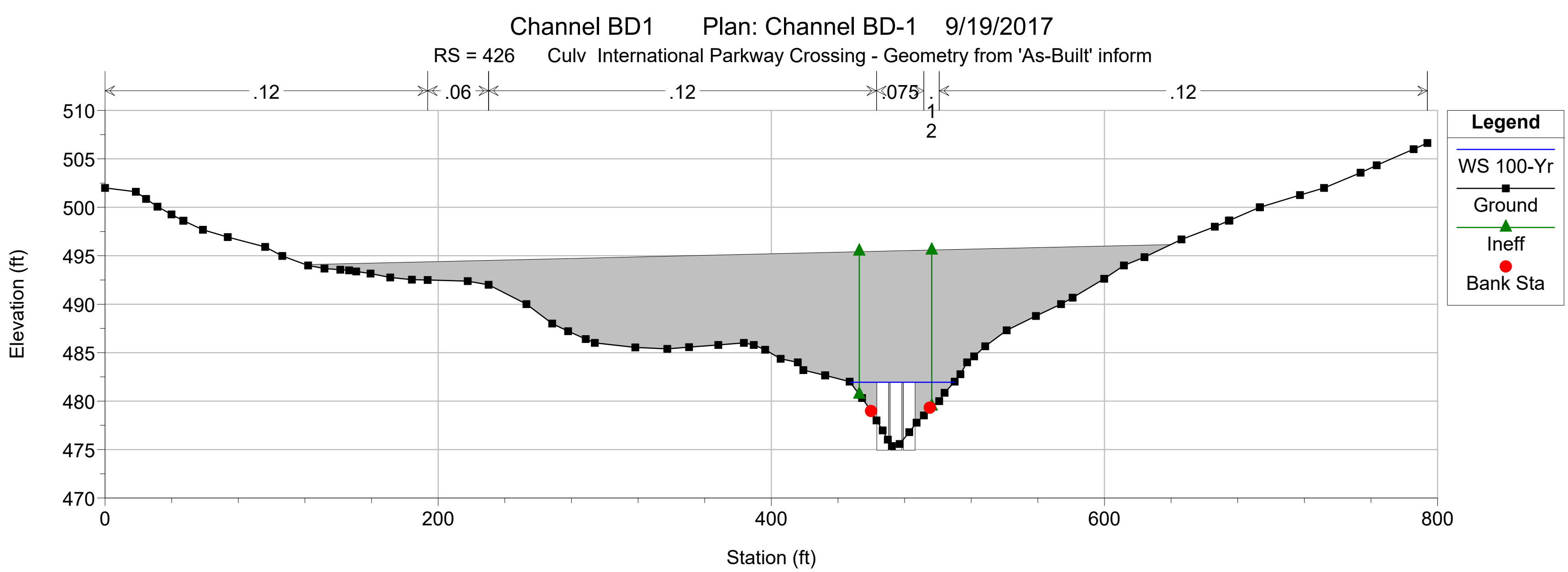

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 1165 Surveyed Cross section
.12
.06
.12
.075
.12
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
510
505
500
495
490
485
480
475
0
100
200
300
400
500
600
700


Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 956 In-channel geometry obtained from interpolated survey data
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

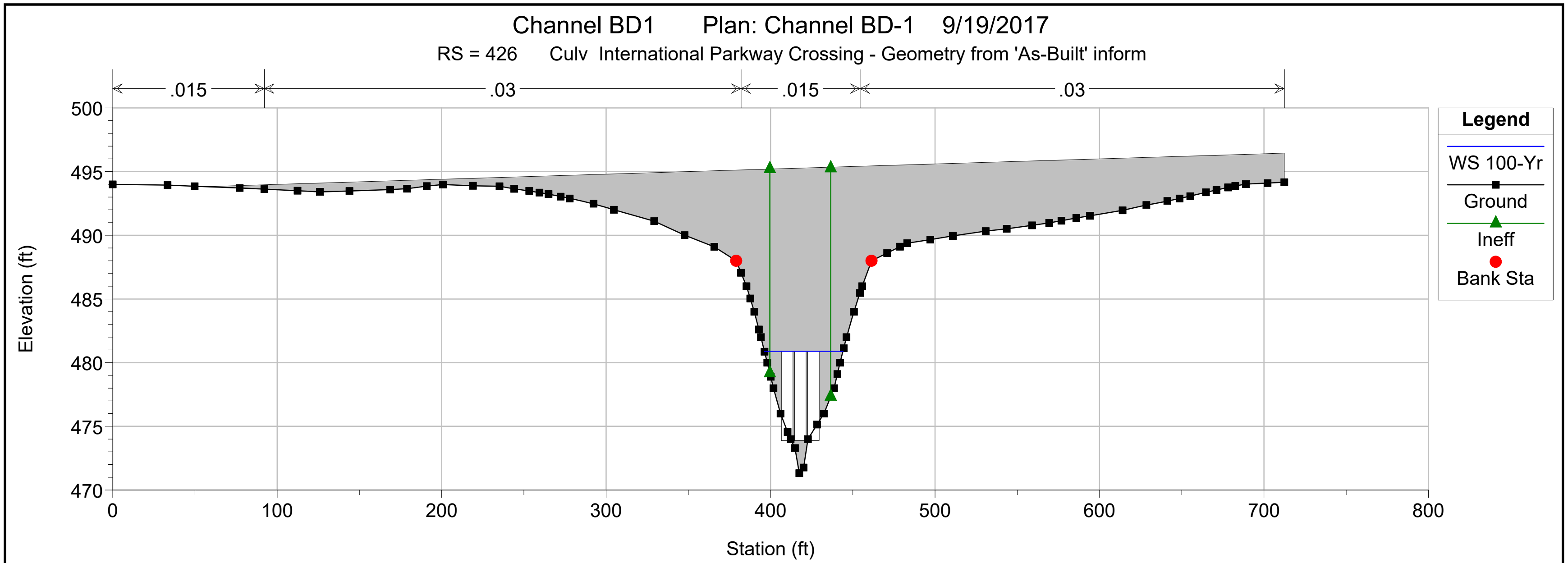

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 832 Ineffective flow added for contraction into International Parkwa
.12
.06
.12
.075
.12
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

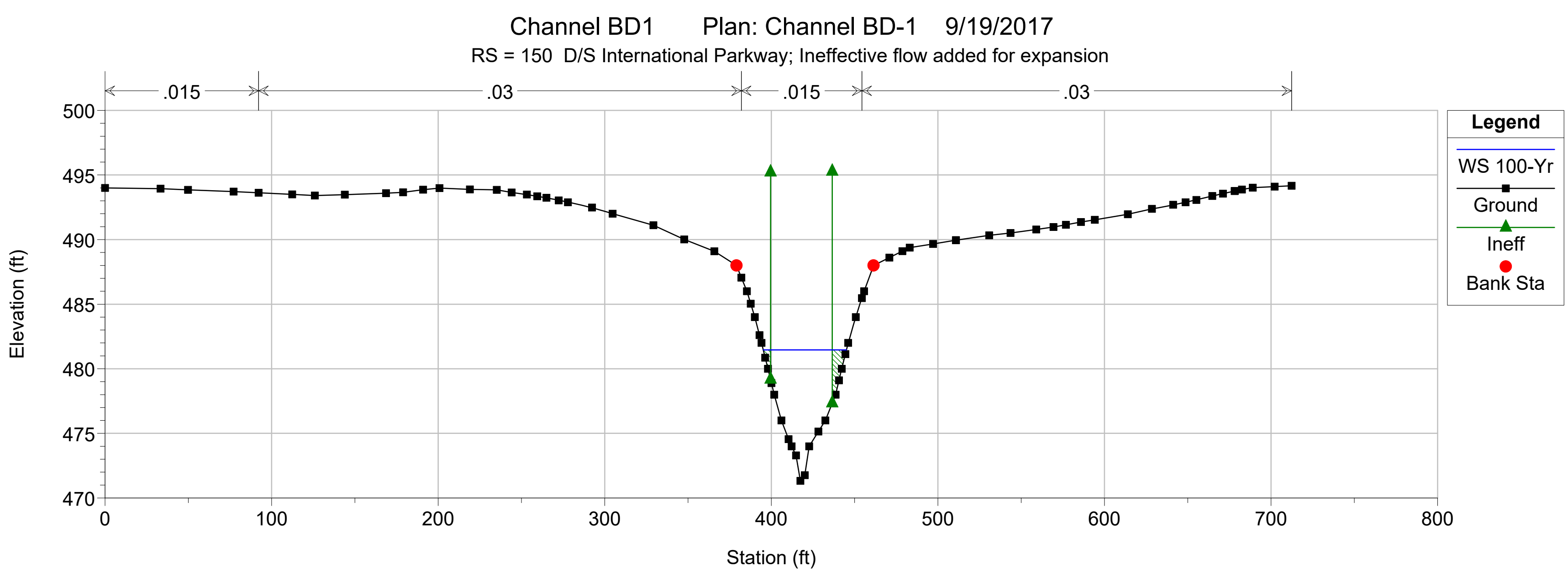


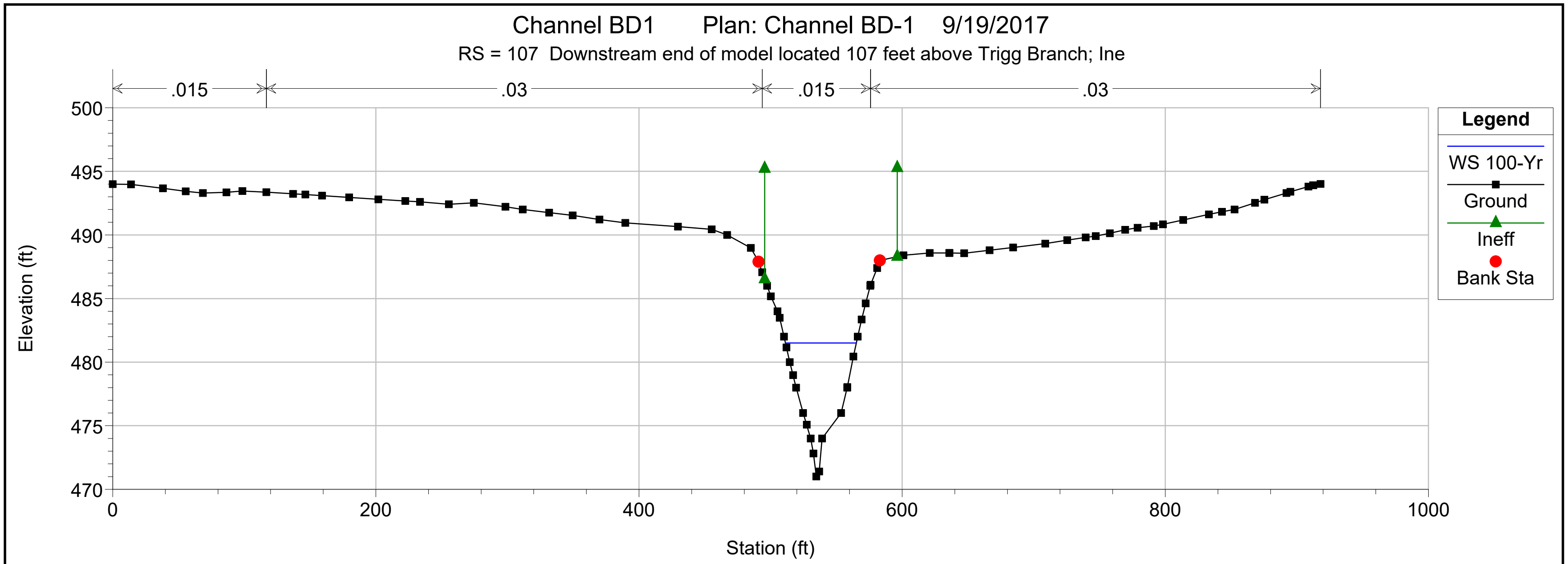
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 697 U/S International Parkway; Ineffective flow added for contractio
.12
.06
.12
.075
.12
1
2
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



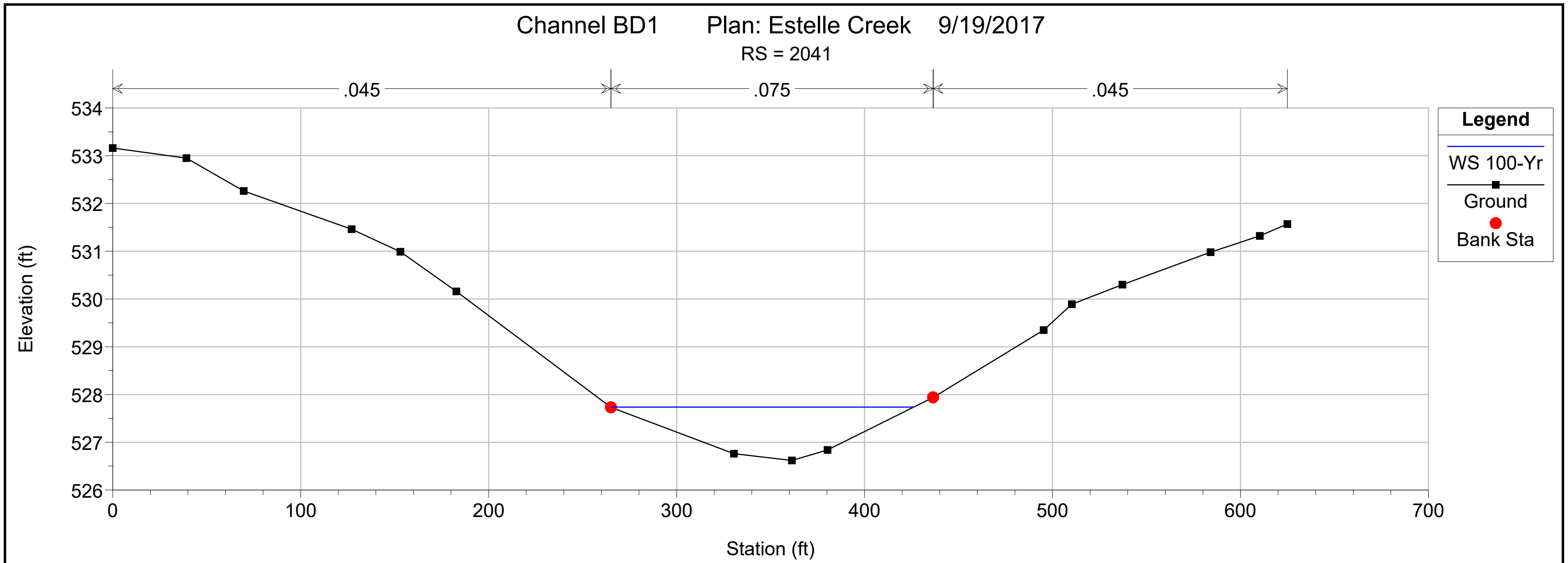
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 426 Culv International Parkway Crossing - Geometry from 'As-Built' inform
.12
.06
.12
.075
.12
1
2
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

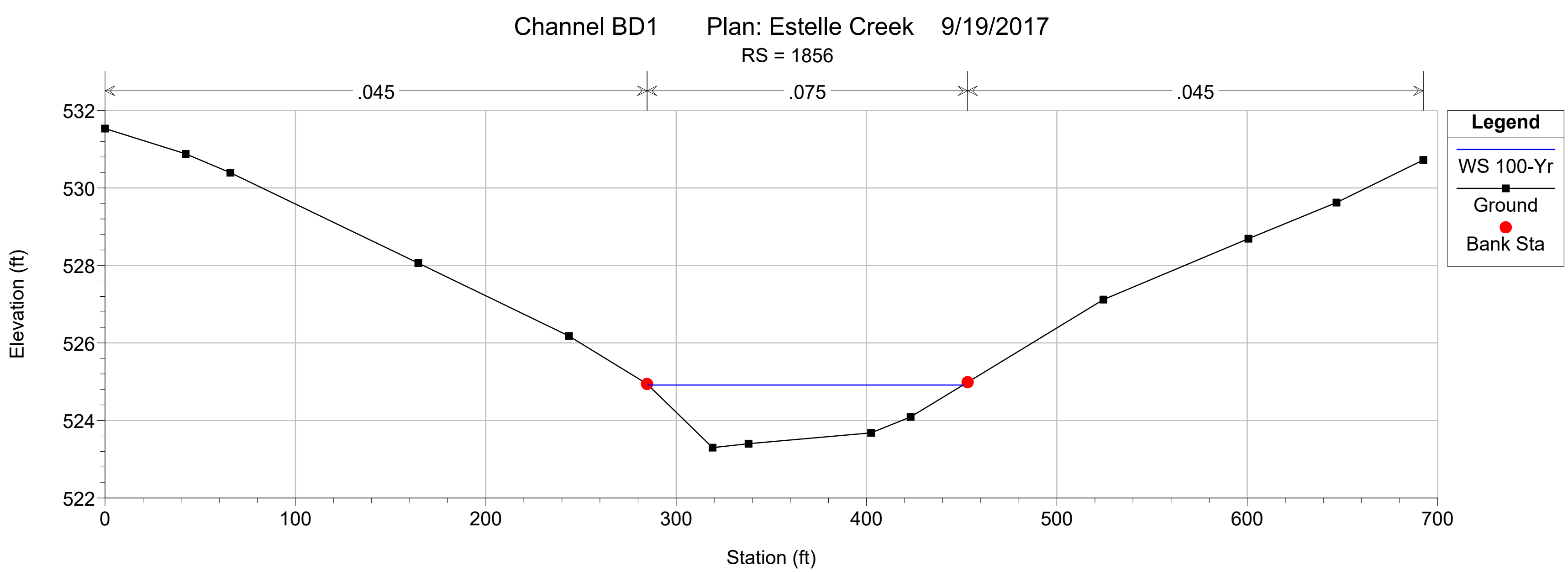

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 426 Culv International Parkway Crossing - Geometry from 'As-Built' inform
.015
.03
.015
.03
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta

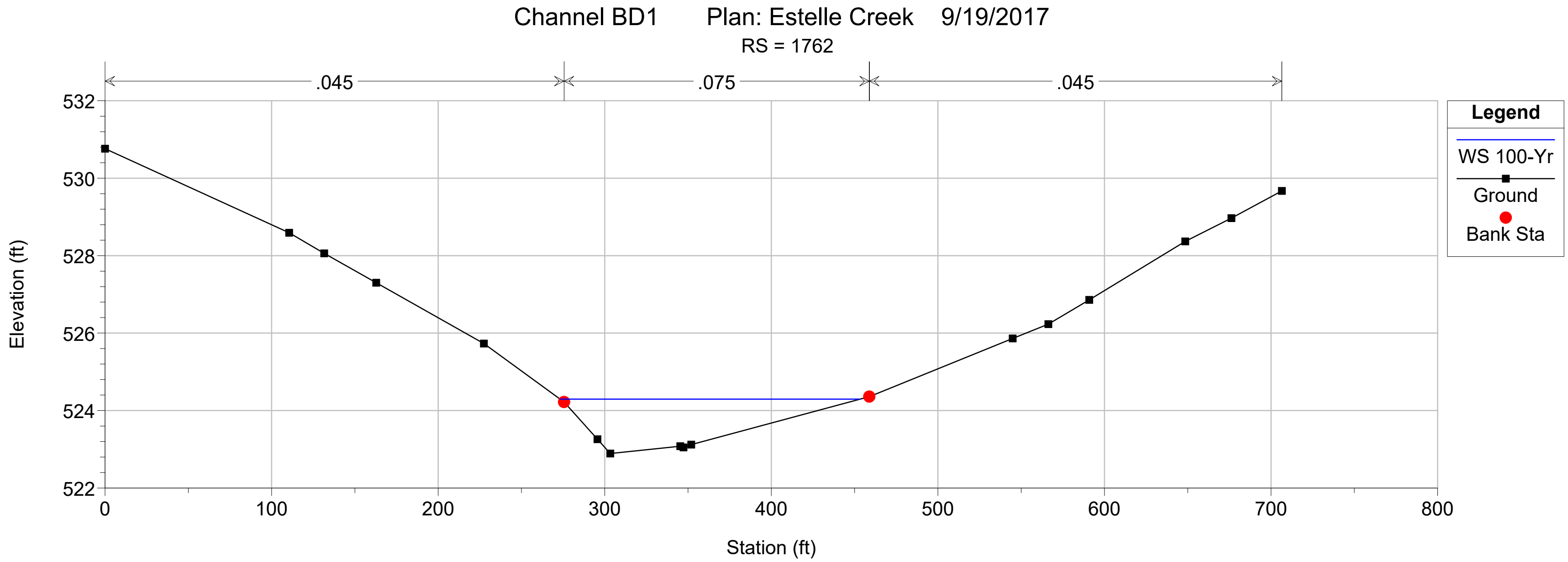

Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 150 D/S International Parkway; Ineffective flow added for expansion
.015
.03
.015
.03
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Ineff
Bank Sta



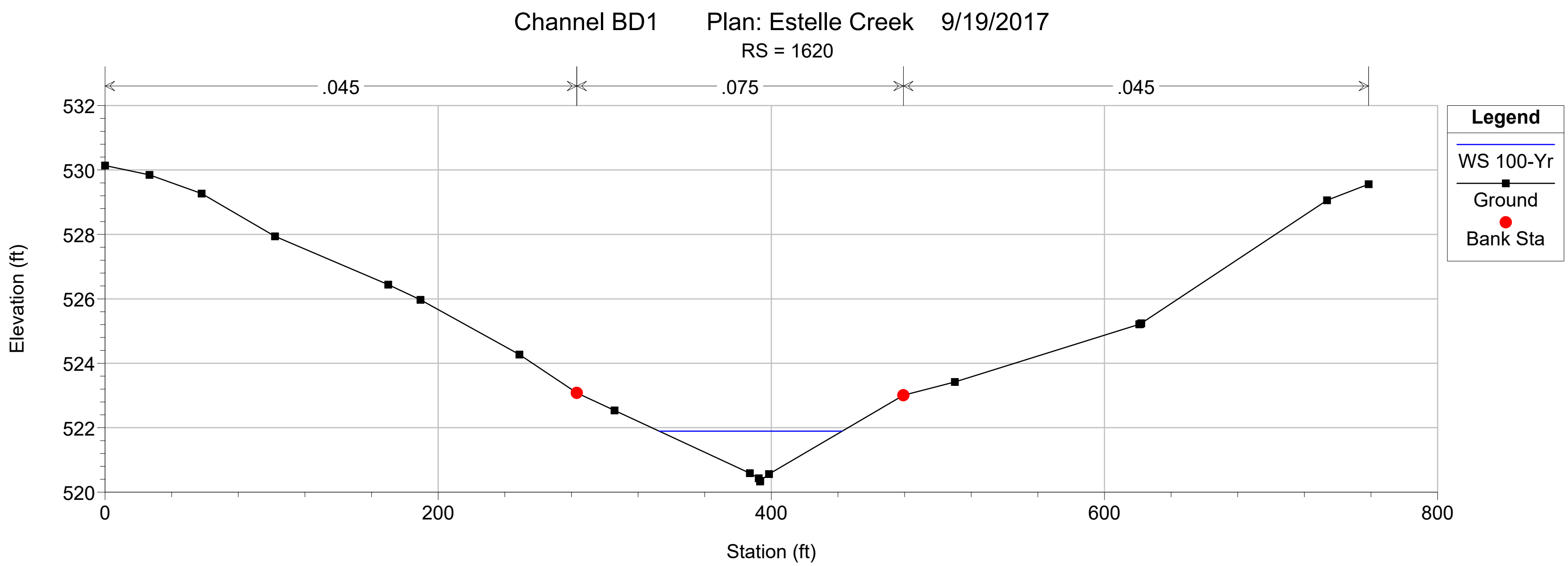
Channel BD1 Plan: Channel BD-1 9/19/2017
RS = 107 Downstream end of model located 107 feet above Trigg Branch; Ine
.015
.03
.015
.03
Legend
WS 100-Yr
Ground
Ineff
Bank Sta
Elevation (ft)
500
495
490
485
480
475
470
0
200
400
600
800
1000
Station (ft)


Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 2041
.045
.075
.045
Elevation (ft)
534
533
532
531
530
529
528
527
526
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

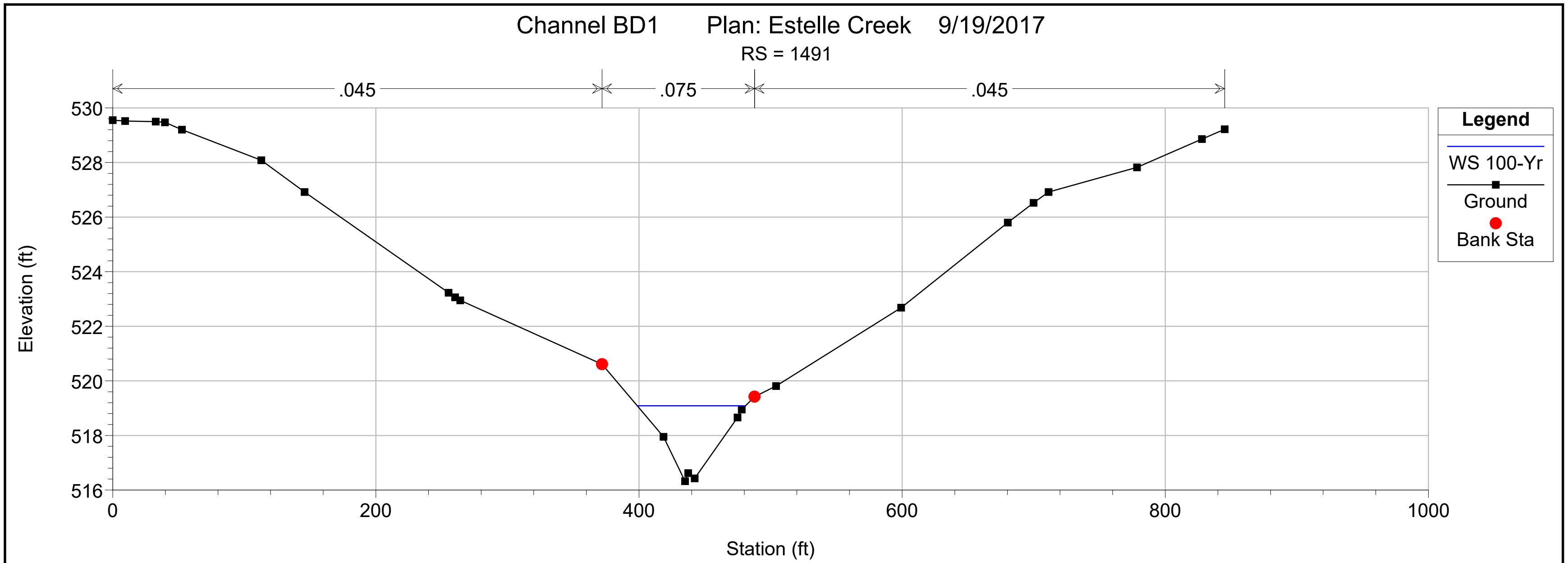

Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1856
.045
.075
.045
Elevation (ft)
532
530
528
526
524
522
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

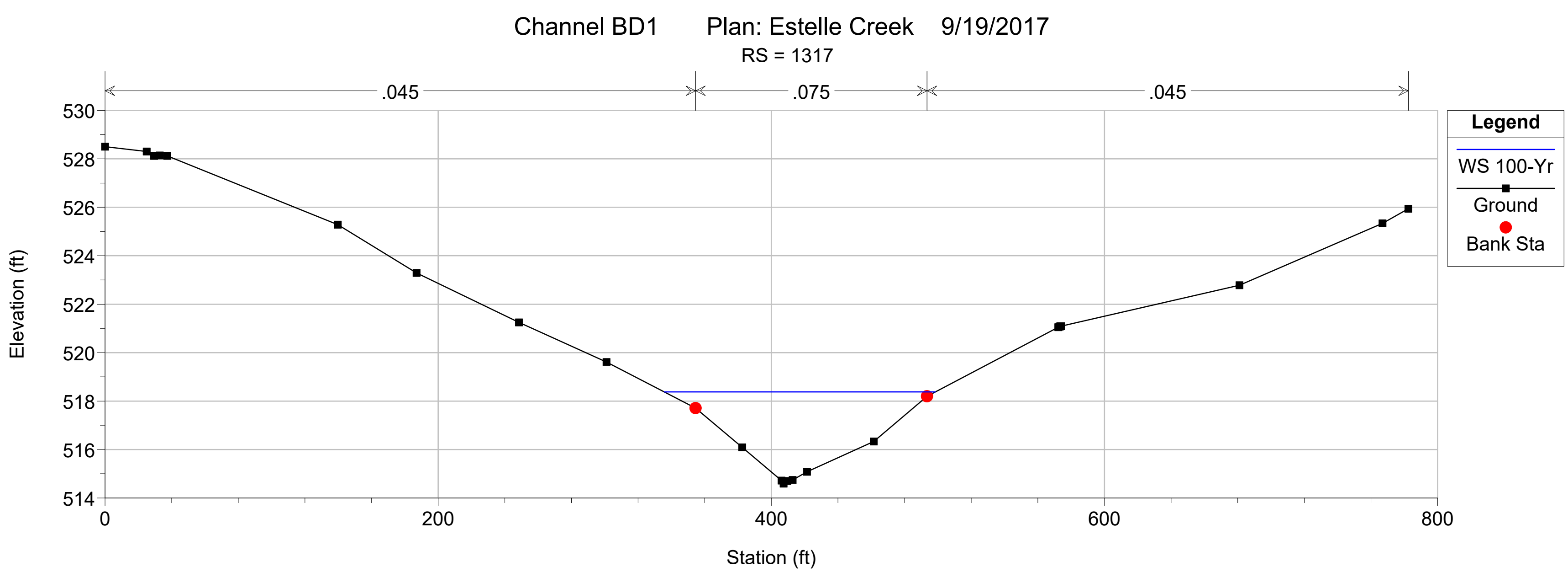


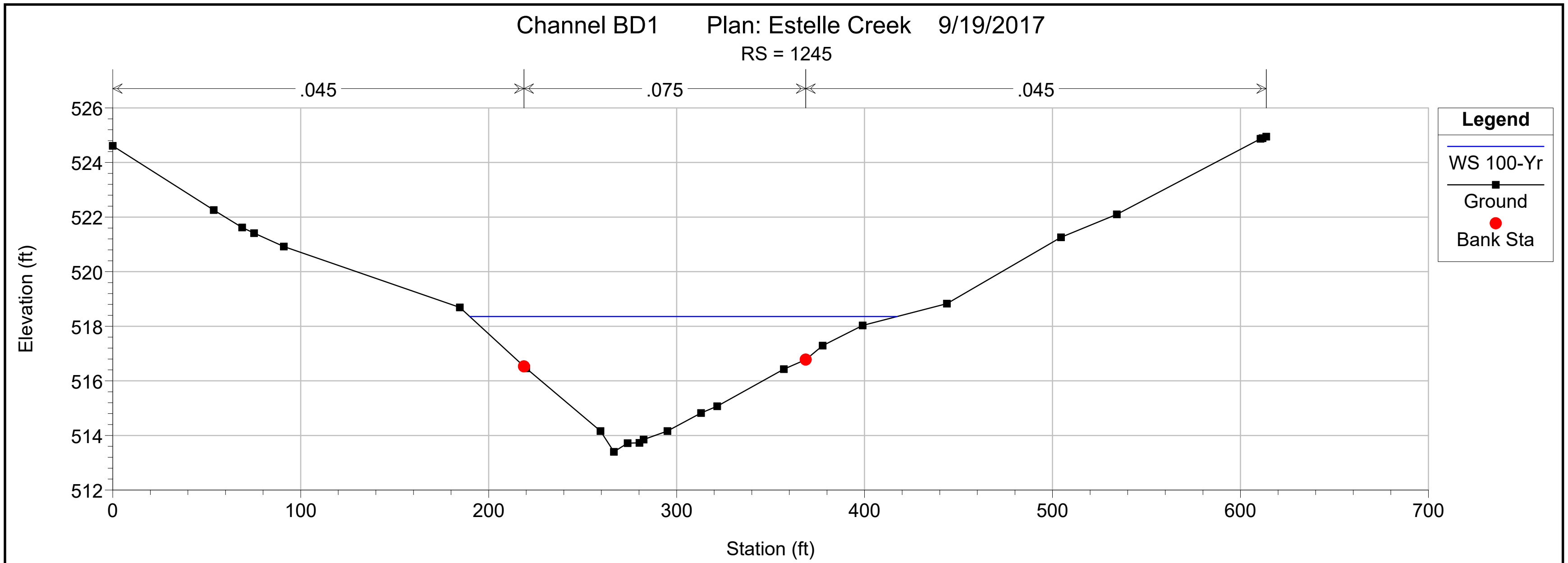
Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1762
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
532
530
528
526
524
522
0
100
200
300
400
500
600
700
800
Station (ft)



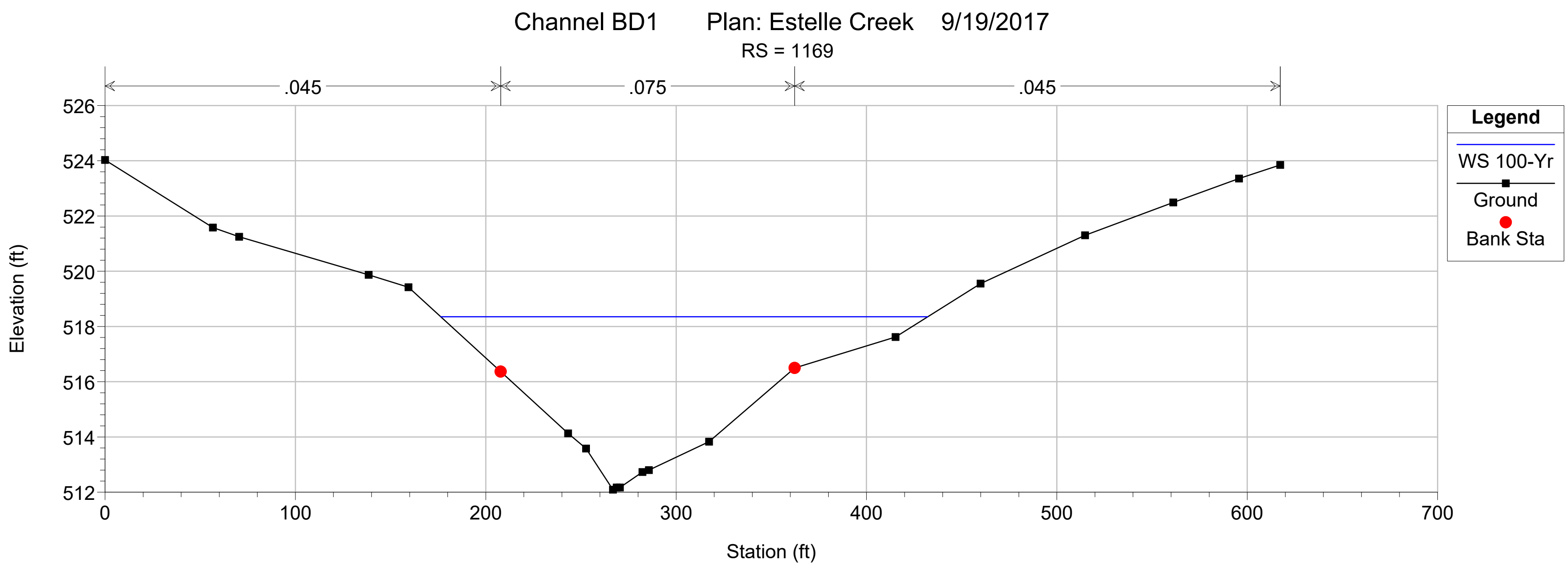
Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1620
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
532
530
528
526
524
522
520
0
200
400
600
800
Station (ft)


Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1491
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
530
528
526
524
522
520
518
516
0
200
400
600
800
1000
Station (ft)

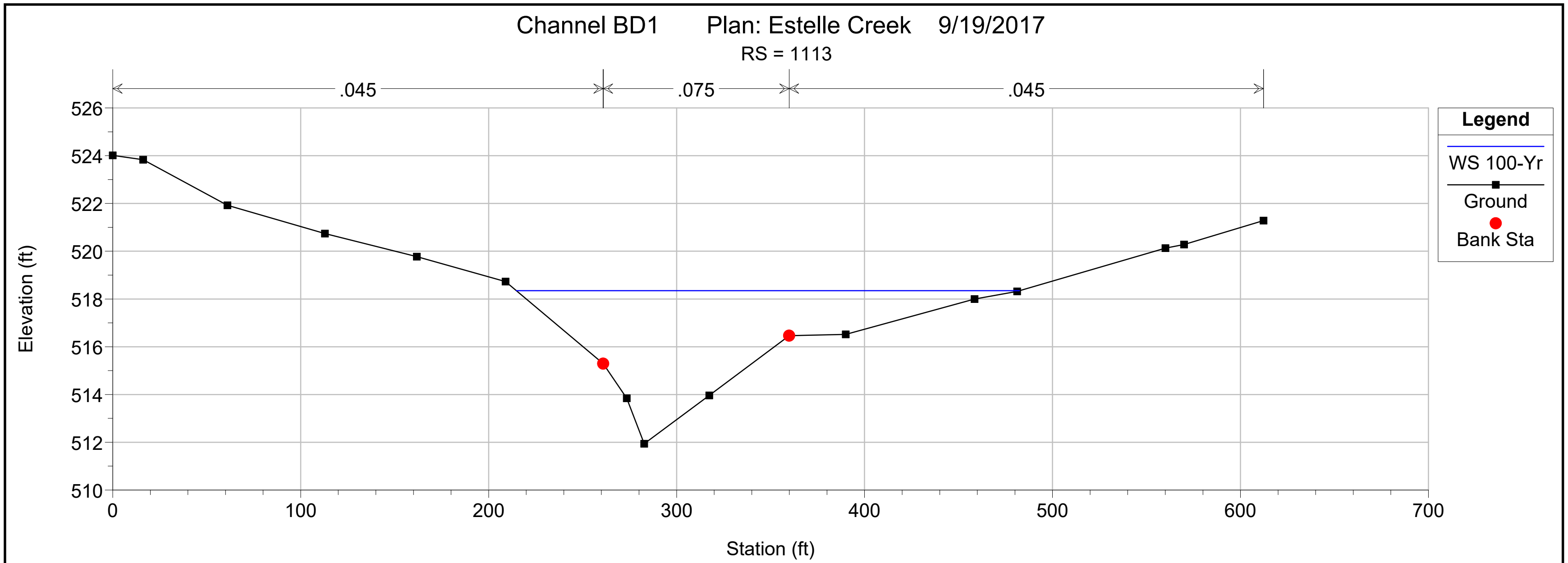

Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1317
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
530
528
526
524
522
520
518
516
514
0
200
400
600
800
Station (ft)



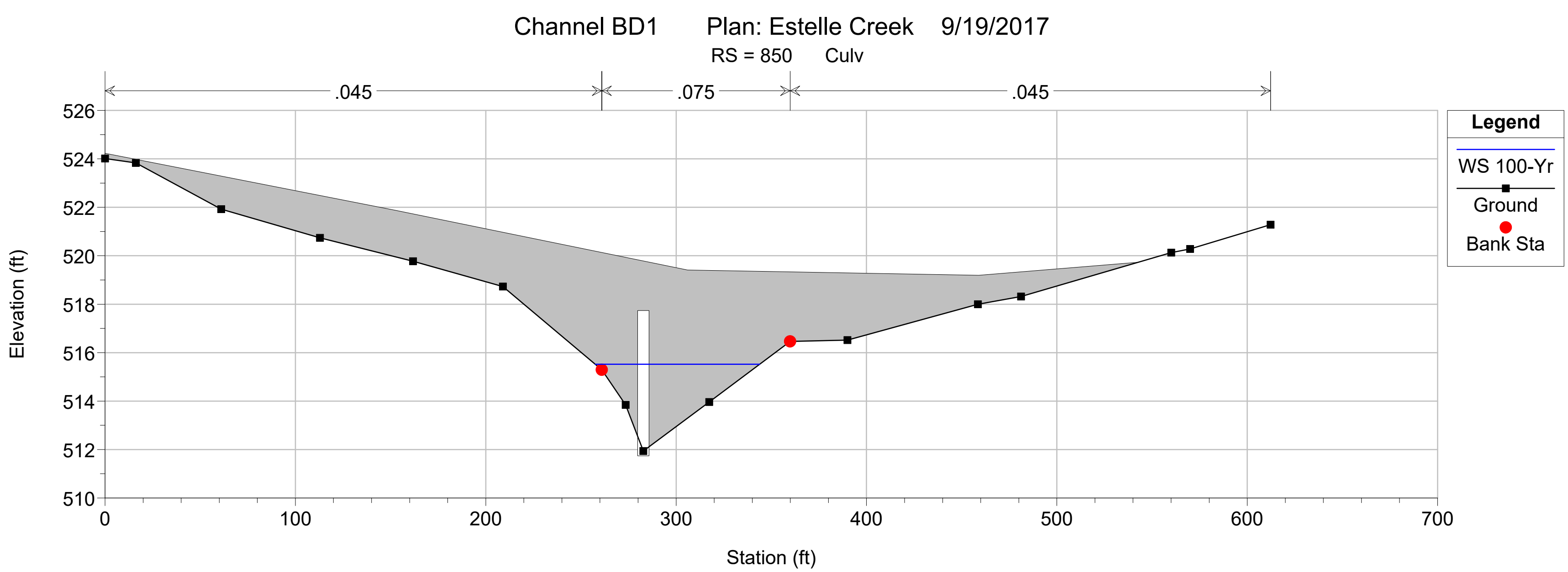
Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1245
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
526
524
522
520
518
516
514
512
0
100
200
300
400
500
600
700



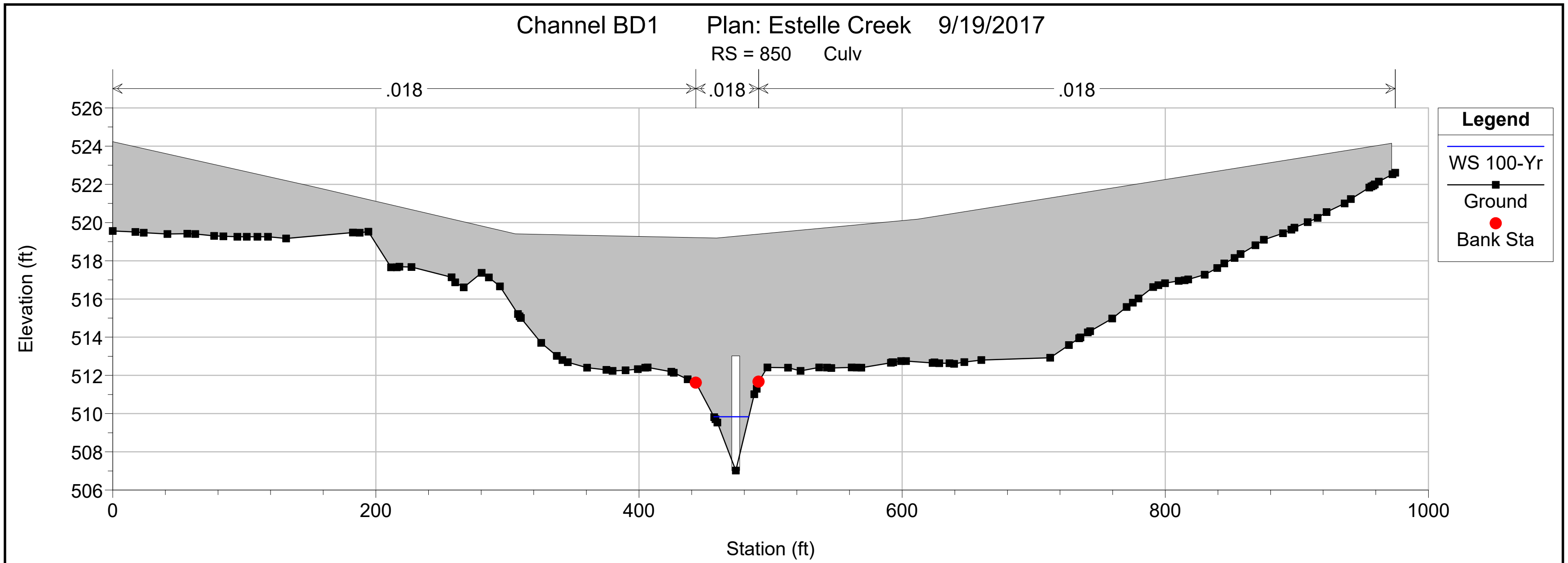
Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1169
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
526
524
522
520
518
516
514
512
0
100
200
300
400
500
600
700

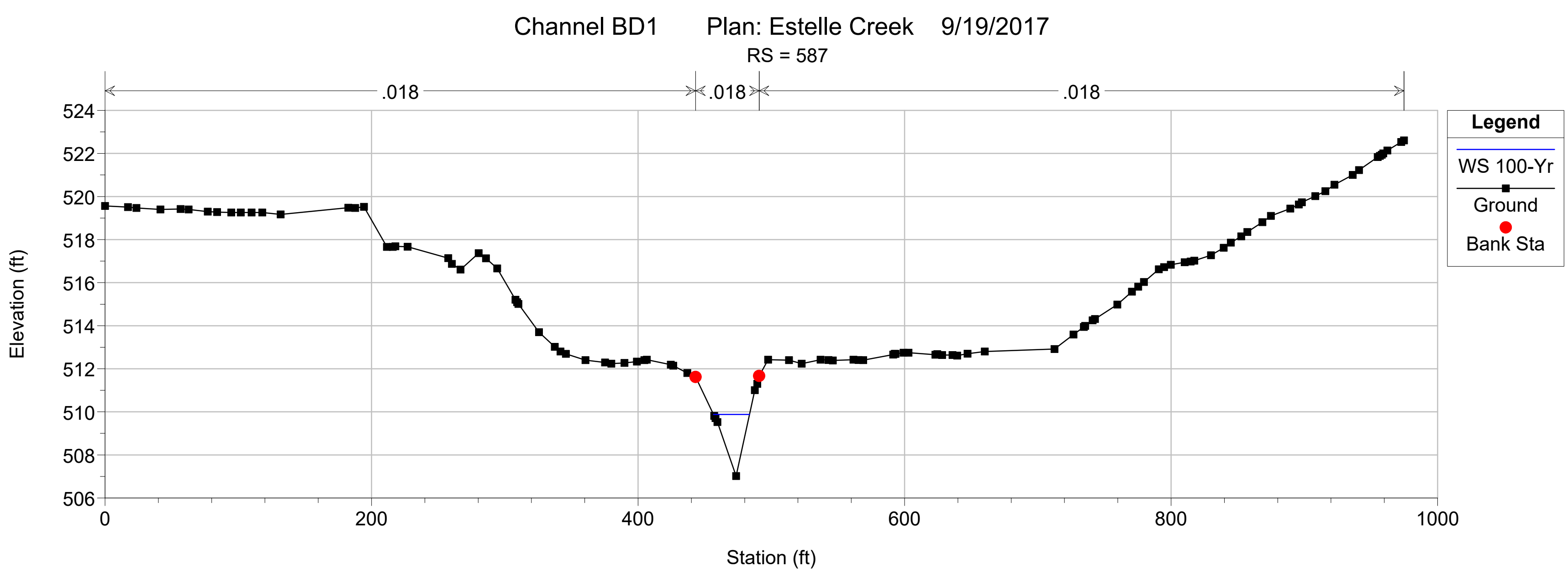


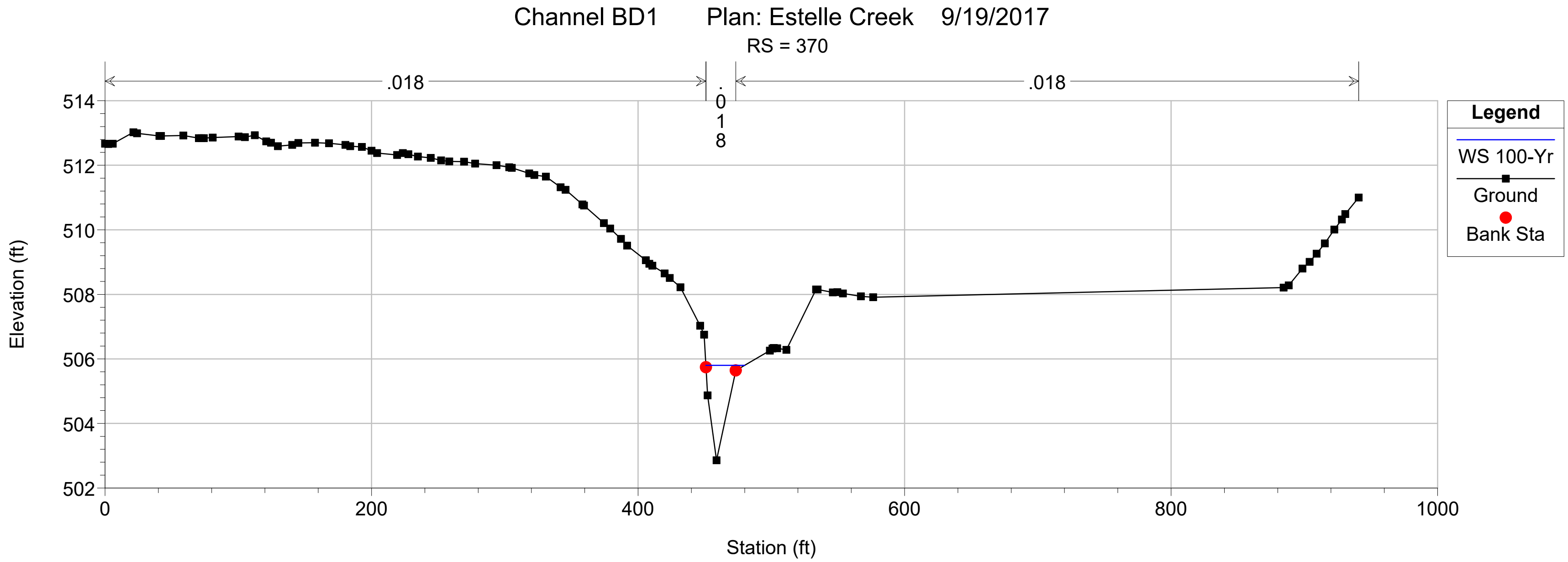
Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 1113
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
526
524
522
520
518
516
514
512
510
0
100
200
300
400
500
600
700
Station (ft)

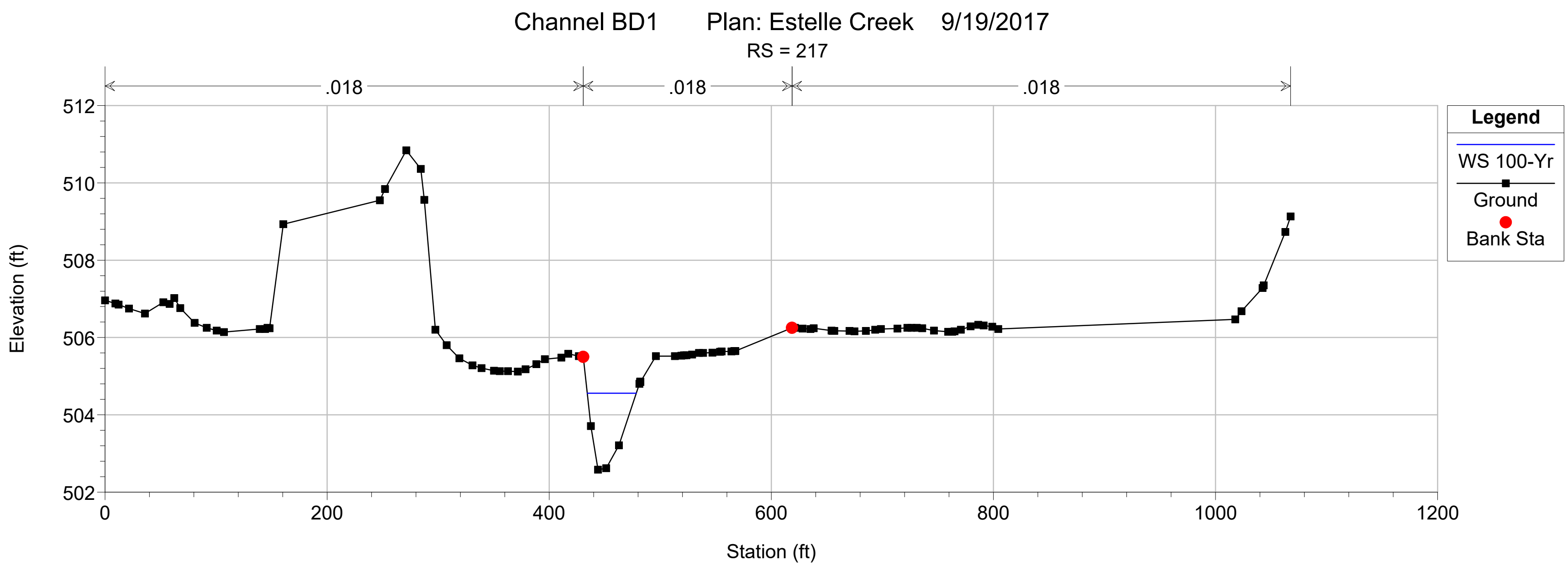


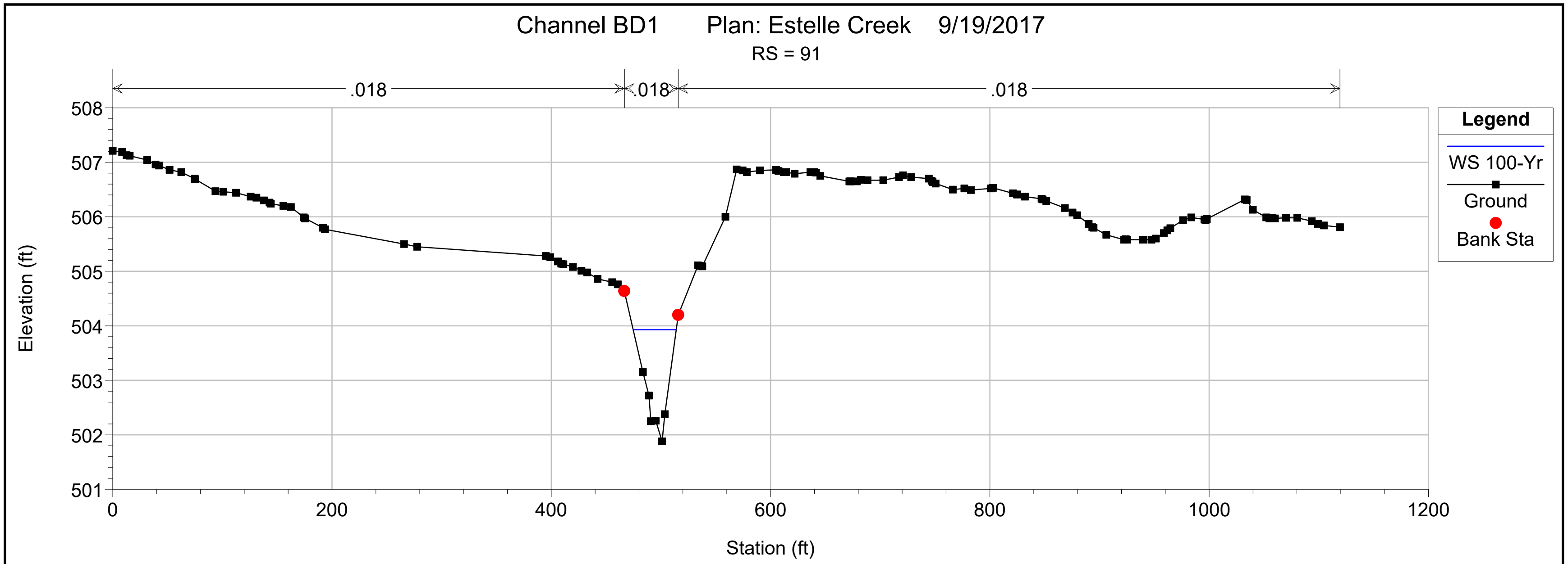
Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 850 Culv
.045
.075
.045
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
526
524
522
520
518
516
514
512
510
0
100
200
300
400
500
600
700
Station (ft)


Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 850 Culv
.018
.018
.018
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta


Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 587
.018
.018
.018
Elevation (ft)
Station (ft)
Legend
WS 100-Yr
Ground
Bank Sta

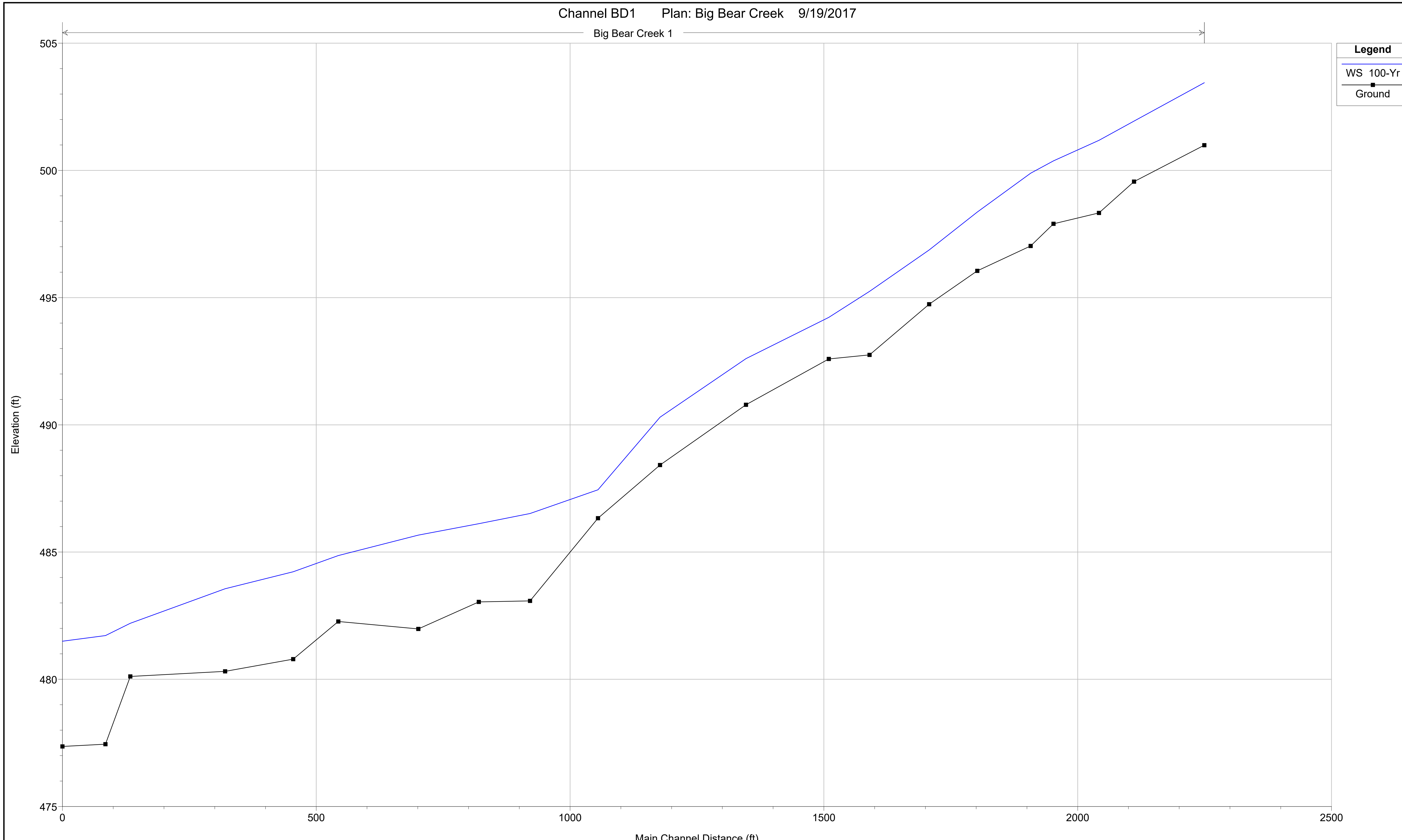

Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 370
.018
.018
.018
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
514
512
510
508
506
504
502
0
200
400
600
800
1000


Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 217
.018
.018
.018
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
512
510
508
506
504
502
0
200
400
600
800
1000
1200

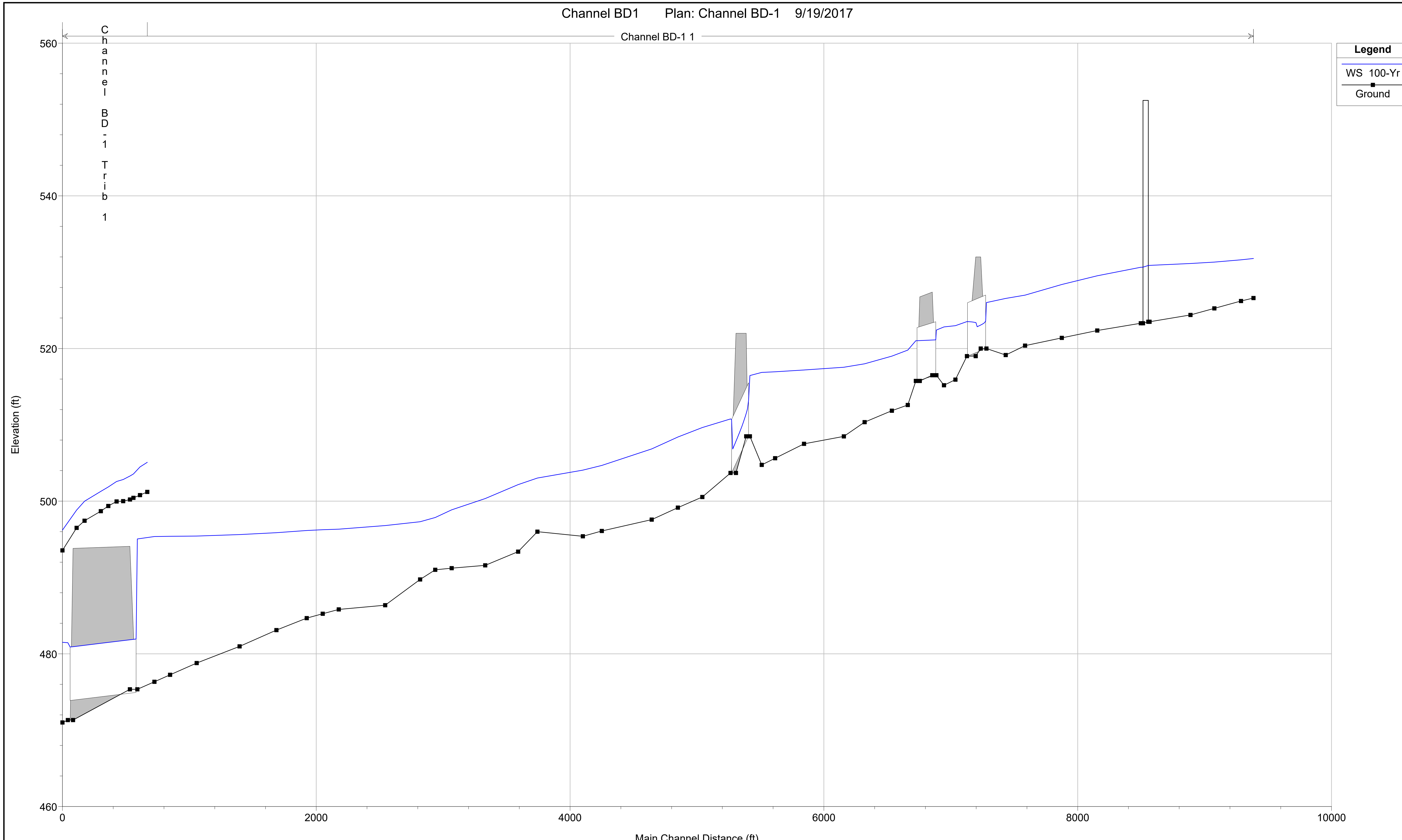


Channel BD1 Plan: Estelle Creek 9/19/2017
RS = 91
.018
.018
.018
Legend
WS 100-Yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
508
507
506
505
504
503
502
501
0
200
400
600
800
1000
1200

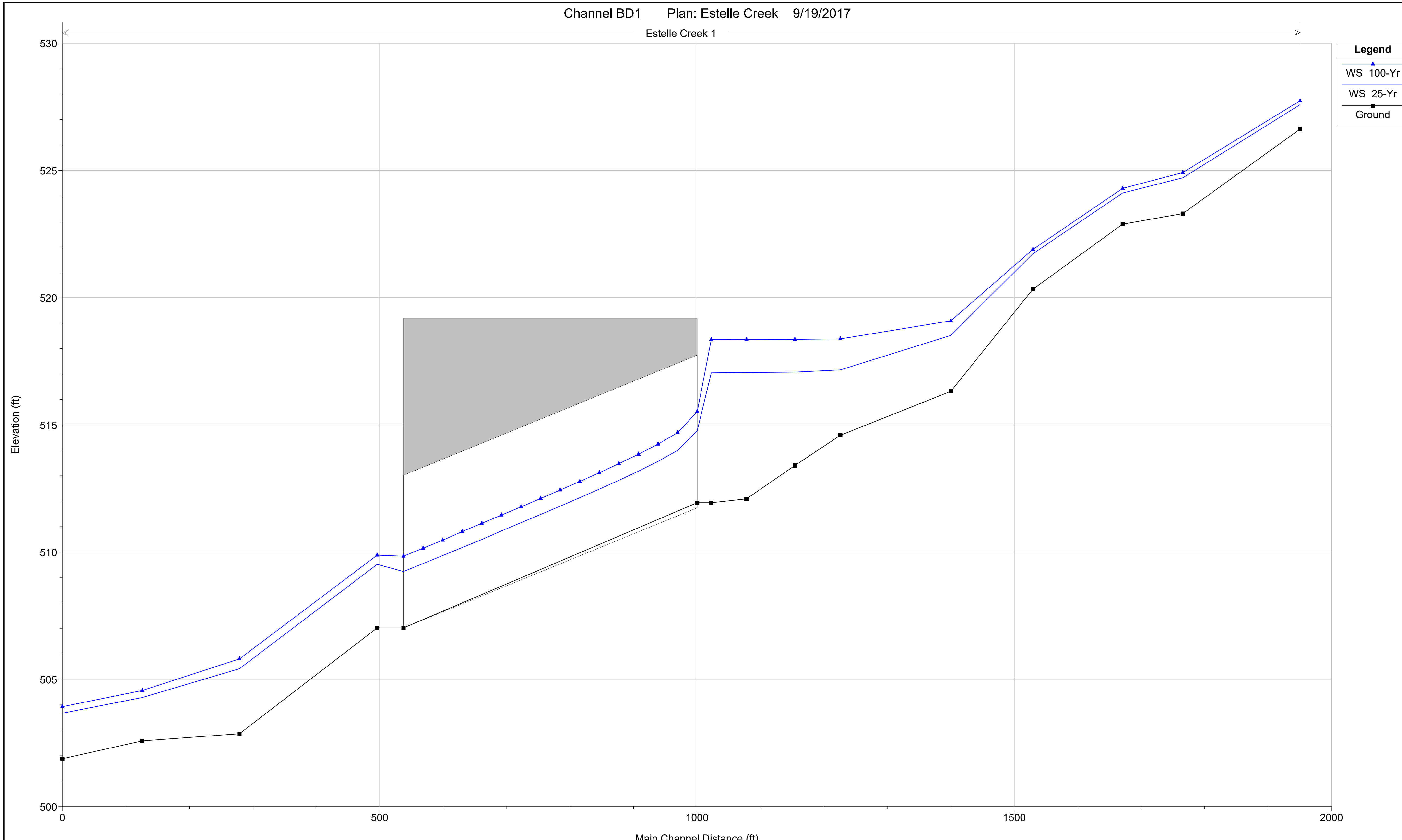
Flood Profile



Channel BD1 Plan: Big Bear Creek 9/19/2017
Big Bear Creek 1
Legend
WS 100-Yr
Ground
Elevation (ft)
505
500
495
490
485
480
475
0
500
1000
1500
2000
2500
Main Channel Distance (ft)



Channel BD1 Plan: Channel BD-1 9/19/2017
Channel BD-1 1
Channel BD-1 Trib 1
Legend
WS 100-Yr
Ground
Elevation (ft)
560
540
520
500
480
460
0
2000
4000
6000
8000
10000
Main Channel Distance (ft)



Channel BD1 Plan: Estelle Creek 9/19/2017
Estelle Creek 1
Legend
WS 100-Yr
WS 25-Yr
Ground
Elevation (ft)
530
525
520
515
510
505
500
0
500
1000
1500
2000
Main Channel Distance (ft)
1

Existing Conditions Model Output

HEC-RAS Plan: BBC ECM River: Big Bear Creek Reach: 1 Profile: 100-Yr

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)	
1	2139	100-Yr	320.00	500.99	503.45		503.54	0.008150	2.43	131.52	82.67	0.34
1	2001	100-Yr	320.00	499.56	501.94		502.08	0.014636	3.08	111.97	101.94	0.45
1	1932	100-Yr	320.00	498.33	501.18		501.27	0.008576	2.39	145.45	134.35	0.34
1	1842	100-Yr	320.00	497.90	500.38	499.51	500.49	0.008953	2.88	143.40	138.60	0.37
1	1797	100-Yr	320.00	497.03	499.89		500.03	0.013382	3.68	160.33	188.63	0.45
1	1692	100-Yr	320.00	496.05	498.36		498.47	0.017384	2.60	123.08	123.80	0.46
1	1597	100-Yr	320.00	494.74	496.87		496.96	0.014309	2.40	133.12	130.10	0.42
1	1480	100-Yr	320.00	492.75	495.25		495.32	0.013495	2.19	145.81	156.36	0.40
1	1400	100-Yr	320.00	492.59	494.22		494.29	0.012300	2.05	155.88	172.54	0.38
1	1236	100-Yr	320.00	490.79	492.60		492.65	0.007775	1.87	171.52	155.31	0.31
1	1098	100-Yr	320.00	488.42	490.30	490.04	490.40	0.033257	2.99	147.79	260.05	0.61
1	976	100-Yr	320.00	486.33	487.45		487.52	0.014035	1.75	146.27	165.58	0.38
1	842	100-Yr	320.00	483.08	486.52		486.53	0.003290	1.55	365.63	334.46	0.22
1	778	100-Yr	320.00	483.04	486.11		486.14	0.004638	1.89	320.41	358.71	0.26
1	714	100-Yr	320.00	481.98	485.67		485.70	0.003181	1.68	330.56	388.36	0.22
1	558	100-Yr	320.00	482.27	484.86		484.95	0.008651	2.65	202.31	364.13	0.35
1	469	100-Yr	320.00	480.79	484.23	483.18	484.32	0.006509	2.57	172.15	200.61	0.32
1	335	100-Yr	480.00	480.31	483.56		483.62	0.004151	2.05	254.15	205.16	0.25
1	148	100-Yr	480.00	480.11	482.20		482.37	0.017708	3.32	144.66	102.29	0.49
1	99	100-Yr	480.00	477.45	481.72		481.79	0.004882	2.15	225.26	130.22	0.27
1	14	100-Yr	480.00	477.36	481.50	479.11	481.53	0.001001	1.38	370.50	276.63	0.13

HEC-RAS Plan: CBD1 ECM   Profile: 100-Yr

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)	
1	9492	100-Yr	490.00	526.61	531.79		532.00	0.004463	4.04	151.07	62.60	0.34
1	9394	100-Yr	490.00	526.22	531.62		531.68	0.001156	2.03	241.38	62.96	0.18
1	9184	100-Yr	490.00	525.26	531.32		531.40	0.001595	2.28	215.36	60.36	0.21
1	8996	100-Yr	490.00	524.40	531.13		531.17	0.000629	1.62	303.09	70.40	0.14
1	8674	100-Yr	490.00	523.51	530.89	526.55	530.94	0.000853	1.78	275.92	69.73	0.16
1	8639		Bridge									
1	8604	100-Yr	1080.00	523.31	530.64	527.72	530.90	0.004526	4.08	264.56	66.88	0.36
1	8261	100-Yr	1080.00	522.36	529.53		529.69	0.002254	3.21	336.79	72.85	0.26
1	7982	100-Yr	1080.00	521.39	528.39		528.72	0.006758	4.66	231.93	65.53	0.44
1	7692	100-Yr	1080.00	520.38	526.99		527.20	0.003540	3.70	292.12	72.02	0.32
1	7540	100-Yr	1080.00	519.14	526.56	524.15	526.72	0.002549	3.28	350.70	100.97	0.28
1	7388	100-Yr	1080.00	520.00	526.01	522.68	526.27	0.002530	4.10	263.45	88.61	0.30
1	7318		Culvert									
1	7234	100-Yr	1080.00	519.00	523.53	522.01	524.18	0.009321	6.49	166.31	65.65	0.54
1	7143	100-Yr	1080.00	515.92	522.99	520.52	523.24	0.004284	4.08	268.28	74.41	0.36
1	7053	100-Yr	1080.00	515.19	522.83		522.95	0.001272	2.89	399.00	88.02	0.21
1	6993	100-Yr	1080.00	516.50	522.42	519.36	522.75	0.001447	4.62	233.67	87.69	0.33
1	6904		Culvert									
1	6832	100-Yr	1080.00	515.75	521.03	518.53	521.41	0.004427	4.99	216.29	76.15	0.38
1	6768	100-Yr	1520.00	512.60	519.79	518.82	520.65	0.020246	9.48	279.83	79.34	0.65
1	6643	100-Yr	1520.00	511.85	519.00	516.64	519.23	0.004966	4.77	544.34	154.42	0.33
1	6428	100-Yr	1520.00	510.35	518.00		518.27	0.006564	5.28	521.97	173.49	0.37
1	6264	100-Yr	1520.00	508.49	517.55		517.60	0.001149	2.40	1180.15	346.44	0.16
1	5951	100-Yr	1620.00	507.51	517.19	513.40	517.28	0.001732	2.94	911.41	220.73	0.19
1	5723	100-Yr	1620.00	505.62	516.95		517.00	0.000985	2.64	1290.76	283.81	0.15
1	5618	100-Yr	1620.00	504.75	516.87	509.13	516.91	0.000322	1.60	1278.06	243.66	0.09
1	5524	100-Yr	1620.00	508.50	516.46	511.96	516.72	0.001131	4.15	390.04	109.51	0.26
1	5458		Culvert									
1	5372	100-Yr	1730.00	503.70	510.78	507.49	511.29	0.004167	5.77	299.79	65.31	0.39
1	5150	100-Yr	1730.00	500.55	509.64	508.57	509.88	0.013125	6.47	524.24	189.35	0.40
1	4957	100-Yr	1730.00	499.15	508.41		508.58	0.008264	4.96	609.25	229.93	0.36
1	4751	100-Yr	1730.00	497.58	506.84		507.10	0.008053	5.68	603.28	224.66	0.39
1	4357	100-Yr	1730.00	496.09	504.68		504.84	0.009406	4.68	671.34	262.79	0.35
1	4208	100-Yr	1730.00	495.40	504.07		504.24	0.003396	4.20	779.54	236.17	0.27
1	3850	100-Yr	1730.00	496.00	503.03		503.22	0.006676	4.73	676.40	247.03	0.36
1	3698	100-Yr	1730.00	493.39	502.17		502.37	0.008268	5.89	635.93	207.98	0.38
1	3439	100-Yr	1730.00	491.60	500.34		500.75	0.013280	7.28	531.49	229.25	0.49
1	3174	100-Yr	1730.00	491.23	498.87		499.07	0.008535	5.79	661.46	235.80	0.40

HEC-RAS Plan: CBD1 ECM   Profile: 100-Yr (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	3045	100-Yr	1730.00	491.01	497.86		498.26	0.015984	7.33	521.32	244.25	0.54
1	2925	100-Yr	1730.00	489.75	497.31		497.42	0.006868	4.34	737.36	238.73	0.34
1	2650	100-Yr	1730.00	486.37	496.81		496.88	0.002146	3.18	1055.54	287.80	0.21
1	2284	100-Yr	1730.00	485.82	496.33		496.44	0.001817	3.68	1018.32	263.08	0.21
1	2158	100-Yr	1730.00	485.25	496.26		496.31	0.001047	2.80	1329.01	284.24	0.16
1	2032	100-Yr	1730.00	484.68	496.15		496.20	0.000879	2.42	1288.38	280.02	0.14
1	1793	100-Yr	2520.00	483.11	495.87		495.97	0.001855	4.10	1291.18	249.72	0.21
1	1503	100-Yr	2520.00	480.97	495.62		495.67	0.001461	3.41	1532.22	252.67	0.16
1	1165	100-Yr	2520.00	478.79	495.43		495.47	0.000534	2.54	2012.35	391.55	0.11
1	956	100-Yr	2520.00	477.25	495.40		495.41	0.000092	1.25	4141.54	450.89	0.05
1	832	100-Yr	2520.00	476.34	495.37	485.66	495.39	0.000309	2.15	2688.18	382.51	0.09
1	697	100-Yr	2520.00	475.35	495.05	482.44	495.23	0.000893	3.53	759.09	520.85	0.15
1	426		Culvert									
1	150	100-Yr	2520.00	471.33	481.46	480.19	483.16	0.001020	10.46	240.91	49.95	0.72
1	107	100-Yr	2520.00	471.01	481.51	480.11	482.74	0.001000	8.91	282.76	53.94	0.69
Trib 1	829	100-Yr	380.00	501.21	505.09		505.30	0.012628	3.89	127.96	88.39	0.45
Trib 1	772	100-Yr	380.00	500.79	504.49		504.56	0.010550	2.91	201.70	154.93	0.37
Trib 1	720	100-Yr	380.00	500.43	503.57	503.14	503.81	0.019148	4.30	118.96	171.51	0.54
Trib 1	693	100-Yr	380.00	500.22	503.30	502.54	503.38	0.010641	2.35	161.66	131.36	0.37
Trib 1	639	100-Yr	380.00	500.00	502.84		502.93	0.006326	2.41	163.36	117.44	0.31
Trib 1	587	100-Yr	380.00	499.96	502.58	501.27	502.64	0.004536	1.94	196.38	150.45	0.26
Trib 1	521	100-Yr	380.00	499.37	501.86		502.13	0.019918	4.18	91.01	49.10	0.54
Trib 1	463	100-Yr	380.00	498.69	501.29	499.97	501.35	0.004637	2.03	187.34	118.69	0.26
Trib 1	334	100-Yr	380.00	497.44	499.99		500.30	0.028087	4.46	85.11	54.13	0.63
Trib 1	272	100-Yr	380.00	496.51	498.84		498.98	0.012869	3.01	126.12	81.02	0.43
Trib 1	160	100-Yr	380.00	493.55	496.21	495.97	496.69	0.046702	5.57	68.28	46.91	0.80

HEC-RAS Plan: EC ECM River: Estelle Creek Reach: 1 Profile: 100-Yr

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)	
1	2041	100-Yr	250.00	526.62	527.74	527.45	527.83	0.026503	2.41	103.83	161.15	0.53
1	1856	100-Yr	250.00	523.30	524.91		524.94	0.004566	1.41	177.91	165.38	0.24
1	1762	100-Yr	250.00	522.89	524.29		524.34	0.010422	1.75	142.96	179.90	0.34
1	1620	100-Yr	250.00	520.33	521.89	521.65	522.04	0.036192	3.08	81.18	109.88	0.63
1	1491	100-Yr	250.00	516.32	519.09		519.16	0.008099	2.20	113.39	82.22	0.33
1	1317	100-Yr	250.00	514.59	518.38		518.39	0.000566	0.80	315.44	162.67	0.09
1	1245	100-Yr	250.00	513.40	518.36		518.36	0.000115	0.47	552.39	227.45	0.05
1	1169	100-Yr	250.00	512.09	518.35		518.35	0.000046	0.35	750.52	255.85	0.03
1	1113	100-Yr	250.00	511.94	518.35	513.94	518.35	0.000072	0.44	623.76	267.60	0.04
1	850		Culvert									
1	587	100-Yr	250.00	507.02	509.88	509.88	510.57	0.004385	6.69	37.40	27.01	1.00
1	370	100-Yr	250.00	502.86	505.80	505.80	506.55	0.003954	6.95	36.44	29.08	0.97
1	217	100-Yr	250.00	502.58	504.56		504.89	0.002394	4.61	54.21	44.15	0.73
1	91	100-Yr	250.00	501.88	503.93	503.93	504.47	0.004672	5.90	42.37	39.34	1.00

Appendix C

Engineered Plans

- Valley View Lane
- State Highway 183 (Dallas)
- State Highway 183 (Irving)
- International Parkway

Valley View Lane

LEGEND

Major Divide

Drainage Area

Inlet Area

STATE OF TEXAS
JEFFREY M. HAWKINS
#59845
REGISTERED
PROFESSIONAL ENGINEER

Jeffrey M. Hawkins, P.E.
5-6-97

NO.	REVISION	BY	DATE

COUNTY OF DALLAS, TEXAS

DEPARTMENT OF PUBLIC WORKS

DRAINAGE AREA MAP & CALCULATIONS

VALLEY VIEW LANE

S.H. 183 TO 750' NORTH OF NORTHGATE DRIVE

BEGINNING 37+00

DESIGNED–JMS	DRAWN–JMS	DATE OCTOBER 1996	FILE– 91-899
APPROVED–JMH	CHECKED–JMH	SCALE– 1"=200'	SHEET 48 OF 90

NO.	REVISION	BY	DATE

COUNTY OF DALLAS, TEXAS

DEPARTMENT OF PUBLIC WORKS

DRAINAGE AREA MAP & CALCULATIONS

VALLEY VIEW LANE

S.H. 183 TO 750' NORTH OF NORTHGATE DRIVE

BEGINNING 37+00

DESIGNED-JMS	DRAWN-	DATE-OCTOBER/1996	FILE- 91-899
APPROVED-JMH	CHECKED-JMH	SCALE- 1"=200'	SHEET 49 OF 90

WLA JOB NO. 94011.01

State Highway 183 (Dallas)

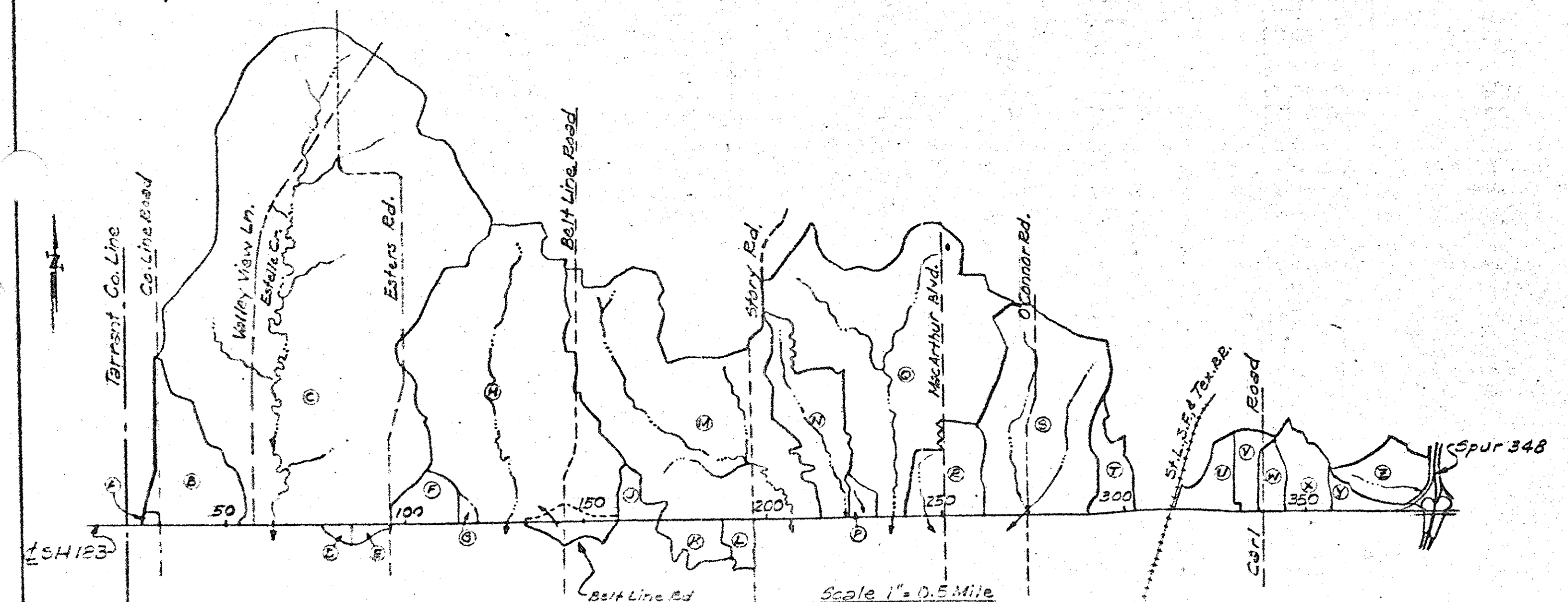
RUN-OFF COMPUTATIONS

STATION	DRAINAGE AREA	AREA (AC)	T	C	I	Q							
31+02	A	3.13	13	0.9	$4.4^{(2)}$	13	Extend 3'x2' Box as storm sewer						
41+54	B	170.76	23.7	0.58	$4.4^{(10)}$	435	Extend 10'x5' Box D.S. as storm sewer.						
63+30	C	1,846.75	92	0.73	$2.8^{(50)}$	3,778	Ext. 3-10'x10' MBC U.S.&D.S. - Add 2 extra barrels						
75+00	D	6.52	12.7	0.90	$4.4^{(2)}$	26	Extend 3'x2' Box as storm sewer						
85+38	E	6.16	30	0.90	$5.7^{(50)}$	32	Prop. 42" RCP Culvert						
112+07	F	55.58	"	0.70	"	222	Extend exist. 6'x6' U.S. & D.S.						
120+66	G	15.10	"	0.90	"	78	Extend exist. 3'x3' U.S. & D.S.						
128+57	H	833.29	47.3	0.70	$4.4^{(50)}$	2,567	Ext. 4-7x6 MBC U.S.&D.S - Add 4 extra barrels.						
164+80	J	39.54	30	0.70	$4.4^{(10)}$	122	Complete culvert existing (7'x3')						
188+00	K	39.20	16.6	0.50	$5.0^{(5)}$	98.	To Storm sewer system						
196+70	L	25.30	11.1	0.50	$5.8^{(5)}$	73.	To Storm Sewer system						
208+37	M	705.84	39.2	0.48	$3.75^{(10)}$	1,271.	Complete culvert existing (4-6'x6')						
224+00	N	200.00	30	0.50	$3.8^{(5)}$	380.	To Storm Sewer system						
231+70	P	17.50	"	0.70	$3.8^{(5)}$	47.	To Storm Sewer system						
235+55	Q	649.34	60.8	0.66	$2.9^{(10)}$	1,242.	Complete culvert existing (3-7'x6')						
245+30	R	99.85	30	0.70	$4.4^{(10)}$	308.	Complete culvert existing (2-7'x3')						
273+16	S	384.39	"	0.48	"	812.	Complete culvert existing (3-7'x4')						
299+50	T	49.94	"	0.52	"	114.	Extend exist. 6'x2' U.S.& D.S.						
330+94	U	41.50	"	0.70	"	128.	Exist. 3-36" RCP to remain						
331+00	V	Q(U+V) - Q(U)			=	127.	Exist. 40"x25" CGM Storm Sewer to remain						
342+33	W	25.23	"	0.50	$4.4^{(10)}$	56.	Complete culvert existing (2-24" RCP)						
355+55	X	56.23	"	0.70	"	173.	Extend exist. 2-6'x3' U.S. & D.S.						
372+52	Y	24.29	"	0.90	"	96.	Extend exist. 6'x2' U.S.& D.S.						
*587+67	Z	79.96	"	0.90	"	316.	Extend exist. 3-60" RCP U.S.						
330+94	(U+V)	81.90	"	0.70	"	255.	Ext. exist. 2-6'x3' D.S. - Connect to pipes U.S.						

* W.B. Frt. Rd Stationing

CULVERT COMPUTATIONS

STATION	Q	ALLOW HW	OUTLET CHANNEL					CULVERT														
			W	SS	n	S	TW	SIZE, LENGTH, & DESCRIPTION	d_c	S_c	S	$\frac{v^2}{2g}$	Ce	he	hf	H	P	SL	HW	Vout.	TYPE OPER.	REMARKS
31+02	13		4	3:1	0.02	1.8	0.72															Storm Sewer
41+54	435		10	35:1	0.025	1.43%	2.70															Storm Sewer
63+30	3,778	11.00	30	4:1	0.025	0.38%	6.20	5-10'x10'x285.5' MBC	5.6	0.31	0.405								9.5	14.85	III	Add 2-10'x10' barrels
75+00	26		4	3:1	0.025	2.0%	1.00															Storm Sewer
85+38	32	3.0	6	16:1	0.025	1.85%	1.46	42"x275' RCP Culv.	2.84	0.58	0.65								2.45	10.0	III	
112+07	222	6.0	6	8:1	0.025	3.32%	1.72	6'x6'x304' Box Culv.	3.5	0.39	0.366	1.74		0.61	0.73			0.58	6.00	9.46	I	
120+66	78	4.5	4	8:1	0.035	4.76%	0.8	3'x3'x306' Box Culv.	2.8	0.58	2.048					2.6	2.9	1.3	4.2	8.66	I/IV h	
128+57	2,567	7.0	20	10:1	0.025	3.62%	5.05	8-7'x6'x275' MBC	4.0	0.25	0.576								6.98	10.71	II/III	Add 4-7'x6' barrels
299+50	114.	4.6	4	10:1	0.035	0.75%	1.78	6'x2'x224.75' Box Culv.	2.2	0.34	0.45					2.85		0.12	4.51	9.6	IV	
330+94	128	4.0	—	—	—	—	3.0	3-36" RCP (existing)	2.1	0.47	0.3					1.0		0.15	3.85	6.2	IV	Disch. into junct. box
330+94	255	—	—	—	—	—	—	2-6'x3'x187' MBC	2.4	0.15	2.36					4.26	2.70	3.68	3.28	17.8	IV	Continues off R.O.W.
355+55	173	4.0	10	4:1	0.025	0.86%	2.2	2-6'x3'x258' MBC	1.9	0.32	0.474								3.18	8.9	III	
372+52	96	4.0	4	6:1	0.035	0.36%	1.41	6'x2'x255' Box Culv.	2.0	0.33	0.33					2.10	2.0	0.36	3.74	8.0	IV/III	
*587+67	316	5.0	—	—	—	—	—	3-60"x520.7 R.C.P.	2.9	0.35	0.7								4.5	11.8	III	Disch. into exist. pipes

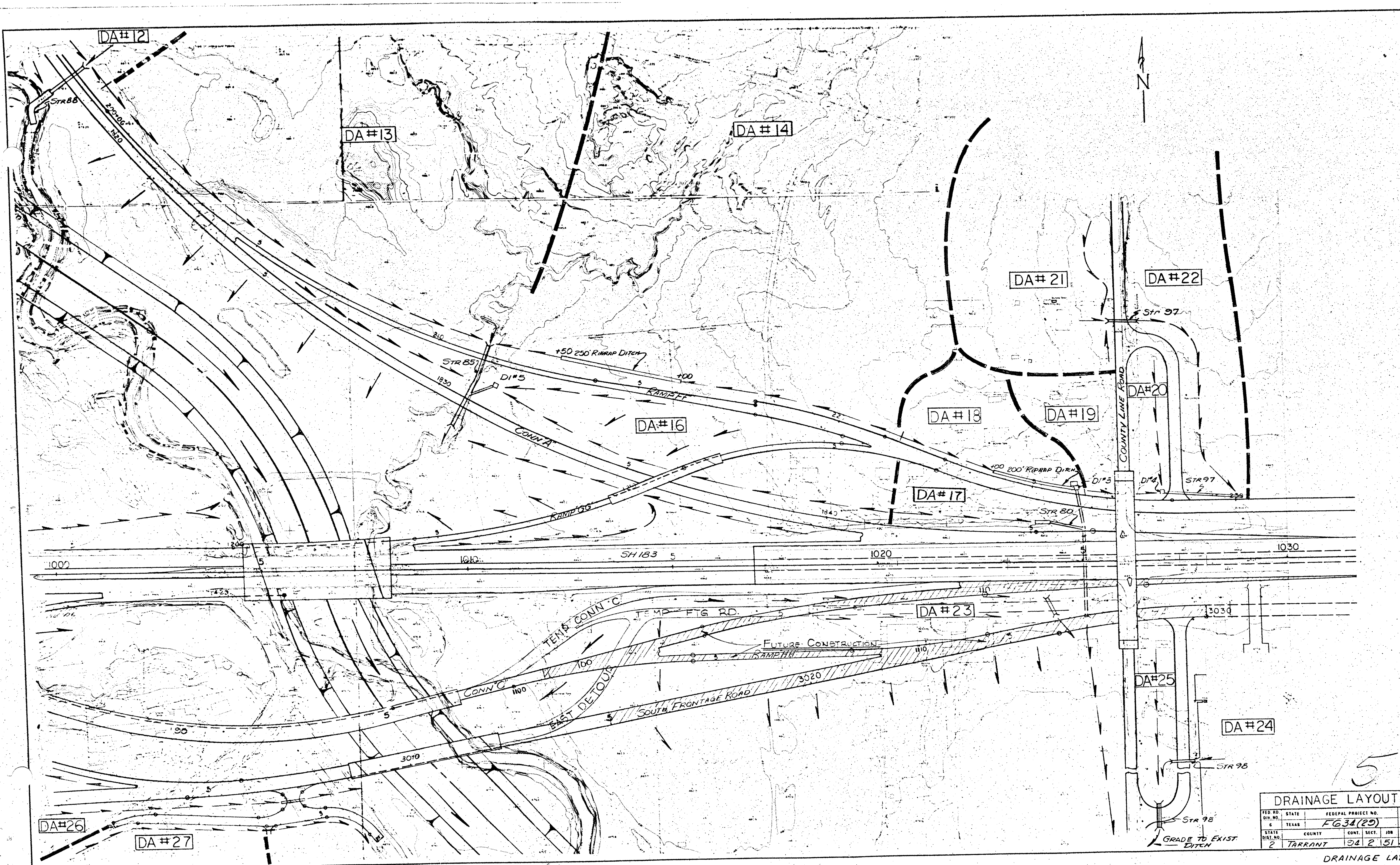


89

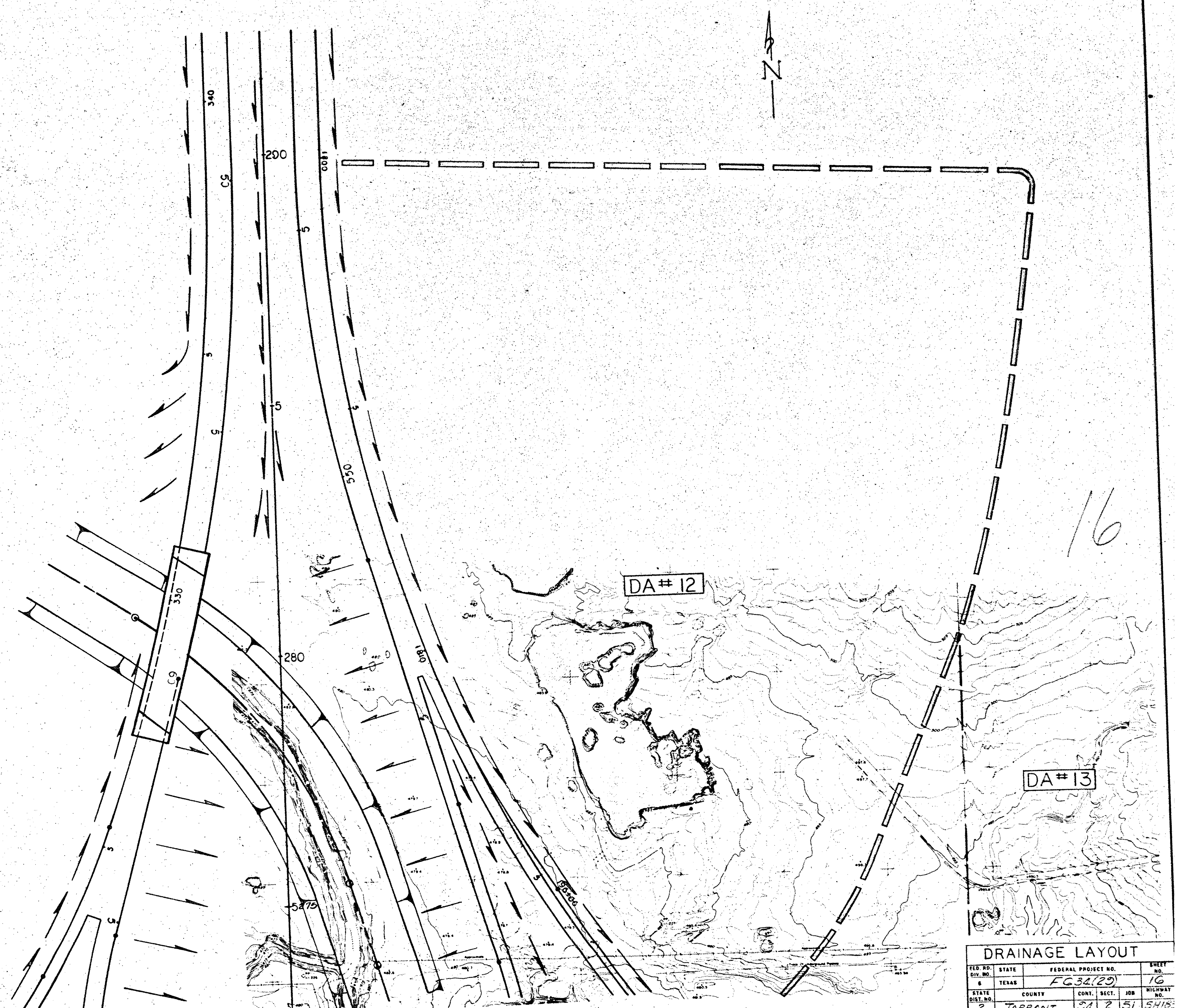
HYDRAULIC DATA

FED RD DIV NO	STATE	FEDERAL PROJECT NO.				SHEET NO.
6	TEXAS	U-634(27)				89
STATE DIST NO	COUNTY		CONT.	SECT.	JOB	HIGHWAY NO.
18	Dallas		94	3	56	S-183

State Highway 183 (Irving)



DRAINAGE LAYOUT

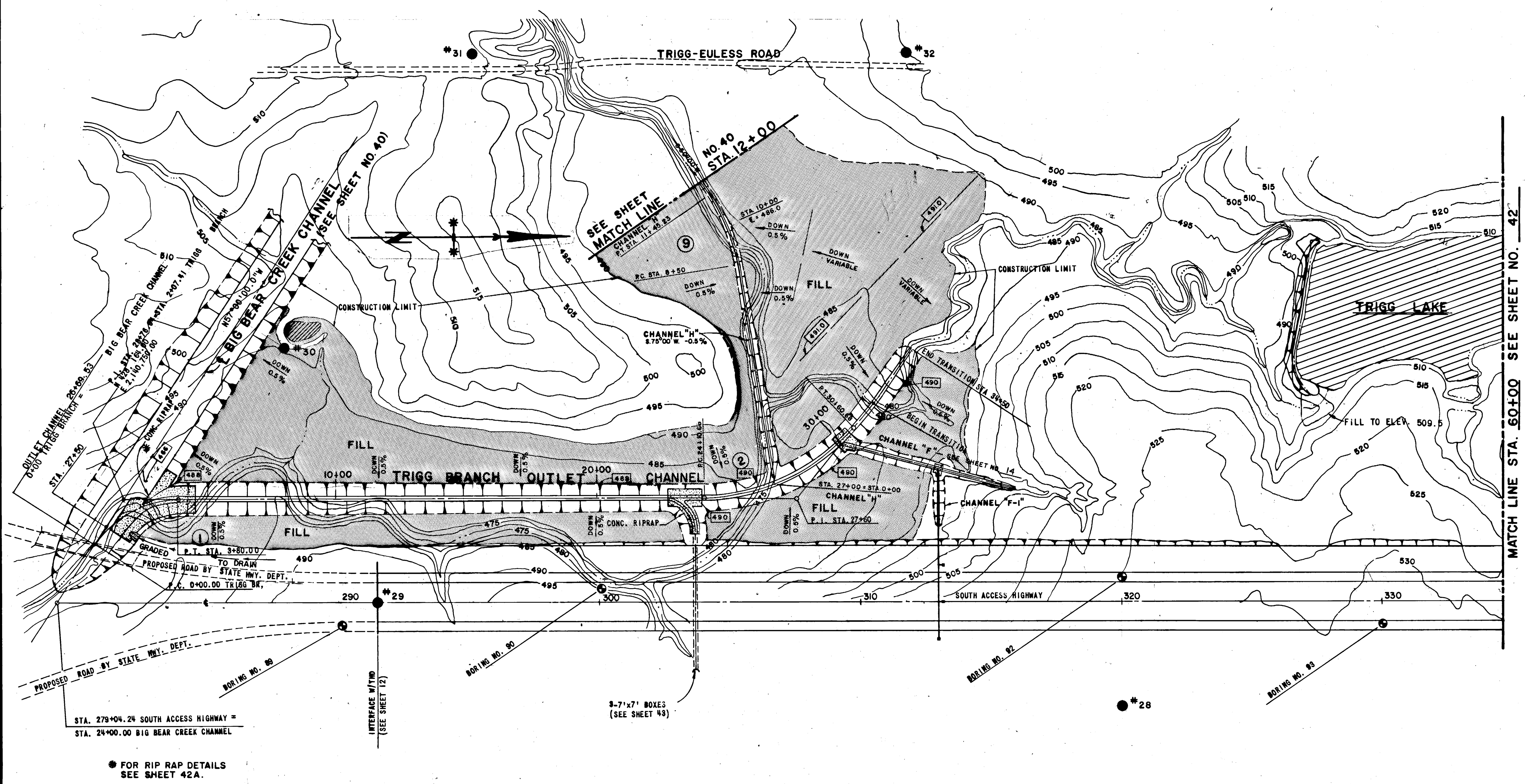


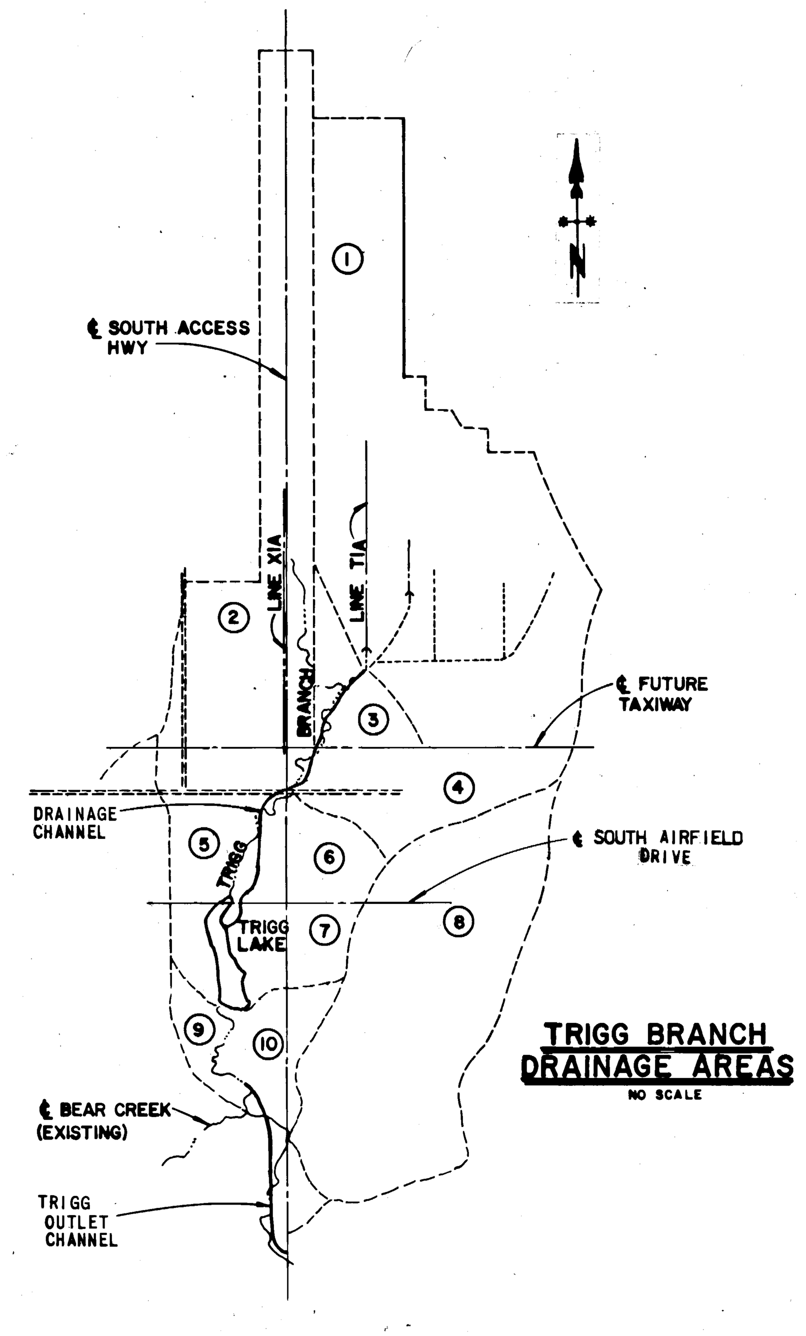
DRAINAGE LAYOUT

FED. RD. DIV. NO.	STATE	FEDERAL PROJECT NO.			SHEET NO.
6	TEXAS	FG34(29)			16
STATE DIST. NO.	COUNTY	CONT.	SECT.	JOB	HIGHWAY NO.
2	TARRANT	34	2	51	SH18

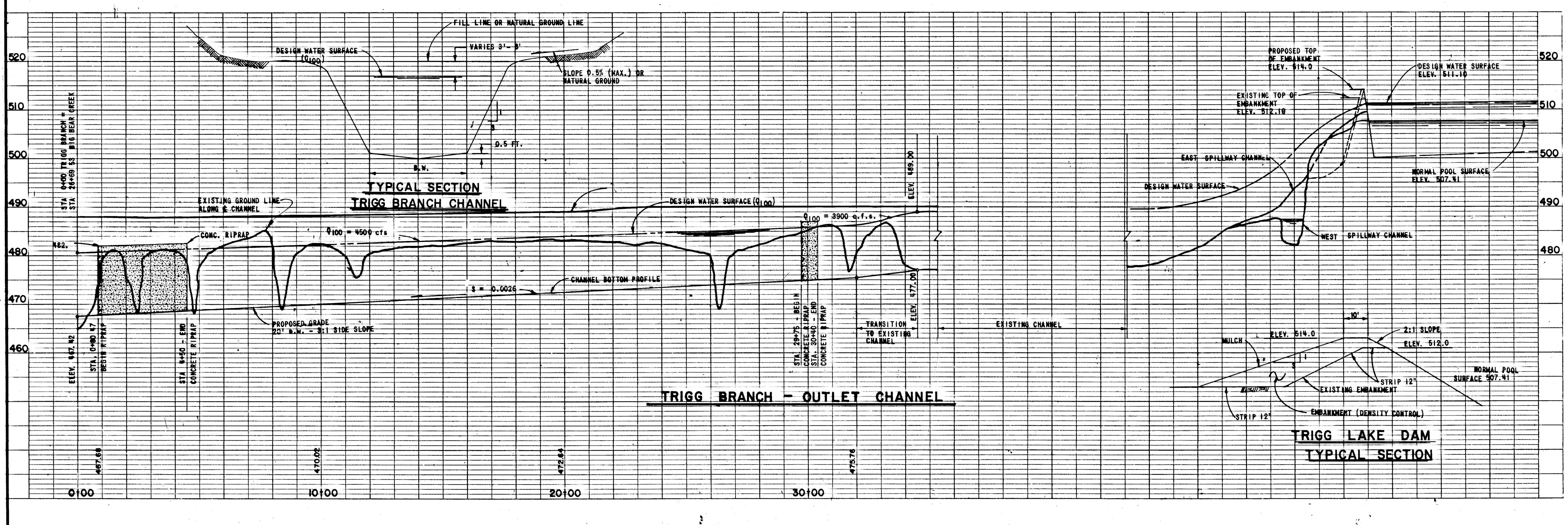
DRAINAGE LAYOUT

International Parkway





DRAINAGE AREAS			
DRAINAGE AREA NO.	DRAINAGE AREA (ACRES)	TOTAL DRAINAGE AREA (ACRES)	REMARKS (ADOPTED DESIGN DISCHARGE - C. F. S.)
1	829.24	829.24	
2	426.69	1255.93	
3	75.97	1331.90	2800
4	154.89	1486.79	3000
5	154.20	1640.99	
6	73.01	1714.00	
7	126.91	1840.91	3900
8	511.74	2352.65	
9	39.58	2392.23	
10	85.29	2477.52	4500



IMPROVED CHANNEL CURVE DATA							
CHANNEL	CURVE NO.	P. I. COORDINATES		DEFL. ∢	RADIUS (FT.)	TANGENT (FT.)	CURVE LENGTH (FT.)
OUTLET	1	428,164.76	2,140750.00	57°RT.	382.00	207.41	380.00
↕	2	430,750.00	2,140,750.00	52°LT.	716.25	349.32	650.00
		431,040.87	2,140,376.52	STA. 32+00 BEGIN TRANSITION			
		431,199.38	2,140,174.82	STA. 34+50 END			
DRAINAGE	1	434,860.00	2,140,350.00	55° LT.	318.39	165.74	305.63
↕	2	435,520.00	2,140,350.00	60° RT.	286.46	165.39	299.98
	3	435,693.21	2,140,650.0	60° LT.	286.46	165.39	299.98
	4	436,657.83	2,140,650.00	70° RT.	194.21	135.99	237.27
	5	437,040.00	2,141,700.00	60° LT.	286.46	165.39	299.98
	6	438,103.59	2,141,887.54	40° RT.	573.00	208.55	400.03
	7	438,410.59	2,142,253.41	21°52' LT.	955.00	184.53	364.82
DRAINAGE	8	438,937.35	2,142,616.06	16°07' RT.	1579.40	22.37	44.44
CHANNEL "H"	9	430,491.41	2,139,710.72	25° LT.	676.61	150.00	295.23

REVISED AS BUILT
DATE 7-2-73

NO.	DATE	REVISION	BY

DESIGNED BY M.L.
DRAWN BY C.W.
CHECKED BY F.L.H.

RECOMMENDED — DATE 11-12-70
FREESE, NICHOLS AND ENDRESS RADY AND ASSOCIATES

RECOMMENDED — DATE 11-12-70
TIPPETTS-ABBETT-McCARTHY STRATTON

APPROVED — DATE 11-12-70
REGIONAL AIRPORT BOARD

DALLAS-FORT WORTH REGIONAL AIRPORT
REGIONAL AIRPORT BOARD

TIPPETTS-ABBETT-McCARTHY-STRATTON
ENGINEERS AND ARCHITECTS
ARLINGTON, TEXAS NEW YORK, N.Y.

FREESE, NICHOLS AND ENDRESS
CONSULTING ENGINEERS
FORT WORTH, TEXAS

RADY AND ASSOCIATES
CONSULTING ENGINEERS
FORT WORTH, TEXAS

ACCESS HIGHWAYS PHASE I

TRIGG BRANCH CHANNEL PLAN & PROFILE

F.A.A. PROJECT NO. 8-48-0064-01

DRAWING NUMBER 31-552-03-041
SHEET 41 OF 92
DATE NOV. 12, 1970
SCALE V.1"=10' H.1"=200'

001232

Appendix D

Digital Data

- HEC-HMS Model
- HEC-RAS Model
- GIS Supporting Data
- Digital Copy of Report

pkce.com

DALLAS
7557 Rambler Rd
Suite 1400
Dallas, TX 75231
972.235.3031

FORT WORTH
6100 Western Place
Suite 1001
Fort Worth, TX 76107
817.412.7155

HOUSTON
20445 State Highway 249
Suite 380
Houston, TX 77070
281.883.0103