



Drainage Reports

PRELIMINARY DRAINAGE REPORT

FIESTA RANCH

**Rio Verde Drive and 136th Street
Scottsdale, AZ**

Prepared For:

Lyle Anderson Compaies.

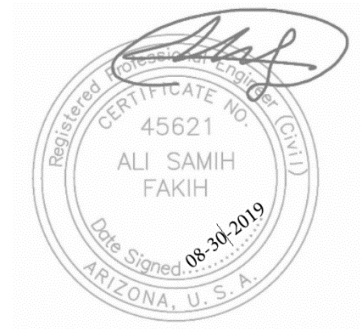
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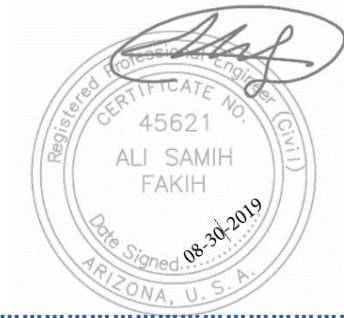


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1. INTRODUCTION

This Preliminary Drainage Report supports the rezoning request (from a mix of R1-190 ESL and R1-70 to a mix of R1-18 ESL and R1-43 ESL) and represents the storm water analysis for the proposed residential development in Scottsdale, Arizona. The purpose of this report is to provide the hydrologic and hydraulic analyses, required by the City of Scottsdale, to support the proposed subdivision. This report includes discussions and calculations defining the storm water management concepts for collection, conveyance, and retention systems necessary to comply with the drainage requirements of the City of Scottsdale and Maricopa County. Preparation of this report has been done in accordance with the requirements of the City of Scottsdale Design Standards & Policies Manual (DS&PM) 2018 ¹, and the Drainage Design Manuals for Maricopa County, Arizona, Volumes I² and Volume II³.

2. LOCATION AND PROJECT DESCRIPTION

2.1 LOCATION:

The project property consists of six (6) parcels of land located in a portion of Section 31. Township 5 north, Range 6 East of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. The total project area contains approximately 263.73 acres. Parcel ID numbers are 219-39-010M, 219-39-010N, 219-39-010G, 219-39-010U, 219-39-010V and 219-39-010P. Refer to **FIGURE 1 - Vicinity Map** for the project's location with respect to major cross streets.

2.2 EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE:

The site is bounded as follows:

North: East Rio Verde Drive with Maricopa County across.

East: City of Scottsdale boundary with Maricopa County adjacent.

South: City of Scottsdale boundary with Maricopa County adjacent.

West:

- 136TH Street with Reatta Ranch across; zoned R-4R ESL off the northwest corner of the site.
- City of Scottsdale boundary with Maricopa County adjacent.

2.3 EXISTING SITE DESCRIPTION:

The site is currently undeveloped with general land slope from west (elevation 2480+/-) to east (elevation 2370+/-) at approximately 2.5% in the buildable area with a change in elevation of approximately 110 feet. Two existing washes flow through the property from the west to east. Refer to **FIGURE 3** for off-site wash flowrates.

2.4 PROPOSED SITE DEVELOPMENT:

The proposed development for the site includes single-family homes, local streets, drainage facilities and open space. Site access is provided via southerly extensions of 136th Street and 141st Street from E. Rio Verde Drive. The proposed development includes drainage infrastructure to collect, store, and convey flood water runoff.

2.5 FLOOD HAZARD ZONE:

As defined by the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona, Community number 040037, Panel number 1331 of 4425 and 1332 of 4425, as shown on Map Number 04013C1331M and 04013C1332M dated November 4, 2015 this site is designated as **Zone "AE"**, having a 1% probability of flooding every year (also known as the "100-year floodplain"), and where predicted flood water elevations above mean sea level have been established. Refer to **FIGURE 2** for the FIRM.

3. EXISTING DRAINAGE CONDITIONS

3.1 OFF-SITE DRAINAGE:

There are two floodplains to the west of the property affecting the site. The north floodplain is called Rio Verde Wash 10-Tributary 1. According to the FIS study the 100-year flow of Rio Verde Wash 10- Tributary 1 is 980 cfs at the site western boundary. The south floodplain is called Rio Verde Wash 10. According to the FIS study the 100-year flow of Rio Verde Wash 10 is 3,150 cfs at the site western boundary. The following table shows the off-site discharge rate into the property. There are also eight smaller stormwater inflow that flow into the site, Refer to **Appendix II** for existing off-site drainage concentration points. Additional off-site flows will be considered based on McDOT design information for the roadway upgrades if applicable.

Concentration Points	Q (IN) CFS
HI-1	980
HI-2	3,150
CP-8	5.13
CP-9	23.72
CP-10	31.31
CP-11	2.9
CP-12	2.75
CP-13	1.62
CP-14	8.55
CP-15	8.81

3.2 ON-SITE DRAINAGE:

The site generally drains from the west to the east with an average slope of approximately 2.5%. Most of the onsite flows concentrate in two main channels (Wash-1 and Wash-2, refer to **Appendix II** – Existing Drainage Area Map for channel locations), except drainage areas: EX-1 (to CP-1), EX-3 (to CP-2), EX-10 (to CP-4), EX-16 (to CP-7) and EX-17 (to CP-6). See Section 3.3 below for Historical Outlet information.

3.3 HISTORICAL OUTLETS

There are seven existing historical outlets from the project site, the following table shows the relationship between existing drainage areas and historical outlet:

Existing and Onsite-Condition Drainage Area Calculations						
	DA	Area(ac)	Desert Landscape Cwt = 0.45	Concrete/Asphalt/ Roof Cwt = 0.95	Cw	Q Concentrated(CFS)
To CP-1	EX-1	3.70	0.00	3.70	0.95	41.83
To CP-2	EX-3	53.45	53.45	0.00	0.45	286.22
To CP-3	EX-2, EX-4, EX-5, EX-6, EX-7, and EX-8; HI-1, OFF EX-1	85.22	85.22	0.00	0.45	1424.09
To CP-4	EX-10	7.96	7.96	0.00	0.45	42.63
To CP-5	EX-9, EX-11, EX-12, EX-13, EX- 14, and EX-15; HI-2, OFF SITE -2, OFF SITE-3, OFF SITE-4, OFF SITE-5, OFF SITE-6, OFF SITE -7, OFF SITE-8	133.87	133.87	0.00	0.45	3762.34
To CP-6	EX-17	7.68	7.68			41.13
To CP-7	EX-16	6.07	6.07	0.00	0.45	32.50

Final site design will ensure no detrimental impact to downstream properties. Refer to Appendix II for HECRAS Modeling.

4. PROPOSED STORM WATER MANAGEMENT

4.1 DESIGN INTENT:

The site has been designed in accordance with the regulatory requirements contained in the City of Scottsdale Design Standards and Policies Manual [1]. Supplemental design criteria to address technical drainage issues not contained in the City Manual were derived from the Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology (Hydrology Manual) [2], and the Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics (Hydraulics Manual) [3], as accepted by the City of Scottsdale.

On-site drainage will be handled within street sections, onsite channels, or retention basins as necessary. On-site retention will be provided as allowed by site configuration with three (3) foot maximum depth basins. Total discharge of the storm water will occur within thirty-six (36) hours. First Flush treatment storage will be provided in the proposed retention basins with drywells or raised bleed-off pipes to allow sediment to settle out.

The wash(es) are modeled with proposed walls as necessary to limit water surface elevation increases. Refer to the preliminary Grading Exhibit in Appendix III.

4.2 DESIGN STORM REQUIREMENTS

The On-site hydrology will be completed during the final design using the rational method in accordance with the City Manual [1] and the FCDMC Hydrology Manual [2] during final engineering. The site is in an ESL zone, is currently undeveloped and will require full storage of the 100-yr 2-hr storm event for developed areas or as needed to attenuate post-development peak discharge rates to pre-development levels for the 10- and 100- year flood events.

4.3 CHARACTERISTICS OF BASINS:

The proposed basins are a combination of proposed R1-18 and R1-43 residential lots, open spaces, and road rights-of-way. Based on Figure 4.1-4 of the DS&PM, runoff coefficients for the 100-year storm event used are as follows:

- C=0.45 for undisturbed natural desert or desert landscape
- C=0.61 for R1-43
- C=0.64 for R1-18
- C=0.95 for R.O.W areas.

HYDROLOGIC ANALYSIS: The hydrologic analysis is determined using the procedures in the City of Scottsdale Design Standards & Policies Manual and the Drainage Design Manual for Maricopa County, Arizona, Volume I. The Rational Method was utilized to compute the on-site peak discharges. The following established the Rational Method equation and the basic input data required:

$$Q = C_{wt}IA$$

Where: C_{wt} = The runoff coefficient relating runoff to rainfall
 I = Average rainfall intensity in inches/hour, lasting for T_c
 T_c = The time of concentration (minutes)
 A = The contributing drainage area in acres

Based on the preliminary site plan, 11 drainage areas are developed to separate the storm runoff. The runoff coefficients for drainage areas and the rainfall data can be found to **APPENDIX II**. The following table indicates the proposed drainage areas that contribute runoff to the outlets:

Concentration Point	Drainage area ID
To CP-1	DA-1A
To CP-2	DA-1
To CP-3	DA-5; HI-1
To CP-4	0
To CP-5	DA-9; HI-2
To CP-6	0
To CP-7	0
To Basin 1	DA-2
To Basin 2	DA-3
To Basin 3	DA-4
To Basin 4	DA-6
To Basin 5	DA-7
To Basin 6	DA-8
To Basin 7	DA-10
To Basin 8	DA-11

Based on the table provided above, the historical outlets' flow rate in proposed condition are preliminarily summarized below:

	Existing Discharge(cfs)	Proposed Discharge (cfs)
To CP-1	41.83	20.46
To CP-2	286.22	70.79
To CP-3	1424.09	1036.45
To CP-4	42.63	0.00
To CP-5	3762.34	3211.41
To CP-6	41.13	0.00
To CP-7	32.50	0.00

Referring to *APPENDIX II-Proposed Drainage Area Map and Proposed and Existing Drainage Calculation*.

Note: Ultimately, HEC-1 modeling of the flow paths including retention routing will be completed once site design is better defined. This may occur in phases as the site develops.

4.4 STORMWATER RETENTION:

First Flush storage required is calculated in accordance with COS– DS&PM.

Required Retention (Acre-Feet) = $(0.5''/12) * A * (C_{wt})$

The following table shows the required volume of first flush for each basin:

First Flush for each Basin		
Basin Number	Area (ac)	First flush volume (CF)
Basin 1	18.33	21,292
Basin 2	7.51	8,724
Basin 3	16.12	18,140
Basin 4	10.01	11,083
Basin 5	69.01	80,162
Basin 6	20.04	23,278
Basin 7	10.42	12,104
Basin 8	15.19	16,818
	Total	191,600

4.4.1 REQUIRED STORAGE:

Because the site is currently undeveloped, the required storage volume should be calculated under full 100-year, 2-hour storm event storage volume for developed areas. The 100-Yr, 2-hour stormwater storage required is calculated by rational method in accordance with the COS – DS&PM. Refer to Appendix II for calculations.

Required Retention (Acre-Feet) = $(P/12) * A * (C_{wt})$.

Where: P = 100 Yr. 2 Hr. Precipitation in Inches (Ref: Isopluvial from DS&PM, Appendix 4-1D, pg. 11 and NOAA Atlas 14 table)
A = Area (Acres) – excludes NAOS area
C = C_{wt} (See Appendix II for calculation)

4.4.2 PROPOSED STORAGE

Open retention basins will be used for this project. In accordance with COS design requirements, an open basin is limited to three (3) feet maximum depth with maximum side slopes of 4:1 (6:1 near streets) with one (1) foot freeboard and include an emergency overflow outlet.

- The volume for open basins is calculated using the area-sum volume method based on design contours.

A summary of preliminary available retention follows:

BASIN ID	VOLUME REQUIRED (C.F.)	VOLUME PROVIDED (C.F.)
1	117,107	170,108
2	250,122	352,865
3	99,769	133,481
4	60,954	78,650
5	440,891	629,210
6	128,032	174,161
7	63,451	82,586
8	92,497	123,545
TOTAL	1,252,822	1,744,606

The above summary indicated there is approximately 1,744,606 c.f. of storage volume available. 1,744,606 c.f. available is larger than 1,252,822 c.f. required. The final storage volume calculations will be adjusted based on developed area after the site plan becomes more defined.

Refer to Appendix II for individual basin volume calculations.

4.4.3 STORAGE DISCHARGE:

Retention basin discharge will be designed in accordance with City of Scottsdale requirements using either bleeder pipes or drywells as required to provide total discharge within 36-hours.

4.5 PIPE CAPACITY CALCULATIONS:

These calculations will be provided in the Final Drainage Report

4.6 STREET CAPACITY CALCULATIONS:

The City of Scottsdale DS&PM, Section 4-1 requires that runoff for a 10-year storm be contained within the curbs and that the 100-year storm has a maximum depth confined within the right-of-way.

These calculations will be provided in the Final Drainage Report

4.7 STORM DRAIN INLET CALCULATIONS

These calculations will be provided in the Final Drainage Report

4.8 CHANNEL CALCULATIONS – HECRAS MODELING

The existing washes will remain largely undisturbed and HEC-RAS modeling was performed to compare existing conditions with the proposed development to ensure High-water elevations with respect to proposed finish floor elevations and channel confinement are not negatively impacted. Based on the modeling, proposed building locations do not create an adverse impact to the washes. Levees were used in the HEC-RAS model for the proposed channel. The Grading Exhibit in **Appendix III** reflects the hydraulic model and flows for both washes.

Refer to **Appendix II** for calculations.

5. FLOOD SAFETY FOR DWELLINGS

5.1 FINISHED FLOOR ELEVATIONS

All proposed building finished floor elevations will be set a minimum of 14 inches above emergency overflow points, and a minimum of 12 inches above the 100-year high-water elevation of any adjacent streets and drainage paths. This will ensure that each building will be well above the 100-year water level.

6. ADEQ WATER QUALITY REQUIREMENTS

6.1 NOTICE OF INTENT

The total disturbed area of this site is approximately 198 acres. The Arizona Department of Environmental Quality requires that any site over an acre is required to submit an NOI. An NOI will be submitted to ADEQ for this site after the first submittal of the construction documents as this site disturbance is over 1 acre.

7. CONCLUSIONS

7.1 OVERALL PROJECT:

1. The finish floor elevations will be designed a minimum of 12 inches above the 100-year water surface in adjacent streets and drainage paths and a minimum of 14 inches above the low top of curb of the lot.
2. Storm water storage is provided in accordance with City of Scottsdale requirements and shall discharge within 36 hours in accordance with City of Scottsdale requirements.
3. First flush treatment will be provided.

7.2 PROJECT PHASING:

As a residential development the infrastructure will be constructed in a single phase to accommodate dwelling unit growth. The dwelling units will be phased based on consumer demand.

8. WARNING AND DISCLAIMER OF LIABILITY

RE: following page.

GRADING & DRAINAGE LANGUAGE

WARNING AND DISCLAIMER OF LIABILITY

The City's Stormwater and Floodplain Management Ordinance is intended to minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding. The Stormwater and Floodplain Management Ordinance identifies floodplains, floodways, flood fringes and special flood hazard areas. However, a property outside these areas could be inundated by floods. Also, much of the city is a dynamic flood area; floodways, floodplains, flood fringes and special flood hazard areas may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY

The flood protection provided by the Stormwater and Floodplain Management Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by constructed or natural causes. The Stormwater and Floodplain Management Ordinance does not create liability on the part of the city, any officer or employee thereof, or the federal, state or county government for any flood damages that result from reliance on the Ordinance or any administrative decision lawfully made thereunder.

Compliance with the Stormwater and Floodplain Management Ordinance does not ensure complete protection from flooding. Flood-related problems such as natural erosion, streambed meander, or constructed obstructions and diversions may occur and have an adverse effect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above.

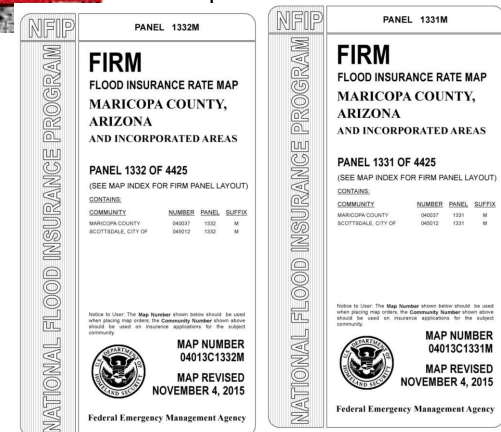
Plan Check #

Owner

Date



FIGURE 1
Vicinity Map



Notice to User: The **Map Number** shown below should be used when placing map orders. The **Correspondence Number** shown above should be used as insurance applications for the subject community.

 **MAP NUMBER**
04013C1332M

MAP REVISED
NOVEMBER 4, 2015

Federal Emergency Management Agency

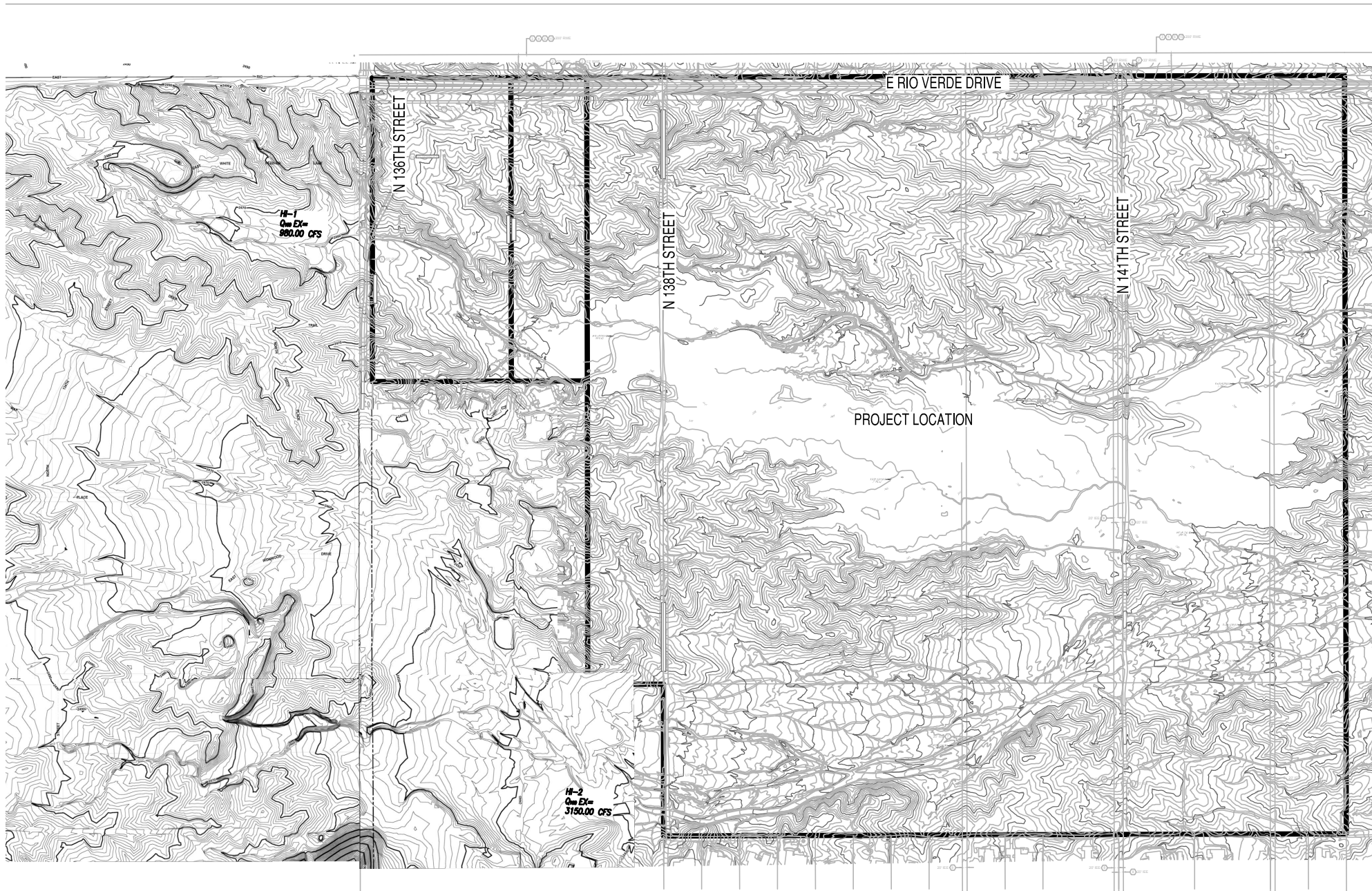


FIGURE 3
OFF-SITE DRAINAGE MAP

APPENDIX I

Rainfall Data



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.7391°, Longitude: -111.7963°
Elevation: 2519.87 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.243 (0.203-0.299)	0.318 (0.266-0.390)	0.428 (0.354-0.523)	0.510 (0.420-0.622)	0.619 (0.502-0.752)	0.701 (0.563-0.846)	0.783 (0.619-0.943)	0.865 (0.675-1.04)	0.975 (0.742-1.18)	1.06 (0.791-1.29)
10-min	0.370 (0.309-0.455)	0.484 (0.405-0.593)	0.651 (0.539-0.797)	0.777 (0.639-0.947)	0.943 (0.765-1.14)	1.07 (0.857-1.29)	1.19 (0.942-1.44)	1.32 (1.03-1.58)	1.48 (1.13-1.79)	1.62 (1.20-1.96)
15-min	0.459 (0.383-0.564)	0.600 (0.502-0.736)	0.807 (0.669-0.987)	0.963 (0.792-1.17)	1.17 (0.948-1.42)	1.32 (1.06-1.60)	1.48 (1.17-1.78)	1.63 (1.27-1.96)	1.84 (1.40-2.22)	2.00 (1.49-2.42)
30-min	0.619 (0.516-0.759)	0.808 (0.676-0.991)	1.09 (0.900-1.33)	1.30 (1.07-1.58)	1.57 (1.28-1.91)	1.78 (1.43-2.15)	1.99 (1.57-2.40)	2.20 (1.71-2.64)	2.48 (1.89-2.98)	2.70 (2.01-3.27)
60-min	0.766 (0.639-0.940)	1.00 (0.837-1.23)	1.35 (1.11-1.65)	1.61 (1.32-1.96)	1.95 (1.58-2.36)	2.21 (1.77-2.66)	2.46 (1.95-2.96)	2.72 (2.12-3.27)	3.07 (2.33-3.69)	3.34 (2.49-4.04)
2-hr	0.879 (0.742-1.05)	1.14 (0.960-1.37)	1.51 (1.26-1.81)	1.79 (1.49-2.15)	2.17 (1.79-2.59)	2.46 (2.00-2.93)	2.75 (2.21-3.27)	3.05 (2.41-3.62)	3.44 (2.66-4.09)	3.75 (2.85-4.48)
3-hr	0.944 (0.797-1.15)	1.21 (1.02-1.47)	1.57 (1.32-1.91)	1.86 (1.55-2.25)	2.26 (1.86-2.72)	2.58 (2.10-3.09)	2.91 (2.32-3.49)	3.25 (2.56-3.89)	3.71 (2.84-4.44)	4.09 (3.06-4.90)
6-hr	1.14 (0.985-1.35)	1.44 (1.25-1.70)	1.83 (1.57-2.15)	2.13 (1.82-2.50)	2.56 (2.15-2.98)	2.89 (2.39-3.35)	3.23 (2.64-3.75)	3.57 (2.87-4.15)	4.03 (3.16-4.68)	4.39 (3.37-5.10)
12-hr	1.37 (1.20-1.60)	1.73 (1.51-2.01)	2.17 (1.88-2.52)	2.52 (2.17-2.92)	3.00 (2.55-3.46)	3.36 (2.83-3.88)	3.74 (3.11-4.31)	4.12 (3.38-4.75)	4.61 (3.70-5.34)	4.99 (3.94-5.82)
24-hr	1.67 (1.48-1.92)	2.12 (1.88-2.44)	2.77 (2.44-3.17)	3.29 (2.88-3.77)	4.03 (3.49-4.63)	4.63 (3.96-5.33)	5.27 (4.45-6.10)	5.95 (4.93-6.93)	6.91 (5.59-8.15)	7.69 (6.10-9.17)
2-day	1.93 (1.70-2.22)	2.47 (2.17-2.83)	3.26 (2.85-3.74)	3.91 (3.40-4.47)	4.82 (4.15-5.52)	5.56 (4.72-6.39)	6.34 (5.33-7.35)	7.18 (5.95-8.40)	8.37 (6.77-9.91)	9.33 (7.41-11.2)
3-day	2.08 (1.83-2.38)	2.67 (2.35-3.06)	3.55 (3.11-4.06)	4.28 (3.73-4.88)	5.32 (4.59-6.09)	6.17 (5.26-7.10)	7.10 (5.97-8.22)	8.09 (6.70-9.46)	9.51 (7.69-11.3)	10.7 (8.48-12.8)
4-day	2.23 (1.97-2.55)	2.87 (2.53-3.28)	3.84 (3.37-4.38)	4.65 (4.06-5.30)	5.82 (5.02-6.65)	6.79 (5.80-7.80)	7.85 (6.61-9.09)	8.99 (7.45-10.5)	10.7 (8.61-12.6)	12.0 (9.54-14.5)
7-day	2.57 (2.25-2.96)	3.30 (2.89-3.79)	4.43 (3.87-5.09)	5.38 (4.67-6.18)	6.76 (5.80-7.78)	7.92 (6.71-9.15)	9.19 (7.68-10.7)	10.6 (8.69-12.5)	12.6 (10.1-15.1)	14.3 (11.2-17.3)
10-day	2.82 (2.48-3.23)	3.63 (3.19-4.15)	4.85 (4.25-5.54)	5.86 (5.10-6.69)	7.33 (6.31-8.39)	8.56 (7.28-9.84)	9.89 (8.31-11.5)	11.3 (9.37-13.3)	13.4 (10.8-16.0)	15.2 (12.0-18.3)
20-day	3.59 (3.17-4.09)	4.63 (4.08-5.26)	6.14 (5.39-6.98)	7.34 (6.41-8.34)	9.01 (7.81-10.3)	10.3 (8.88-11.8)	11.8 (9.98-13.6)	13.2 (11.1-15.4)	15.3 (12.6-18.1)	17.0 (13.7-20.3)
30-day	4.27 (3.76-4.85)	5.51 (4.86-6.24)	7.30 (6.43-8.27)	8.71 (7.64-9.85)	10.7 (9.27-12.1)	12.2 (10.5-13.9)	13.8 (11.8-15.8)	15.5 (13.1-17.8)	17.8 (14.7-20.8)	19.6 (16.0-23.2)
45-day	5.11 (4.51-5.80)	6.60 (5.82-7.49)	8.75 (7.70-9.92)	10.4 (9.12-11.8)	12.7 (11.0-14.5)	14.5 (12.5-16.6)	16.4 (14.0-18.8)	18.3 (15.5-21.3)	21.1 (17.4-24.8)	23.3 (18.9-27.6)
60-day	5.81 (5.14-6.58)	7.52 (6.64-8.51)	9.93 (8.75-11.2)	11.7 (10.3-13.3)	14.2 (12.4-16.1)	16.1 (13.9-18.4)	18.1 (15.5-20.7)	20.1 (17.0-23.2)	22.9 (19.0-26.8)	25.1 (20.6-29.7)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

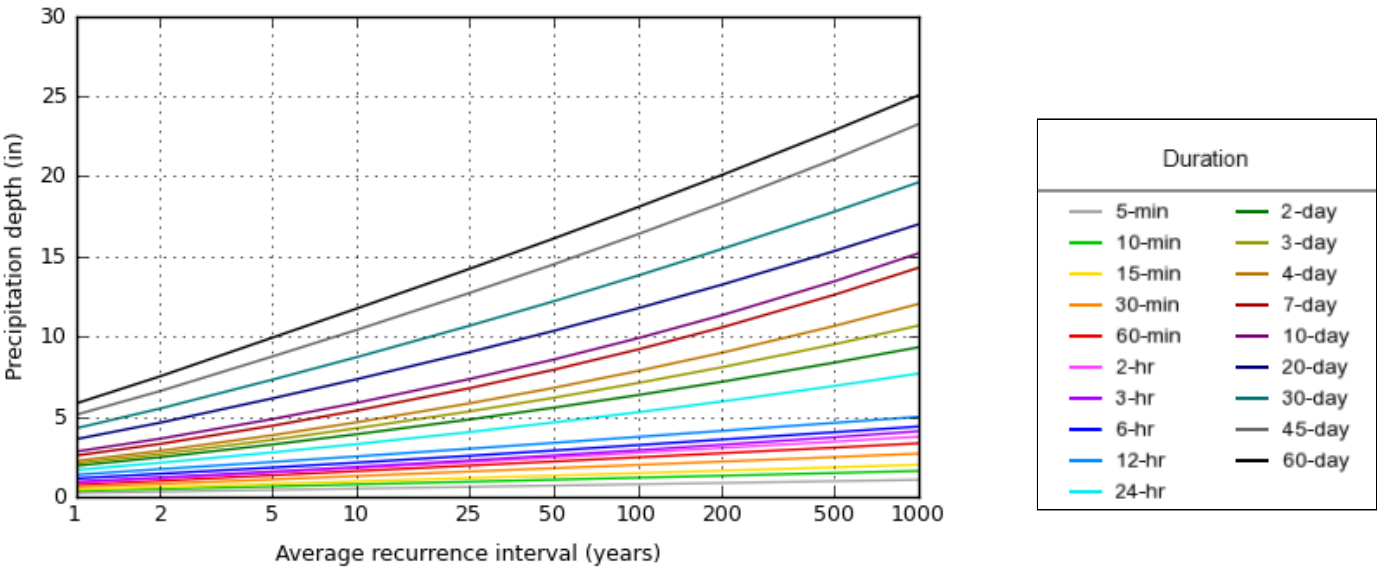
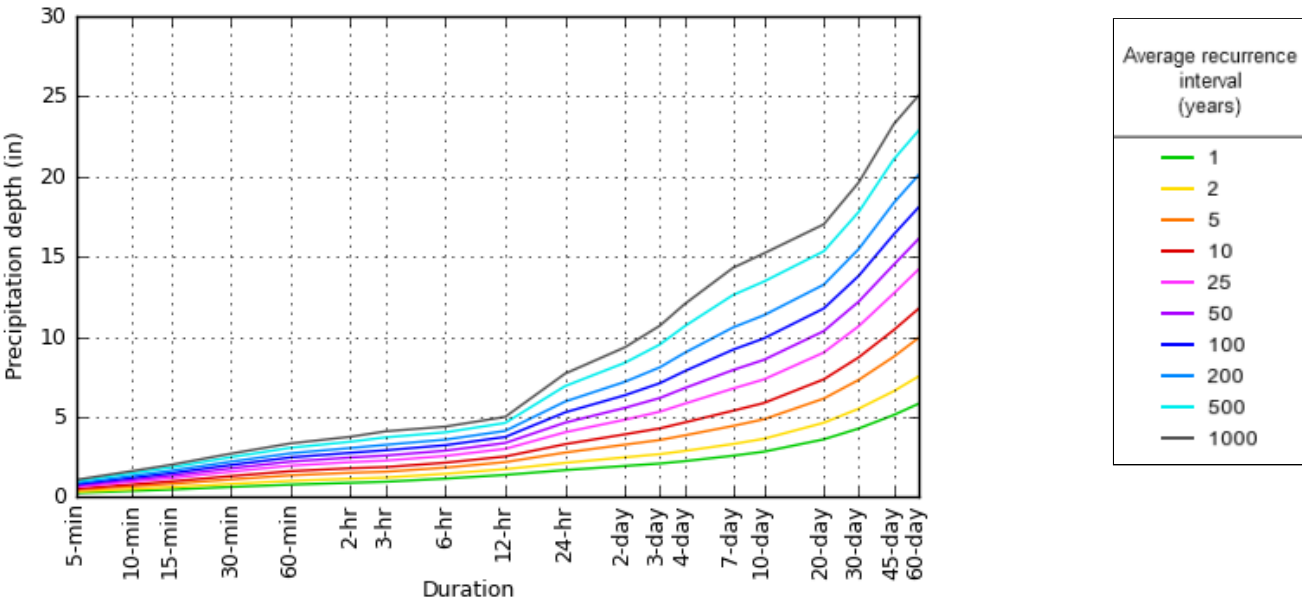
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.7391°, Longitude: -111.7963°



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Maps & aerials

Small scale terrain



NOAA Atlas 14, Volume 8, Version 2
Location name: Bronson, Kansas, USA*
Latitude: 38°, Longitude: -95°
Elevation: 1038.83 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

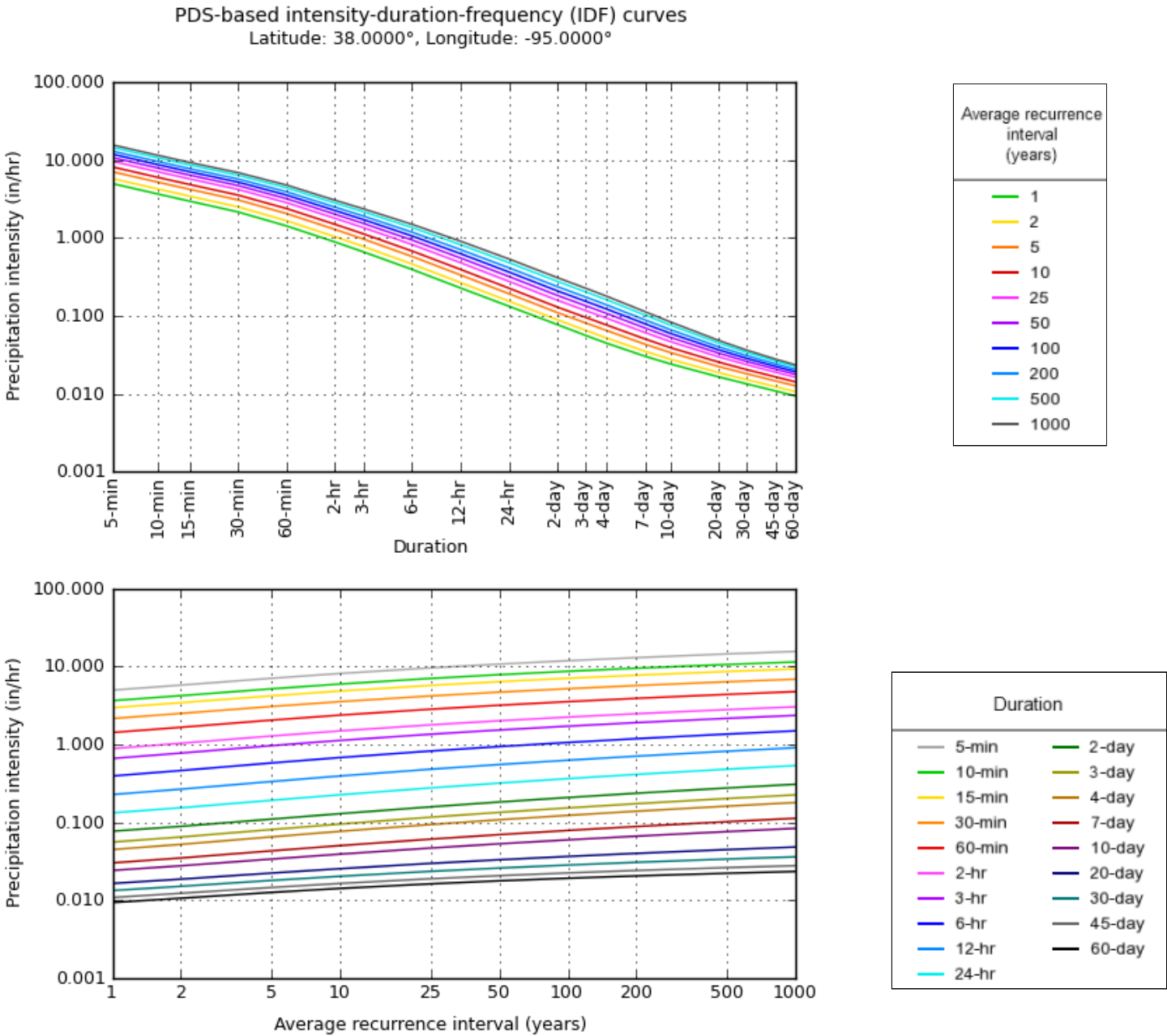
PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.98 (3.91-6.26)	5.77 (4.54-7.27)	7.07 (5.54-8.92)	8.15 (6.35-10.3)	9.61 (7.26-12.4)	10.7 (7.96-14.0)	11.9 (8.52-15.7)	13.0 (9.01-17.5)	14.5 (9.71-19.9)	15.6 (10.2-21.7)
10-min	3.65 (2.87-4.59)	4.23 (3.32-5.32)	5.18 (4.06-6.53)	5.96 (4.64-7.54)	7.04 (5.32-9.08)	7.87 (5.82-10.2)	8.69 (6.24-11.5)	9.52 (6.59-12.8)	10.6 (7.10-14.6)	11.4 (7.49-15.9)
15-min	2.96 (2.33-3.73)	3.44 (2.70-4.33)	4.21 (3.30-5.31)	4.85 (3.78-6.13)	5.72 (4.32-7.38)	6.40 (4.73-8.32)	7.06 (5.08-9.35)	7.74 (5.36-10.4)	8.64 (5.78-11.9)	9.31 (6.09-12.9)
30-min	2.15 (1.69-2.71)	2.50 (1.97-3.15)	3.07 (2.41-3.87)	3.54 (2.76-4.48)	4.19 (3.17-5.41)	4.70 (3.48-6.11)	5.20 (3.73-6.88)	5.70 (3.95-7.68)	6.37 (4.26-8.75)	6.88 (4.50-9.56)
60-min	1.42 (1.12-1.79)	1.66 (1.31-2.09)	2.05 (1.61-2.59)	2.38 (1.85-3.01)	2.83 (2.14-3.66)	3.19 (2.36-4.16)	3.54 (2.55-4.70)	3.91 (2.71-5.27)	4.39 (2.94-6.04)	4.76 (3.12-6.62)
2-hr	0.886 (0.705-1.10)	1.04 (0.824-1.29)	1.28 (1.02-1.60)	1.49 (1.18-1.87)	1.79 (1.37-2.28)	2.01 (1.51-2.60)	2.24 (1.63-2.95)	2.48 (1.74-3.32)	2.80 (1.90-3.82)	3.04 (2.01-4.19)
3-hr	0.661 (0.530-0.817)	0.775 (0.621-0.958)	0.966 (0.771-1.20)	1.13 (0.895-1.40)	1.35 (1.05-1.72)	1.53 (1.16-1.97)	1.72 (1.26-2.24)	1.91 (1.35-2.54)	2.16 (1.48-2.94)	2.36 (1.57-3.24)
6-hr	0.394 (0.320-0.481)	0.463 (0.375-0.565)	0.579 (0.468-0.708)	0.680 (0.547-0.834)	0.824 (0.646-1.04)	0.940 (0.720-1.20)	1.06 (0.788-1.37)	1.19 (0.849-1.57)	1.36 (0.939-1.83)	1.50 (1.01-2.03)
12-hr	0.228 (0.187-0.275)	0.267 (0.219-0.322)	0.335 (0.274-0.404)	0.394 (0.321-0.478)	0.482 (0.383-0.603)	0.553 (0.430-0.698)	0.628 (0.473-0.808)	0.708 (0.514-0.928)	0.819 (0.574-1.10)	0.907 (0.619-1.22)
24-hr	0.133 (0.111-0.158)	0.154 (0.128-0.184)	0.192 (0.159-0.229)	0.226 (0.187-0.271)	0.277 (0.224-0.344)	0.320 (0.252-0.400)	0.365 (0.278-0.465)	0.413 (0.304-0.537)	0.481 (0.342-0.639)	0.536 (0.370-0.716)
2-day	0.077 (0.065-0.091)	0.089 (0.075-0.105)	0.110 (0.093-0.130)	0.129 (0.108-0.153)	0.158 (0.130-0.195)	0.183 (0.146-0.226)	0.209 (0.161-0.263)	0.237 (0.176-0.305)	0.276 (0.199-0.364)	0.309 (0.216-0.408)
3-day	0.056 (0.048-0.065)	0.065 (0.055-0.076)	0.081 (0.069-0.095)	0.095 (0.080-0.112)	0.117 (0.096-0.142)	0.135 (0.108-0.165)	0.153 (0.120-0.192)	0.174 (0.130-0.223)	0.203 (0.147-0.265)	0.226 (0.159-0.297)
4-day	0.045 (0.038-0.052)	0.052 (0.045-0.061)	0.065 (0.056-0.076)	0.077 (0.065-0.090)	0.094 (0.078-0.114)	0.108 (0.087-0.132)	0.123 (0.096-0.154)	0.139 (0.105-0.177)	0.162 (0.118-0.211)	0.180 (0.127-0.236)
7-day	0.030 (0.026-0.035)	0.035 (0.030-0.040)	0.043 (0.037-0.050)	0.050 (0.043-0.058)	0.061 (0.051-0.073)	0.070 (0.057-0.084)	0.079 (0.062-0.097)	0.089 (0.067-0.112)	0.102 (0.075-0.132)	0.113 (0.081-0.147)
10-day	0.024 (0.021-0.028)	0.028 (0.024-0.032)	0.034 (0.029-0.039)	0.039 (0.034-0.045)	0.047 (0.039-0.056)	0.053 (0.044-0.064)	0.060 (0.047-0.073)	0.067 (0.051-0.084)	0.076 (0.056-0.098)	0.084 (0.060-0.109)
20-day	0.016 (0.015-0.019)	0.019 (0.016-0.021)	0.022 (0.020-0.025)	0.025 (0.022-0.029)	0.030 (0.025-0.035)	0.033 (0.028-0.039)	0.037 (0.029-0.044)	0.040 (0.031-0.050)	0.045 (0.033-0.057)	0.048 (0.035-0.062)
30-day	0.013 (0.012-0.015)	0.015 (0.013-0.017)	0.018 (0.016-0.020)	0.020 (0.018-0.023)	0.024 (0.020-0.027)	0.026 (0.022-0.030)	0.028 (0.023-0.034)	0.031 (0.024-0.038)	0.034 (0.025-0.043)	0.036 (0.027-0.046)
45-day	0.011 (0.010-0.012)	0.012 (0.011-0.014)	0.015 (0.013-0.016)	0.016 (0.015-0.018)	0.019 (0.016-0.022)	0.021 (0.017-0.024)	0.022 (0.018-0.027)	0.024 (0.019-0.029)	0.026 (0.020-0.033)	0.028 (0.021-0.035)
60-day	0.009 (0.008-0.010)	0.011 (0.010-0.012)	0.013 (0.011-0.014)	0.014 (0.013-0.016)	0.016 (0.014-0.018)	0.018 (0.015-0.020)	0.019 (0.016-0.023)	0.021 (0.016-0.025)	0.022 (0.017-0.028)	0.023 (0.017-0.030)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

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PF graphical



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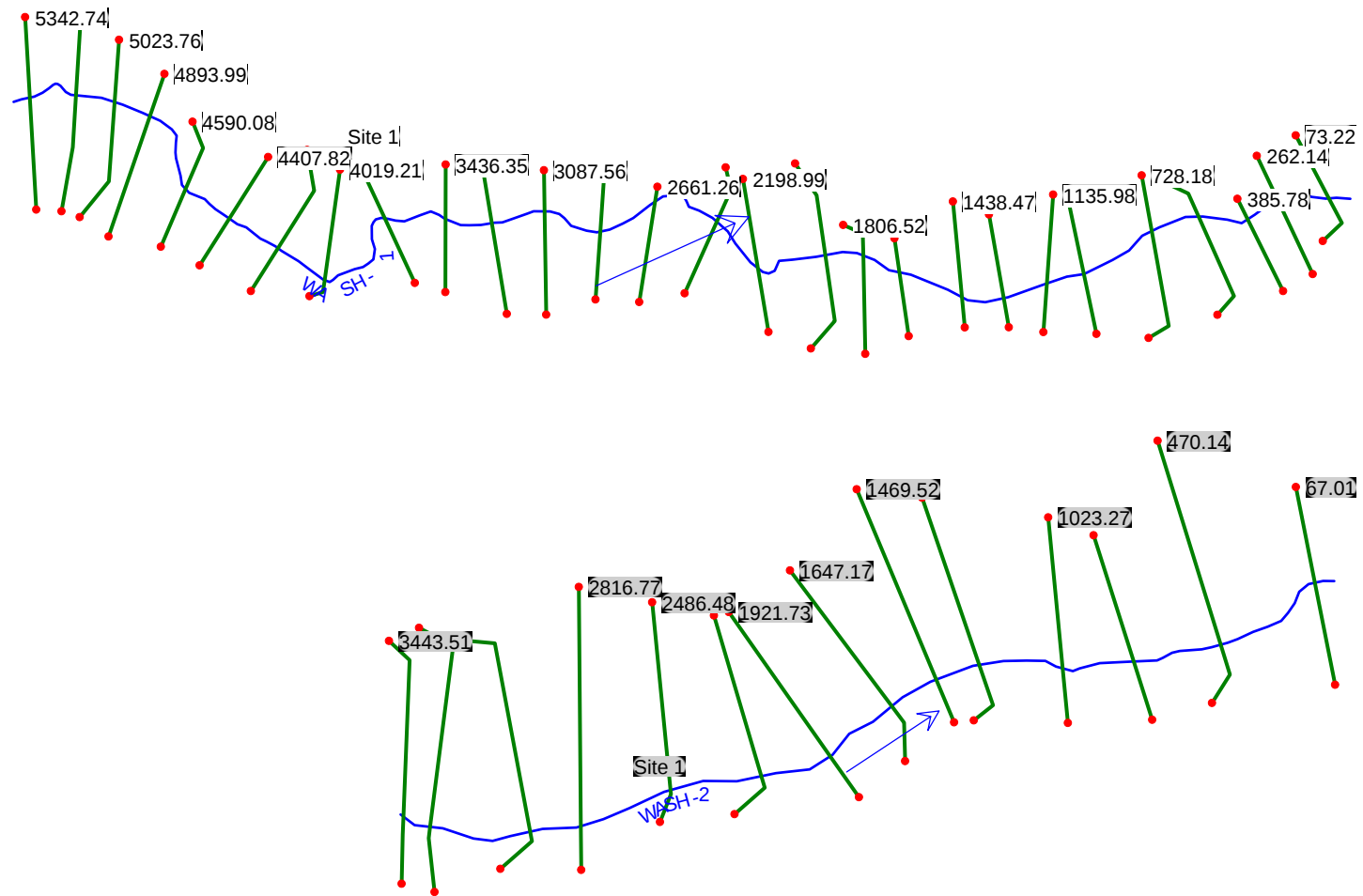
Maps & aerials

Small scale terrain

APPENDIX II

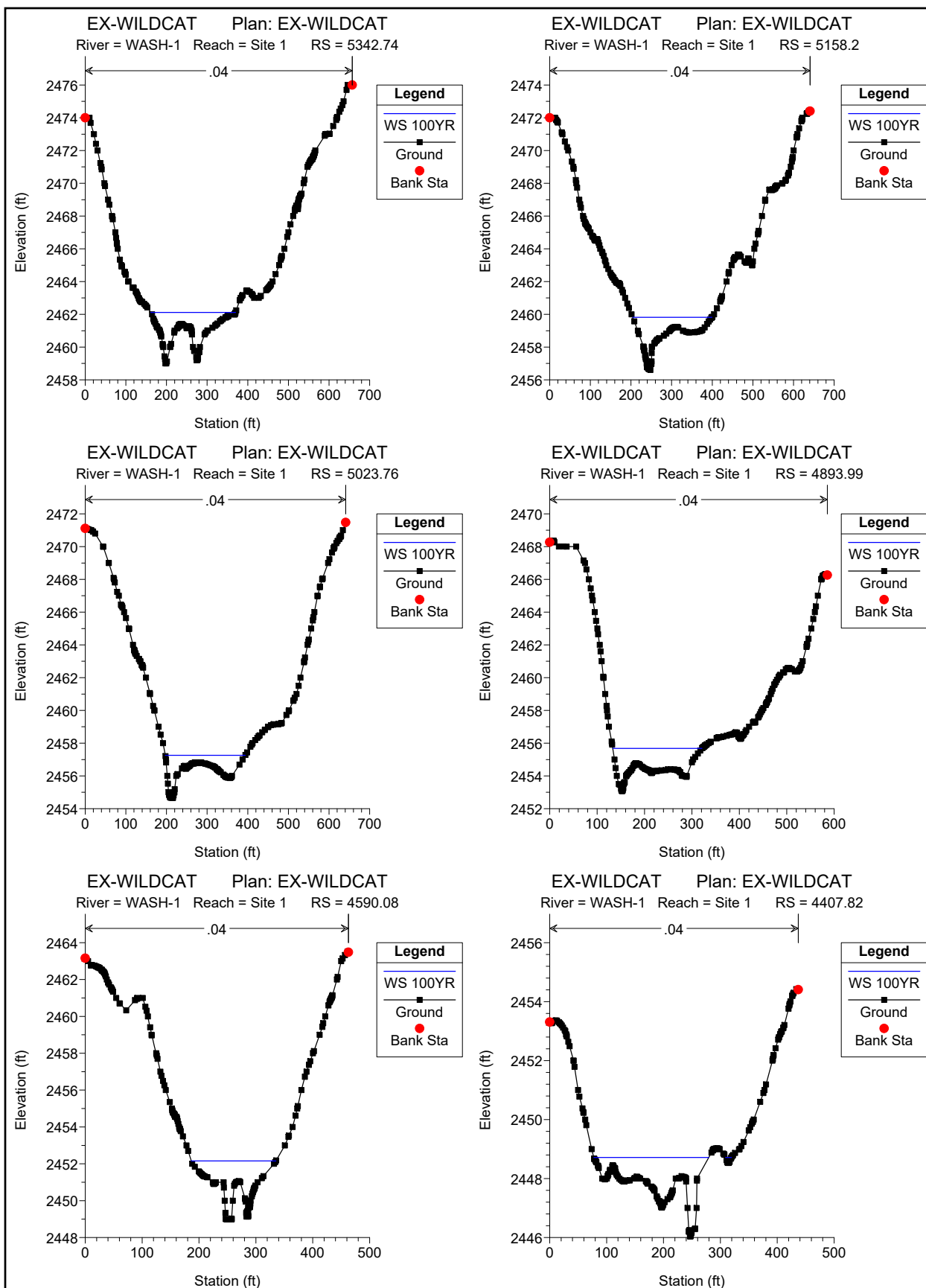
Calculations

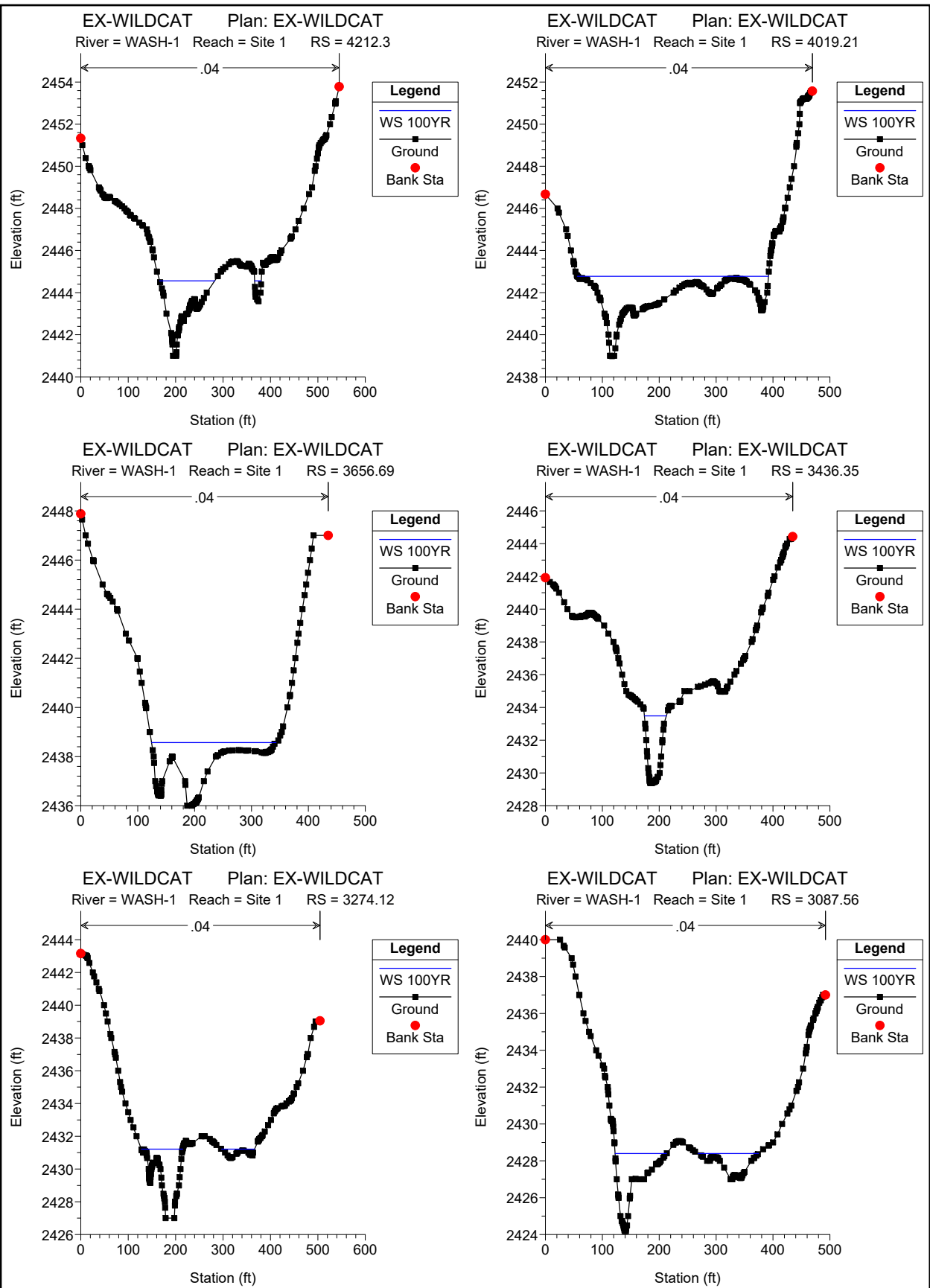
Existing Condition HEC-RAS Model

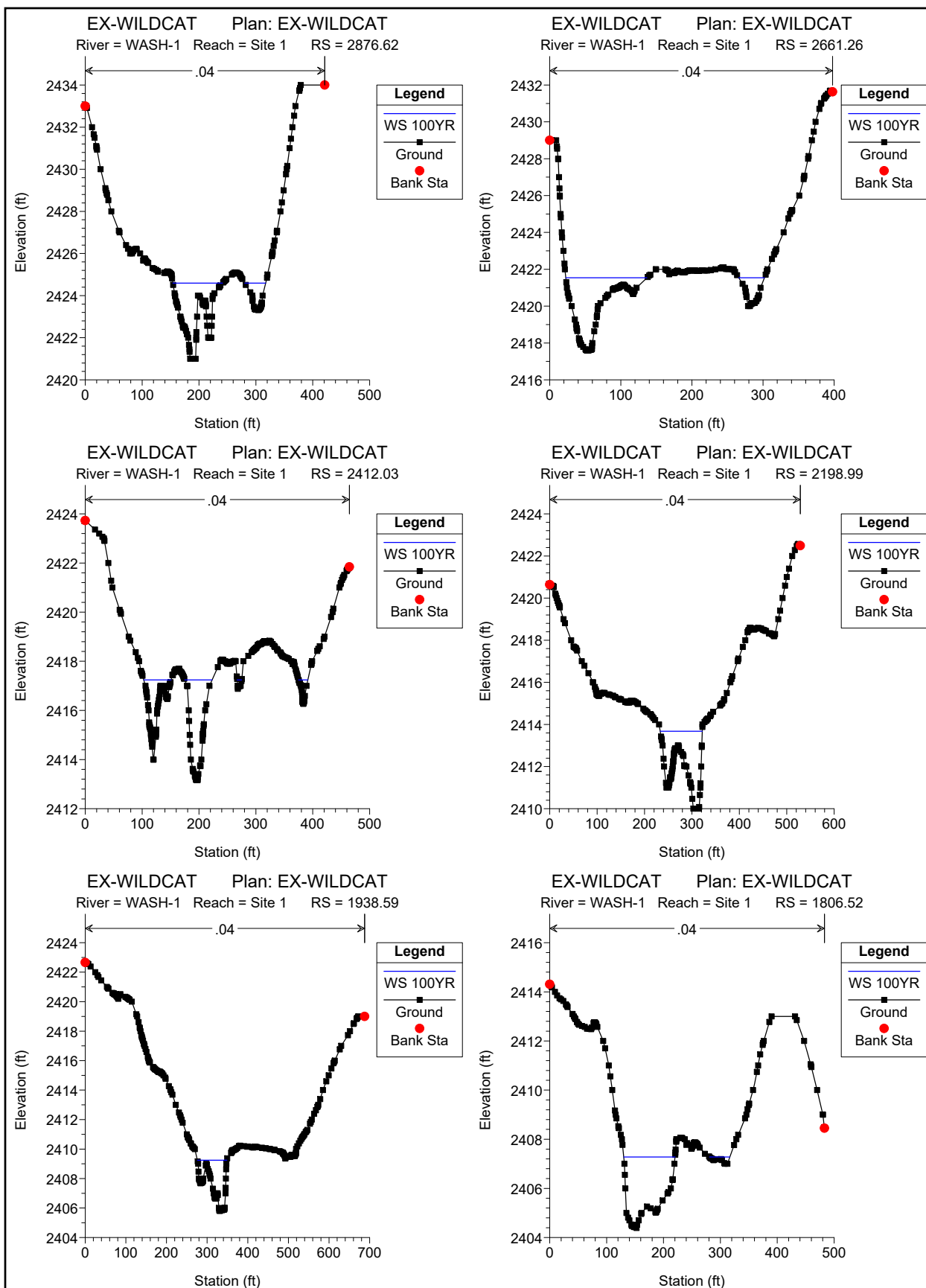


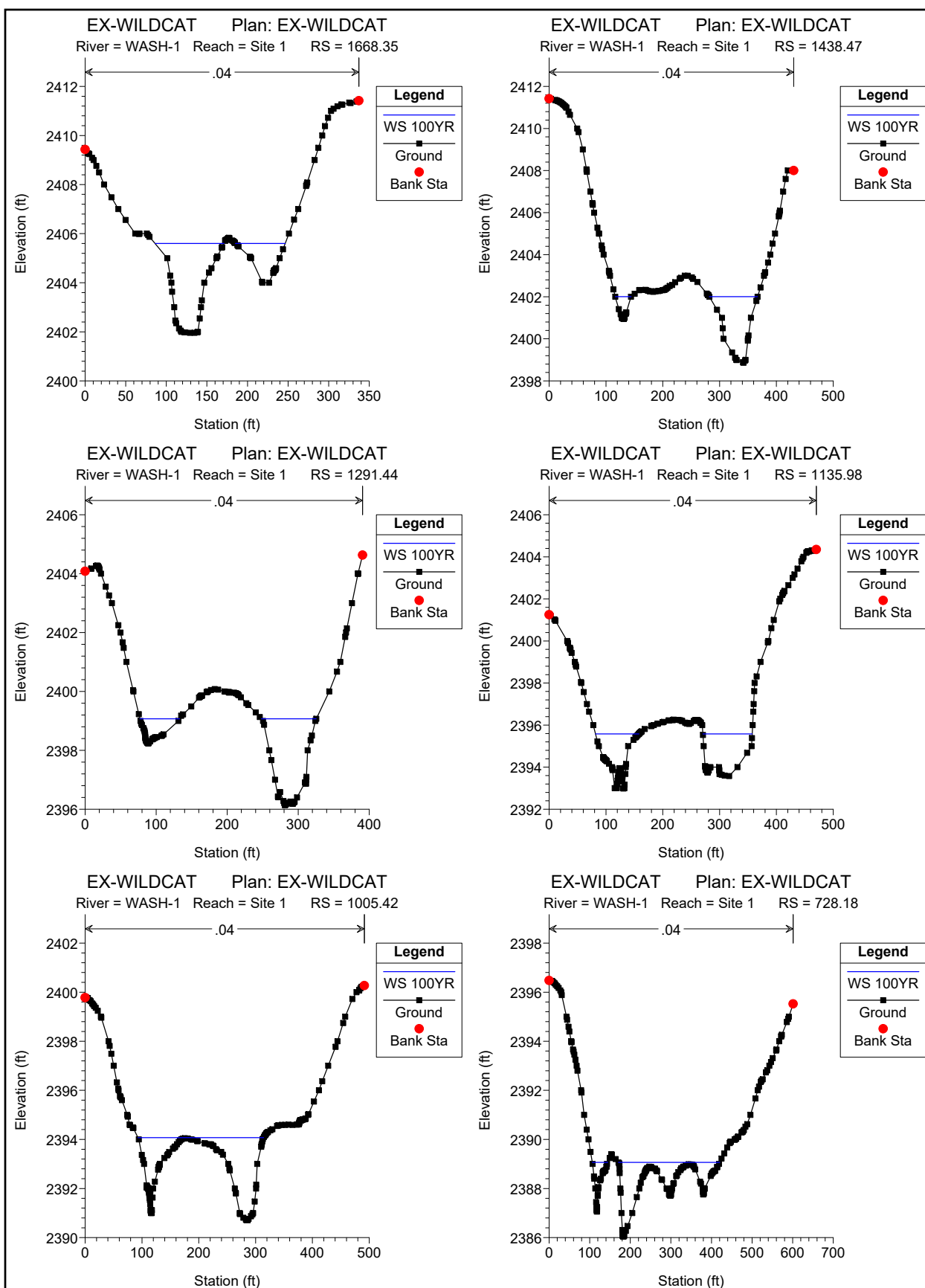
HEC-RAS Plan: EX Profile: 100YR

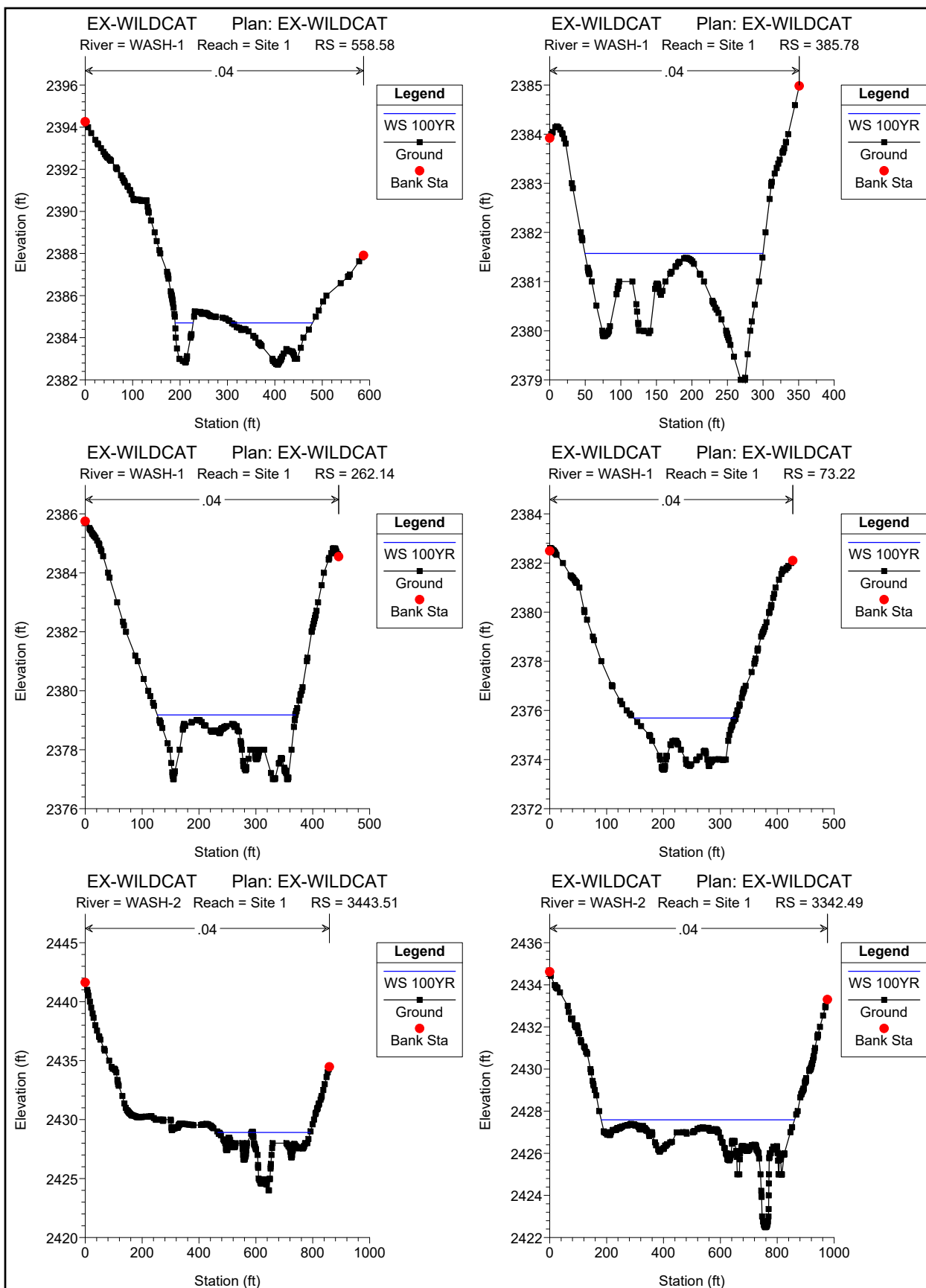
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
WASH-2	Site 1	3443.51	100YR	3150.00	2424.00	2428.91	2428.86	2429.60	0.019483	6.67	472.60	322.07	0.97
WASH-2	Site 1	3342.49	100YR	3150.00	2422.49	2427.59		2427.89	0.013069	4.39	717.48	679.66	0.75
WASH-2	Site 1	2991.03	100YR	3150.00	2416.35	2421.32	2421.32	2422.01	0.021906	6.66	472.76	352.26	1.01
WASH-2	Site 1	2816.77	100YR	3192.03	2413.35	2417.66	2417.57	2418.11	0.018701	5.35	596.78	548.73	0.90
WASH-2	Site 1	2486.48	100YR	3192.03	2408.04	2412.44	2412.16	2412.85	0.013646	5.11	624.17	486.59	0.80
WASH-2	Site 1	2171.29	100YR	3192.03	2403.12	2406.95	2406.92	2407.53	0.021189	6.08	525.12	438.43	0.98
WASH-2	Site 1	1921.73	100YR	3192.03	2399.32	2402.73		2403.34	0.013586	6.24	511.19	293.98	0.83
WASH-2	Site 1	1647.17	100YR	3192.03	2395.00	2397.98	2397.98	2398.79	0.020486	7.22	442.00	278.72	1.01
WASH-2	Site 1	1469.52	100YR	3223.47	2392.08	2394.64	2394.51	2395.11	0.016774	5.49	587.18	481.29	0.88
WASH-2	Site 1	1314.32	100YR	3223.47	2388.63	2391.50	2391.50	2392.12	0.022122	6.31	510.52	417.42	1.01
WASH-2	Site 1	1023.27	100YR	3223.47	2381.98	2386.20	2385.89	2386.57	0.011944	4.88	660.99	501.31	0.75
WASH-2	Site 1	775.59	100YR	3372.56	2379.23	2382.19	2382.14	2382.71	0.020724	5.75	586.40	524.74	0.96
WASH-2	Site 1	470.14	100YR	3379.99	2373.88	2375.94	2375.89	2376.38	0.020645	5.32	635.84	638.34	0.94
WASH-2	Site 1	67.01	100YR	3486.10	2366.23	2368.41	2368.31	2368.85	0.017021	5.28	659.82	579.29	0.87
WASH-1	Site 1	5342.74	100YR	980.00	2459.00	2462.11	2461.76	2462.37	0.009909	4.07	241.04	208.45	0.67
WASH-1	Site 1	5158.2	100YR	980.00	2456.60	2459.82	2459.65	2460.16	0.014633	4.69	208.81	194.92	0.80
WASH-1	Site 1	5023.76	100YR	980.00	2454.66	2457.26	2457.25	2457.71	0.023137	5.37	182.56	196.64	0.98
WASH-1	Site 1	4893.99	100YR	980.00	2453.08	2455.68	2455.31	2455.94	0.008570	4.06	241.59	188.21	0.63
WASH-1	Site 1	4590.08	100YR	980.00	2448.98	2452.16	2451.98	2452.58	0.014604	5.21	188.13	148.80	0.82
WASH-1	Site 1	4407.82	100YR	980.00	2446.04	2448.72	2448.72	2449.16	0.024966	5.32	184.29	212.66	1.01
WASH-1	Site 1	4212.3	100YR	980.00	2441.00	2444.56	2444.43	2445.07	0.016779	5.74	170.63	129.83	0.88
WASH-1	Site 1	4019.21	100YR	980.00	2438.99	2442.77	2442.26	2442.92	0.007283	3.06	319.82	335.76	0.55
WASH-1	Site 1	3656.69	100YR	980.00	2436.00	2438.57	2438.49	2438.93	0.018347	4.80	204.25	218.74	0.88
WASH-1	Site 1	3436.35	100YR	980.00	2429.38	2433.48	2433.48	2434.85	0.017756	9.38	104.52	38.60	1.00
WASH-1	Site 1	3274.12	100YR	980.00	2427.00	2431.21	2430.72	2431.63	0.015688	5.21	188.12	156.85	0.84
WASH-1	Site 1	3087.56	100YR	980.00	2424.19	2428.40	2428.19	2428.74	0.015013	4.71	208.07	196.45	0.81
WASH-1	Site 1	2876.62	100YR	980.00	2421.00	2424.59	2424.51	2425.16	0.019076	6.04	162.13	124.18	0.93
WASH-1	Site 1	2661.26	100YR	980.00	2417.59	2421.54	2421.24	2421.91	0.011852	4.88	200.71	150.24	0.74
WASH-1	Site 1	2412.03	100YR	1059.91	2413.16	2417.24	2417.24	2417.92	0.021897	6.58	161.09	120.53	1.00
WASH-1	Site 1	2198.99	100YR	1059.91	2410.00	2413.68		2414.26	0.011340	6.11	173.46	88.61	0.77
WASH-1	Site 1	1938.59	100YR	1059.91	2405.81	2409.25	2409.24	2410.25	0.021659	8.02	132.16	72.59	1.05
WASH-1	Site 1	1806.52	100YR	1059.91	2404.39	2407.28		2407.79	0.014436	5.74	184.75	125.99	0.84
WASH-1	Site 1	1668.35	100YR	1059.91	2401.96	2405.60		2405.99	0.011283	5.02	211.06	146.21	0.74
WASH-1	Site 1	1438.47	100YR	1059.91	2398.87	2402.00	2401.94	2402.66	0.018950	6.51	162.83	112.81	0.96
WASH-1	Site 1	1291.44	100YR	1059.91	2396.14	2399.07	2399.07	2399.69	0.021445	6.33	167.53	132.99	0.99
WASH-1	Site 1	1135.98	100YR	1081.79	2392.99	2395.58		2395.95	0.011368	4.85	222.97	163.19	0.73
WASH-1	Site 1	1005.42	100YR	1081.79	2390.71	2394.07	2393.64	2394.38	0.012483	4.42	244.53	221.11	0.74
WASH-1	Site 1	728.18	100YR	1196.53	2386.05	2389.06	2389.06	2389.47	0.025624	5.15	232.53	287.68	1.01
WASH-1	Site 1	558.58	100YR	1196.53	2382.73	2384.71	2384.66	2385.18	0.020870	5.50	217.42	208.89	0.95
WASH-1	Site 1	385.78	100YR	1196.53	2379.00	2381.57	2381.44	2381.93	0.016661	4.79	250.01	250.30	0.84
WASH-1	Site 1	262.14	100YR	1214.07	2377.00	2379.18	2379.13	2379.61	0.021070	5.23	232.23	242.55	0.94
WASH-1	Site 1	73.22	100YR	1214.07	2373.59	2375.69	2375.53	2376.15	0.016004	5.43	223.46	179.39	0.86

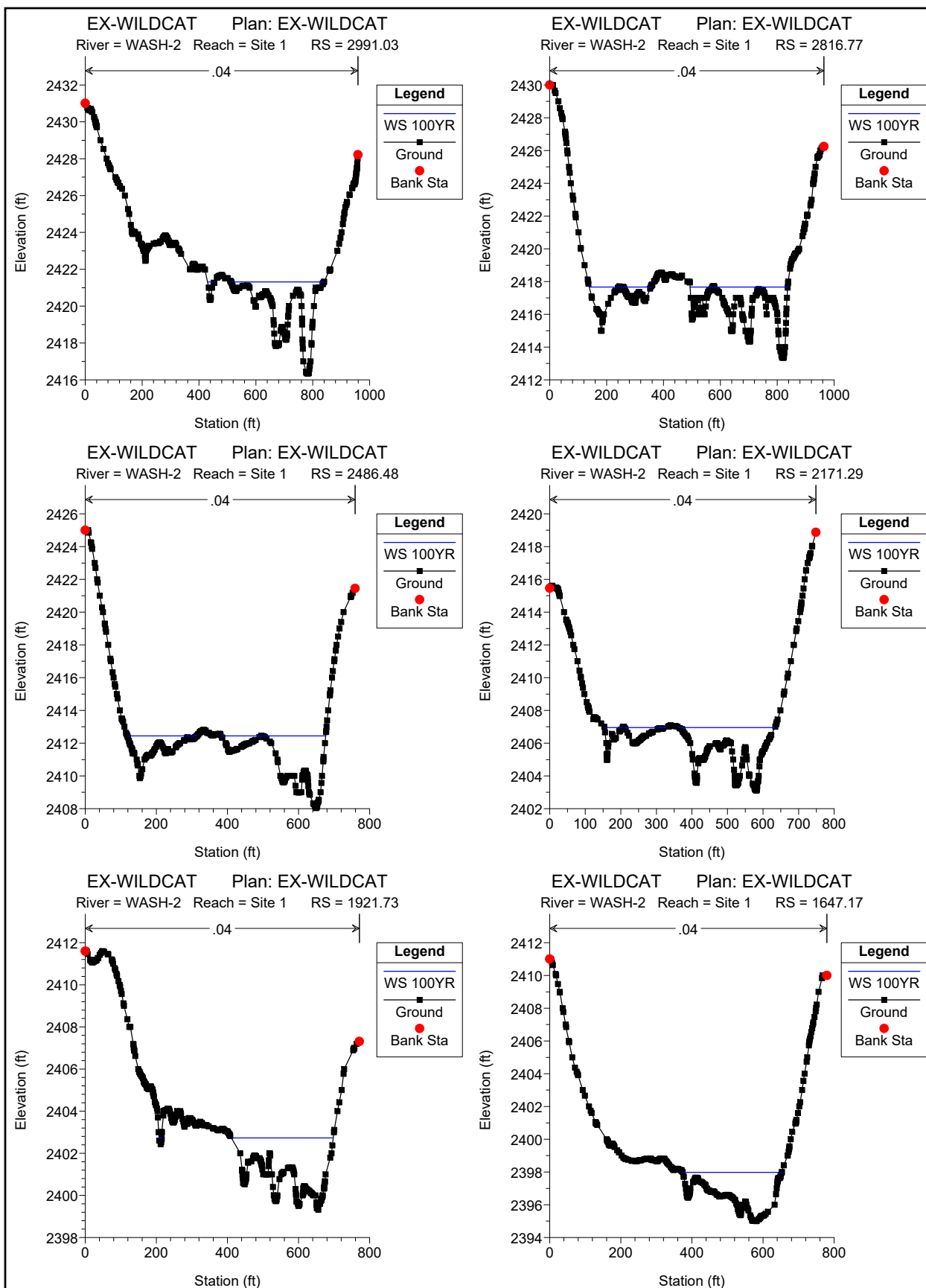


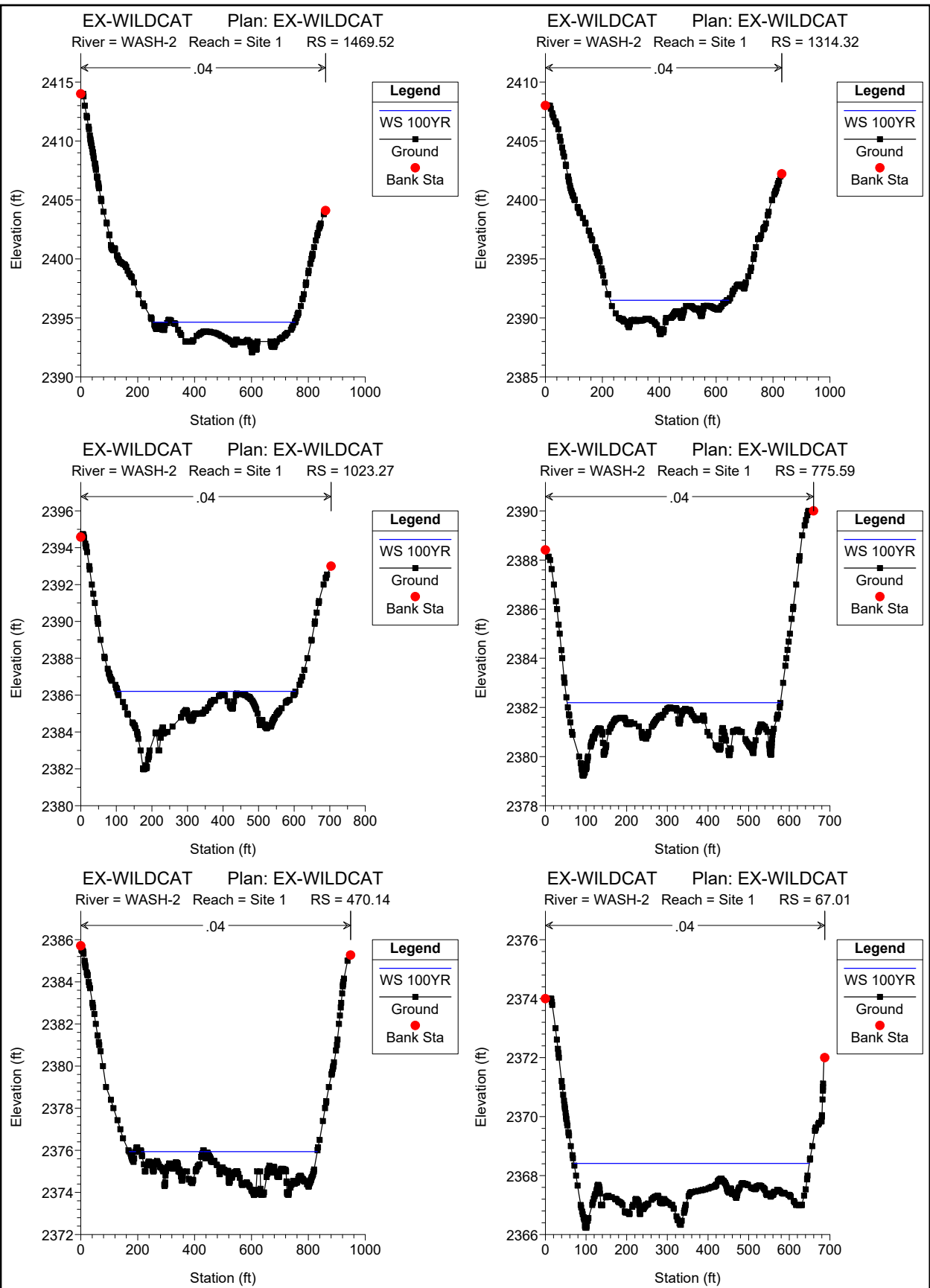




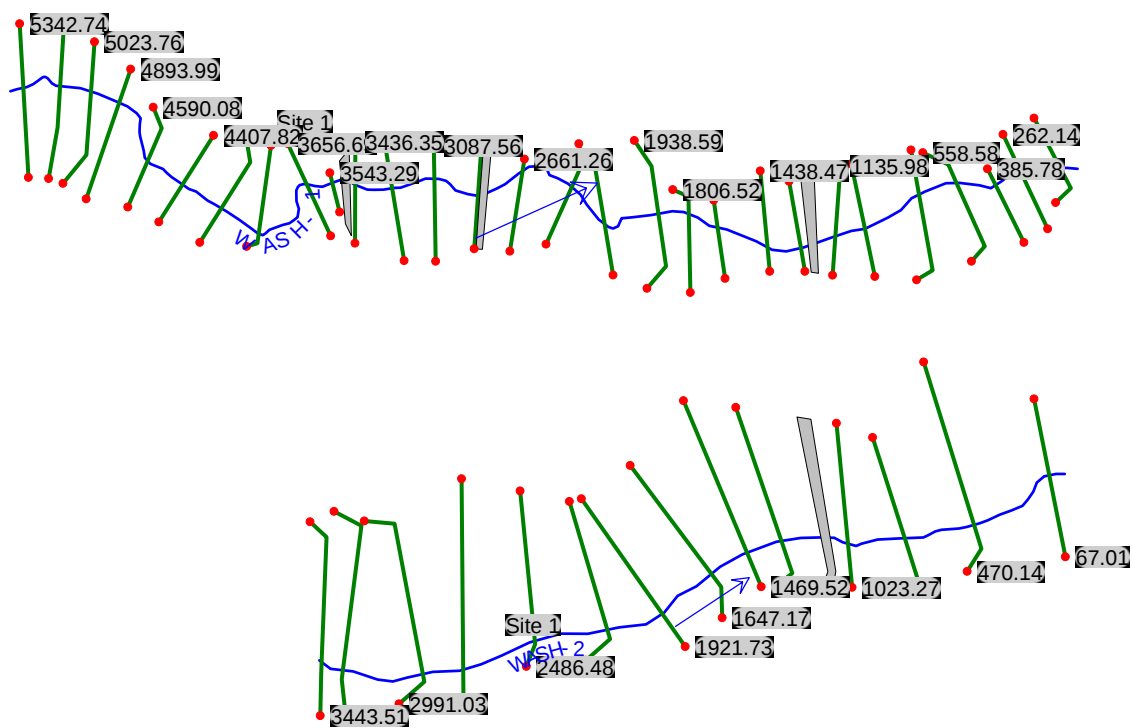






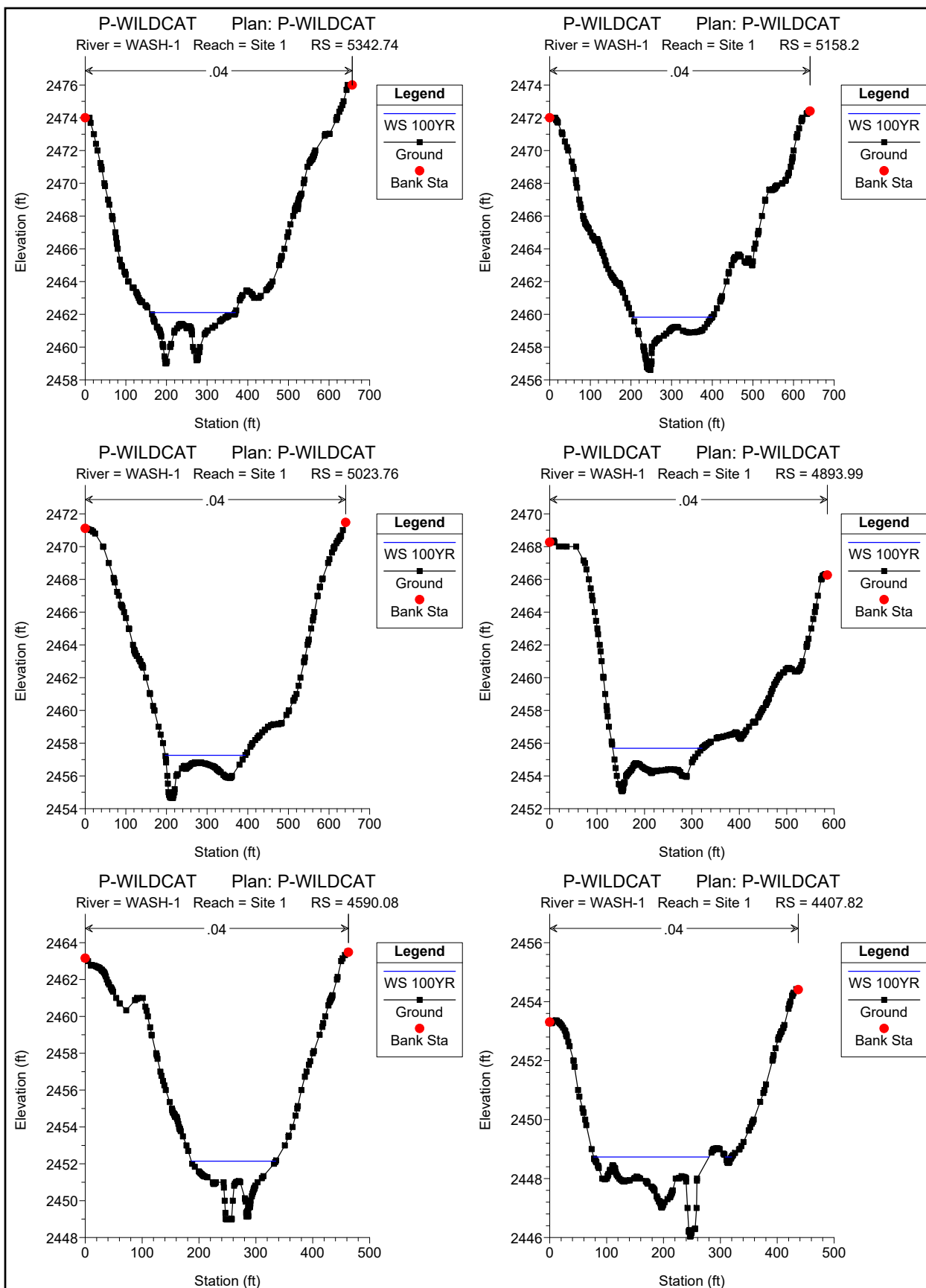


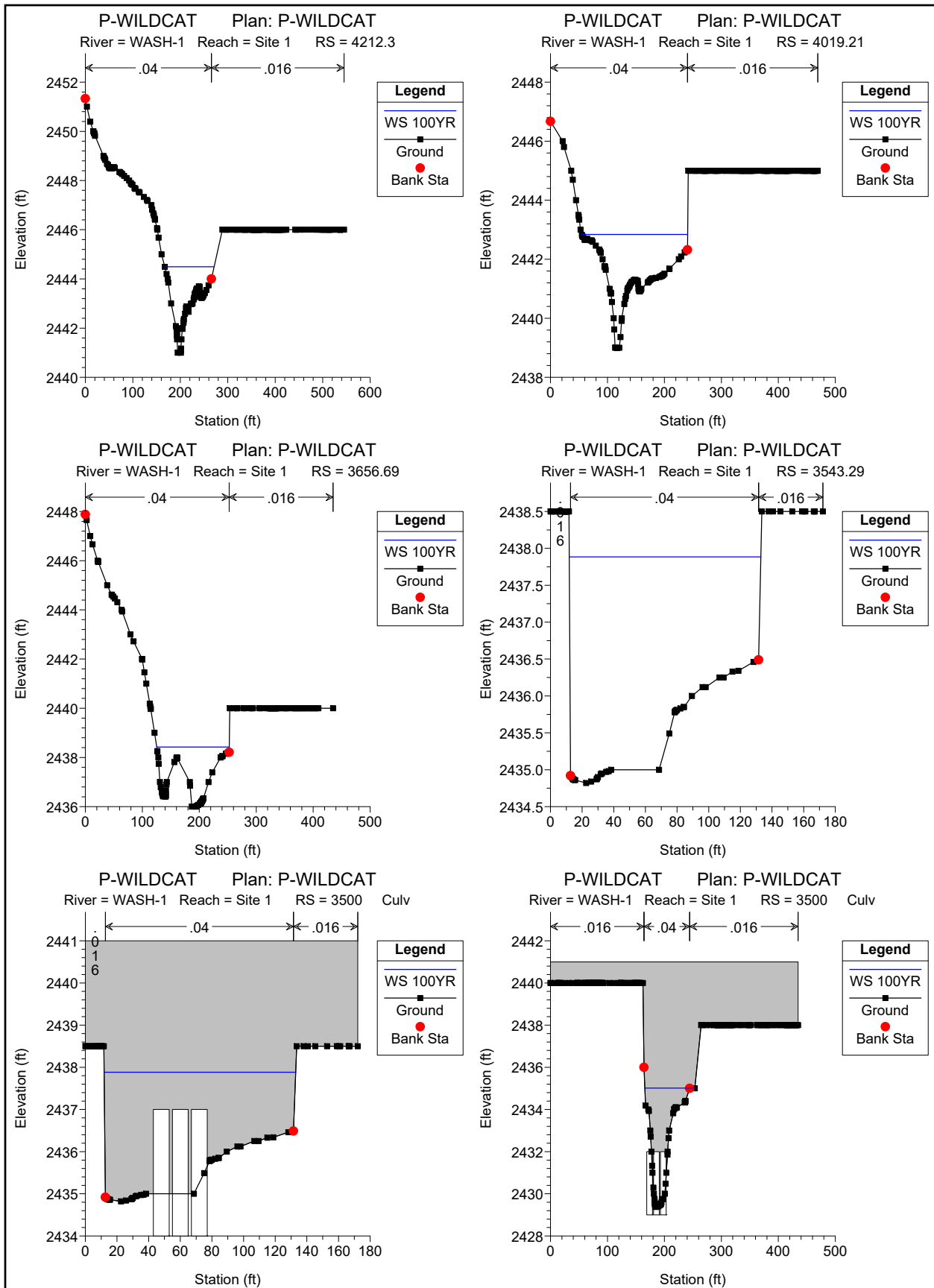
Proposed Condition HEC-RAS Model

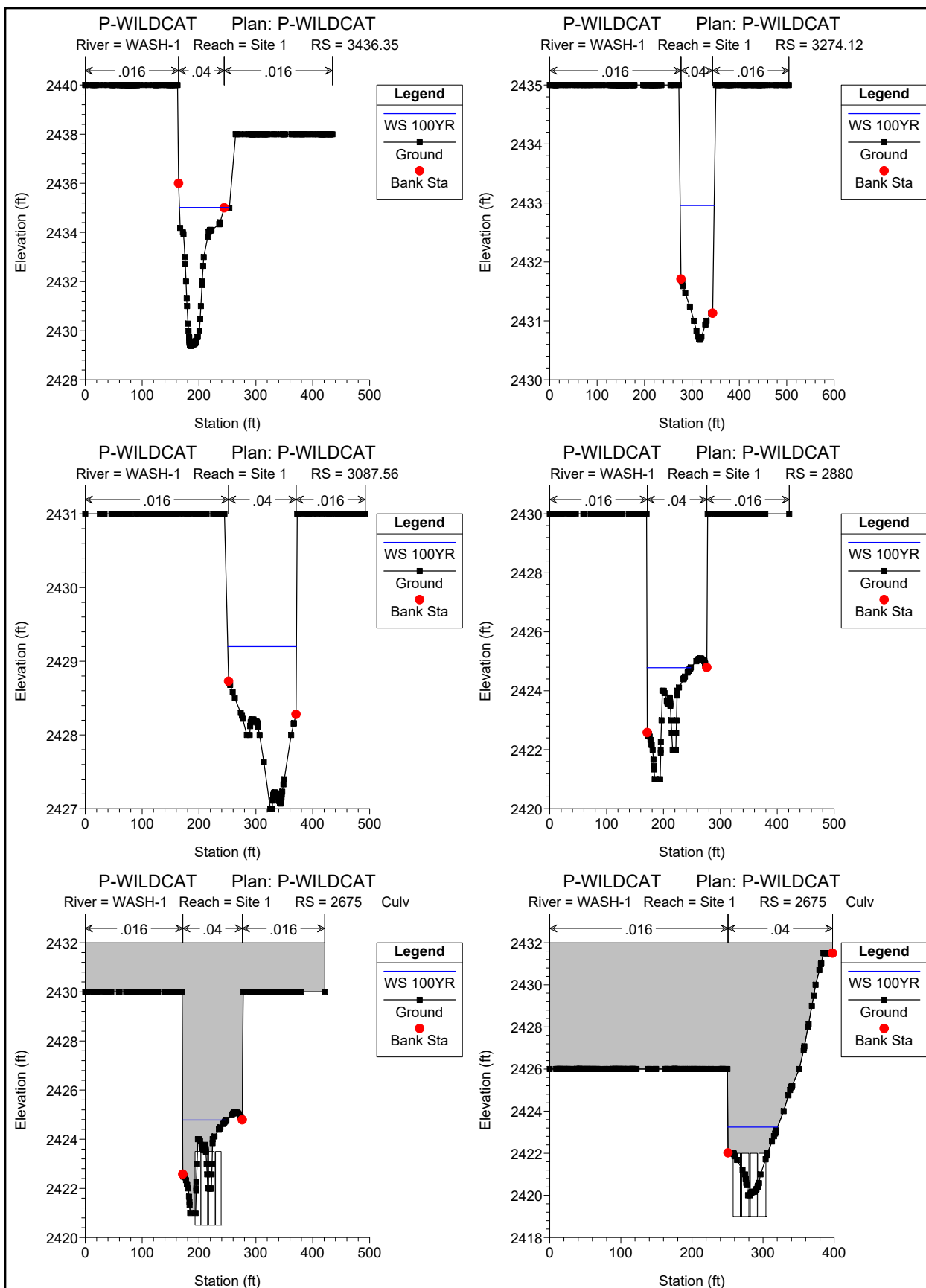


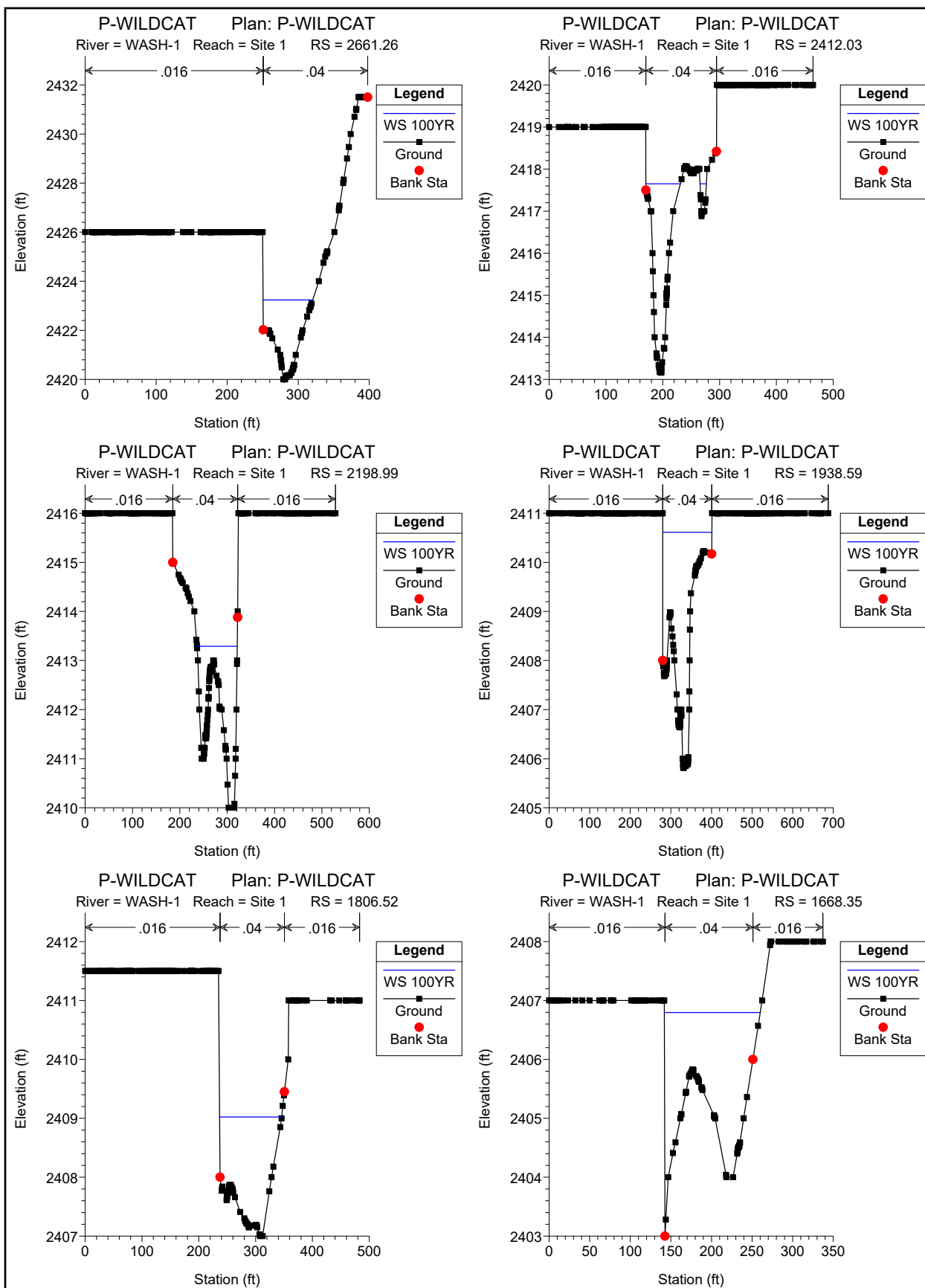
HEC-RAS Plan: P Profile: 100YR

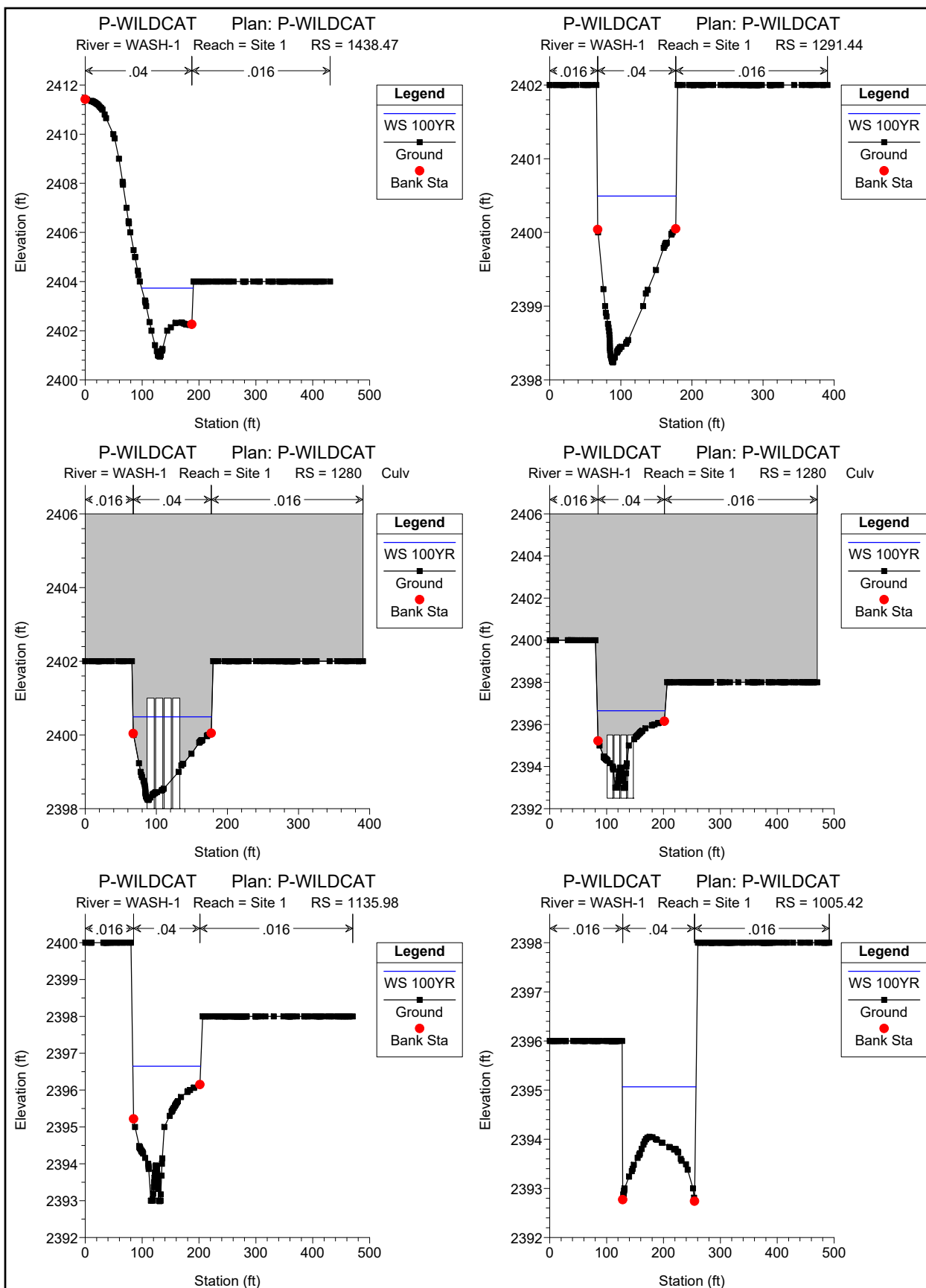
River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
WASH-2	Site 1	3443.51	100YR	3150.00	2424.00	2428.93	2428.86	2429.60	0.018941	6.60	477.33	323.28	0.96
WASH-2	Site 1	3342.49	100YR	3150.00	2422.49	2427.58		2427.88	0.013562	4.44	709.35	679.16	0.77
WASH-2	Site 1	2991.03	100YR	3150.00	2416.35	2421.34	2421.34	2422.01	0.020907	6.55	480.87	354.95	0.99
WASH-2	Site 1	2816.77	100YR	3150.00	2413.35	2417.82	2417.82	2418.63	0.015256	5.84	487.75	356.14	0.86
WASH-2	Site 1	2486.48	100YR	3150.00	2408.04	2412.28	2412.28	2413.73	0.009402	7.19	370.34	147.08	0.75
WASH-2	Site 1	2171.29	100YR	3150.00	2403.12	2407.33	2407.33	2408.76	0.002662	3.67	456.33	148.92	0.40
WASH-2	Site 1	1921.73	100YR	3150.00	2399.39	2403.01	2403.01	2404.17	0.017253	8.52	367.58	157.45	0.98
WASH-2	Site 1	1647.17	100YR	3208.51	2395.00	2398.52	2398.45	2399.82	0.013769	8.80	357.72	129.38	0.92
WASH-2	Site 1	1469.52	100YR	3208.51	2392.54	2395.83	2395.83	2397.05	0.017377	8.86	361.94	145.69	0.99
WASH-2	Site 1	1314.32	100YR	3208.51	2390.17	2394.33	2392.94	2394.68	0.003248	4.72	679.03	201.39	0.45
WASH-2	Site 1	1200		Culvert									
WASH-2	Site 1	1023.27	100YR	3208.51	2382.07	2386.47	2386.33	2387.04	0.015293	6.09	527.05	344.76	0.87
WASH-2	Site 1	775.59	100YR	3208.51	2379.23	2382.36	2382.28	2382.89	0.018335	5.86	547.46	431.50	0.92
WASH-2	Site 1	470.14	100YR	3208.51	2373.88	2376.19	2376.19	2376.83	0.021489	6.42	499.51	385.72	1.00
WASH-2	Site 1	67.01	100YR	3208.51	2366.23	2368.36	2368.25	2368.76	0.017032	5.12	627.05	577.90	0.87
WASH-1	Site 1	5342.74	100YR	980.00	2459.00	2462.11	2461.76	2462.37	0.010021	4.08	240.13	208.26	0.67
WASH-1	Site 1	5158.2	100YR	980.00	2456.60	2459.82	2459.65	2460.16	0.014386	4.67	210.05	195.31	0.79
WASH-1	Site 1	5023.76	100YR	980.00	2454.66	2457.26	2457.25	2457.71	0.023639	5.40	181.32	196.44	0.99
WASH-1	Site 1	4893.99	100YR	980.00	2453.08	2455.69	2455.29	2455.94	0.008389	4.03	243.29	188.50	0.63
WASH-1	Site 1	4590.08	100YR	980.00	2448.98	2452.14		2452.57	0.015124	5.27	185.95	148.37	0.83
WASH-1	Site 1	4407.82	100YR	980.00	2446.04	2448.73	2448.72	2449.16	0.023886	5.23	187.21	213.97	0.99
WASH-1	Site 1	4212.3	100YR	980.00	2441.00	2444.50	2444.42	2445.15	0.017647	6.50	151.18	104.12	0.93
WASH-1	Site 1	4019.21	100YR	980.00	2438.99	2442.84	2442.28	2443.06	0.006569	3.77	260.30	185.80	0.56
WASH-1	Site 1	3656.69	100YR	980.00	2436.00	2438.43	2438.43	2439.04	0.021952	6.29	155.88	127.21	1.00
WASH-1	Site 1	3543.29	100YR	980.00	2434.82	2437.88	2436.81	2438.07	0.002824	3.49	281.37	121.05	0.40
WASH-1	Site 1	3500		Culvert									
WASH-1	Site 1	3436.35	100YR	980.00	2429.38	2435.02		2435.41	0.005555	5.00	195.95	87.78	0.56
WASH-1	Site 1	3274.12	100YR	980.00	2430.68	2432.96	2432.96	2433.87	0.018005	7.55	128.66	71.77	0.97
WASH-1	Site 1	3087.56	100YR	980.00	2427.00	2429.20	2429.14	2429.78	0.018482	6.14	159.75	120.78	0.93
WASH-1	Site 1	2880	100YR	980.00	2421.00	2424.78	2424.78	2425.65	0.020595	7.48	131.17	76.74	1.01
WASH-1	Site 1	2675		Culvert									
WASH-1	Site 1	2661.26	100YR	980.00	2420.00	2423.24	2423.24	2424.16	0.019220	7.68	127.75	70.05	1.00
WASH-1	Site 1	2412.03	100YR	980.00	2413.16	2417.65	2417.65	2418.55	0.019875	7.62	128.58	71.87	1.00
WASH-1	Site 1	2198.99	100YR	1030.56	2410.00	2413.29	2413.29	2414.13	0.020773	7.37	139.90	85.08	1.01
WASH-1	Site 1	1938.59	100YR	1030.56	2405.81	2410.61		2410.86	0.004356	4.02	256.87	121.31	0.49
WASH-1	Site 1	1806.52	100YR	1030.56	2407.00	2409.02	2409.02	2409.73	0.021052	6.75	152.64	109.22	1.00
WASH-1	Site 1	1668.35	100YR	1030.56	2403.00	2406.80	2406.31	2407.17	0.007517	4.92	210.16	118.16	0.63
WASH-1	Site 1	1438.47	100YR	1030.56	2400.94	2403.73	2403.73	2404.52	0.019123	7.08	144.97	90.78	0.98
WASH-1	Site 1	1291.44	100YR	1030.56	2398.24	2400.49	2400.49	2401.20	0.021299	6.75	152.77	110.74	1.01
WASH-1	Site 1	1280		Culvert									
WASH-1	Site 1	1135.98	100YR	1030.56	2392.99	2396.65		2397.06	0.009303	5.12	201.38	119.23	0.69
WASH-1	Site 1	1005.42	100YR	1030.56	2392.74	2395.07	2394.92	2395.58	0.014046	5.56	183.05	129.63	0.82
WASH-1	Site 1	728.18	100YR	1030.56	2387.76	2390.16	2390.16	2390.82	0.021209	6.54	157.56	118.76	1.00
WASH-1	Site 1	558.58	100YR	1030.56	2382.90	2385.57	2385.57	2386.26	0.020081	6.67	154.51	111.58	0.98
WASH-1	Site 1	385.78	100YR	1030.56	2379.00	2381.88	2381.81	2382.50	0.018125	6.35	162.43	113.64	0.93
WASH-1	Site 1	262.14	100YR	1030.56	2377.00	2379.45	2379.45	2379.96	0.022740	5.53	183.63	187.65	0.98
WASH-1	Site 1	73.22	100YR	1030.56	2373.59	2375.54	2375.39	2375.96	0.016007	5.20	198.00	169.53	0.85

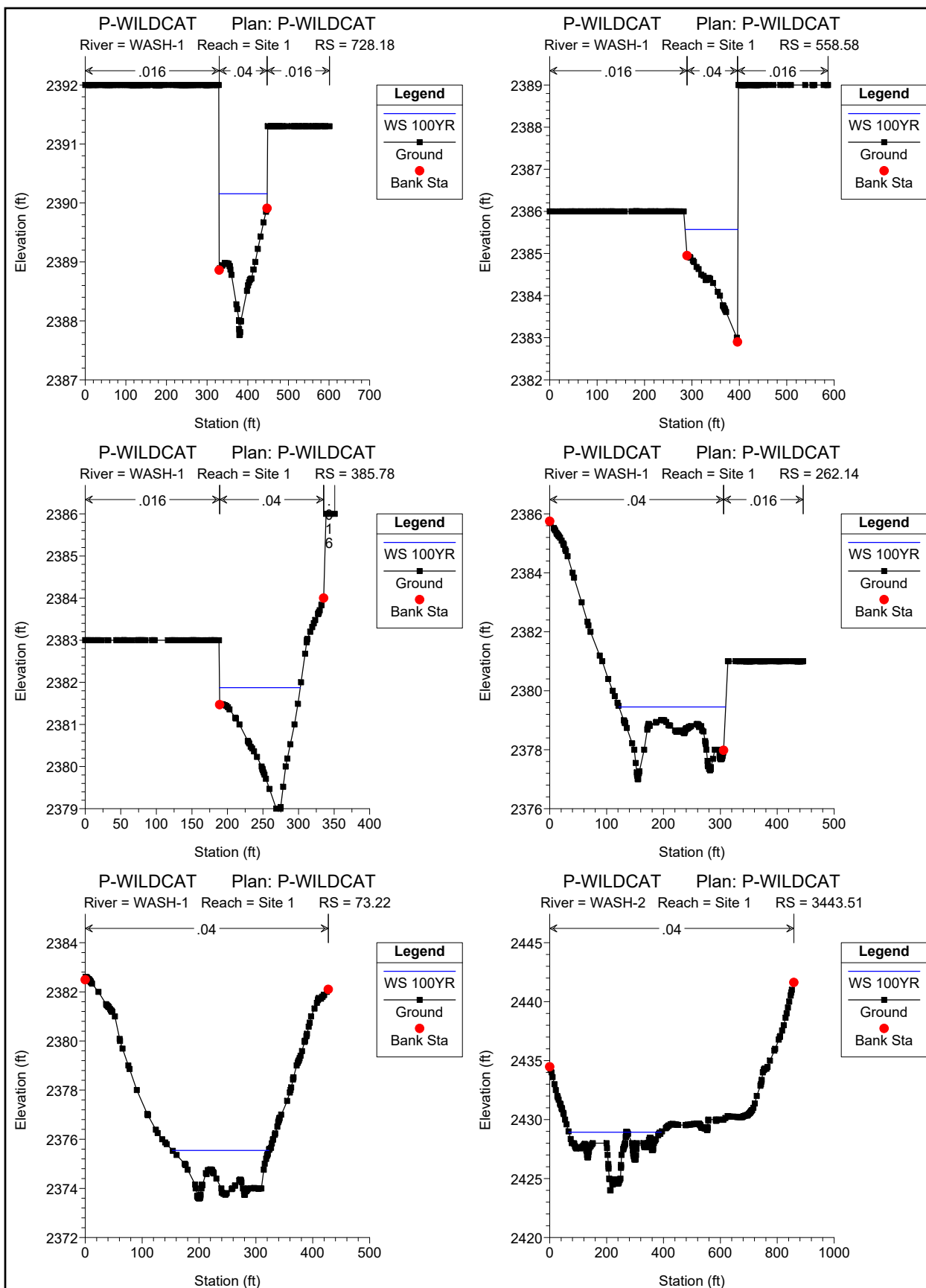


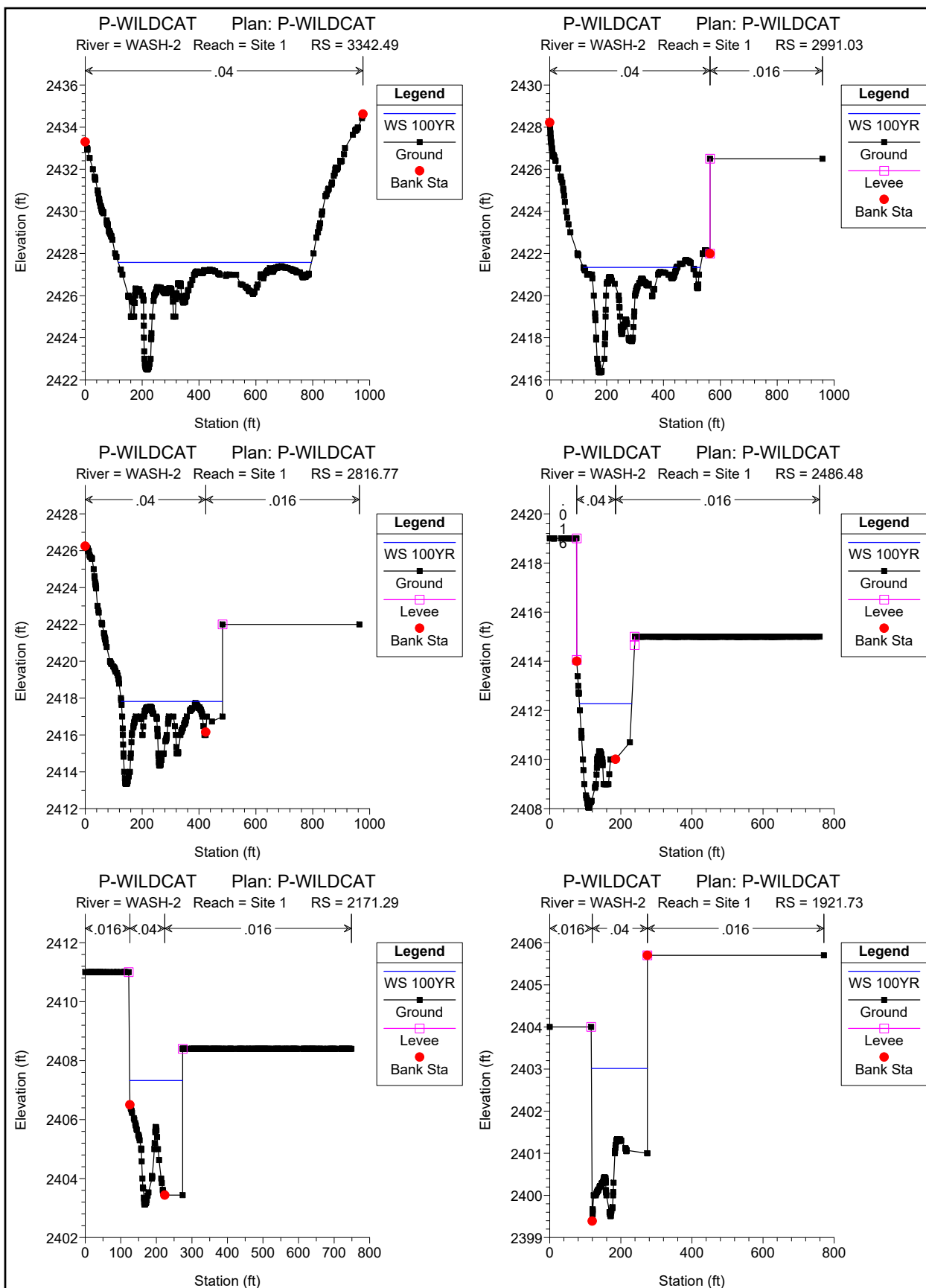


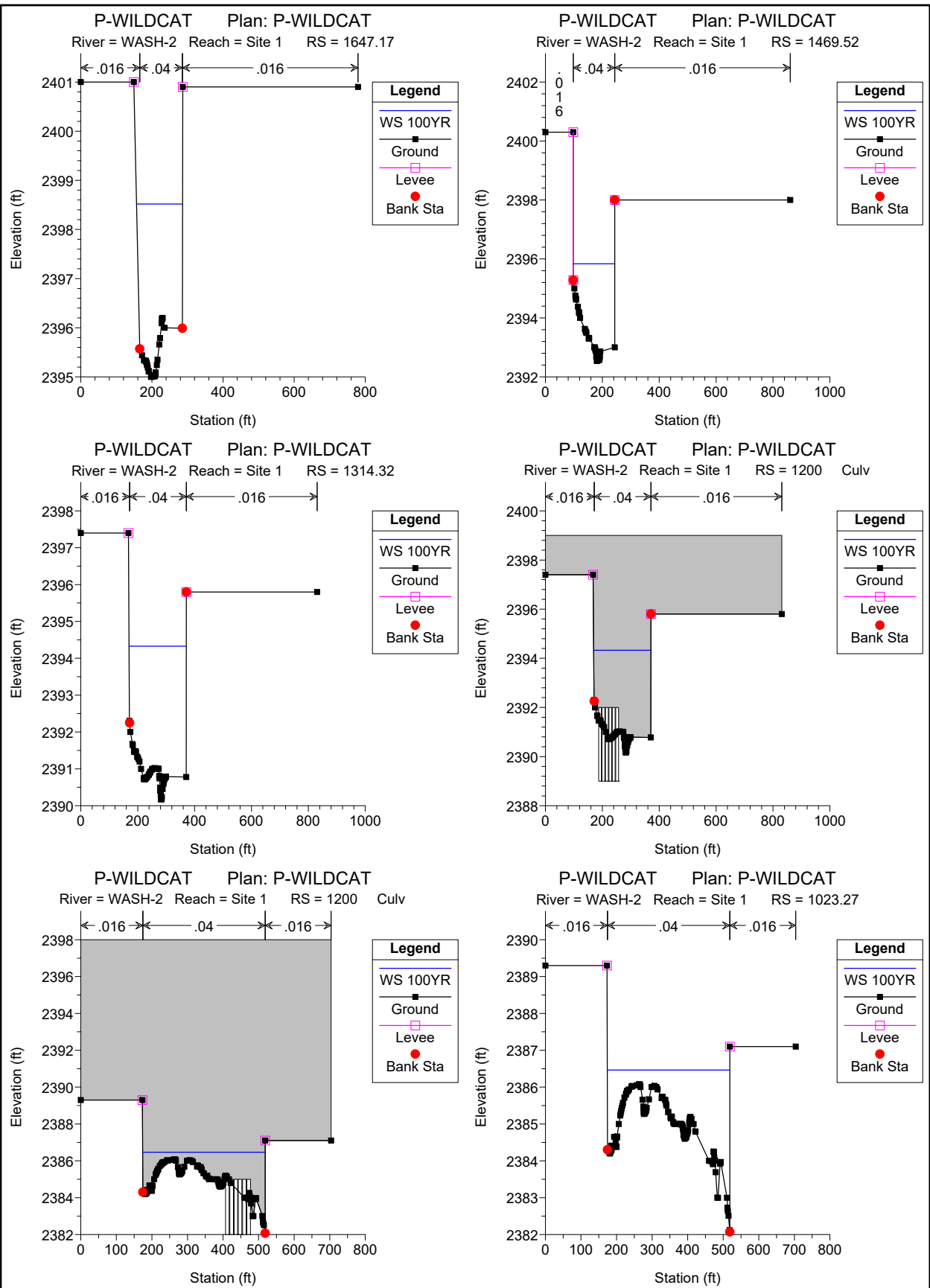


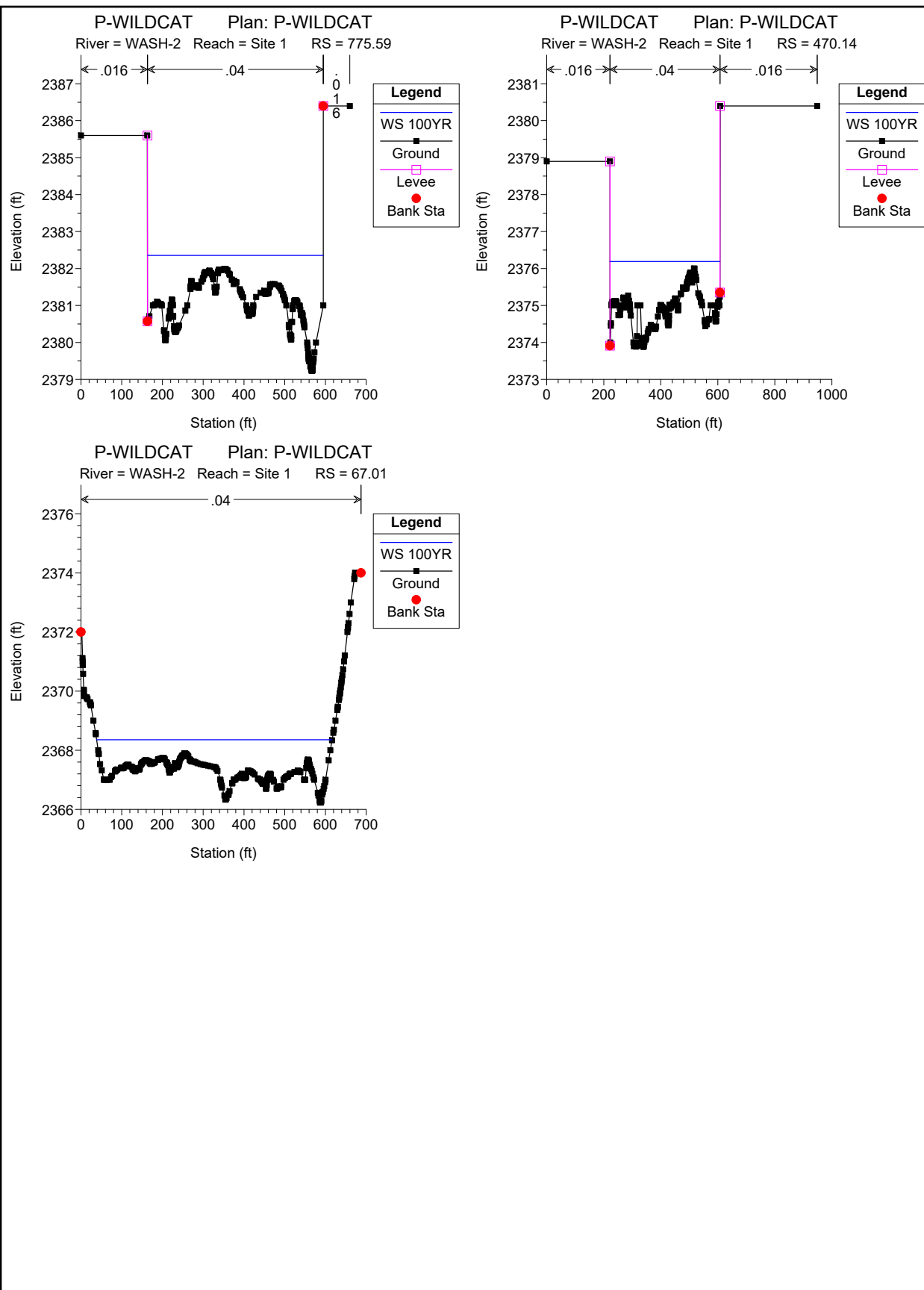












Required Storage Volume Calculations				
			$V_r = 1 * (P/12) * C_w * A$	
			P=100-yr, 2-hr=2.65 in.	
Drainage	Disturbed Area	C _w	Volume Req.	Volume Req.
Area ID	(acres)	(-)	(acre-ft)	(CF)
RETENTION BASIN 1				
DA-2	18.33	0.64	2.688	117,106.70
Basin 1 Totals:	18.33	0.64	2.688	117,106.70
RETENTION BASIN 2				
DA-3	39.15	0.64	5.742	250,121.52
Basin 2 Totals:	39.15	0.64	5.742	250,121.52
RETENTION BASIN 3				
DA-4	16.12	0.62	2.290	99,769.10
Basin 3 Totals:	16.12	0.62	2.290	99,769.10
RETENTION BASIN 4				
DA-6	10.01	0.61	1.399	60,954.14
Basin 4 Totals:	10.01	0.61	1.399	60,954.14
RETENTION BASIN 5				
DA-7	69.01	0.64	10.121	440,891.09
Basin 5 Totals:	69.01	0.64	10.121	440,891.09
RETENTION BASIN 6				
DA-8	20.04	0.64	2.939	128,031.55
Basin 6 Totals:	20.04	0.64	2.939	128,031.55
RETENTION BASIN 7				
DA-10	10.42	0.61	1.457	63,450.77
Basin 7 Totals:	10.42	0.61	1.457	63,450.77
RETENTION BASIN 8				
DA-11	15.19	0.61	2.123	92,496.85
Basin 8 Totals:	15.19	0.61	2.123	92,496.85
Totals	83.61		12.12	527,951.47

PROPOSED RETENTION VOLUME CALCULATIONS

BASIN 1					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2457.00	51,076			0.00	
		1.00	52,916.00		
2458.00	54,756			52,916.00	
		1.00	56,660.00		
2459.00	58,564			109,576.00	
		1.00	60,532.00		
2460.00	62,500			170,108.00	

BASIN 2					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2413.00	109,475			0.00	
		1.00	112,155.00		
2414.00	114,835			112,155.00	
		1.00	117,579.00		
2415.00	120,323			229,734.00	
		1.00	123,131.00		
2416.00	125,939			352,865.00	

BASIN 3					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2395.00	39,515			0.00	
		1.00	41,139.00		
2396.00	42,763			41,139.00	
		1.00	44,451.00		
2397.00	46,139			85,590.00	
		1.00	47,891.00		
2398.00	49,643			133,481.00	

BASIN 4					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2431.00	22,414			0.00	
		1.00	23,646.00		
2432.00	24,878			23,646.00	
		1.00	26,174.00		
2433.00	27,470			49,820.00	
		1.00	28,830.00		
2434.00	30,190			78,650.00	

BASIN 5					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2420.00	198,830			0.00	
		1.00	202,430.00		
2421.00	206,030			202,430.00	
		1.00	209,694.00		
2422.00	213,358			412,124.00	
		1.00	217,086.00		
2423.00	220,814			629,210.00	

BASIN 6					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2373.00	52,355			0.00	
		1.00	54,219.00		
2374.00	56,083			54,219.00	
		1.00	58,011.00		
2375.00	59,939			112,230.00	
		1.00	61,931.00		
2376.00	63,923			174,161.00	

BASIN 7					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2396.00	23,630			0.00	
		1.00	24,894.00		
2397.00	26,158			24,894.00	
		1.00	27,486.00		
2398.00	28,814			52,380.00	
		1.00	30,206.00		
2399.00	31,598			82,586.00	

BASIN 8					
ELEV.	AREA	DEPTH	AVG VOLUME	SUM VOLUME	Comment
(FT)	(SF)	(FT)	(CF)	(CF)	
2373.00	36,395			0.00	
		1.00	37,955.00		
2374.00	39,515			37,955.00	
		1.00	41,139.00		
2375.00	42,763			79,094.00	
		1.00	44,451.00		
2376.00	46,139			123,545.00	

TOTAL: 1,744,606.00

EXISTING CONDITIONS RUNOFF

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.319 Hours		19.17 Min.	
L=	0.80 MILES		
K _u =	0.1358	$m \log_{10} A+b=$	
S=	119.85 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	3.70 ACRES	E1	E2 Delta E
Q=CIA	41.8285 CFS	2480.9	2385.02 95.88
C=	0.95		
i=	11.900 IN/HR		
A=	3.70 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.417 Hours		25.04 Min.	
L=	0.52 MILES		
K _u =	0.1501	$m \log_{10} A+b=$	
S=	29.79 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	0.99 ACRES	E1	E2 Delta E
Q=CIA	5.3015 CFS	2481	2465.54 15.46
C=	0.45		
i=	11.900 IN/HR		
A=	0.99 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.308 Hours		18.49 Min.	
L=	0.93 MILES		
K _u =	0.1068	$m \log_{10} A+b=$	
S=	115.60 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	53.45 ACRES	E1	E2 Delta E
Q=CIA	286.2248 CFS	2481	2372.98 108.02
C=	0.45		
i=	11.900 IN/HR		
A=	53.45 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.236 Hours		14.14 Min.	
L=	0.53 MILES		
K _u =	0.1145	$m \log_{10} A+b=$	
S=	122.88 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	26.19 ACRES	E1	E2 Delta E
Q=CIA	140.2475 CFS	2478.37	2413.5 64.87
C=	0.45		
i=	11.900 IN/HR		
A=	26.19 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.106 Hours		6.39 Min.	
L=	0.12 MILES		
K _u =	0.1339	$m \log_{10} A+b=$	
S=	198.53 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	4.42 ACRES	E1	E2 Delta E
Q=CIA	23.6691 CFS	2420.11	2395.63 24.48
C=	0.45		
i=	11.900 IN/HR		
A=	4.42 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.128 Hours		7.68 Min.	
L=	0.15 MILES		
K _u =	0.1357	$m \log_{10} A+b=$	
S=	175.84 FT/MILE		
i=	10.420 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	3.74 ACRES	E1	E2 Delta E
Q=CIA	20.0277 CFS	2404	2378.07 25.93
C=	0.45		
i=	11.900 IN/HR		
A=	3.74 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.344 Hours		20.66 Min.	
L=	0.96 MILES		
K _u =	0.1084	$m \log_{10} A+b=$	
S=	85.96 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	46.19 ACRES	E1	E2 Delta E
Q=CIA	247.3475 CFS	2457	2374.8 82.2
C=	0.45		
i=	11.900 IN/HR		
A=	46.19 ACRES		

$T_p=11.4L^{0.5}K_u^{0.52}S^{0.31}i^{0.38}$			
0.120 Hours		7.20 Min.	
L=	0.11 MILES		
K _u =	0.1463	$m \log_{10} A+b=$	
S=	130.09 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	1.40 ACRES	E1	E2 Delta E
Q=CIA	7.4970 CFS	2463.31	2449 14.31
C=	0.45		
i=	11.900 IN/HR		
A=	1.40 ACRES		

EX-9

OFF SITE EXISTING CONDITIONS RUNOFF

OFF EX-1			
0.121 Hours		7.24 Min.	
L=	0.10 MILES		
K _u =	0.1410	$m \log_{10} A+b=$	
S=	300.00 FT/MILE		
i=	4.980 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	2.29 ACRES	E1	E2 Delta E
Q=CIA	5.1319 CFS	2495	2465 30
C=	0.45		
i=	4.980 IN/HR		
A=	2.29 ACRES		

OFF EX-2			
0.110 Hours		6.61 Min.	
L=	0.10 MILES		
K _u =	0.1322	$m \log_{10} A+b=$	
S=	150.00 FT/MILE		
i=	10.218 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	5.16 ACRES	E1	E2 Delta E
Q=CIA	23.7262 CFS	2485	2470 15
C=	0.45		
i=	10.218 IN/HR		
A=	5.16 ACRES		

OFF EX-3			
0.101 Hours		6.07 Min.	
L=	0.10 MILES		
K _u =	0.1292	$m \log_{10} A+b=$	
S=	190.00 FT/MILE		
i=	10.218 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	6.81 ACRES	E1	E2 Delta E
Q=CIA	31.3131 CFS	2486	2467 19
C=	0.45		
i=	10.218 IN/HR		
A=	6.81 ACRES		

OFF EX-4			
0.037 Hours		2.24 Min.	
L=	0.02 MILES		
K _u =	0.1489	$m \log_{10} A+b=$	
S=	950.00 FT/MILE		
i=	5.520 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	1.11 ACRES	E1	E2 Delta E
Q=CIA	2.7572 CFS	2480	2461 19
C=	0.45		
i=	5.520 IN/HR		
A=	1.11 ACRES		

OFF EX-5			
0.057 Hours		3.41 Min.	
L=	0.03 MILES		
K _u =	0.1483	$m \log_{10} A+b=$	
S=	466.67 FT/MILE		
i=	5.520 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	1.17 ACRES	E1	E2 Delta E
Q=CIA	2.9063 CFS	2467	2453 14
C=	0.45		
i=	5.520 IN/HR		
A=	1.17 ACRES		

OFF EX-6			
0.989 Hours		59.33 Min.	
L=	0.80 MILES		
K _u =	0.1559	$m \log_{10} A+b=$	
S=	8.75 FT/MILE		
i=	6.220 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	0.58 ACRES	E1	E2 Delta E
Q=CIA	1.6234 CFS	2457	2450 7
C=	0.45		
i=	6.220 IN/HR		
A=	0.58 ACRES		

OFF EX-7			
0.600 Hours		36.00 Min.	
L=	0.80 MILES		
K _u =	0.1409	$m \log_{10} A+b=$	
S=	26.25 FT/MILE		
i=	8.230 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	2.31 ACRES	E1	E2 Delta E
Q=CIA	8.5551 CFS	2460	2439 21
C=	0.45		
i=	8.230 IN/HR		
A=	2.31 ACRES		

OFF EX-8			
0.754 Hours		45.25 Min.	
L=	0.80 MILES		
K _u =	0.1406	$m \log_{10} A+b=$	
S=	12.50 FT/MILE		
i=	8.230 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	2.38 ACRES	E1	E2 Delta E
Q=CIA	8.8143 CFS	2450	2440 10
C=	0.45		
i=	8.230 IN/HR		
A=	2.38 ACRES		

Concentration Points	Q (IN) CFS
HI-1	980
HI-2	3,150
CP-8	5.13
CP-9	23.72
CP-10	31.31
CP-11	2.9
CP-12	2.75
CP-13	1.62
CP-14	8.55
CP-15	8.81

$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.285 Hours	17.12 Min.
L=	0.73 MILES		
K _p =	0.1105	$m \log_{10} A+b=$	
S=	105.40 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	37.91 ACRES		
Q=CIA	203.0081 CFS	E1	E2 Delta E
C=	0.45	2449	2372.07 76.93
i=	11.900 IN/HR		
A=	37.91 ACRES		

EX-10			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.144 Hours	8.61 Min.
L=	0.22 MILES		
K _p =	0.1275	$m \log_{10} A+b=$	
S=	171.91 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	7.96 ACRES		
Q=CIA	42.6258 CFS	E1	E2 Delta E
C=	0.45	2405.62	2368.56 37.06
i=	11.900 IN/HR		
A=	7.96 ACRES		

EX-11			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.166 Hours	9.97 Min.
L=	0.27 MILES		
K _p =	0.1236	$m \log_{10} A+b=$	
S=	142.59 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	11.35 ACRES		
Q=CIA	60.7793 CFS	E1	E2 Delta E
C=	0.45	2453.91	2416 37.91
i=	11.900 IN/HR		
A=	11.35 ACRES		

EX-12			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.149 Hours	8.92 Min.
L=	0.23 MILES		
K _p =	0.1274	$m \log_{10} A+b=$	
S=	172.81 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	8.04 ACRES		
Q=CIA	43.0542 CFS	E1	E2 Delta E
C=	0.45	2435.13	2395 40.13
i=	11.900 IN/HR		
A=	8.04 ACRES		

EX-13			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.116 Hours	6.96 Min.
L=	0.14 MILES		
K _p =	0.1450	$m \log_{10} A+b=$	
S=	206.68 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	1.58 ACRES		
Q=CIA	6.4609 CFS	E1	E2 Delta E
C=	0.45	2405	2376.49 28.51
i=	11.900 IN/HR		
A=	1.58 ACRES		

EX-14			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.270 Hours	16.18 Min.
L=	0.61 MILES		
K _p =	0.1071	$m \log_{10} A+b=$	
S=	90.13 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	51.85 ACRES		
Q=CIA	277.6568 CFS	E1	E2 Delta E
C=	0.45	2421.81	2366.7 55.11
i=	11.900 IN/HR		
A=	51.85 ACRES		

EX-15			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.130 Hours	7.78 Min.
L=	0.16 MILES		
K _p =	0.1360	$m \log_{10} A+b=$	
S=	162.73 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	3.62 ACRES		
Q=CIA	19.3851 CFS	E1	E2 Delta E
C=	0.45	2426	2400.11 25.89
i=	11.900 IN/HR		
A=	3.62 ACRES		

EX-16			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.141 Hours	8.47 Min.
L=	0.18 MILES		
K _p =	0.1304	$m \log_{10} A+b=$	
S=	136.23 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
A=	6.07 ACRES		
Q=CIA	32.5049 CFS	E1	E2 Delta E
C=	0.45	2410	2386 24
i=	11.900 IN/HR		
A=	6.07 ACRES		

EX-17			
$T_r=11.4L^{1.5}K_p^{0.52}S^{0.31}i^{0.38}$		0.159 Hours	9.54 Min.
L=	0.22 MILES		
K _p =	0.1279	$m \log_{10} A+b=$	
S=	127.97 FT/MILE		
i=	11.900 IN/HR	From NOAA	
m =	-0.025	From Table 3.1 of FCDMC Hydrology Manual (Type C)	
b=	0.15	From Table 3.1 of FCDMC Hydrology Manual (Type C)	

A=	7.68 ACRES				
		E1	E2	Delta E	
Q=GA	41.1264 GPD	2402	2373.9		28.1
C=	0.45				
I=	11.900 IN/HR				
A=	7.68 ACRES				

DA-1

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}=$	0.338 Hours	20.27 Min.
L=	0.71 MILES	
$K_b=$	0.1152	$m \log_{10}A+b=$
S=	133.89 FT/MILE	
i=	6.400 IN/HR	From NOAA
$m =$	-0.025	h Table 3.1 of FCDMC Hydrology Manual (Typ
b=	0.15	h Table 3.1 of FCDMC Hydrology Manual (Typ
A=	24.58 ACRES	

	E1	E2	Delta E
Q=CiA	2475	2380	95
C=			
i=			
A=			

DA-1A

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}=$	0.419 Hours	25.16 Min.
L=	0.80 MILES	
$K_b=$	0.1358	$m \log_{10}A+b=$
S=	119.85 FT/MILE	
i=	5.820 IN/HR	From NOAA
$m =$	-0.025	h Table 3.1 of FCDMC Hydrology Manual (Typ
b=	0.15	h Table 3.1 of FCDMC Hydrology Manual (Typ
A=	3.70 ACRES	

	E1	E2	Delta E
Q=CiA	2480.9	2385.02	95.88
C=			
i=			
A=			

DA-5

$T_c=11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}=$	0.451 Hours	27.05 Min.
L=	0.96 MILES	
$K_b=$	0.1162	$m \log_{10}A+b=$
S=	102.48 FT/MILE	
i=	5.580 IN/HR	From NOAA
$m =$	-0.025	h Table 3.1 of FCDMC Hydrology Manual (Typ
b=	0.15	h Table 3.1 of FCDMC Hydrology Manual (Typ
A=	22.48 ACRES	

	E1	E2	Delta E
Q=CiA	2481	2383	98

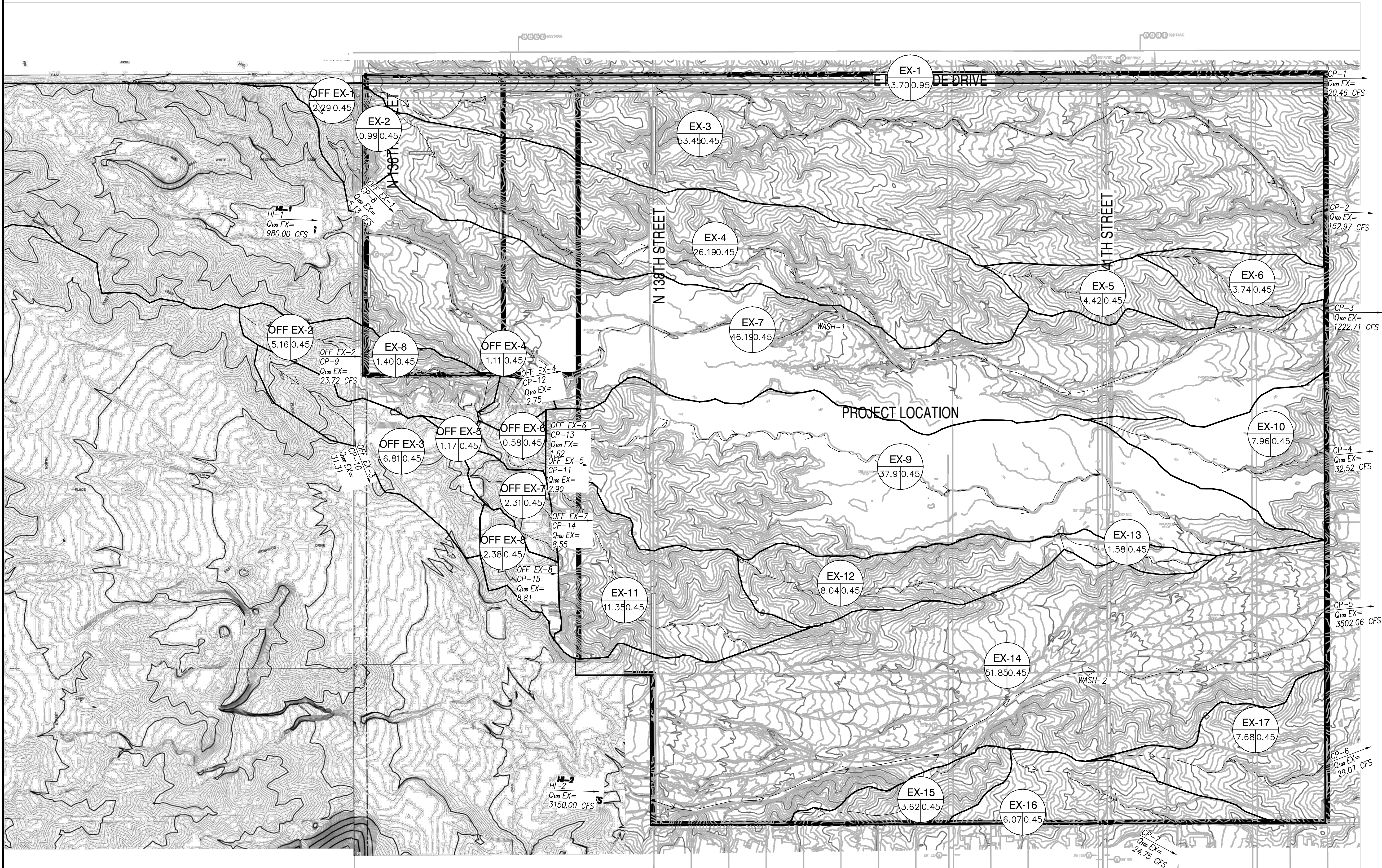
C=	0.45
i=	5.580 IN/HR
A=	22.48 ACRES

DA-9

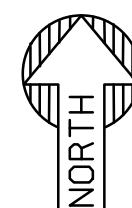
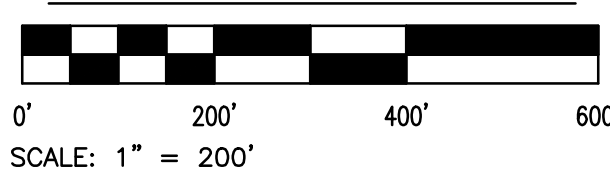
$T_c = 11.4 L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38} =$		0.359 Hours	21.54 Min.
L=	0.61 MILES		
K _b =	0.1166	$m \log_{10} A + b =$	
S=	90.13 FT/MILE		
i=	6.300 IN/HR	From NOAA	
m =	-0.025	n Table 3.1 of FCDMC Hydrology Manual (Typ	
b=	0.15	n Table 3.1 of FCDMC Hydrology Manual (Typ	
A=	21.66 ACRES		

E1	E2	Delta E
2421.81	2366.7	55.11

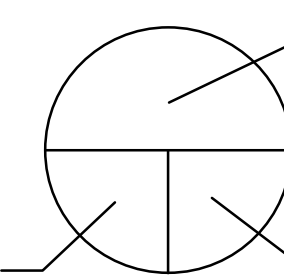
Q=CiA	61.4061 CFS
C=	0.45
i=	6.300 IN/HR
A=	21.66 ACRES



DRAINAGE AREA MAP



AREA IN ACRES



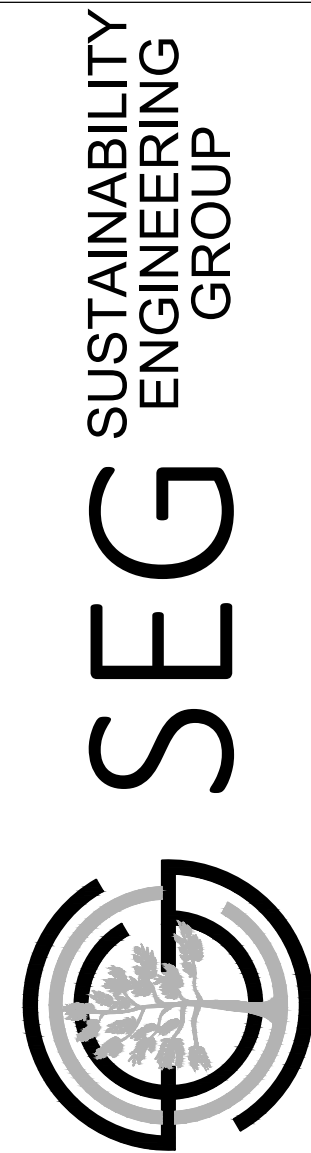
DRAINAGE AREA

RUNOFF COEFFICIENT

DRAINAGE AREA KEY



NOTES TO CONTRACTOR:
THIS SET OF DRAWINGS AND DOCUMENTS IS INTENDED AS A SET OF GUIDELINES FOR THE PROJECT AND ARE INTENDED TO BE USED IN CONJUNCTION WITH A SET OF CONSTRUCTION SPECIFICATIONS TO BE SUPPLIED BY OWNER. THEY MUST BE READ TO INCORPORATE ALL APPLICABLE FEDERAL, STATE, AND LOCAL CODES AND CONSTRUCTION SPECIFICATIONS. THIS SET ASSUMES THAT THERE ARE NO UNUSUAL SOIL CONDITIONS OR UNUSUAL LOADS. THE HOLDER OF THIS DRAWING MAY REQUIRE SIGNIFICANT CHANGES TO THESE DOCUMENTS. FOR THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLY WITH ALL APPLICABLE CODES AND TO INFORM THE ARCHITECTS OF ANY QUESTIONS OR CLARIFICATIONS NEEDED, CONTRACTORS SHALL ALSO VISIT THE SITE BEFORE BIDDING. CONTRACTORS ARE REQUIRED TO KNOW ALL OBSERVABLE CONDITIONS AND APPLICABLE CODES.



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PROJECT
WILDCAT

LOCATION
WILDCAT RIO VERDE & 136TH
SCOTTSDALE

DRAWN
DESIGNED
CHECKED
PROJ. MGR.

DATE: 02/27/2018

ISSUED FOR:

REVISION NO.:

DATE:

JOB NO.: 171081

SHEET TITLE:

EXISTING CONDITIONS
DRAINAGE AREA MAP

SHEET NO.:

DAM-EX

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2. A rainfall runoff model using the USACE's HEC 1 Flood Hydrograph Package (generally used for watersheds that are larger than 160 acres, irregular in shape and contour, or if routing of flows is necessary).

B. Watershed Conditions

Watersheds are subject to change. Grading and drainage plans shall consider all watershed conditions that would result in the greatest peak discharge rate, to:

1. Size drainage facilities, and
2. Determine lowest floor elevations.

C. Split-Flow Conditions

Projects in northern parts of Scottsdale must address split-flow channel conditions where applicable. These splits in the alluvial channels usually include highly erosive soils and are generally unstable and unpredictable. In setting lowest floor elevations relative to upstream splits, assume that 100% of the flow could go either direction in any given flood event. For infrastructure design, the estimate of the actual split, based on a hydraulic analysis of the current channel cross sections, must include a minimum safety factor of 30% of the total flow. If there are extenuating factors affecting the stability of the split, the safety factor should be increased accordingly.

D. Environmentally Sensitive Lands

For special considerations regarding Environmentally Sensitive Lands, refer to the City Zoning Ordinance and DSPM Chapter 2 Section 2-2. Modification of natural watercourses with a flow of 50 cfs or greater are addressed in the City Zoning Ordinance.

E. The Rational Method

1. Precipitation. Precipitation input is rainfall intensity, "i," and can be obtained directly from [NOAA 14](#).
2. Time of Concentration. Time of concentration " t_c " is the total time of travel from the most hydraulically remote part of the watershed to the concentration point of interest. The calculation of " t_c " must follow FCDMC Hydrology Manual procedures.
3. Runoff Coefficients. Use Fig. 4-1.5, Runoff Coefficients for Use with Rational Method, or equivalent to obtain the runoff coefficients or "C" values. Composite "C" values for the appropriate zoning category or weighted average values calculated for the specific site are both acceptable approaches.

RUNOFF COEFFICIENTS – "C" VALUE

LAND USE	STORM FREQUENCY		
	2-25 Year	50 Yea r	100 Yea r
Composite Area-wide Values			
Commercial & Industrial Areas	0.80	0.83	0.86
Residential Areas – Single Family, slopes 10% or less			
R1-190	0.33	0.50	0.53
R1-130	0.35	0.51	0.59

R1-70	0.37	0.52	0.60
R1-43	0.38	0.55	0.61
R1-35	0.40	0.56	0.62
R1-18	0.43	0.58	0.64
R1-10	0.47	0.62	0.70
R1-7	0.51	0.66	0.80
R1-5	0.54	0.69	0.86
Residential Areas – Single Family, slopes greater than 10%			
R1-190	0.65	0.74	0.82
R1-130	0.68	0.76	0.84
R1-70	0.69	0.77	0.85
R1-43	0.70	0.77	0.85
R1-35	0.70	0.78	0.85
R1-18	0.71	0.79	0.86
R1-10	0.75	0.82	0.88
R1-7	0.81	0.86	0.91
R1-5	0.85	0.89	0.92
Townhouse (R-2, R-4)	0.63	0.74	0.94
Apartments & Condominiums (Condos) (R-3, R-5)	0.76	0.83	0.94
Specified Surface Type Values			
Paved streets, parking lots (concrete or asphalt), roofs, driveways, etc.	0.90	0.93	0.95
Lawns, golf courses, & parks (grassed areas)	0.20	0.25	0.30
Undisturbed natural desert or desert landscaping (no impervious weed barrier)	0.37	0.42	0.45
Desert landscaping (with impervious weed barrier)	0.63	0.73	0.83
Mountain terrain - slopes greater than 10%	0.60	0.70	0.80
Agricultural areas (flood irrigated fields)	0.16	0.18	0.20
Gravel floodways and shoulders	0.68	0.78	0.82

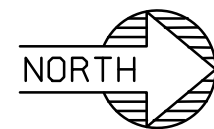
FIGURE 4-1.5 RUNOFF COEFFICIENTS FOR RATIONAL METHOD

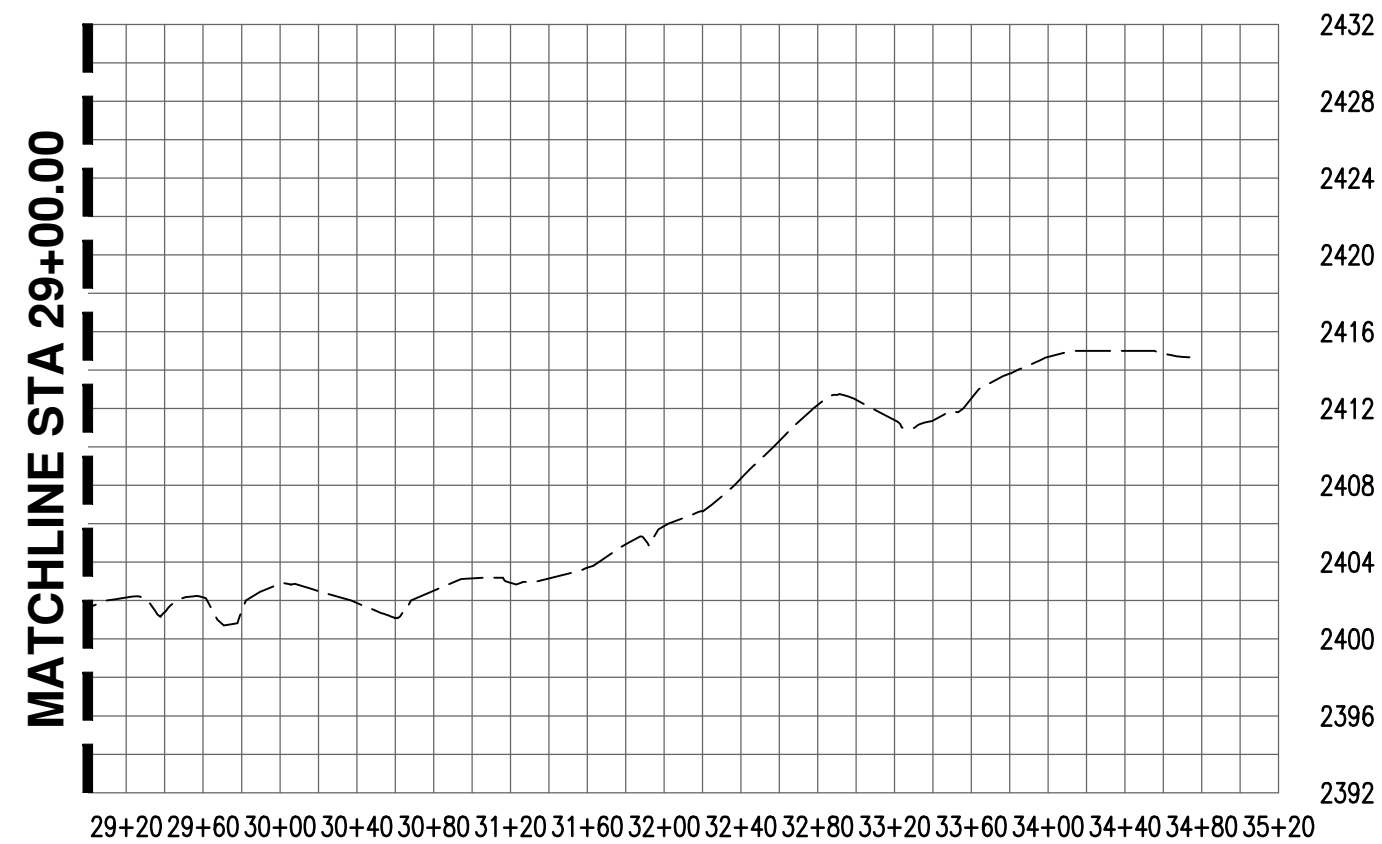
F. HEC-1 Model

1. Minimum submittals
 - a. A printout of the input data.
 - b. A schematic (routing) diagram of the stream network.
 - c. The runoff summary output table, including drainage basin name, area, 2, 10, and 100- year flow values.
 - d. Electronic input file(s) on compact disc (CD) or digital versatile/video disc (DVD).
 - e. Supporting documentation and source material for parameter selection.

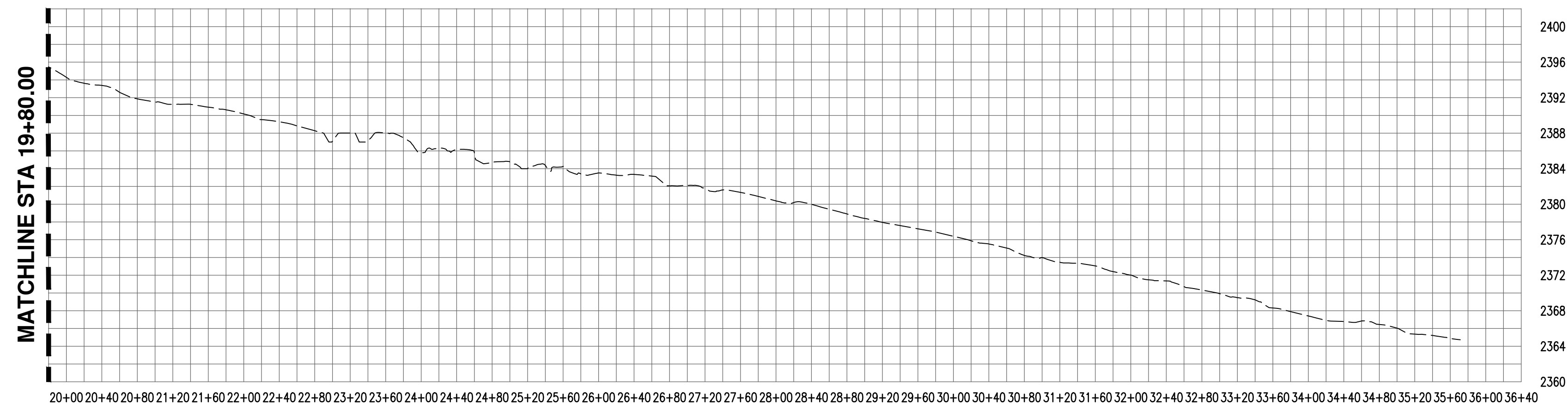
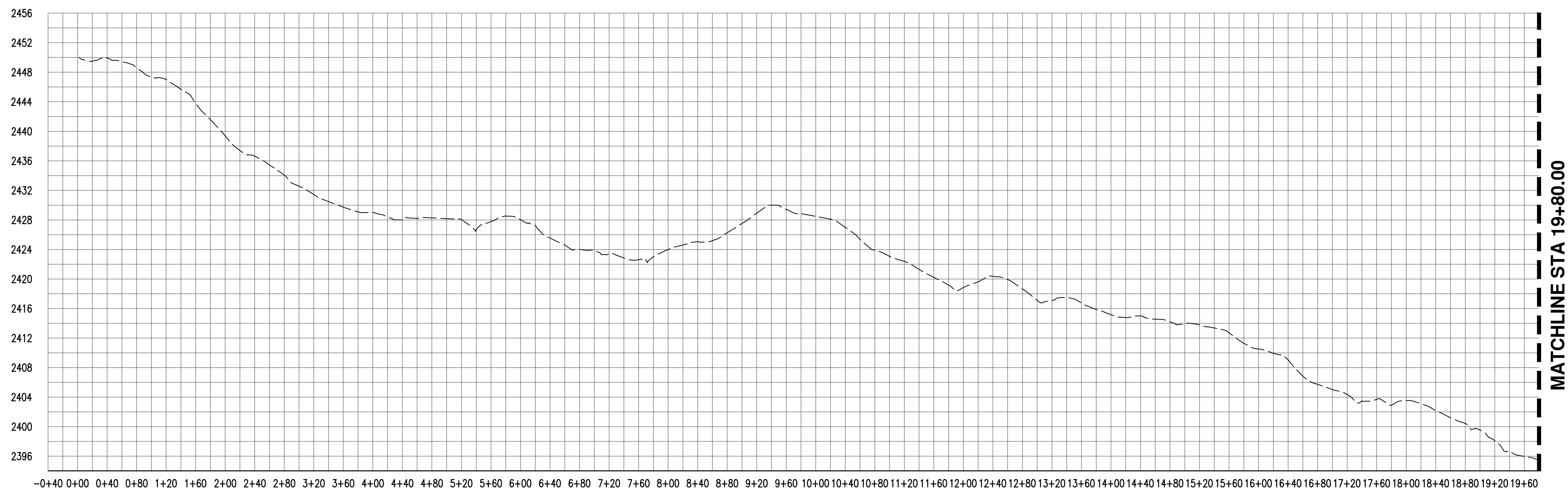
Appendix III

Grading Exhibit

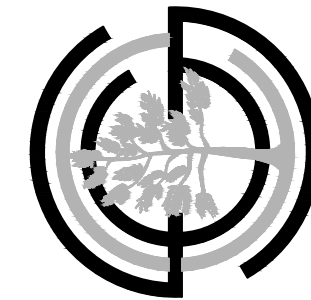




(A) CROSS-SECTION A-A
X-AXIS: 1"=100'
Y-AXIS: 1"=10'



(B) CROSS-SECTION B-B
X-AXIS: 1"=100'
Y-AXIS: 1"=10'



SEG

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WWW.AZSEG.COM TEL. 480.588.7226 FAX 480.259.3534

DRAWN _____
 DESIGNED _____
 CHECKED _____
 PROJ. MGR. _____

LOCATION
WILDCAT RIO VERDE & 136TH
SCOTTSDALE

DATE: 02/27/2018

ISSUED FOR

REVISION NO.:

 Δ

2

3

JCB NO.: 171081

SHEET TITLE

CROSS SECTIONS

SHEET NO.:

C3.10

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