CONCEPTUAL
MASTER DRAINAGE REPORT
FOR
McDOWELL MOUNTAIN BACK BOWL

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WP #042054

Prepared for

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Engineer **Peer Reviewer**

1 0 INTRODUCTION

This Conceptual Master Drainage Report has been prepared to meet the master drainage plan requirements, in accordance with the City of Scottsdale development criteria for the proposed McDowell Mountain Back Bowl Project (Back Bowl) The Back Bowl project is a planned 330-acre residential subdivision located in the northeastern portion of Scottsdale, Arizona This report presents the hydrological and hydraulic modeling and storm water storage requirements

The Back Bowl is located in Section 11, Township 4 North, Range 5 East The site is currently an assemblage of undeveloped parcels bound to the west by the existing Sonoran Crest Development (122nd Street alignment), to the east by the 128th Street alignment, to the north by the Happy Valley Road alignment, and to the south by the McDowell Mountain Sonoran Preserve Access to the development is planned from the west via the ½ -mile section roadway, Alameda Road Plate 1 provides a Vicinity Map for the project and surrounding areas

The Back Bowl is a proposed custom lot sub-division, nestled at the northern base of the McDowell Mountains The development includes approximately 121 lots ranging in size from 2 to 3 acres and a Clubhouse with amenities such as jacuzzis, pools, water falls, and restaurant facilities Interpretive trails and scattered pocket parks with water features will also be incorporated into the site plan

2 0 GENERAL LOCATION AND DESCRIPTION

2 1 Site Features

The proposed project lies in the northern planning section of the City of Scottsdale The site drains from the south to the north Elevations range from 2,830 in the south to 2,675 feet in the northeast Vegetation is typical Sonoran Desert type with creosote bush, jumping cholla, saguaro cacti, palo verde, ironwood and mesquite trees

2 2 Flood Insurance Rate Map (FIRM)

The Flood Insurance Rate Maps (FIRM) for Maricopa County, Arizona and incorporated areas, Map Numbers 04013C1255F and 04013C1260E, dated July 19, 2001 indicates the site is within Zone "X" (shaded), and Zone 'D"

Zone "X" (shaded) is defined by FEMA as follows

> *Areas of 500-year flood, areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood*

Zone "D" is defined by FEMA as follows

> *Areas in which flood hazards are undetermined*

The location of the parcel relative to the FIRM panels is illustrated on Plate 2 – *Flood Insurance Rate Map (FIRM)*

3 0 HYDROLOGY

3 1 Methodology

The U S Army Corps of Engineers' HEC-1 hydrologic model was utilized to compute the pre- and post-development 100-year, 6-hour storm runoff discharge rates The preparation of input data necessary for the computer analysis included definition and measurement of the drainage sub-basins, assignment of soil curve numbers and calculations of the proposed impervious factors The City of Scottsdale modeling procedures were followed as outlined in Chapter 2 of the *City of Scottsdale Design Standards and Policies Manual*

Provided below is a more detailed explanation of the method utilized to compute the definition of drainage sub-basins, determination of soil curve numbers and impervious percentages for the study area and the selection of the design rainfall event

3 2 Drainage Sub-Basins

3 2 1 Offsite Contributing Areas

U S G S quad maps with 20-foot contour interval topography were utilized to define the drainage sub-basins for the offsite portions of the drainage areas Refer to Plate 3 for the drainage sub-basins

3 2 2 Onsite Contributing Areas

Digital topography with 1-foot contours was used to define the shape of the onsite drainage areas Plate 3 provides the location of onsite drainage sub-basins and concentration points

3 3 Soil Curve Numbers

Soil curve numbers for the HEC-1 models were calculated based on published guidelines and engineering experience for the type of soils present within the drainage sub-basins Figure 2 2-19 'Runoff Curve Numbers for Urban Areas" located in the *City of Scottsdale Design Standards and Policies Manual* was used to determine the soil curve number

The cover type and hydrologic condition were estimated as desert shrub areas with poor hydrologic conditions Runoff curve numbers of 77, 85, and 88 were used respectively,

for the corresponding soils groups B, C, and D that occur within the watershed area See Appendix A for the curve number selection

3 4 Impervious Area

Impervious percentages were determined for each sub-basin for the developed condition HEC-1 models Presently no development consists on the site For the onsite developed conditions, impervious percentages were calculated utilizing the "Percent of Impervious Area vs Dwelling Units/Acre" (Figure 2 2-16), as contained in Chapter 2 of the *City of Scottsdale Drainage Design Standards and Policies Manual* Based on the lot sizes, an impervious percentage of 12 percent was used for the developed areas

3 5 Rainfall Event

The precipitation amount for the 100-year, 6-hour return period was obtained from NOAA Atlas 2 Volume VIII maps located in the *City of Scottsdale Manual* A copy of this map is included in Appendix A The total calculated 100-year rainfall depth was 3 37 inches for the 100-year, 6-hour rainfall event

3 6 Onsite Detention

According to the City's Drainage Ordinance, all runoff generated from the developed portion of the site must be managed and the peak discharge rate from the site reduced to at least pre-development values However, since the property is located within the lower desert landform of the Environmentally Sensitive Lands Ordinance, storing the 100-year, 2-hour storm event would require storage basins that would severely impact natural vegetation and the rural "feel" of the area With the development being sparse in nature at approximately 0 5 dwelling units per acre and no mass grading being proposed, post-development flows are only slightly higher than pre-development flows It is our understanding that the site qualifies for a storm water storage waiver, therefore online detention basins, located immediately upstream of culverted roadway crossings are proposed to reduce the post-development flows to at or below the pre-development flows for all concentration points The smaller basins situated adjacent to the project boundary were not included in the HEC-1 analysis as their developed stormwater runoff is negligible Please refer to Appendix E for the 100-year 2 hr detention volume calculations for all detention basins

4 0 PROPOSED DRAINAGE SYSTEMS

4 1 Identification of Major Drainage Courses

There are no washes on the site with an anticipated 100-year flow of 750 cfs Therefore, no washes will be categorized as a Vista Corridor

4 2 Drainage System Requirements

The existing drainage patterns will be maintained in their natural location and condition where possible The site is being developed as large custom lots Therefore, as lots are developed individual lot engineers need to provide drainage documentation to substantiate the development of the lot

4 3 Easement Requirements

Where flows from the 100-year storm event are greater than 50 cfs, natural area open space (NAOS) drainage easements have been provided

4 4 Roadway Crossing Requirements

In all cases the depth of flow over streets is in accordance with City of Scottsdale Flood Plain and Drainage Ordinance

4.5 Maintenance

Ongoing maintenance of the designed or recommended drainage systems is required to preserve the design integrity and purpose of the drainage system Failure to provide maintenance can prevent the drainage system from performing to its intended design purpose and can result in reduced performance It is the responsibility of private developers, homeowner associations, etc for facilities on private property, within all drainage easements, private streets, and right-of-ways unless accepted by the City for maintenance A regular maintenance program is required to have drainage systems perform to the level of protection or service as presented in this report and the project's plans and specifications

6 0 CONCLUSIONS

1 The project site located within FEMA Zone "X" (shaded), and Zone "D" designated flood zones as shown on Plate 2

2 Drainage corridors have been designated for the identified washes in accordance with the appropriate City of Scottsdale ordinance requirements

3 The differences of the peak flow rates for the pre- versus post-development conditions for the 100-year, 6-hour storm event is negligible in instances where the post-development flows have increased over the pre-development conditions

4 It is being proposed that in lieu of providing 100-year, 2-hour detention, online detention on the upstream side of the road culvert crossings be provided to reduce post-development flows to at or below pre-development levels A storm water storage waiver will be submitted to the City of Scottsdale

5 The design of hydraulic structures are to be based on generally accepted engineering practices and in accordance with City of Scottsdale requirements

6 On-going maintenance is required for all drainage systems in order to assure design performance

7 All finished floor elevations are to be designed to be above the 100-year water surface elevation

7 0 REFERENCES

1 City of Scottsdale, *Design Standards and Policies Manual Chapter 2 Drainage*, December, 1999

2 Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona Volume I – Hydrology*, revised January 1995

3 Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona Volume II – Hydraulics*, January 28, 1996

4 U S Army Corps of Engineers, *HEC-1, Flood Hydrograph Package*, June 1998

5 U S Army Corps of Engineers, *HEC-RAS, Version 3 1 2*, April 2004

APPENDIX A

HEC-1 Input Parameters

Flood Control District of Maricopa County
BACKBOWL -
Rainfall Data

Primary Zone Number	7	Latitude	0 0	Elevation	0
Short Duration Zone Number	*8*	*Longitude*	*0 0*		

	Point Values (in)					
Duration	2-Yr	5 Yr	10-Yr	25-Yr	50-Yr	100-Yr
5 MIN	0 38	0 46	0 52	0 60	0 66	0 73
10 MIN	0 57	0 70	0 78	0 91	1 01	1 11
15 MIN	0 70	0 87	0 99	1 16	1 29	1 43
30 MIN	0 92	1 16	1 33	1 56	1 75	1 94
1 HOUR	1 12	1 43	1 64	1 95	2 19	2 42
2 HOUR	1 27	1 62	1 87	2 21	2 48	2 74
3 HOUR	1 38	1 75	2 01	2 38	2 67	2 96
6 HOUR	1 57	2 00	2 29	2 71	3 04	3 37
12 HOUR	1 81	2 31	2 66	3 15	3 53	3 91
24 HOUR	2 05	2 62	3 02	3 58	4 02	4 45

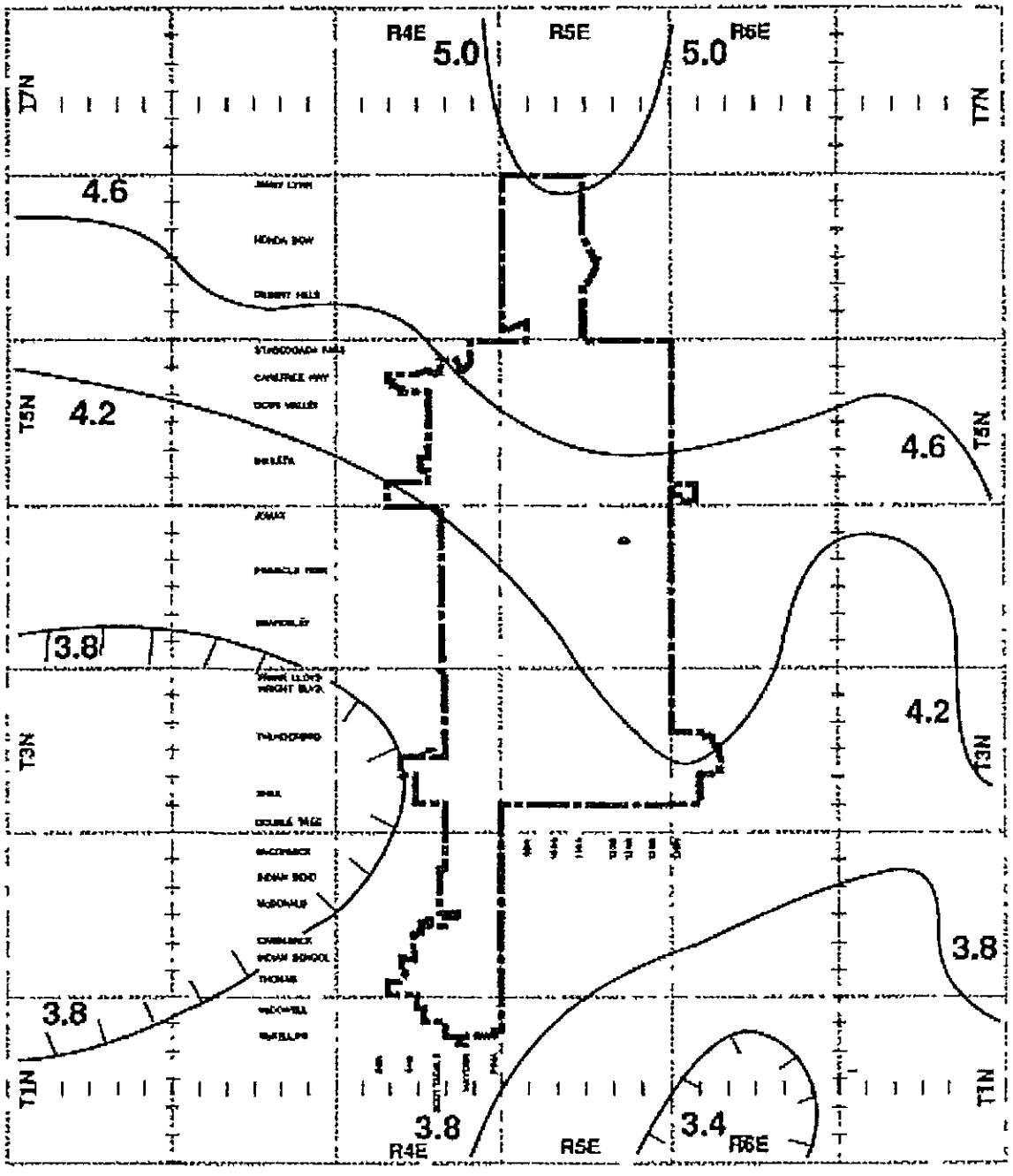

FIGURE 2.2-12

Isopluvials 100 Year 24 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol VIII

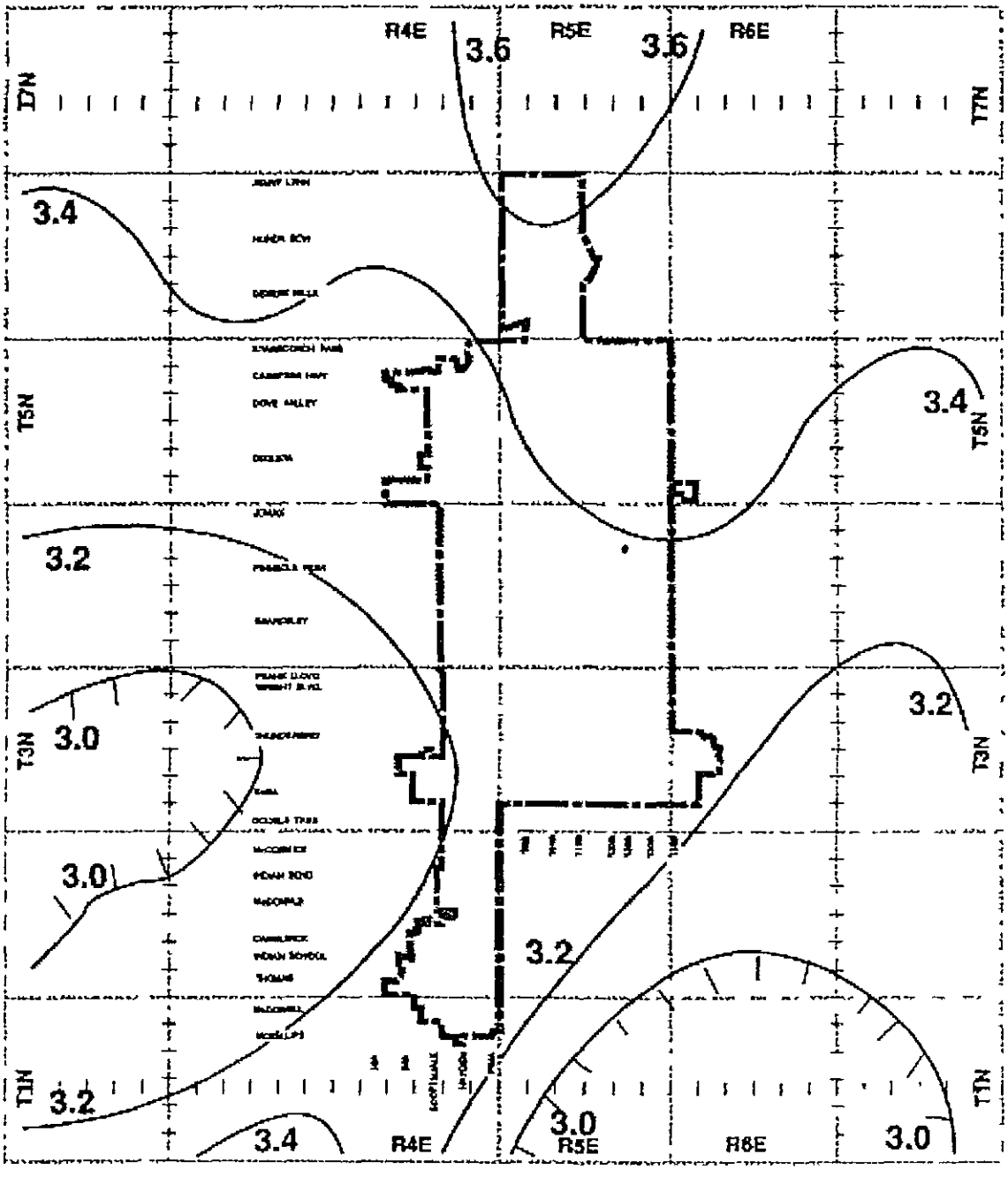

FIGURE 2.2-6

Isopluvials 100 Year 6 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol VIII

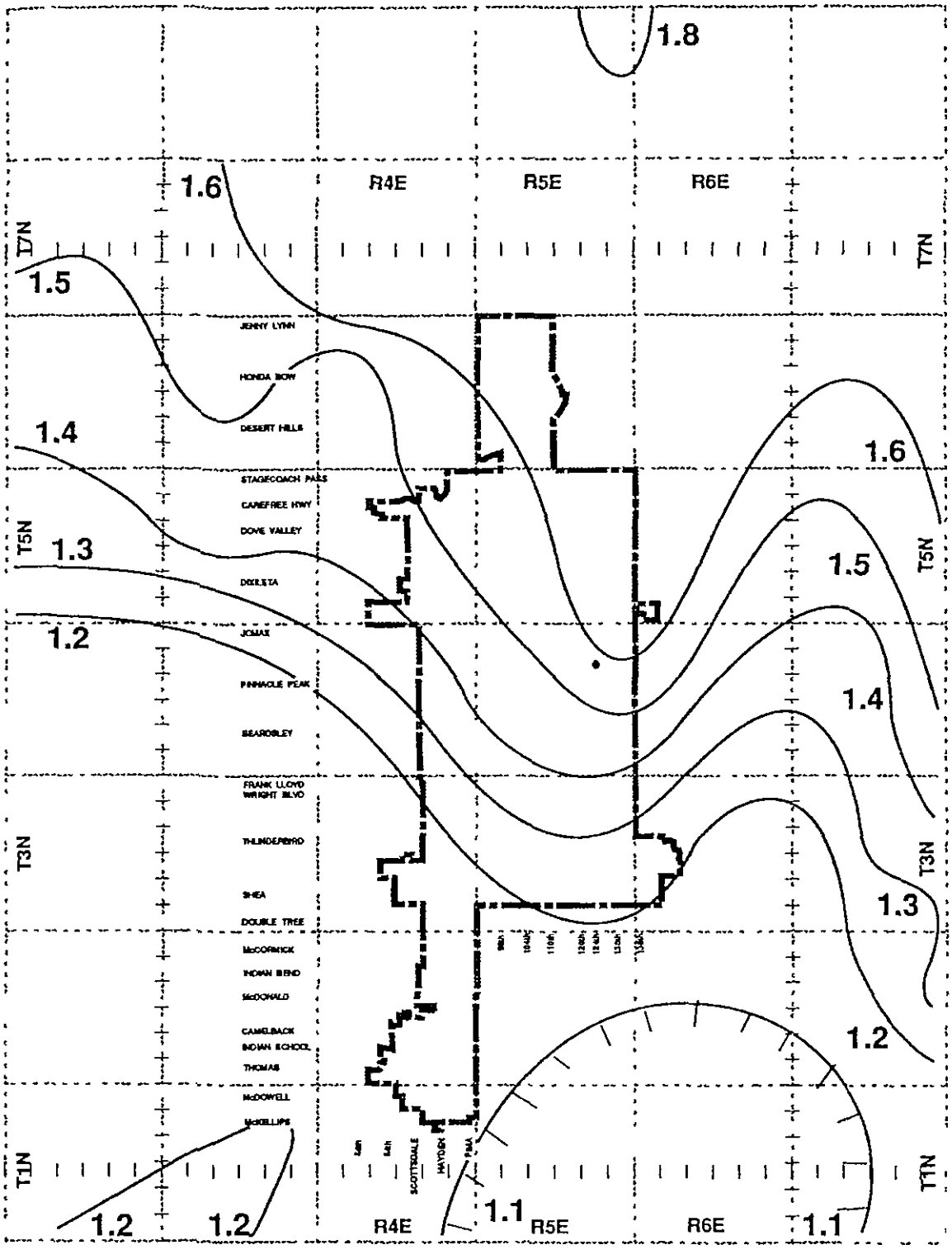

FIGURE 2.2-1

Isopluvials 2 Year 6 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol VIII

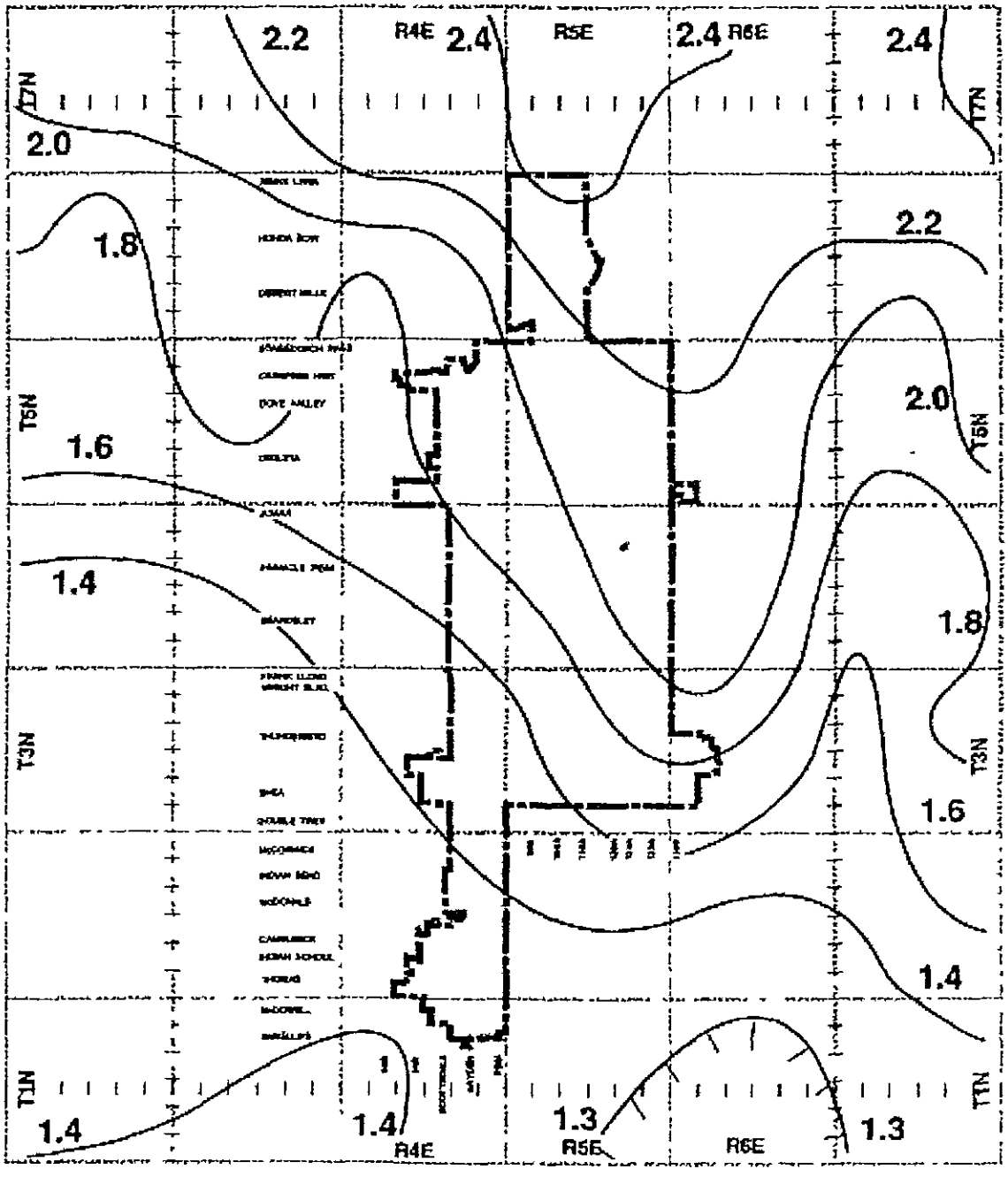

FIGURE 2.2-7

Isopluvials 2 Year 24 Hour Precipitation in Inches

Rainfall Data From NOAA Atlas 2, Vol VIII

Runoff Curve Numbers for Urban Areas[1]

Cover type and hydrologic condition	Average % Impervious Area[2]	Curve numbers for hydrologic soil group A	B	C	D
Fully developed urban areas with vegetation established					
Open space (lawns, parks, golf courses cemeteries, etc)[3]-					
Poor condition (grass cover less that 50%)		68	79	86	89
Fair condition (grass cover 50-75%)		49	69	79	84
Good condition (grass cover greater than 75%)		39	61	74	80
Impervious areas.					
Paved parking lots roads driveways etc. (excld right-of-way)		98	98	98	98
Streets and roads					
Paved, curbs and storm sewer (excld right-of-way)		98	98	98	98
Paved, open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1 to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts.					
Commercial and business	85				
Industrial	85				
Townhouse duplexes	65	Not Applicable in Scottsdale			
Multi-Family	85				
Residential districts by average lot size (See Figure 2 2 16)					
Developing Urban Areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

[1]Average runoff condition, and I_a = 0.2S; Table 2-2a, 210 VI TR55, Second Ed. June 1986

[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition (not applicable in Scottsdale)

[3]CN's shown are equavalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type

[4]Composite CN's for natural desert landscaping should be computed based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition

[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas

FIGURE 2.2-19

Runoff Curve Numbers for Urban Areas[1]

Runoff Curve Numbers for Arid and Semiarid Rangelands[1]

Cover type and hydrologic condition	Hydrologic Condition[2]	Curve numbers for hydrologic soil group A	B	C	D
Herbaceous - mixture of grass, weeds, and low-growing brush, with brush the minor element	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen - mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush maple, and other brush	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper - pinyon, juniper, or both, grass understory	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub - major plants include saltbush greasewood, creosotebush, blackbrush bursage, palo verde, mequite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and I_a = 0 2S, Table 2 2d, 210-VI-TR55, Second Ed June 1986.
[2]Poor <30% ground cover (litter grass, and brush overstory).
Fair 30 to 70% ground cover (not applicable in Scottsdale)
Good: >70% ground cover (not applicable in Scottsdale)
[3]Curve Numbers for group A have been developed only for desert shrub.

FIGURE 2.2-20

Runoff Curve Numbers for Arid and Semiarid Rangelands[1]

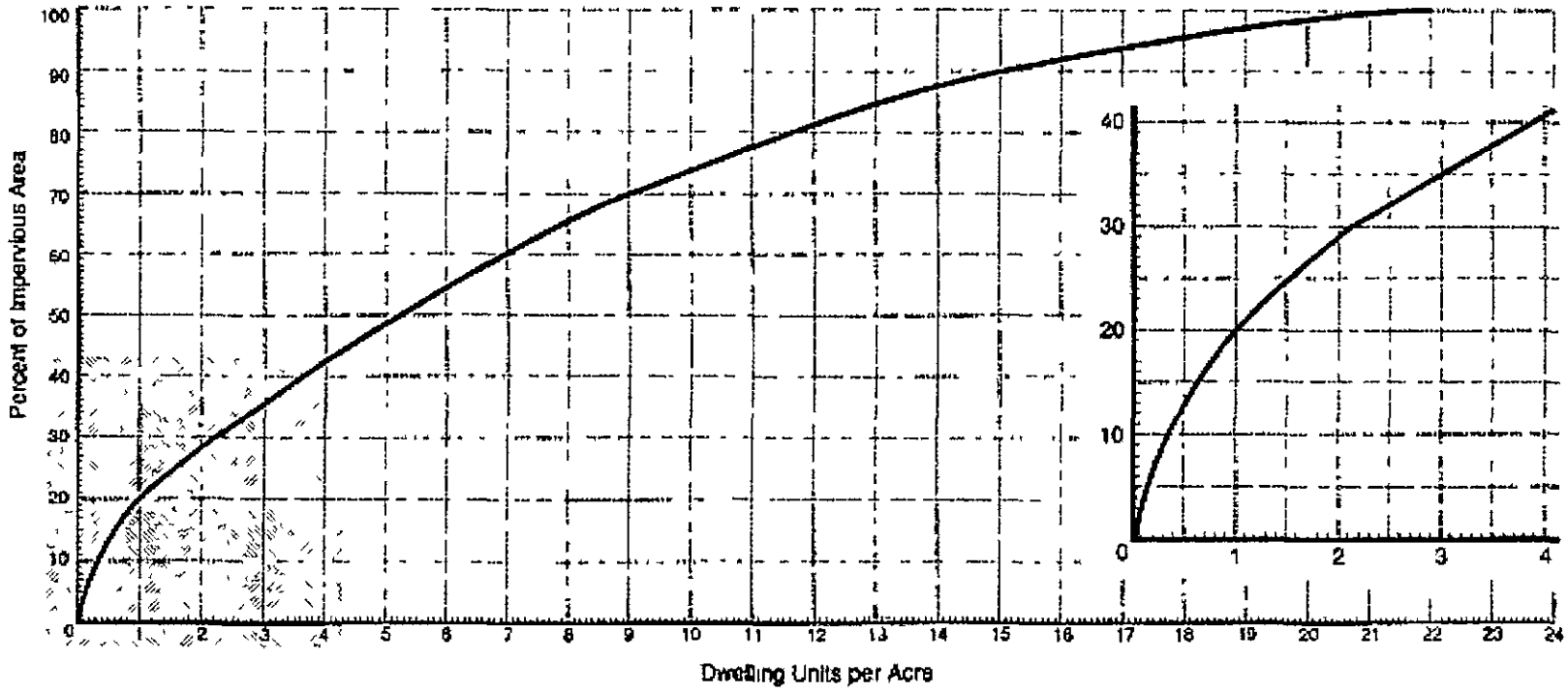

FIGURE 2.2-16

Percent of Impervious Area vs Dwelling Density

Developed by Water Resources Associates, Inc from data in Table 2 2a of TR-55, Urban Hydrology For Small Watersheds, and from discussions with Scottsdale city staff

McDowell Moutain Back Bowl
Online Detention Volumes

Sub-Basin A1

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2755	437	0 010	0 000	0 000
2756	1762	0 040	0 025	0 025
2757	3113	0 071	0 056	0 081
2758	4788	0 110	0 091	0 172

TOTAL PROVIDED VOLUME **0 17 acre-feet**

Sub-Basin A2

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2757	71	0 002	0 000	0 000
2758	406	0 009	0 005	0 005
2759	1038	0 024	0 017	0 022
2760	2176	0 050	0 037	0 059
2761	3483	0 080	0 065	0 124
2762	7769	0 178	0 129	0 253

TOTAL PROVIDED VOLUME **0 25 acre-feet**

Sub-Basin B

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2779	662	0 015	0 000	0 000
2780	1865	0 043	0 029	0 029
2781	3305	0 076	0 059	0 088
2782	5175	0 119	0 097	0 186
2783	7601	0 174	0 147	0 332
2784	10263	0 236	0 205	0 537

TOTAL PROVIDED VOLUME **0 54 acre-feet**

Sub-Basin C

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2779	211	0 005	0 000	0 000
2780	1232	0 028	0 017	0 017
2781	2680	0 062	0 045	0 061
2782	4153	0 095	0 078	0 140
2783	6614	0 152	0 124	0 263
2784	10181	0 234	0 193	0 456

TOTAL PROVIDED VOLUME **0 46 acre-feet**

Sub-Basin D

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2739	91	0 002	0 000	0 000
2740	1528	0 035	0 019	0 019
2741	3160	0 073	0 054	0 072
2742	5156	0 118	0 095	0 168
2743	7491	0 172	0 145	0 313

TOTAL PROVIDED VOLUME **0 31 acre-feet**

Sub-Basin E1

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2694	25	0 001	0 000	0 000
2695	843	0 019	0 010	0 010
2696	2627	0 060	0 040	0 050
2697	5367	0 123	0 092	0 142
2698	8611	0 198	0 160	0 302
2699	12335	0 283	0 240	0 542
2700	17669	0 406	0 344	0 887

TOTAL PROVIDED VOLUME **0 89 acre-feet**

Sub-Basin E2

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2693	23 5	0 001	0 000	0 000
2694	588	0 013	0 007	0 007
2695	4722	0 108	0 061	0 068
2696	9159	0 210	0 159	0 227
2697	14440	0 331	0 271	0 498
2698	20604	0 473	0 402	0 900

TOTAL PROVIDED VOLUME **0 90 acre-feet**

McDowell Moutain Back Bowl
Online Detention Volumes

Sub-Basin E3

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2700	400	0 009	0 000	0 000
2701	1352	0 031	0 020	0 020
2702	2856	0 066	0 048	0 068
2703	5049	0 116	0 091	0 159

TOTAL PROVIDED VOLUME **0 16 acre-feet**

Sub-Basin F1

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2696	98	0 002	0 000	0 000
2697	584	0 013	0 008	0 008
2698	1694	0 039	0 026	0 034
2699	3800	0 087	0 063	0 097
2700	9470	0 217	0 152	0 249

TOTAL PROVIDED VOLUME **0 25 acre-feet**

Sub-Basin F2

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2701	93	0 002	0 000	0 000
2702	545	0 013	0 007	0 007
2703	1341	0 031	0 022	0 029
2704	3126	0 072	0 051	0 080
2705	5640	0 129	0 101	0 181

TOTAL PROVIDED VOLUME **0 18 acre-feet**

Sub-Basin F3

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2720	0	0 000	0 000	0 000
2721	192	0 004	0 002	0 002
2722	808	0 019	0 011	0 014
2723	1908	0 044	0 031	0 045
2724	3360	0 077	0 060	0 105
2725	5225	0 120	0 099	0 204

TOTAL PROVIDED VOLUME **0 20 acre-feet**

Sub-Basin G

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2745	44	0 001	0 000	0 000
2746	305	0 007	0 004	0 004
2747	871	0 020	0 014	0 018
2748	1786	0 041	0 048	0 052
2749	3136	0 072	0 092	0 110

TOTAL PROVIDED VOLUME **0 11 acre-feet**

Sub-Basin H1

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2765	69	0 002	0 000	0 000
2766	270	0 006	0 004	0 004
2767	698	0 016	0 011	0 015
2768	1485	0 034	0 025	0 040
2769	2655	0 061	0 048	0 088
2770	4775	0 110	0 085	0 173
2771	6819	0 157	0 133	0 306

TOTAL PROVIDED VOLUME **0 31 acre-feet**

Sub-Basin H2

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2771	192	0 004	0 000	0 000
2772	1598	0 037	0 021	0 021
2773	5361	0 123	0 080	0 100
2774	8349	0 192	0 157	0 258
2775	12231	0 281	0 236	0 494
2776	16738	0 384	0 333	0 827

TOTAL PROVIDED VOLUME **0 83 acre-feet**

McDowell Moutain Back Bowl
Online Detention Volumes

Sub-Basin I

STAGE	AREA		VOLUME	
	(ft2)	(acres)	INC (acre-feet)	CUM (acre-feet)
2755	272	0 006	0 000	0 000
2756	2462	0 057	0 031	0 031
2757	6002	0 138	0 097	0 129
2758	10089	0 232	0 185	0 313
2759	14432	0 331	0 281	0 595

TOTAL PROVIDED VOLUME **0 59 acre-feet**

APPENDIX B

Existing HEC-1 Model

```
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*              JUN  1998                *
*            VERSION 4 1                *
*                                       *
*  RUN DATE   12MAY05  TIME  17 12:19   *
*                                       *
*****************************************
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**************** ***************** *****
*                                       *
*    U S  ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS  CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73) HEC1GS HEC1DB AND HEC1KW

THE DEFINITIONS OF VARIABLES RTIMP- AND RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973 STYLE INPUT STRUCTURE
THE DEFINITION OF -AMSKK ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81 THIS IS THE FORTRAN77 VERSION
NEW OPTIONS DAMBREAK OUTFLOW SUBMERGENCE SINGLE EVENT DAMAGE CALCULATION DSS WRITE STAGE FREQUENCY
DSS READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE GREEN AND AMPT INFILTRATION
KINEMATIC WAVE NEW FINITE DIFFERENCE ALGORITHM

1 HEC 1 INPUT PAGE 1

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LINE          ID       1       2       3       4       5       6       7       8       9      10
   1          ID        HEC-1 MODEL FOR MCDOWELL MOUNTAIN BACKBOWL
   2          ID        100 YEAR  6-HOUR STORM
   3          ID        RAINFALL FROM NOAA ATLAS
   4          ID        SCS CURVE NUMBER SOIL LOSS PARAMETERS
   5          ID        KINEMATIC WAVE HYDROGRAPH ROUTING
   6          ID        EXISTING CONDITIONS
   7          ID
   8          ID        PREPARED BY WOOD/PATEL  8 4 2004
   9          ID        FILE NAME   EX-100 DAT
  10          ID
              *DIAGRAM
  11          IT      2                    2000
  12          IO      5
  13          JD              01
  14          PH                     73    1 43    2 42    2 74    2 96    3 37

  15          KK     A1
  16          KM      RUNOFF FROM SUB BASIN A1
              *      1
  17          BA    084
  18          LS             88
  19          UK    260     025      15     100
  20          RK   3520     023     045            TRAP      15       5

  21          KK     A2
  22          KM      RUNOFF FROM SUB BASIN A2
  23          BA    036
  24          LS             88
  25          UK    235     025      15     100
  26          RK   2000      02     045            TRAP      15       5

  27          KK      B
  28          KM      RUNOFF FROM SUB BASIN B
  29          BA    077
  30          LS             88
  31          UK    400     025      15     100
  32          RK   2420     024     045            TRAP      15       5

  33          KK      C
  34          KM      RUNOFF FROM SUB-BASIN C
  35          BA     03
  36          LS             88
  37          UK    250     023      15     100
  38          RK   1570     017     045            TRAP      15       5

  39          KK      D
  40          KM      RUNOFF FROM SUB BASIN D
  41          BA    034
  42          LS             88
  43          UK    300      02      15     100
  44          RK   1425     014     045            TRAP      15       5
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID       1       2       3       4       5       6       7       8       9      10
  45          KK     E1
```

```
          46          KM       RUNOFF FROM SUB-BASIN E1
          47          BA     061
          48          LS               88
          49          UK     400       02       15      100
          50          RK    2050      013      045             TRAP       15        5

          51          KK      E2
          52          KM       RUNOFF FROM SUB-BASIN E2
          53          BA     046
          54          LS               88
          55          UK     200       02       15      100
          56          RK    2370      013      045             TRAP       15        5

          57          KK   COMBE
          58          KM        COMBINE SECTIONS E1 AND E2
          59          HC       2
                      *

          60          KK   CLEAR
          61          KM        CLEAR HYDROGRAPH STACK
          62          HC       6
                      *

          63          KK      E3
          64          KM       RUNOFF FROM SUB-BASIN E3
          65          BA     007
          66          LS               88
          67          UK     175       025      15      100
          68          RK     750       032      045             TRAP       15        5

          69          KK      F1
          70          KM       RUNOFF FROM SUB BASIN F1
          71          BA     036
          72          LS               88
          73          UK     225       018      15      100
          74          RK    2500       012      045             TRAP       15        5
                      *

          75          KK      F2
          76          KM       RUNOFF FROM SUB BASIN F2
          77          BA     014
          78          LS               88
          79          UK     200       018      15      100
          80          RK    1440       028      045             TRAP       15        5
                      *

          81          KK      F3
          82          KM       RUNOFF FROM SUB-BASIN F3
          83          BA     013
          84          LS               88
          85          UK     225       018      15      100
          86          RK     850       026      045             TRAP       15        5
                      *
1                                                 HEC 1 INPUT                                                 PAGE  3

        LINE          ID       1         2        3        4        5        6        7        8        9       10

          87          KK       G
          88          KM       RUNOFF FROM SUB-BASIN G
          89          BA     017
          90          LS               88
          91          UK     400       025      15      100
          92          RK     720       022      045             TRAP       15        5

          93          KK      H1
          94          KM       RUNOFF FROM SUB BASIN H1
          95          BA     059
          96          LS               88
          97          UK     375       025      15      100
          98          RK    2210       019      045             TRAP       15        5

          99          KK      H2
         100          KM       RUNOFF FROM SUB-BASIN H2
         101          BA     072
         102          LS               88
         103          UK     400       025      15      100
         104          RK    3480       019      045             TRAP       15        5

         105          KK       I
         106          KM       RUNOFF FROM SUB-BASIN I
         107          BA     025
         108          LS               88
         109          UK     225       02       15      100
         110          RK    2100       026      045             TRAP       15        5
         111          ZZ
1
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
 LINE     (V) ROUTING          ( -->) DIVERSION OR PUMP FLOW

  NO      ( ) CONNECTOR        (<- -) RETURN OF DIVERTED OR PUMPED FLOW

   15          A1
```

```
   21                    A2

   27                                 B

   33                                           C

   39                                                     D

   45                                                              E1

   51                                                                       E2

   57                                                              COMBE

   60       CLEAR

   63                    E3

   69                                 F1

   75                                           F2

   81                                                     F3

   87                                                              G

   93                                                                       H1

   99                                                                                H2

  105                                                                                     I

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC 1)  *
*             JUN  1998                *
*           VERSION 4 1                *
*                                      *
*  RUN DATE   12MAY05  TIME  17 12 19  *
*                                      *
********************* ***************** *

****************************************
*                                      *
*    U S  ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS  CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
************************** ******** *

                          HEC 1 MODEL FOR MCDOWELL MOUNTAIN BACKBOWL
                          100 YEAR  6-HOUR STORM
                          RAINFALL FROM NOAA ATLAS
                          SCS CURVE NUMBER SOIL LOSS PARAMETERS
                          KINEMATIC WAVE HYDROGRAPH ROUTING
                          EXISTING CONDITIONS

                          PREPARED BY WOOD/PATEL  8 4 2004
                          FILE NAME   EX-100 DAT

  12 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL          0  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1   0  STARTING DATE
                       ITIME       0000  STARTING TIME
                         NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     3   0  ENDING DATE
                       NDTIME      1838  ENDING TIME
                       ICENT         19  CENTURY MARK

                    COMPUTATION INTERVAL      03 HOURS
                        TOTAL TIME BASE   66 63 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH  ELEVATION     FEET
```

FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

13 JD INDEX STORM NO 1
STRM 3 37 PRECIPITATION DEPTH
TRDA 01 TRANSPOSITION DRAINAGE AREA

14 PI PRECIPITATION PATTERN

00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00
00	00	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	03	03	03	03	03
04	04	04	06	06	07	09	12	17	29
29	24	15	11	07	07	06	05	04	04
04	03	03	03	03	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	01	01
01	01	01	01	01	01	01	01	00	00
00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00	00	00

*** FDKRUT NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED ITERATION= 1

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24 HOUR	72 HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	A1	213	3 20	19	5	2	08		
+	HYDROGRAPH AT	A2	100	3 17	8	2	1	04		
+	HYDROGRAPH AT	B	177	3 20	18	4	2	08		
+	HYDROGRAPH AT	C	83	3 17	7	2	1	03		
+	HYDROGRAPH AT	D	85	3 17	8	2	1	03		
+	HYDROGRAPH AT	E1	133	3 23	14	4	1	06		
+	HYDROGRAPH AT	E2	122	3 17	11	3	1	05		
+	2 COMBINED AT	COMBE	251	3 20	24	6	2	11		
+	6 COMBINED AT	CLEAR	897	3 20	84	21	8	37		
+	HYDROGRAPH AT	E3	22	3 10	2	0	0	01		
+	HYDROGRAPH AT	F1	87	3 20	8	2	1	04		
+	HYDROGRAPH AT	F2	40	3 17	3	1	0	01		
+	HYDROGRAPH AT	F3	37	3 13	3	1	0	01		
+	HYDROGRAPH AT	G	41	3 17	4	1	0	02		
+	HYDROGRAPH AT	H1	140	3 20	13	3	1	06		
+	HYDROGRAPH AT	H2	155	3 23	16	4	1	07		
+	HYDROGRAPH AT	I	67	3 17	6	1	1	03		

1

SUMMARY OF KINEMATIC WAVE MUSKINGUM CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR STORM = 1 STORM AREA (SQ MI) = 01									
A1	MANE	1 84	215 36	191 18	2 14	2 00	213 24	192 00	2 14

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 9633E+01 OUTFLOW= 9599E+01 BASIN STORAGE= 3750E-03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01									
A2	MANE	1 88	100 57	189 37	2 14	2 00	99 86	190 00	2 14

CONTINUITY SUMMARY (AC-FT) - INFLOW= 0000E+00 EXCESS= 4129E+01 OUTFLOW= 4113E+01 BASIN STORAGE= 1196E-03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01									
B	MANE	1 80	178 02	192 66	2 14	2 00	177 17	192 00	2 14

CONTINUITY SUMMARY (AC-FT) - INFLOW= 0000E+00 EXCESS= 8830E+01 OUTFLOW= 8777E+01 BASIN STORAGE= 6009E-03 PERCENT ERROR= 6

FOR STORM = 1 STORM AREA (SQ MI) = 01									
C	MANE	1 71	82 90	189 95	2 14	2 00	82 77	190 00	2 15

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 3440E+01 OUTFLOW= 3430E+01 BASIN STORAGE= 1239E-03 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01									
D	MANE	1 53	86 22	190 92	2 14	2 00	84 94	190 00	2 14

CONTINUITY SUMMARY (AC-FT) - INFLOW= 0000E+00 EXCESS= 3899E+01 OUTFLOW= 3884E+01 BASIN STORAGE= 1962E-03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01									
E1	MANE	2 00	133 36	194 55	2 14	2 00	133 14	194 00	2 14

CONTINUITY SUMMARY (AC FT) - INFLOW= 0000E+00 EXCESS= 6996E+01 OUTFLOW= 6955E+01 BASIN STORAGE= 5608E 03 PERCENT ERROR= 6

FOR STORM = 1 STORM AREA (SQ MI) = 01									
E2	MANE	1 89	121 94	190 01	2 14	2 00	121 89	190 00	2 15

CONTINUITY SUMMARY (AC-FT) - INFLOW= 0000E+00 EXCESS= 5275E+01 OUTFLOW= 5259E+01 BASIN STORAGE= 1471E 03 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01									
E3	MANE	90	22 74	186 82	2 15	2 00	22 38	186 00	2 15

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 8028E+00 OUTFLOW= 8015E+00 BASIN STORAGE= 1492E-04 PERCENT ERROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01									
F1	MANE	2 00	88 17	192 44	2 14	2 00	86 82	192 00	2 14

CONTINUITY SUMMARY (AC PT) - INFLOW= 0000E+00 EXCESS= 4129E+01 OUTFLOW= 4112E+01 BASIN STORAGE= 1537E-03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01									
F2	MANE	1 50	39 90	188 55	2 14	2 00	39 62	190 00	2 14

CONTINUITY SUMMARY (AC PT) - INFLOW= 0000E+00 EXCESS= 1606E+01 OUTFLOW= 1601E+01 BASIN STORAGE= 4495E 04 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01									
F3	MANE	1 04	37 48	188 27	2 15	2 00	37 29	188 00	2 15

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 1491E+01 OUTFLOW= 1488E+01 BASIN STORAGE= 4746E-04 PERCENT ERROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01									
G	MANE	94	40 94	190 89	2 14	2 00	40 78	190 00	2 14

CONTINUITY SUMMARY (AC-FT) - INFLOW= 0000E+00 EXCESS= 1950E+01 OUTFLOW= 1939E+01 BASIN STORAGE= 1252E-03 PERCENT ERROR= 5

FOR STORM = 1 STORM AREA (SQ MI) = 01									
H1	MANE	1 85	141 10	192 31	2 14	2 00	140 41	192 00	2 14

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 6766E+01 OUTFLOW= 6736E+01 BASIN STORAGE= 3891E-03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01

H2	MANE	2 00	155 41	195 66	2 14	2 00	154 63	194 00	2 14

CONTINUITY SUMMARY (AC FT) - INFLOW= 0000E+00 EXCESS= 8257E+01 OUTFLOW= 8203E+01 BASIN STORAGE= 6010E 03 PERCENT ERROR= 6

FOR STORM = 1 STORM AREA (SQ MI) = 01

I	MANE	1 91	66 92	191 14	2 14	2 00	66 84	190 00	2 14

CONTINUITY SUMMARY (AC FT) - INFLOW= 0000E+00 EXCESS= 2867E+01 OUTFLOW= 2856E+01 BASIN STORAGE= 1048E-03 PERCENT ERROR= 4

*** NORMAL END OF HEC-1 ***

APPENDIX C

Proposed HEC-1 Model

```
1**********                    ******
*                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC 1)  *
*             JUN  1998              *
*           VERSION 4 1              *
*                                    *
*   RUN DATE   12MAY05  TIME  18 22 36  *
*                                    *
**********  *******  **     ***  **********  *  **
```

```
**   *  ****  ***  ********************

     U S  ARMY CORPS OF ENGINEERS
*    HYDROLOGIC ENGINEERING CENTER
*         609 SECOND STREET
        DAVIS  CALIFORNIA 95616
*           (916) 756 1104            *
*                                     *
****  *        *   **  **  **************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC 1 KNOWN AS HEC1 (JAN 73) HEC1GS HEC1DB AND HEC1KW

THE DEFINITIONS OF VARIABLES RTIMP AND RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE
THE DEFINITION OF AMSKK ON RM CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81 THIS IS THE FORTRAN77 VERSION
NEW OPTIONS DAMBREAK OUTFLOW SUBMERGENCE SINGLE EVENT DAMAGE CALCULATION DSS WRITE STAGE FREQUENCY
DSS READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE GREEN AND AMPT INFILTRATION
KINEMATIC WAVE NEW FINITE DIFFERENCE ALGORITHM

1 HEC 1 INPUT PAGE 1

LINE	ID	1	2	3	4	5	6	7	8	9	10
1	ID	HEC-1 MODEL FOR MCDOWELL MOUNTAIN BACKBOWL									
2	ID	100 YEAR 6 HOUR STORM									
3	ID	RAINFALL FROM NOAA ATLAS									
4	ID	SCS CURVE NUMBER SOIL LOSS PARAMETERS									
5	ID	KINEMATIC WAVE HYDROGRAPH ROUTING									
6	ID	DEVELOPED CONDITIONS									
7	ID	12% IMPERVIOUS AREA USED FOR SITE									
8	ID										
9	ID	PREPARED BY WOOD/PATEL 1 10 2005									
10	ID	FILE NAME DEV-100 DAT									
11	ID	DIAGRAM									
12	IT	2			2000						
13	IO	5									
14	JD		01								
15	PH			73	1 43	2 42	2 74	2 96	3 37		
16	KK	A1									
17	KM	RUNOFF FROM SUB BASIN A1									
18	BA	083									
19	LS		88	1 4							
20	UK	260	025	15	100						
21	RK	3520	023	045		TRAP	15	5			
22	KK	A2									
23	KM	RUNOFF FROM SUB BASIN A2									
24	BA	036									
25	LS		88	8 7							
26	UK	235	025	15	100						
27	RK	2000	02	045		TRAP	15	5			
28	KK	BASA2									
29	KM	2 36 PIPES									
30	KM	V NOTCH WEIR WITH 75 DEGREE ANGLE AT HEADWALL									
31	RS	1	STOR	0							
32	SV	0	005	022	026	059	124	253			
33	SE	2757	2758	2759	2759 5	2760	2761	2762			
34	SQ	0	1 9	10 8	18 8	29 7	60 9	106 4			
35	KK	B									
36	KM	RUNOFF FROM SUB BASIN B									
37	BA	077									
38	LS		88	6 9							
39	UK	400	025	15	100						
40	RK	2420	024	045		TRAP	15	5			
41	KK	BASB									
42	KM	2-48" PIPES									
43	RS	1	STOR	0							
44	SV	0	029	088	137	186	332	537			
45	SE	2779	2780	2781	2781 5	2782	2783	2784			
46	SQ	0	16	46	69	92	142	190			

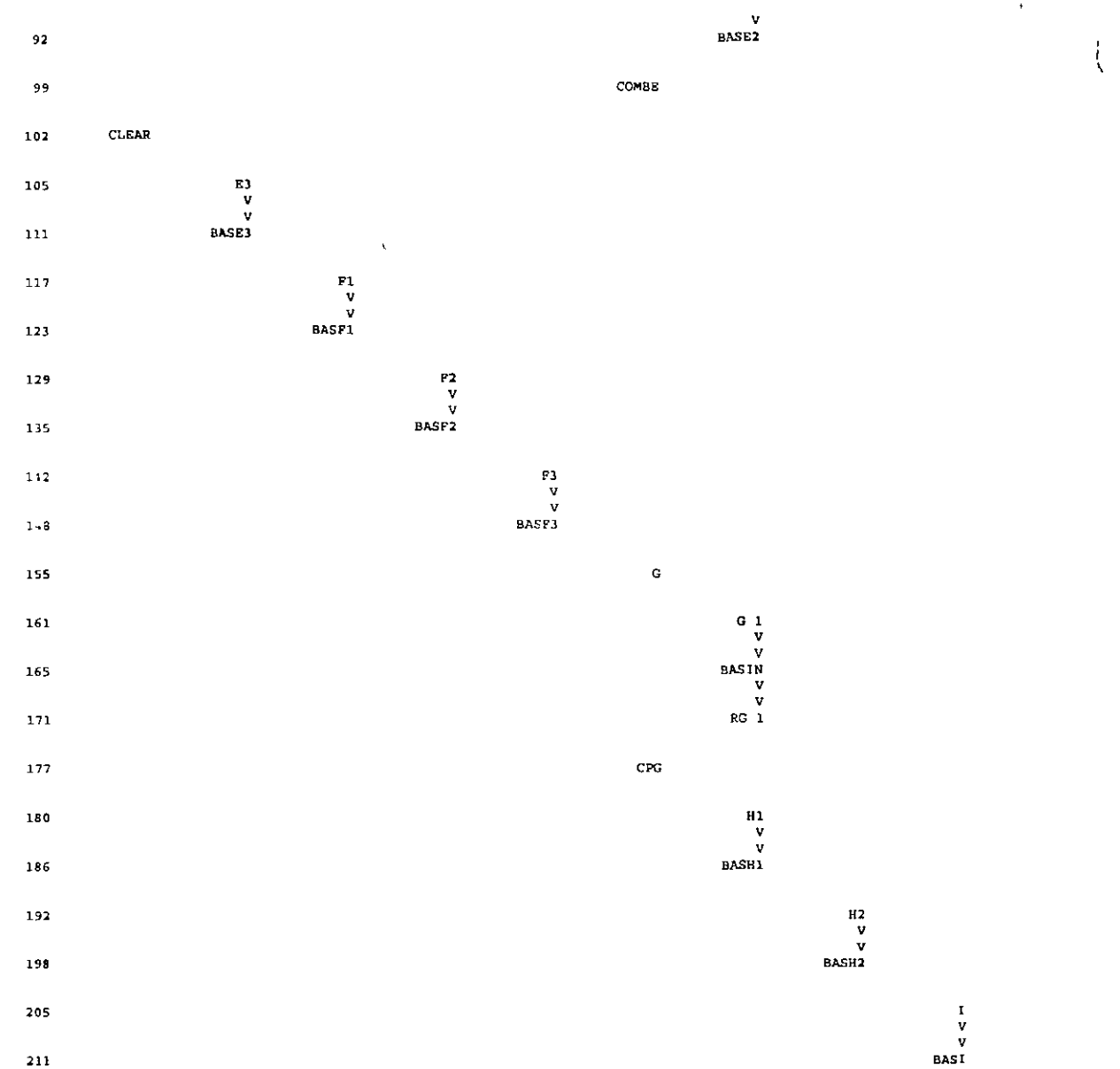
1 HEC 1 INPUT PAGE 2

LINE	ID	1	2	3	4	5	6	7	8	9	10

```
 47          KK       C
 48          KM       RUNOFF FROM SUB-BASIN C
 49          BA      03
 50          LS              88      6 8
 51          UK     250      023      15      100
 52          RK    1570      017      045             TRAP      15        5


 53          KK    BASC
 54          KM        2 30" PIPES
 55          KM        1 12  PIPE AND 9  WEIR AT HEADWALL
 56          RS       1    STOR       0
 57          SV       0     017      061      14      263      456
 58          SE    2779    2780     2781    2782     2783     2784
 59          SQ       0       2        5      15       53      108


 60          KK       D
 61          KM       RUNOFF FROM SUB-BASIN D
 62          BA     034
 63          LS              88      12
 64          UK     300      02      15      100
 65          RK    1425      014     045             TRAP      15        5


 66          KK    BASD
 67          KM        2 36" PIPES
 68          KM        V NOTCH WEIR WITH 95 DEGREE ANGLE AT HEADWALL
 69          RS       1    STOR       0
 70          SV       0     019      072     168      313
 71          SE    2739    2740     2741    2742     2743
 72          SQ       0     2 7     15 3    42 2     86 ?


 73          KK      E1              5
 74          KM       RUNOFF FROM SUB-BASIN E1
 75          BA     061
 76          LS              88      12
 77          UK     400      02      15      100
 78          RK    2050      013     045             TRAP      15        5
             *

 79          KK   BASE1
 80          KM        2 36  PIPES
 81          KM        V NOTCH WEIR WITH 65 DEGREE ANGLE AT HEADWALL
 82          RS       1    STOR       0
 83          SV       0      01       05      142      302      542      887
 84          SE    2694    2695     2696    2697     2698     2699     2700
 85          SQ       0     1 6      8 9    24 6     50 6     88 4    139 4
1                                                HEC 1 INPUT                                                PAGE  3
          LINE      ID       1        2        3        4        5        6        7        8        9       10

 86          KK      E2
 87          KM       RUNOFF FROM SUB BASIN E2
 88          BA     046
 89          LS              88      12
 90          UK     200      02      15      100
 91          RK    2370      013     045             TRAP      15        5
             *

 92          KK   BASE2
 93          KM        2 42" PIPES
 94          KM        1 12  PIPE AND 13  WEIR AT HEADWALL
 95          RS       1    STOR       0
 96          SV       0     007      068     227      498        9
 97          SE    2693    2694     2695    2696     2697     2698
 98          SQ       0     2 2      4 5    18 9       74   152 1
             *

 99          KK   COMBE
100          KM        COMBINE SECTIONS E1 AND E2
101          HC       2


102          KK   CLEAR
103          KM        CLEAR HYDROGRAPH STACK
104          HC       6
             *

105          KK      E3
106          KM       RUNOFF FROM SUB-BASIN E3
107          BA     007
108          LS              88      12
109          UK     175      025      15      100
110          RK     750      032     045             TRAP      15        5
             *

111          KK   BASE3
112          KM        1 24  PIPE
113          RS       1    STOR       0
114          SV       0      02      068     159
115          SE    2700    2701     2702    2703
116          SQ       0     4 2     12 5    20 2
```

```
                *
          117   KK      F1
          118   KM       RUNOFF FROM SUB-BASIN F1
          119   BA     036
          120   LS              88      12
          121   UK     225      018      15      100
          122   RK    2500      012     045             TRAP      15       5
                *
1                                        HEC-1 INPUT                                                    PAGE  4

          LINE  ID       1       2       3       4       5       6       7       8       9      10

          123   KK   BASF1
          124   KM        2 36  PIPES
          125   RS        1    STOR       0
          126   SV        0     008      034      097      249
          127   SE     2696    2697     2698     2699     2700
          128   SQ        0      12       36       70      100
                *
          129   KK      F2
          130   KM       RUNOFF FROM SUB BASIN F2
          131   BA     014
          132   LS              88      12
          133   UK     200      018      15      100
          134   RK    1440      028     045             TRAP      15       5

          135   KK   BASF2
          136   KM        1 30  PIPE
          137   KM        V NOTCH WEIR WITH 50 DEGREE ANGLE AT HEADWALL
          138   RS        1    STOR       0
          139   SV        0     007      029       08      181
          140   SE     2701    2702     2703     2704     2705
          141   SQ        0     1 2      6 6       18       37
                *
          142   KK      F3
          143   KM       RUNOFF FROM SUB BASIN F3
          144   BA     013
          145   LS              88      12
          146   UK     225      018      15      100
          147   RK     850      026     045             TRAP      15       5
                *
          148   KK   BASF3
          149   KM        1-30  PIPE
          150   KM        V NOTCH WEIR WITH 50 DEGREE ANGLE AT HEADWALL
          151   RS        1    STOR       0
          152   SV        0     011      043      103      202
          153   SE     2721    2722     2723     2724     2725
          154   SQ        0     1 2      6 6       18       37
                *
          155   KK      G
          156   KM       RUNOFF FROM SUB-BASIN G
          157   BA     015
          158   LS              88      12
          159   UK     400      025      15      100
          160   RK     720      022     045             TRAP      15       5
                *
1                                        HEC-1 INPUT                                                    PAGE  5

          LINE  ID       1       2       3       4       5       6       7       8       9      10

          161   KK     G 1
          162   KM       RUNOFF FROM SUB-BASIN G 1
          163   BA    0014
          164   LS              88      12
                *
          165   KK   BASIN G 1
          166   KM        1 24" PIPE
          167   RS        1    STOR       0
          168   SV        0     004      014      048
          169   SE     2745    2746     2747     2748
          170   SQ        0     4 2     12 5     20 2
                *
          171   KK    RG 1
          172   KM       ROUTE BASIN G 1 THROUGH G
          173   RS        1    FLOW       0
          174   RC       45      35       45      610      048     2744
          175   RX      100     110      120      138      148      166      176      186
          176   RY       10      99       98       95       95       98       99      100
                *
          177   KK     CPG
          178   KM    CONCENTRATION POINT G
          179   HC        2
                *
```

```
180          KK      H1
181          KM       RUNOFF FROM SUB BASIN H1
182          BA     059
183          LS              88    11 4
184          UK     375      025      15     100
185          RK    2210      019      045            TRAP      15       5


186          KK    BASH1
187          KM         2 36  PIPE
188          RS        1    STOR       0
189          SV        0     004      015      04      088      173      306
190          SE     2765    2766     2767    2768     2769     2770     2771
191          SQ        0      12       36      70      100      122      140
             *

192          KK      H2
193          KM       RUNOFF FROM SUB BASIN H2
194          BA     072
195          LS              88      5 7
196          UK     400      025      15     100
197          RK    3480      019      045            TRAP      15       5
             *
1                                                  HEC 1 INPUT                                                    PAGE  6

          LINE          ID       1        2        3        4        5        6        7        8        9       10

198          KK    BASH2
199          KM         2 42" PIPES
200          KM         1-12" PIPE AND 1.  WEIR AT HEADWALL
201          RS        1    STOR       0
202          SV        0     021        1      258      494      827
203          SE     2771    2772     2773    2774     2775     2776
204          SQ        0      2 2      4 5    18 9       74   152 1
             *

205          KK        I
206          KM       RUNOFF FROM SUB BASIN I
207          BA     025
208          LS              88      8 3
209          UK     225      02       15     100
210          RK    2100      026      045            TRAP      15       5
             *

211          KK     BASI
212          KM         2 30  PIPE
213          KM         1 12" PIPE AND 9  WEIR AT HEADWALL
214          RS        1    STOR       0
215          SV        0     031      129      313      595
216          SE     2755    2756     2757    2758     2759
217          SQ        0       2        5       31       78
218          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
 LINE       (V) ROUTING          (   >) DIVERSION OR PUMP FLOW

  NO        ( ) CONNECTOR        (< - ) RETURN OF DIVERTED OR PUMPED FLOW

  16           A1

  22                    A2
                         V
                         V
  28                  BASA2

  35                                 B
                                     V
                                     V
  41                               BASB

  47                                          C
                                              V
                                              V
  53                                        BASC

  60                                                    D
                                                        V
                                                        V
  66                                                  BASD

  73                                                             E1
                                                                  V
                                                                  V
  79                                                           BASE1

  86                                                                      E2
                                                                           V
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1**************************************
*                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC 1)   *
*             JUN   1998             *
*           VERSION 4 1              *
*                                    *
*  RUN DATE   12MAY05  TIME  18 22:36   *
*                                    *
 *** **************************************
```

```
**************************************
*                                    *
*    U S  ARMY CORPS OF ENGINEERS    *
*    HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET         *
*       DAVIS  CALIFORNIA 95616      *
*           (916) 756 1104           *
*                                    *
**************************************
```

HEC 1 MODEL FOR MCDOWELL MOUNTAIN BACKBOWL
100-YEAR 6 HOUR STORM
RAINFALL FROM NOAA ATLAS
SCS CURVE NUMBER SOIL LOSS PARAMETERS
KINEMATIC WAVE HYDROGRAPH ROUTING
DEVELOPED CONDITIONS
12% IMPERVIOUS AREA USED FOR SITE

PREPARED BY WOOD/PATEL 1 10 2005
FILE NAME   DEV-100 DAT

13 IO OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL

```
                IPLOT          0  PLOT CONTROL
                QSCAL          0  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                NMIN          2  MINUTES IN COMPUTATION INTERVAL
               IDATE      1   0  STARTING DATE
               ITIME         0000  STARTING TIME
                  NQ         2000  NUMBER OF HYDROGRAPH ORDINATES
              NDDATE      3   0  ENDING DATE
              NDTIME         1838  ENDING TIME
               ICENT           19  CENTURY MARK

             COMPUTATION INTERVAL       03 HOURS
                TOTAL TIME BASE    66 63 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH  ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT

14 JD        INDEX STORM NO  1
                STRM        3 37  PRECIPITATION DEPTH
                TRDA          01  TRANSPOSITION DRAINAGE AREA

15 PI         PRECIPITATION PATTERN
              00   00   00   00   00   00   00   00   00   00
              00   00   00   00   00   00   00   00   00   00
              00   00   00   00   00   00   00   00   00   00
              00   00   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   03   03   03   03
              04   04   04   06   06   07   09   12   17   29
              29   24   15   11   07   07   06   05   04   04
              04   03   03   03   03   01   01   01   01   01
              01   01   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   01   01   01   01
              01   01   01   01   01   01   01   01   00   00
              00   00   00   00   00   00   00   00   00   00
              00   00   00   00   00   00   00   00   00   00
              00   00   00   00   00   00   00   00   00   00

      *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE  STABILITY PROBLEMS MAY RESULT


      *** FDKRUT   NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED   ITERATION=  1

1
                                    RUNOFF SUMMARY
                              FLOW IN CUBIC FEET PER SECOND
                            TIME IN HOURS   AREA IN SQUARE MILES

                                        PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
      OPERATION        STATION          FLOW    PEAK      6 HOUR    24-HOUR    72 HOUR         AREA      STAGE     MAX STAGE
+
      HYDROGRAPH AT
+                        A1             213    3 20         19         5          2             08
      HYDROGRAPH AT
+                        A2             103    3 17          9         2          1             04
      ROUTED TO
+                       BASA2            98    3 20          9         2          1             04
+                                                                                                    2761 81      3 20
      HYDROGRAPH AT
+                         B             186    3 20         18         5          2             08
      ROUTED TO
+                       BASB             174    3 23         18         5          2             08
+                                                                                                    2783 66      3 23
      HYDROGRAPH AT
+                         C              85    3 17          7         2          1             03
      ROUTED TO
+                       BASC             78    3 20          7         2          1             03
+                                                                                                    2783 46      3 20
      HYDROGRAPH AT
+                         D              91    3 17          8         2          1             03
      ROUTED TO
+                       BASD             85    3 20          8         2          1             03
+                                                                                                    2742 96      3 20
```

+	HYDROGRAPH AT	E1	142	3 20	15	4	1	06	
+	ROUTED TO	BASE1	125	3 30	15	4	1	06	
+									2699 71 3 30
+	HYDROGRAPH AT	E2	128	3 17	11	3	1	05	
+	ROUTED TO	BASE2	112	3 23	11	3	1	05	
+									2697 49 3 23
+	2 COMBINED AT	COMBE	233	3 27	26	7	2	11	
+	6 COMBINED AT	CLEAR	855	3 23	88	22	8	37	
+	HYDROGRAPH AT	E3	24	3 10	2	0	0	01	
+	ROUTED TO	BASE3	17	3 20	2	0	0	01	
+									2702 01 3 20
+	HYDROGRAPH AT	F1	93	3 20	9	2	1	04	
+	ROUTED TO	BASF1	86	3 27	9	2	1	04	
+									2699 52 3 27
+	HYDROGRAPH AT	F2	42	3 13	3	1	0	01	
+	ROUTED TO	BASF2	36	3 20	3	1	0	01	
+									2704 95 3 20
+	HYDROGRAPH AT	F3	39	3 13	3	1	0	01	
+	ROUTED TO	BASF3	34	3 20	3	1	0	01	
+									2724 82 3 20
+	HYDROGRAPH AT	G	39	3 17	4	1	0	01	
+	HYDROGRAPH AT	G 1	0	00	0	0	0	00	
+	ROUTED TO	BASIN	0	00	0	0	0	00	
+									2745 00 00
+	ROUTED TO	RG 1	0	00	0	0	0	00	
+									10 00 00
+	2 COMBINED AT	CPG	39	3 17	4	1	0	02	
+	HYDROGRAPH AT	H1	149	3 20	14	4	1	06	
+	ROUTED TO	BASH1	135	3 23	14	4	1	06	
+									2770 72 3 23
+	HYDROGRAPH AT	H2	160	3 23	17	4	2	07	
+	ROUTED TO	BASH2	149	3 30	17	4	2	07	
+									2775 96 3 30
+	HYDROGRAPH AT	I	70	3 17	6	2	1	03	
+	ROUTED TO	BASI	58	3 23	6	2	1	03	
+									2758 57 3 23

1

SUMMARY OF KINEMATIC WAVE MUSKINGUM CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)

FOR STORM = 1 STORM AREA (SQ MI) = 01

A1	MANE	1 89	213 77	191 82	2 16	2 00	212 79	192 00	2 16

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 9594E+01 OUTFLOW 9557E+01 BASIN STORAGE= 3502E-03 PERCENT ERROR= 1

FOR STORM = 1 STORM AREA (SQ MI) = 01

A2	MANE	1 81	103 47	189 97	2 25	2 00	103 38	190 00	2 25

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 4332E+01 OUTFLOW= 4323E+01 BASIN STORAGE= 1434E 03 PERCENT EPROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01

B	MANE	1 76	186 57	192 53	2 23	2 00	186 02	192 00	2 23

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 9176E+01 OUTFLOW= 9144E+01 BASIN STORAGE= 5317E 03 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01

C	MANE	1 70	86 27	189 53	2 23	2 00	85 10	190 00	2 23

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 3573E+01 OUTFLOW= 3562E+01 BASIN STORAGE= 1213E-03 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01

D	MANE	1 54	91 45	190 44	2 29	2 00	90 74	190 00	2 29

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 4165E+01 OUTFLOW= 4151E+01 BASIN STORAGE= 1845E-03 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01

E1	MANE	1 91	143 07	193 32	2 29	2 00	141 94	192 00	2 29

CONTINUITY SUMMARY (AC FT) - INFLOW= 0000E+00 EXCESS= 7472E+01 OUTFLOW= 7442E+01 BASIN STORAGE= 5914E 03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01

E2	MANE	1 88	128 90	191 15	2 29	2 00	127 60	190 00	2 29

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 5634E+01 OUTFLOW= 5622E+01 BASIN STORAGE= 1638E-03 PERCENT ERROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01

E3	MANE	95	23 99	186 21	2 29	2 00	23 78	186 00	2 29

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 8574E+00 OUTFLOW= 8566E+00 BASIN STORAGE= 1659E 04 PERCENT ERROR= 1

FOR STORM = 1 STORM AREA (SQ MI) = 01

F1	MANE	2 00	93 19	191 92	2 29	2 00	93 06	192 00	2 29

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 4409E+01 OUTFLOW= 4392E+01 BASIN STORAGE= 1704E-03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01

F2	MANE	1 56	42 05	189 24	2 29	2 00	41 60	188 00	2 29

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 1715E+01 OUTFLOW= 1712E+01 BASIN STORAGE= 5243E 04 PERCENT ERROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01

F3	MANE	90	39 23	187 53	2 29	2 00	39 15	188 00	2 29

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 1592E+01 OUTFLOW= 1589E+01 BASIN STORAGE= 5312E 04 PERCENT ERROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01

G	MANE	96	38 58	189 40	2 29	2 00	38 55	190 00	2 29

CONTINUITY SUMMARY (AC-FT) INFLOW= 0000E+00 EXCESS= 1837E+01 OUTFLOW= 1834E+01 BASIN STORAGE= 1056E 03 PERCENT ERROR= 2

FOR STORM = 1 STORM AREA (SQ MI) = 01

H1	MANE	1 78	149 40	191 90	2 28	2 00	149 04	192 00	2 28

CONTINUITY SUMMARY (AC-FT) - INFLOW= 0000E+00 EXCESS= 7204E+01 OUTFLOW= 7183E+01 BASIN STORAGE= 4047E 03 PERCENT ERROR= 3

FOR STORM = 1 STORM AREA (SQ MI) = 01

H2	MANE	2 00	161 47	194 90	2 21	2 00	159 91	194 00	2 21

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 8524E+01 OUTFLOW= 8492E+01 BASIN STORAGE= 5742E 03 PERCENT ERROR= 4

FOR STORM = 1 STORM AREA (SQ MI) = 01

I	MANE	1 99	69 91	189 88	2 25	2 00	69 74	190 00	2 25

CONTINUITY SUMMARY (AC FT) INFLOW= 0000E+00 EXCESS= 3002E+01 OUTFLOW= 2994E+01 BASIN STORAGE= 1066E-03 PERCENT ERROR= 3

* NORMAL END OF HEC-1 ***

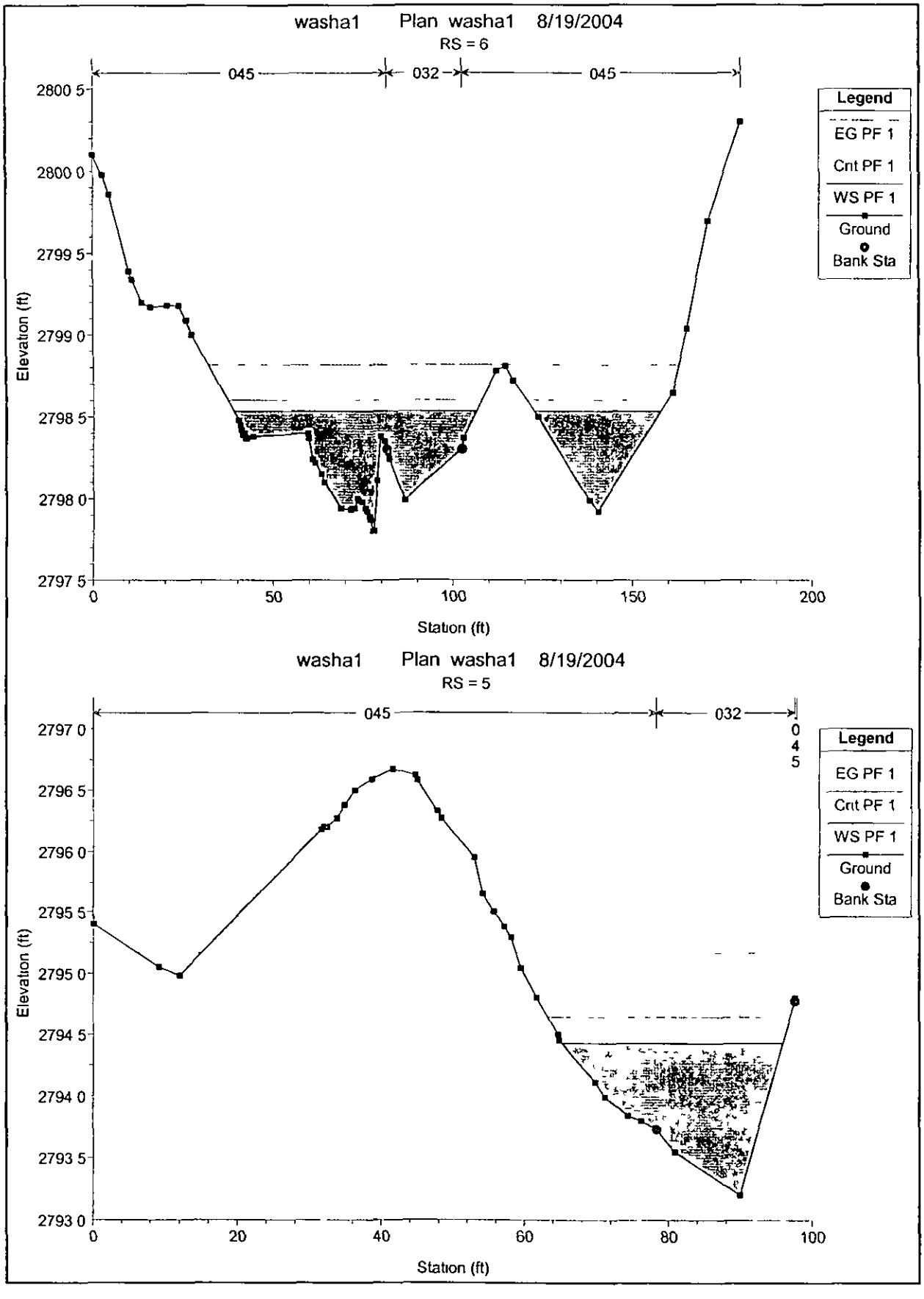
APPENDIX D

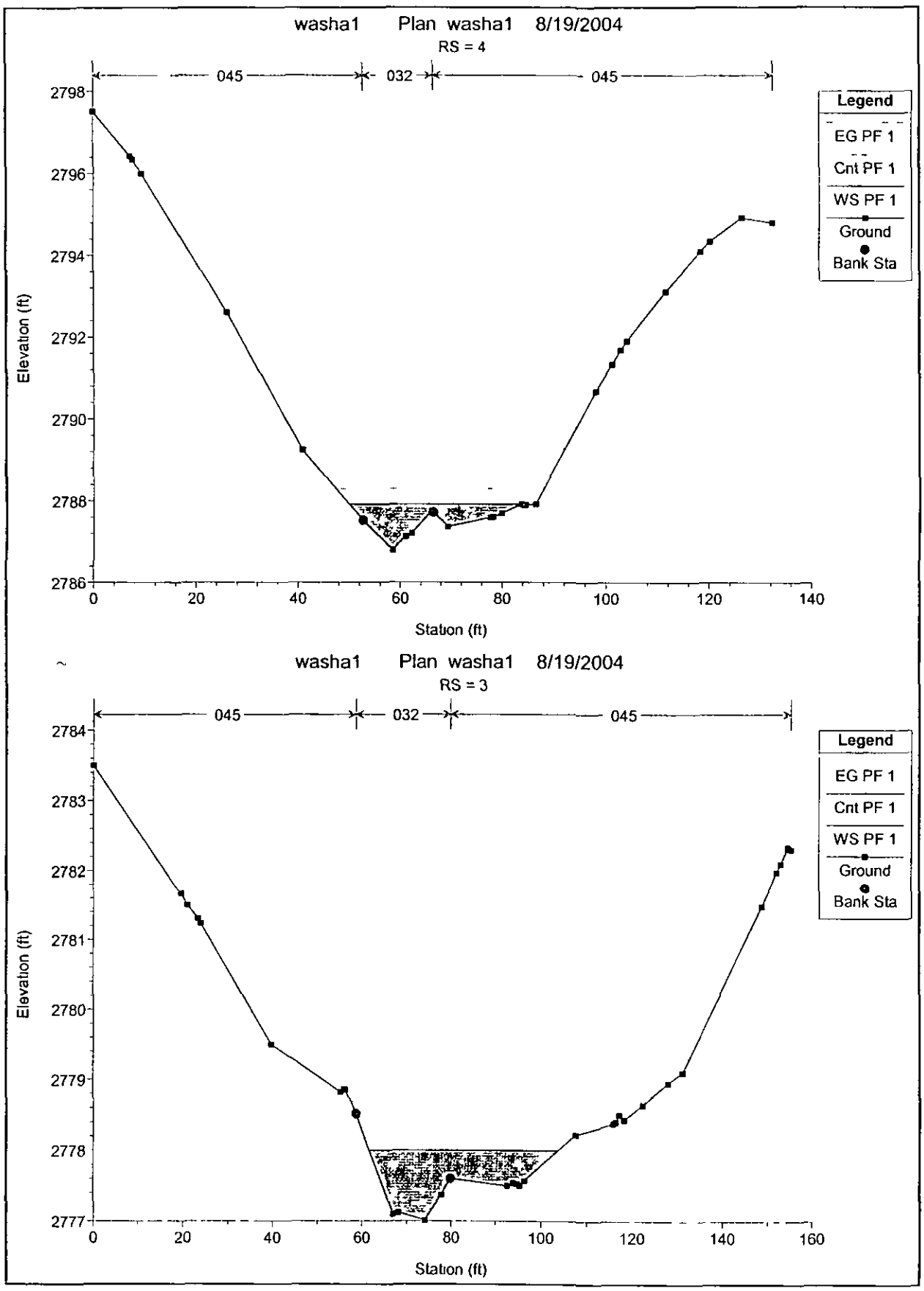
HEC-RAS Output Files

Wash A1

HEC-RAS Plan wasa1 River RIVER 1 Reach Reach-1 Profile PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W S Elev	Crit W S	E G Elev	E G Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6	PF 1	128 00	2797 99	2798 54	2798 60	2798 82	0 050032	5 55	32 78	102 82	1 56
Reach-1	5	PF 1	128 00	2793 20	2794 43	2794 64	2795 16	0 030199	7 29	20 61	30 80	1 38
Reach 1	4	PF 1	128 00	2786 79	2787 92	2788 29	2789 29	0 082570	10 40	15 94	35 78	2 20
Reach 1	3	PF 1	128 00	2777 01	2778 00	2778 19	2778 68	0 039435	7 37	22 21	42 18	1 53
Reach 1	2	PF 1	229 00	2761 68	2763 42	2764 11	2765 71	0 069287	13 15	22 42	33 27	2 17
Reach-1	1	PF 1	229 00	2753 00	2754 40	2754 64	2755 22	0 029825	8 34	38 85	60 93	1 43


washa1 Plan washa1 8/19/2004
RS = 6
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washa1 Plan washa1 8/19/2004
RS = 5
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)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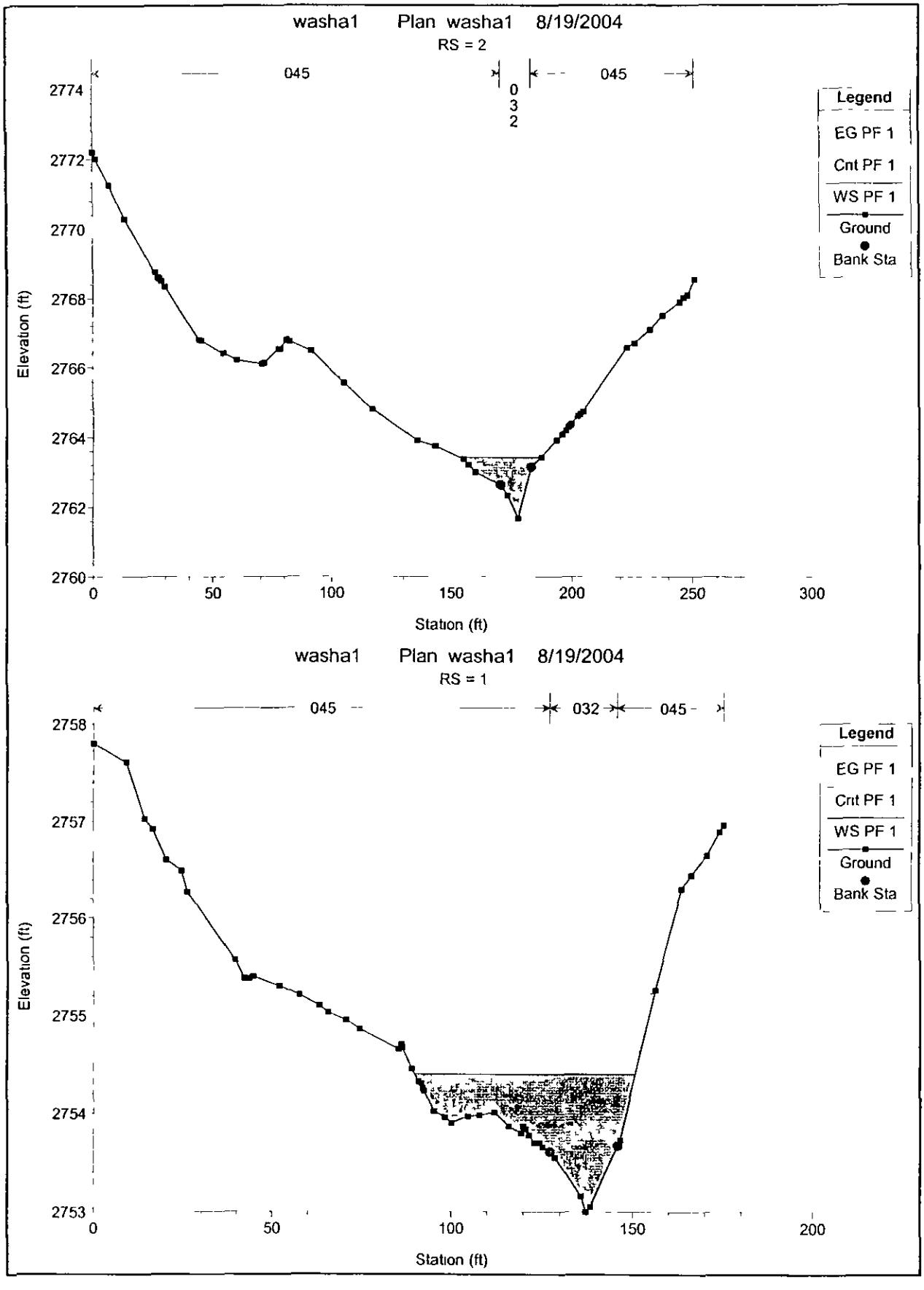
RS = 4
045
032
045
Legend
EG PF 1
Cnt PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washa1 Plan washa1 8/19/2004
RS = 3
045
032
045
Legend
EG PF 1
Cnt PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)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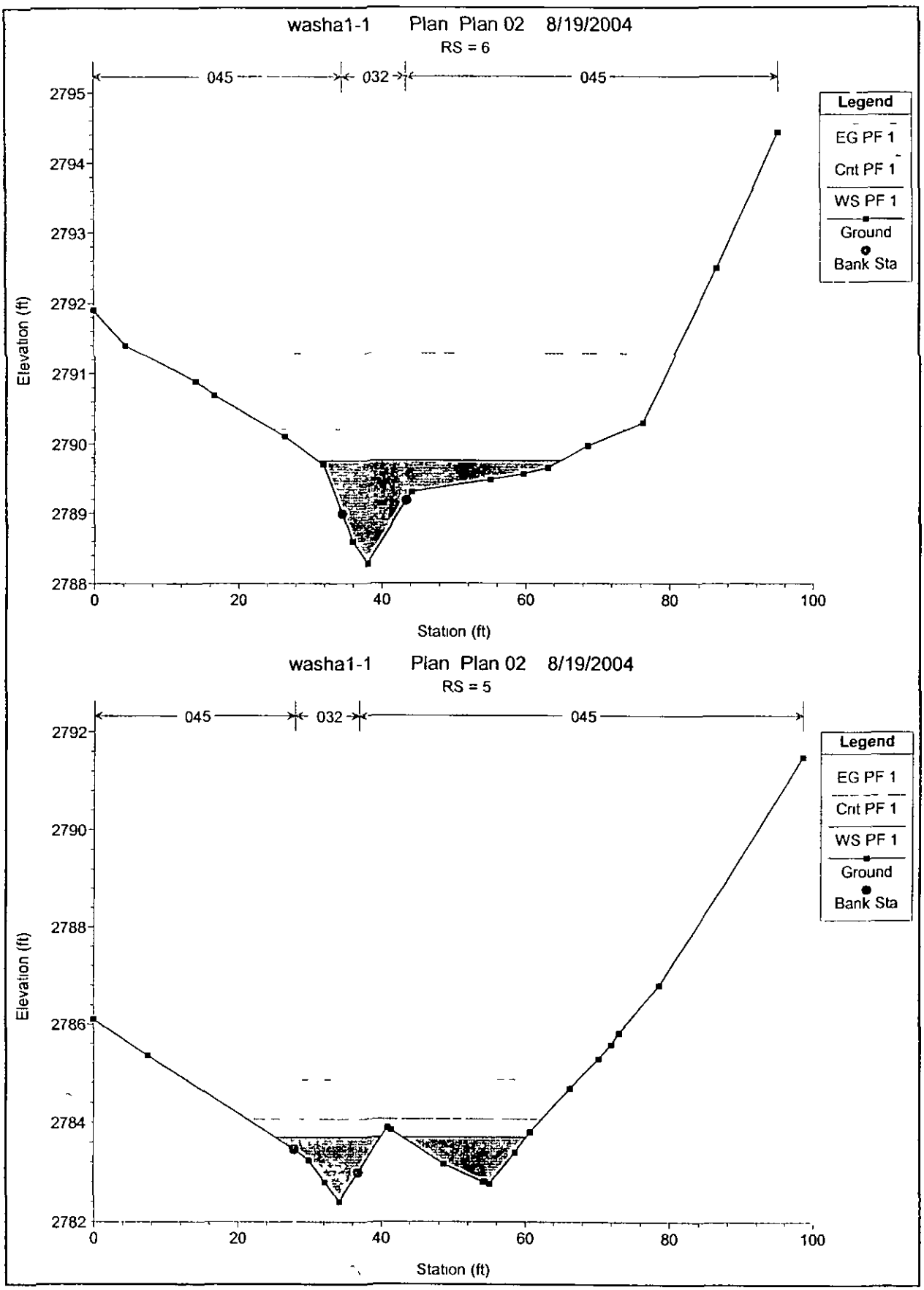
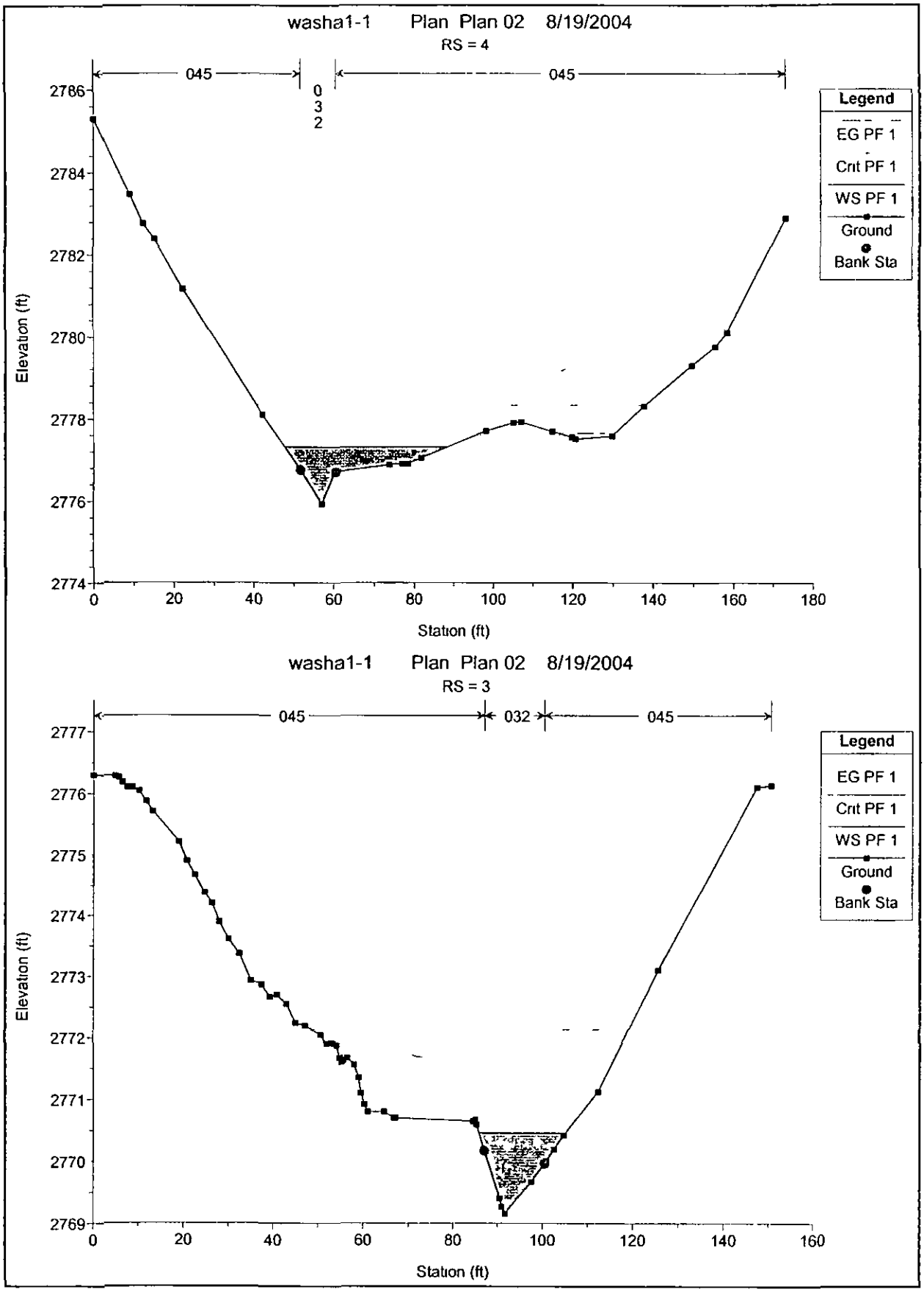
RS = 2
045
045
0
3
2
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2774
2772
2770
2768
2766
2764
2762
2760
0
50
100
150
200
250
300
Station (ft)
washa1 Plan washa1 8/19/2004
RS = 1
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2758
2757
2756
2755
2754
2753
0
50
100
150
200
Station (ft)

Wash A1-1

HEC-RAS Plan: Plan 02 River: RIVER 1 Reach: Reach 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W S Elev	Crit W S	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach 1	6	PF 1	128.00	2788.28	2789.75	2790.21	2791.28	0.050053	10.84	16.83	33.79	1.83
Reach 1	5	PF 1	128.00	2782.40	2783.71	2784.06	2784.85	0.068334	10.34	17.44	32.03	2.04
Reach 1	4	PF 1	128.00	2775.92	2777.31	2777.64	2778.33	0.045358	9.63	20.71	40.76	1.72
Reach 1	3	PF 1	128.00	2769.16	2770.46	2771.03	2772.13	0.062347	10.54	13.08	19.34	1.98
Reach 1	2	PF 1	229.00	2761.84	2763.68	2764.16	2765.02	0.036416	9.46	27.27	39.30	1.58
Reach 1	1	PF 1	229.00	2753.00	2754.30	2754.64	2755.46	0.045746	9.83	33.18	58.33	1.74


washa1-1 Plan Plan 02 8/19/2004
RS = 6
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2795
2794
2793
2792
2791
2790
2789
2788
0
20
40
60
80
100
Station (ft)
washa1-1 Plan Plan 02 8/19/2004
RS = 5
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2792
2790
2788
2786
2784
2782
0
20
40
60
80
100
Station (ft)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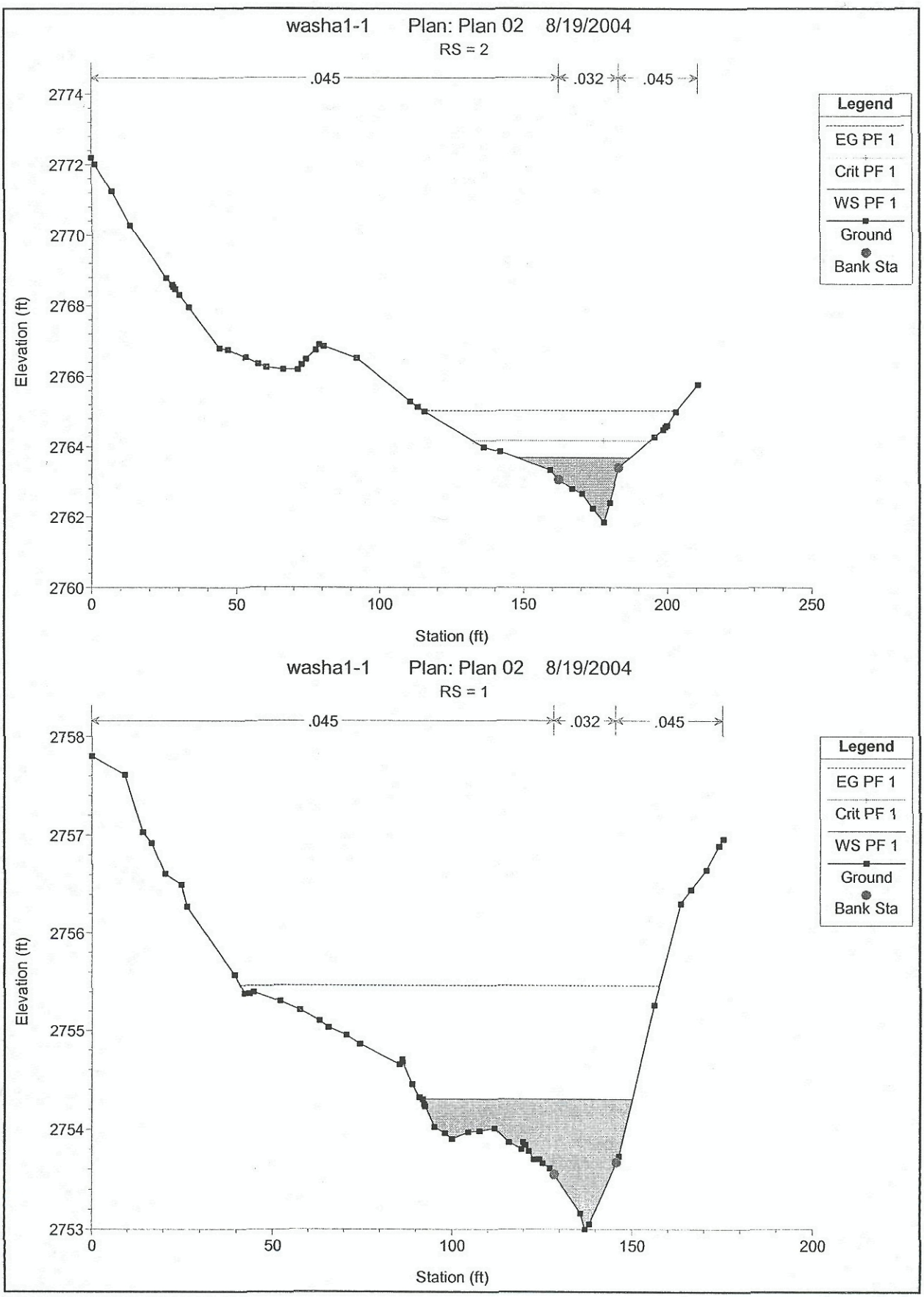
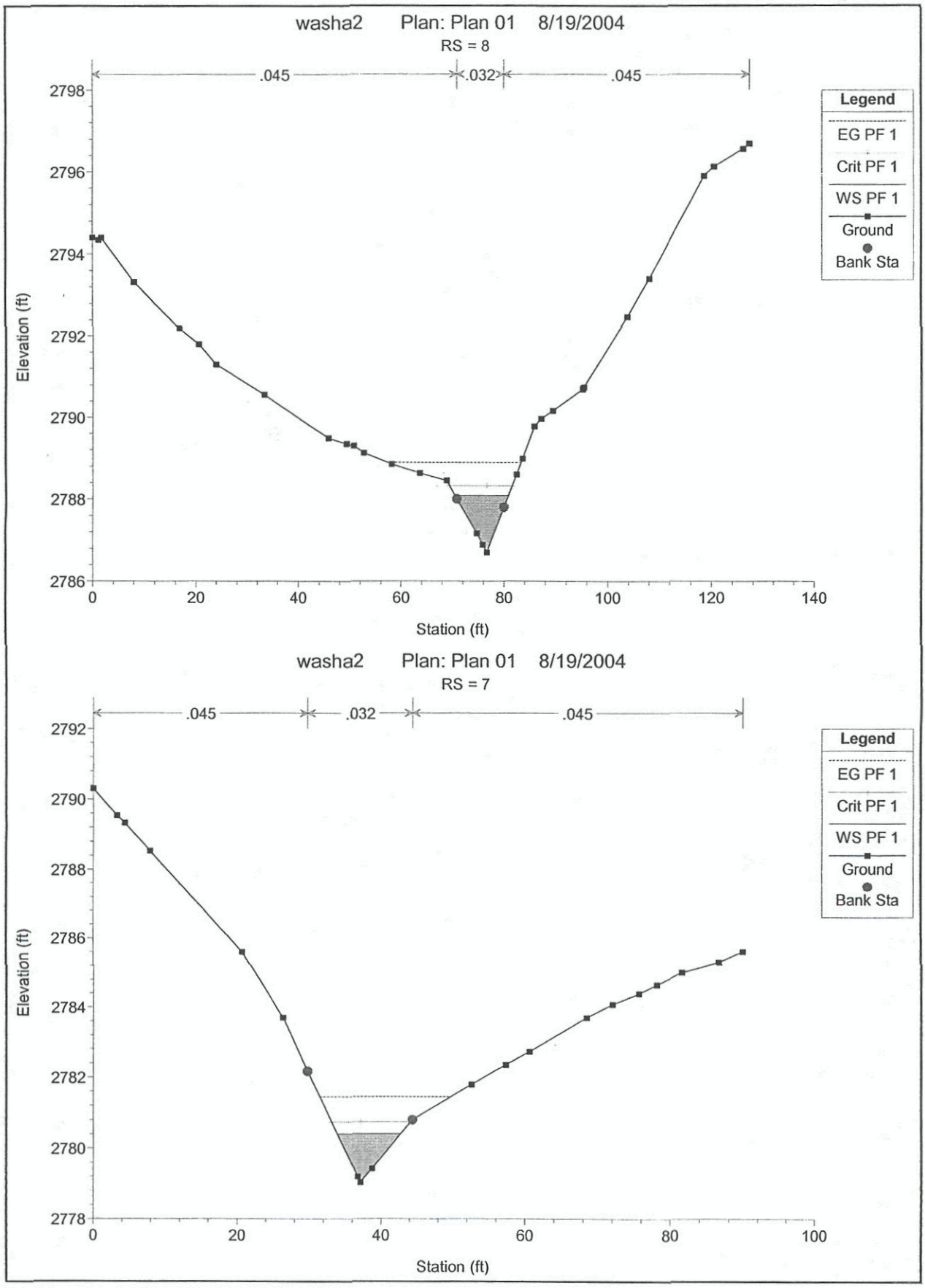
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washa1-1 Plan Plan 02 8/19/2004
RS = 3
045
032
045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

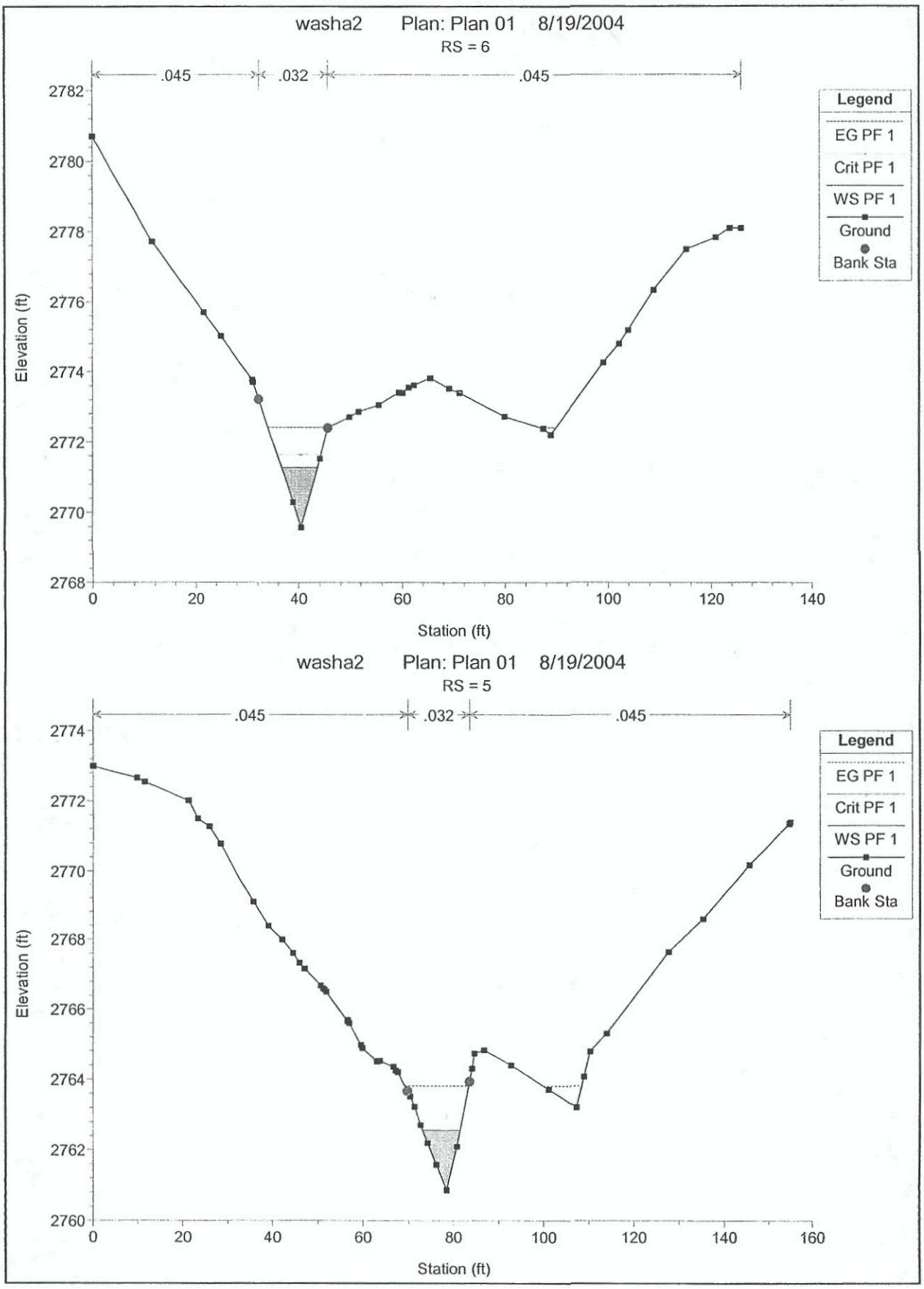

washa1-1 Plan: Plan 02 8/19/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2774
2772
2770
2768
2766
2764
2762
2760
0
50
100
150
200
250
Station (ft)
washa1-1 Plan: Plan 02 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2758
2757
2756
2755
2754
2753
0
50
100
150
200
Station (ft)

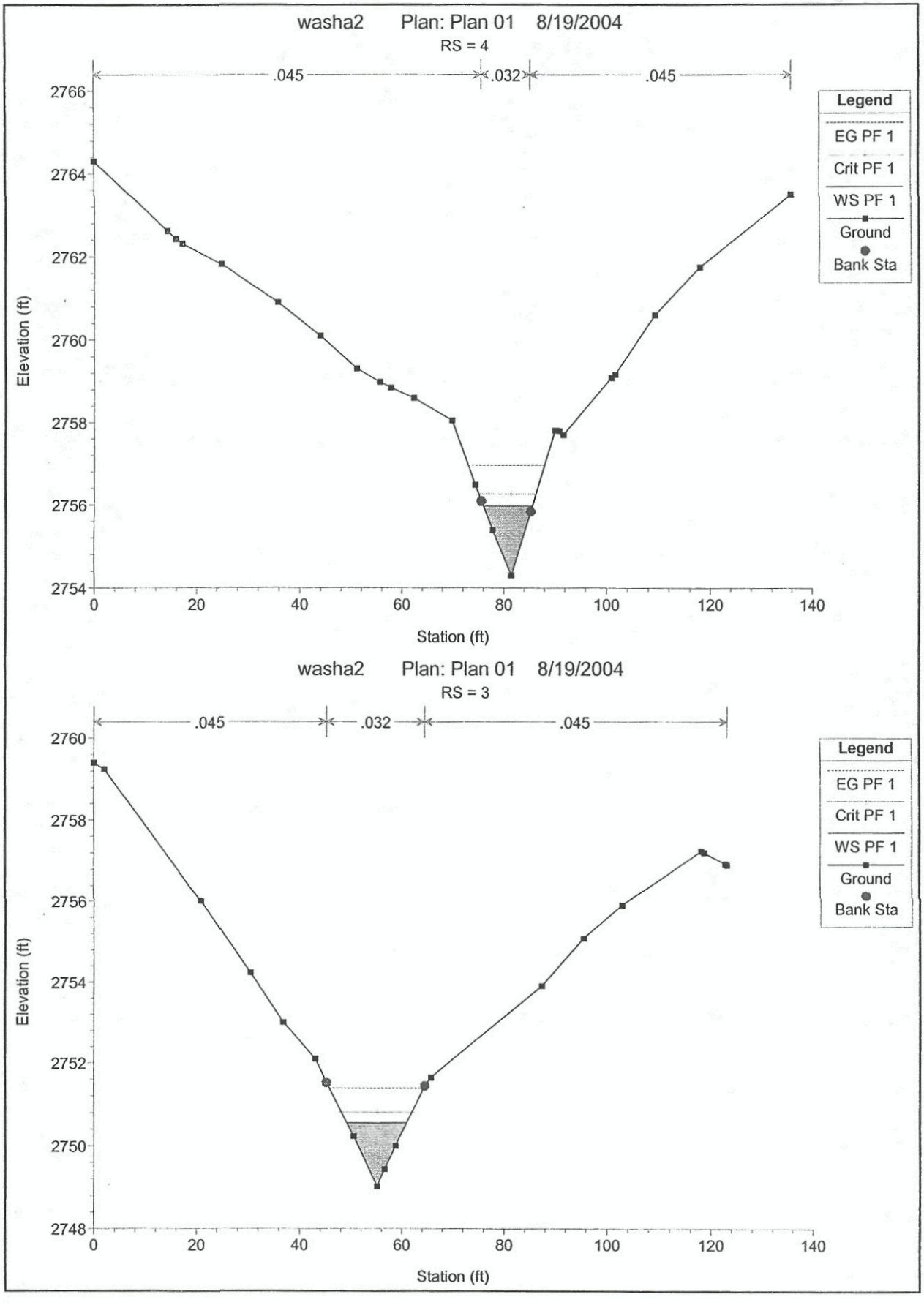
Wash A2

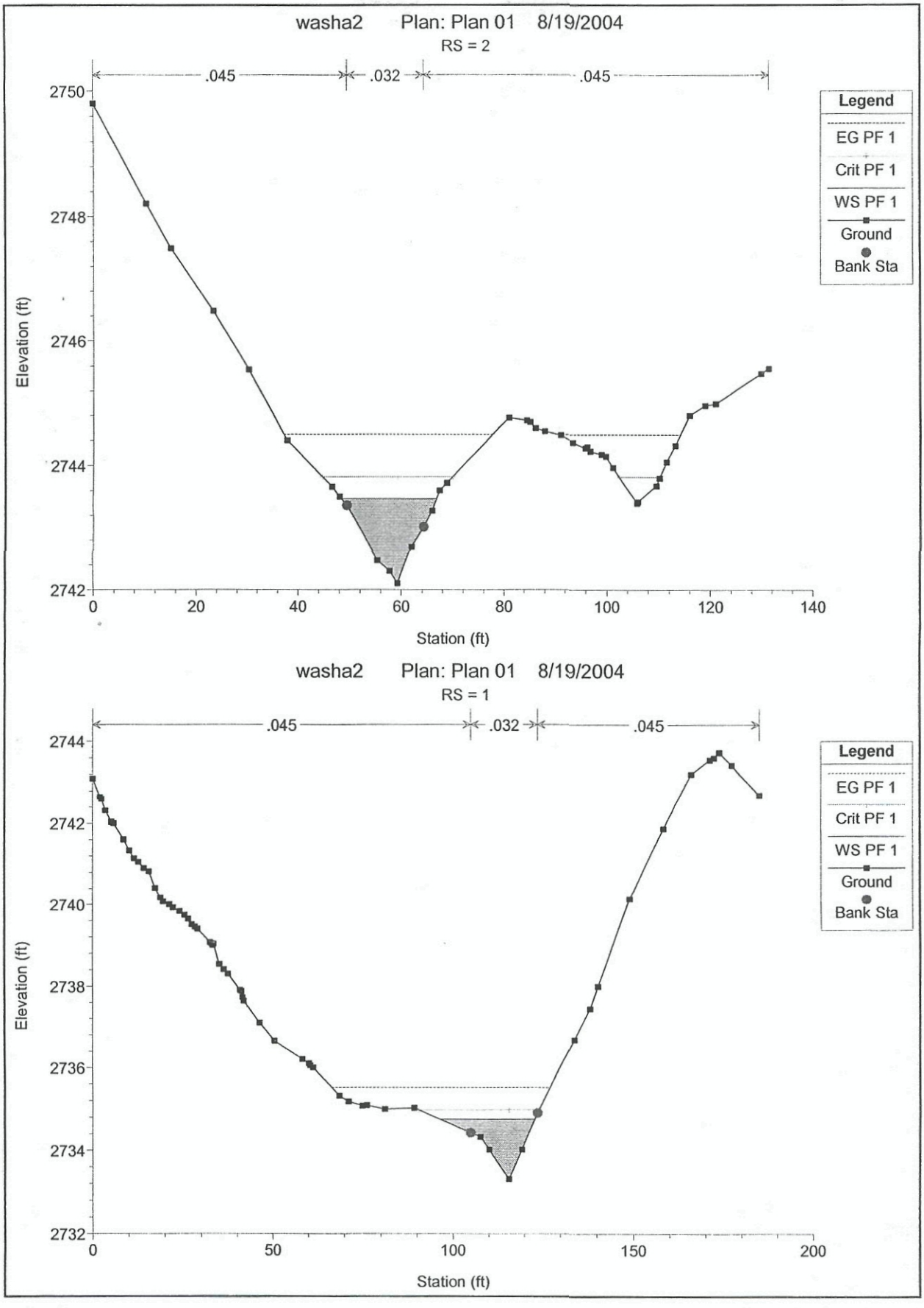
HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	8	PF 1	50.00	2786.70	2788.08	2788.32	2788.89	0.037052	7.25	7.00	10.29	1.47
Reach-1	7	PF 1	50.00	2779.03	2780.41	2780.74	2781.45	0.054930	8.20	6.09	8.86	1.74
Reach-1	6	PF 1	50.00	2769.58	2771.28	2771.64	2772.41	0.049137	8.55	5.85	6.93	1.64
Reach-1	5	PF 1	65.00	2760.85	2762.56	2762.96	2763.82	0.050493	9.00	7.22	8.30	1.70
Reach-1	4	PF 1	65.00	2754.30	2755.98	2756.26	2756.97	0.038091	7.97	8.17	9.67	1.50
Reach-1	3	PF 1	65.00	2749.02	2750.55	2750.80	2751.38	0.037807	7.31	8.89	11.81	1.48
Reach-1	2	PF 1	100.00	2742.10	2743.46	2743.82	2744.50	0.042671	8.24	12.63	19.53	1.62
Reach-1	1	PF 1	100.00	2733.30	2734.75	2734.98	2735.51	0.033817	7.10	15.08	26.24	1.43


washa2 Plan: Plan 01 8/19/2004
RS = 8
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washa2 Plan: Plan 01 8/19/2004
RS = 7
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washa2 Plan: Plan 01 8/19/2004
RS = 6
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washa2 Plan: Plan 01 8/19/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

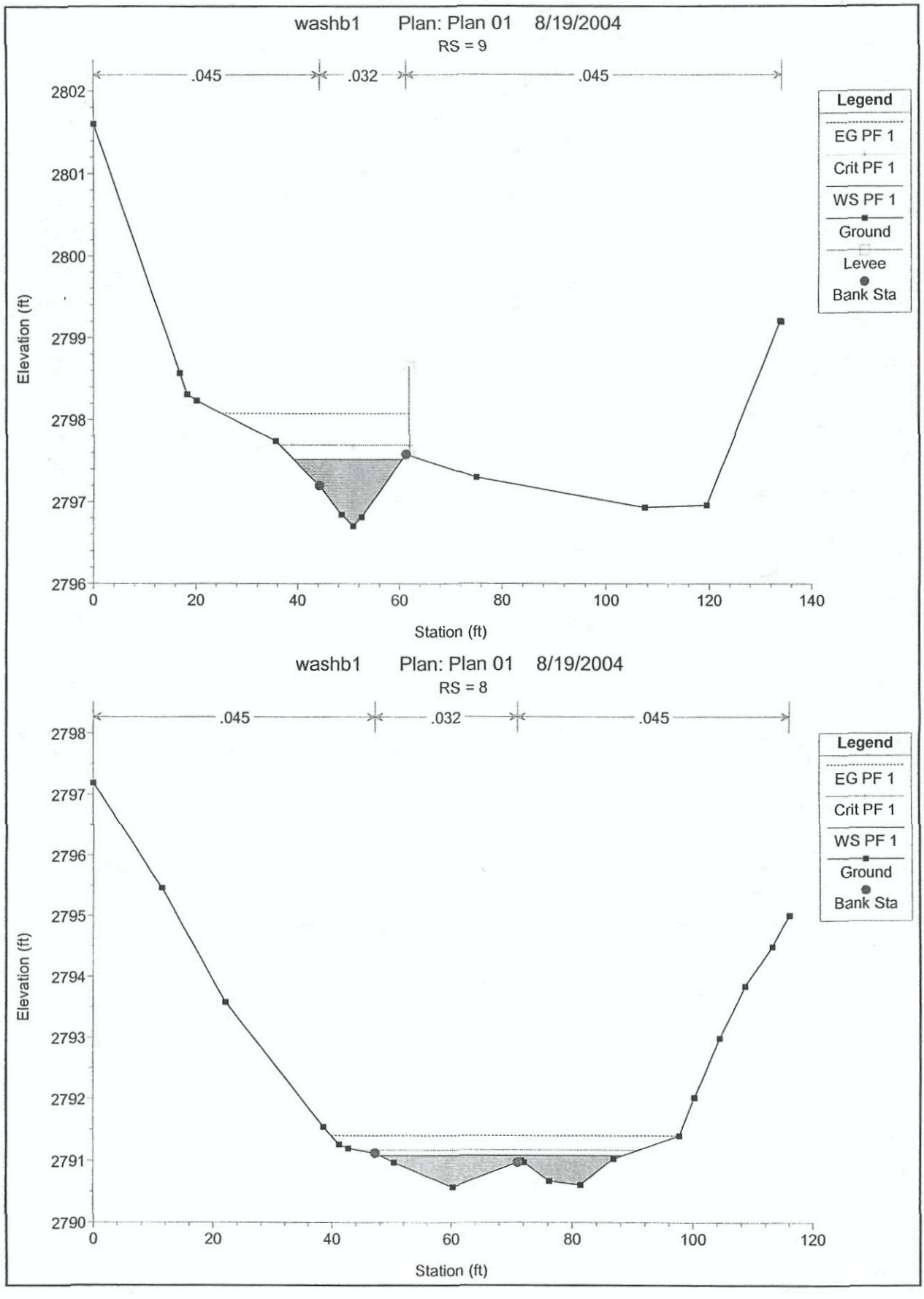

washa2 Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
2766
2764
2762
2760
2758
2756
2754
Elevation (ft)
0
20
40
60
80
100
120
140
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
washa2 Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
2760
2758
2756
2754
2752
2750
2748
Elevation (ft)
0
20
40
60
80
100
120
140
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

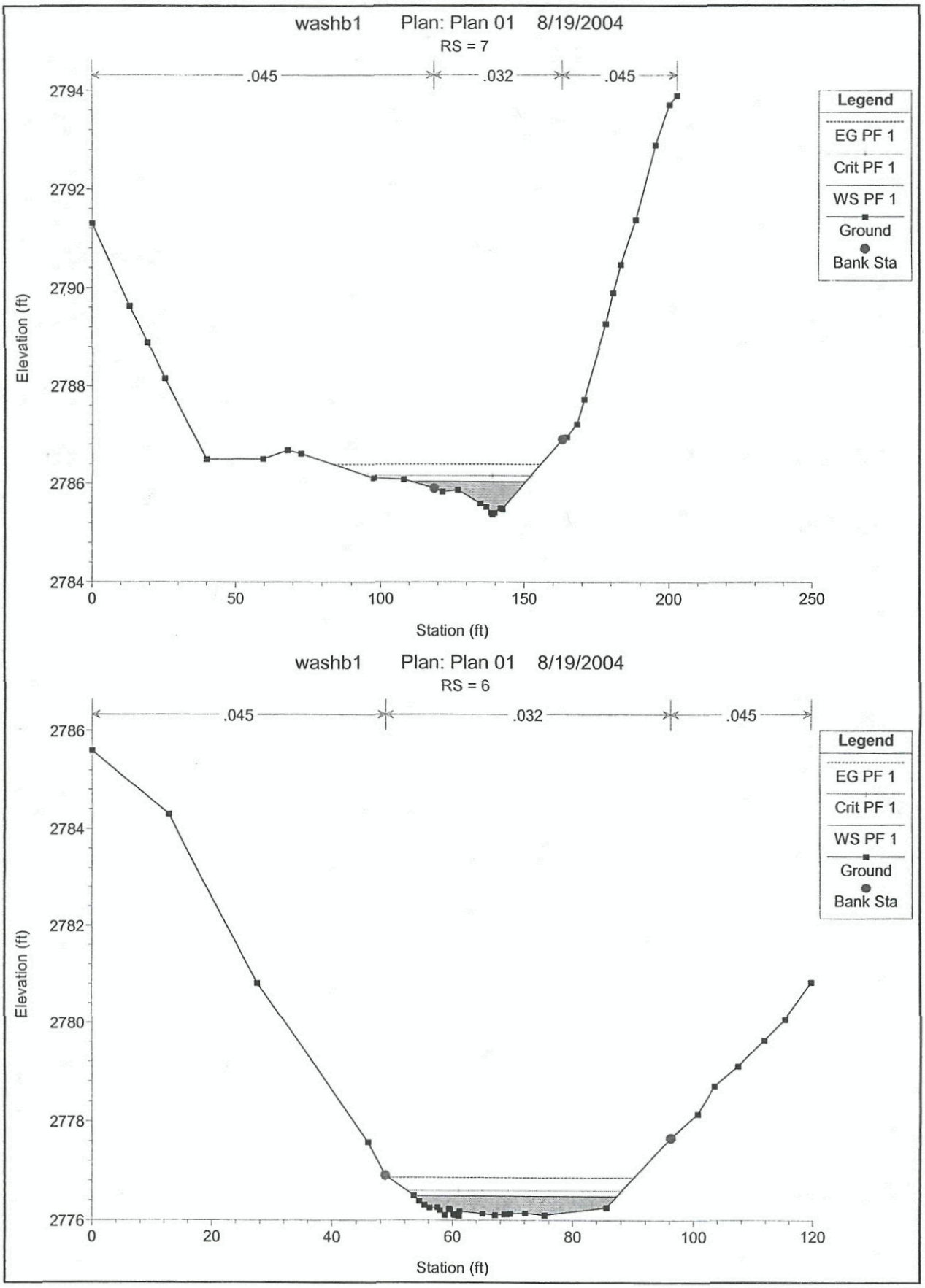

washa2 Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
2750
2748
2746
2744
2742
Elevation (ft)
0
20
40
60
80
100
120
140
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
washa2 Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
2744
2742
2740
2738
2736
2734
2732
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

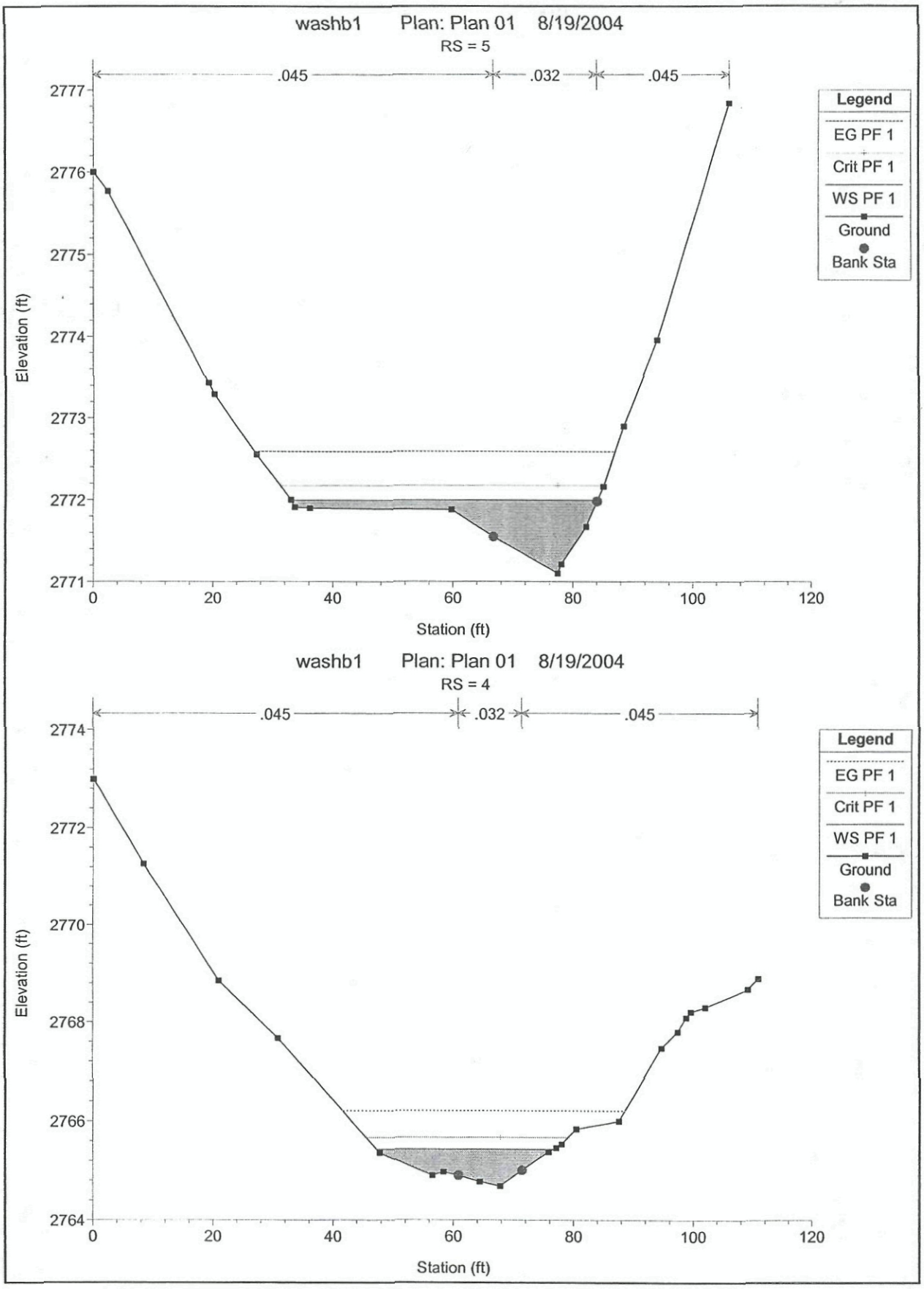
Wash B1

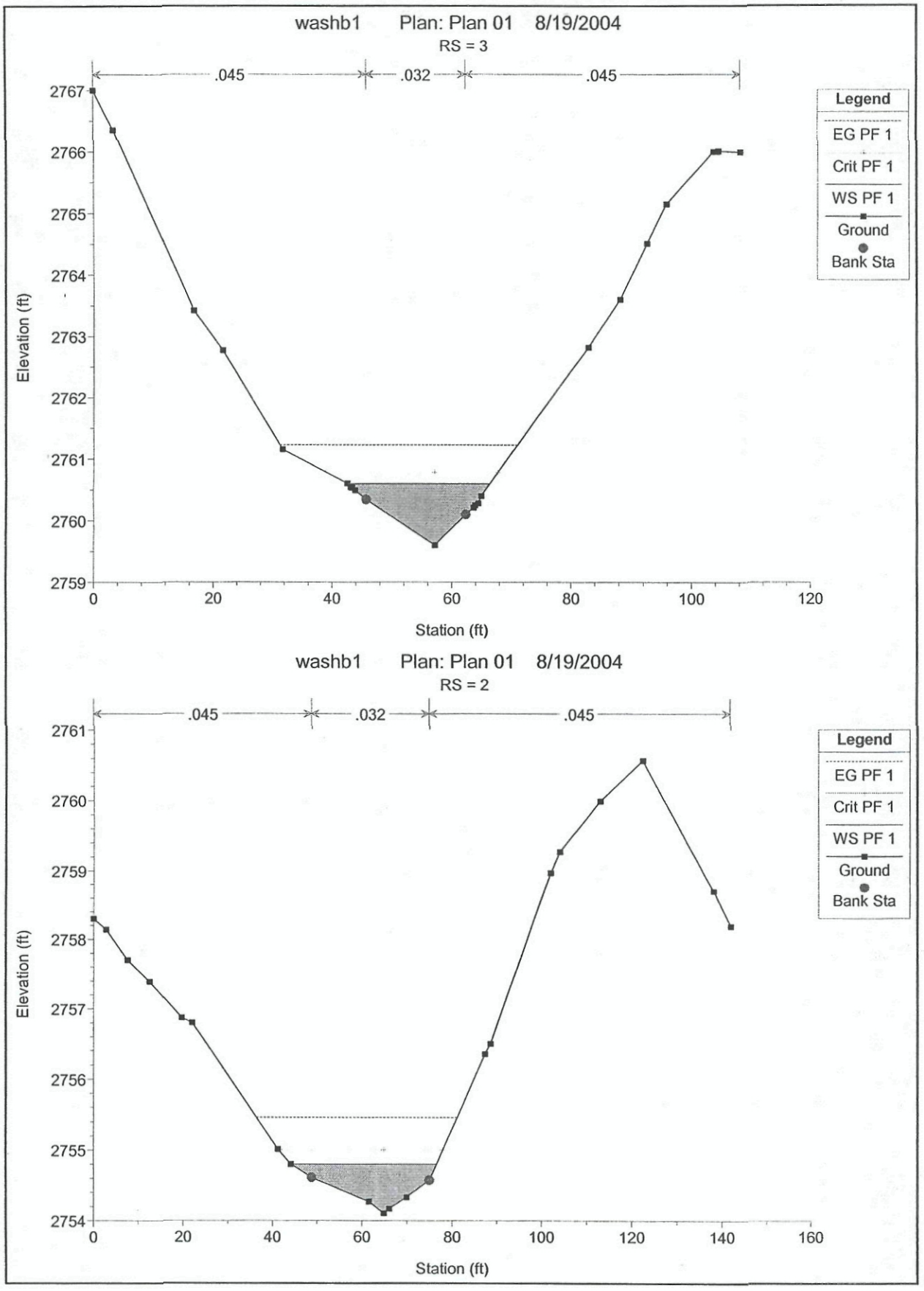
HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

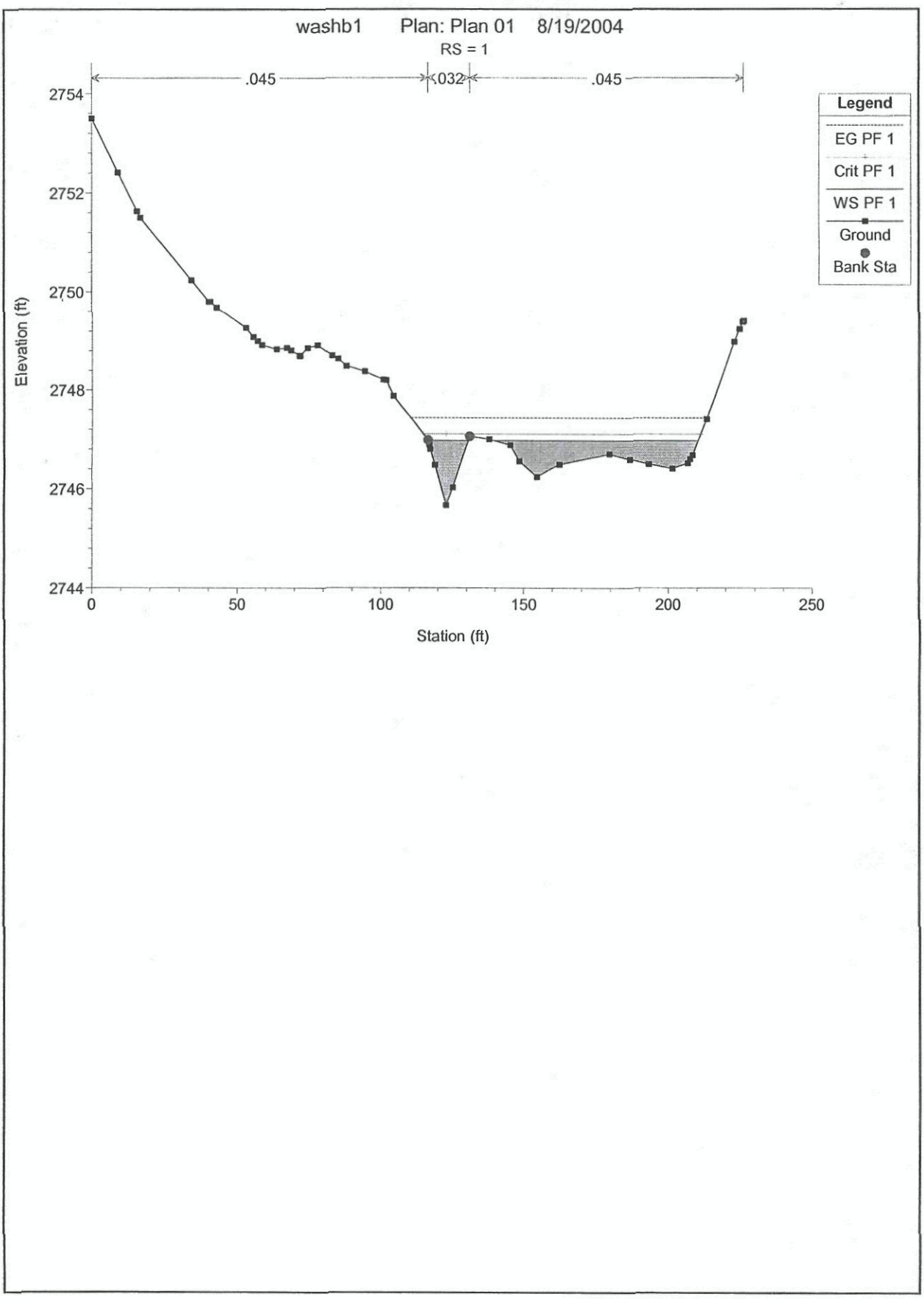
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	9	PF 1	50.00	2796.70	2797.52	2797.69	2798.08	0.045030	6.09	8.74	21.32	1.54
Reach-1	8	PF 1	50.00	2790.57	2791.08	2791.17	2791.40	0.059767	4.94	11.57	40.41	1.62
Reach-1	7	PF 1	50.00	2785.37	2786.03	2786.15	2786.38	0.048169	4.80	10.80	39.56	1.49
Reach-1	6	PF 1	50.00	2776.08	2776.49	2776.59	2776.86	0.053930	4.87	10.26	33.67	1.56
Reach-1	5	PF 1	75.00	2771.10	2771.99	2772.17	2772.59	0.039898	6.52	14.82	50.97	1.49
Reach-1	4	PF 1	75.00	2764.68	2765.43	2765.67	2766.21	0.055256	8.02	12.56	29.42	1.78
Reach-1	3	PF 1	75.00	2759.60	2760.60	2760.78	2761.23	0.034124	6.50	12.51	23.71	1.41
Reach-1	2	PF 1	75.00	2754.10	2754.80	2755.00	2755.46	0.061819	6.57	11.87	32.36	1.77
Reach-1	1	PF 1	177.00	2745.67	2746.97	2747.10	2747.43	0.044024	7.31	38.06	84.85	1.58


washb1 Plan: Plan 01 8/19/2004
RS = 9
.045
.032
.045
2802
2801
2800
2799
2798
2797
2796
Elevation (ft)
0
20
40
60
80
100
120
140
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Levee
Bank Sta
washb1 Plan: Plan 01 8/19/2004
RS = 8
.045
.032
.045
2798
2797
2796
2795
2794
2793
2792
2791
2790
Elevation (ft)
0
20
40
60
80
100
120
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta


washb1 Plan: Plan 01 8/19/2004
RS = 7
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2794
2792
2790
2788
2786
2784
0
50
100
150
200
250
Station (ft)
washb1 Plan: Plan 01 8/19/2004
RS = 6
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2786
2784
2782
2780
2778
2776
0
20
40
60
80
100
120
Station (ft)


washb1 Plan: Plan 01 8/19/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2777
2776
2775
2774
2773
2772
2771
0
20
40
60
80
100
120
Station (ft)
washb1 Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2774
2772
2770
2768
2766
2764
0
20
40
60
80
100
120
Station (ft)

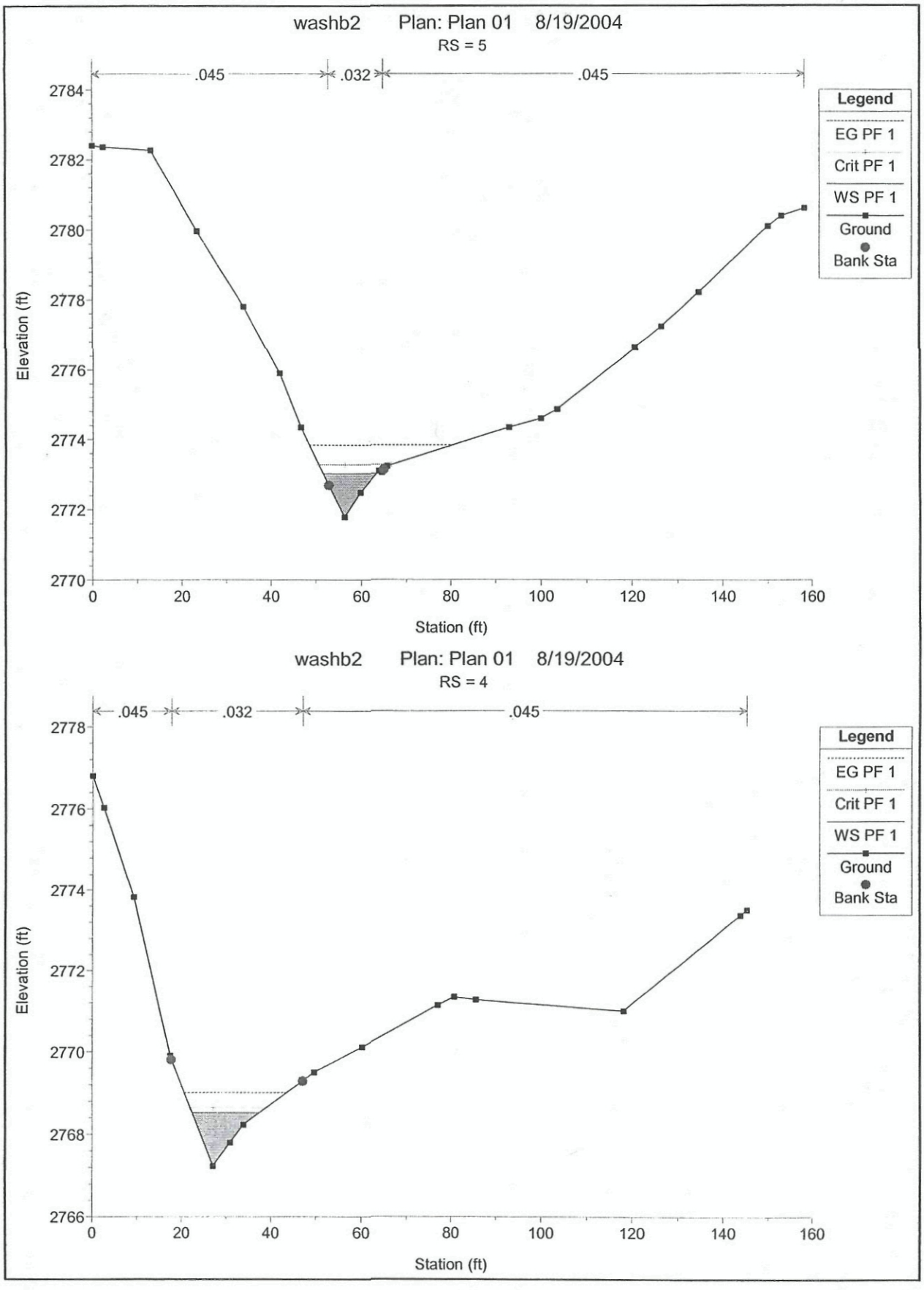

washb1 Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washb1 Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

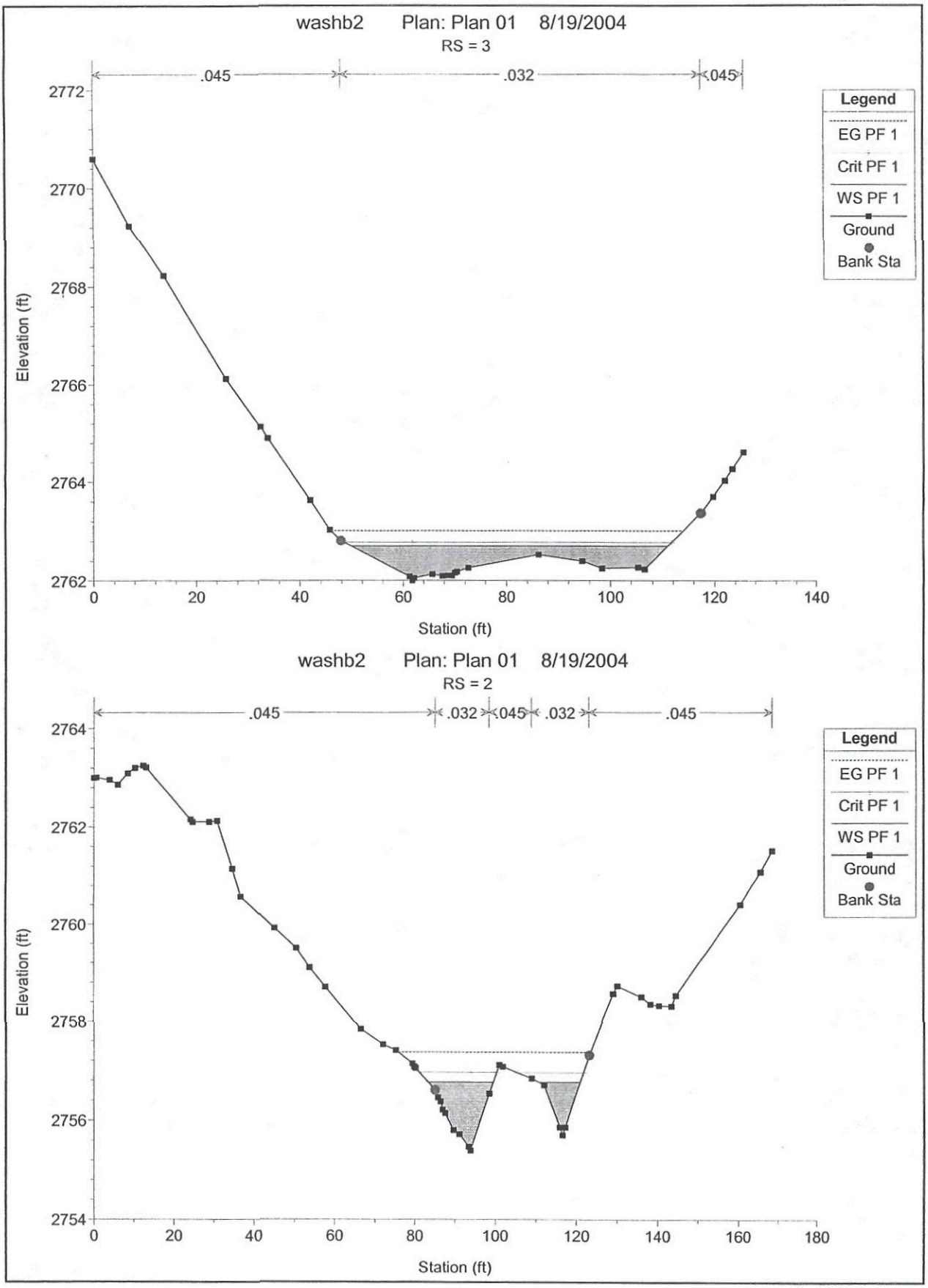

washb1 Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2754
2752
2750
2748
2746
2744
0
50
100
150
200
250
Station (ft)

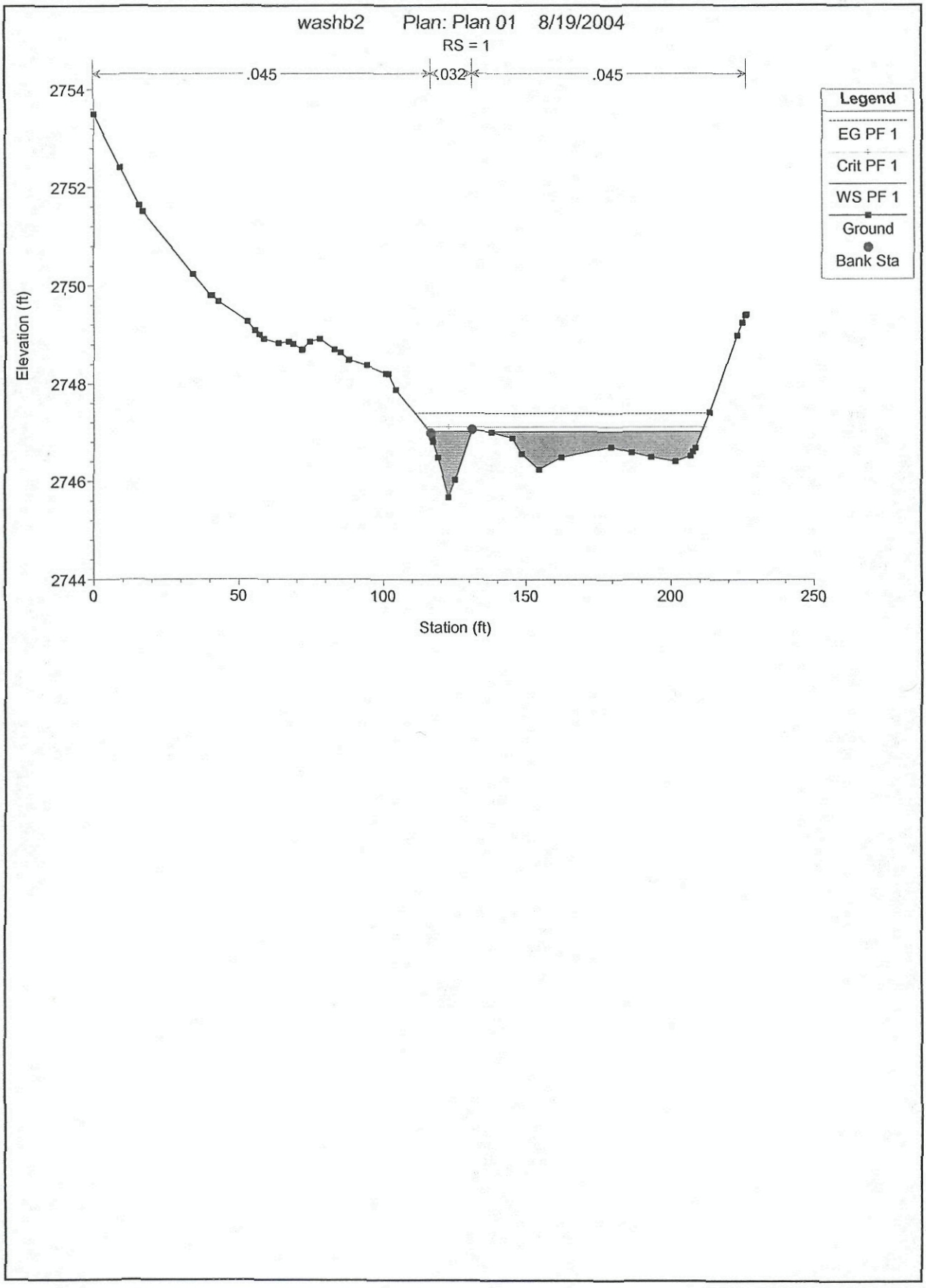
Wash B2

HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5	PF 1	50.00	2771.78	2773.02	2773.28	2773.84	0.045021	7.27	7.03	11.78	1.59
Reach-1	4	PF 1	50.00	2767.23	2768.51	2768.64	2769.01	0.030968	5.67	8.82	15.02	1.30
Reach-1	3	PF 1	100.00	2762.00	2762.70	2762.78	2763.01	0.035521	4.47	22.35	61.10	1.30
Reach-1	2	PF 1	100.00	2755.39	2756.75	2756.95	2757.36	0.029636	6.24	16.13	26.25	1.36
Reach-1	1	PF 1	177.00	2745.67	2747.01	2747.11	2747.39	0.035101	6.71	41.55	88.99	1.42


washb2 Plan: Plan 01 8/19/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washb2 Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

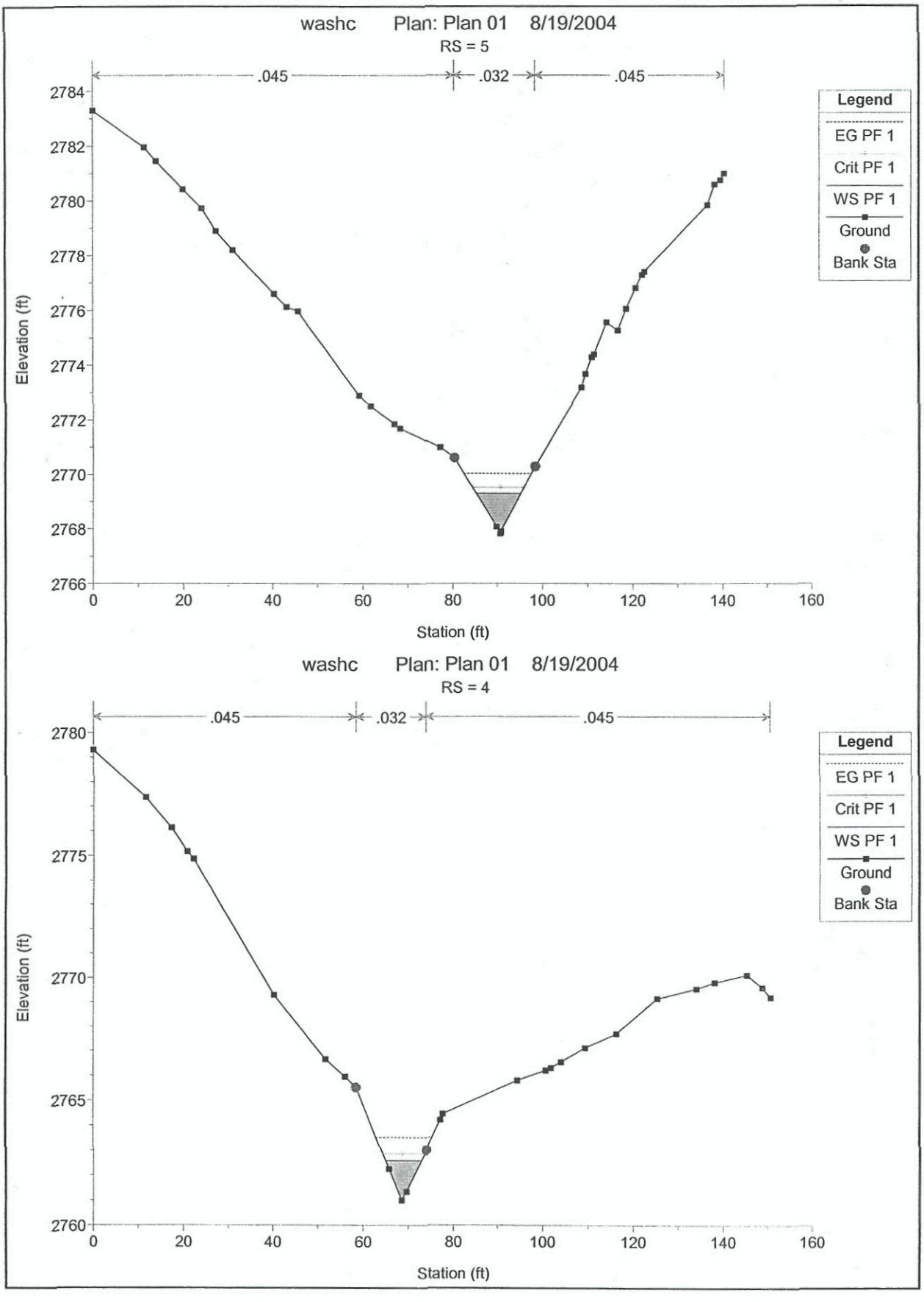

washb2 Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washb2 Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

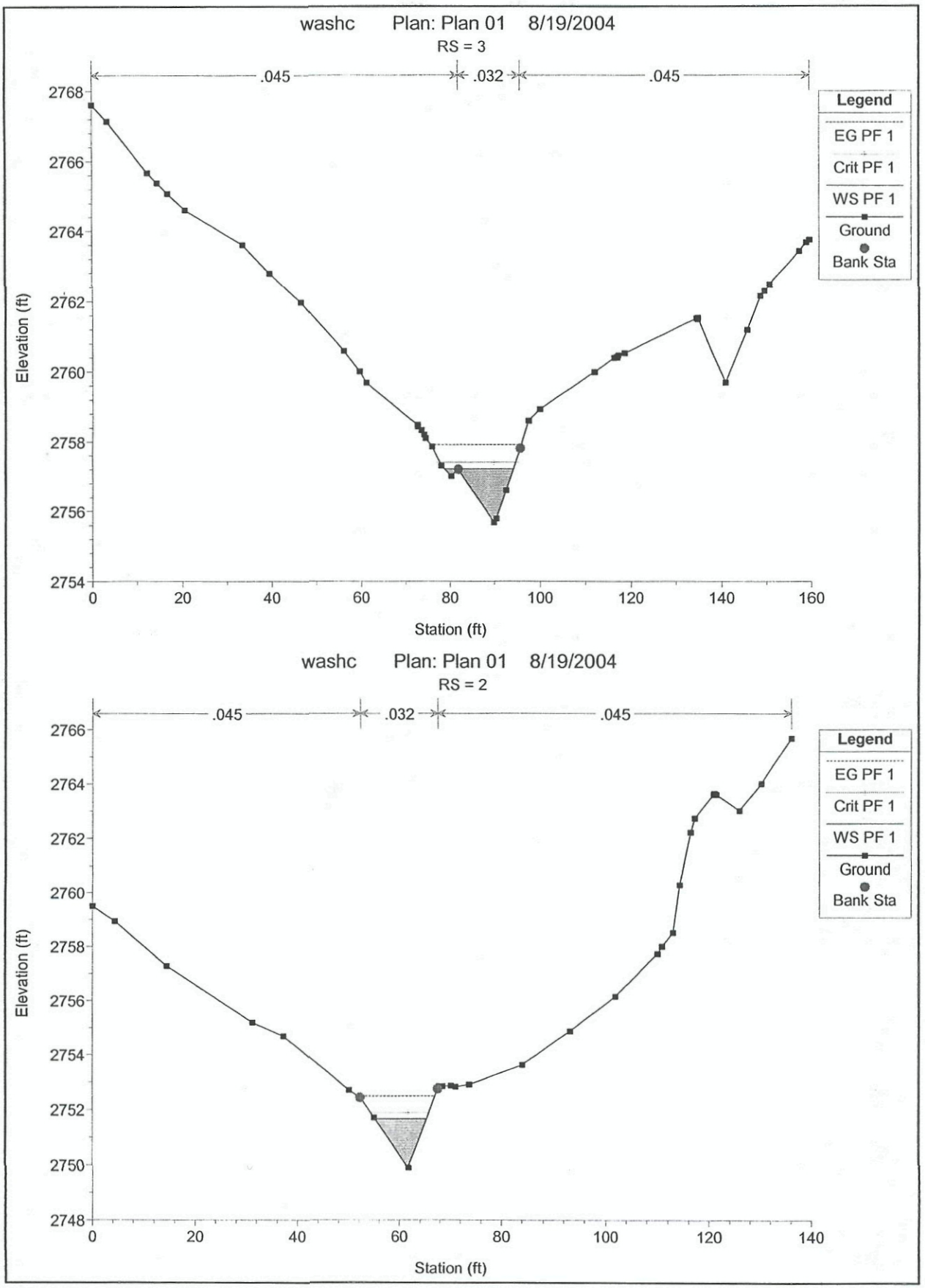

washb2 Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2754
2752
2750
2748
2746
2744
0
50
100
150
200
250
Station (ft)

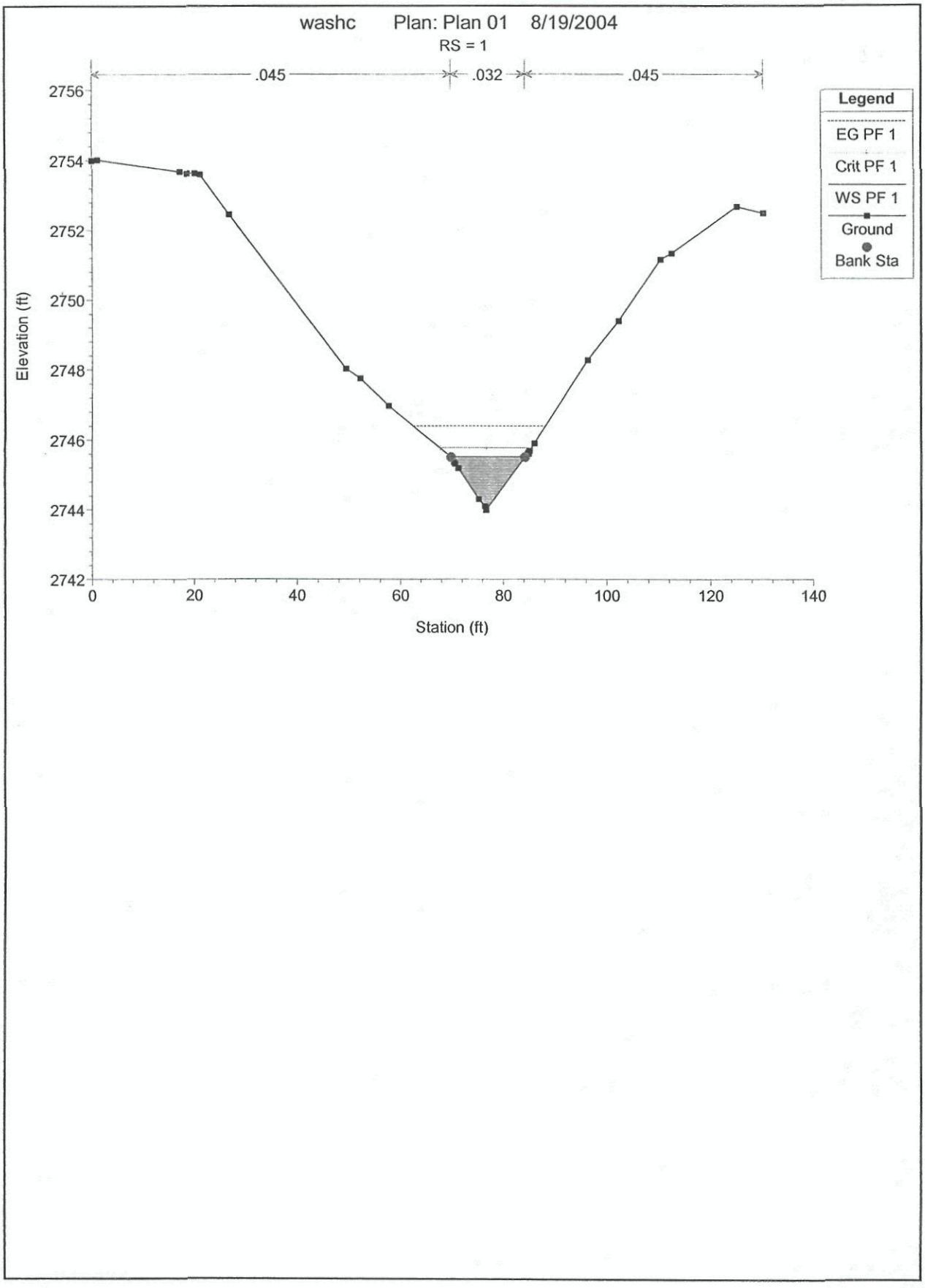
Wash C

HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5	PF 1	50.00	2767.82	2769.29	2769.50	2770.03	0.036028	6.90	7.25	10.04	1.43
Reach-1	4	PF 1	50.00	2761.00	2762.59	2762.87	2763.50	0.039393	7.65	6.54	8.03	1.49
Reach-1	3	PF 1	65.00	2755.68	2757.22	2757.41	2757.91	0.029952	6.70	9.98	15.38	1.33
Reach-1	2	PF 1	65.00	2749.90	2751.66	2751.89	2752.48	0.031341	7.25	8.96	10.17	1.36
Reach-1	1	PF 1	83.00	2743.99	2745.52	2745.77	2746.39	0.038330	7.52	11.03	14.53	1.51


washc Plan: Plan 01 8/19/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washc Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

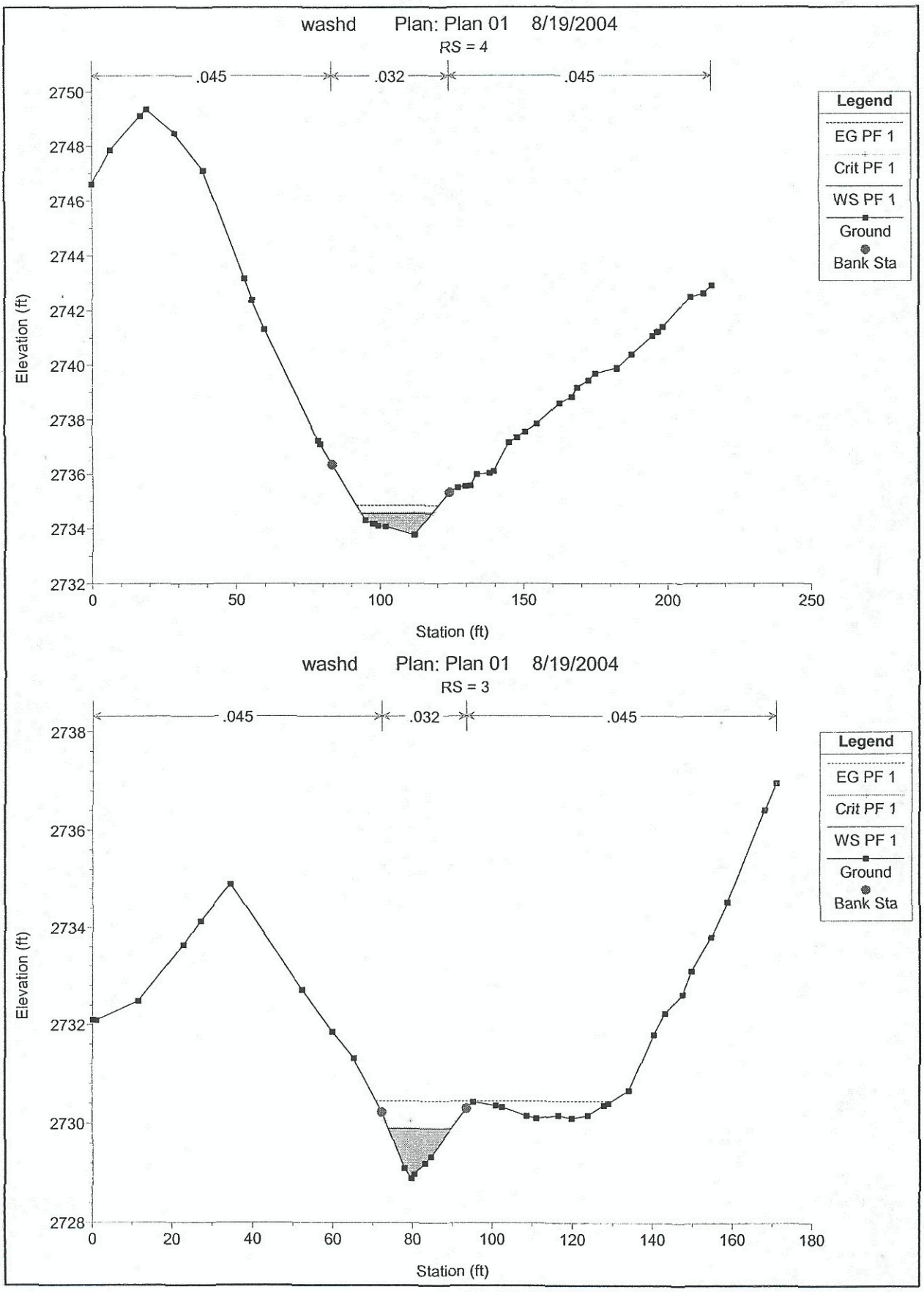

washc Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washc Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

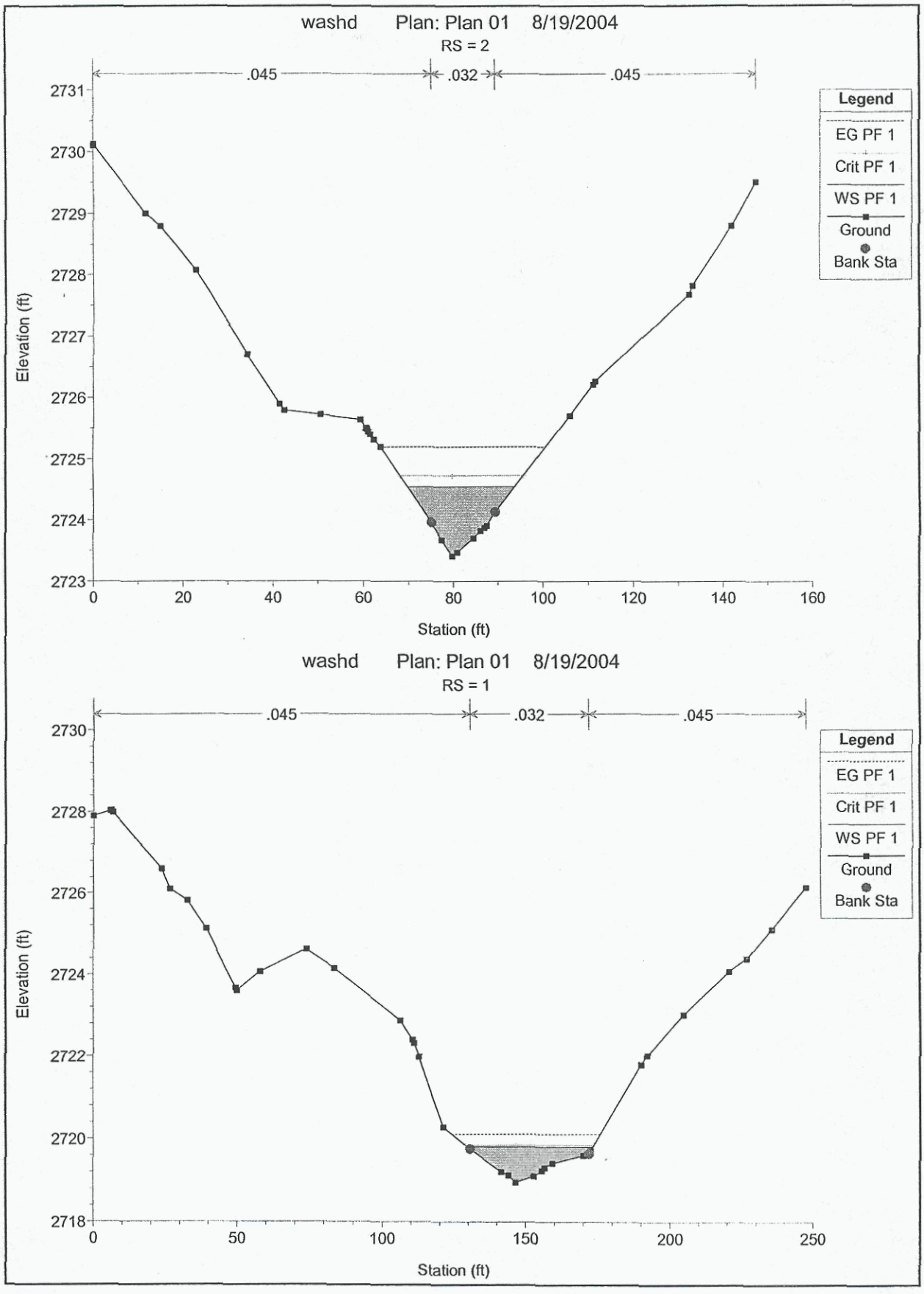

washc Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2756
2754
2752
2750
2748
2746
2744
2742
0
20
40
60
80
100
120
140
Station (ft)

Wash D

HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4	PF 1	50.00	2733.77	2734.54	2734.58	2734.84	0.025006	4.39	11.38	24.53	1.14
Reach-1	3	PF 1	50.00	2728.90	2729.90	2730.05	2730.45	0.038474	5.94	8.42	15.86	1.44
Reach-1	2	PF 1	85.00	2723.41	2724.54	2724.73	2725.20	0.026452	6.69	14.36	23.90	1.29
Reach-1	1	PF 1	85.00	2718.95	2719.80	2719.85	2720.11	0.025808	4.45	19.20	43.50	1.15

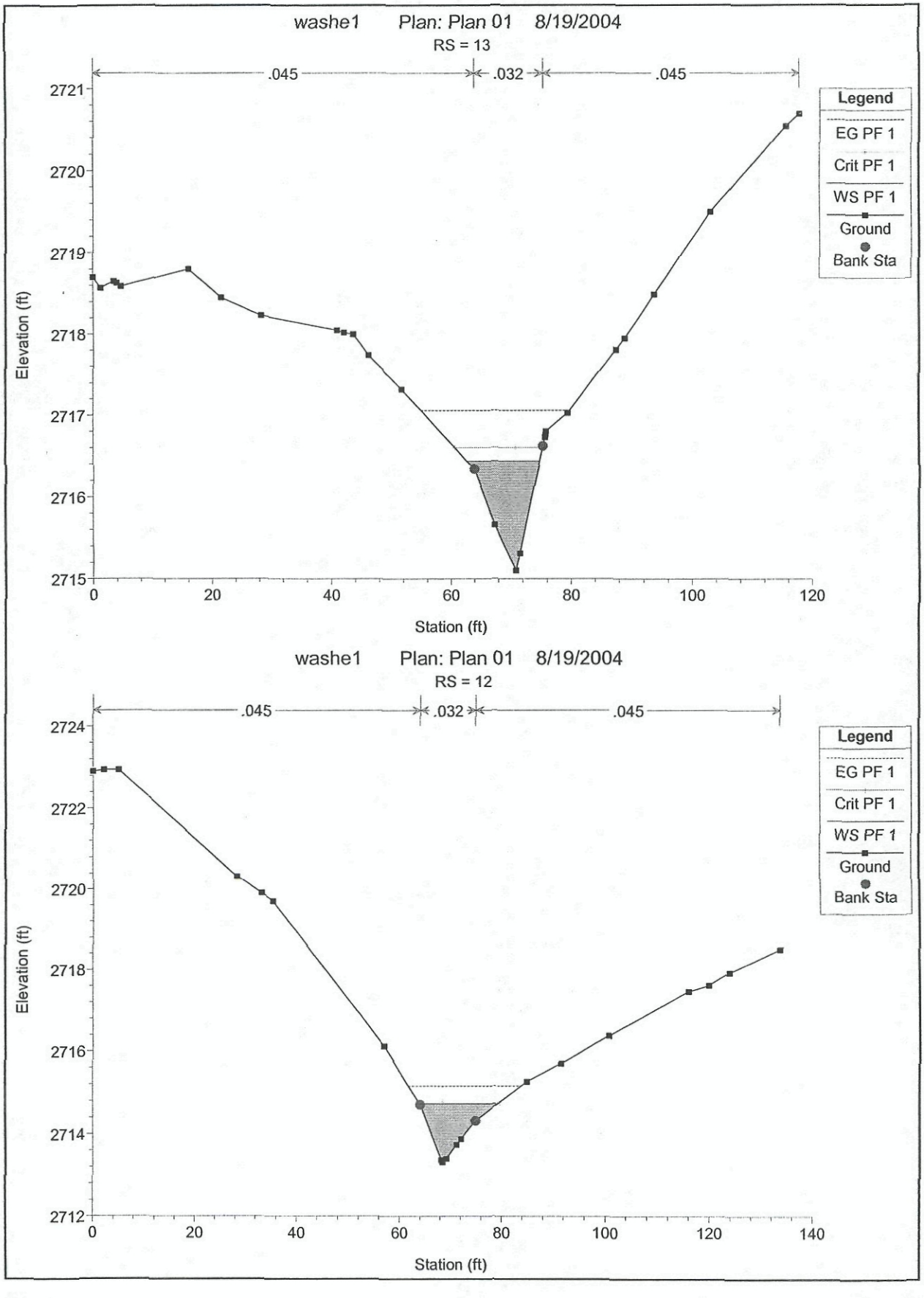

washd Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washd Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

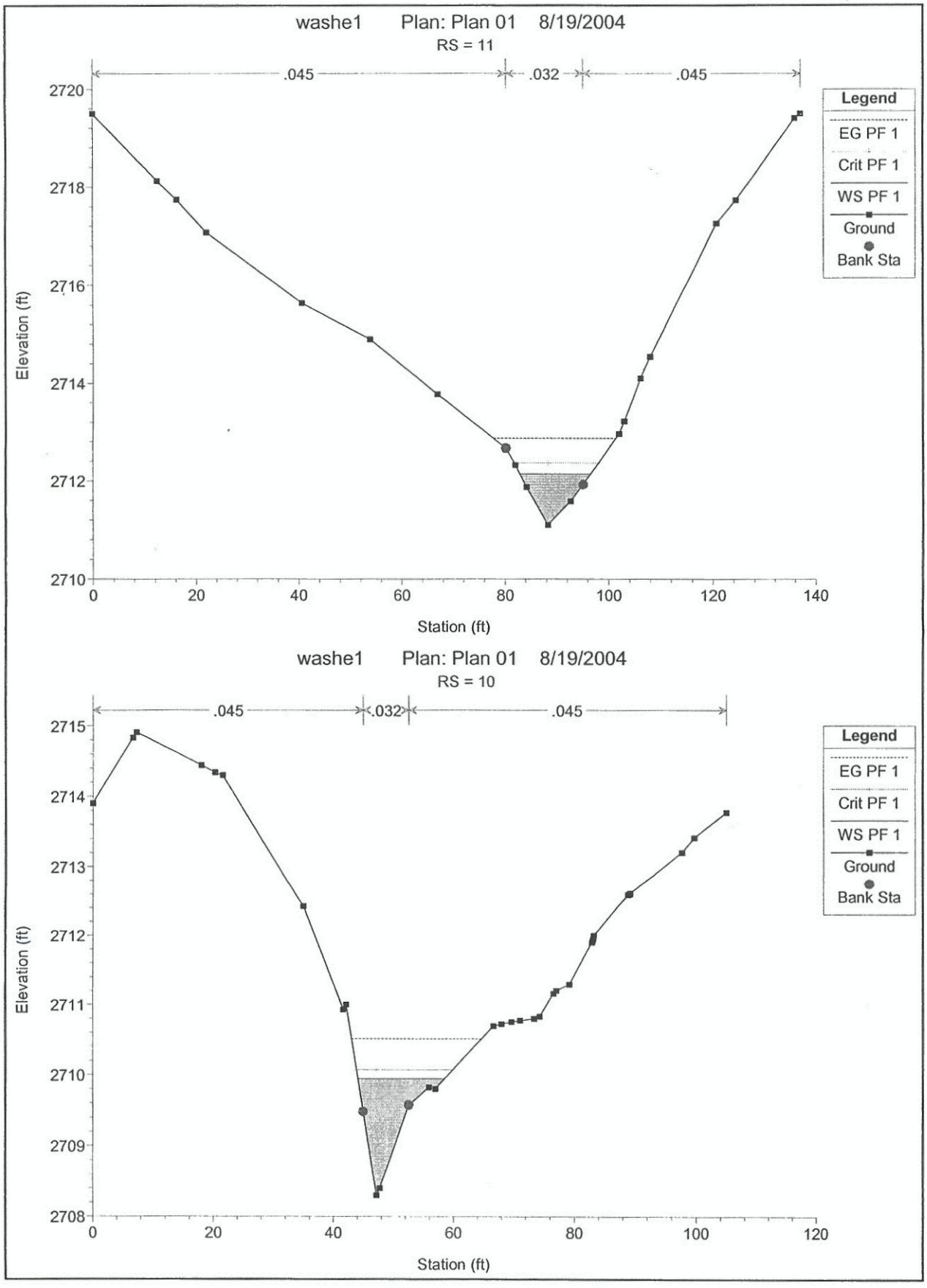

washd Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washd Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

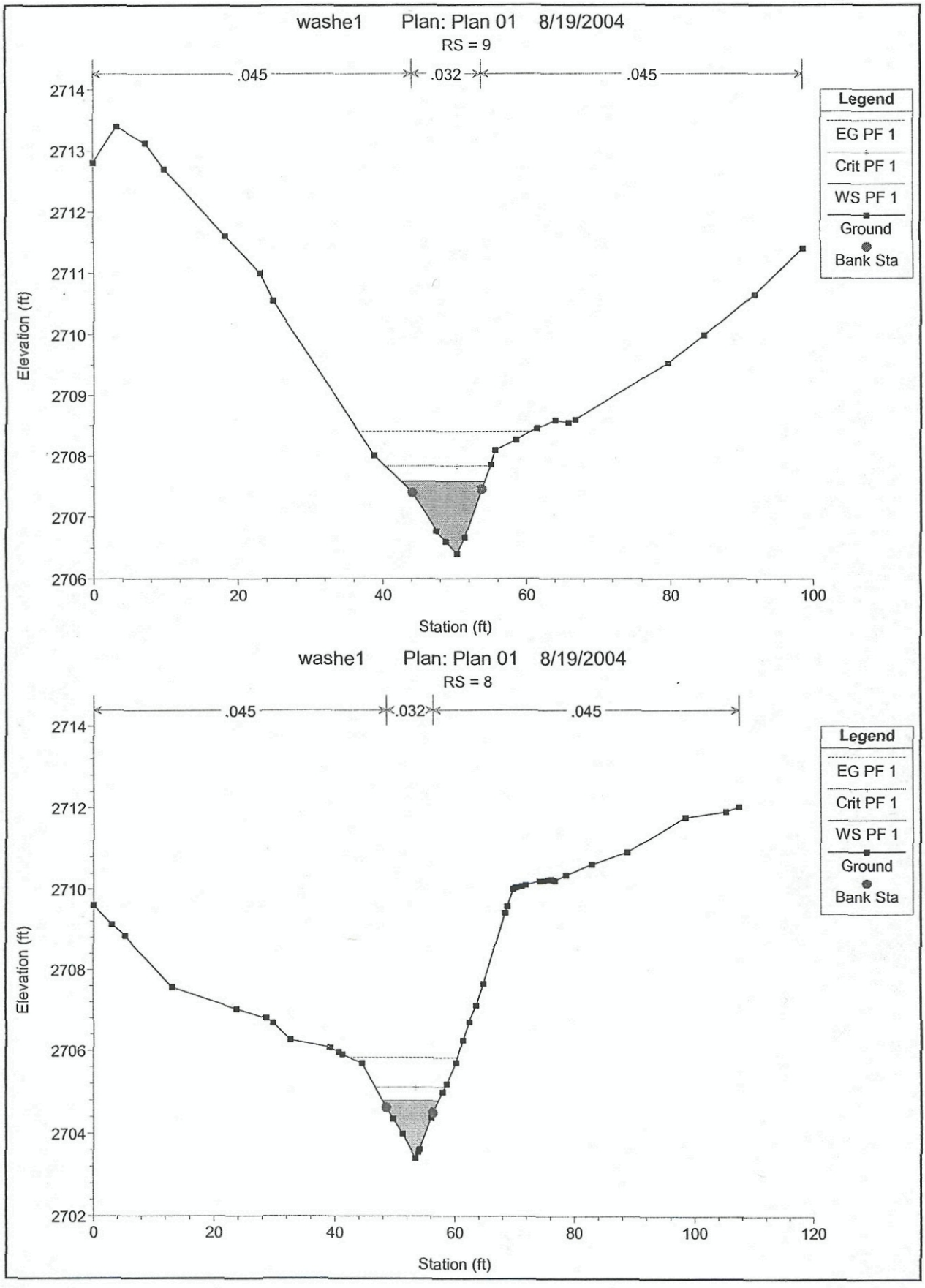
Wash E1

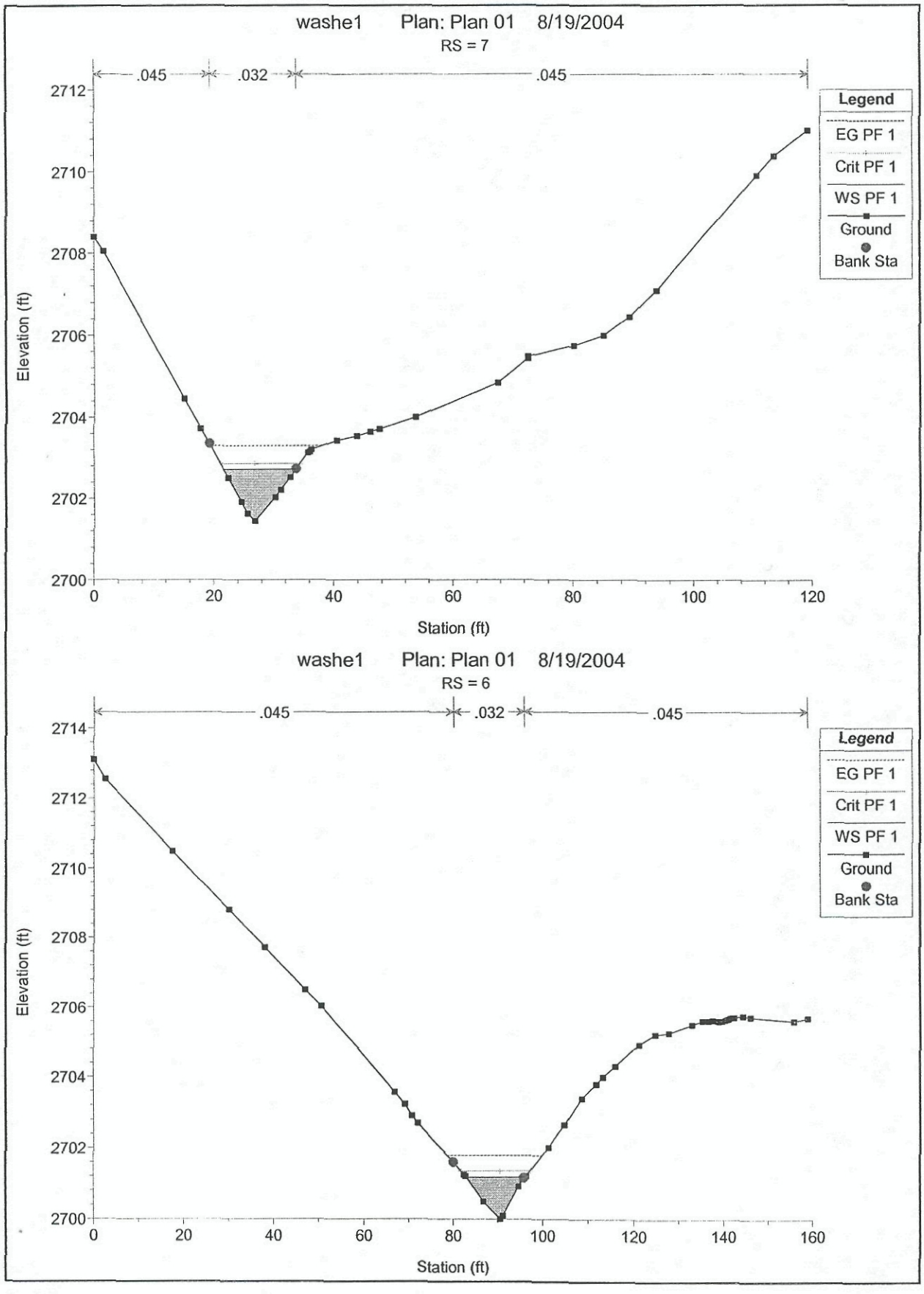
HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

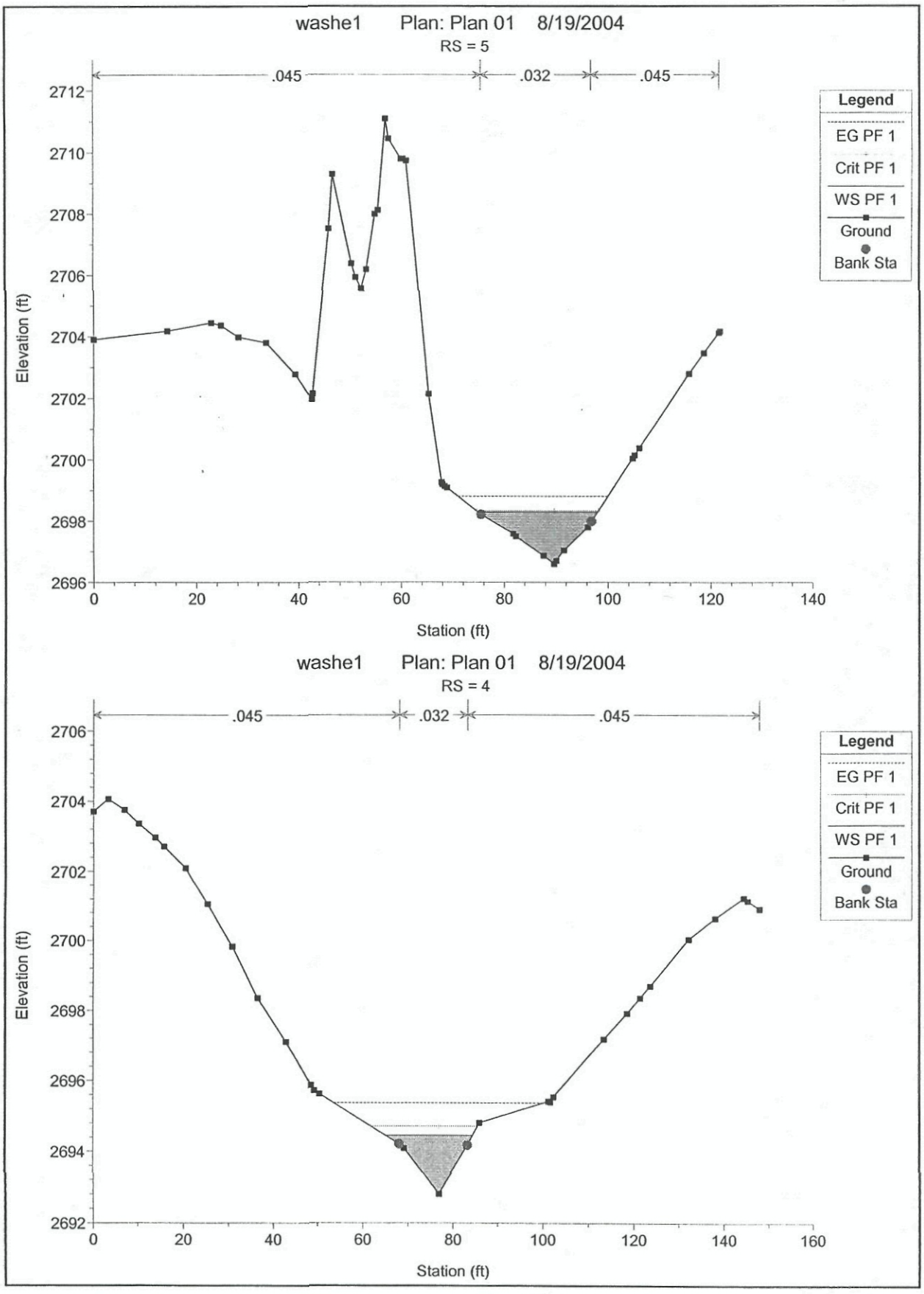
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	13	PF 1	50.00	2715.10	2716.43	2716.60	2717.06	0.030018	6.34	7.93	12.10	1.32
Reach-1	12	PF 1	50.00	2713.32	2714.73	2714.77	2715.16	0.017142	5.31	10.05	15.35	1.02
Reach-1	11	PF 1	50.00	2711.10	2712.13	2712.36	2712.87	0.045013	6.89	7.38	13.63	1.58
Reach-1	10	PF 1	50.00	2708.30	2709.94	2710.07	2710.51	0.018336	6.16	9.08	14.42	1.07
Reach-1	9	PF 1	50.00	2706.40	2707.58	2707.84	2708.40	0.040012	7.29	7.00	11.58	1.52
Reach-1	8	PF 1	50.00	2703.40	2704.77	2705.10	2705.82	0.046780	8.23	6.21	9.25	1.65
Reach-1	7	PF 1	50.00	2701.44	2702.70	2702.85	2703.29	0.030785	6.17	8.11	12.04	1.32
Reach-1	6	PF 1	50.00	2700.00	2701.17	2701.35	2701.79	0.036001	6.31	7.92	13.05	1.42
Reach-1	5	PF 1	110.00	2696.59	2698.30	2698.33	2698.80	0.017684	5.71	19.43	23.16	1.06
Reach-1	4	PF 1	110.00	2692.81	2694.46	2694.72	2695.37	0.030755	7.70	14.71	19.32	1.40
Reach-1	3	PF 1	133.00	2689.21	2690.99	2691.19	2691.58	0.015633	6.47	25.89	50.20	1.04
Reach-1	2	PF 1	251.00	2679.83	2681.69	2682.26	2683.44	0.042975	10.66	24.18	24.72	1.72
Reach-1	1	PF 1	251.00	2677.00	2679.32	2679.50	2680.13	0.014601	7.94	41.91	40.16	1.06

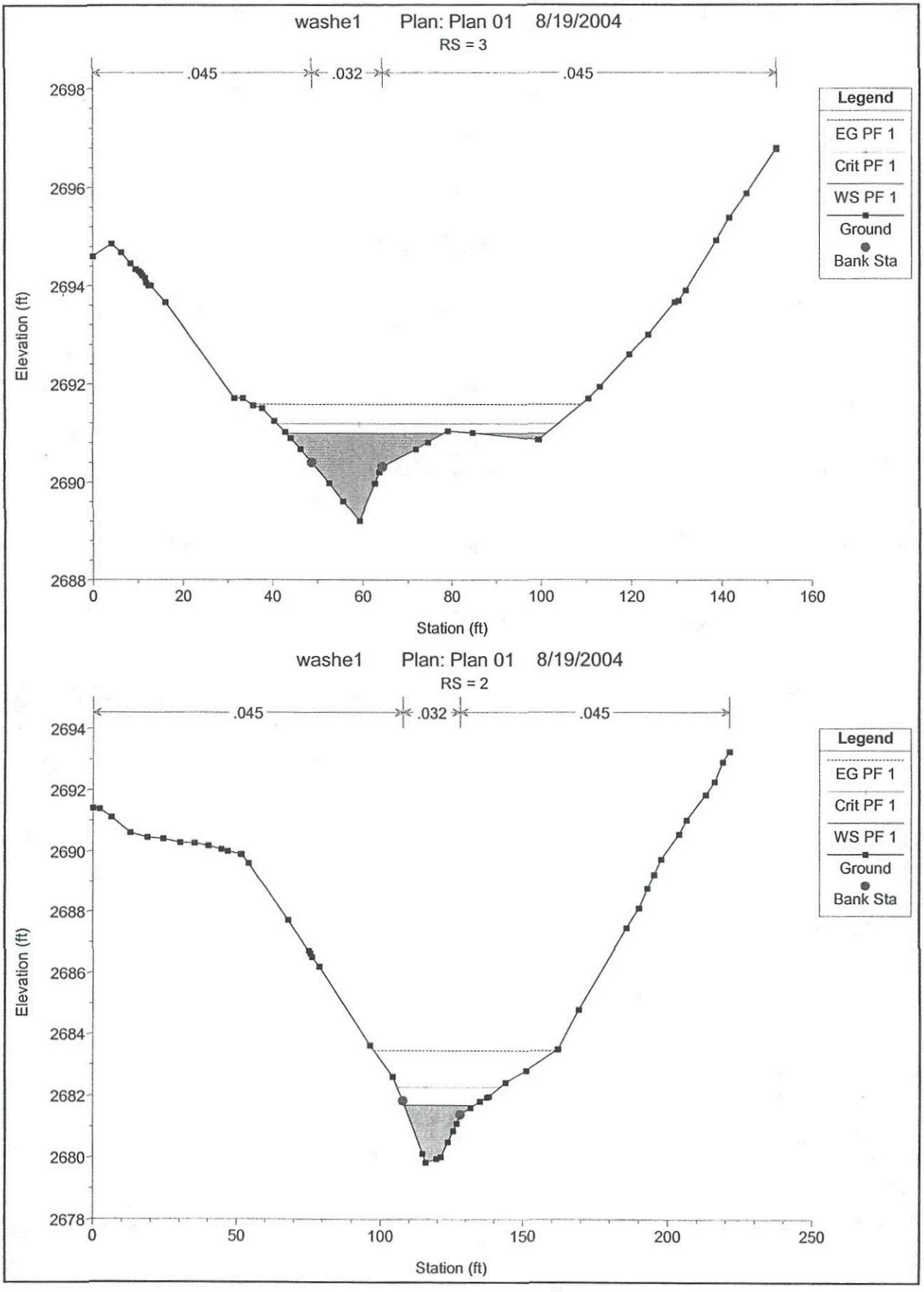

washe1 Plan: Plan 01 8/19/2004
RS = 13
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe1 Plan: Plan 01 8/19/2004
RS = 12
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

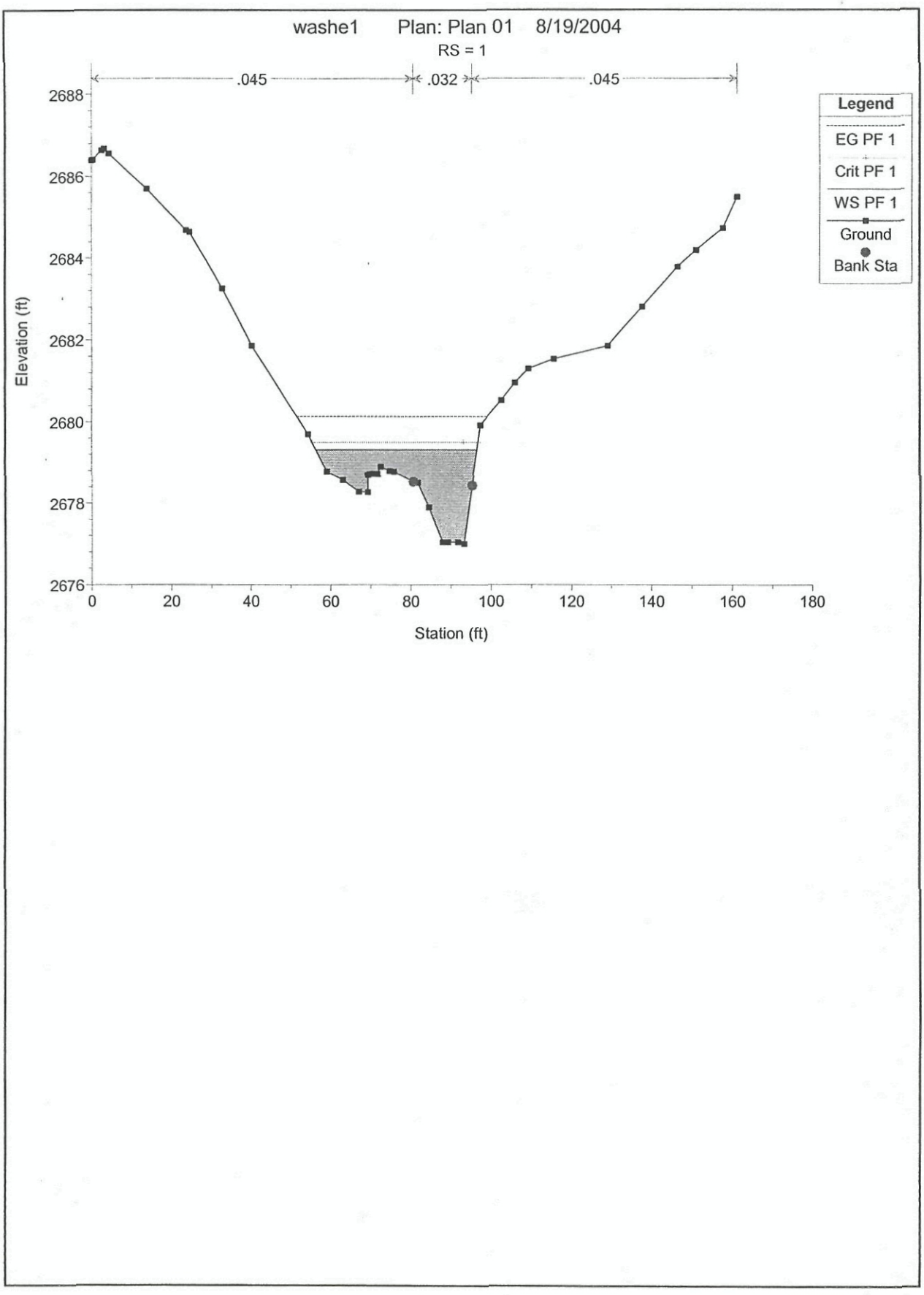

washe1 Plan: Plan 01 8/19/2004
RS = 11
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe1 Plan: Plan 01 8/19/2004
RS = 10
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washe1 Plan: Plan 01 8/19/2004
RS = 9
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe1 Plan: Plan 01 8/19/2004
RS = 8
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washe1 Plan: Plan 01 8/19/2004
RS = 7
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe1 Plan: Plan 01 8/19/2004
RS = 6
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washe1 Plan: Plan 01 8/19/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe1 Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

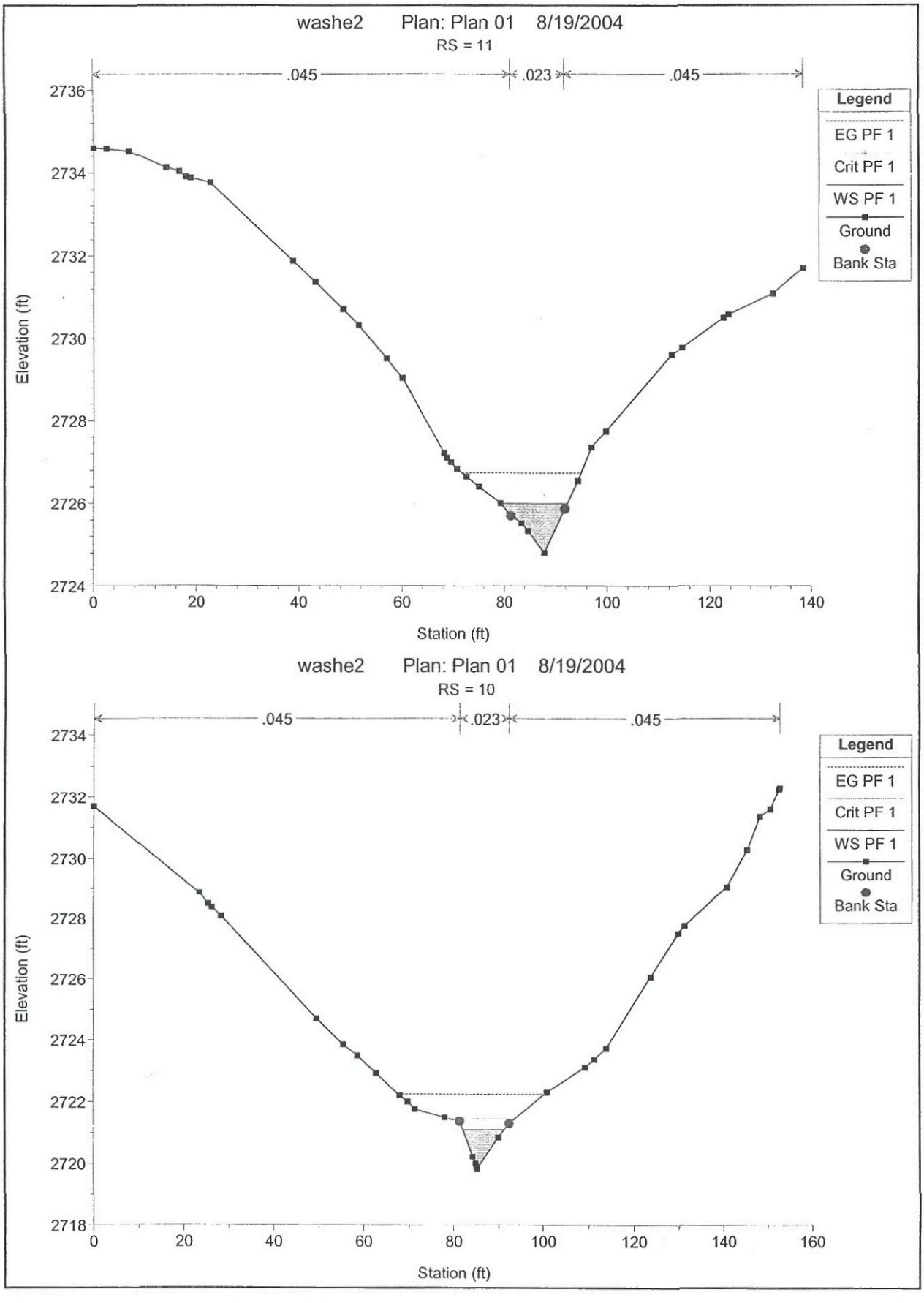

washe1 Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe1 Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

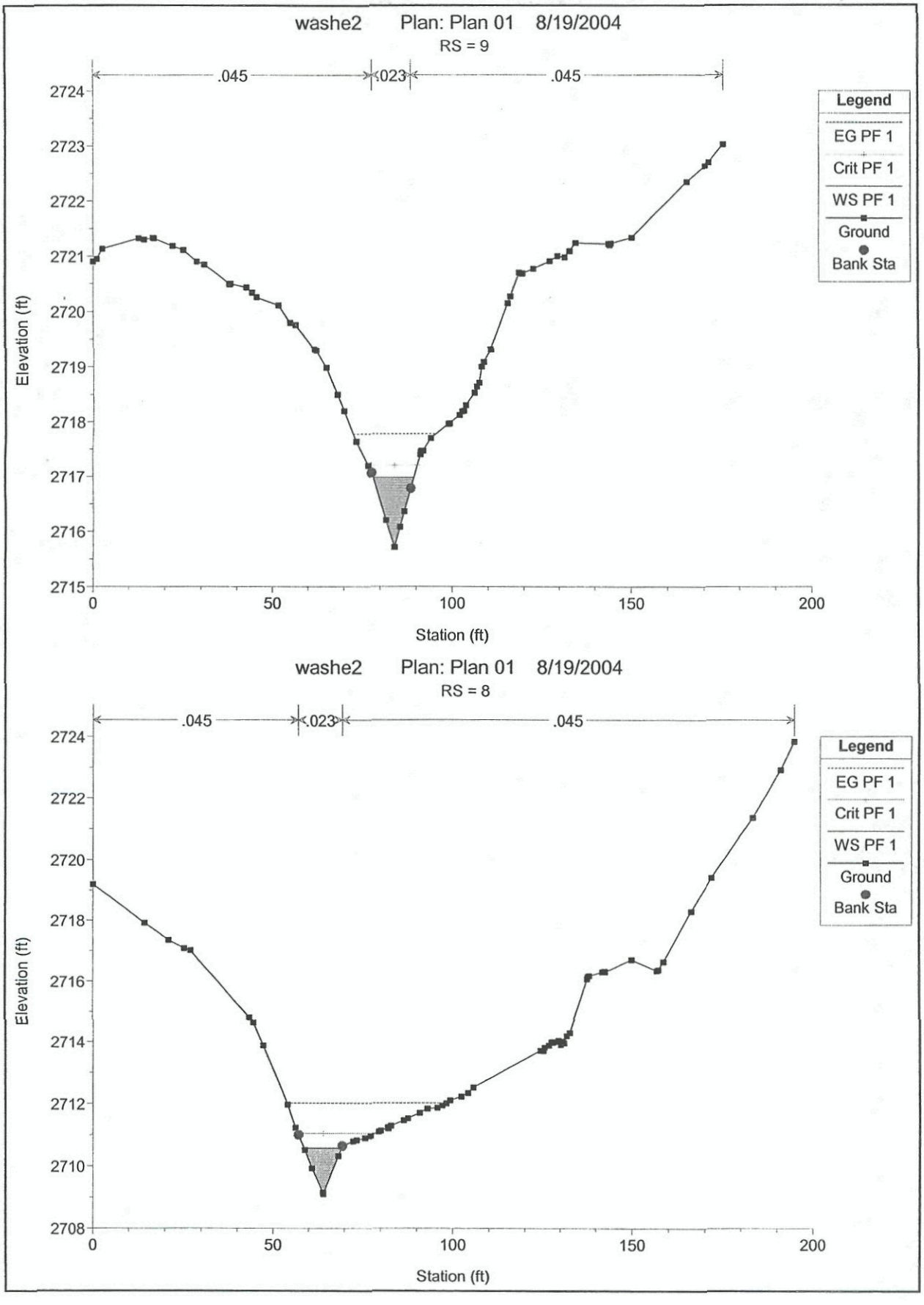

washe1 Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2688
2686
2684
2682
2680
2678
2676
0
20
40
60
80
100
120
140
160
180
Station (ft)

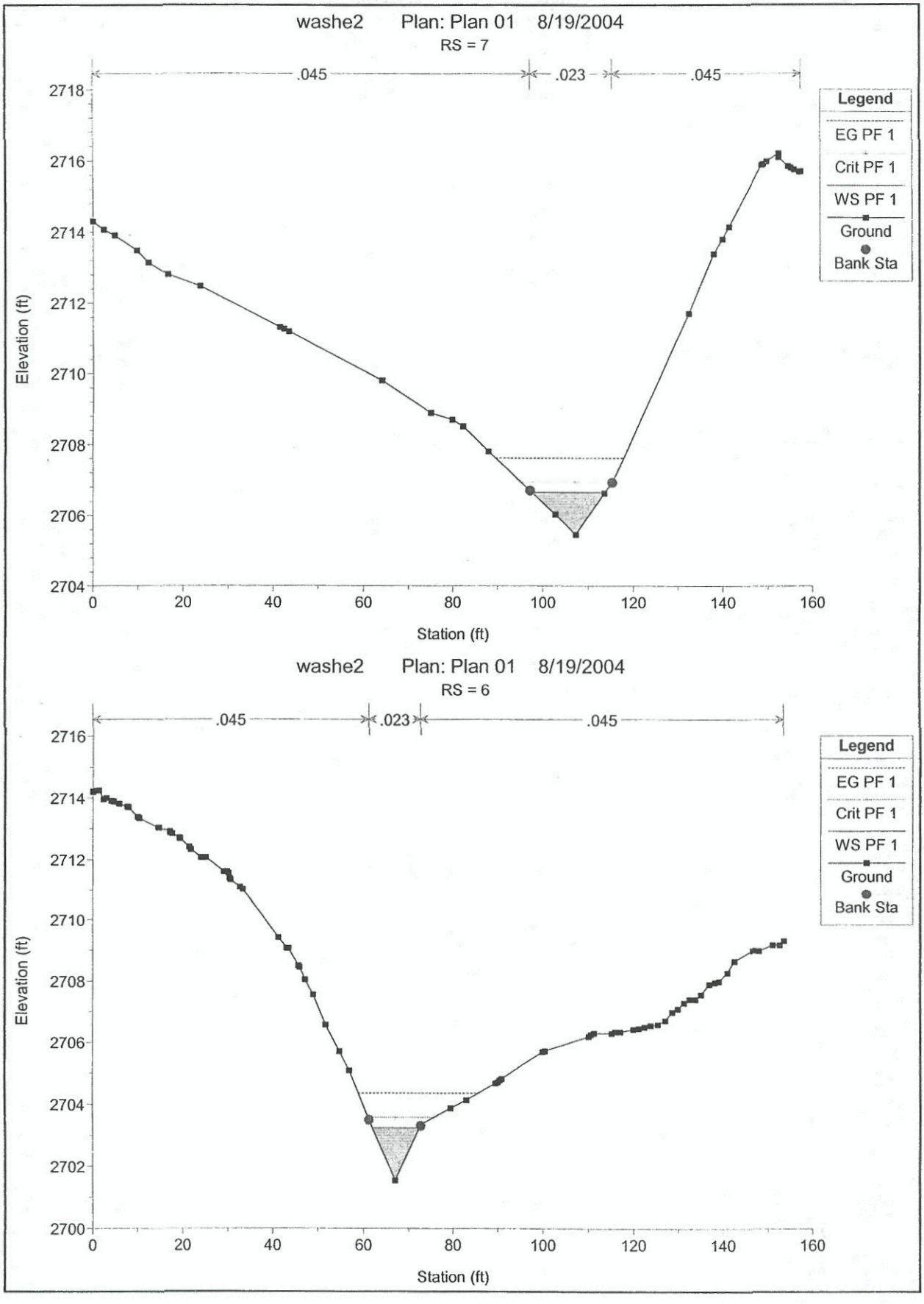
Wash E2

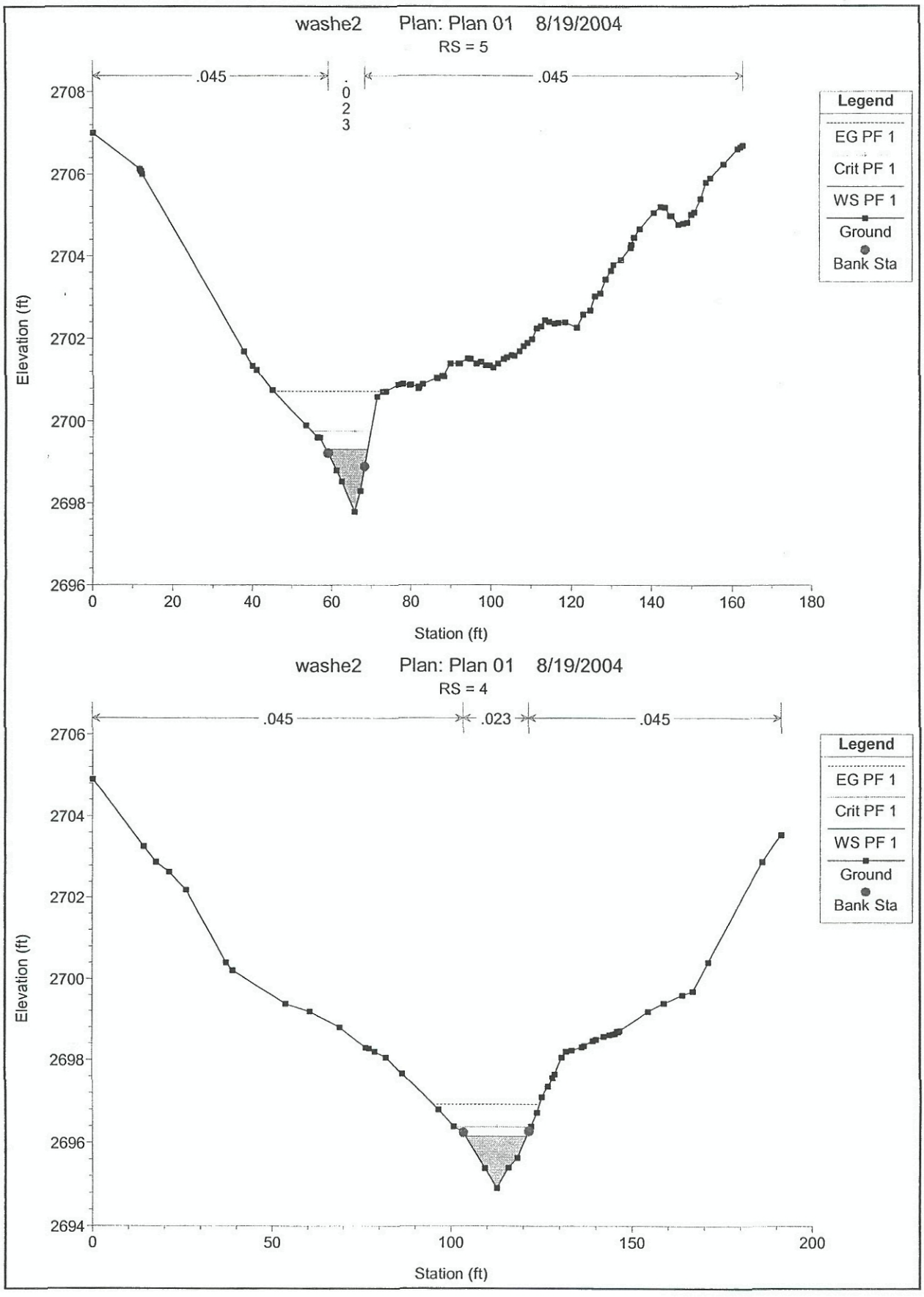
HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

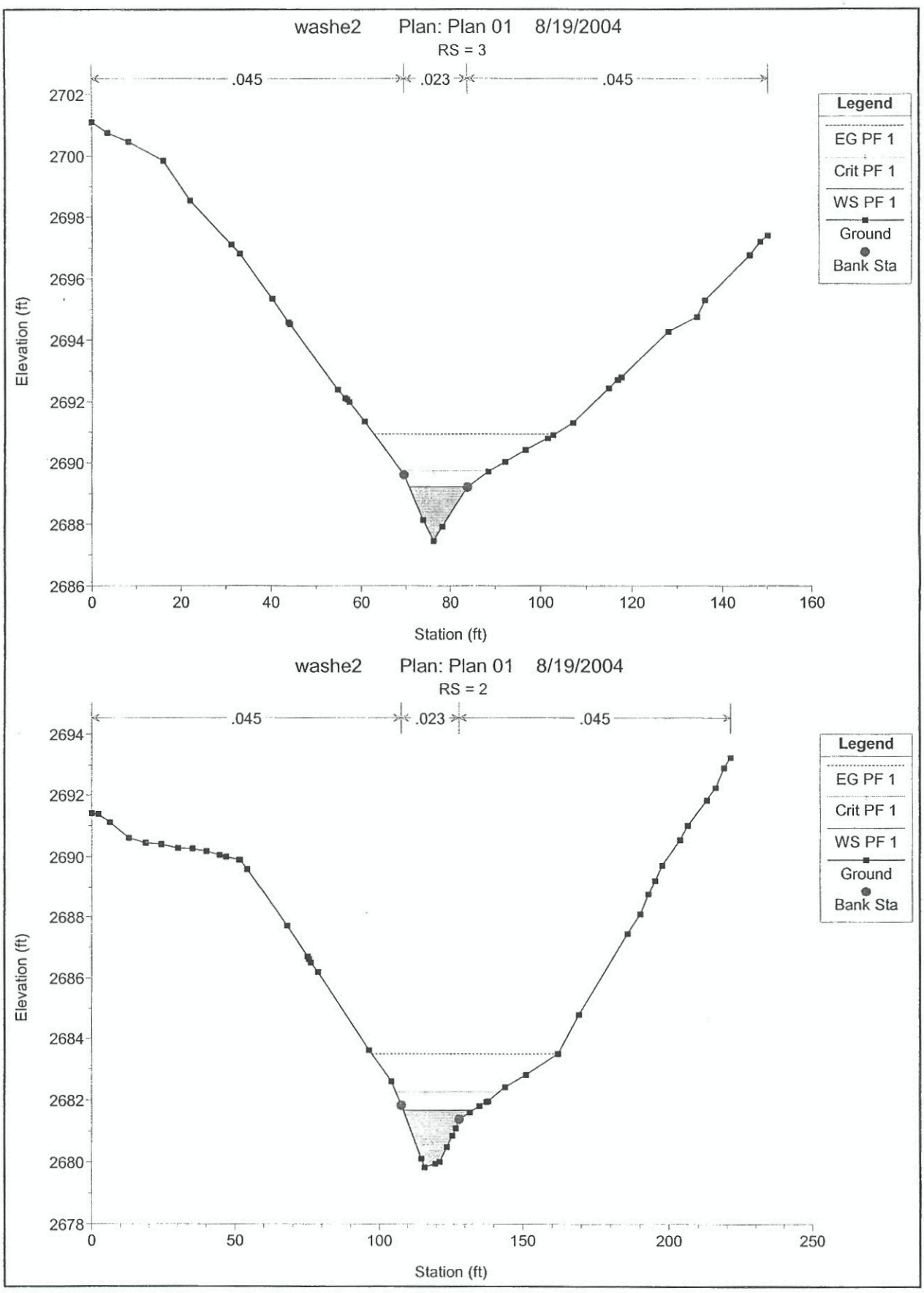
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	11	PF 1	50.00	2724.80	2725.99	2726.21	2726.73	0.020013	6.94	7.48	13.08	1.49
Reach-1	10	PF 1	50.00	2719.82	2721.09	2721.44	2722.24	0.035149	8.63	5.80	9.27	1.92
Reach-1	9	PF 1	50.00	2715.71	2716.97	2717.21	2717.78	0.021955	7.21	7.01	11.19	1.55
Reach-1	8	PF 1	75.00	2709.10	2710.57	2711.05	2712.02	0.034731	9.64	7.78	10.45	1.97
Reach-1	7	PF 1	75.00	2705.46	2706.65	2706.94	2707.61	0.030625	7.88	9.51	16.16	1.81
Reach-1	6	PF 1	75.00	2701.53	2703.23	2703.57	2704.35	0.023010	8.49	8.83	10.42	1.62
Reach-1	5	PF 1	75.00	2697.79	2699.31	2699.76	2700.73	0.028580	9.56	8.00	10.43	1.82
Reach-1	4	PF 1	75.00	2694.91	2696.14	2696.38	2696.93	0.022699	7.11	10.55	16.72	1.58
Reach-1	3	PF 1	122.00	2687.45	2689.20	2689.73	2690.94	0.033261	10.58	11.53	13.14	1.99
Reach-1	2	PF 1	251.00	2679.83	2681.67	2682.25	2683.48	0.023084	10.80	23.84	24.44	1.76
Reach-1	1	PF 1	251.00	2677.00	2678.99	2679.54	2680.76	0.019267	11.08	29.30	38.04	1.63

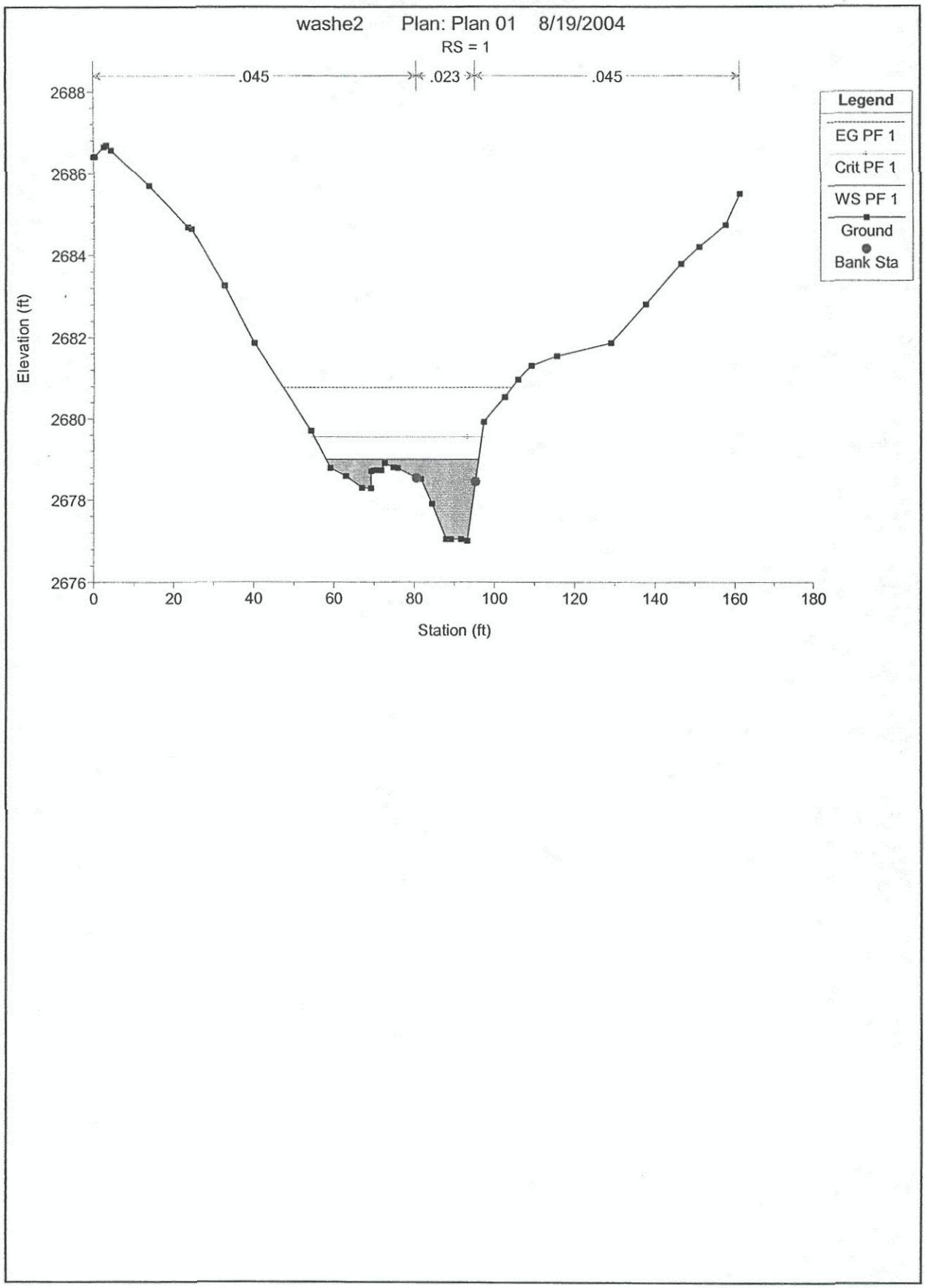

washe2 Plan: Plan 01 8/19/2004
RS = 11
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe2 Plan: Plan 01 8/19/2004
RS = 10
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washe2 Plan: Plan 01 8/19/2004
RS = 9
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe2 Plan: Plan 01 8/19/2004
RS = 8
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washe2 Plan: Plan 01 8/19/2004
RS = 7
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe2 Plan: Plan 01 8/19/2004
RS = 6
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


washe2 Plan: Plan 01 8/19/2004
RS = 5
.045
.0
2
3
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2708
2706
2704
2702
2700
2698
2696
0
20
40
60
80
100
120
140
160
180
Station (ft)
washe2 Plan: Plan 01 8/19/2004
RS = 4
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2706
2704
2702
2700
2698
2696
2694
0
50
100
150
200
Station (ft)

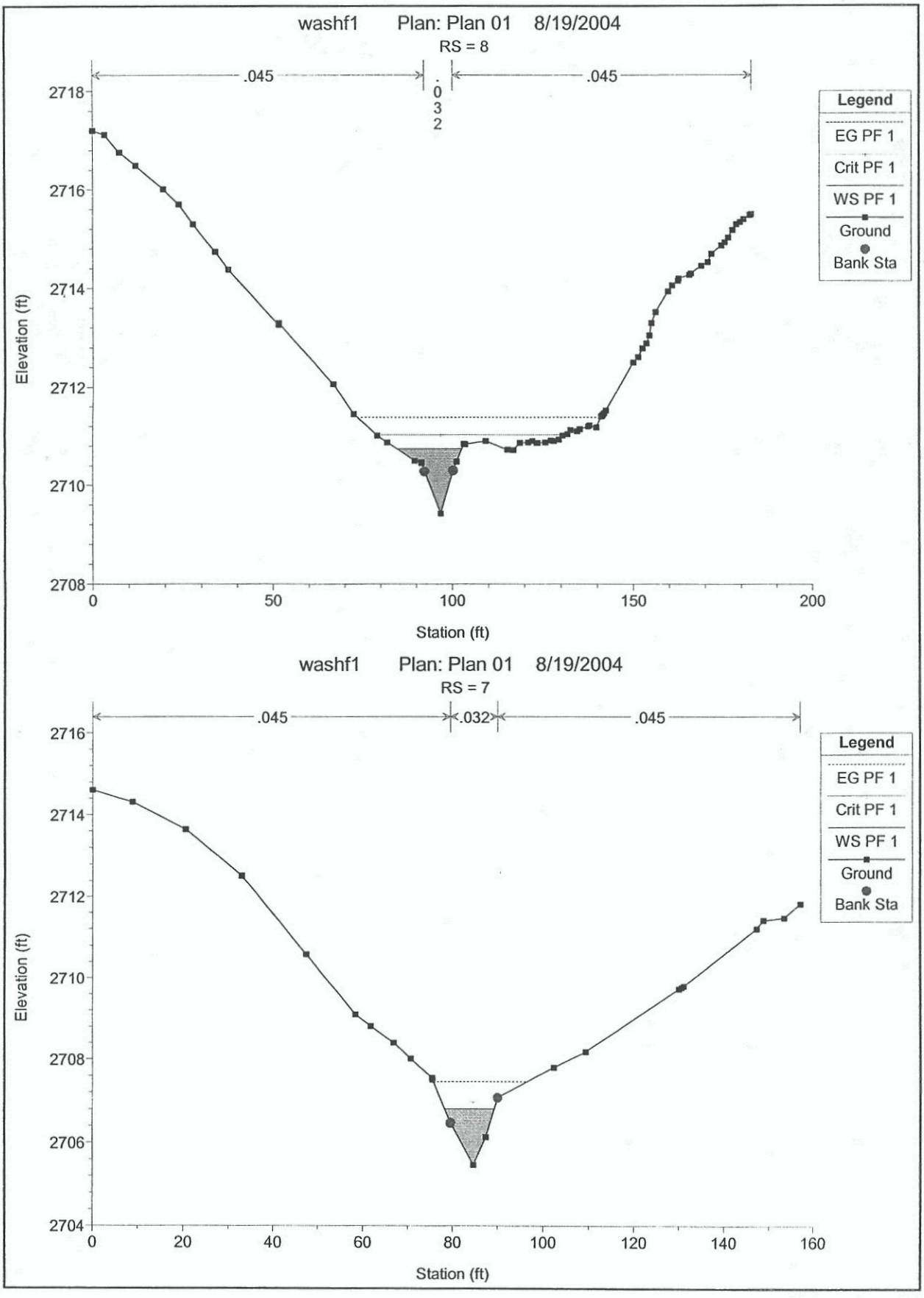

washe2 Plan: Plan 01 8/19/2004
RS = 3
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washe2 Plan: Plan 01 8/19/2004
RS = 2
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

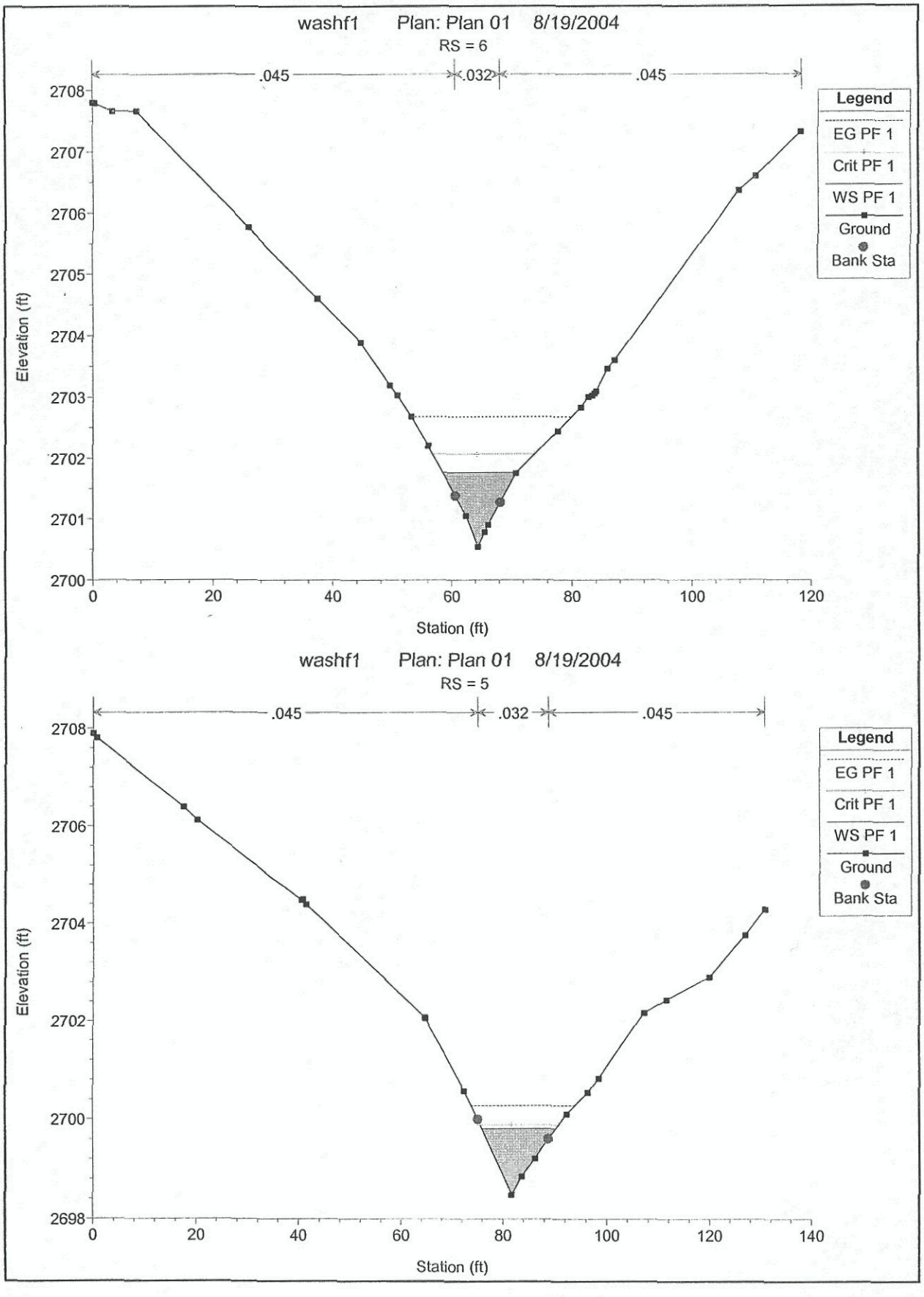

washe2 Plan: Plan 01 8/19/2004
RS = 1
.045
.023
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2688
2686
2684
2682
2680
2678
2676
0
20
40
60
80
100
120
140
160
180
Station (ft)

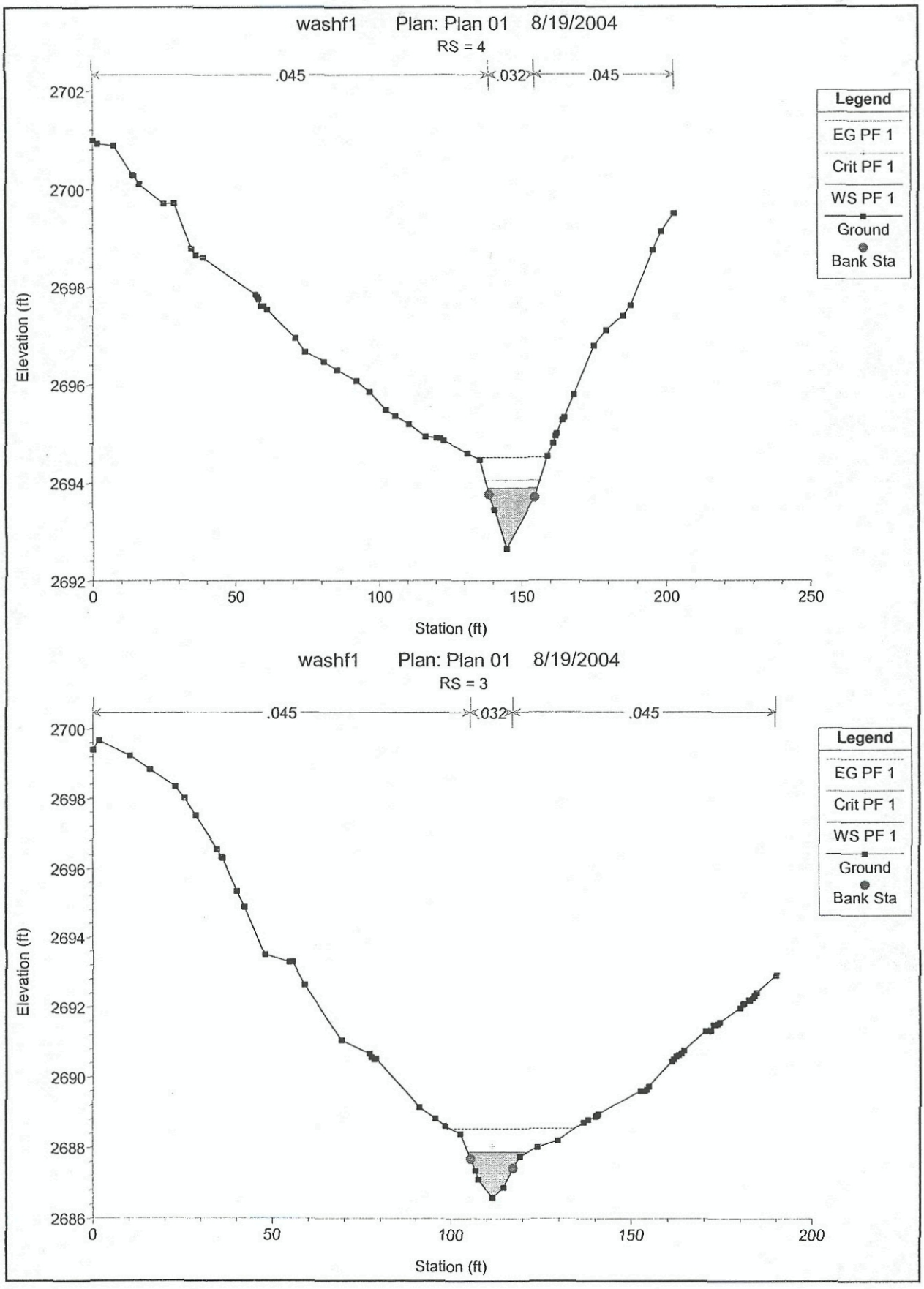
Wash F1

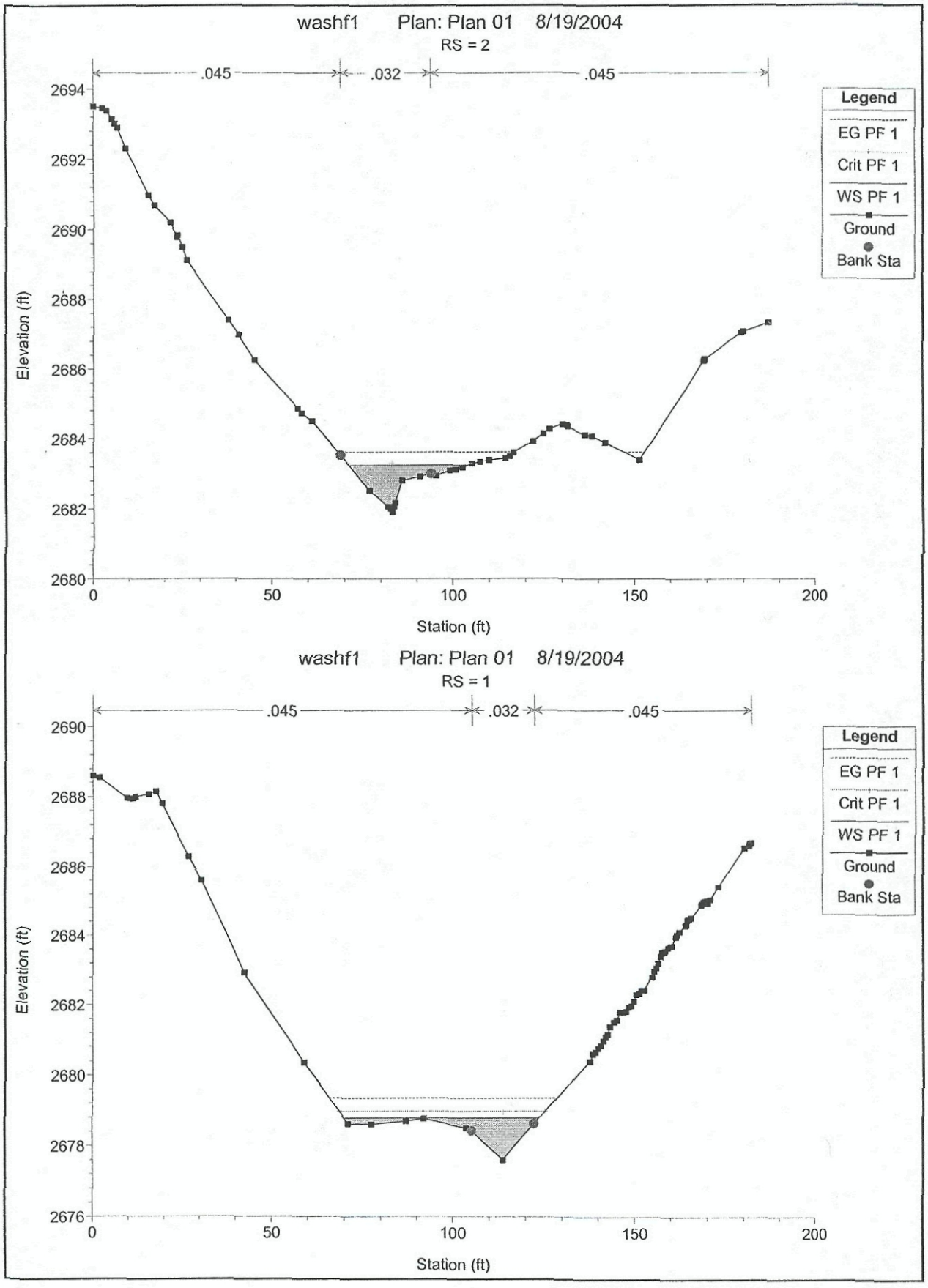
HEC-RAS Plan: Plan 01 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	8	PF 1	50.00	2709.42	2710.74	2711.03	2711.38	0.025021	6.65	8.95	20.46	1.25
Reach-1	7	PF 1	50.00	2705.46	2706.81	2706.97	2707.46	0.027912	6.49	7.87	11.03	1.29
Reach-1	6	PF 1	50.00	2700.54	2701.76	2702.06	2702.68	0.039439	7.86	7.10	12.34	1.54
Reach-1	5	PF 1	50.00	2698.48	2699.81	2699.89	2700.28	0.022873	5.50	9.22	14.31	1.15
Reach-1	4	PF 1	70.00	2692.65	2693.88	2694.04	2694.51	0.031360	6.38	11.08	17.37	1.35
Reach-1	3	PF 1	70.00	2686.57	2687.86	2688.03	2688.53	0.023987	6.59	11.24	16.79	1.23
Reach-1	2	PF 1	70.00	2681.90	2683.24	2683.31	2683.61	0.023295	4.97	15.25	32.77	1.14
Reach-1	1	PF 1	87.00	2677.60	2678.79	2678.98	2679.35	0.028227	6.29	17.84	53.95	1.30


washf1 Plan: Plan 01 8/19/2004
RS = 8
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2718
2716
2714
2712
2710
2708
0
50
100
150
200
washf1 Plan: Plan 01 8/19/2004
RS = 7
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2716
2714
2712
2710
2708
2706
2704
0
20
40
60
80
100
120
140
160


washf1 Plan: Plan 01 8/19/2004
RS = 6
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washf1 Plan: Plan 01 8/19/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

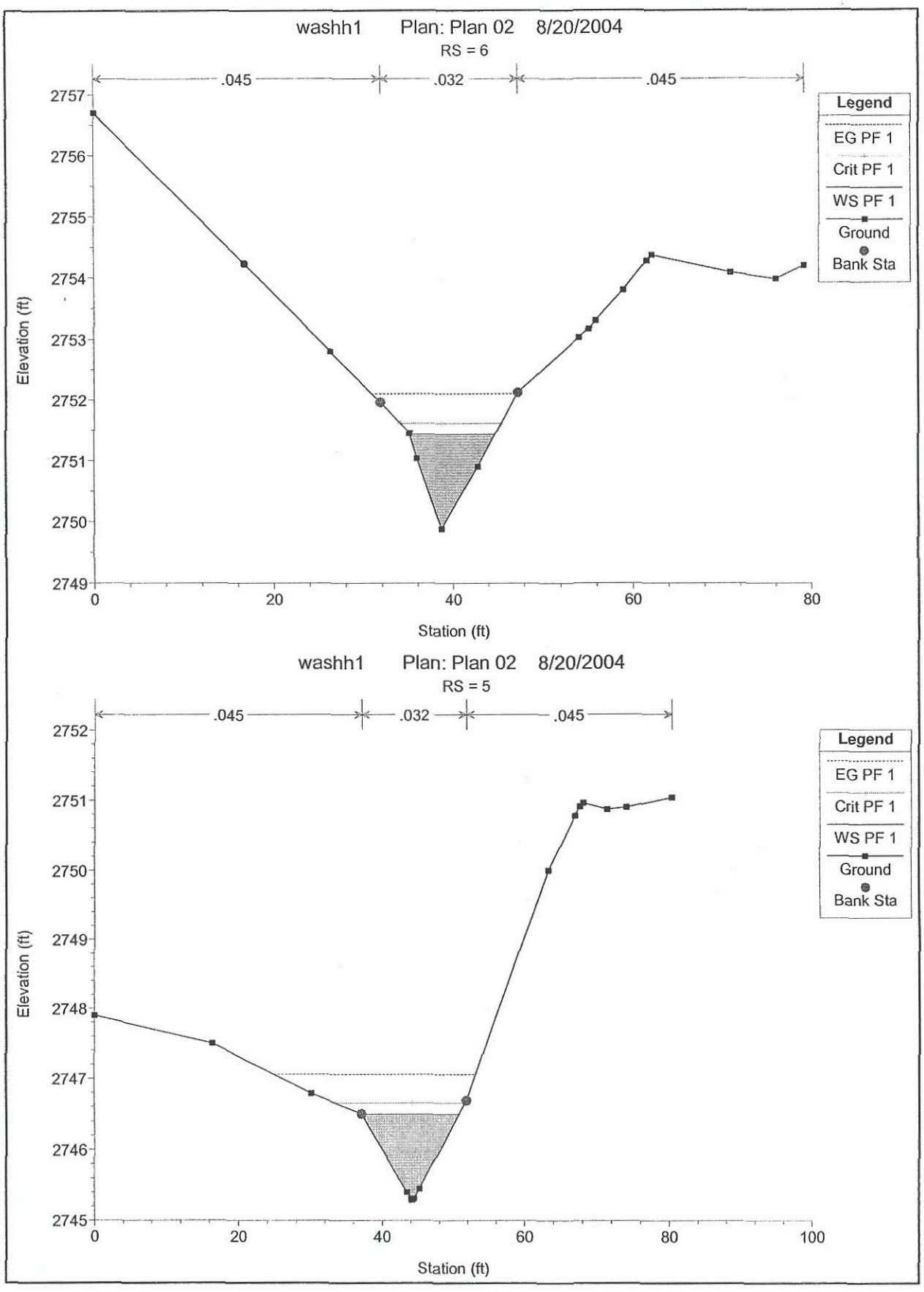

washf1 Plan: Plan 01 8/19/2004
RS = 4
.045
.032
.045
2702
2700
2698
2696
2694
2692
Elevation (ft)
0
50
100
150
200
250
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
washf1 Plan: Plan 01 8/19/2004
RS = 3
.045
.032
.045
2700
2698
2696
2694
2692
2690
2688
2686
Elevation (ft)
0
50
100
150
200
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

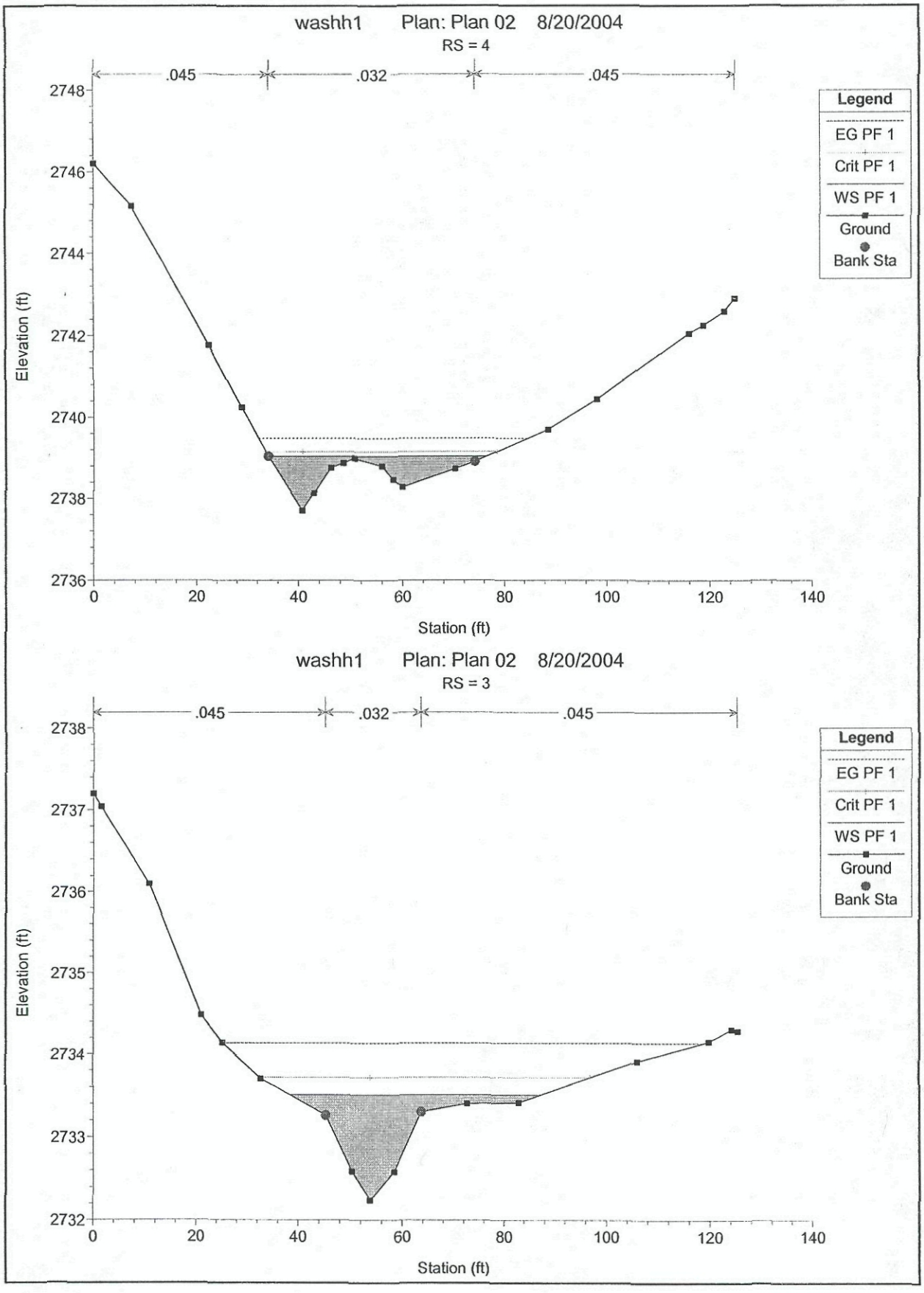

washf1 Plan: Plan 01 8/19/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2694
2692
2690
2688
2686
2684
2682
2680
0
50
100
150
200
Station (ft)
washf1 Plan: Plan 01 8/19/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2690
2688
2686
2684
2682
2680
2678
2676
0
50
100
150
200
Station (ft)

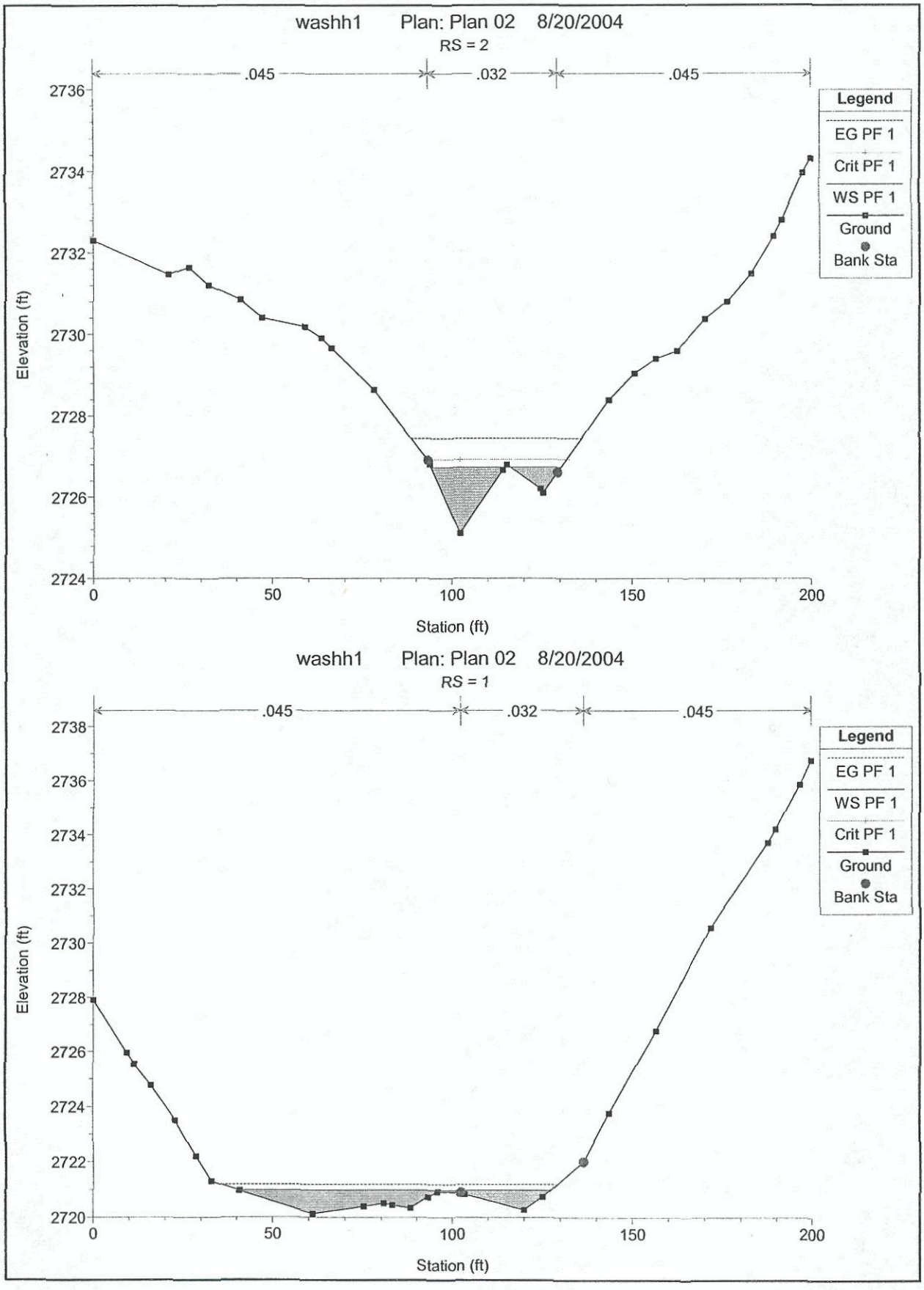
Wash H1

HEC-RAS Plan: Plan 02 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6	PF 1	50.00	2749.88	2751.43	2751.61	2752.10	0.028975	6.55	7.63	9.59	1.29
Reach-1	5	PF 1	50.00	2745.29	2746.49	2746.65	2747.06	0.033158	6.03	8.30	13.57	1.36
Reach-1	4	PF 1	100.00	2737.70	2739.04	2739.15	2739.48	0.037087	5.36	18.79	42.22	1.38
Reach-1	3	PF 1	100.00	2732.24	2733.50	2733.71	2734.13	0.026736	6.51	18.10	48.74	1.28
Reach-1	2	PF 1	140.00	2725.11	2726.72	2726.92	2727.44	0.041456	6.79	20.66	34.49	1.53
Reach-1	1	PF 1	140.00	2720.27	2720.97	2720.96	2721.18	0.029041	4.23	38.81	86.82	1.19


washh1 Plan: Plan 02 8/20/2004
RS = 6
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2757
2756
2755
2754
2753
2752
2751
2750
2749
0
20
40
60
80
washh1 Plan: Plan 02 8/20/2004
RS = 5
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
2752
2751
2750
2749
2748
2747
2746
2745
0
20
40
60
80
100

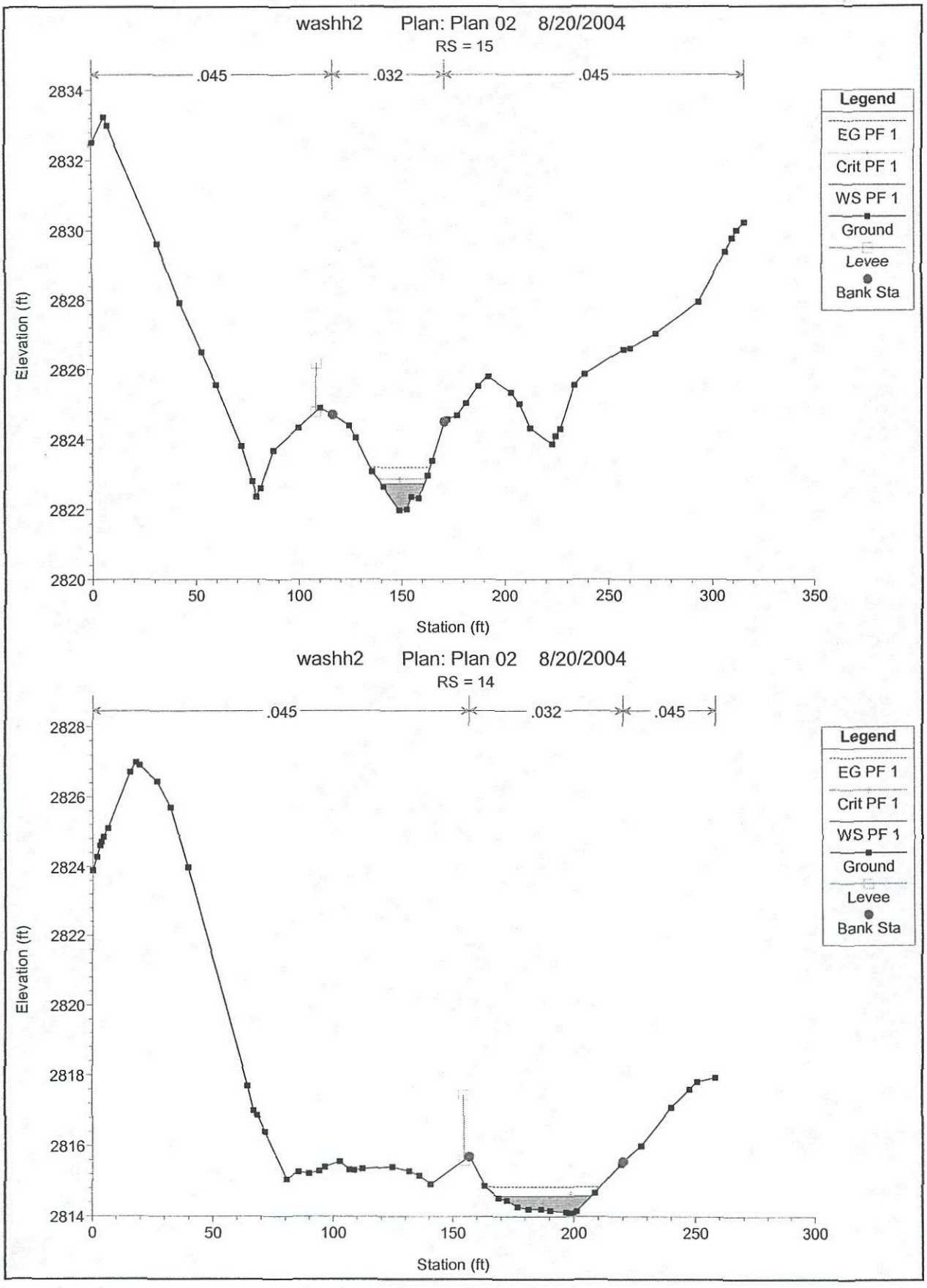

washh1 Plan: Plan 02 8/20/2004
RS = 4
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2748
2746
2744
2742
2740
2738
2736
0
20
40
60
80
100
120
140
Station (ft)
washh1 Plan: Plan 02 8/20/2004
RS = 3
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
2738
2737
2736
2735
2734
2733
2732
0
20
40
60
80
100
120
140
Station (ft)


washh1 Plan: Plan 02 8/20/2004
RS = 2
.045
.032
.045
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
washh1 Plan: Plan 02 8/20/2004
RS = 1
.045
.032
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

Wash H2

HEC-RAS Plan: Plan 02 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	15	PF 1	50.00	2821.98	2822.73	2822.87	2823.20	0.043010	5.50	9.10	21.01	1.47
Reach-1	14	PF 1	50.00	2814.10	2814.57	2814.63	2814.83	0.038439	4.16	12.02	38.88	1.32
Reach-1	13	PF 1	50.00	2808.80	2809.31	2809.36	2809.54	0.036980	3.82	13.10	46.83	1.27
Reach-1	12	PF 1	50.00	2800.73	2801.22	2801.31	2801.52	0.063174	4.36	11.47	50.18	1.61
Reach-1	11	PF 1	110.00	2783.25	2784.86	2785.16	2785.85	0.038129	8.00	13.76	16.27	1.53
Reach-1	10	PF 1	110.00	2773.90	2775.12	2775.38	2775.90	0.045460	7.23	16.84	37.06	1.61
Reach-1	9	PF 1	110.00	2764.93	2766.11	2766.36	2766.92	0.038379	7.21	15.26	21.49	1.51
Reach-1	8	PF 1	110.00	2757.40	2758.22	2758.36	2758.72	0.045595	5.69	19.35	44.32	1.52
Reach-1	7	PF 1	110.00	2751.66	2752.49	2752.67	2753.06	0.034695	6.03	18.55	36.22	1.39
Reach-1	6	PF 1	110.00	2749.39	2750.04	2750.26	2750.75	0.056994	6.76	16.28	34.17	1.72
Reach-1	5	PF 1	110.00	2746.81	2747.73	2747.91	2748.36	0.039069	6.37	17.27	29.75	1.47
Reach-1	4	PF 1	110.00	2744.09	2745.00	2745.29	2745.95	0.045868	7.84	14.03	19.83	1.64
Reach-1	3	PF 1	110.00	2739.56	2740.83	2741.04	2741.51	0.036401	6.61	16.63	25.58	1.45
Reach-1	2	PF 1	155.00	2735.23	2736.19	2736.50	2737.17	0.050299	7.92	19.57	29.38	1.71
Reach-1	1	PF 1	155.00	2731.01	2731.59	2731.77	2732.22	0.050013	6.39	24.27	49.93	1.61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Crit PF 1
WS PF 1
Ground
Levee
Bank Sta
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2830
2828
2826
2824
2822
2820
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50
100
150
200
250
300
350
Station (ft)
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WS PF 1
Ground
Levee
Bank Sta
Elevation (ft)
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50
100
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200
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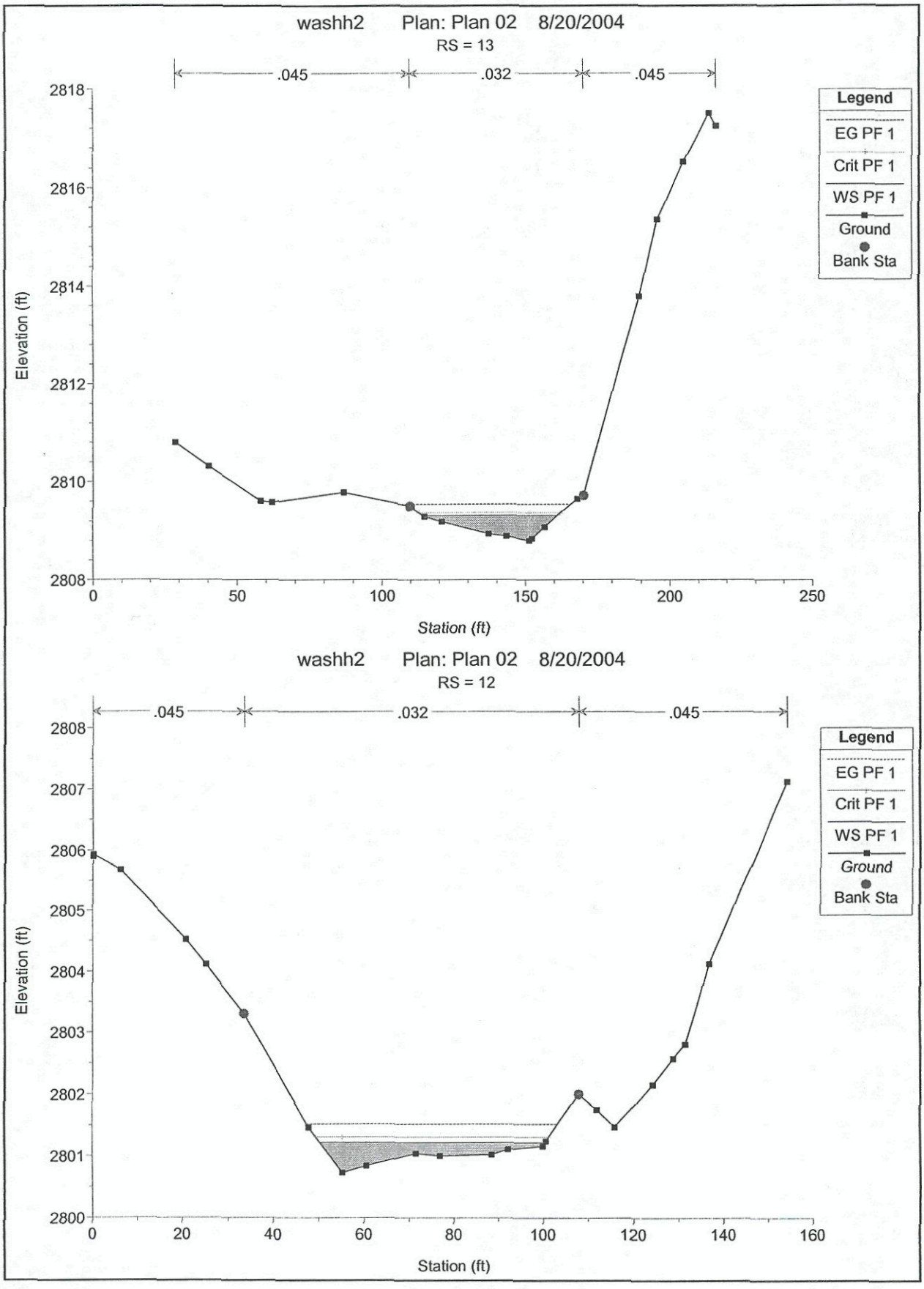
300
Station (ft)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200
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Station (ft)
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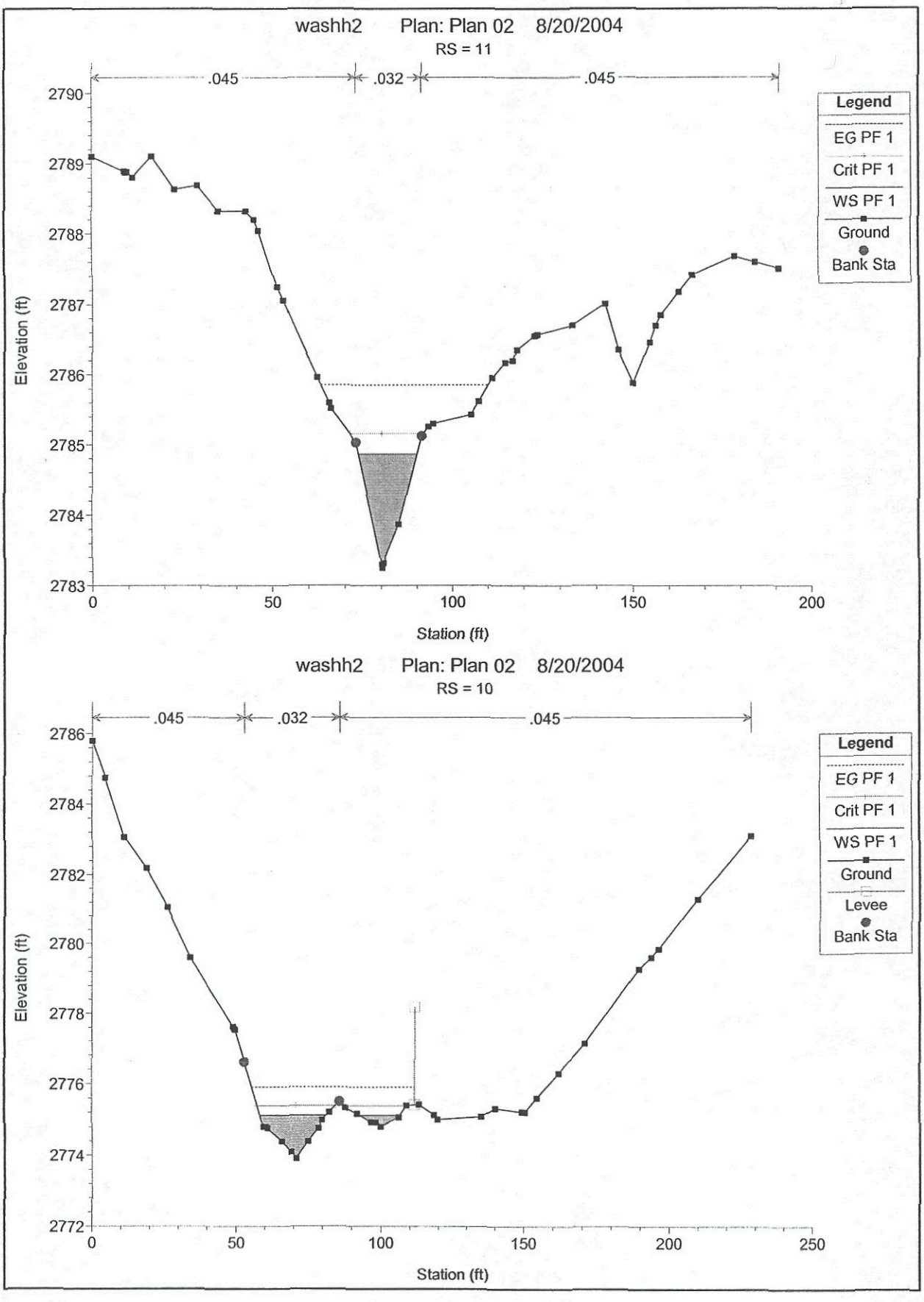
Station (ft)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Station (ft)
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Bank Sta
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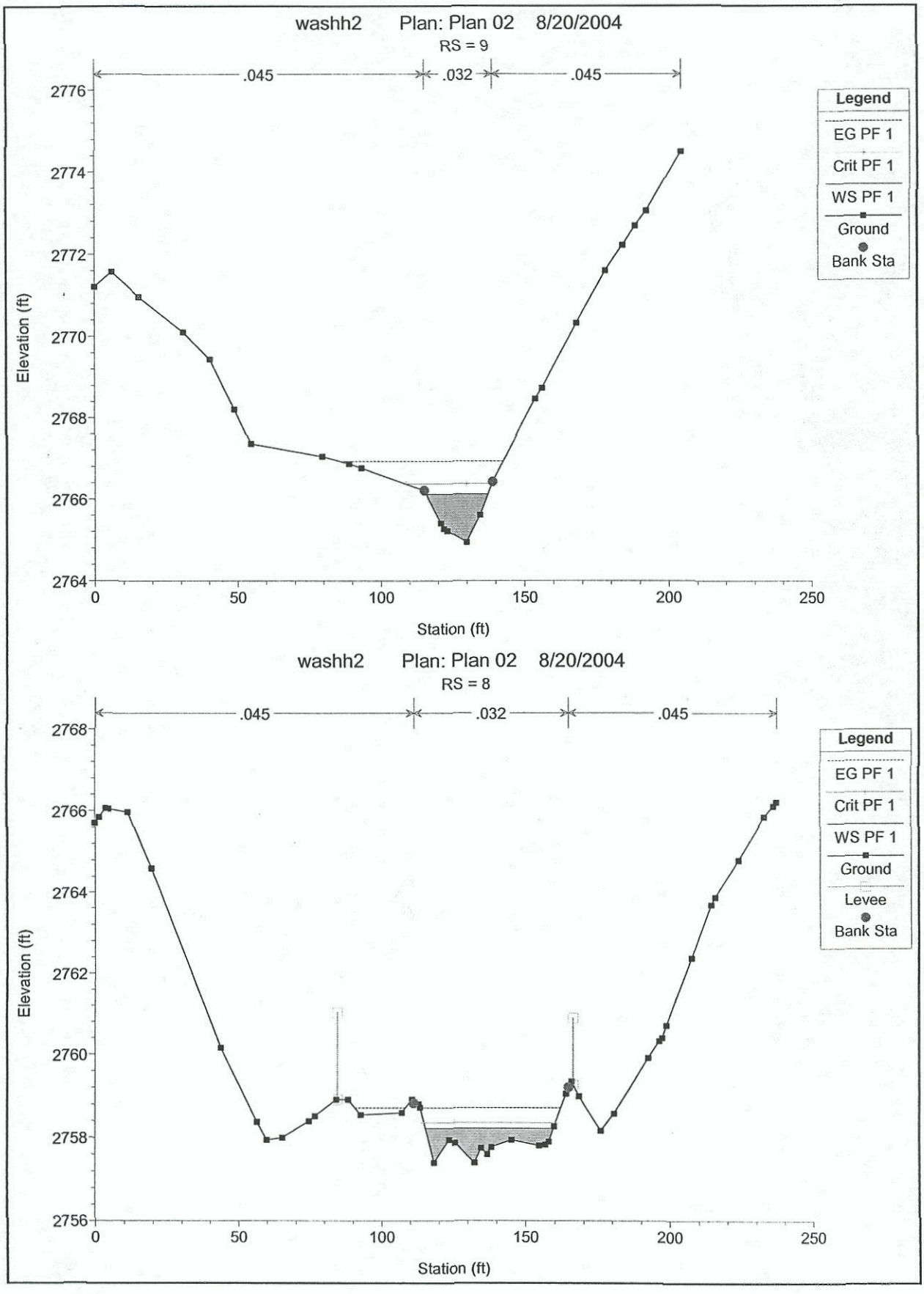
Station (ft)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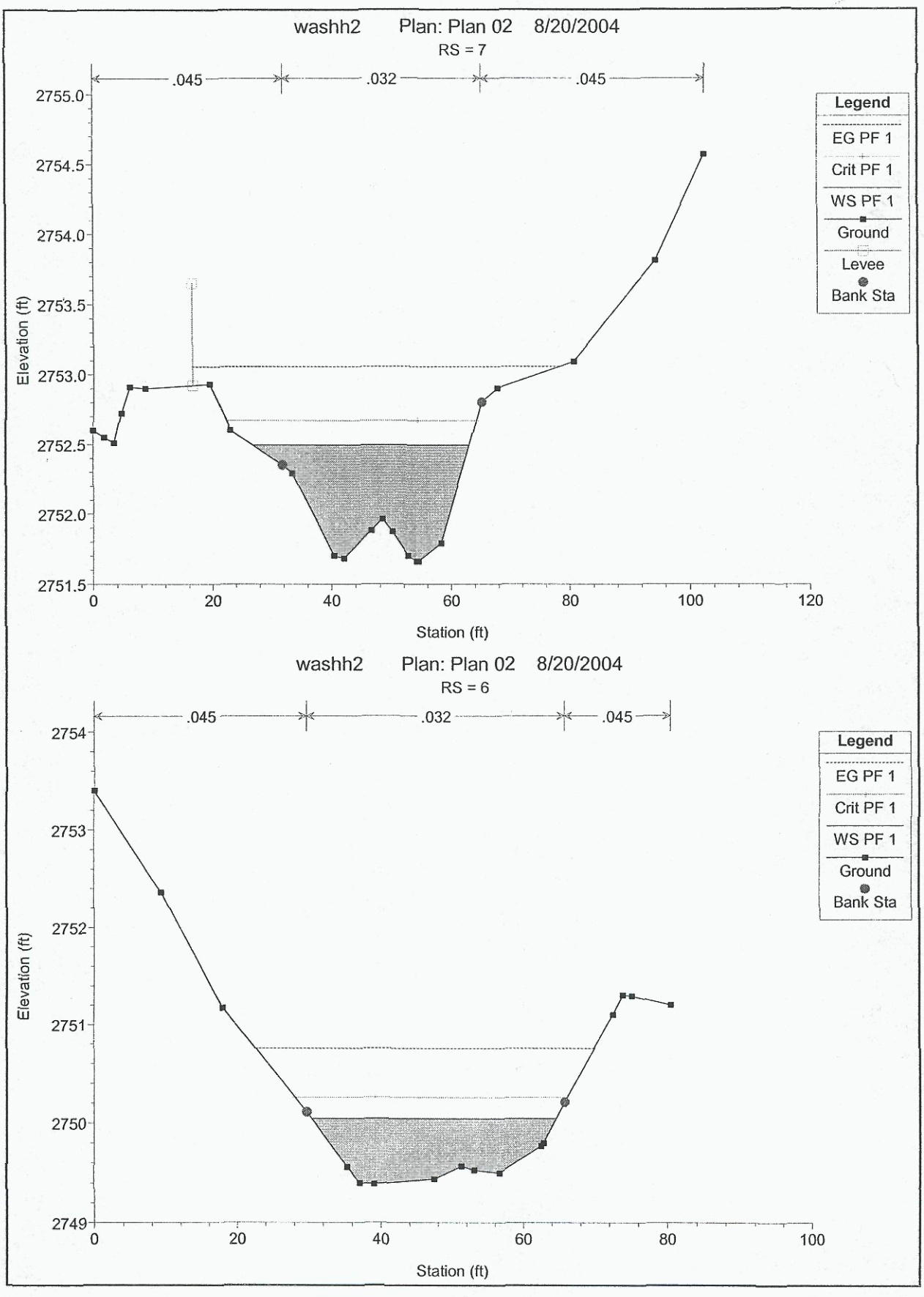
Station (ft)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60
80
100
120
Station (ft)
Legend
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Crit PF 1
WS PF 1
Ground
Levee
Bank Sta
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.032
.045
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2753
2752
2751
2750
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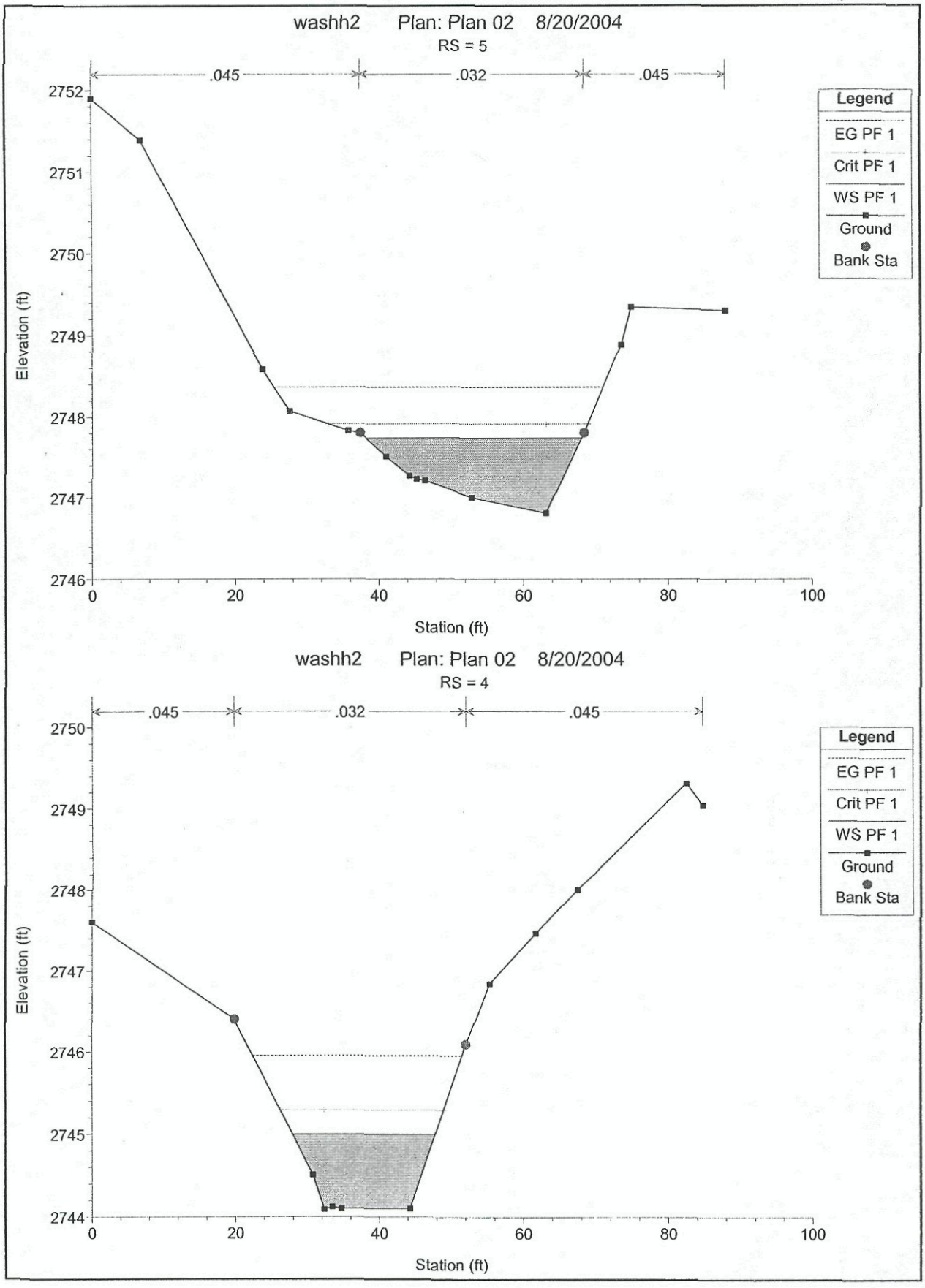
WS PF 1
Ground
Bank Sta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Station (ft)
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WS PF 1
Ground
Bank Sta
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.032
.045
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2747
2746
2745
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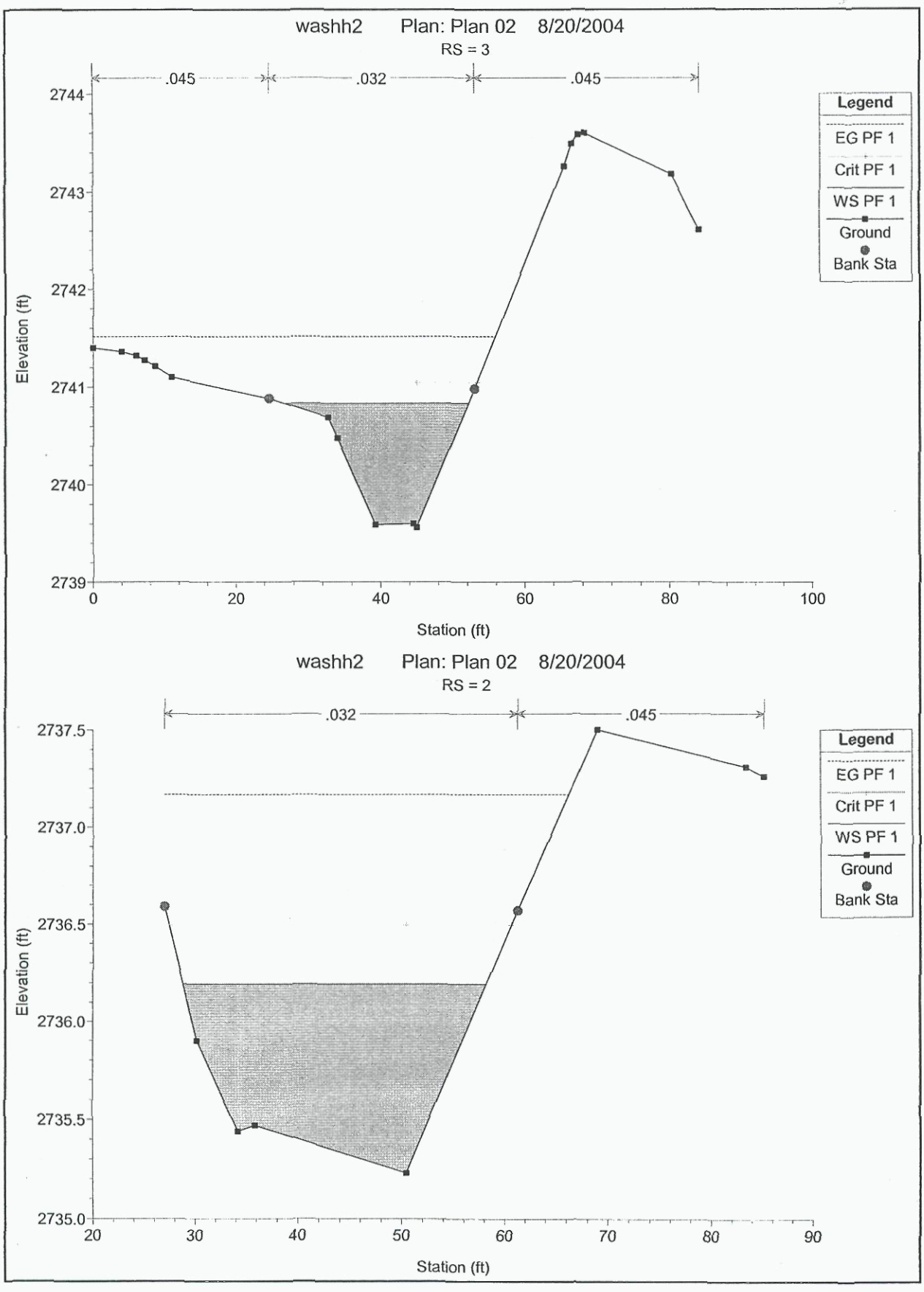
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta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Crit PF 1
WS PF 1
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Bank Sta
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80
100
Station (ft)
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Crit PF 1
WS PF 1
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Bank Sta
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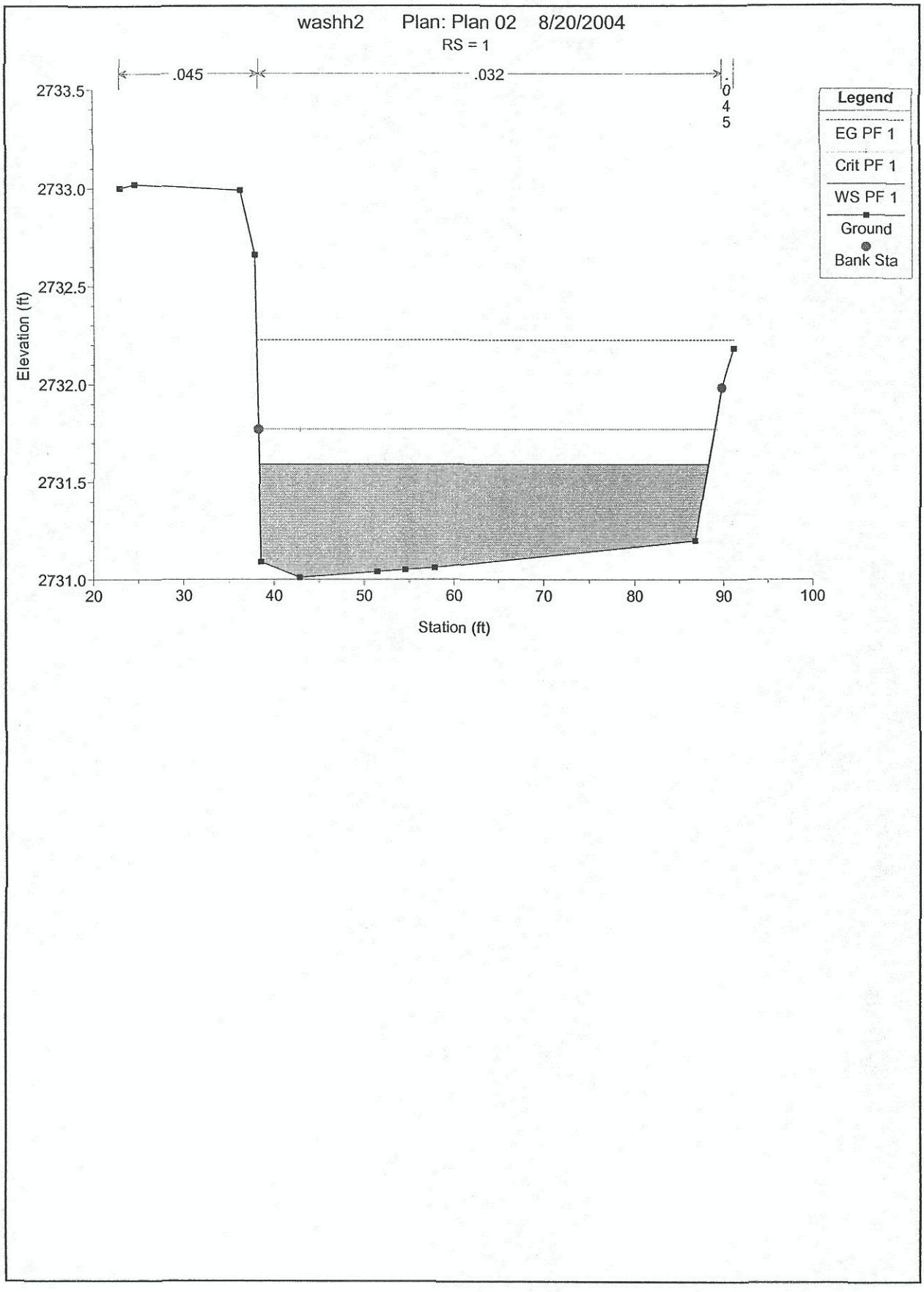
50
60
70
80
90
Station (ft)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Ground
Bank Sta
Elevation (ft)
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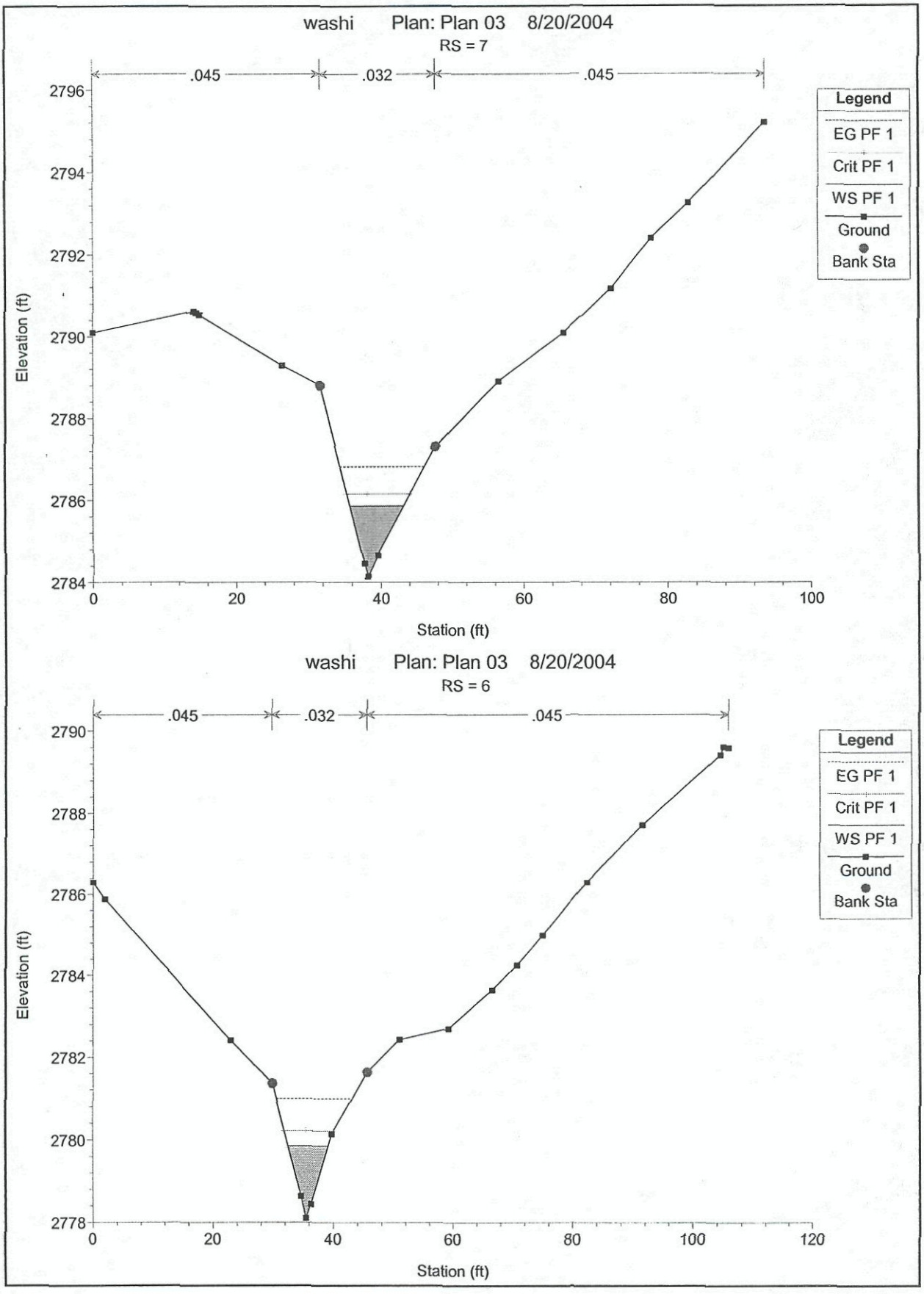
2732.5
2732.0
2731.5
2731.0
20
30
40
50
60
70
80
90
100
Station (ft)

Wash I

HEC-RAS Plan: Plan 03 River: RIVER-1 Reach: Reach-1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7	PF 1	50.00	2784.14	2785.86	2786.15	2786.82	0.041077	7.86	6.36	7.51	1.50
Reach-1	6	PF 1	50.00	2778.10	2779.85	2780.22	2780.99	0.047685	8.57	5.84	6.64	1.61
Reach-1	5	PF 1	50.00	2772.66	2773.89	2774.14	2774.70	0.043982	7.22	6.92	10.54	1.57
Reach-1	4	PF 1	50.00	2768.37	2769.92	2770.18	2770.77	0.038173	7.42	6.74	8.58	1.47
Reach-1	3	PF 1	65.00	2764.31	2765.87	2766.22	2766.90	0.043829	8.14	7.99	9.95	1.60
Reach-1	2	PF 1	65.00	2760.53	2762.04	2762.48	2763.16	0.053335	8.49	7.66	10.43	1.75
Reach-1	1	PF 1	79.00	2754.90	2755.84	2756.06	2756.47	0.046038	6.70	13.77	33.46	1.58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40
60
80
100
Station (ft)
Legend
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Crit PF 1
WS PF 1
Ground
Bank Sta
washi Plan: Plan 03 8/20/2004
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Elevation (ft)
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60
80
100
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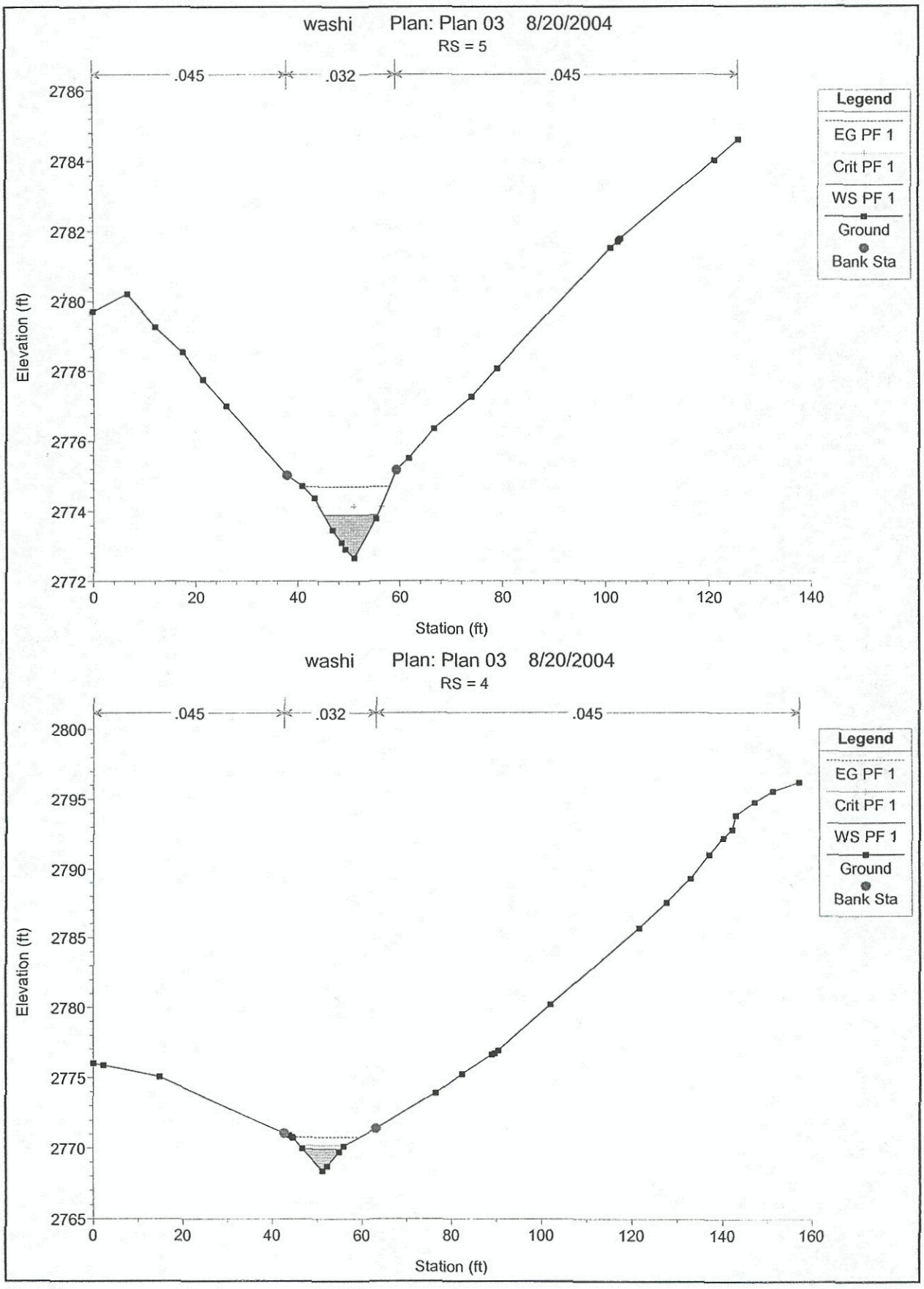
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta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Station (ft)
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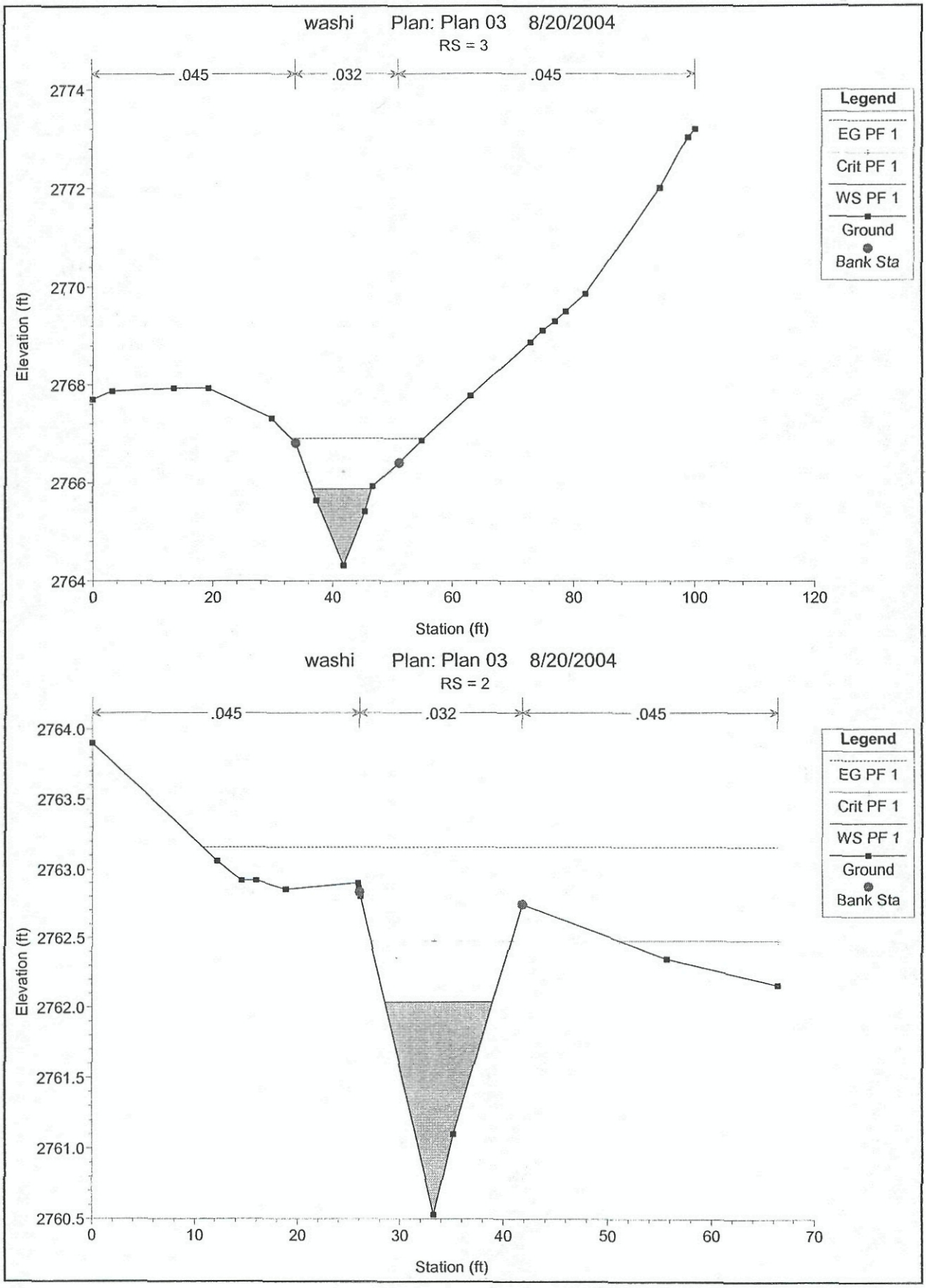
Bank Sta
Elevation (ft)
Station (ft)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Elevation (ft)
Station (ft)
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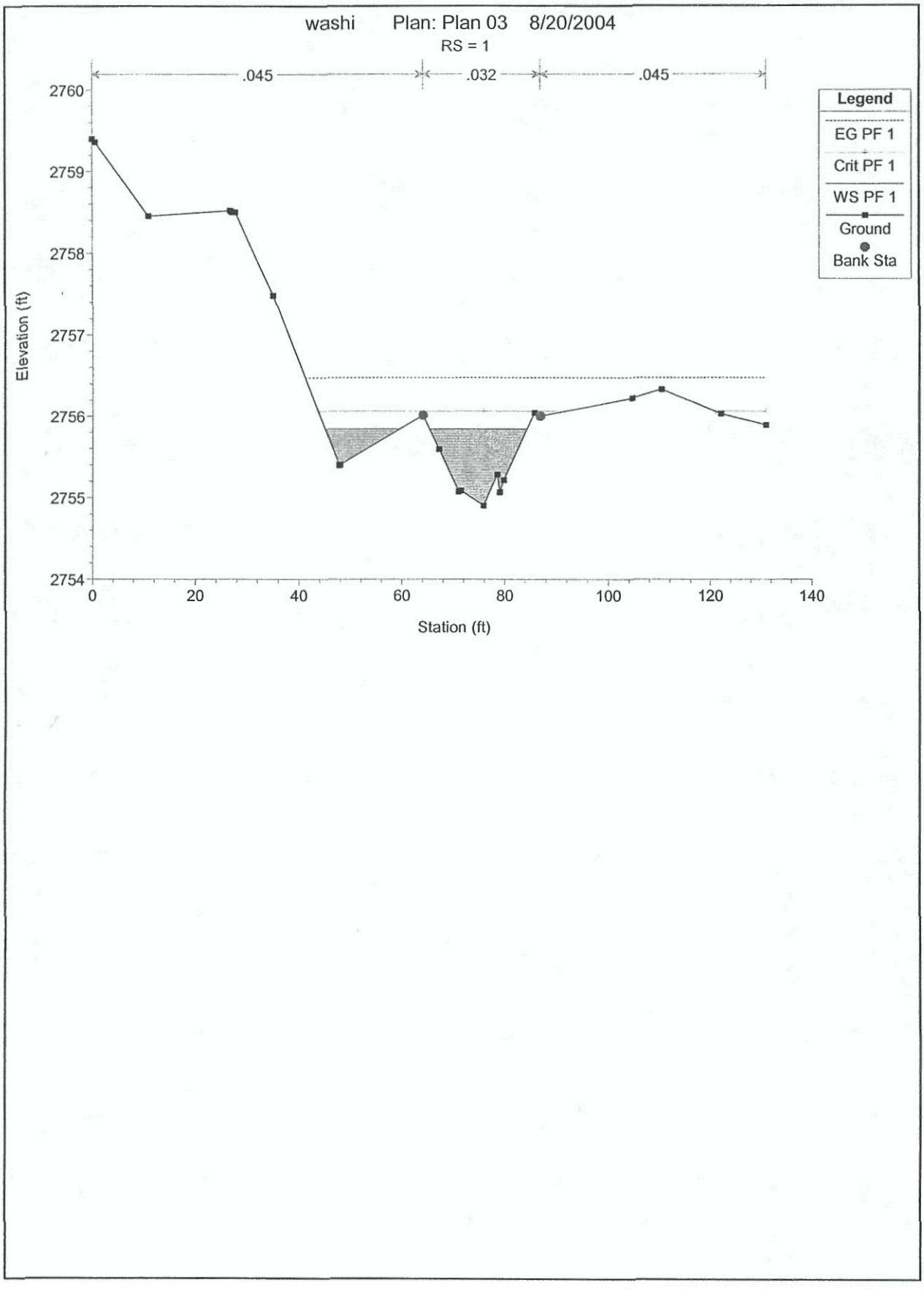
Elevation (ft)
Station (ft)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Ground
Bank Sta
Elevation (ft)
2760
2759
2758
2757
2756
2755
2754
0
20
40
60
80
100
120
140
Station (ft)

APPENDIX E

Detention Basin Volume Calculations

McDowell Mountain Back Bowl
Detention Basin Volume Calculations

Basin	Total Development Area (Acre)	100yr-2 hr. Volume (acre-ft)	Provided Volume (acre-ft)	Waiver Volume (acre-ft)
A1	3.79	0.53	0.17	0.36
A2	7.21	1.02	0.25	0.77
B	10.94	1.54	0.54	1
C	3.65	0.51	0.46	0.05
D	7.73	1.09	0.31	0.78
E1	14.24	2.01	0.89	1.12
E2	13.23	1.87	0.9	0.97
E3	2.19	0.31	0.16	0.15
F1	10.24	1.44	0.25	1.19
F2	3.56	0.5	0.18	0.32
F3	2.93	0.41	0.2	0.21
G	3.7	0.52	0.11	0.41
HI	12.94	1.82	0.31	1.51
H2	8.5	1.2	0.83	0.37
1	4.44	0.63	0.59	0.04
J	4.81	0.68		0.68
K	2.06	0.29		0.29
L	1.49	0.21		0.21
M	1.44	0.2		0.2
N	2.81	0.4		0.4
O	0.05	0.01		0.01
P	0.55	0.08		0.08
Q	1.73	0.24		0.24
R	0.52	0.07		0.07
S	0.18	0.02		0.02
Total	125	17.6	6.15	11.57

Q=(CIA)/12
Q is the volume in acre-ft
C = 0.6
I =2.82 in.
A =building envelope & roadway area in ACRES

'Total Development Area Includes the Right-of-Way for the Roads plus the Building Envelopes*

McDowell Mountain Back Bowl
Area Calculation Study
Wood/Patel

Section	S.F. Total Development Area	S.F. Drainage Area	Percent of Total Drainage Area, %
A1	164,942	2,502,397	7
A2	314,229	989,311	32
B	476,593	2,153,597	22
C	158,838	808,701	20
D	336,803	962,840	35
E1	620,146	1,714,032	36
E2	576,414	1,296,994	44
E3	95,400	204,569	47
F1	446,220	987,558	45
F2	154,889	397,173	39
F3	127,604	359,761	35
G	161,125	455,632	35
H1	563,578	1,639,478	34
H2	370,064	1,998,066	19
I	193,334	700,376	28

Area of Development Outside Specified Drainage Sections
588013.75 S.F.

Area of Right-of-Way Outside Specified Drainage Sections
94576.98 S.F.

APPENDIX F

Stormwater Storage Waiver Application

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ ___ - PP - ___

The applicant/developer must complete and submit this form to the city for processing and obtain approval of waiver request ***before submitting improvement plans***. Denial of the waiver may require a revised site plan be submitted to the Development Review Board.

Date: May 12, 2005 **Project Name:** McDowell Mountain Back Bowl

Project Location: 330ac. within Section II, T4N, R5E (122nd Street and Happy Valley Rd.)

Applicant Contact: Gordon Wark @Wood.Patel E-mail: gwark@woodpatel.com

Phone: 602-335-8500 Fax: 602-335-8580

Address: 2051 W. Northern Ave. Suite 100, Phoenix, AZ 85021

Waiver Criteria

A waiver is an intentional relinquishment of a claim or right. Before the city can waive some or all required stormwater storage, at least one of the following city ordinance criteria (**in bold**) must be met. Check the criteria that applies to this project and provide the engineering analyses that demonstrate that the effect of this waiver will not increase the potential for flooding on any property.

☐ 1. **The runoff has been included in a storage facility at another location.** The developer must demonstrate that runoff from this site will be safely conveyed to the other location through an adequately designed conveyance facility.

☐ 2. **Application is for a building permit to construct a single family residential structure.**

☐ 3. **Development is adjacent to a watercourse or channel that has been designed and constructed to handle the additional runoff flow without increasing the potential for flood damage to any other downstream property.** The developer must demonstrate that the watercourse has the extra capacity needed to convey the additional runoff.

☐ 4. **The development is for a parcel under one-half acre in an area where it can be demonstrated by engineering analysis that no significant increase in the potential for flood damage will be created by the development.**

☒ 5. **There is a possible conflict with the requirements of the city's Environmentally Sensitive Lands Ordinance** (city staff must make this determination).

By signing below, I certify that the stated project meets the ordinance criteria selected above.

Developer or Engineer (circle one) May 12, 2005 Date

Planning & Development Services Department

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-7000 • Fax: 480-312-7088

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ ___ - PP - ___

CITY STAFF TO COMPLETE THIS PAGE

Project Name McDowell Mountain Back Bowl

Check Appropriate Boxes:

☐ Meets waiver criteria (specify): ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

☐ Recommend approve waiver.

☐ Recommend deny waiver:

- ☐ None of waiver criteria met.
- ☐ Downstream conditions prohibit waiver of any storage.
- ☐ Other:

Explain: _____

_____

☐ Return waiver request:

- ☐ Insufficient data provided.
- ☐ Other: _____

Explain: _____

_____

Recommended Conditions of Waiver:

- ☐ All storage requirements waived.
- ☐ Pre development conditions must be maintained.
- ☐ Other:

Explain: _____

_____

☐ **Waiver approved per above conditions.**

☐ **Waiver denied.**

_____ _____

Floodplain Administrator/Engineering Coordination Manager Date

Planning & Development Services Department

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-7000 • Fax: 480-312-7088

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ____ ____ - ZN - ____ ____ - UP - ____ ____ - DR - ____ ____ - PP - ____

In-Lieu Fee Calculations

If the city grants a waiver, the developer is required to contribute the following In-Lieu Fees for the cost of drainage facilities as determined in 1, 2, or 3 below. Please check the appropriate box for determining the In-Lieu Fee.

Project Name McDowell Mountain Back Bowl

☐ 1. The fee is based on runoff contribution determined as follows:

_____

_____

_____

The scope and cost of drainage facilities that fees are being contributed towards include the following components:

- _____ $ _____
- _____ _____
- _____ _____

TOTAL In-Lieu Fee $ _____

☒ 2. The fee is based on what it would cost to provide the volume of storage being waived. Payment in-lieu of stormwater storage shall include all applicable costs, including, but not limited to:

- See Attached $ 271411
- _____ _____
- _____ _____

TOTAL In-Lieu Fee $ 271411

☐ 3. No In-Lieu Fee recommended by city staff.
Reason: _____

Approved by:

_____ _____

Floodplain Administrator/Engineering Coordination Manager Date

Planning & Development Services Department

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-7000 • Fax: 480-312-7088

2. The fee is based on what it would cost to provide the volume of storage being waived. Payment in-lieu of stormwater storage shall include all applicable costs, including, but not limited to:

• Land costs (documentation must be provided for verification of land costs)	$191,047
• Construction costs	
o Evacuation and disposal	$18,586
o Fill	$ 4,646
o Inlet and outlet structures	$ 4,000
o Overflow structures	$ 3,200
• Plant salvage and/or revegetation costs	$49,932
In-lieu Fees Total	**$271,411**

Detention Basin Volume Requirements

Site Data

Vp =	Volume provided =	6.15	ac-ft
Vr =	Required Volume =	17.61	ac-ft
Vn=	Needed Volume=	11.46	ac-ft
Area =	Total site area =	330	ac
NAOS =	Natural Area Open Space Area =	205	ac
Ad =	Net development area = Area - NAOS =	125	ac
P =	100 Yr - 2 Hr precipitation =	2.82	in
C =	Runoff coefficient =	0.6	
Vr =	Required volume = P/12*Ad*C =	17.6	ac-ft
Yb =	Average depth of detention basins =	3	ft
Ab =	Surface area for detention basins	3.8	ac
=		166440	sq ft
*Cut =	Average volume of excavation * 0.67 =	12391	cu yd
Fill =	Average volume of berm fill = cut * .5 =	6195	cu yd
EP =	Permanent erosion protection is the		
=	same regardless of basin size	15	cu yd
N =	Number of basins =	1	ea
Lp =	Length of pipe per basin =	80	ft

Construction Cost

Item No.	Description	Unit	Quantity	Unit Cost	Cost
1	Excavation	Cu. Yd.	12,391	$ 1.50	$ 18,586
2	Compacted Fill	Cu. Yd.	6,195	$ 0.75	$ 4,646
3	Outlet Pipe	Feet	80	$ 40.00	$ 3,200
4	Headwalls	Ea	2	$ 2,000	$ 4,000
5	Landscape	Sq. Ft.	166,440	$ 0.30	$ 49,932
				Totals =	$ 80,364
				Cost per ac. ft. of volume =	$ 7,011
				Cost per cu. yd. of volume =	$ 4
				Cost per acre =	$ 21,032
				Cost per basin =	$ 80,364

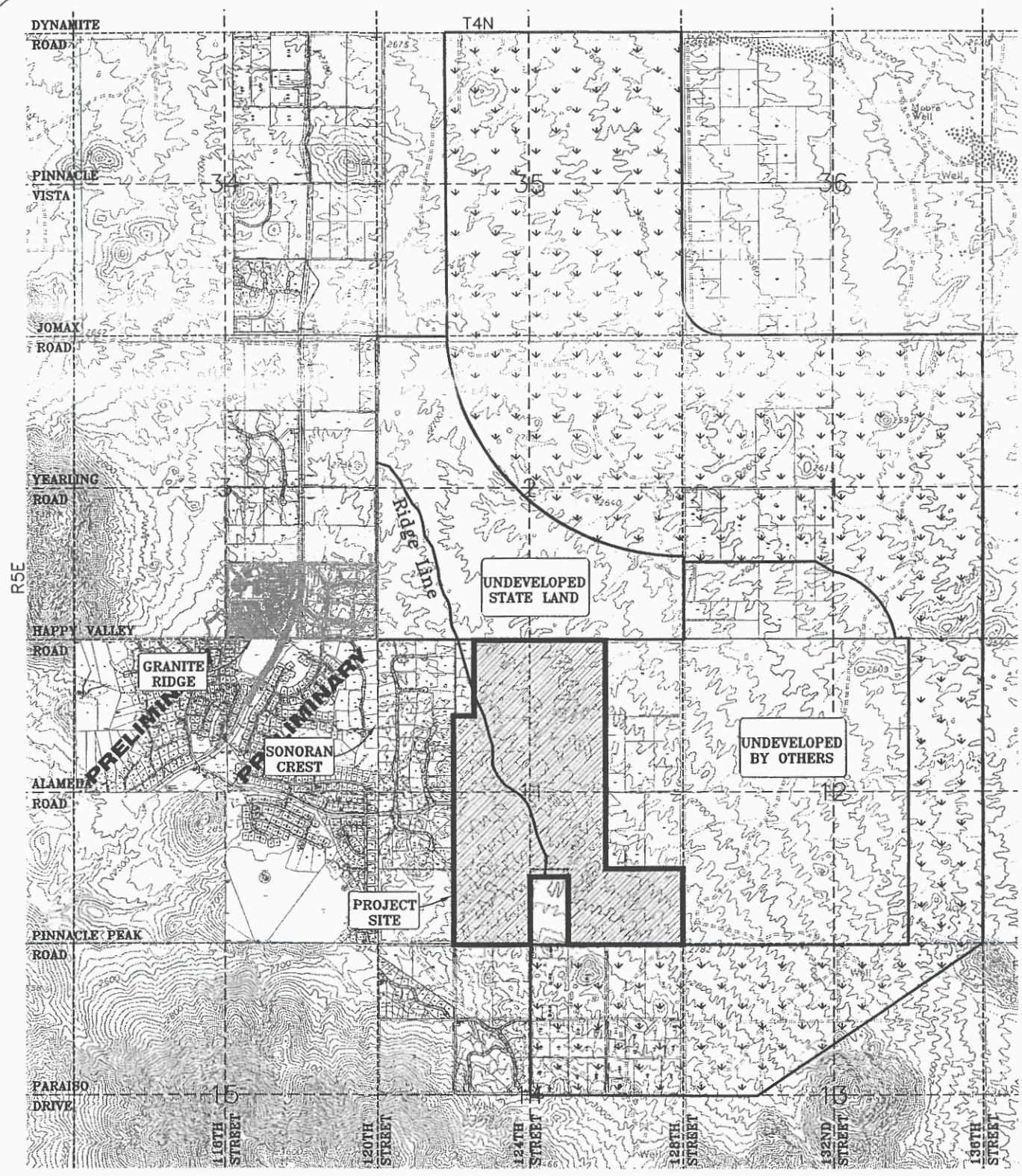
Estimated Cost for Payment in Lieu of Required Detention Volume

Required Land Area	3.8 ac	
Land Cost per Acre	$ 50,000	
Total Land Cost	3.9 ac x $50,000	$ 191,047
Required Volume	17.63 ac ft	
Volume Provided	6.15 ac ft	
Difference	11.48 ac ft	
Cost per ac ft of volume	$ 7,011	
Total Cost for Volume	11.57 ac ft x $7005	$ 80,449
Payment In-Lieu		$ 271,497

* This number assumes area of excavation in 2% - 3% slopes. Therefore it is multiplied by 0.67.

PLATE 1

Vicinity Map



CROWN COMMUNITY DEVELOPMENT
A Henry Crown Company

McDOWELL MOUNTAIN BACK BOWL

Plate 1
"Vicinity Map"

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500

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01/07/05

PLATE 2

Flood Insurance Rate Map (FIRM)

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A — No base flood elevations determined

ZONE AE — Base flood elevations determined

ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.

ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X — Areas determined to be outside 500-year floodplain

ZONE D — Areas in which flood hazards are undetermined

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas

Floodplain Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum

(D)—(D) — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum

RM7 × — Elevation Reference Mark

M2 — River Mile

97°07'30" 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection

NOTES

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated data, BFEs, and/or any revisions to the floodway delineations prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, VE, and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Corporate limits shown are as of the date of this map. The user should contact appropriate community officials to determine if corporate limit changes have been subsequent to the issuance of this map.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and/or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

For community map revision history prior to countywide mapping, see Section 8.0 of the Flood Insurance Study Report.

For adjoining map panels, and base map sources not separately printed, see Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

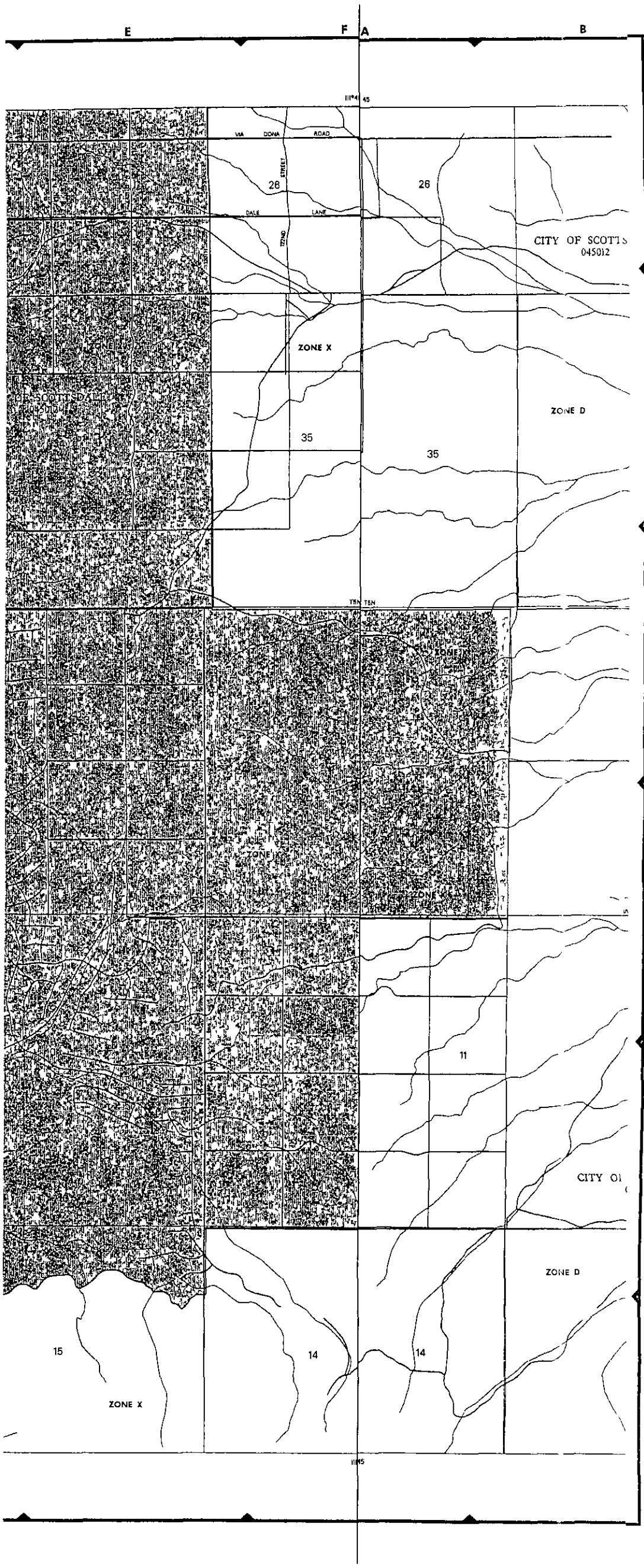
EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP
APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 2, 1993

Map revised July 19, 2001 to update corporate limits, to change base flood elevations, to add base flood elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

APPROXIMATE SCALE IN FEET
1000 0 1000



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Floodway Boundary

Zone D Boundary

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For adjoining map panels, and base map sources not separately printed, see Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

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COUNTYWIDE FLOOD INSURANCE RATE MAP
APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1255 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE, CITY OF	045012	1255	F

MAP NUMBER
04013C1255 F

MAP REVISED
JULY 19, 2001

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1260 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1260	E
SCOTTSDALE, CITY OF	045012	1260	E

MAP NUMBER
04013C1260 E

MAP REVISED
JULY 19, 2001

Federal Emergency Management Agency

CROWN COMMUNITY DEVELOPMENT
A Hearing Chevron Company

McDOWELL MOUNTAIN BACK BOWL

Plate 2
"Flood Insurance Rate Map"

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500

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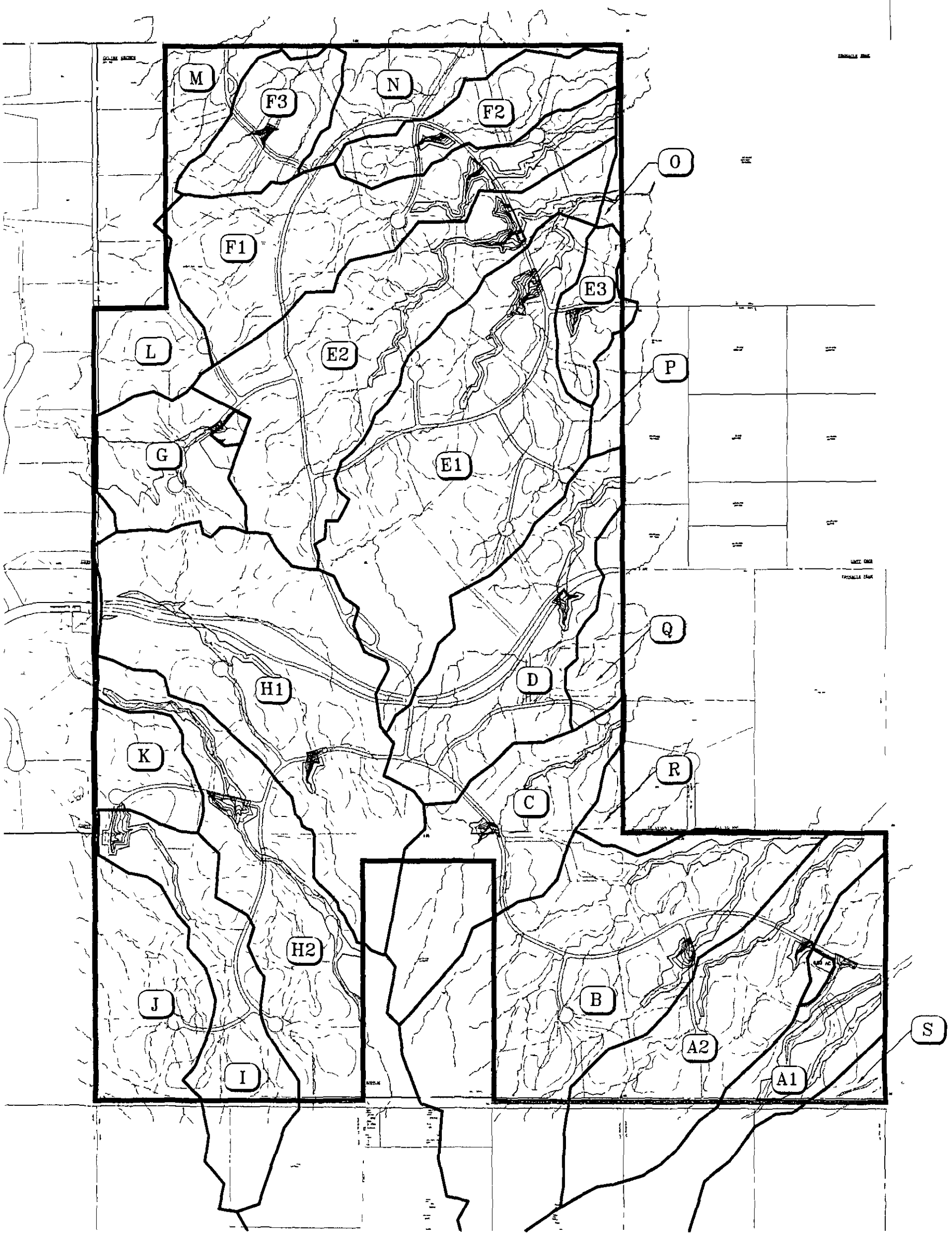
PLATE 3

Watershed Map



LEGEND

H2 HEC-1 SUB-BASIN ID S

SUB-BASIN BOUNDARY

ONLINE RETENTION BASINS

PROJECT BOUNDARY

EXISTING 5 FOOT CONTOURS

500 0 250 500

1 inch = 500 ft.

CROWN COMMUNITY DEVELOPMENT

A Div. of Crown C Corp

McDOWELL MOUNTAIN BACK BOWL

Plate 3

"Watershed Map"

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
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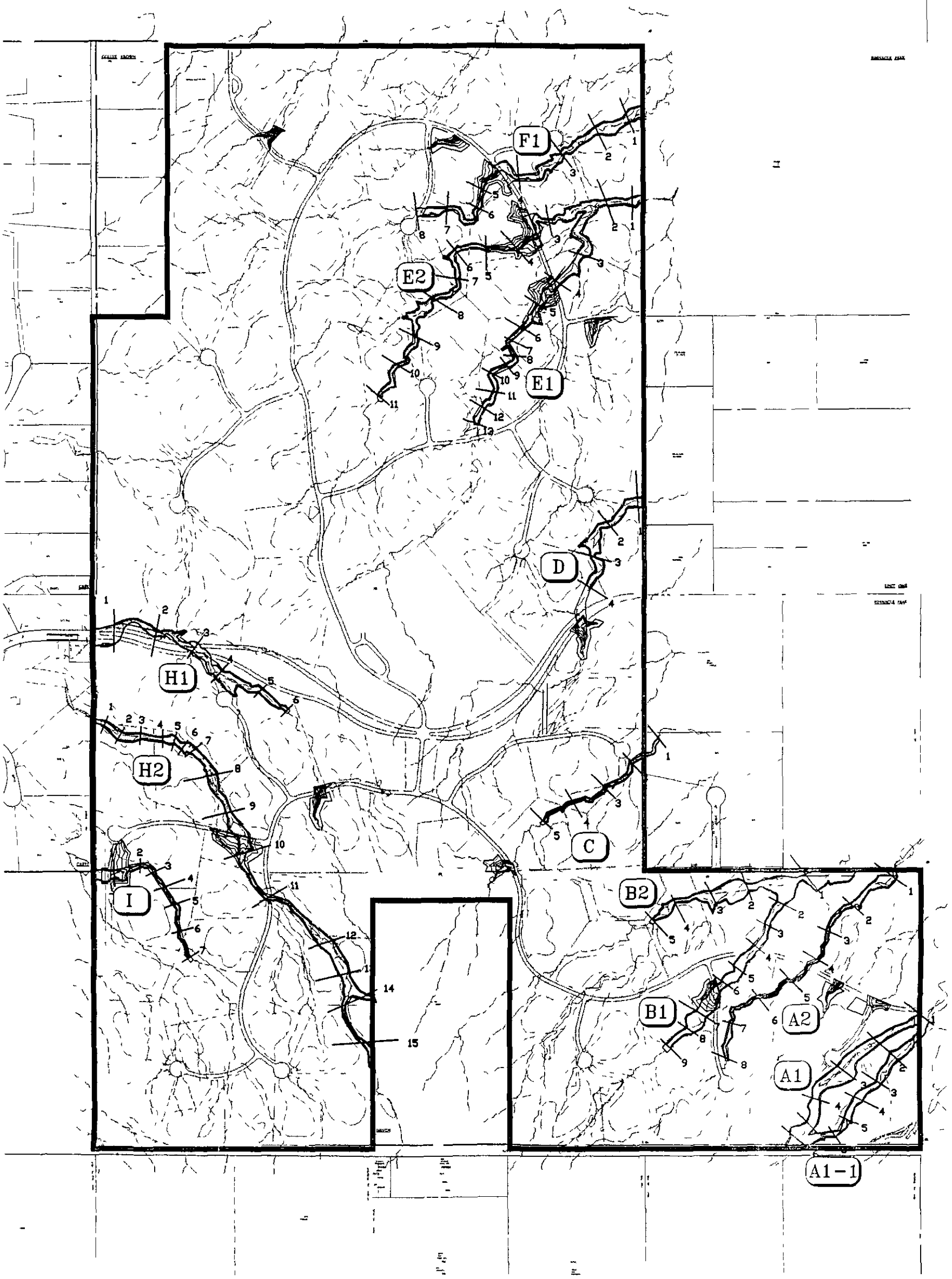
N \2004\042054\Project Support\Hydro\Exhibits\PLATE3-WATERSHED DWG

PLATE 4

Floodplain Exhibit



CROWN COMMUNITY DEVELOPMENT
A Kenny Crown Company

McDOWELL MOUNTAIN BACK BOWL

Plate 4
"Floodplain Exhibit"

WOOD/PATEL ASSOCIATES
Civil Engineers
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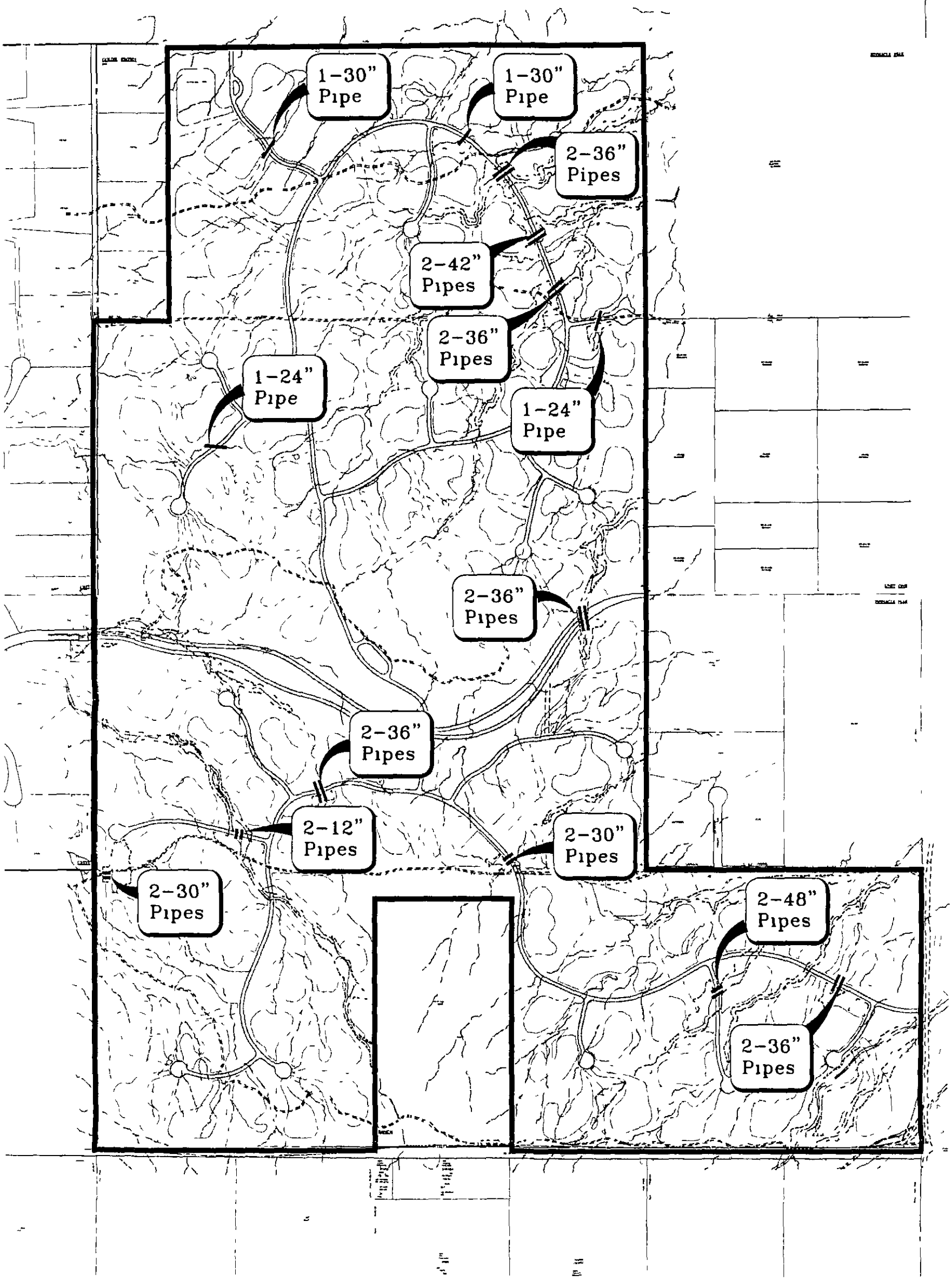
Land Surveyors
(602) 335-8500

N \2004\042054\Project Support\Hydro\Exhibits\PLATE4-HEC-RAS DWG

PLATE 5

Major Culverts



500 0 250 500

1 inch = 500 ft

LEGEND

PIPES

PROJECT BOUNDARY

EXISTING 5 FOOT CONTOURS

CROWN COMMUNITY DEVELOPMENT
A Henry Crown Company

McDOWELL MOUNTAIN BACK BOWL

Plate 5
"Major Culverts"

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 335-8500

N \2004\042054\Project Support\Hydro\Exhibits\PLATE5-CULVERTS.DWG

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James S Campbell, PE
Thomas R. Gettings, R.L S
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May 12, 2005

Mr Tim Curtis, AICP
Senior Planner
City of Scottsdale, Community Development
7447 East Indian School Road
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Scottsdale, AZ 85251

Phone (480) 312-4210
Fax (480) 312-7088
Email tcurtis@scottsdaleaz gov

Re **McDowell Mountain Back Bowl**
1st Review Drainage Master Plan Comments – Response
City of Scottsdale
WP #042054

In response to your 1st review comments dated March 9, 2005, the following are our responses

Drainage Master Plan Comments:

Comment (c) This site qualifies for a stormwater storage waiver (SSW), which allows the developer to pay in lieu fees, rather than construct detention basins to store stormwater runoff Please submit a drainage report and apply for a stormwater storage waiver (SSW) The SSW needs to include documentation of present day land values, such as recent certified land appraisal Also, provide estimated construction cost for the proposed drainage improvements as part of the in-lieu fees calculations Construction cost documentation needs to be submitted with the SSW, and include a detailed quantity takeoff and a cost estimate Please state how the construction cost estimate was determined and what publications were used for the cost basis, such as ADOT sample bid prices, Means Construction Cost Estimator Texts or other equivalent methods

Response (c) ***An application for a request for a stormwater storage waiver will be submitted to the City of Scottsdale. Supporting documentation for this application and a copy of the request has been attached with the drainage report.***

Comment (d) The computations for the in-lieu fees shall be based on providing full stormwater storage for the 100-year, 2-hour storm event as described in the City of Scottsdale Design Standards and Policy Manual

Response (d): ***We have added calculations for the in-lieu fees. Please see attached Stormwater Storage Waiver application.***

Comment (e) Post-development stormwater discharge flowrates shall not exceed pre-development stormwater discharge flowrates

Response (e): ***We have updated the design concept so that post-development flows are at or below pre-development flows.***

Comment (f) Submit 2 copies of a revised drainage report addressing the drainage comments to the City's One Stop Shop for a Stormwater Storage Waiver review Pay a Stormwater Storage Waiver review fee of $619 00

Response (f): ***We will submit to the One Stop Shop with the review fee.***

Comment (g) Please provide the following information in the drainage report and on the Grading and Drainage Plan

Response (g). ***We will add this information to the Grading and Drainage Plan at the time of Improvement Plan submittal.***

Comment (h) Use bold lines to delineate the drainage sub areas and show all grade breaks on the Grading and Drainage Plan

Response (h). ***We have updated sub areas to bold lines. We will add grade breaks to the Grading and Drainage Plan at the time of Improvement Plan submittal.***

Comment (i) Calculate the volume required and volume provided in each drainage sub area

Response (i): ***We have added the volume calculations to the Drainage Report. Please see Appendix E for details.***

Comment (j) Demonstrate that on-site stormwater runoff from each drainage sub area is accounted for in specific drainage detention basin Calculate and show the percentage runoff that is contributed from each drainage sub area to a specific drainage basin Use a table or spreadsheet format to show the results

Response (j): ***We have added a spreadsheet to show the results. Please see Appendix E for details***

Comment (k) Please do not use staples to hold the drainage report together The drainage report shall be bound (3-ring, GBC, or Coil wire, no staples) with card stock front and back covers, and must include all required exhibits, full color topographic aerial maps and grading and drainage plans Full size plans/maps shall be folded and contained in pockets

Response (k): ***Will comply***

If you have any questions, please contact me

Sincerely,

WOOD, PATEL & ASSOCIATES, INC.

Gordon W R Wark, P E
Senior Vice President

GWRW/km

Y \WP\General Correspondence\042054 MMBB 1st Review Drainage MP City Comments Response doc