CITY OF RAEFORD

MBD CONSULTING ENGINEERS, P.A.

760A NW Broad Street
P.O. Box 1215
Southern Pines, NC 28388
Phone: 910-915-8200

PATTERSON STREET AND EAST PROSPECT AVENUE STORM DRAINAGE IMPROVEMENTS

FEMA GO

Benefit-Cost Analysis Report

JANUARY, 2023

CITY OF RAEFORD

PATTERSON STREET & EAST PROSPECT AVENUE
STORM DRAINAGE IMPROVEMENTS

BENEFIT-COST ANALYSIS REPORT

TABLE OF CONTENTS

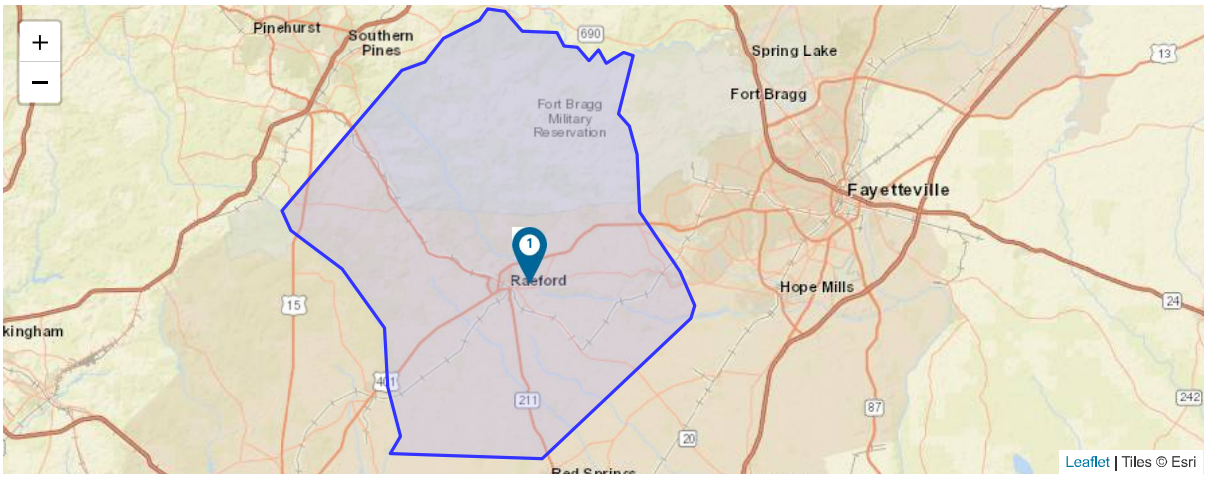
APPENDIX

FEMA Benefit-Cost Calculator

V.6.0 (Build 20230103.1822 | Release Notes)

Benefit-Cost Analysis

Project Name: City of Raeford, NC - Patterson Ave. & E. Prospect Ave. Storm Drainage Improvements (Historical)



Map Marker ▲	Mitigation Title	Property Type	Hazard	Using 7% Discount Rate Benefits (B)	Using 7% Discount Rate Costs (C)	Using 7% Discount Rate BCR (B/C)	Using 3% Discount Rate (For FY22 BRIC and FMA only) Benefits (B)	Using 3% Discount Rate (For FY22 BRIC and FMA only) Costs (C)	Using 3% Discount Rate (For FY22 BRIC and FMA only) BCR (B/C)	
1	Drainage Improvement @ 34.9825340, -79.2027250		DFA - Riverine Flood	$ 1,650,193	$ 1,402,808	1.18	$ 3,654,311	$ 1,454,797	2.51	!
TOTAL (SELECTED)				$ 0	$ 0	0.00	$ 0	$ 0	0.00	
TOTAL				$ 0	$ 0	0.00	$ 0	$ 0	0.00	

Property Configuration

Property Title:	Drainage Improvement @ 34.9825340; -79.2027250
Property Location:	28376, Hoke, North Carolina
Property Coordinates:	34.982534, -79.202725
Hazard Type:	Riverine Flood
Mitigation Action Type:	Drainage Improvement
Property Type:	Roads & Bridges
Analysis Method Type:	Historical Damages

Cost Estimation
Drainage Improvement @ 34.9825340; -79.2027250

Project Useful Life (years):	100
Project Cost:	$1,360,000
Number of Maintenance Years:	100 Use Default:Yes
Annual Maintenance Cost:	$3,000

Comments

- **Project Useful Life:**
The U.S. Army Corps of Engineers Engineering Design Manual describes reinforced concrete pipes as having a life expectancy of 75 to 100 years.
- **Mitigation Project Cost:**
Initial Project Costs are based upon the proposed project cost estimate. The Project Cost Estimate is attached in the "Budget" Section of Sub-Application and the BCA Report.
- **Annual Maintenance Cost:**
Maintenance costs are based on: 1 Working Day per culvert 1 Time Annually per culvert Crew: 3-Man Crew w/ a small/mini excavator Cost: $1500 per day/ per crew / per culvert (2 culverts)

Damage Analysis Parameters - Damage Frequency Assessment
Drainage Improvement @ 34.9825340; -79.2027250

Year of Analysis was Conducted:	2019
Year Property was Built:	1975
Analysis Duration:	45 Use Default:Yes

Comments

- **Analysis Year:**
Hydrological & Hydraulic Analysis conducted by Hillard Engineering 1-22-19. (Analysis Attached to Budget Section of Sub-Application and to the BCA Report.)
- **Year Built:**
"Year Built" estimate based upon Hydrological & Hydraulic analysis by Hillard Engineering. The analysis completed 1-22-2019 indicated the structure was estimated to be 45 years old. Attached)

Roads and Bridges Properties
Drainage Improvement @ 34.9825340; -79.2027250

Estimated Number of One-Way Traffic Detour Trips per Day:	3,168
Additional Time per One-Way Detour Trip (minutes):	1.06
Number of Additional Miles:	0.08
Federal Rate ($):	0.625 Use Default:Yes
Economic Loss Per Day of Loss of Function ($):	2,150.86

Comments

-

Number of Trips:
Estimated Data obtained from "Speed Zone Survey" Dated 11-7-22 thru 11-9-22 conducted by NCDOT. The surveys are attached in the "BCA Report".

-

Time per Trip:
Additional Time per One-Way Traffic Detour was calculated using the most recently published NCDOT Traffic Count Data "NCDOT 2019 AADT Report". The attached calculations indicate additional time of 1.08 minutes to detour around the site. Travel time calculations include calculations for published estimated traffic volumes, 3-way and 4-way traffic signals, as well as differentiating speed limit zones along the proposed route. These appurtenances and proposed route are referenced on the attached map located in the "BCA Report".

-

Number of Miles:
Additional mileage for the proposed detour route was obtained by use of Google Earth Measuring tools, with common points being the centerline of the Prospect Street intersections.

Historical Damages Before Mitigation
Drainage Improvement @ 34.9825340; -79.2027250

		ROADS AND BRIDGES	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL		
Damage Year	Recurrence Interval (years)	Impact (days)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)	Current Dollars?	Inflated Damages ($)
2016	2	73	58,610	5,610	0	0	0	221,233	No	227,091

Comments

-

Damages Before Mitigation:
In 2016 as a result of Hurricane Matthew, flood waters overtopped Prospect Ave. and Patterson Street in the City of Raeford, NC. Prospect St. suffered significant roadway damage at the Peddlers Branch culvert and was subsequently closed for 73 days while repairs were made. The existing box culvert at Prospect Ave. was not damaged. The contracted construction cost for the roadway repairs was $53,000. Engineering and Contract Administration costs were $5,610, for a total project cost of $58,610. The Engineer & Contractors' invoices are attached in the "BCA Report". The repairs were strictly to the roadway and did not provide any mitigation against future storm events. The Hydrology and Hydraulic study for the project concluded that the existing culvert at Patterson St. cannot pass the 2-year flood recurrence interval. Also the maximum flood recurrence interval that can be passed by the existing culvert at Prospect Ave. is the 2-year interval.

Annualized Damages Before Mitigation
Drainage Improvement @ 34.9825340; -79.2027250

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
2	227,091	113,545
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	227,091	113,545

Expected Damages After Mitigation
Drainage Improvement @ 34.9825340; -79.2027250

	ROADS AND BRIDGES	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
25	1	3,000	0	0	0	0	5,151

Comments

-

Damages After Mitigation:
The maximum storm that the proposed replacement culverts at Patterson Ave. and Prospect Ave. will pass is the 25-year flood recurrence interval. No damages are anticipated after mitigation for storm events up to the 25-year interval, however it is understood that annual maintenance will be required to maintain the new culverts. The cost for the annual maintenance of 2 new box culverts is estimated as $3,000.

Annualized Damages After Mitigation
Drainage Improvement @ 34.9825340; -79.2027250

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
25	5,151	206
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	5,151	206

Standard Benefits - Ecosystem Services
Drainage Improvement @ 34.9825340; -79.2027250

Total Project Area (sq.ft):	22,260
Percentage of Urban Green Open Space:	0.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	12.14%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$2,308

Comments

-

Percent Riparian:

Riparian areas exist within the proposed project site of Prospect & Patterson Street and within the worksite area of the proposed culverts for these areas. Prospect Worksite Location: 1,800 SF Patterson Worksite Location: 907 SF 1,800 + 907 = 2,702 SF Total Worksite Area: 22,260 SF 2,702/22,260 = 12.14% Riparian (Riparian Areas defined as indicated By US Fish & Wildlife - https://www.fws.gov/program/national-wetlands-inventory/riparian-data)

-

Total Project Area:

Estimated areas include: 100' L x 100' W Worksite Area at Prospect Street Culvert 60' L x 80' W Worksite Area at Patterson Street Culvert 373' L Ditch line x 20' W Area for ditch lining along Prospect Street

Benefits-Costs Summary
Drainage Improvement @ 34.9825340; -79.2027250

Total Standard Mitigation Benefits:	$1,650,193
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$1,650,193
Total Mitigation Project Cost:	$1,402,808
Benefit Cost Ratio - Standard:	1.18
Benefit Cost Ratio - Standard + Social:	1.18

APPENDIX

MBD CONSULTING ENGINEERS, P.A.

EAST PROSPECT AVENUE:
REPLACE EXIST. PAVED DITCH W/ SOD

PATTERSON STREET:
REPLACE EXIST. 60" RCP W/
DOUBLE 8' X 5' BOX CULVERT

EAST PROSPECT AVENUE:
REPLACE EXIST. 8' X 5' BOX CULVERT W/
DOUBLE 9' X 5' BOX CULVERT

E Donaldson Ave
E Donaldson Ave
Peddlers Branch
Patterson St
Polaris Cir
E Prospect Ave
Pinecone Ave
Pinewood Cir
Pinewood Ave
Family Dollar
Crumpler Dr
197 ft
Hwy 401 Bus
401
Central Ave

0 100 200 400 FEET
1"=100'

PATTERSON STREET & EAST PROSPECT AVENUE
STORM DRAINAGE IMPROVEMENTS
CITY OF RAEFORD, NORTH CAROLINA

MBD CONSULTING ENGINEERS, P.A.
760-A Broad Street
Southern Pines, NC 28388

CITY OF RAEFORD

PATTERSON STREET & EAST PROSPECT AVENUE

STORM DRAINAGE IMPROVEMENTS

OPINION OF COST SUMMARY (1.13.23)

Section A - Prospect Avenue Culvert Replacement:	**$644,516**
Section B - Patteron Street Culvert Replacement:	**$517,568**
Total Construction Cost:	**$1,162,084**
5% Contingency on Construction:	**$58,104**
Hydrologic & Hydraulic Study:	**$19,000**
Engineering & Contract Administration:	**$75,000**
Grant Administration:	**$45,500**
TOTAL PROJECT COST:	**$1,359,688**

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CITY OF RAEFORD

EAST PROSPECT AVENUE

STORM DRAINAGE IMPROVEMENTS

OPINION OF COST (1.13.23)

Section A: East Prospect Ave. Culvert Replacement					
	ITEM	UNIT	QTY.	UNIT PRICE	TOTAL COST
1.	Mobilization	LS			$16,500.00
2.	Staking	LS			$2,700.00
3.	Traffic Control	LS			$9,000.00
4.	Clearing and Grubbing	LS			$4,500.00
5.	Remove and Dispose of Existing 8' x 5' Culvert	LF	50.0	$175.00	$8,750.00
6.	Remove and Salvage Ex. Guardrail (E. Prospect Ave.)	LF	200	$15.00	$3,000.00
7.	Re-Install Guardrail	LF	200	$35.00	$7,000.00
8.	Guardrail Terminal End Section (Salvaged)	Ea.	4	$2,750.00	$11,000.00
9.	Stream Bypassing	Ea.	1	$35,000.00	$35,000.00
10.	Double 9' x 5' RCBC (E. Prospect Ave.)	LF	60	$6,650.00	$399,000.00
11.	Comprehensive Grading	LS			$12,898.00
12.	Select Fill	CY	150	$60.00	$9,000.00
13.	Remove and Replace Ex. Asphalt	SY	210	$250.00	$52,500.00
14.	Thermoplastic Pavement Marking (4" Double Yellow)	LF	40	$20.00	$800.00
15.	Thermoplastic Pavement Marking (4" White)	LF	80	$9.60	$768.00
16.	Existing Utility Adjustments / Coordination	LS			$20,000.00
17.	Erosion Control, Cleanup, Seed & Mulch	Ac.	0.6	$8,500.00	$5,100.00
18.	Permanent and Temporary Easements	LS			$12,000.00
19.	Replace 400 LF Paved Ditch Line with Sod Ditch Line	LS			$35,000.00

TOTAL CONSTRUCTION COST: $644,516

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CITY OF RAEFORD

PATTERSON STREET

STORM DRAINAGE IMPROVEMENTS

OPINION OF COST (1.13.23)

Section B: Patterson St. Culvert Replacement					
	ITEM	**UNIT**	**QTY.**	**UNIT PRICE**	**TOTAL COST**
1.	Mobilization	LS			$11,000.00
2.	Staking	LS			$1,800.00
3.	Traffic Control	LS			$6,000.00
4.	Clearing and Grubbing	LS			$3,000.00
5.	Remove and Dispose of Existing 60" Culvert	LF	64.0	$50.00	$3,200.00
6.	Stream Bypassing	Ea.	1	$35,000.00	$35,000.00
7.	Double 8' x 5' RCBC (Patterson St.)	LF	60	$6,150.00	$369,000.00
8.	Reconnect Existing Storm Branches	Ea.	2	$3,000.00	$6,000.00
9.	Comprehensive Grading	LS			$8,600.00
10.	Select Fill	CY	100	$60.00	$6,000.00
11.	Remove and Replace Ex. Asphalt	SY	140	$250.00	$35,000.00
12.	Thermoplastic Pavement Marking (4" Double Yellow)	LF	40	$20.00	$800.00
13.	Thermoplastic Pavement Marking (4" White)	LF	80	$9.60	$768.00
14.	Existing Utility Adjustments / Coordination	LS			$20,000.00
15.	Erosion Control, Cleanup, Seed & Mulch	Ac.	0.4	$8,500.00	$3,400.00
16.	Permanent and Temporary Easements	LS			$8,000.00

TOTAL CONSTRUCTION COST: $517,568

PEDLERS BRANCH AT PATTERSON STREET & E. PROSPECT AVENUE
EXISTING CULVERTS HYDROLOGIC & HYDRAULIC STUDY
AND PROJECT AREA FLOOD STUDY

CITY OF RAEFORD, HOKE COUNTY, NC

The certification shown below applies only to the items listed on this 'Table of Contents'

Table of Contents

HILLIARD ENGINEERING

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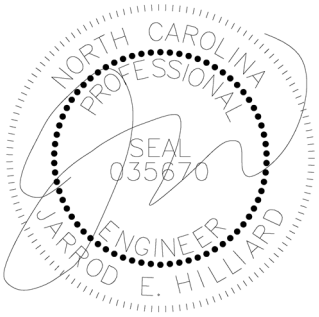


Date: 1/22/19

I. Scope of Study

This report presents hydrologic study of the upper reach of two (2)-streams within the Upper Rockfish Creek basin of the Cape Fear River basin, hydraulic study of an existing 8'x5' reinforced concrete box culvert (RCBC), hydraulic study of an existing 60" reinforced concrete pipe (RCP), and flood study of Pedler Branch. The streams contributing to the drainage area associated with this study include most of Pedler Branch and all of Pedler Branch Tributary. There are two points of interest (POI) for this study. One is at the intersection of Patterson Street and Pedler Branch and the other is at the intersection of E. Prospect Avenue and Pedler Branch.

The purpose of this study is to perform a hydrologic evaluation of the drainage basin associated with the aforementioned existing culverts, to perform hydraulic evaluation of the existing culverts in order to verify existing capacity, and to evaluate the effects, potential impacts, and estimated costs of proposed improvements.

II. Analysis

II.a.1 Hydrologic Analysis Methods

The hydrologic methods utilized for this study include regression equations from the Sandhills Hydrologic Region of the United States Geological Survey (USGS) Water Resources Investigations Report (WRIR) 01-4207 and USGS WRIR 96-4084.

WRIR 01-4207 regression equations were applied to Pedler Branch Tributary due to the rural nature of the drainage basin and WRIR 96-4084 regression equations were applied to Pedler Branch due to the urban nature of the drainage basin.

The upper reach of Pedler Branch basin includes a significant portion of impervious area within the City of Raeford. The fixed impervious area portion of the Pedler Branch drainage area was determined by manual delineation utilizing orthophotographic images obtained from the *NC One Map* geospatial portal and previous studies performed by this office for Pedler Branch and Pedler Branch Tributary.

The drainage areas associated with the regression equations were determined by manual delineation utilizing contours and related structures within the project area from each POI to the highest point within the watershed.

II.a.2 Recurrence Interval Discharges at POI #1 (Patterson Street @ Pedler Branch)

Stream Name:	**Pedler Branch Tributary**					
Hydrologic Method Utilized:	USGS WRIR Investigations Report 01-4207					
Delineated Drainage Area (sq. mi.):	0.79					
Rural Flood Recurrence Interval:	2	5	10	25	50	100
Rural Flood Recurrence Discharges (cfs):	28.32	47.05	61.85	83.32	101.96	121.59

Stream Name:	**Pedler Branch**					
Hydrologic Method Utilized:	USGS WRIR Investigations Report 96-4084					
Delineated Drainage Area (sq. mi.):	1.68					
Relative Impervious Area (%):	24.60					
Flood Recurrence Interval:	2	5	10	25	50	100
Rural Equivalent Flood Recurrence Discharges (cfs):	*43.44*	*71.56*	*94.54*	*127.27*	*155.51*	*187.19*
Urban Flood Recurrence Discharges (cfs):	279.63	445.06	559.28	725.37	839.65	947.26

Total Flood Recurrence Discharges @ POI (cfs):	**307.96**	**492.11**	**621.13**	**808.68**	**941.61**	**1068.85**

II.a.3 Recurrence Interval Discharges at POI #2 (E. Prospect Ave. @ Pedler Branch)

Stream Name:	**Pedler Branch Tributary**					
Hydrologic Method Utilized:	USGS WRIR Investigations Report 01-4207					
Delineated Drainage Area (sq. mi.):	0.79					
Rural Flood Recurrence Interval:	2	5	10	25	50	100
Rural Flood Recurrence Discharges (cfs):	28.32	47.05	61.85	83.32	101.96	121.59

Stream Name:	**Pedler Branch**					
Hydrologic Method Utilized:	USGS WRIR Investigations Report 96-4084					
Delineated Drainage Area (sq. mi.):	1.78					
Relative Impervious Area (%):	24.60					
Flood Recurrence Interval:	2	5	10	25	50	100
Rural Equivalent Flood Recurrence Discharges (cfs):	*45.32*	*74.68*	*98.67*	*132.91*	*162.46*	*195.63*
Urban Flood Recurrence Discharges (cfs):	292.05	463.45	581.60	752.88	871.15	982.40

Total Flood Recurrence Discharges @ POI (cfs):	**320.38**	**510.50**	**643.46**	**836.19**	**973.11**	**1104.00**

II.b Hydraulic Analysis Methods

The hydraulic method utilized for the culverts in this study are based upon the United States Department of Transportation (USDOT) Federal Highway Administration (FHWA) Publication No. FHWA-HIF-12-026 Hydraulic Design Series Number 5 (HDS-5).

The effect of the 100-year flood recurrence interval was evaluated utilizing the Hydrologic Engineering Center River Analysis System (HEC-RAS) floodplain modeling software due to the project location being with a Zone AE Flood Hazard Area as depicted on Panel 9434 of the Flood Insurance Rate Map (FIRM) and in accordance with the National Flood Insurance Program (NFIP).

Existing data related to roadway, stream, terrain and culvert invert elevations, including culvert material, entrance treatment, and exit treatment, were obtained by a combination of topographical survey, field reconnaissance and effective flood model data.

II.c Comparison to Accepted Standards

The 25-year recurrence discharges calculated for this study were utilized for the culverts at Patterson Street and E. Prospect Ave based upon North Carolina Department of Transportation (NCDOT) design criteria and due to their location within a City street.

The 100-year recurrence discharges calculated for this study were compared to that of the limited detail study, hydrology, and hydraulic modeling techniques utilized to create the effective FIRM associated with the project area. The calculated discharges represent a difference of an additional 170 cfs at Patterson Street and an additional 159 cfs at E. Prospect Ave. Based upon consultation with North Carolina Floodplain Mapping staff, the effective discharges were utilized for the existing and proposed conditions floodplain analysis.

III. Results

The results of the evaluation of the existing 60" RCP at Patterson Street and the existing 8'x5' RCBC at East Prospect Avenue indicate that the culvert capacity of each culvert is significantly exceeded during the 25-year recurrence interval or higher. These results indicate that roadway over-topping could occur during these storm events.

IV. Recommendation(s) / Disclaimer(s)

Based upon the 25-year recurrence interval evaluation, **we recommend that the existing 60" RCP culvert on Patterson Street be replaced with a double line of 8'x5' RCBC or equivalent. We recommend that the existing 8'x5' RCBC on E. Prospect Ave. be replaced with a double line of 9'x5' RCBC or equivalent.** All calculations and cost estimates for the proposed culvert replacements are based upon the use of the aforementioned recommended culverts. Should an equivalent different material, shape, or configuration of culvert be considered for use on this project, contact this office for evaluation of the culvert being considered prior to final design.

The recommended culvert size for this project was based upon a target freeboard of 1.0' from the lowest surveyed edge of the existing pavement for this project in accordance with hydraulic

Engineering standards. The actual calculated freeboard for Patterson Street is 11" and for E. Prospect Ave. is 10". Based upon the proximity to the target freeboard of 1.0' and the cost increase and benefit associated with up-sizing the culvert to obtain a few inches of freeboard, we recommend that the roadway be built back with these additional few inches of height in order to obtain the recommended 1.0' freeboard. The additional cost for this increased roadway height is included in the budget estimate proposed for the project.

Although an increase in the size of the culvert at the POIs should eliminate roadway over-topping during the 25-year recurrence interval or smaller storm events, a significant change in the hydraulic characteristics of the stream could occur due to this change.

Based upon the floodplain hydraulic evaluation mentioned herewithin, a reduction in the Base Flood Elevations would occur along Pedler Branch from a point approximately 311' upstream of Patterson Street to E. Prospect Ave. No additional effects downstream of E. Prospect Ave. were discovered during the evaluation.

As described herewithin, the proposed culvert replacements would result in changes to Special Flood Hazard Areas as defined by the Federal Emergency Management Agency (FEMA). According to the FEMA Community Status Book Report, the City of Raeford is a participating community in the National Flood Program (Community ID: 370132) and will have additional floodplain management permitting requirements associated with this project.

Reference the Appendices of this report for calculations, results and estimates associated with this study.

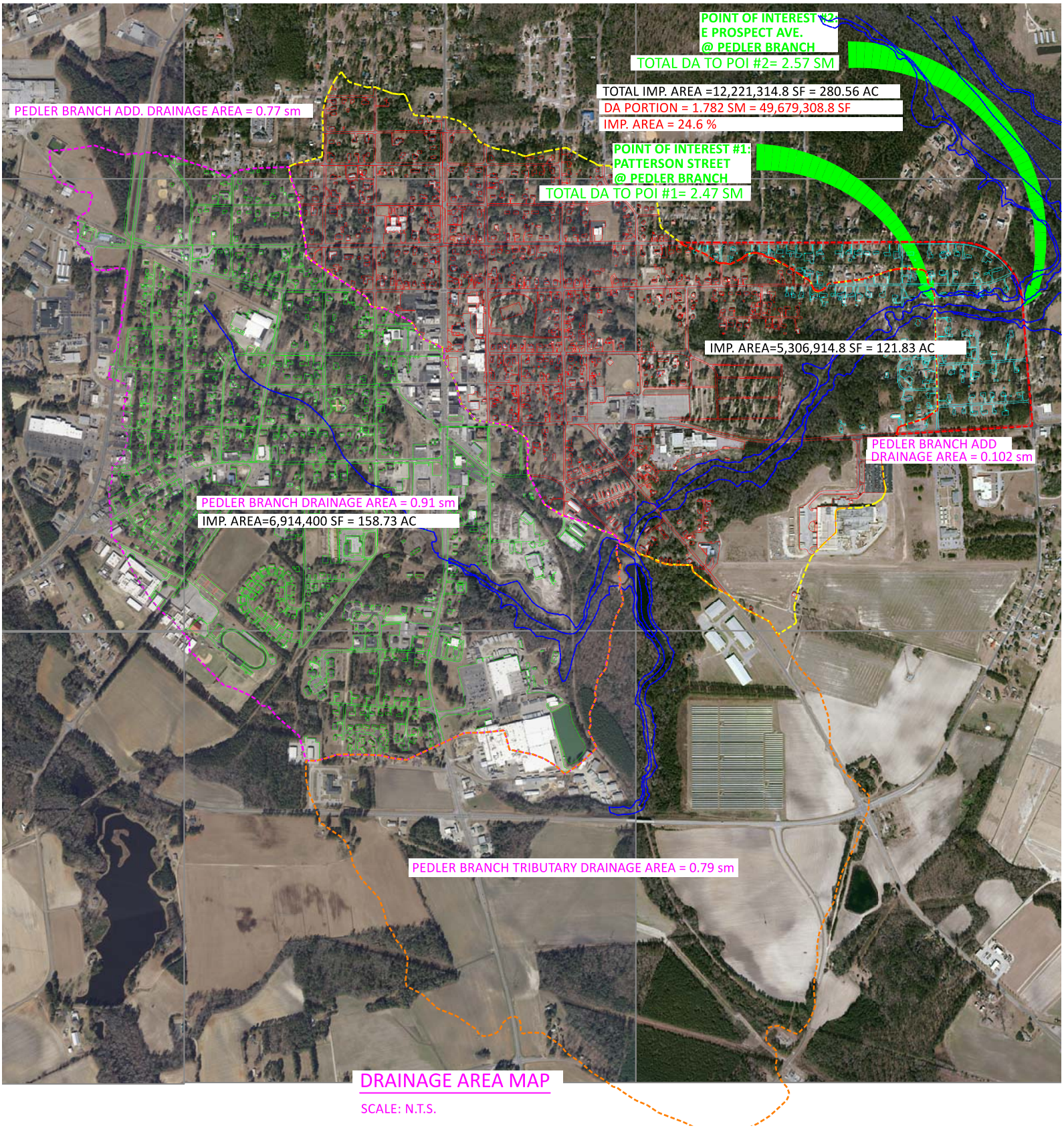
APPENDIX A

HYDROLOGICAL ANALYSIS DATA

Drainage/Impervious Area Map

Patterson Street Runoff

E. Prospect Ave. Runoff



DRAINAGE AREA MAP

SCALE: N.T.S.

PATTERSON STREET CULVERT EVALUATION

RECURRENCE INTERVAL DISCHARGES

Point of Interest (POI)=Intersection of Pedler Branch and Patterson Street

Stream Name: **Pedler Branch Tributary** Hydrologic Method Utilized: USGS WRIR Investigations Report 01-4207 Delineated Drainage Area (sq. mi.): 0.79						
Rural Flood Recurrence Interval:	2	5	10	25	50	100
Rural Flood Recurrence Discharges (cfs):	28.32	47.05	61.85	83.32	101.96	121.59

Stream Name: **Pedler Branch** Hydrologic Method Utilized: USGS WRIR Investigations Report 96-4084 Delineated Drainage Area (sq. mi.): 1.68 Relative Impervious Area (%): 24.60						
Flood Recurrence Interval:	2	5	10	25	50	100
Rural Equivalent Flood Recurrence Discharges (cfs):	*43.44*	*71.56*	*94.54*	*127.27*	*155.51*	*187.19*
Urban Flood Recurrence Discharges (cfs):	279.63	445.06	559.28	725.37	839.65	947.26

Total Flood Recurrence Discharges @ POI (cfs):	**307.96**	**492.11**	**621.13**	**808.68**	**941.61**	**1068.85**

EAST PROSPECT AVENUE CULVERT EVALUATION

RECURRENCE INTERVAL DISCHARGES

Point of Interest (POI)=Intersection of Pedler Branch and E Prospect Avenue

Stream Name: **Pedler Branch Tributary** Hydrologic Method Utilized: USGS WRIR Investigations Report 01-4207 Delineated Drainage Area (sq. mi.): 0.79						
Rural Flood Recurrence Interval:	2	5	10	25	50	100
Rural Flood Recurrence Discharges (cfs):	28.32	47.05	61.85	83.32	101.96	121.59

Stream Name: **Pedler Branch** Hydrologic Method Utilized: USGS WRIR Investigations Report 96-4084 Delineated Drainage Area (sq. mi.): 1.78 Relative Impervious Area (%): 24.60						
Flood Recurrence Interval:	2	5	10	25	50	100
Rural Equivalent Flood Recurrence Discharges (cfs):	*45.32*	*74.68*	*98.67*	*132.91*	*162.46*	*195.63*
Urban Flood Recurrence Discharges (cfs):	292.05	463.45	581.60	752.88	871.15	982.40

Total Flood Recurrence Discharges @ POI (cfs):	**320.38**	**510.50**	**643.46**	**836.19**	**973.11**	**1104.00**

APPENDIX B

HYDRAULIC CULVERT ANALYSIS DATA

EXISTING CONDITIONS

Patterson St. Existing Conditions, HDS-5 Analysis

E. Prospect Ave. Existing Conditions, HDS-5 Analysis

Existing Conditions Culvert Sizes and Flow Areas

PROPOSED CONDITIONS

Patterson St. Proposed Conditions, HDS-5 Analysis

E. Prospect Ave. Proposed Conditions, HDS-5 Analysis

Proposed Conditions Culvert Sizes and Flow Areas

EXISTING CONDITIONS

PROJECT: **RF1801**

Patterson Street Culvert Evaluation

Evaluate Existing 60" RCP Culvert

STATION: **FIRM Panel 9434, XS 031 Pedler Branch**

Sheet: 1 of 1

CULVERT EVALUATION FORM

DESIGNER/DATE: JEH 12/9/2018

REVIEWER/DATE: JEH 1/7/2019

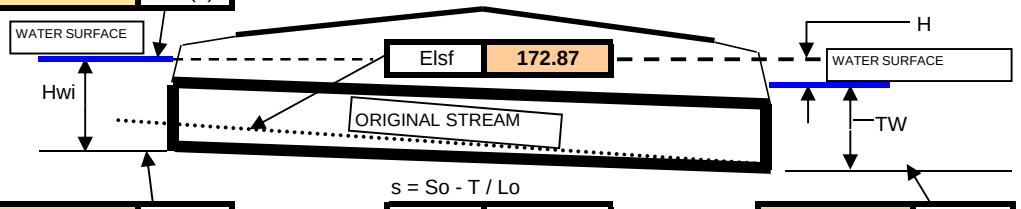
SEE ADD'L SHTS.

HYDROLOGICAL DATA

X	METHOD:	WRI 01-4207 & WRI 96-4084
X	DRAINAGE AREA:	2.47 sm
	CHANNEL SHAPE:	
	ROUTING:	

ROADWAY ELEVATION: 180.92 ft.

179.92 Elha (ft)



DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
25	808.68	0.00

172.71 Eli (ft)

s = So - T / Lo

s = -0.20%

Lo = 64

172.84 Elo (ft)

CULVERT DESCRIPTION MATERIAL - SHAPE - SIZE (in) - ENTRANCE SHAPE: C=CIRCULAR, A=ARCH, B=BOX				TOTAL FLOW Q (cfs)	FLOW PER BARREL Q / N (1)
RCP	*C*	*60*	*EW*	808.68	808.68

NUMBER OF BARRELS TO TRY: 1

HEADWATER CALCULATIONS

INLET CONTROL				OUTLET CONTROL							Control Headwater Elevation	Comments
HWI / D (2)	Hwi	T (3)	Elhi (4)	TW (5)	dc	dc + D / 2	ho (6)	ke	H (7)	El ho (8)		
6	30.00	22.95	202.71	0	5.15	5.075	5.075	0.5	20	197.92	202.71	over-tops road
(Not within range of Chart 1B)					*(Not within range of Chart 4B)*				*(Not within range of Chart 5B)*			

r (ft.):	2.50	
d (ft):	27.50	Over Half
Area of Pipe (ft²):	19.63	9.817477042
Flow Area (ft²):	19.63	
Outlet Velocity (ft/s):	41.19	*false velocity*
Top of Pipe Elevation (ft):	178.38	

(1) USE Q / NB FOR BOX CULVERTS (PI()*M27^2)-(M27^2*ACOS(M28/M27)-M28*SQRT(M27^2-M28^2)

(2) FROM HDS-5 DESIGN CHARTS

(3) T = Hwi - (ELhd-Elsf); T IS ZERO FOR CULVERTS ON GRADE

(4) Elhi = Hwi+Eli

(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW DEPTH IN CHANNEL

(6) ho = TW or (dc + D/2); (WHICHEVER IS GREATER)

(7) FROM HDS-5 DESIGN CHARTS

(8) Elho = Elo + H + ho

PROJECT: **RF1801**

E. Prospect Avenue Culvert Evaluation

Evaluate Existing 8'x5' RC Box Culvert

STATION: **FIRM Panel 9434, XS 021 Pedler Branch**

Sheet: 1 of 1

CULVERT EVALUATION FORM

DESIGNER/DATE: JEH 12/11/2018

REVIEWER/DATE: JEH 1/8/2019

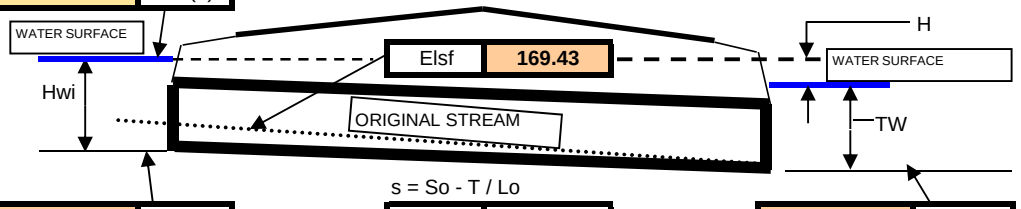
SEE ADD'L SHTS.

HYDROLOGICAL DATA

X	METHOD:	**WRI 01-4207 & WRI 96-4084**
X	DRAINAGE AREA:	**2.57 sm**
	CHANNEL SHAPE:	
	ROUTING:	

ROADWAY ELEVATION: **177.05** ft.

176.05 Elha (ft)



DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
25	**836.19**	**2.12**

169.43 Eli (ft)

s = So - T / Lo

s = **3.07%**

Lo = **48.5**

167.94 Elo (ft)

CULVERT DESCRIPTION				TOTAL FLOW Q (cfs)	FLOW PER BARREL Q / N (1)
MATERIAL - SHAPE - SIZE (in) - ENTRANCE					
SHAPE: C=CIRCULAR, A=ARCH, B=BOX					
RC	***B***	***60***	***EW***	**836.19**	**836.19**

NUMBER OF BARRELS TO TRY: **1**

SINGLE 8'X5'

HEADWATER CALCULATIONS

INLET CONTROL				OUTLET CONTROL							Control Headwater Elevation	Comments
HWI / D (2)	Hwi	T (3)	Elhi (4)	TW (5)	dc	dc + D / 2	ho (6)	ke	H (7)	El ho (8)		
3.9	**19.50**	**12.88**	**188.93**	**2.12**	**7**	**6**	**6**	**0.5**	**11**	**184.94**	**188.93**	**over-tops road**
(Chart 8B)					***(Chart 14B)***				***(Chart 15B)***			

r (ft.):	**2.50**	
d (ft):	**17.00**	**Over Half**
Area of Pipe (ft²):	**40.00**	**20**
Flow Area (ft²):	**40.00**	
Outlet Velocity (ft/s):	**20.90**	*false velocity*
Top of Pipe Elevation (ft):	**175.1**	

(1) USE Q / NB FOR BOX CULVERTS (PI()*M27^2)-(M27^2*ACOS(M28/M27)-M28*SQRT(M27^2-M28^2)

(2) FROM HDS-5 DESIGN CHARTS

(3) T = Hwi - (ELhd-Elsf); T IS ZERO FOR CULVERTS ON GRADE

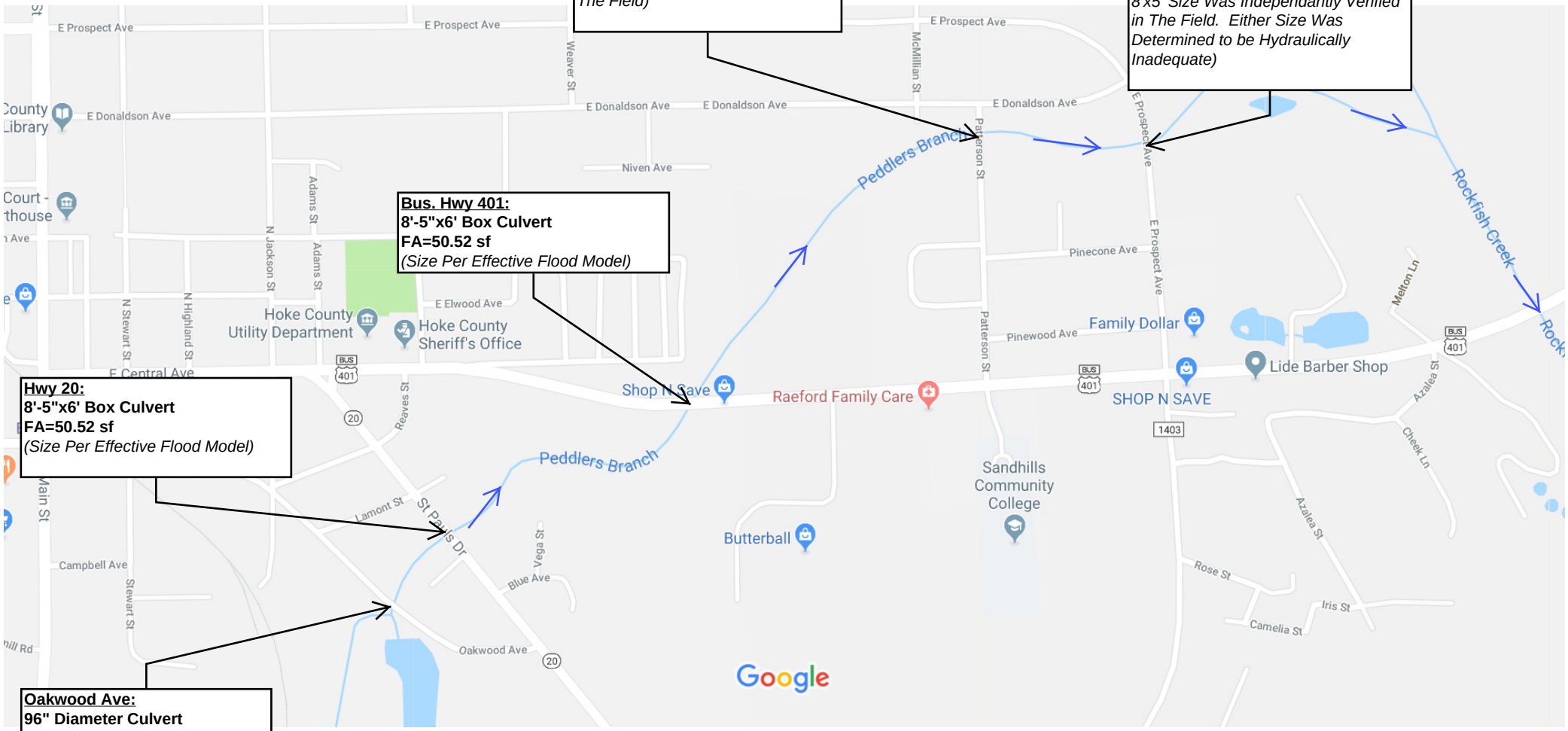
(4) Elhi = Hwi+Eli

(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW DEPTH IN CHANNEL

(6) ho = TW or (dc + D/2); (WHICHEVER IS GREATER)

(7) FROM HDS-5 DESIGN CHARTS

(8) Elho = Elo + H + ho



EXISTING CONDITIONS CULVERT SIZES AND FLOW AREAS (FA)
N.T.S.

PROPOSED CONDITIONS

PROJECT: **RF1801**
Patterson Street Culvert Evaluation
Evaluate Proposed Culvert

STATION: **FIRM Panel 9434, XS 031 Pedler Branch**
Sheet: 1 of 1

CULVERT EVALUATION FORM

DESIGNER/DATE: JEH 12/9/2018
REVIEWER/DATE: JEH 1/7/2019

HYDROLOGICAL DATA

SEE ADD'L SHTS.

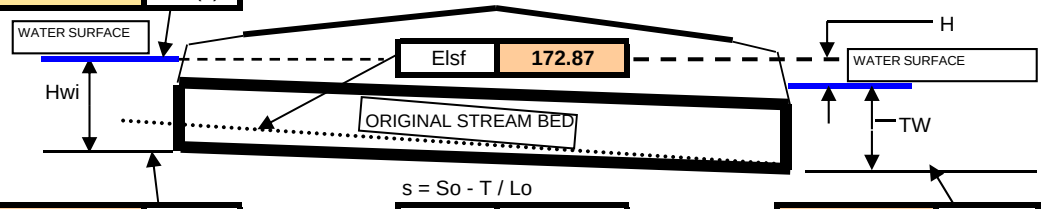
X	METHOD:	WRI 01-4207 & WRI 96-4084
X	DRAINAGE AREA:	2.47 sm
	CHANNEL SHAPE:	
	ROUTING:	

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
25	808.68	0.00

ROADWAY ELEVATION: 180.92 ft.

179.96 Elha (ft)



172.71 Eli (ft)

s = So - T / Lo

s = 0.36%
Lo = 58.55

172.5 Elo (ft)

CULVERT DESCRIPTION				TOTAL FLOW Q (cfs)	FLOW PER BARREL Q / N (1)
MATERIAL - SHAPE - SIZE (in) - ENTRANCE					
SHAPE: C=CIRCULAR, A=ARCH, B=BOX					
RC	*B*	*60*	*EW*	808.68	404.34

NUMBER OF BARRELS TO TRY: 2

Double 8'x5'

HEADWATER CALCULATIONS

INLET CONTROL				OUTLET CONTROL							Control Headwater Elevation	Comments
HWI / D (2)	Hwi	T (3)	Elhi (4)	TW (5)	dc	dc + D / 2	ho (6)	ke	H (7)	El ho (8)		
1.45	7.25	0.16	179.96	0	4.3	4.65	4.65	0.5	2.7	179.85	179.96	O.K.
(Chart 8B)					*(Chart 14B)*				*(Chart 15B)*			

r (ft.):	2.50
d (ft):	4.75
Area of Pipe (ft²):	40.00
Flow Area (ft²):	40.00
Outlet Velocity (ft/s):	10.11
Top of Pipe Elevation (ft):	178.38

Over Half
20

NOTE: Freeboard =11"

(1) USE Q / NB FOR BOX CULVERTS (PI()*M27^2)-(M27^2*ACOS(M28/M27)-M28*SQRT(M27^2-M28^2)
(2) FROM HDS-5 DESIGN CHARTS
(3) T = Hwi - (ELhd-Elsf); T IS ZERO FOR CULVERTS ON GRADE
(4) Elhi = Hwi+Eli
(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW DEPTH IN CHANNEL
(6) ho = TW or (dc + D/2); (WHICHEVER IS GREATER)
(7) FROM HDS-5 DESIGN CHARTS
(8) Elho = Elo + H + ho

PROJECT: **RF1801**

E. Prospect Avenue Culvert Evaluation

Evaluate Proposed Culvert

STATION: **FIRM Panel 9434, XS 021 Pedler Branch**

Sheet: 1 of 1

CULVERT EVALUATION FORM

DESIGNER/DATE: JEH 12/11/2018

REVIEWER/DATE: JEH 1/8/2019

SEE ADD'L SHTS.

HYDROLOGICAL DATA

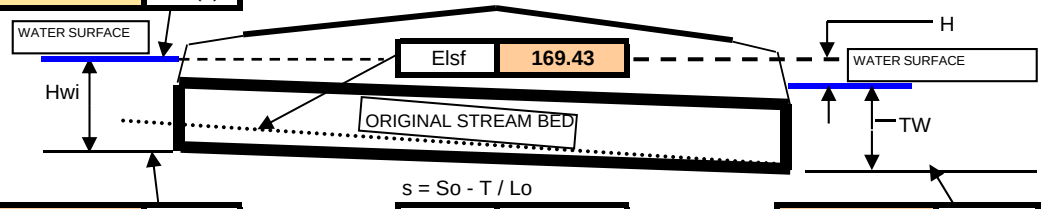
X	METHOD:	**WRI 01-4207 & WRI 96-4084**
X	DRAINAGE AREA:	**2.57 sm**
	CHANNEL SHAPE:	
	ROUTING:	

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
25	**836.19**	**2.12**

ROADWAY ELEVATION **177.05** ft.

176.18 Elha (ft)



s = So - T / Lo

s =	**3.07%**
Lo =	**48.5**

167.94 Elo (ft)

169.43 Eli (ft)

CULVERT DESCRIPTION MATERIAL - SHAPE - SIZE (in) - ENTRANCE SHAPE: C=CIRCULAR, A=ARCH, B=BOX				TOTAL FLOW Q (cfs)	FLOW PER BARREL Q / N (1)
RC	***B***	***60***	***EW***	**836.19**	**418.095**

NUMBER OF BARRELS TO TRY: **2**

DOUBLE 9'X5'

HEADWATER CALCULATIONS

INLET CONTROL				OUTLET CONTROL							Control Headwater Elevation	Comments
HWI / D (2)	Hwi	T (3)	Elhi (4)	TW (5)	dc	dc + D / 2	ho (6)	ke	H (7)	El ho (8)		
1.35	**6.75**	**0**	**176.18**	**2.12**	**4**	**4.5**	**4.5**	**0.5**	**2.125**	**174.57**	**176.18**	**O.K.**
(Chart 8B)					***(Chart 14B)***				***(Chart 15B)***			

r (ft.):	**2.50**
d (ft):	**4.25**
Area of Pipe (ft²):	**45.00**
Flow Area (ft²):	**45.00**
Outlet Velocity (ft/s):	**9.29**
Top of Pipe Elevation (ft):	**175.1**

Over Half

22.5

NOTE: FREEBOARD = 10"

(1) USE Q / NB FOR BOX CULVERTS (PI()*M27^2)-(M27^2*ACOS(M28/M27)-M28*SQRT(M27^2-M28^2)

(2) FROM HDS-5 DESIGN CHARTS

(3) T = Hwi - (ELhd-Elsf); T IS ZERO FOR CULVERTS ON GRADE

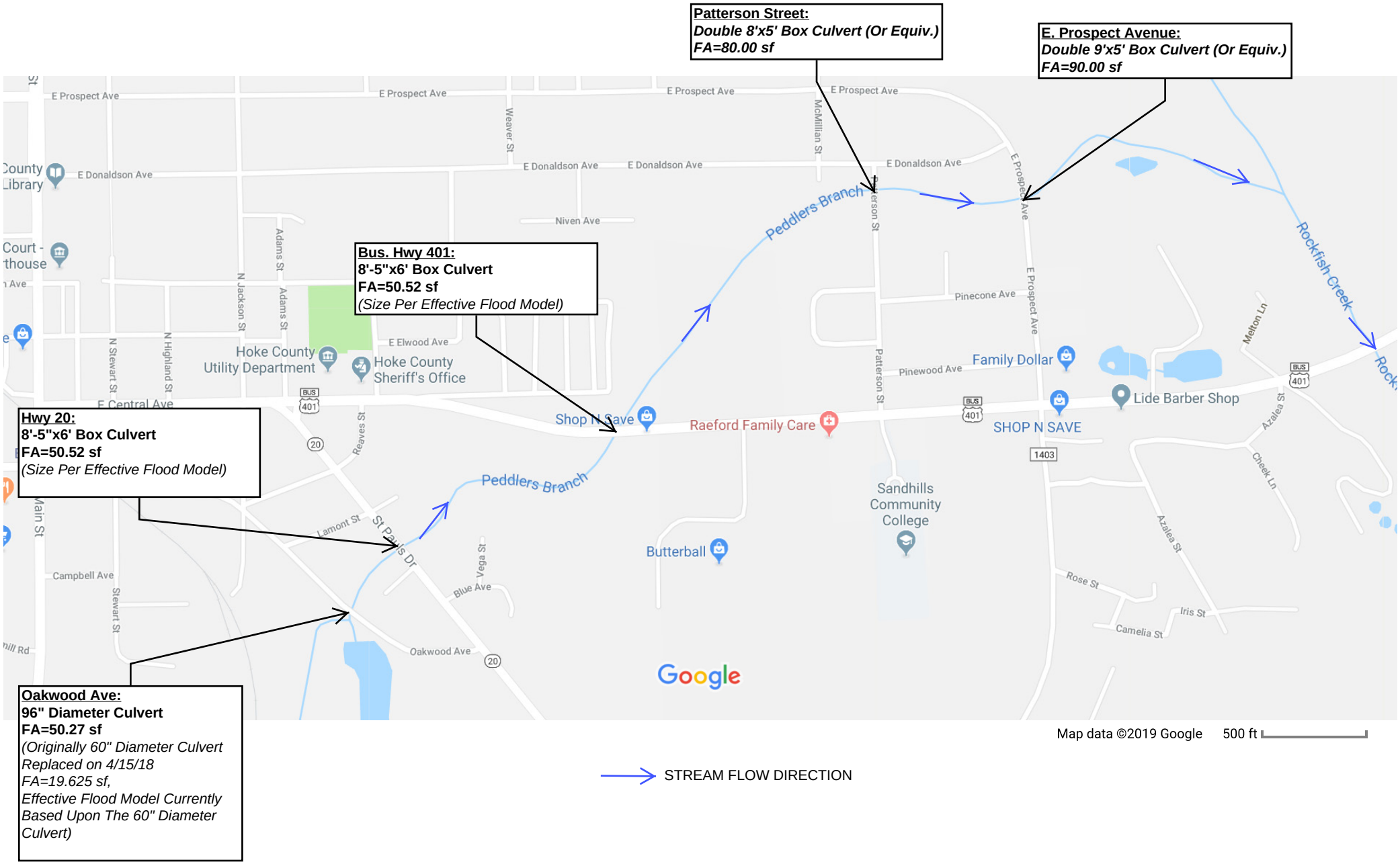
(4) Elhi = Hwi+Eli

(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW DEPTH IN CHANNEL

(6) ho = TW or (dc + D/2); (WHICHEVER IS GREATER)

(7) FROM HDS-5 DESIGN CHARTS

(8) Elho = Elo + H + ho



PROPOSED CONDITIONS CULVERT SIZES AND FLOW AREAS (FA)
N.T.S.

APPENDIX C

HYDRAULIC FLOODPLAIN ANALYSIS DATA

Effective Flood Insurance Rate Map, Panel 9434

Duplicate Effective Data (Multiple Pages)

Existing Conditions Data (Multiple Pages

Proposed Conditions Data (Multiple Pages)

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://FRIS.NC.GOV/FRIS

FLOOD HAZARD INFORMATION

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*

OTHER AREAS

- Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike, or Floodwall
- Non-accredited Levee, Dike, or Floodwall
- BM5510 North Carolina Geodetic Survey bench mark
- BM5510 National Geodetic Survey bench mark
- BM5510 Contractor Est. NCFMP Survey bench mark
- 012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline

OTHER FEATURES

- Hydrographic Feature
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at http://www.ncfloodmaps.com, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

- Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

This map may include approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

- CBRS Area
- Otherwise Protected Area

SCALE

Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 9434

FEMA

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
HOKE COUNTY	370397	9434	J
RAEFORD, CITY OF	370132	9434	J

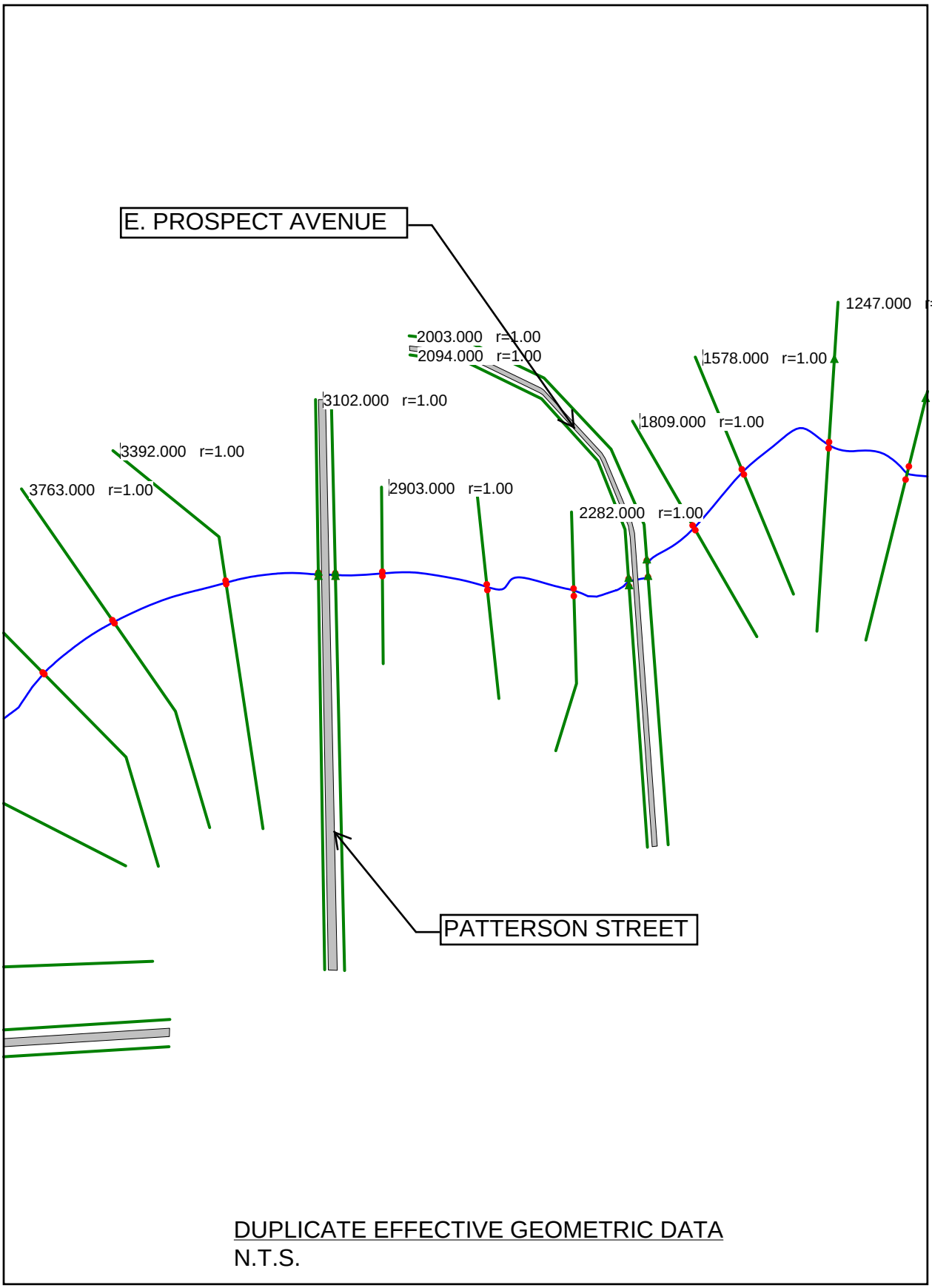
MAP NUMBER
3710943400J

MAP REVISED
10/17/06

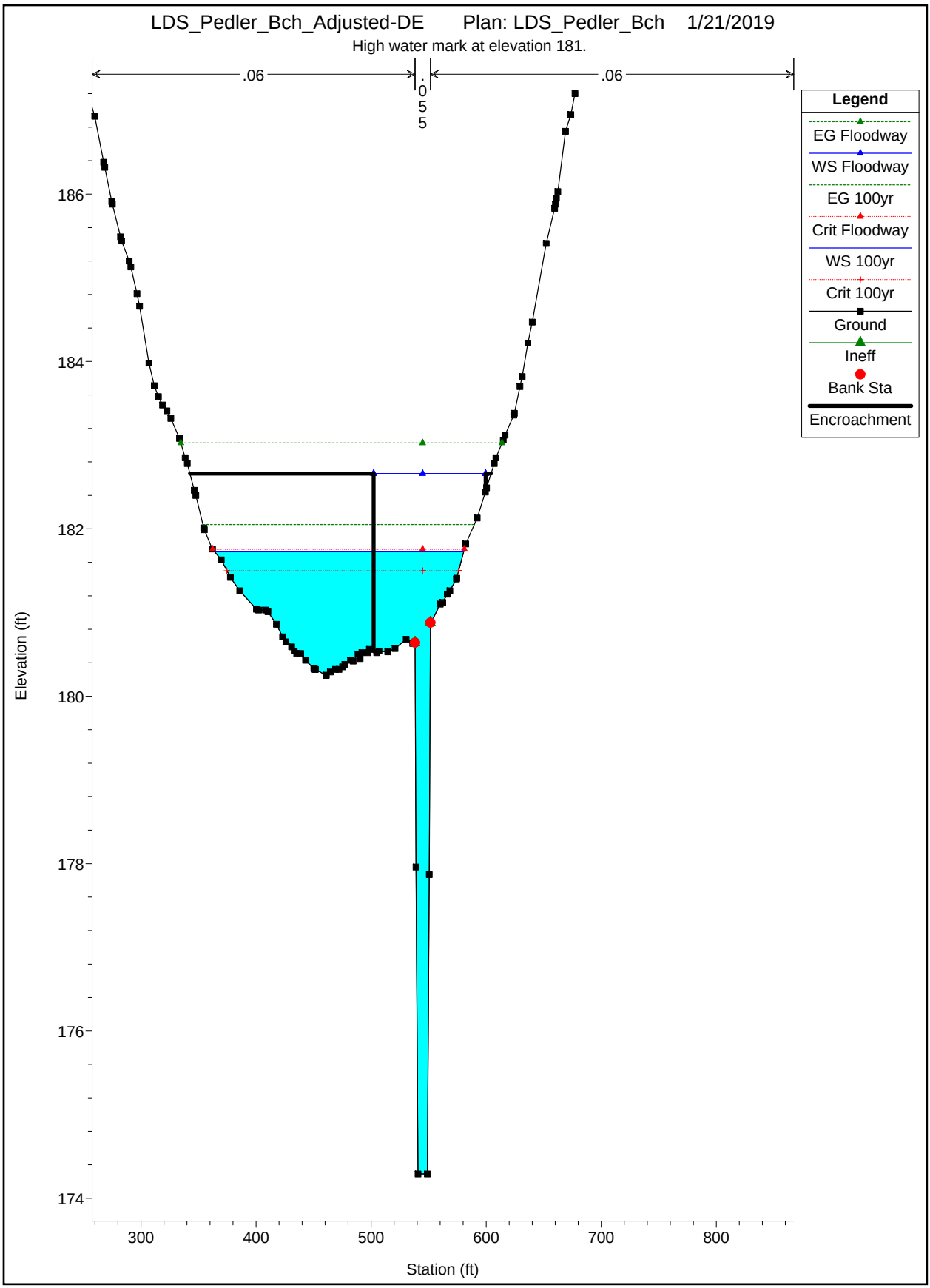
NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

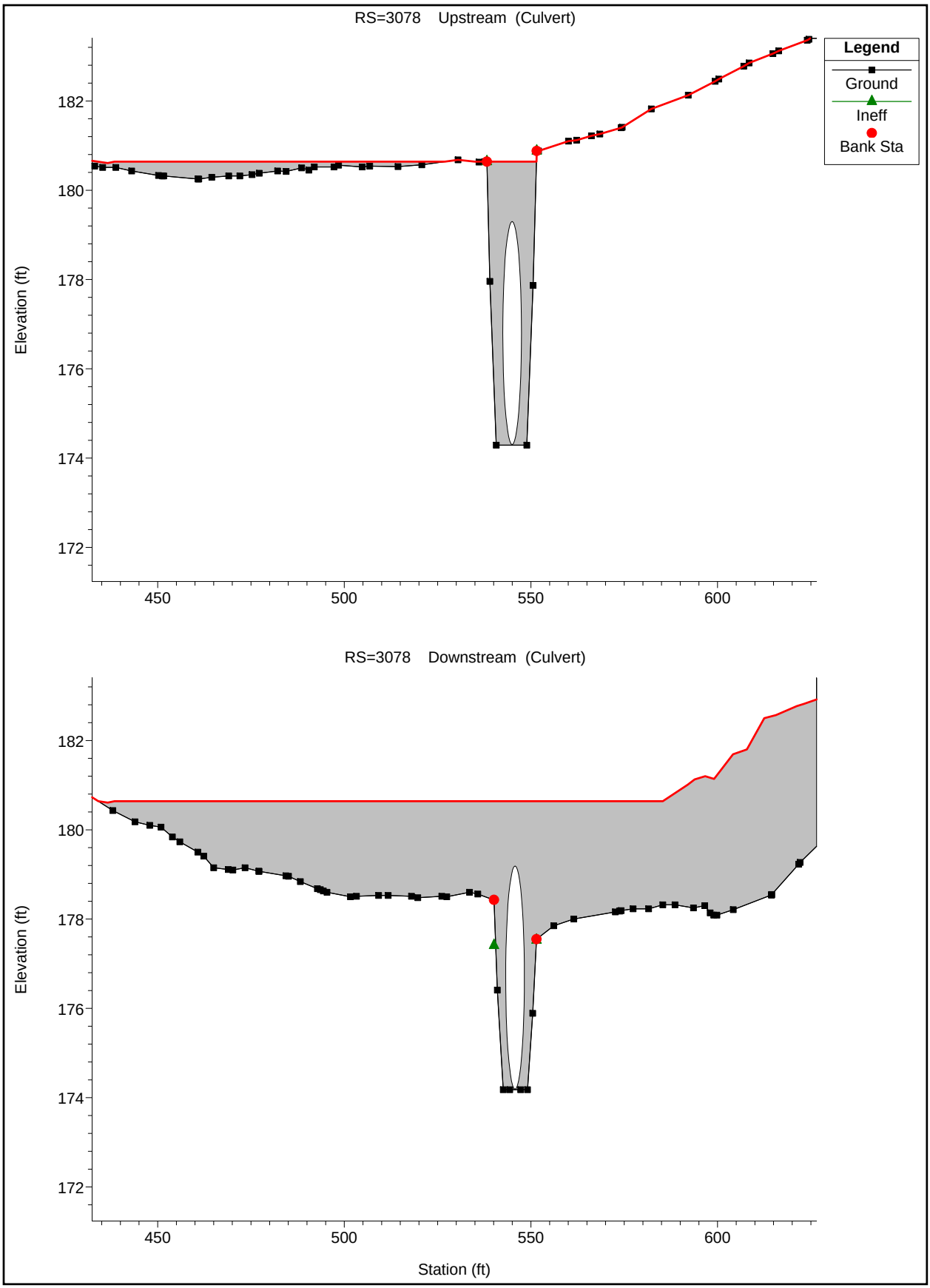
This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

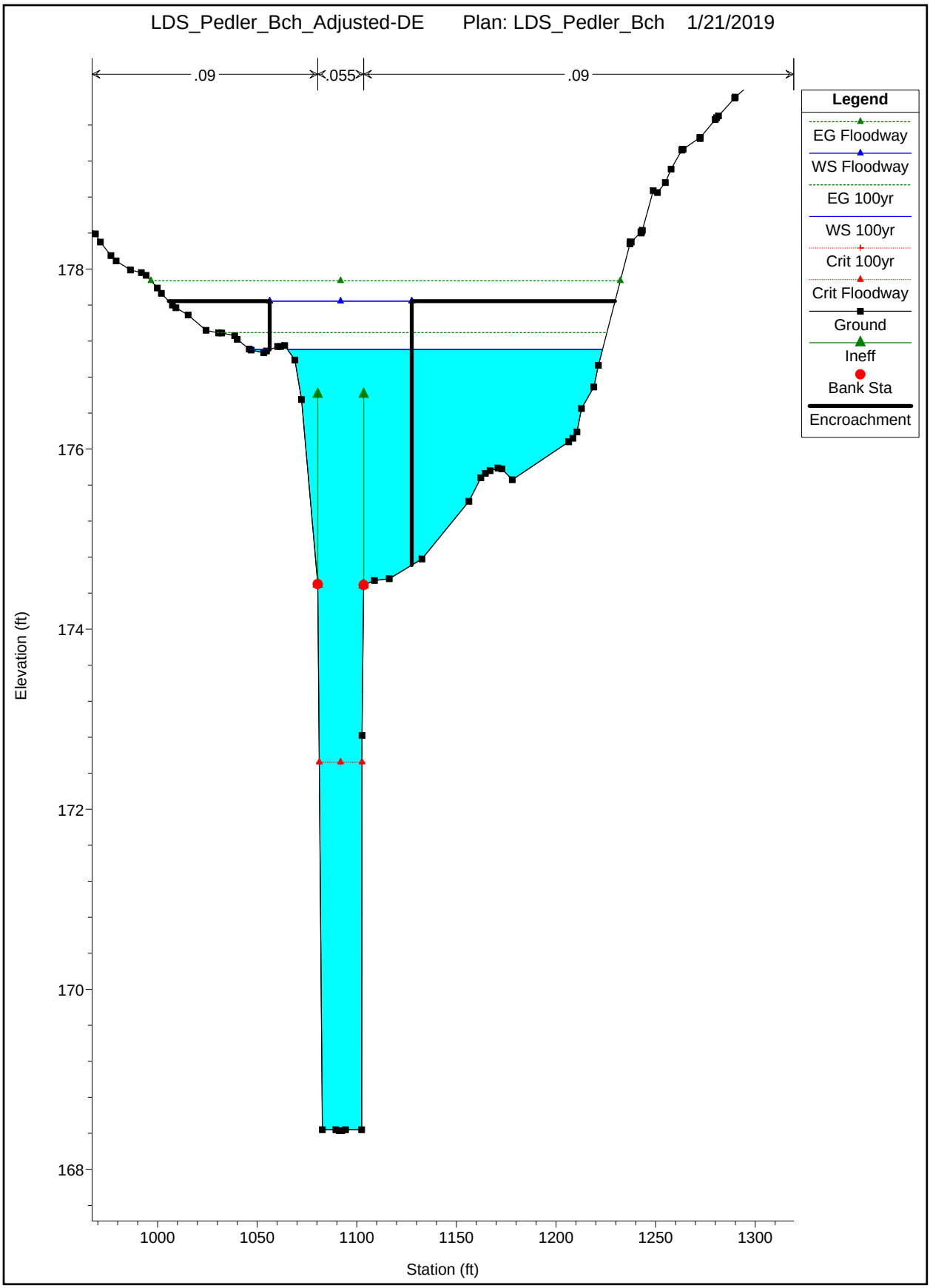
DUPLICATE EFFECTIVE DATA

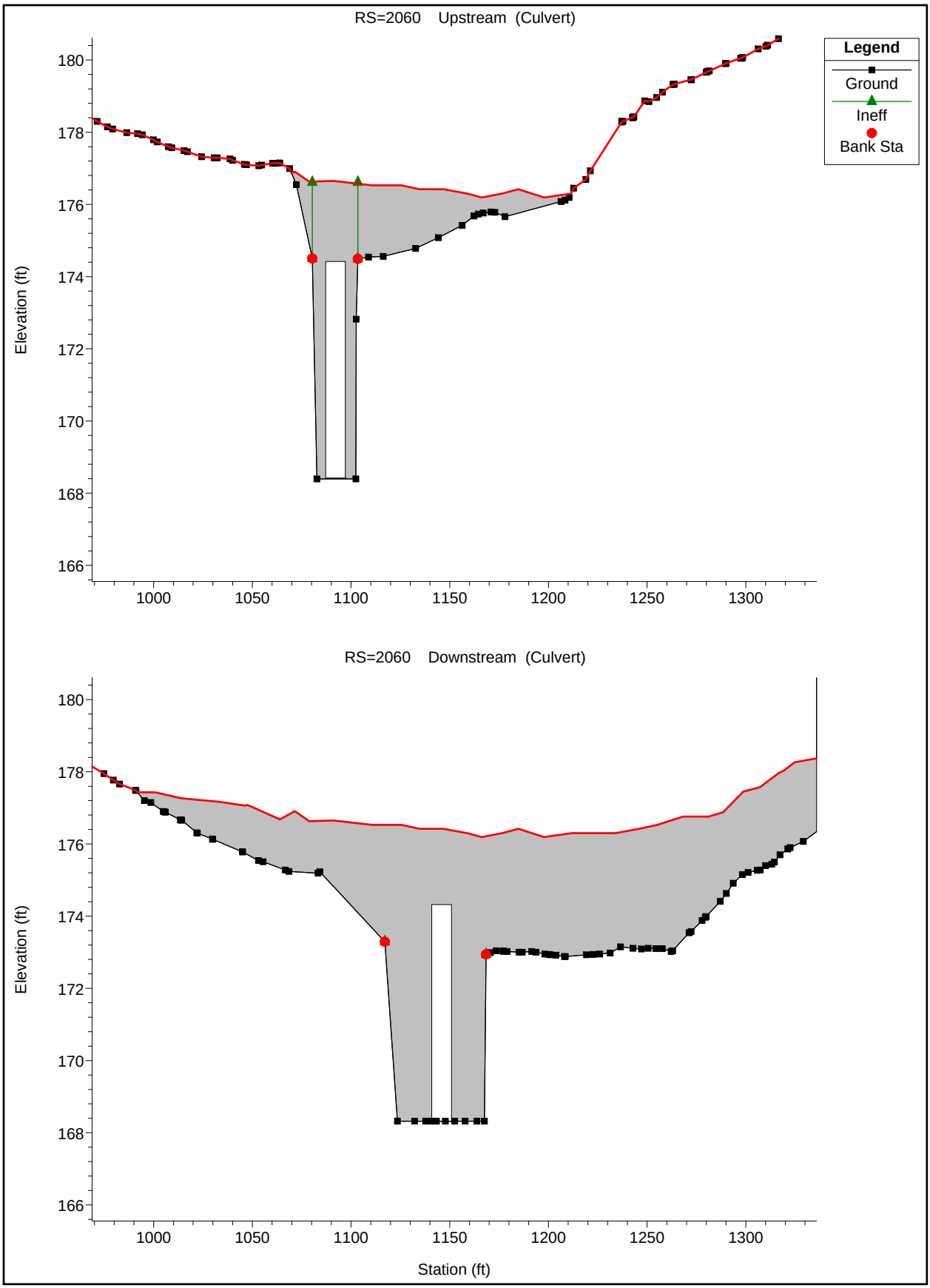


DUPLICATE EFFECTIVE GEOMETRIC DATA
N.T.S.


LDS_Pedler_Bch_Adjusted-DE Plan: LDS_Pedler_Bch 1/21/2019
High water mark at elevation 181.
.06
.055
.06
Legend
EG Floodway
WS Floodway
EG 100yr
Crit Floodway
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
186
184
182
180
178
176
174
300
400
500
600
700
800
Station (ft)


RS=3078 Upstream (Culvert)
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
182
180
178
176
174
172
450
500
550
600
RS=3078 Downstream (Culvert)
Elevation (ft)
182
180
178
176
174
172
450
500
550
600
Station (ft)


LDS_Pedler_Bch_Adjusted-DE Plan: LDS_Pedler_Bch 1/21/2019
.09
.055
.09
Legend
EG Floodway
WS Floodway
EG 100yr
WS 100yr
Crit 100yr
Crit Floodway
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
178
176
174
172
170
168
1000
1050
1100
1150
1200
1250
1300
Station (ft)


RS=2060 Upstream (Culvert)
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
180
178
176
174
172
170
168
166
1000
1050
1100
1150
1200
1250
1300
RS=2060 Downstream (Culvert)
Elevation (ft)
Station (ft)

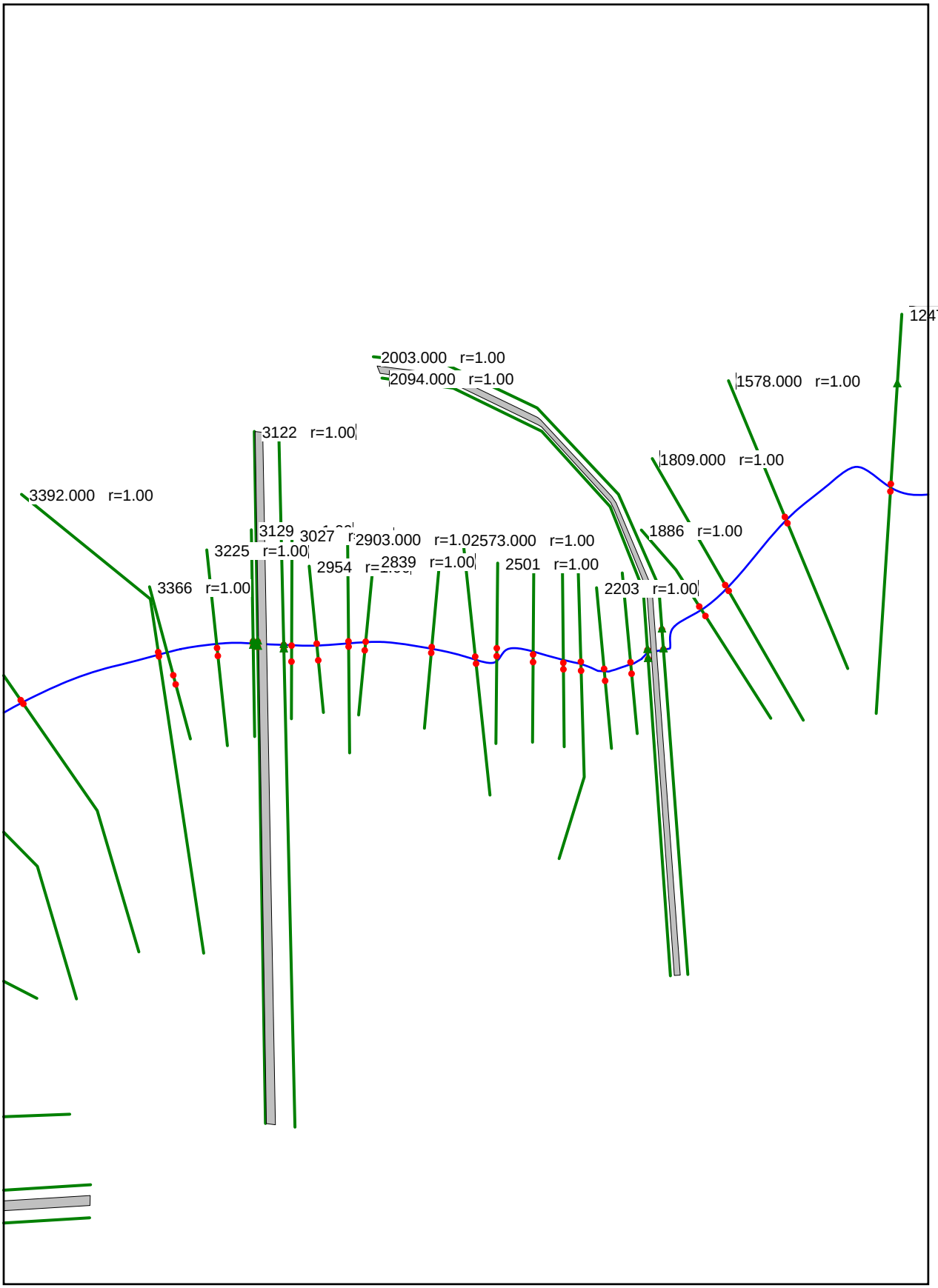
HEC-RAS Plan: Pedler River: PeddlersBranch Reach: PeddlersBranch Profile: 100yr

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)	
PeddlersBranch	10694.00	100yr	519.00	219.39	226.38	225.87	227.74	0.029926	9.35	55.48	40.59	0.83
PeddlersBranch	10507.00	100yr	519.00	217.98	226.21		226.35	0.002261	3.63	194.27	63.15	0.25
PeddlersBranch	10354.00	100yr	519.00	217.64	225.90		226.02	0.002050	3.46	230.50	73.09	0.24
PeddlersBranch	10192.00	100yr	519.00	217.29	225.38		225.64	0.002509	4.11	139.84	33.45	0.30
PeddlersBranch	10118.00	100yr	519.00	216.74	225.26		225.47	0.001810	3.71	159.15	48.06	0.26
PeddlersBranch	10031.00	100yr	519.00	215.74	225.31		225.34	0.000484	1.93	472.02	137.09	0.12
PeddlersBranch	9781.000	100yr	519.00	212.48	225.29		225.29	0.000076	0.94	892.55	179.07	0.05
PeddlersBranch	9516.000	100yr	519.00	210.47	225.28		225.28	0.000033	0.62	1423.84	259.49	0.03
PeddlersBranch	9246.000	100yr	519.00	208.43	225.27	214.94	225.27	0.000026	0.61	1507.49	293.91	0.03
PeddlersBranch	9071.000	100yr	519.00	207.11	225.27	213.38	225.27	0.000003	0.27	3789.31	509.72	0.01
PeddlersBranch	9039		Culvert									
PeddlersBranch	9017.000	100yr	519.00	206.70	214.85	212.30	214.88	0.000796	2.21	479.37	156.07	0.15
PeddlersBranch	8734.000	100yr	519.00	204.70	214.74		214.75	0.000245	1.31	732.85	196.57	0.08
PeddlersBranch	8230.000	100yr	519.00	201.14	214.70		214.70	0.000057	0.93	1095.92	173.43	0.05
PeddlersBranch	8012.000	100yr	519.00	199.61	214.70	205.48	214.70	0.000007	0.28	3688.66	699.36	0.01
PeddlersBranch	7874.000	100yr	718.00	198.63	214.68	207.84	214.69	0.000436	1.07	787.14	335.28	0.05
PeddlersBranch	7825		Culvert									
PeddlersBranch	7792.000	100yr	718.00	198.42	205.45	203.01	205.52	0.001298	2.68	371.70	131.06	0.19
PeddlersBranch	7555.000	100yr	718.00	193.35	205.41		205.42	0.000138	1.49	832.76	166.26	0.08
PeddlersBranch	7322.000	100yr	718.00	193.06	205.06	197.18	205.28	0.002072	3.76	190.87	184.09	0.20
PeddlersBranch	7289		Culvert									
PeddlersBranch	7252.000	100yr	718.00	192.62	200.54	198.66	200.65	0.001999	3.71	316.48	124.37	0.25
PeddlersBranch	7012.000	100yr	718.00	190.11	200.44		200.46	0.000284	1.70	756.63	204.04	0.10
PeddlersBranch	6481.000	100yr	718.00	188.59	200.36		200.37	0.000124	0.93	1082.73	219.79	0.05
PeddlersBranch	5911.000	100yr	718.00	186.98	200.30		200.31	0.000103	1.15	1336.17	258.86	0.06
PeddlersBranch	5561.000	100yr	718.00	186.80	199.94	191.17	200.16	0.001396	3.75	191.39	232.22	0.18
PeddlersBranch	5520		Culvert									
PeddlersBranch	5480.000	100yr	718.00	186.43	195.42	191.67	195.46	0.000693	2.41	651.14	204.14	0.14
PeddlersBranch	5132.000	100yr	718.00	185.94	194.37		194.73	0.010983	6.16	202.48	138.50	0.46
PeddlersBranch	4469.000	100yr	899.00	181.46	191.30		191.39	0.003182	3.67	519.05	253.88	0.26
PeddlersBranch	4034.000	100yr	899.00	179.30	188.19	188.19	188.57	0.020487	7.40	293.91	276.21	0.52
PeddlersBranch	3763.000	100yr	899.00	177.44	183.98		184.03	0.001608	2.85	540.72	262.61	0.22
PeddlersBranch	3392.000	100yr	899.00	175.58	183.27		183.36	0.002674	3.51	415.32	194.45	0.26
PeddlersBranch	3102.000	100yr	899.00	174.29	181.73	181.50	182.05	0.007935	5.86	273.10	216.35	0.41
PeddlersBranch	3078		Culvert									
PeddlersBranch	3049.000	100yr	899.00	174.18	180.22	179.53	180.38	0.004915	4.67	327.20	189.10	0.36
PeddlersBranch	2903.000	100yr	945.00	173.18	179.36		179.57	0.005797	5.27	318.65	174.71	0.42
PeddlersBranch	2573.000	100yr	945.00	170.86	178.41		178.52	0.001964	3.54	479.88	227.35	0.25
PeddlersBranch	2282.000	100yr	945.00	168.86	177.56		177.79	0.003432	4.54	391.13	201.70	0.33
PeddlersBranch	2094.000	100yr	945.00	168.43	177.11	172.52	177.29	0.002001	3.90	398.86	168.46	0.24
PeddlersBranch	2060		Culvert									
PeddlersBranch	2003.000	100yr	945.00	168.32	173.85	170.71	174.00	0.001866	3.26	353.29	169.59	0.25
PeddlersBranch	1809.000	100yr	945.00	167.90	173.32	172.38	173.47	0.003282	4.43	376.18	182.27	0.35
PeddlersBranch	1578.000	100yr	945.00	167.50	171.59	171.52	172.04	0.017870	7.16	213.53	167.09	0.70
PeddlersBranch	1247.000	100yr	945.00	167.42	170.87	169.12	170.89	0.001347	2.13	785.35	548.28	0.21
PeddlersBranch	976.000	100yr	945.00	167.15	170.61	168.83	170.62	0.000718	1.57	1007.59	651.84	0.15

Patterson St.

E. Prospect Ave.

EXISTING CONDITIONS DATA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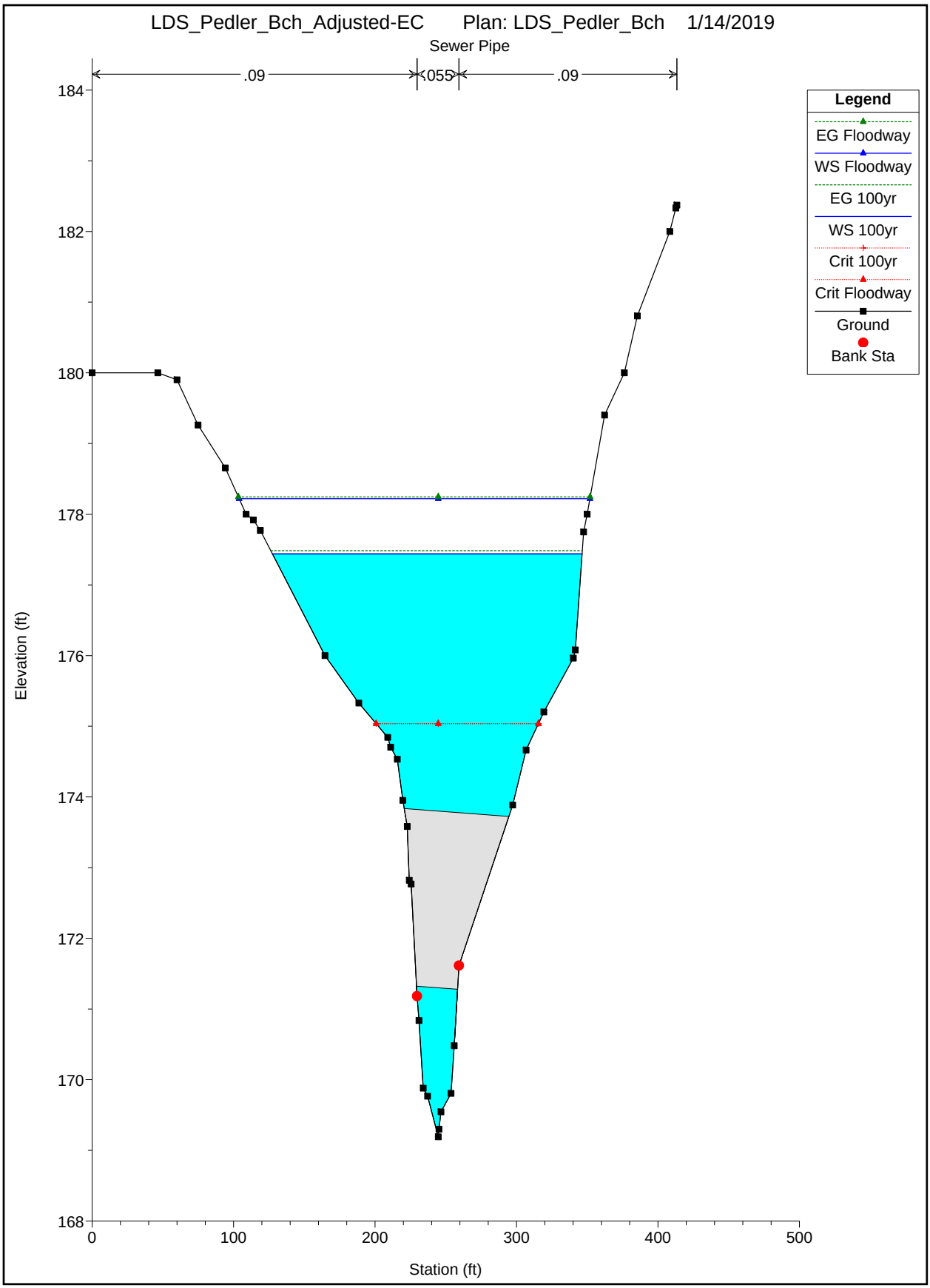
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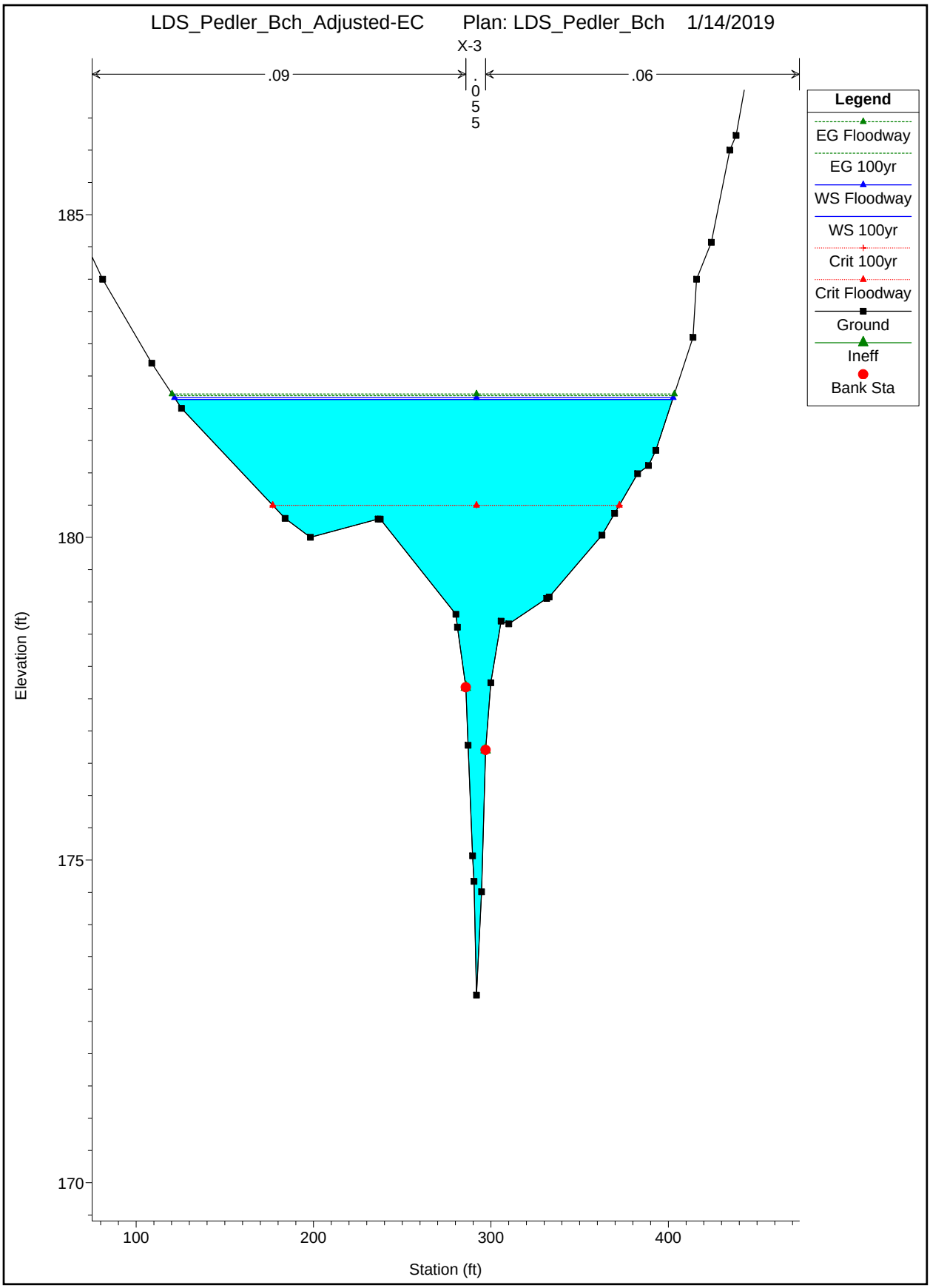
Sewer Pipe
.09
.055
.09
Legend
EG Floodway
WS Floodway
EG 100yr
WS 100yr
Crit 100yr
Crit Floodway
Ground
Bank Sta
Elevation (ft)
184
182
180
178
176
174
172
170
168
0
100
200
300
400
500
Station (ft)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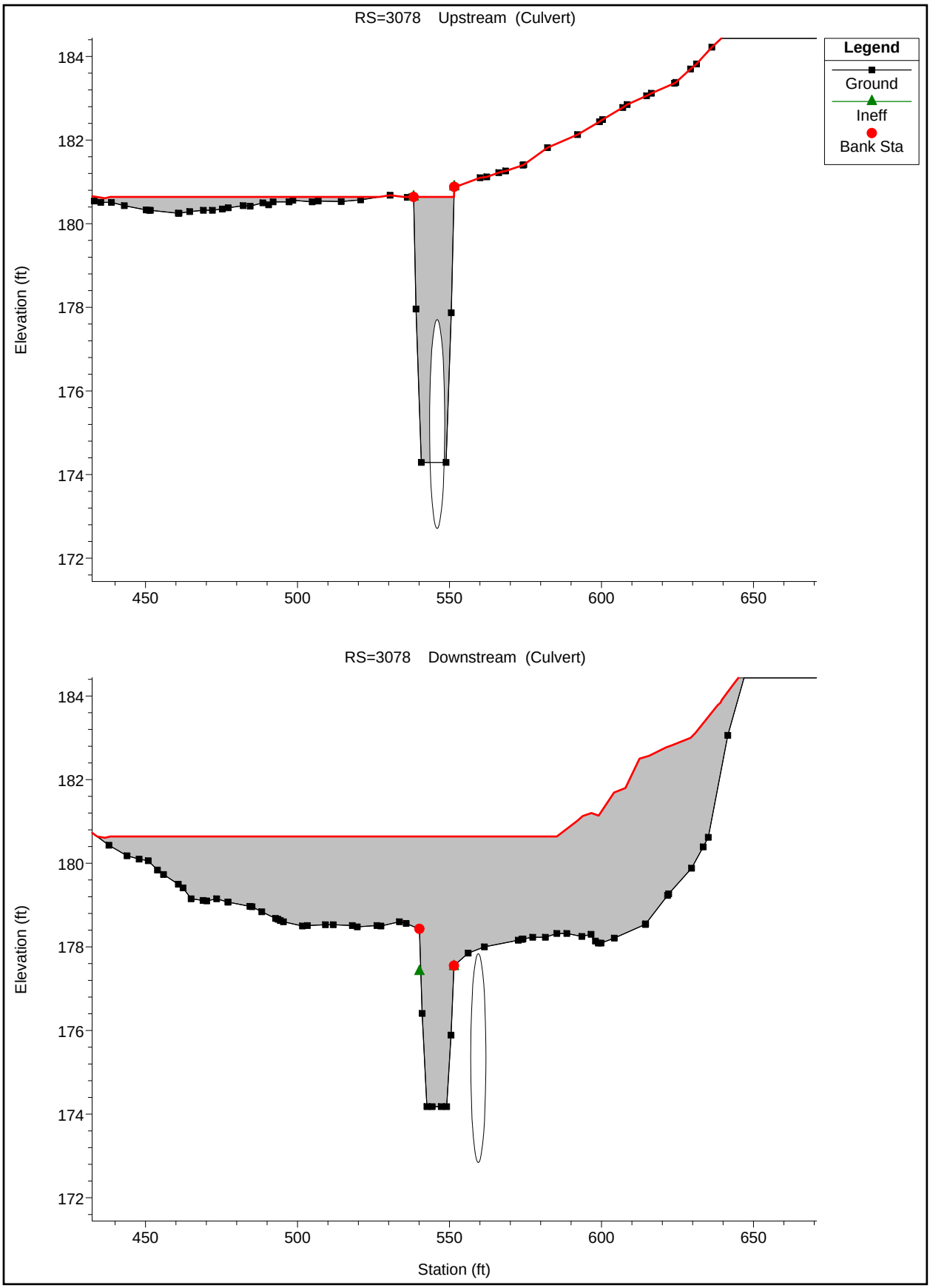
X-3
.09
.055
.06
Legend
EG Floodway
EG 100yr
WS Floodway
WS 100yr
Crit 100yr
Crit Floodway
Ground
Ineff
Bank Sta
185
180
175
170
Elevation (ft)
100
200
300
400
Station (ft)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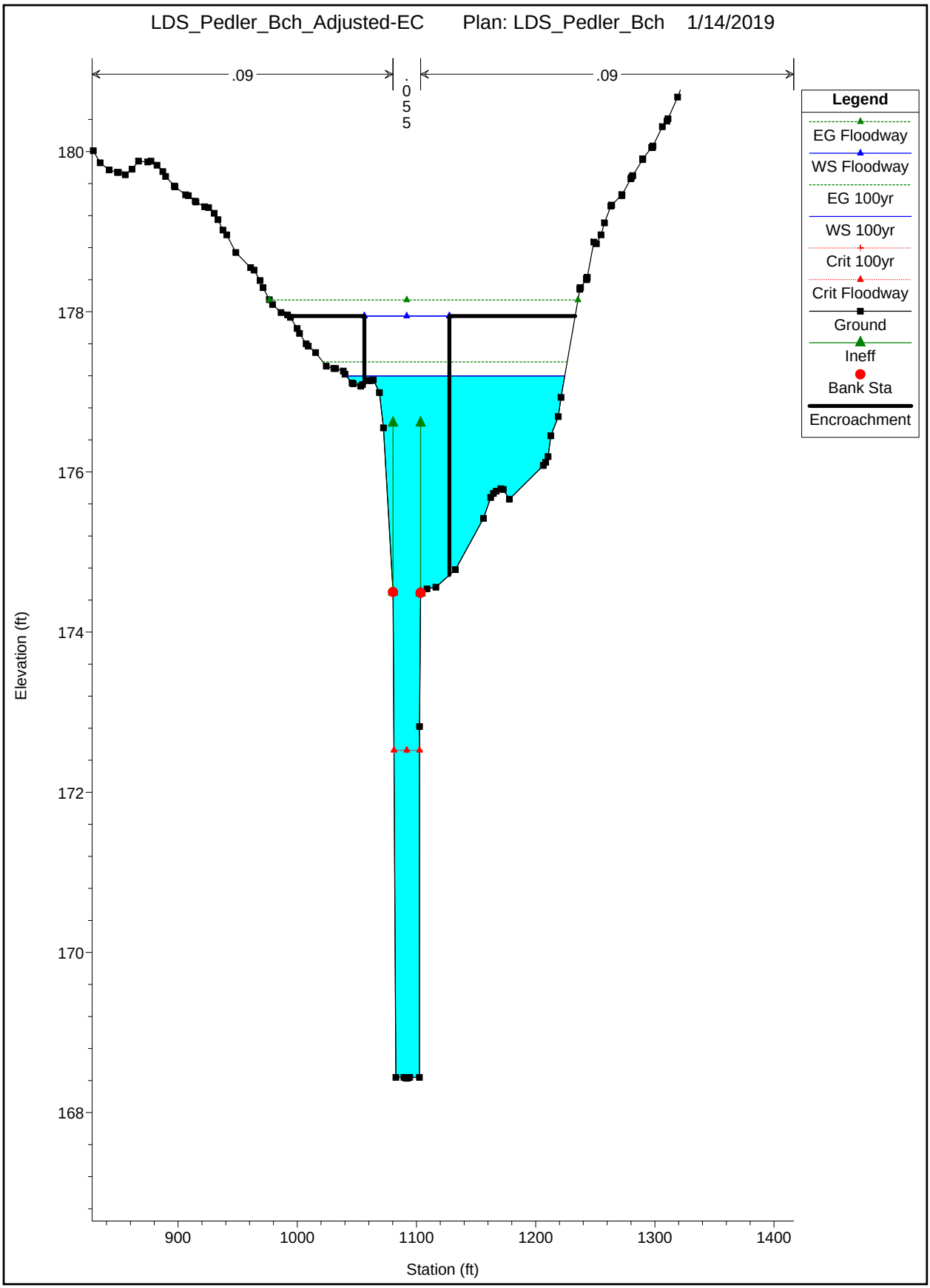
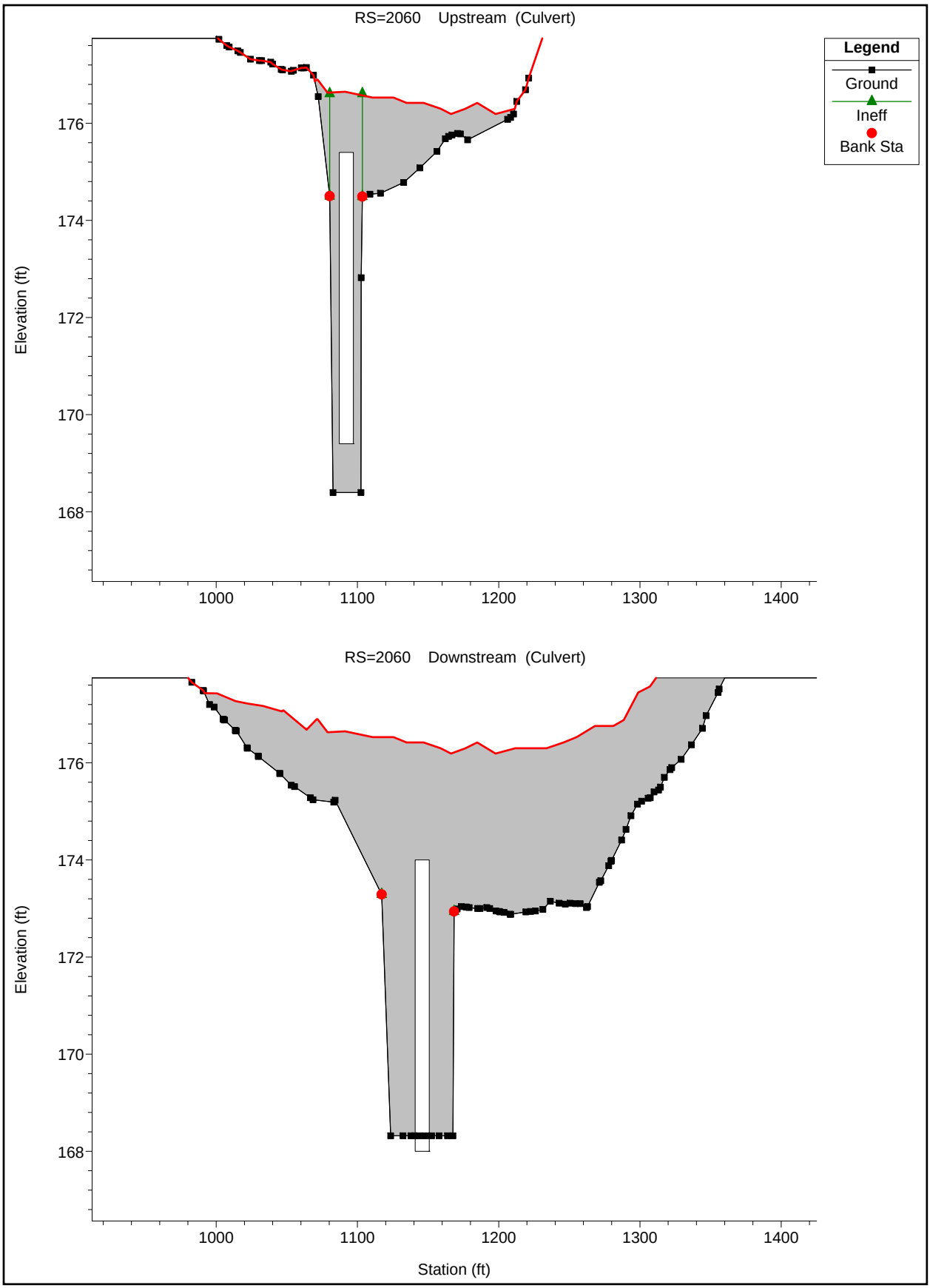
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
184
182
180
178
176
174
172
450
500
550
600
650
RS=3078 Downstream (Culvert)
Elevation (ft)
184
182
180
178
176
174
172
450
500
550
600
650
Station (ft)

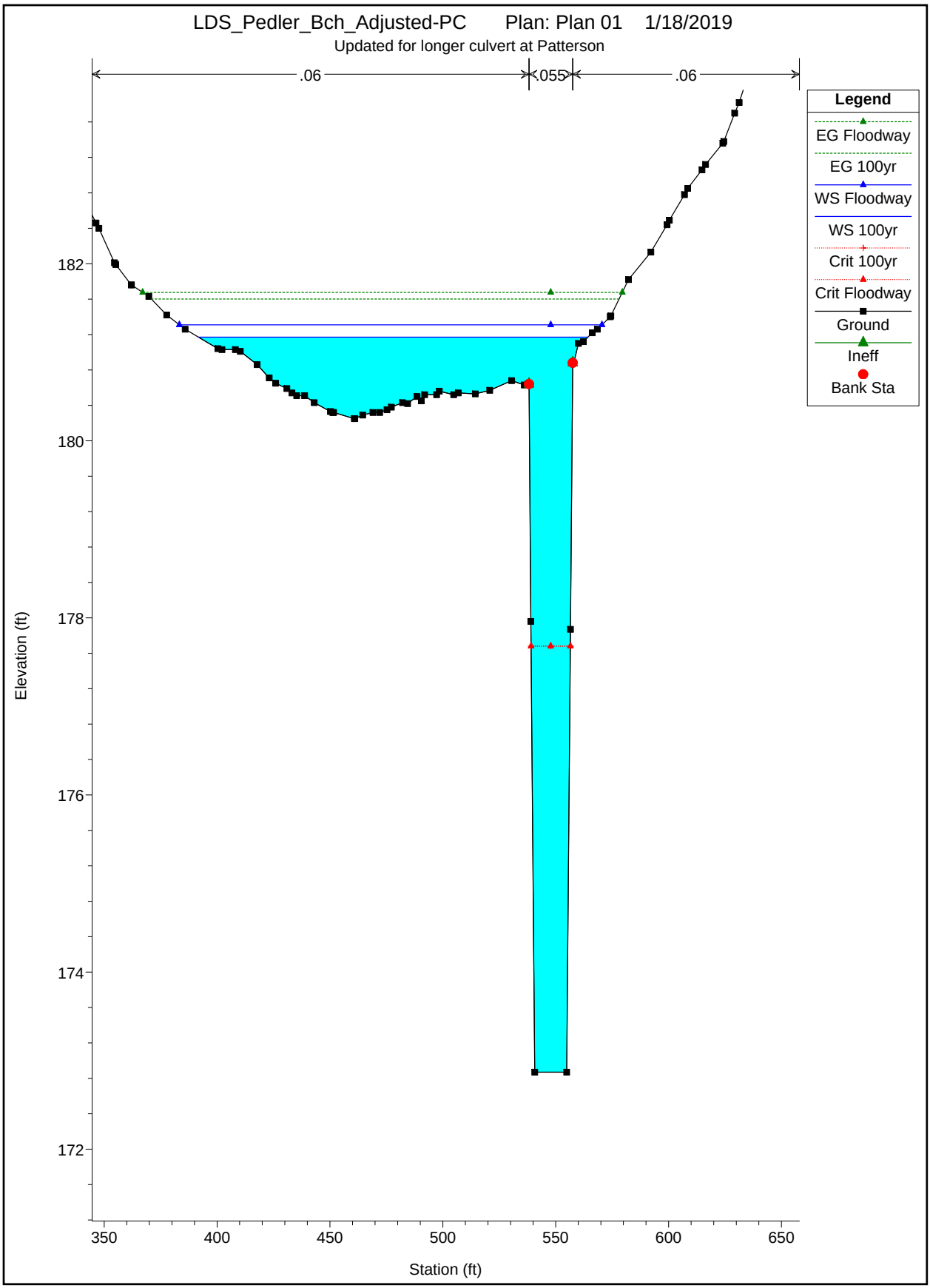

LDS_Pedler_Bch_Adjusted-EC Plan: LDS_Pedler_Bch 1/14/2019
.09
.055
.09
Legend
EG Floodway
WS Floodway
EG 100yr
WS 100yr
Crit 100yr
Crit Floodway
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
180
178
176
174
172
170
168
900
1000
1100
1200
1300
1400
Station (ft)


RS=2060 Upstream (Culvert)
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
176
174
172
170
168
1000
1100
1200
1300
1400
RS=2060 Downstream (Culvert)
Elevation (ft)
176
174
172
170
168
1000
1100
1200
1300
1400
Station (ft)

HEC-RAS Plan: Pedler River: PeddlersBranch Reach: PeddlersBranch Profile: 100yr

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)	
PeddlersBranch	10694.00	100yr	519.00	219.39	226.37	225.87	227.74	0.030036	9.37	55.41	40.55	0.83
PeddlersBranch	10507.00	100yr	519.00	217.98	226.20		226.34	0.002282	3.65	193.55	63.01	0.26
PeddlersBranch	10354.00	100yr	519.00	217.64	225.88		226.00	0.002076	3.48	229.35	72.90	0.25
PeddlersBranch	10192.00	100yr	519.00	217.29	225.36		225.62	0.002541	4.12	139.13	33.24	0.30
PeddlersBranch	10118.00	100yr	519.00	216.74	225.24		225.45	0.001834	3.73	158.05	46.77	0.26
PeddlersBranch	10031.00	100yr	519.00	215.74	225.29		225.32	0.000492	1.94	468.82	136.56	0.13
PeddlersBranch	9781.000	100yr	519.00	212.48	225.26		225.27	0.000076	0.94	888.33	178.17	0.05
PeddlersBranch	9516.000	100yr	519.00	210.47	225.25		225.26	0.000034	0.63	1417.69	259.05	0.03
PeddlersBranch	9246.000	100yr	519.00	208.43	225.25	214.94	225.25	0.000026	0.62	1500.49	293.35	0.03
PeddlersBranch	9071.000	100yr	519.00	207.11	225.25	213.38	225.25	0.000003	0.27	3777.18	508.62	0.01
PeddlersBranch	9039		Culvert									
PeddlersBranch	9017.000	100yr	519.00	206.70	213.68	212.30	213.75	0.002425	3.38	313.30	130.21	0.25
PeddlersBranch	8734.000	100yr	519.00	204.70	213.31		213.34	0.000806	2.07	474.21	168.63	0.15
PeddlersBranch	8230.000	100yr	519.00	201.14	213.22		213.23	0.000108	1.16	856.81	153.59	0.06
PeddlersBranch	8012.000	100yr	519.00	199.61	213.22	205.48	213.22	0.000022	0.46	1955.30	654.15	0.03
PeddlersBranch	7890	100yr	718.00	198.63	208.61	207.84	212.14	0.127098	15.09	47.59	5.24	0.88
PeddlersBranch	7825		Culvert									
PeddlersBranch	7776	100yr	718.00	198.42	205.45	203.01	205.51	0.001304	2.69	371.04	130.92	0.19
PeddlersBranch	7555.000	100yr	718.00	193.35	205.41		205.42	0.000138	1.49	832.76	166.26	0.08
PeddlersBranch	7322.000	100yr	718.00	193.06	205.06	197.18	205.28	0.002072	3.76	190.87	184.09	0.20
PeddlersBranch	7289		Culvert									
PeddlersBranch	7252.000	100yr	718.00	192.62	200.54	198.66	200.65	0.001999	3.71	316.48	124.37	0.25
PeddlersBranch	7012.000	100yr	718.00	190.11	200.44		200.46	0.000284	1.70	756.63	204.04	0.10
PeddlersBranch	6481.000	100yr	718.00	188.59	200.36		200.37	0.000124	0.93	1082.73	219.79	0.05
PeddlersBranch	5911.000	100yr	718.00	186.98	200.30		200.31	0.000103	1.15	1336.17	258.86	0.06
PeddlersBranch	5561.000	100yr	718.00	186.80	199.94	191.17	200.16	0.001396	3.75	191.39	232.22	0.18
PeddlersBranch	5520		Culvert									
PeddlersBranch	5480.000	100yr	718.00	186.43	195.42	191.67	195.46	0.000693	2.41	651.14	204.14	0.14
PeddlersBranch	5132.000	100yr	718.00	185.94	194.37		194.73	0.010983	6.16	202.48	138.50	0.46
PeddlersBranch	4469.000	100yr	899.00	181.46	191.30		191.39	0.003182	3.67	519.05	253.88	0.26
PeddlersBranch	4034.000	100yr	899.00	179.30	188.19	188.19	188.57	0.020487	7.40	293.91	276.21	0.52
PeddlersBranch	3763.000	100yr	899.00	177.44	183.84		183.90	0.001990	3.11	503.80	260.58	0.24
PeddlersBranch	3392.000	100yr	899.00	175.58	182.56		182.77	0.007127	5.23	287.59	165.86	0.42
PeddlersBranch	3366	100yr	899.00	174.16	182.38		182.55	0.002008	3.94	391.23	161.34	0.27
PeddlersBranch	3225	100yr	899.00	173.45	182.25		182.31	0.001019	2.62	642.82	265.03	0.19
PeddlersBranch	3129	100yr	899.00	172.91	182.14	180.50	182.20	0.001299	3.04	625.95	280.13	0.20
PeddlersBranch	3122	100yr	899.00	174.29	181.70	181.50	182.04	0.008213	5.95	268.61	214.72	0.42
Patterson St. PeddlersBranch	3078		Culvert									
PeddlersBranch	3049.000	100yr	899.00	174.18	180.54	179.53	180.65	0.003032	3.81	390.85	198.73	0.28
PeddlersBranch	3027	100yr	899.00	171.76	180.29		180.39	0.001133	2.78	456.56	194.92	0.20
PeddlersBranch	2954	100yr	899.00	171.99	180.23		180.31	0.000943	2.63	485.71	179.94	0.19
PeddlersBranch	2903.000	100yr	945.00	173.18	180.13		180.22	0.002170	3.55	469.41	208.23	0.26
PeddlersBranch	2839	100yr	945.00	171.74	179.08		179.30	0.003723	4.65	339.79	175.80	0.36
PeddlersBranch	2675	100yr	945.00	171.65	178.56		178.69	0.003164	4.04	405.36	199.68	0.31
PeddlersBranch	2573.000	100yr	945.00	170.86	178.32		178.44	0.002180	3.70	459.72	223.45	0.26
PeddlersBranch	2501	100yr	945.00	171.01	178.14		178.27	0.002307	3.90	439.65	219.31	0.29
PeddlersBranch	2401	100yr	945.00	170.54	178.02		178.09	0.001236	3.10	566.22	248.22	0.21
PeddlersBranch	2308	100yr	945.00	170.31	177.88		177.96	0.001283	3.27	597.99	193.83	0.22
PeddlersBranch	2282.000	100yr	945.00	168.86	177.67		177.87	0.003065	4.34	412.20	203.33	0.31
PeddlersBranch	2203	100yr	945.00	169.39	177.59		177.67	0.001086	2.86	598.04	194.51	0.20
PeddlersBranch	2126	100yr	945.00	169.19	177.44	175.04	177.48	0.002671	1.99	578.67	218.88	0.10
PeddlersBranch	2094.000	100yr	945.00	168.43	177.20	172.52	177.37	0.001885	3.81	414.86	183.18	0.23
E. Prospect Ave. PeddlersBranch	2060		Culvert									
PeddlersBranch	2003.000	100yr	945.00	168.32	173.90	170.71	174.04	0.001780	3.21	361.87	171.36	0.25
PeddlersBranch	1886	100yr	945.00	167.80	173.53		173.71	0.003731	4.23	338.96	175.63	0.36
PeddlersBranch	1809.000	100yr	945.00	167.90	173.32	172.38	173.47	0.003282	4.43	376.18	182.27	0.35
PeddlersBranch	1578.000	100yr	945.00	167.50	171.59	171.52	172.04	0.017870	7.16	213.53	167.09	0.70
PeddlersBranch	1247.000	100yr	945.00	167.42	170.87	169.12	170.89	0.001347	2.13	785.35	548.28	0.21
PeddlersBranch	976.000	100yr	945.00	167.15	170.61	168.83	170.62	0.000718	1.57	1007.59	651.84	0.15

PROPOSED CONDITIONS DATA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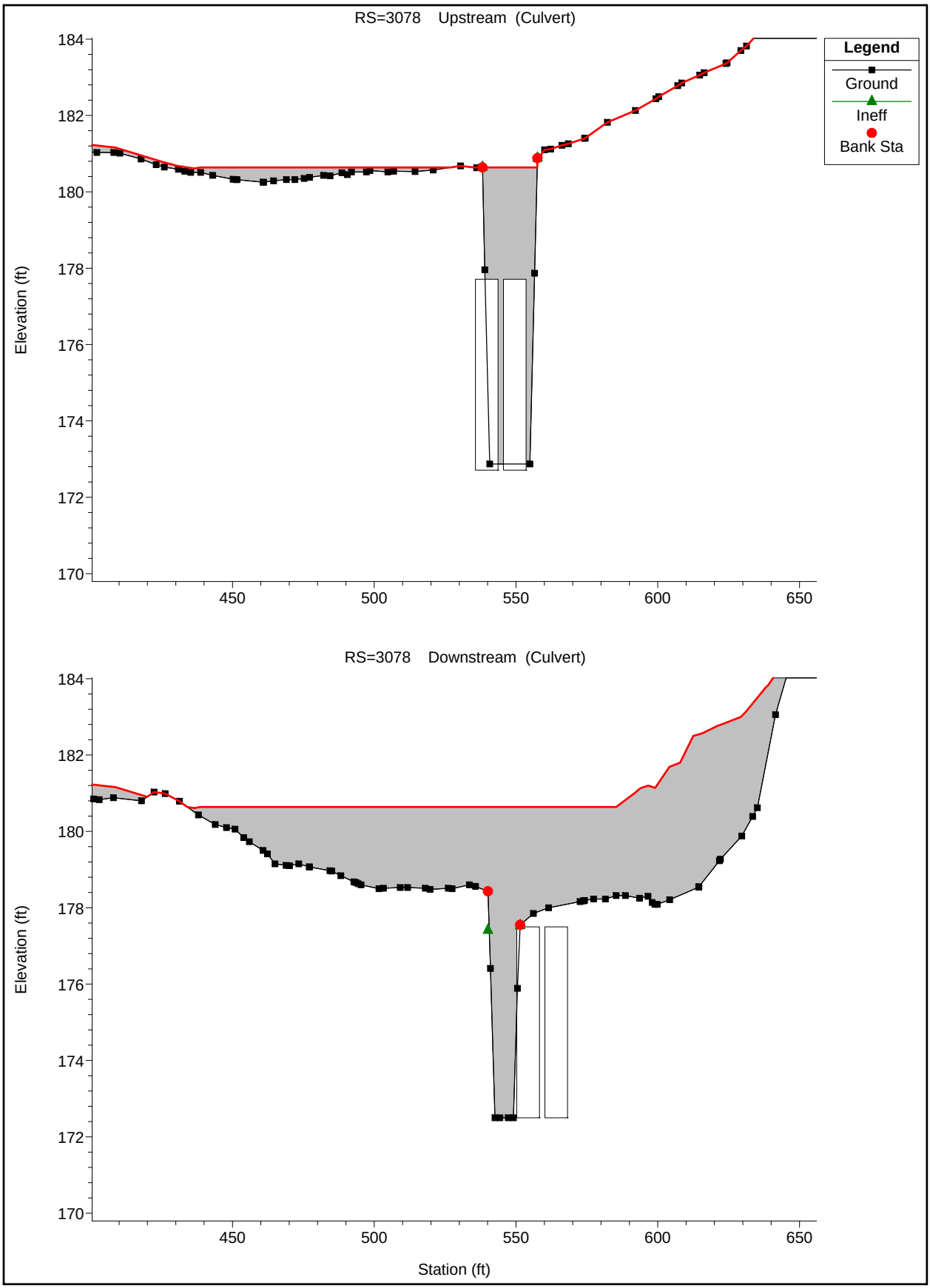
Updated for longer culvert at Patterson
.06
.055
.06
Legend
EG Floodway
EG 100yr
WS Floodway
WS 100yr
Crit 100yr
Crit Floodway
Ground
Ineff
Bank Sta
182
180
178
176
174
172
Elevation (ft)
350
400
450
500
550
600
650
Station (ft)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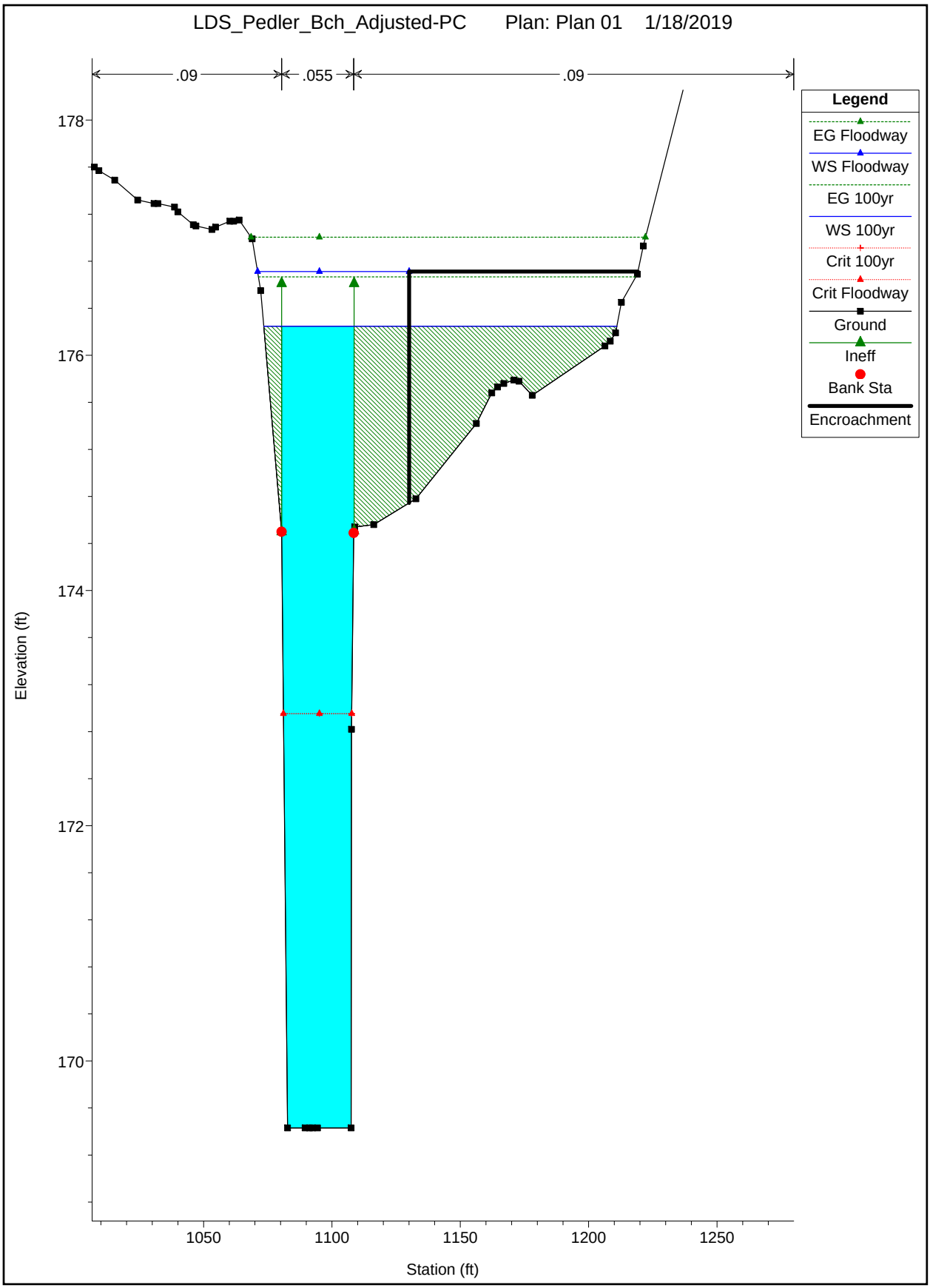
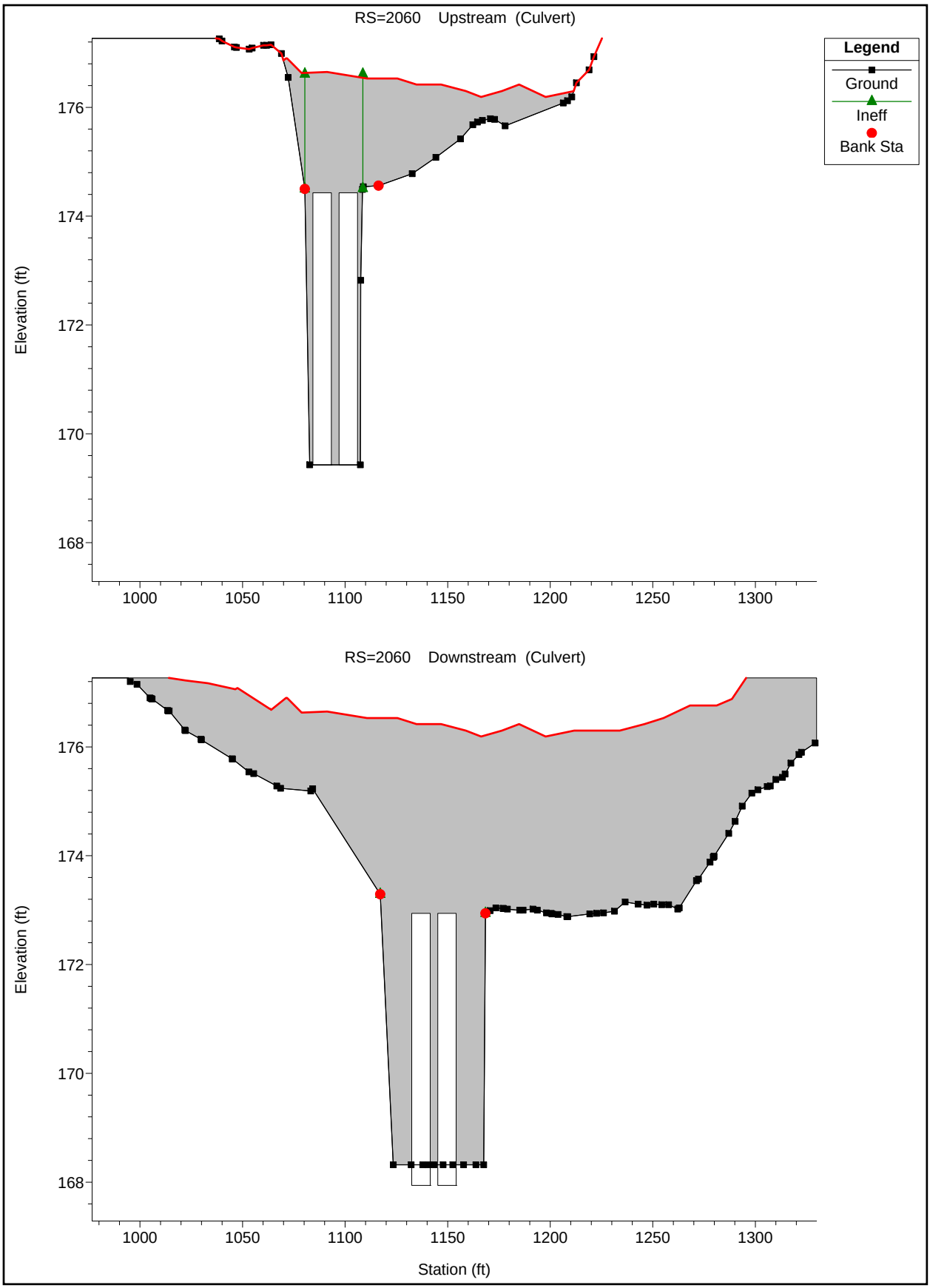
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
184
182
180
178
176
174
172
170
450
500
550
600
650
RS=3078 Downstream (Culvert)
Elevation (ft)
Station (ft)


LDS_Pedler_Bch_Adjusted-PC Plan: Plan 01 1/18/2019
.09
.055
.09
Legend
EG Floodway
WS Floodway
EG 100yr
WS 100yr
Crit 100yr
Crit Floodway
Ground
Ineff
Bank Sta
Encroachment
178
176
174
172
170
Elevation (ft)
1050
1100
1150
1200
1250
Station (ft)


RS=2060 Upstream (Culvert)
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
176
174
172
170
168
1000
1050
1100
1150
1200
1250
1300
RS=2060 Downstream (Culvert)
Elevation (ft)
176
174
172
170
168
1000
1050
1100
1150
1200
1250
1300
Station (ft)

HEC-RAS Plan: Plan 01 River: PeddlersBranch Reach: PeddlersBranch Profile: 100yr

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)	
PeddlersBranch	10694.00	100yr	519.00	219.39	226.37	225.87	227.74	0.030036	9.37	55.41	40.55	0.83
PeddlersBranch	10507.00	100yr	519.00	217.98	226.20		226.34	0.002282	3.65	193.55	63.01	0.26
PeddlersBranch	10354.00	100yr	519.00	217.64	225.88		226.00	0.002076	3.48	229.35	72.90	0.25
PeddlersBranch	10192.00	100yr	519.00	217.29	225.36		225.62	0.002541	4.12	139.13	33.24	0.30
PeddlersBranch	10118.00	100yr	519.00	216.74	225.24		225.45	0.001834	3.73	158.05	46.77	0.26
PeddlersBranch	10031.00	100yr	519.00	215.74	225.29		225.32	0.000492	1.94	468.82	136.56	0.13
PeddlersBranch	9781.000	100yr	519.00	212.48	225.26		225.27	0.000076	0.94	888.33	178.17	0.05
PeddlersBranch	9516.000	100yr	519.00	210.47	225.25		225.26	0.000034	0.63	1417.69	259.05	0.03
PeddlersBranch	9246.000	100yr	519.00	208.43	225.25	214.94	225.25	0.000026	0.62	1500.49	293.35	0.03
PeddlersBranch	9071.000	100yr	519.00	207.11	225.25	213.38	225.25	0.000003	0.27	3777.18	508.62	0.01
PeddlersBranch	9039		Culvert									
PeddlersBranch	9017.000	100yr	519.00	206.70	213.68	212.30	213.75	0.002425	3.38	313.30	130.21	0.25
PeddlersBranch	8734.000	100yr	519.00	204.70	213.31		213.34	0.000806	2.07	474.21	168.63	0.15
PeddlersBranch	8230.000	100yr	519.00	201.14	213.22		213.23	0.000108	1.16	856.81	153.59	0.06
PeddlersBranch	8012.000	100yr	519.00	199.61	213.22	205.48	213.22	0.000022	0.46	1955.30	654.15	0.03
PeddlersBranch	7890	100yr	718.00	198.63	208.61	207.84	212.14	0.127098	15.09	47.59	5.24	0.88
PeddlersBranch	7825		Culvert									
PeddlersBranch	7776	100yr	718.00	198.42	205.45	203.01	205.51	0.001304	2.69	371.04	130.92	0.19
PeddlersBranch	7555.000	100yr	718.00	193.35	205.41		205.42	0.000138	1.49	832.76	166.26	0.08
PeddlersBranch	7322.000	100yr	718.00	193.06	205.06	197.18	205.28	0.002072	3.76	190.87	184.09	0.20
PeddlersBranch	7289		Culvert									
PeddlersBranch	7252.000	100yr	718.00	192.62	200.54	198.66	200.65	0.001999	3.71	316.48	124.37	0.25
PeddlersBranch	7012.000	100yr	718.00	190.11	200.44		200.46	0.000284	1.70	756.63	204.04	0.10
PeddlersBranch	6481.000	100yr	718.00	188.59	200.36		200.37	0.000124	0.93	1082.73	219.79	0.05
PeddlersBranch	5911.000	100yr	718.00	186.98	200.30		200.31	0.000103	1.15	1336.17	258.86	0.06
PeddlersBranch	5561.000	100yr	718.00	186.80	199.94	191.17	200.16	0.001396	3.75	191.39	232.22	0.18
PeddlersBranch	5520		Culvert									
PeddlersBranch	5480.000	100yr	718.00	186.43	195.42	191.67	195.46	0.000693	2.41	651.14	204.14	0.14
PeddlersBranch	5132.000	100yr	718.00	185.94	194.37		194.73	0.010983	6.16	202.48	138.50	0.46
PeddlersBranch	4469.000	100yr	899.00	181.46	191.30		191.39	0.003182	3.67	519.05	253.88	0.26
PeddlersBranch	4034.000	100yr	899.00	179.30	188.19	188.19	188.57	0.020487	7.40	293.91	276.21	0.52
PeddlersBranch	3763.000	100yr	899.00	177.44	183.84		183.90	0.001980	3.10	504.67	260.62	0.24
PeddlersBranch	3392.000	100yr	899.00	175.58	182.31		182.61	0.010697	6.18	247.17	157.68	0.51
PeddlersBranch	3366	100yr	899.00	174.16	182.07		182.30	0.002605	4.35	343.83	152.81	0.30
PeddlersBranch	3225	100yr	899.00	173.45	181.89		181.97	0.001497	3.05	550.72	246.35	0.22
PeddlersBranch	3129	100yr	899.00	172.91	181.69	180.50	181.79	0.002234	3.82	504.77	260.86	0.26
PeddlersBranch	3122	100yr	899.00	172.87	181.17	177.68	181.60	0.005676	5.60	226.65	172.53	0.37
PeddlersBranch	3078		Culvert									
PeddlersBranch	3049.000	100yr	899.00	172.50	180.53	179.45	180.63	0.002750	3.67	401.24	198.34	0.25
PeddlersBranch	3027	100yr	899.00	171.76	180.28		180.38	0.001142	2.79	454.72	194.39	0.20
PeddlersBranch	2954	100yr	899.00	171.99	180.22		180.30	0.000951	2.63	483.92	179.40	0.19
PeddlersBranch	2903.000	100yr	945.00	173.18	180.12		180.21	0.002201	3.57	467.00	207.91	0.26
PeddlersBranch	2839	100yr	945.00	171.74	179.04		179.26	0.003924	4.75	331.89	173.73	0.36
PeddlersBranch	2675	100yr	945.00	171.65	178.45		178.59	0.003657	4.28	383.45	195.66	0.34
PeddlersBranch	2573.000	100yr	945.00	170.86	178.16		178.30	0.002621	3.99	424.92	215.13	0.28
PeddlersBranch	2501	100yr	945.00	171.01	177.92		178.09	0.002966	4.31	393.78	207.15	0.33
PeddlersBranch	2401	100yr	945.00	170.54	177.76		177.86	0.001639	3.48	504.51	236.88	0.25
PeddlersBranch	2308	100yr	945.00	170.31	177.59		177.69	0.001546	3.49	545.82	175.83	0.24
PeddlersBranch	2282.000	100yr	945.00	168.86	177.21		177.54	0.005136	5.33	320.55	195.20	0.40
PeddlersBranch	2203	100yr	945.00	169.39	177.10		177.21	0.001612	3.29	507.25	180.17	0.25
PeddlersBranch	2126	100yr	945.00	169.19	176.84	175.04	176.92	0.005343	2.58	453.74	201.45	0.14
PeddlersBranch	2094.000	100yr	945.00	169.43	176.25	172.95	176.67	0.004214	5.20	181.93	137.55	0.36
PeddlersBranch	2060		Culvert									
PeddlersBranch	2003.000	100yr	945.00	168.32	173.90	170.71	174.04	0.001780	3.21	361.87	171.36	0.25
PeddlersBranch	1886	100yr	945.00	167.80	173.53		173.71	0.003731	4.23	338.96	175.63	0.36
PeddlersBranch	1809.000	100yr	945.00	167.90	173.32	172.38	173.47	0.003282	4.43	376.18	182.27	0.35
PeddlersBranch	1578.000	100yr	945.00	167.50	171.59	171.52	172.04	0.017870	7.16	213.53	167.09	0.70
PeddlersBranch	1247.000	100yr	945.00	167.42	170.87	169.12	170.89	0.001347	2.13	785.35	548.28	0.21
PeddlersBranch	976.000	100yr	945.00	167.15	170.61	168.83	170.62	0.000718	1.57	1007.59	651.84	0.15

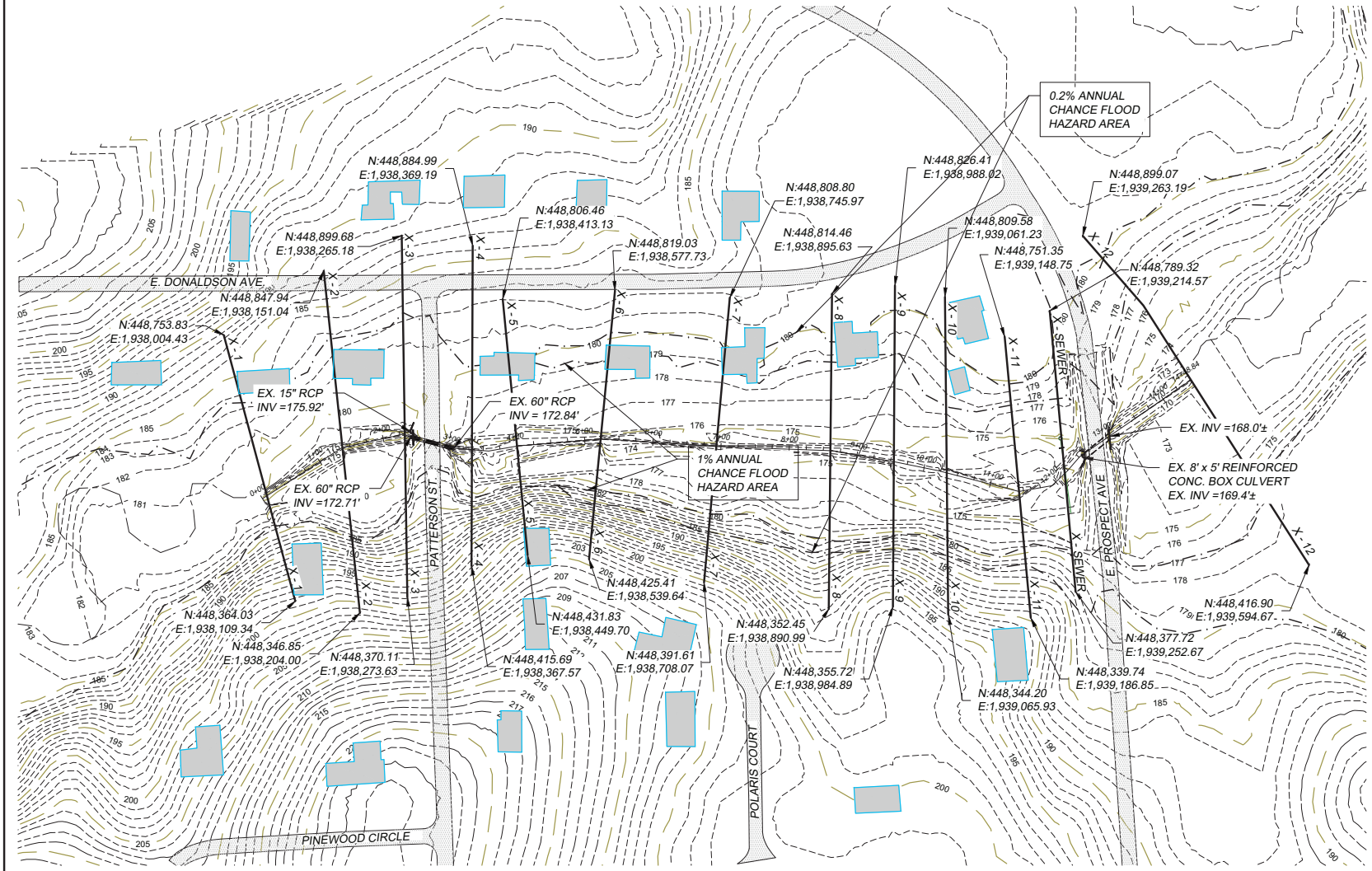
APPENDIX D

FLOODPLAIN EXHIBITS

Duplicate Effective Conditions

Existing Conditions

Proposed Conditions



CROSS-SECTIONS FLOOD MAP

SCALE: 1" = 150'

SURVEY NOTE:

SURVEY PROVIDED FROM:
MASER CONSULTING P. A.
2000 Regency Parkway, Suite 295
Raleigh, NC 27518
Phone: 919.439.6083
www.maserconsulting.com

SCALE IN FEET

0' 75 150 300

Know what's below Call before you dig. Dial 811 Or Call 800-632-4949

NORTH CAROLINA PROFESSIONAL SEAL 035670 ENGINEER JARROD E. HILLIARD

1/22/19

HILLIARD ENGINEERING, PLLC
740 Walker Road, Sanford, NC 27332
PO Box 249, Sanford, NC 27331
Phone: (919) 320-2834
e-mail: jarrod@hilliardengineering.com
NC License # P-0389

NO.	DATE	REVISION DESCRIPTION	BY

EFFECTIVE CONDITIONS

PATTERSON STREET & E PROSPECT AVE.

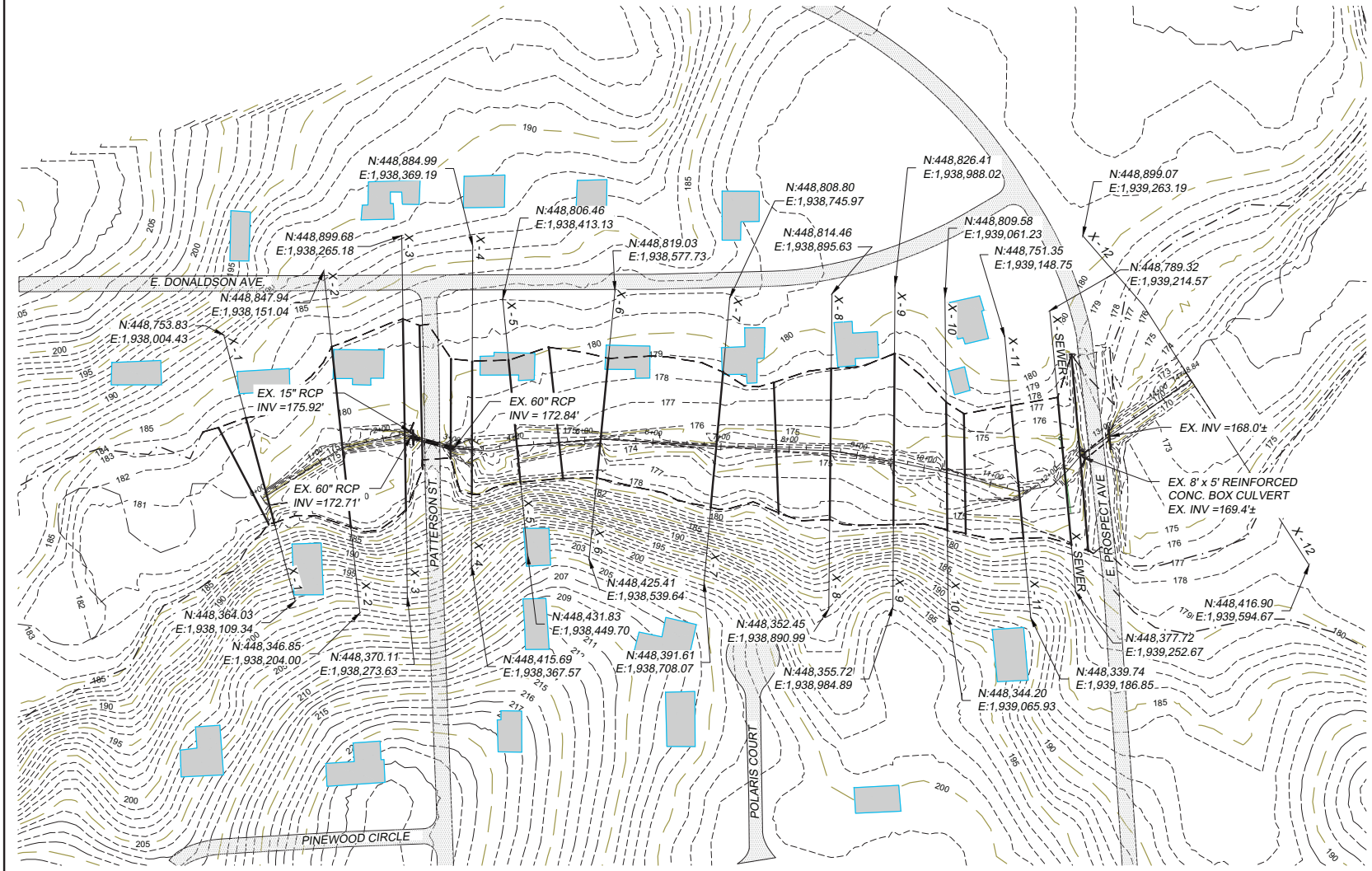
PEDLERS BRANCH
Hoke County, North Carolina

SCALE:	AS SHOWN
DATE:	12/10/18
DESIGNED BY:	JEH
DRAWN BY:	JLF
APROV. BY:	JEH
PROJECT NO.:	-

Exhibit-1

FILE NO.: Pedlers Branch

C:\Hilliard Engineering\Pedlers Branch\DWGS\Pedlar - effective condition.dwg, 12/12/2019 10:16:03 PM, ANSI expand B (11.00 x 17.00 Inches)



CROSS-SECTIONS FLOOD MAP

SCALE: 1" = 150'

SURVEY NOTE:

SURVEY PROVIDED FROM:
MASER CONSULTING P. A.
2000 Regency Parkway, Suite 295
Raleigh, NC 27518
Phone: 919.439.6083
www.maserconsulting.com

LEGENDS:

EXISTING CONDITIONS FLOOD HAZARD LINE - - - - - - -

FLOOD LINE NOTE:

THE REVISED 1% ANNUAL CHANCE FLOOD LINE SHOWN IS FOR REFERENCE ONLY AND DOES NOT CONSTITUTE AN OFFICIAL FLOODPLAIN MAP.

NORTH

SCALE IN FEET

0' 75 150 300

811 Know what's below Call before you dig. Dial 811 Or Call 800-632-4949

NORTH CAROLINA PROFESSIONAL SEAL 035670 ENGINEER JARROD E. HILLIARD

1/22/19

HILLIARD ENGINEERING, PLLC
740 Walker Road, Sanford, NC 27332
PO Box 249, Sanford, NC 27331
Phone: (919) 320-2834
e-mail: jhilliard@hilliardengineering.com
NC License # P-0389

NO.	DATE	REVISION DESCRIPTION	BY

EXISTING CONDTIONS @ PATTERSON STREET & E PROSPECT AVE.

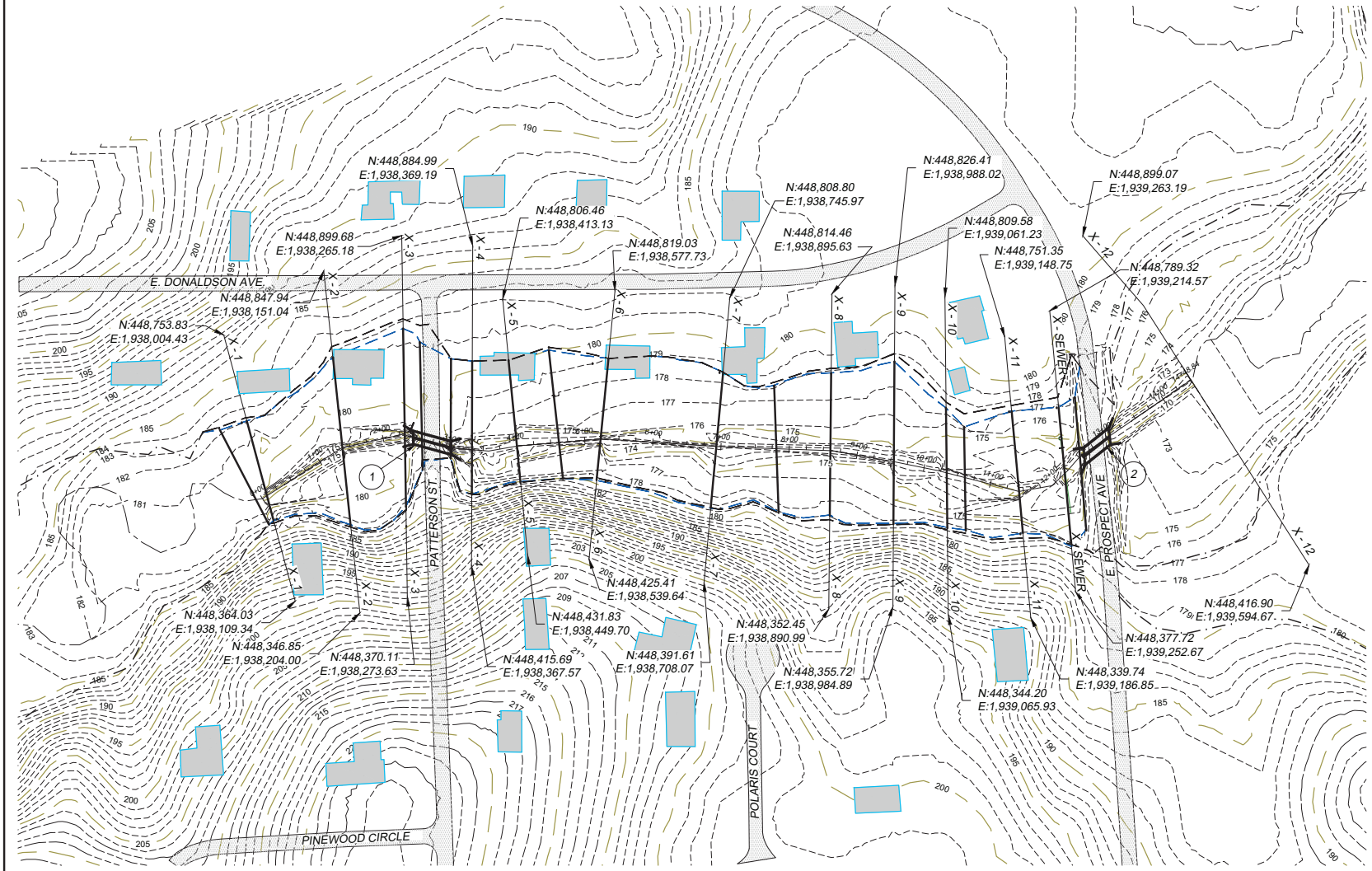
PEDLERS BRANCH
Hoke County, North Carolina

SCALE:	AS SHOWN
DATE:	12/10/18
DESIGNED BY:	JEH
DRAWN BY:	JLF
APROV. BY:	JEH
PROJECT NO.:	-

Exhibit-2

FILE NO.: Pedlers Branch

C:\Hilliard Engineering\Pedlers Branch\DWGS\Pedlar - ex conditions.dwg, 1/22/2019 8:55:04 PM, ANSI expand B (17.00 x 11.00 Inches)



KEYNOTE:

(1) - DOUBLE 8' x 5' BOX CULVERT

(2) - DOUBLE 9' x 5' BOX CULVERT

PROPOSED CONDITIONS FLOOD HAZARD LINE

EXISTING CONDITIONS FLOOD HAZARD LINE

CROSS-SECTIONS FLOOD MAP

SCALE: 1" = 150'

SURVEY NOTE:

SURVEY PROVIDED FROM:
MASER CONSULTING P. A.
2000 Regency Parkway, Suite 295
Raleigh, NC 27518
Phone: 919.439.6083
www.maserconsulting.com

FLOOD LINE NOTE:

THE REVISED 1% ANNUAL CHANCE FLOOD LINE SHOWN IS FOR REFERENCE ONLY AND DOES NOT CONSTITUTE AN OFFICIAL FLOODPLAIN MAP.

SCALE IN FEET

0' 75 150 300

Know what's below Call before you dig. Dial 811 Or Call 800.632-4949

NORTH CAROLINA PROFESSIONAL SEAL 035670 ENGINEER JARROD E. HILLIARD

1/22/19

HILLIARD ENGINEERING, PLLC
740 Walker Road, Sanford, NC 27332
PO Box 249, Sanford, NC 27331
Phone: (919) 320-2834
e-mail: jhilliard@hilliardengineering.com
NC License # P-0289

NO.	DATE	REVISION DESCRIPTION	BY

PROPOSED CONDITIONS @ PATTERSON STREET & E PROSPECT AVE.

PEDLERS BRANCH
Hoke County, North Carolina

SCALE:	AS SHOWN
DATE:	1/18/19
DESIGNED BY:	JEH
DRAWN BY:	JLF
APROV. BY:	JEH
PROJECT NO.:	-

Exhibit-3

FILE NO.: Pedlers Branch

APPENDIX E

City of Raeford
Patterson Street and E. Prospect Ave.
Storm Drainage Improvements

Project Budget Estimate

1/20/2019

HILLIARD ENGINEERING

PO Box 249 Sanford, NC 27331
(919) 352-2834
NC Certificate No. P-0836

Item No.	Description	Quantity	Unit	Unit Price	Unit Total
1	Mobilization	1	ls	$25,000.00	$25,000.00
2	Staking	1	ls	$3,800.00	$3,800.00
3	Traffic Control	1	ls	$9,200.00	$9,200.00
4	Clearing and Grubbing	1	ls	$4,700.00	$4,700.00
5	Remove & Dispose of Existing 60" Culvert	64	lf	$33.00	$2,112.00
6	Remove & Dispose of Existing 8'x5' Culvert	48.5	lf	$72.00	$3,492.00
7	Remove and Salvage Ex. Gaurdrail (E. Prospect Ave.)	200	lf	$4.50	$900.00
8	Re-Install Guardrail	200	lf	$22.50	$4,500.00
9	Guardrail Terminal End Section (Salvaged)	4	ea	$2,400.00	$9,600.00
10	Stream Bypassing	2	ea	$28,000.00	$56,000.00
11	Proposed Double 8'x5' RCBC (Patterson St.)	60	lf	$3,900.00	$234,000.00
12	Proposed Double 9'x5' RCBC (E. Prospect Ave.)	50	ea	$4,860.00	$243,000.00
13	Reconnect Existing Storm Branches	2	ea	$950.00	$1,900.00
14	Comprehensive Grading	1	ls	$7,500.00	$7,500.00
15	Remove and Replace Ex. Asphalt (City)	280	sy	$82.00	$22,960.00
16	Thermoplastic Pavement Marking Lines (4" Double Yellow)	80	lf	$15.00	$1,200.00
17	Thermoplastic Pavement Marking Lines (4" White)	160	lf	$7.00	$1,120.00
18	Existing Utility Adjustments/Coordination	1	ls	$7,000.00	$7,000.00
19	Erosion Control, Cleanup, Seed & Mulch	1	ac	$8,500.00	$8,500.00
20	Permanent and Temporary Easements	1	ls	$12,600.00	$12,600.00
				Subtotal	**$659,084.00**
				Contingency	10.00%
				Engineering & Surveying	9.00%
				Total Estimate	**$784,309.96**

This estimate is based upon limited information and shall not be considered a final construction cost estimate nor shall it be relied upon solely for final technical or legal determinations. Additional detailed information and/or changes in the status of the project may dictate changes in the construction cost estimate.

SPEED ZONE STUDY

	STUDY	STUDY
COUNTY	Hoke	Hoke
ROUTE	E. PROSPECT AVE.	PATTERSON STREET
DATE REQUESTED	10/28/2022	10/28/2022
Study Length	N/A	N/A
From: Near Peddlers Branch Creek	E. DONALDSON AVE.	E. DONALDSON AVE.
To: Near Peddlers Branch Creek	PINECONE AVE.	PINECONE AVE.
CURRENT SPEED LIMIT	35 mph	35 mph

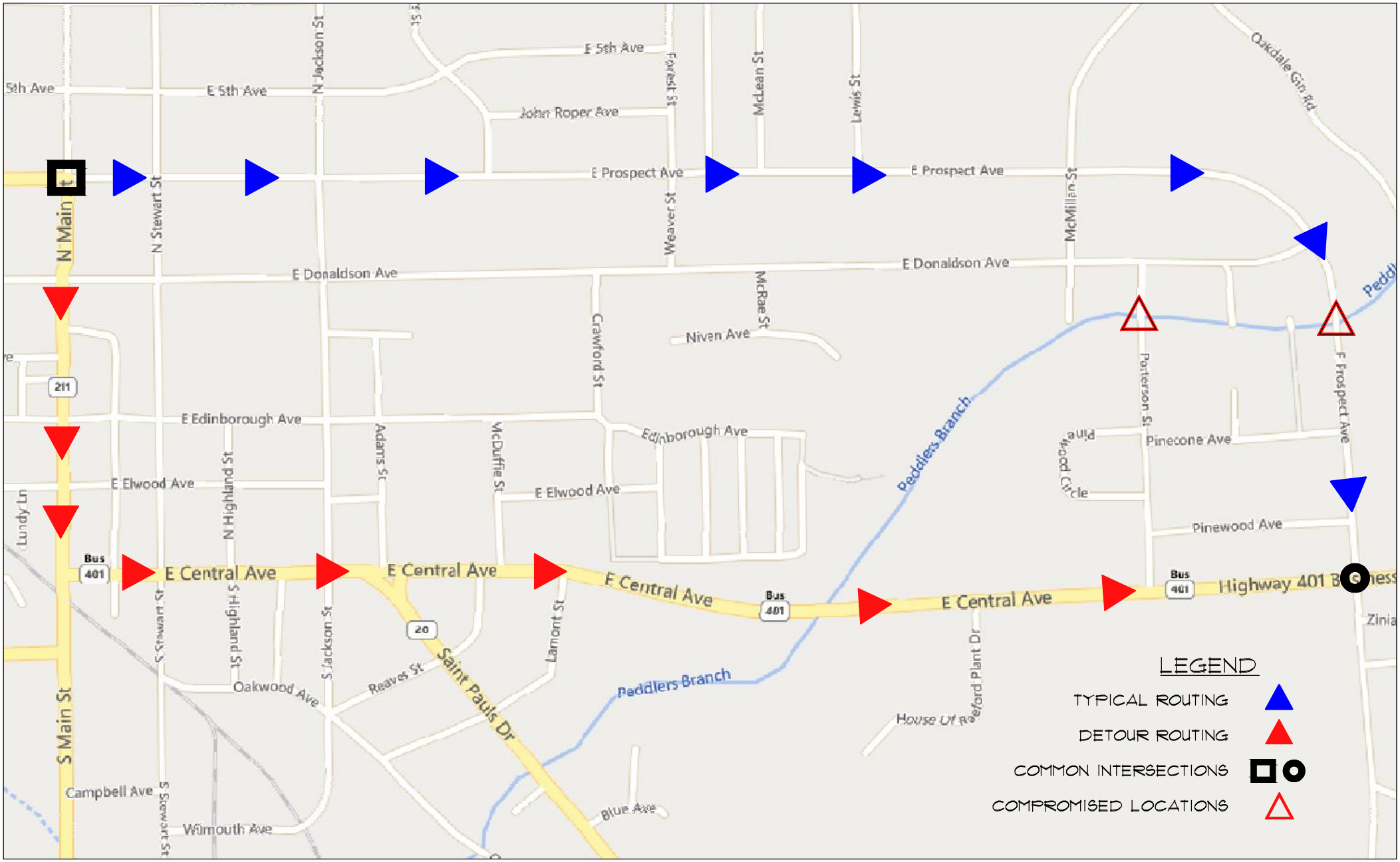
COUNT DATA

Count Dates	11/7-9/2022	11/7-9/2022
Collection MP	Near Peddlers Branch Creek	Near Peddlers Branch Creek
85th Percentile	46.08 mph	30.09 mph
EB	46.64 mph	30.98 mph
WB	45.30 mph	29.42 mph
Volumes	3,168 vpd	196 vpd
Cars %	91.7%	90.03%
Truck %	8.3%	9.97%

MOBLEY CONSULTING ENGINEERS, P.A.
P.O. BOX 1215
SOUTHERN PINES, NC 28388
Phone: (910) 915-8200
NC License No. C-644

TRAFFIC MAP

0 500 1000 2000 FEET
SCALE



MBD
CONSULTING
ENGINEERS, P.A.

December 21, 2016

Ms. Dennis Baxley, City Manager
City of Raeford
315 N. Main Street
Raeford, NC 28376

Re: Prospect Avenue Repairs at Peddler's Branch
Invoice No. 1 (Final) for Engineering Services
MBD No. 15025

Dear Mr. Baxley:

Enclosed please find Invoice No. 1 in the amount of $7,201.60 for engineering services in support of design, part-time inspection, and project administration for the Prospect Avenue Repairs at Peddler's Branch project. The invoice is comprised of $5,610.00 for engineering services and $1,591.60 for two (2) advertisements for bid in the Fayetteville Observer. This will be the final invoice for engineering services.

If you have any questions regarding the invoice please give me a call.

Sincerely,
MBD CONSULTING ENGINEERS, P.A.

Charlie McGougan

Charlie McGougan, P.E.

Attachment: Invoice No. 1
Advertisement Invoices from Fayetteville Observer

MBD CONSULTING ENGINEERS, P.A.
147 A Dublin Square Road
P.O. Drawer 4428
Asheboro, NC 27204-4428

Invoice for Professional Services

Date: 21-Dec-16

Client: City of Raeford

Project: PROSECT AVE. REPAIRS AT PEDDLERS BRANCH Project #: 15025

Invoice No.: 1

Engineering Design Services Budget

Estimated Budget:	$ 5,610
Total Paid To Date:	$ -
Remaining Budget After All Previous Invoices:	$ 5,610
Total of All Services Earned to Date:	$ 5,610
Remaining Budget After This Invoice:	$ -
Total Percent of Design Services to date:	100%
Amount Due:	**$ 5,610.00**

Reimbursibles: **$ 1,591.60** **For:** **Advertisements (see attached Invoices)**

TOTAL INVOICE AMOUNT: $ 7,201.60

MBD CONSULTING ENGINEERS, P.A.

By: Charlie McGougan 21-Dec-16
Charlie McGougan, P.E. (Date)

Approved By Owner:

By: _____
(signature)

_____
(Title) (Date)

THANK YOU FOR THIS OPPORTUNITY TO SERVE THE CITY OF RAEFORD.

FINAL APPLICATION FOR PAYMENT NO. 1

To : City of Raeford (Owner)
From : Utilities Plus, Inc. (Contractor)
Contract :
Project : Prospect Avenue repairs at Peddlers Branch
Owner's Contract No. Engineers' Project No.
For work accomplished through the date of : December 14, 2016

1 Original Contract Price :			$ 53,000.00
2 Net change by Change Order and Written amendents (+ or -) :			
3 Current Contract Price (1 plus 2) :			$ 53,000.00
4 Total completed and stored to date :			$ 53,000.00
5 Retainage (per Agreement) :			$ -
5 % of completed work			
15 % of stored materials	$ -		
6 Total completed and stored to date less retainage (4 minus 5) :			$ 53,000.00
7 Less previous Application for Payments :			$ -
8 DUE THIS APPLICATION (6 MINUS 7) :			$ 53,000.00

Accompanying Documentation :

Final Payment Application No. 1
Sales Tax Record
Stored Materials List
Certified Payroll Forms

Contractor's Certification :

The undersigned CONTRACTOR certifies that (1) all previous progress payments received from OWNER on account of Work done under the Contract referred to above have been applied on account to discharge CONTRACTOR'S legitimate obligations incurred in connection with Work covered by prior Applications for Payment numbered 1 through 1 inclusive; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to OWNER indemnifying OWNER against any such Lein, OWNER indemnifying OWNER against any such Lein, security interest or encumbrance); and (3) all work covered by this Application for Payment is in accordance with the Contract Documents and not defective.

Dated : December 14, 2016

Utilities Plus, Inc.
(Contractor)

By : Doris Hair

DIANE K. HOLLOWAY NOTARY PUBLIC JOHNSTON COUNTY, NC

State of : North Carolina
County of : Cumberland
Subscribed and sworn to before me this 15 day Dec, 2016.
Notary Public : Diane K Holloway
My Commission expires : Dec. 24, 2016

Payment of the above AMOUNT DUE THIS APPLICATION is recommended.

Dated : 12.19.16

J. Chad McLain
(Engineer)

Dated : 12-20-16

(Owner)

EJCDC No. 1910-8-E (1996 Edition)
Prepared by the Engineers Joint Contract Documents Committee and endorsed by The Associated General Contractors of America and the Construction Specification Institute.

MBD Consulting Engineers, P.A.

APPROVED FOR PAYMENT

Utilities Plus, Inc.

8611 Hairs Chapel Church Road
Linden, NC28356
910-980-0946 Fax 910-980-3798

Invoice

DATE	INVOICE #
12/14/2016	1

BILL TO
City of Raeford 315 North Main Street Raeford, NC 28315

P.O. NO.	TERMS	DUE DATE	PROJECT
		12/14/2016	

DESCRIPTION	QTY	RATE	AMOUNT
The work consists of repairs to the road shoulder and pavement of East Prospect Avenue where the roadway crosses Peddlers Branch.	1	53,000.00	53,000.00
		Total	$53,000.00

Phone #	Fax #	E-mail
910-980-0946	910-980-3798	Utilitiesplus@aol.com