SPRINGS AT WATERVIEW
DRAINAGE LETTER
EL PASO COUNTY, COLORADO

July 2019

PREPARED FOR:

SWV, LLC
31 N. Tejon, Suite 500
Colorado Springs, CO 80903

PREPARED BY:

Dakota Springs Engineering
31 N. Tejon Street, Suite 500
Colorado Springs, CO 80903
719.227.7388

PROJECT NO.16-01

PCD No. SP-16-005
PCD No. SF-16-017

CERTIFICATIONS

Design Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____ Seal

Charles K. Cothern, P.E. #24997

Owner/Developer's Statement:

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.

By (signature): _____ Date: _____

Title: _____

Address: _____

_____

El Paso County:

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

_____ _____

Jennifer Irvine, P.E., Date

County Engineer / ECM Administrator

Table of Contents

Appendix

1.0 INTRODUCTION

This report is an amendment to the Preliminary & Final Drainage report prepared by Dakota Springs Engineering and approved October 16, 2018.

Purpose

The purpose of this report is to present revisions to the preliminary and final drainage improvements associated with the construction of Springs at Waterview. Revisions are associated with previously proposed conveyance of storm flows, specifically construction of open channels in place of some of the previously proposed storm sewer pipe along Grinnell Boulevard. No changes have been made concerning onside or offsite hydrology or acceptance of offsite storm water through the site.

2.0 General Location and Description

Location

Springs at Waterview is a planned 85-unit multi-family residential development within the north half of the northeast quarter of Section 7, Township 15 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. It is located south of Goldfield Drive, east of Grinnell Boulevard, north of Bradley Road and west of Painted Sky at Waterview Filing No. 1. This portion of the Waterview development is in the Windmill Gulch Drainage Basin.

Description of Property

The proposed site encompasses 15.68 acres. The topography of the site and surrounding area is typical of a high desert; short prairie grass and weeds with slopes generally ranging from 1% to 9%. The area generally drains to the west.

The site is comprised of several different soil types. From the Soil Survey of El Paso County, the site falls into the following soil types:

1. "3" Ascalon sandy loam, 3 to 9 percent slopes.
2. "8" Blakeland loamy sand, 1 to9 percent slopes.
3. "97" Truckton sandy loam, 3 to 9 percent slopes.

The Blakeland and Truckton soils are classified at Hydrological Group A and the Ascalon soil is classified as Hydrological Group B. Note: "#" indicates Soil Conservation Survey soil classification number. Hydrologic Soil Group B was used in the preparation of this report. See Appendix A: Soils Data.

3.0 Drainage Basins and Sub-Basins

Include the referenced data.

Major Basin Description

Springs at Waterview residential development is located within the Windmill Gulch Drainage Basin. This report complies with the Windmill Gulch Drainage Basin Planning Study (DBPS) by Wilson and Company, the Master Development Drainage Plan for Waterview by Merrick and Company, the

Preliminary Drainage Report for Waterview Phase II, also by Merrick and Company and Painted Sky at Waterview Filing 1 and 2 Final Drainage Report by Merrick and Company and the Approved Springs at Waterview PDR/FDR. All developed runoff will meet El Paso County standards for discharge rates.

Floodplains

The Flood Insurance Rate Map (FIRM No. 08041C0764-G dated 12/7/2018) indicates that there is no floodplain in the vicinity of the proposed site. See Figure 2: FIRM.

Include the referenced data.

4.0 DRAINAGE BASINS

Existing Drainage Analysis

Please refer to the Preliminary and Final Drainage Report for Springs at Waterview, Approved on October 16, 2018, for existing drainage analysis.

Proposed Drainage Analysis

Please refer to the Preliminary and Final Drainage Report for Springs at Waterview, Approved on October 16, 2018, for proposed drainage analysis.

Proposed Storm System

The proposed storm water conveyance system presented in the approved Preliminary and Final Drainage Report of Springs at Waterview remains unchanged except for the facilities that parallel Grinnell Blvd.

The proposed revision to the system parallel to Grinnell Blvd is to replace the storm pipe with open channels. These channels will convey the developed runoff to the existing concrete box culvert under Grinnell Blvd. Hydraulic computations for the proposed channels are contained in the appendix of this letter.

The hydraulic analysis contained in the appendix of the report divides the system parallel to Grinnell Blvd into three reaches, North Reach, South Reach and East Reach. The North Reach is the channel that runs between Goldfield Dr. and the concrete box culvert that crosses under Grinnell Blvd. This reach flows southerly. The South Reach is the channel that runs northerly parallel to Grinnell Blvd between Bradley Rd. and the box culvert under Grinnell Blvd. The East Reach is a short section of channel between the outfall of the storm drain running east-west through the development. And the South Reach. This reach flows westerly and has its confluence with the South Reach approximately 115 feet south of the concrete box culvert under Grinnell Blvd.

There is a section (section 100) in the south channel where the hydraulic computations show a velocity in excess of 5.0 fps (6.71 fps). This section is just downstream of the confluence with the east channel. Current and proposed design calls for rip rap lining of the channel in this area.

There is a section (section 200) in the north channel where the hydraulic computations show a velocity in excess of 5.0 fps (5.91 fps). This section is approximately 100 feet upstream of the box culvert under Grinnell Blvd. The existing design does not call for riprap lining in this area. The design will be revised

to show the necessary riprap lining of the channel in this area. The extents of the additional riprap will be down steam to the currently designed rip rap lining and 25 feet upstream of the section

5.0 DRAINAGE FEES, COST ESTIMATE & MAINTENANCE

There are no additional fees required for this development as a result of the amendments to the approved Preliminary and Final Drainage Report for Springs at Waterview, presented in this Drainage Letter. Those portions of the approved drainage report that established fees for this development remain unchanged. The amendment only addresses changes in conveyance along Grinnell Blvd.

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6.0 REFERENCE MATERIALS

1. "City of Colorado Springs/El Paso County Drainage Criteria Manual" May 2014.

2. "Windmill Gulch Drainage Basin Planning Study", Wilson and Company, February 1992.

3. Master Development Drainage Plan for Waterview, May 2006. Prepared by Merrick & Co.

4. Preliminary Drainage Report for Waterview Phase II, January 2007. Prepared by Merrick & Co.

5. Final Drainage Report for Painted Sky at Waterview Filings 1 and 2, January 2007. Prepared by Merrick & Co.

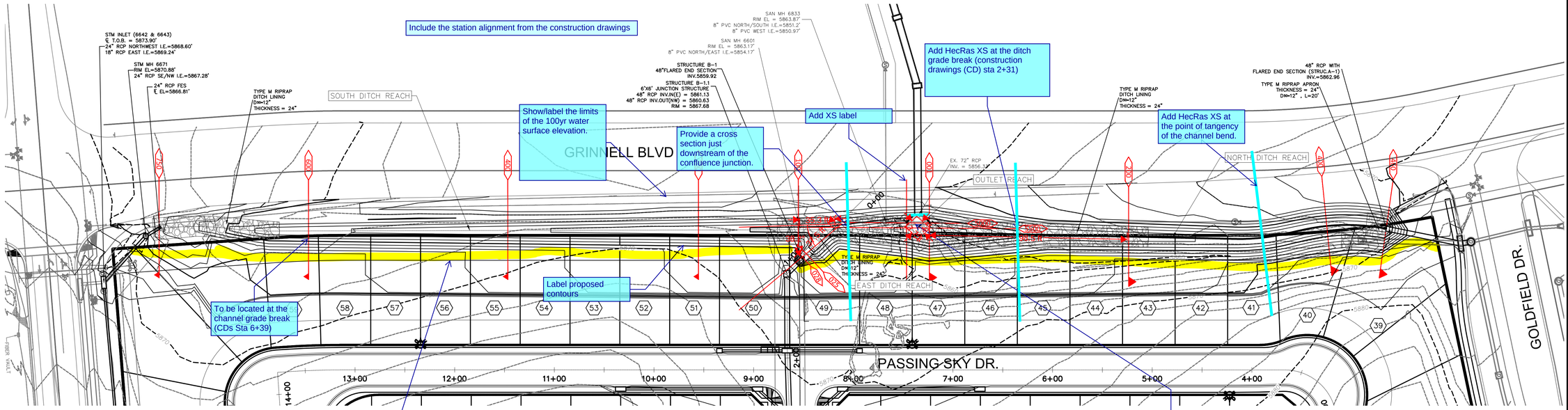
6. Soils Survey of El Paso County Area, Natural Resources Conservation Services of Colorado.

7. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

8. "City of Colorado Springs/El Paso County Drainage Criteria Manual, Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices" May 2014.

9. Springs at Waterview Preliminary and Final Drainage Report, October 2018, Prepared by Dakota Springs Engineering.

- Include the vicinity map from the previous submittal.
- Per the previous comments, include the existing drainage map.
- Per the previous comments, include the proposed drainage map. (See previous redline comments for what needs to be updated on the drainage map. Drainage Map with comments is inserted at the end of this report)



HEC–RAS SECTION MAP

NORTH, EAST, & SOUTH REACHES

Plat must be revised to note the 25' drainage easement as a no-build/no storage of material drainage easement and restriction that fencing shall not be installed within the drainage easement.

The modeling for the outlet reach cross section and junction is not correct. Revise.

1. Cross sections should not overlap or extend into another reach's flow path/cross section (the ends may touch upstream of junctions).
Note: Double check the modeling for the confluence junction. This will also be reviewed in detail on the next submittal when the HEC-RAS model is provided.

2. The model also shows normal depth boundary condition at the outlet reach which does not reflect the actual condition. By defining normal depth the model has assumed continuation of an open channel similar to the geometry of XS5000 to establish the initial water elevation. However the actual condition is not an open channel but a culvert pipe. The model needs to include the culvert crossing.

Provide the HEC-Ras profile with cross section locations shown.

N

50 0 50 100

1" = 50'

PDF: 13 – STORM A PROFILE.PDF

REVISIONS:		
NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: CEB DATE: 8/28/19
DRAWN BY: CEB DATE: 8/28/19
CHECKED BY: CC DATE: 8/28/19

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1–800–922–1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES
GAS, ELECTRIC, WATER AND WASTEWATER

DSE Dakota Springs Engineering
31 N. TEJON, SUITE 500
COLORADO SPRINGS, CO 80903
P: (719) 227–7388
F: (719) 227–7392

PROJECT SPRINGS AT WATERVIEW
SHEET TITLE HEC–RAS EXHIBIT
FROM START TO END
JOB NO. 0102.1 SHEET 1 OF 1

HEC-RAS Plan: 100 YR Profile: 100 Yr

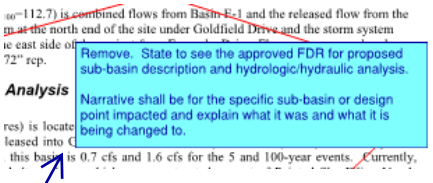
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Ditch	South	750	100 Yr	16.79	5866.90	5867.40	5867.40	5867.57	0.026977	3.27	5.13	15.89	1.01
South Ditch	South	600	100 Yr	16.79	5862.22	5863.23		5863.31	0.005152	2.36	7.10	10.06	0.50
South Ditch	South	400	100 Yr	16.79	5861.22	5863.07		5863.09	0.000423	0.95	17.74	15.13	0.15
South Ditch	South	200	100 Yr	16.79	5860.22	5863.05		5863.06	0.000065	0.47	35.67	21.15	0.06
South Ditch	South 2	100	100 Yr	160.00	5859.72	5861.95	5861.95	5862.65	0.028635	6.71	23.84	17.40	1.01
South Ditch	South 2	000	100 Yr	160.00	5856.00	5859.83		5860.01	0.004562	3.43	46.71	23.29	0.43
Outlet	Outlet	5500	100 Yr	299.47	5856.50	5859.95		5859.96	0.000314	0.88	340.44	203.56	0.11
Outlet	Outlet	5000	100 Yr	299.47	5858.07	5859.78	5859.40	5859.94	0.010019	3.25	92.01	94.09	0.58
North Ditch	North	460	100 Yr	101.57	5862.96	5865.15		5865.34	0.004336	3.52	28.82	19.65	0.51
North Ditch	North	400	100 Yr	101.57	5862.67	5864.94	5864.17	5865.10	0.003483	3.24	31.38	20.64	0.46
North Ditch	North	200	100 Yr	101.57	5861.67	5863.16	5863.16	5863.71	0.018279	5.91	17.19	15.98	1.00
North Ditch	North	001	100 Yr	101.57	5856.50	5859.93		5859.97	0.001030	1.72	59.10	27.51	0.21
East Ditch	East	028	100 Yr	143.64	5859.96	5862.57		5862.78	0.006542	3.72	38.61	22.63	0.50
East Ditch	East	025	100 Yr	143.64	5859.91	5862.33		5862.68	0.013892	4.69	30.60	22.55	0.71

All values on the Qtotal does not match the previous report.

Examples: The approved FDR showed the following flows at the following river station:

-South ditch station 750 = 24.1 cfs (DP K)
-South ditch station 000 is equivalent to FDR Stormcad pipe P-19 which shows 148 cfs

-East Ditch station 028 is equivalend to FDR Stormcad pip P-18 which shows Q = 130 cfs


(60=112.7) is combined flows from Basin E-1 and the released flow from the
m at the north end of the site under Goldfield Drive and the storm system
ie east side of
72" rcp.

Analysis

res) is locate
leased into C
this basin is 0.7 cfs and 1.6 cfs for the 5 and 100-year events. Currently,

Remove. State to see the approved FDR for proposed sub-basin description and hydrologic/hydraulic analysis.

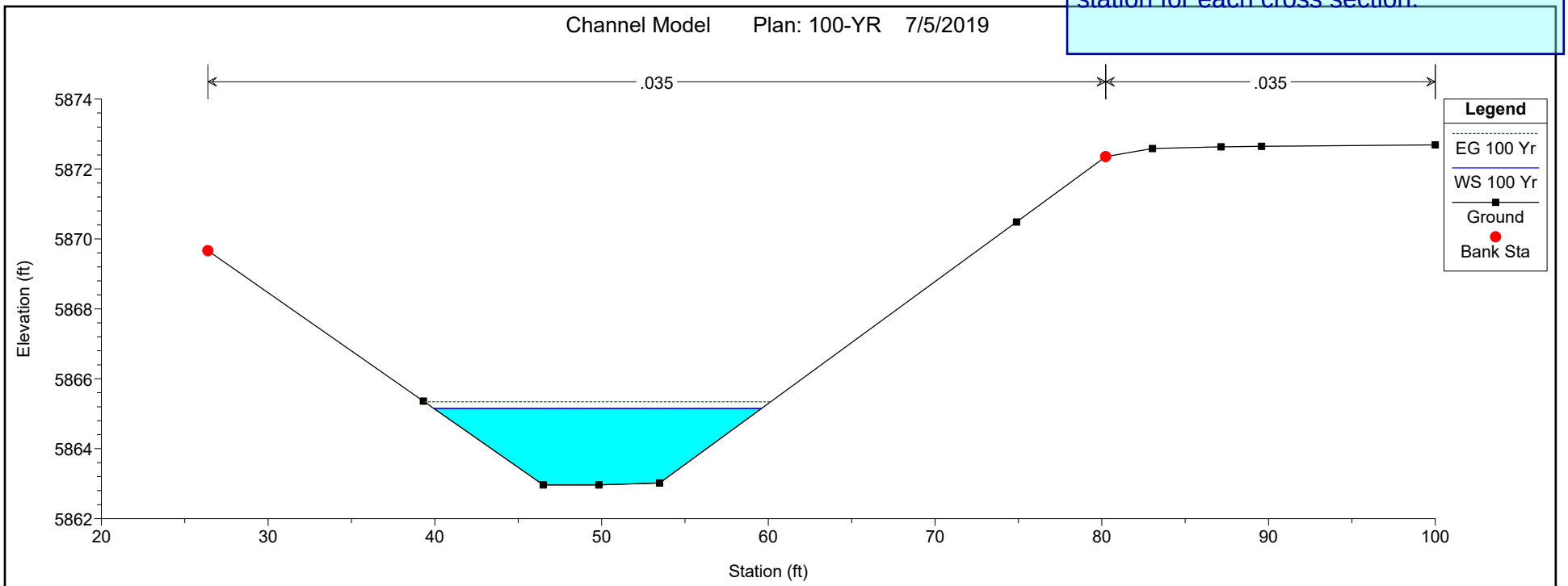
Narrative shall be for the specific sub-basin or design point impacted and explain what it was and what it is being changed to.

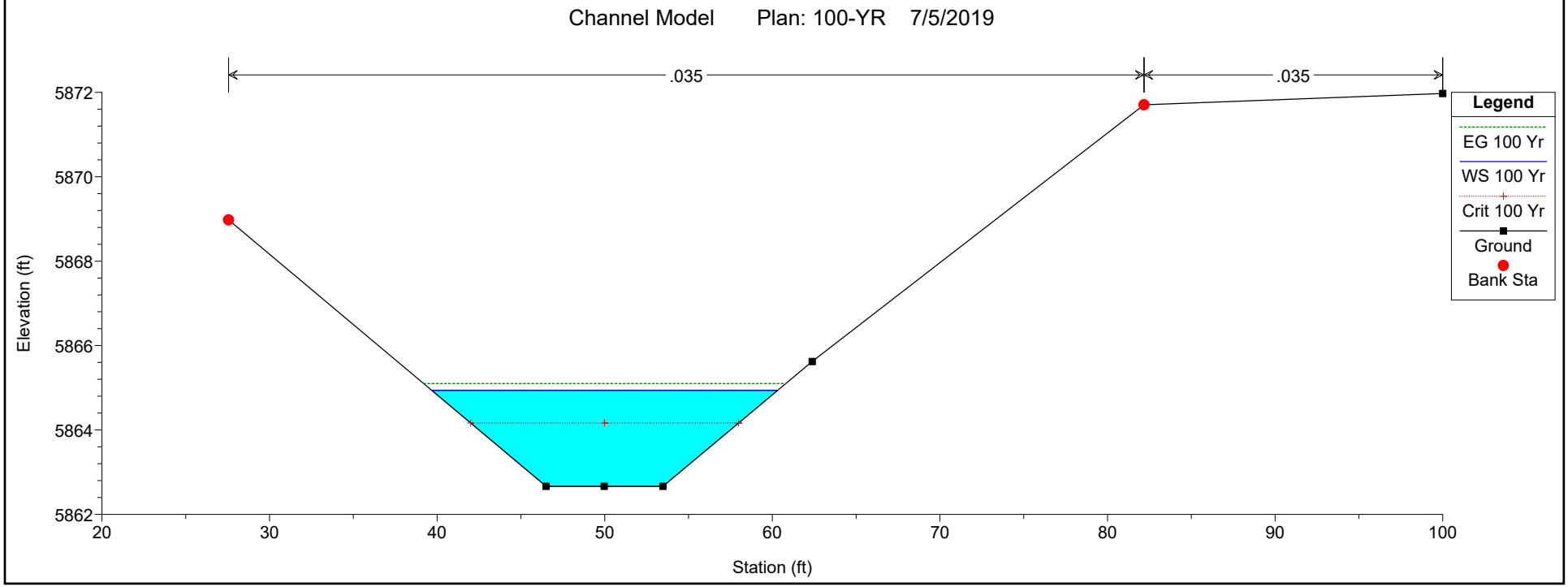
Per the previous review comment, for Section 3.0, provide a narrative for any sub-basin or design point that's changed. If the StormCAD model is now different, then include the updated model and highlighting the segments that has changed.

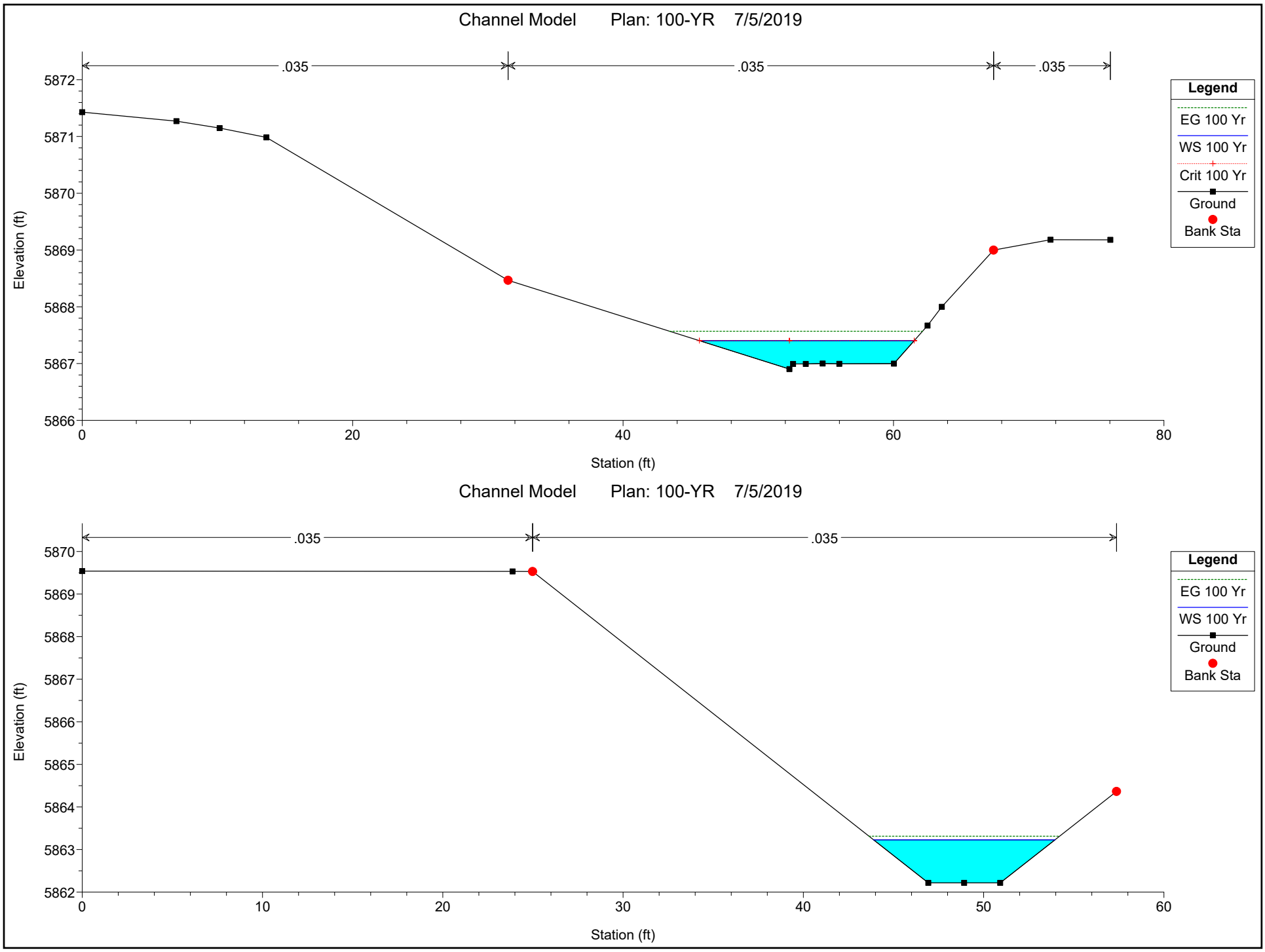
SPRINGS AT WATERVIEW - STORMCAD OUTPUT 100 YEAR

Label	Up. Node	Dn. Node	L (ft)	Size	Q Full (cfs)	System Q (cfs)	Avg. v (ft/s)	Up. Gr Elev. (ft)	HGL In (ft)	Up. Invert (ft)	Up. Cover (ft)	Dn. Gr. Elev. (ft)	In
P-19	Area Inlet DP 42a	Area Inlet DP 43	121.0	72 inch	148.1	285.5	10.19	5864.51	5863.26	5856.93	1.58	5863.79	5
P-25	Area Inlet DP 43	J-8	11.0	72 inch	239.1	285.5	11.31	5863.79	5862.36	5856.38	1.41	5863.50	5
EX P-1	J-8	J-9	128.0	72 inch	239.1	463.0	16.51	5863.50	5861.54	5856.33	1.17	5862.26	5
EX P-2	J-9	J-10	71.3	72 inch	238.8	518.8	17.97	5862.26	5853.20	5847.60	8.66	5854.50	5
EX P-3	J-10	J-11	97.5	72 inch	238.7	518.2	17.95	5854.50	5845.27	5840.06	8.44	5853.70	5
EX P-4	J-11	O-1	143.4	72 inch	238.6	300.1	11.78	5853.70	5843.61	5838.41	9.29	5845.00	5
P-4	Inlet D-7	Inlet DP A	60.0	18 inch	6.8	18.8	9.80	5881.53	5879.12	5877.84	2.19	5881.02	5
P-3	Inlet D-8	Inlet DP A	63.0	18 inch	4.1	15.6	7.41	5881.53	5878.25	5877.29	2.74	5881.02	5
P-1	Ex System Flow East	MH 1	73.0	48 inch	86.1	254.4	18.29	5899.57	5884.38	5881.07	14.50	5884.39	5
P-2	MH 1	Inlet DP A	80.0	48 inch	86.1	253.4	18.23	5884.39	5879.51	5876.20	4.19	5881.02	5
P-15	MH 2	Inlet DP F	54.0	66 inch	122.7	403.6	14.90	5872.56	5867.69	5863.81	3.25	5872.94	5
P-18	Inlet DP F	Area Inlet DP 42a	115.0	66 inch	130.0	720.9	23.01	5872.94	5866.70	5862.73	4.71	5864.51	5
P-16	Inlet D-16	Inlet DP F	63.0	18 inch	2.1	22.9	8.09	5873.45	5870.28	5869.73	2.22	5872.94	5
P-22	Ex System Flow North	MH 7	38.0	48 inch	82.7	127.6	10.81	5872.56	5866.61	5863.35	5.21	5871.42	5
P-23	MH 7	Inlet D-17	367.0	48 inch	82.7	129.4	10.92	5871.42	5866.11	5862.75	4.67	5865.25	5
P-24	Inlet D-17	Area Inlet DP 43	142.0	48 inch	86.6	125.8	10.85	5865.25	5862.85	5859.47	1.78	5863.79	5
P-17	Inlet D-15	Inlet DP F	63.0	18 inch	3.0	22.9	8.93	5873.46	5870.38	5869.72	2.24	5872.94	5
P-11	Inlet DP B	MH 2	25.0	30 inch	11.7	41.0	7.21	5873.06	5868.71	5867.06	3.50	5872.56	5
P-14	Inlet DP C	MH 2	5.0	30 inch	10.1	89.9	12.12	5873.04	5868.61	5867.05	3.49	5872.56	5
P-12	Inlet D-14	Inlet DP E	135.0	18 inch	5.1	11.0	6.09	5874.52	5871.13	5870.26	2.76	5873.06	5
P-13	Inlet DP E	Inlet DP C	28.0	24 inch	9.0	36.8	9.67	5873.06	5869.86	5868.29	2.77	5873.04	5
P-9	Inlet D-11	Inlet DP D	128.0	18 inch	4.9	11.1	6.11	5874.66	5871.25	5870.40	2.76	5873.24	5
P-10	Inlet DP D	Inlet DP B	28.0	24 inch	10.3	40.6	10.77	5873.24	5870.11	5868.46	2.78	5873.06	5
P-5	Inlet DP A	MH-6	34.0	48 inch	98.9	181.0	14.72	5881.02	5877.12	5873.41	3.61	5880.27	5
P-8	MH-6	MH 2	184.0	48 inch	102.1	228.6	17.68	5880.27	5873.23	5869.47	6.80	5872.56	5
P-7	Inlet D-10	MH-6	25.0	18 inch	1.9	22.1	7.85	5881.03	5877.00	5876.48	3.05	5880.27	5
P-6	Inlet D-9	MH-6	45.0	18 inch	2.9	14.9	6.56	5881.19	5877.08	5876.28	3.41	5880.27	5

Identify the corresponding reach and station for each cross section.



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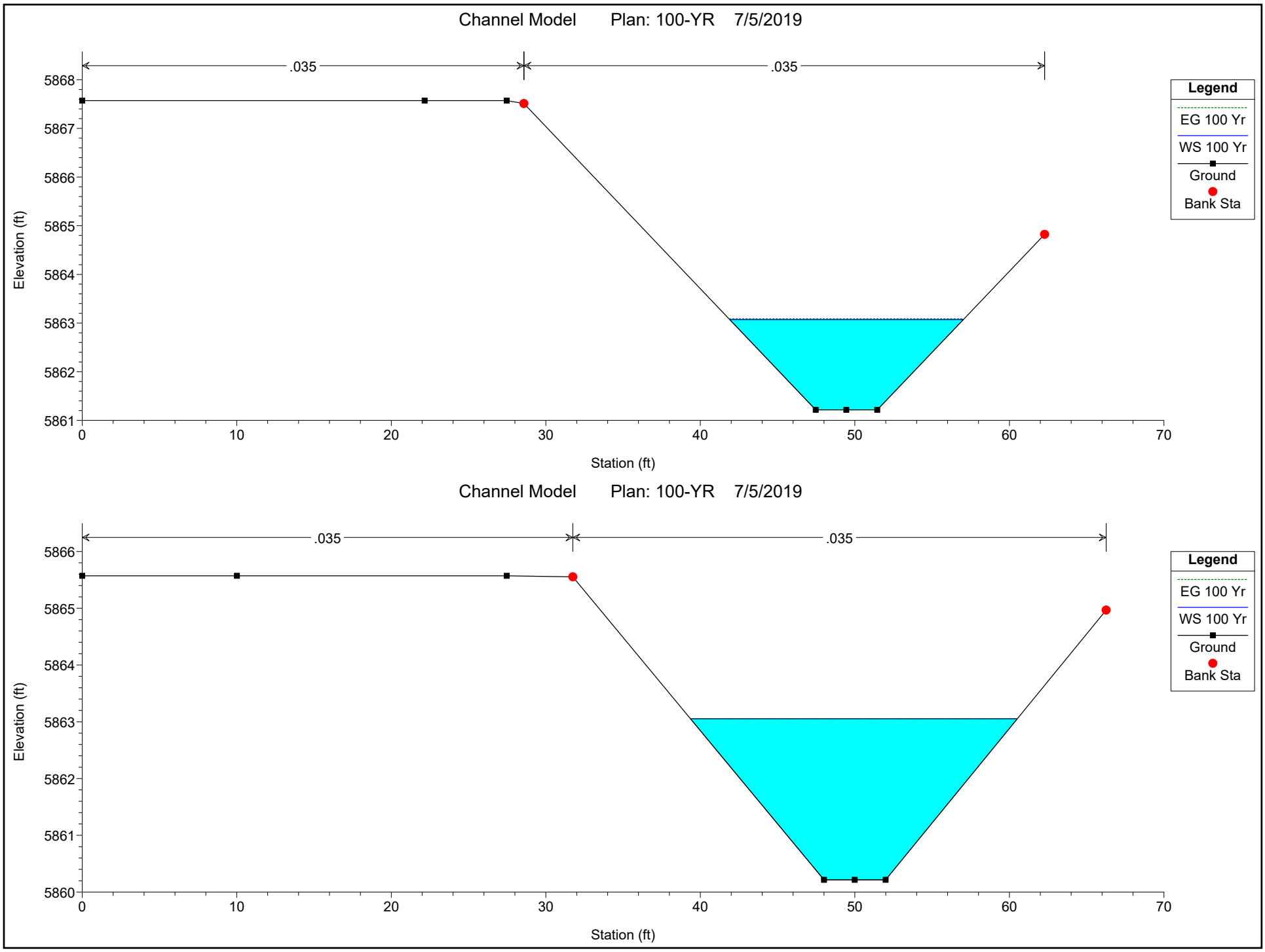
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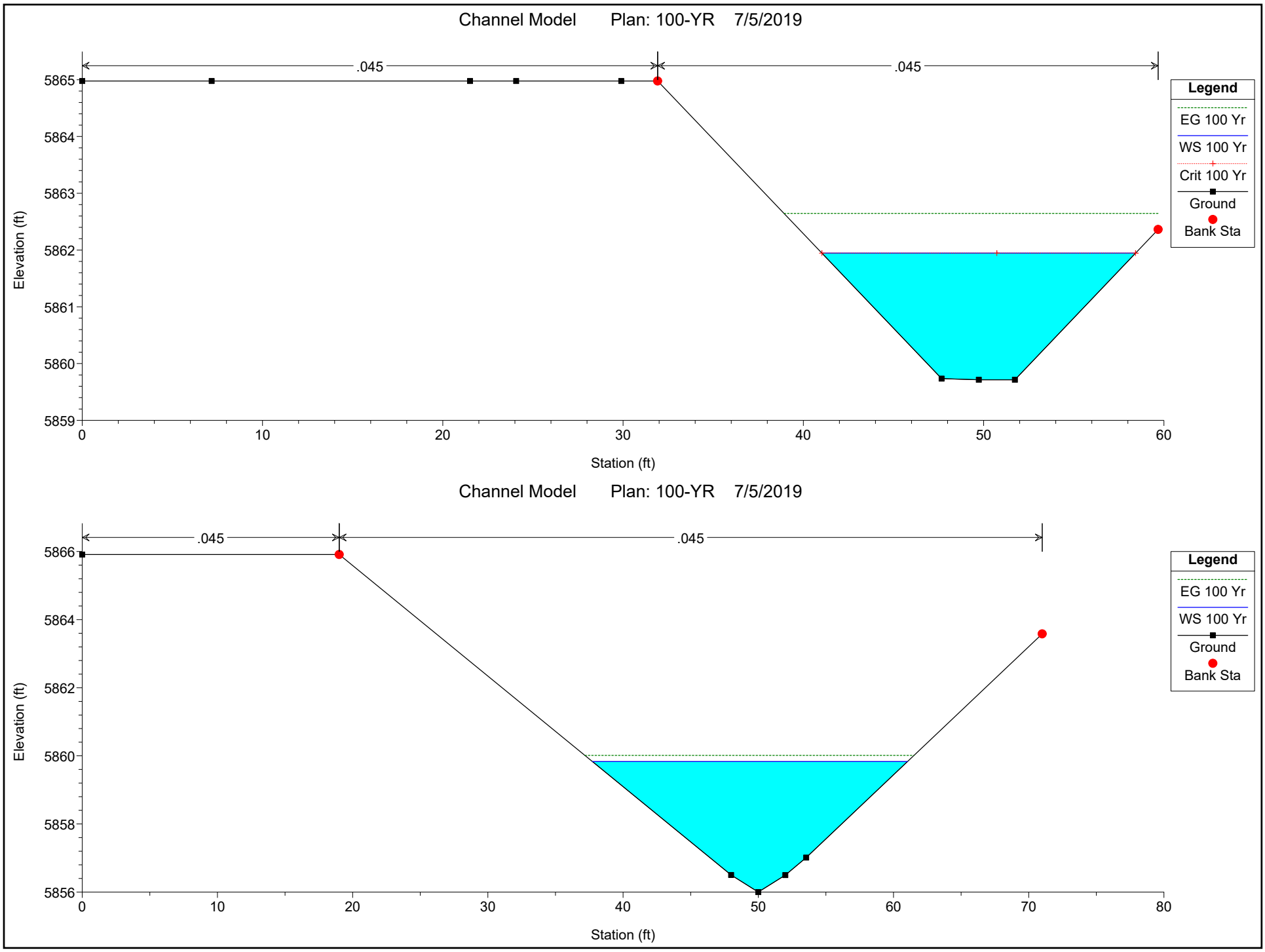
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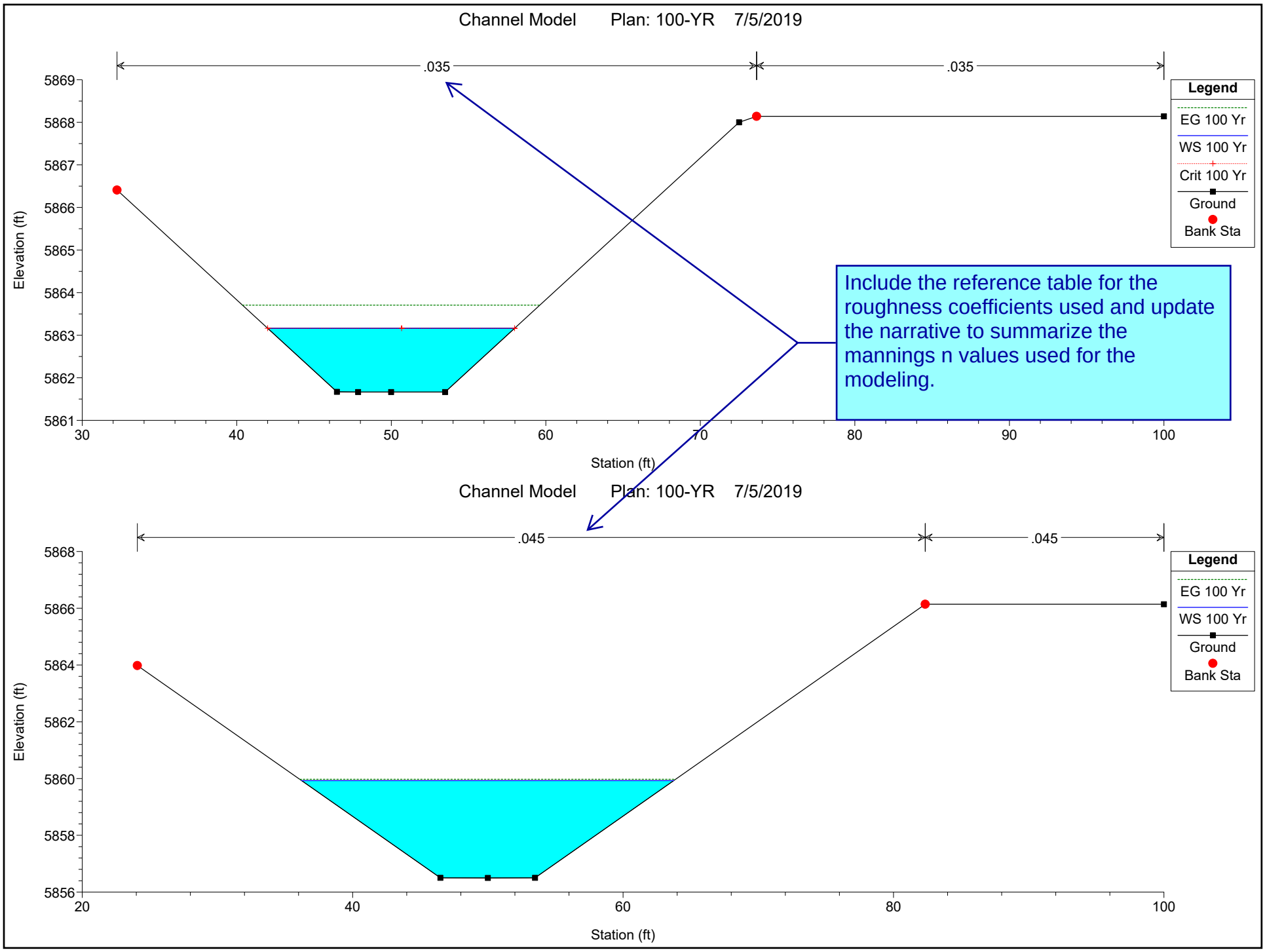
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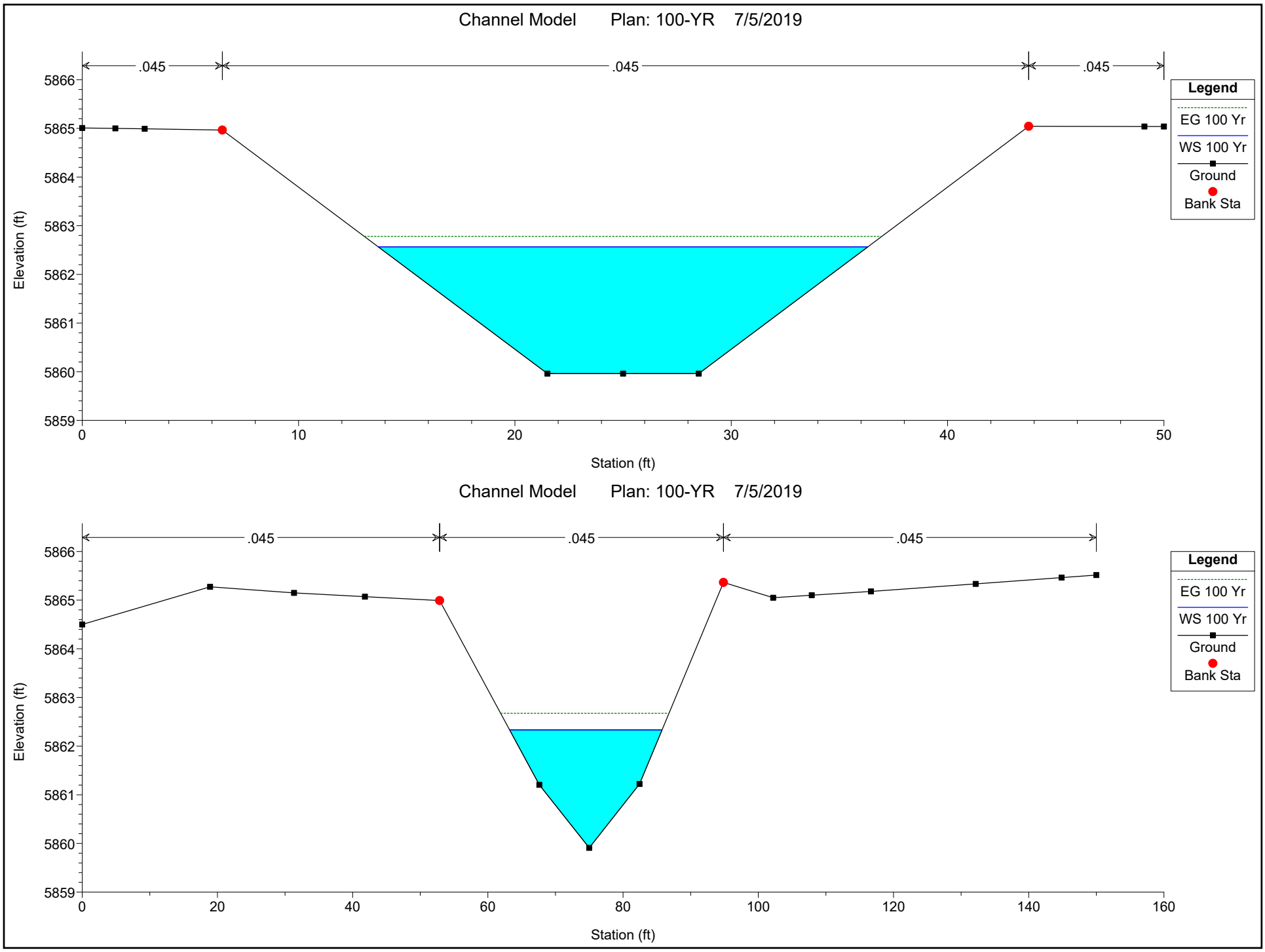
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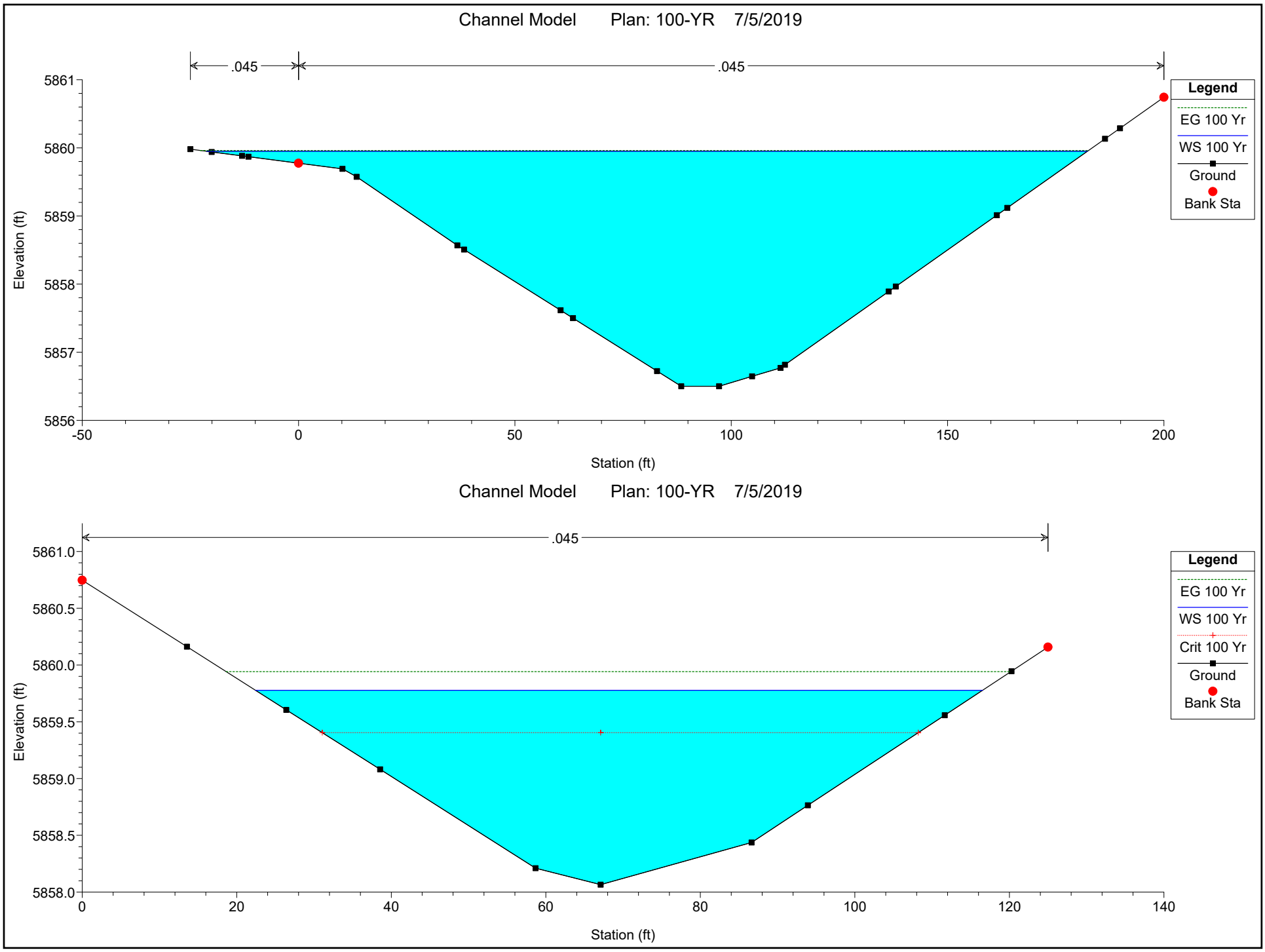
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HEC-RAS HEC-RAS 5.0.3 September 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Channel Model
Project File : ChannelModel.prj
Run Date and Time: 7/5/2019 4:12:26 PM

Project in English units

PLAN DATA

Plan Title: 100-YR
Plan File : z:\Copy\Personal\Springs at Waterview\Download - 070319\CAD\HEC-RAS\RAS Model\ChannelModel.p01

Geometry Title: S@W - Ditch Analysis
Geometry File : z:\Copy\Personal\Springs at Waterview\Download - 070319\CAD\HEC-RAS\RAS Model\ChannelModel.g04

Flow Title : Flow Data
Flow File : z:\Copy\Personal\Springs at Waterview\Download - 070319\CAD\HEC-RAS\RAS Model\ChannelModel.f01

Plan Summary Information:
Number of: Cross Sections = 14 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary

Submit the Hec-Ras model for review

Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Flow Data
Flow File : z:\Copy\Personal\Springs at Waterview\Download - 070319\CAD\HEC-RAS\RAS Model\ChannelModel.f01

Flow Data (cfs)

River	Reach	RS	100 Yr
North Ditch	North	460	101.57
South Ditch	South	750	16.79
South Ditch	South 2	100	160
East Ditch	East	028	143.64
Outlet	Outlet	5500	299.47
Outlet	Outlet	5000	299.47

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
East Ditch	East	100 Yr	Known WS = 5863.18	
North Ditch	North	100 Yr	Known WS = 5866.11	
Outlet	Outlet	100 Yr		Normal S = 0.01
South Ditch	South	100 Yr	Known WS = 5861.73	

Why was a known WS added? Revise. There should only be normal depth at the outfall. WS is not known at the junctions.

Provide narrative explaining how these were determined and include calculations.

GEOMETRY DATA

Geometry Title: S@W - Ditch Analysis
Geometry File : z:\Copy\Personal\Springs at Waterview\Download - 070319\CAD\HEC-RAS\RAS Model\ChannelModel.g04

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
East Ditch	East		Confl
North Ditch	North		Ex Culv
Outlet	Outlet	Ex Culv	
South Ditch	South		Confl
South Ditch	South 2	Confl	Ex Culv

JUNCTION INFORMATION

Name: Ex Culv

It seems more appropriate to use the momentum equation at the culvert junction where the angle of tributary can cause significant energy losses.

Update the narrative explaining why the specific computation method is used. Additional comments may be generated.

Description:
Energy computation Method

Length across Junction River	Reach	Tributary River	Reach	Length	Angle
North Ditch	North	to Outlet	Outlet	0	0
South Ditch	South 2	to Outlet	Outlet	0	0

Update lengths for the junction to match the design.

Example: South Ditch XS-100 is around 35' away from junction, not 100' and east ditch XS-25 is not 0' from the East Ditch.

Name: Confl
Description:
Energy computation Method

Length across Junction River	Reach	Tributary River	Reach	Length	Angle
South Ditch	South	to South Ditch	South 2	100	0
East Ditch	East	to South Ditch	South 2	0	0

CROSS SECTION

RIVER: East Ditch
REACH: East RS: 028

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	5865.01	1.53	5865	2.895	864.991	6.485	864.966	21.5	5859.96
25	5859.96	28.5	5859.96	43.755	865.043	49.1	5865.04	50	5865.039

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	6.48	.045	43.75	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
6.48	43.75	10	10	10	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5862.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.045		
W.S. Elev (ft)	5862.57	Reach Len. (ft)	10.00	10.00	10.00
Crit W.S. (ft)		Flow Area (sq ft)	38.61		
E.G. Slope (ft/ft)	0.006542	Area (sq ft)	38.61		
Q Total (cfs)	143.64	Flow (cfs)	143.64		
Top Width (ft)	22.63	Top Width (ft)	22.63		
Vel Total (ft/s)	3.72	Avg. Vel. (ft/s)	3.72		
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)	1.71		
Conv. Total (cfs)	1775.9	Conv. (cfs)	1775.9		
Length Wtd. (ft)	10.00	Wetted Per. (ft)	23.48		
Min Ch El (ft)	5859.96	Shear (lb/sq ft)	0.67		
Alpha	1.00	Stream Power (lb/ft s)	2.50		
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.01		
C & E Loss (ft)	0.01	Cum SA (acres)	0.01		

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: East Ditch
REACH: East RS: 025

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	5864.501	18.915	5865.273	31.335	5865.149	41.815	5865.072	52.875	864.991
67.625	861.203	75	5859.91	82.445	861.222	94.865	865.364	102.25	865.051
107.915	865.102	116.66	5865.18	132.155	865.335	144.875	865.463	150	5865.514

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	52.87	.045	94.86	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
52.87	94.86	25	25	25	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5862.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.	0.045		
W.S. Elev (ft)	5862.33	Reach Len. (ft)	0.00	0.00	0.00
Crit W.S. (ft)		Flow Area (sq ft)	30.60		
E.G. Slope (ft/ft)	0.013892	Area (sq ft)	30.60		
Q Total (cfs)	143.64	Flow (cfs)	143.64		
Top Width (ft)	22.55	Top Width (ft)	22.55		
Vel Total (ft/s)	4.69	Avg. Vel. (ft/s)	4.69		
Max Chl Dpth (ft)	2.42	Hydr. Depth (ft)	1.36		
Conv. Total (cfs)	1218.7	Conv. (cfs)	1218.7		
Length Wtd. (ft)	0.00	Wetted Per. (ft)	23.10		
Min Ch El (ft)	5859.91	Shear (lb/sq ft)	1.15		
Alpha	1.00	Stream Power (lb/ft s)	5.39		
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)			
C & E Loss (ft)	0.04	Cum SA (acres)			

CROSS SECTION

RIVER: North Ditch
REACH: North RS: 460

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
26.395	869.662	39.31	5865.36	46.55	862.964	49.845	862.965	53.485	863.021
74.885	870.483	80.235	872.354	83.045	872.585	87.155	872.634	89.58	5872.65

Bend must be modeled.

100 5872.69

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
26.39	.035	26.39	.035	80.23	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
26.39	80.23	60	60	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5865.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.035		
W.S. Elev (ft)	5865.15	Reach Len. (ft)	60.00	60.00	60.00
Crit W.S. (ft)		Flow Area (sq ft)	28.82		
E.G. Slope (ft/ft)	0.004336	Area (sq ft)	28.82		
Q Total (cfs)	101.57	Flow (cfs)	101.57		
Top Width (ft)	19.65	Top Width (ft)	19.65		
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)	3.52		
Max Chl Dpth (ft)	2.19	Hydr. Depth (ft)	1.47		
Conv. Total (cfs)	1542.5	Conv. (cfs)	1542.5		
Length Wtd. (ft)	60.00	Wetted Per. (ft)	20.36		
Min Ch El (ft)	5862.96	Shear (lb/sq ft)	0.38		
Alpha	1.00	Stream Power (lb/ft s)	1.35		
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	0.33		
C & E Loss (ft)	0.01	Cum SA (acres)	0.21		

CROSS SECTION

RIVER: North Ditch
REACH: North RS: 400

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
27.56	5868.979	46.55	5862.665	49.975	5862.665	53.475	5862.665	62.385	5865.624
82.185	5871.705	1005	5871.972						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
27.56	.035	27.56	.035	82.18	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
27.56	82.18	200	200	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5865.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.035		
W.S. Elev (ft)	5864.94	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	5864.17	Flow Area (sq ft)	31.38		
E.G. Slope (ft/ft)	0.003483	Area (sq ft)	31.38		
Q Total (cfs)	101.57	Flow (cfs)	101.57		

Top Width (ft)	20.64	Top Width (ft)	20.64
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)	3.24
Max Chl Dpth (ft)	2.27	Hydr. Depth (ft)	1.52
Conv. Total (cfs)	1721.0	Conv. (cfs)	1721.0
Length Wtd. (ft)	200.00	Wetted Per. (ft)	21.37
Min Ch El (ft)	5862.67	Shear (lb/sq ft)	0.32
Alpha	1.00	Stream Power (lb/ft s)	1.03
Frctn Loss (ft)	1.35	Cum Volume (acre-ft)	0.29
C & E Loss (ft)	0.04	Cum SA (acres)	0.18

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

CROSS SECTION

RIVER: North Ditch
REACH: North RS: 200

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
32.25	5866.41	46.48	5861.67	47.85	5861.665	49.995	5861.665	53.485	5861.665
72.51	5868	73.645	5868.141	100	5868.141				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
32.25	.035	32.25	.035	73.64	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
32.25	73.64	200	200	200	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5863.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.	0.035		
W.S. Elev (ft)	5863.16	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	5863.16	Flow Area (sq ft)	17.19		
E.G. Slope (ft/ft)	0.018279	Area (sq ft)	17.19		
Q Total (cfs)	101.57	Flow (cfs)	101.57		
Top Width (ft)	15.98	Top Width (ft)	15.98		
Vel Total (ft/s)	5.91	Avg. Vel. (ft/s)	5.91		
Max Chl Dpth (ft)	1.50	Hydr. Depth (ft)	1.08		
Conv. Total (cfs)	751.3	Conv. (cfs)	751.3		
Length Wtd. (ft)	200.00	Wetted Per. (ft)	16.46		
Min Ch El (ft)	5861.67	Shear (lb/sq ft)	1.19		
Alpha	1.00	Stream Power (lb/ft s)	7.04		
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	0.18		
C & E Loss (ft)	0.15	Cum SA (acres)	0.10		

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: North Ditch
REACH: North RS: 001

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
24.08	5863.982	46.495	856.502	50	5856.5	53.495	856.503	82.355	866.141
100	5866.141								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
24.08	.045	24.08	.045	82.35	.045

Bank Sta: Left Right Coeff Contr. Expan.
24.08 82.35 .1 .3

CROSS SECTION OUTPUT Profile #100 Yr

			Left OB	Channel	Right OB
E.G. Elev (ft)	5859.97	Element			
Vel Head (ft)	0.05	Wt. n-Val.		0.045	
W.S. Elev (ft)	5859.93	Reach Len. (ft)	0.00	0.00	0.00
Crit W.S. (ft)		Flow Area (sq ft)		59.10	
E.G. Slope (ft/ft)	0.001030	Area (sq ft)		59.10	
Q Total (cfs)	101.57	Flow (cfs)		101.57	
Top Width (ft)	27.51	Top Width (ft)		27.51	
Vel Total (ft/s)	1.72	Avg. Vel. (ft/s)		1.72	
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)		2.15	
Conv. Total (cfs)	3164.1	Conv. (cfs)		3164.1	
Length Wtd. (ft)	0.00	Wetted Per. (ft)		28.63	
Min Ch El (ft)	5856.50	Shear (lb/sq ft)		0.13	
Alpha	1.00	Stream Power (lb/ft s)		0.23	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)			
C & E Loss (ft)	0.01	Cum SA (acres)			

CROSS SECTION

RIVER: Outlet
REACH: Outlet RS: 5500

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-255859.981	-20.08	5859.94	-13.065859.883	-11.575859.871		05859.775			
10.145859.692		13.435859.575		36.715858.569		38.255858.507		60.555857.615	
63.43	5857.5	82.865856.723		88.44	5856.5	97.18	5856.5	104.835856.646	
111.38	5856.77	112.45856.816		136.395857.891		138.035857.965		161.395859.012	
163.8	5859.12	186.395860.133		189.865860.288		2005860.743			

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-25	.045	0	.045	200	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	200	5	5	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5859.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.045	0.045	
W.S. Elev (ft)	5859.95	Reach Len. (ft)	5.00	5.00	5.00
Crit W.S. (ft)		Flow Area (sq ft)	1.85	338.59	
E.G. Slope (ft/ft)	0.000314	Area (sq ft)	1.85	338.59	
Q Total (cfs)	299.47	Flow (cfs)	0.21	299.26	
Top Width (ft)	203.56	Top Width (ft)	21.25	182.31	
Vel Total (ft/s)	0.88	Avg. Vel. (ft/s)	0.11	0.88	
Max Chl Dpth (ft)	3.45	Hydr. Depth (ft)	0.09	1.86	
Conv. Total (cfs)	16896.5	Conv. (cfs)	12.0	16884.5	
Length Wtd. (ft)	5.00	Wetted Per. (ft)	21.25	182.44	
Min Ch El (ft)	5856.50	Shear (lb/sq ft)	0.00	0.04	
Alpha	1.01	Stream Power (lb/ft s)	0.00	0.03	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.00	0.02	
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.02	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Outlet
REACH: Outlet RS: 5000

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
05860.747		13.555860.161		26.415859.605		38.565859.081		58.675858.211	
67.15858.066		86.635858.437		93.915858.764		111.635859.558		120.275859.946	

1255860.158

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	0	.045	125	.04

Bank Sta: Left Right Coeff Contr. Expan.
0 125 .1 .3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5859.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.045		
W.S. Elev (ft)	5859.78	Reach Len. (ft)			
Crit W.S. (ft)	5859.40	Flow Area (sq ft)	92.01		
E.G. Slope (ft/ft)	0.010019	Area (sq ft)	92.01		
Q Total (cfs)	299.47	Flow (cfs)	299.47		
Top Width (ft)	94.09	Top Width (ft)	94.09		
Vel Total (ft/s)	3.25	Avg. Vel. (ft/s)	3.25		
Max Chl Dpth (ft)	1.71	Hydr. Depth (ft)	0.98		
Conv. Total (cfs)	2991.8	Conv. (cfs)	2991.8		
Length Wtd. (ft)		Wetted Per. (ft)	94.16		
Min Ch El (ft)	5858.07	Shear (lb/sq ft)	0.61		
Alpha	1.00	Stream Power (lb/ft s)	1.99		
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION

RIVER: South Ditch
REACH: South RS: 750

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	5871.43	6.97	5871.27	10.165	871.149	13.625	870.985	31.55	868.468
52.35	866.903	52.575	866.993	53.515	866.993	54.76	5867	55.995	866.995
60.035	866.999	62.525	867.669	63.57	5868	67.4	5869	71.615	869.181
76.045	869.179								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	31.5	.035	67.4	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
31.5 67.4 150 150 150 .1 .3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5867.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.035		
W.S. Elev (ft)	5867.40	Reach Len. (ft)	150.00	150.00	150.00
Crit W.S. (ft)	5867.40	Flow Area (sq ft)	5.13		

E.G. Slope (ft/ft)	0.026977	Area (sq ft)	5.13
Q Total (cfs)	16.79	Flow (cfs)	16.79
Top Width (ft)	15.89	Top Width (ft)	15.89
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	3.27
Max Chl Dpth (ft)	0.50	Hydr. Depth (ft)	0.32
Conv. Total (cfs)	102.2	Conv. (cfs)	102.2
Length Wtd. (ft)	150.00	Wetted Per. (ft)	15.98
Min Ch El (ft)	5866.90	Shear (lb/sq ft)	0.54
Alpha	1.00	Stream Power (lb/ft s)	1.77
Frctn Loss (ft)	1.50	Cum Volume (acre-ft)	0.27
C & E Loss (ft)	0.02	Cum SA (acres)	0.19

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: South Ditch
REACH: South RS: 600

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	5869.539	23.875	5869.532	24.985	5869.531	46.935	5862.216	48.925	5862.216
50.925	5862.216	57.375	5864.363						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	24.98	.035	57.37	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
24.98	57.37	200	200	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5863.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.035	
W.S. Elev (ft)	5863.23	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)		7.10	
E.G. Slope (ft/ft)	0.005152	Area (sq ft)		7.10	
Q Total (cfs)	16.79	Flow (cfs)		16.79	
Top Width (ft)	10.06	Top Width (ft)		10.06	

Vel Total (ft/s)	2.36	Avg. Vel. (ft/s)	2.36
Max Chl Dpth (ft)	1.01	Hydr. Depth (ft)	0.71
Conv. Total (cfs)	233.9	Conv. (cfs)	233.9
Length Wtd. (ft)	200.00	Wetted Per. (ft)	10.39
Min Ch El (ft)	5862.22	Shear (lb/sq ft)	0.22
Alpha	1.00	Stream Power (lb/ft s)	0.52
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	0.25
C & E Loss (ft)	0.02	Cum SA (acres)	0.14

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: South Ditch
REACH: South RS: 400

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	5867.57	1	2.16	5867.57	1	7.47	5867.57	1	8.58
5867.51	1	7.47	5861.21	6	4.45	5861.21	6	5.45	5861.21
6	2.28	5864.82	2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	28.58	.035	62.28	.035

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

28.58	62.28		200	200	200	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5863.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.035		
W.S. Elev (ft)	5863.07	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)	17.74		
E.G. Slope (ft/ft)	0.000423	Area (sq ft)	17.74		
Q Total (cfs)	16.79	Flow (cfs)	16.79		
Top Width (ft)	15.13	Top Width (ft)	15.13		
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)	0.95		
Max Chl Dpth (ft)	1.86	Hydr. Depth (ft)	1.17		
Conv. Total (cfs)	816.1	Conv. (cfs)	816.1		
Length Wtd. (ft)	200.00	Wetted Per. (ft)	15.73		
Min Ch El (ft)	5861.22	Shear (lb/sq ft)	0.03		
Alpha	1.00	Stream Power (lb/ft s)	0.03		
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.19		
C & E Loss (ft)	0.00	Cum SA (acres)	0.08		

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: South Ditch
REACH: South RS: 200

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
05865.571	10.015865.571	27.475865.571	31.755865.553	485860.216					
49.995860.216	51.995860.216	66.265864.968							

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	31.75	.035	66.26	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
31.75	66.26	100	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5863.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.035		
W.S. Elev (ft)	5863.05	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	35.67		
E.G. Slope (ft/ft)	0.000065	Area (sq ft)	35.67		
Q Total (cfs)	16.79	Flow (cfs)	16.79		
Top Width (ft)	21.15	Top Width (ft)	21.15		
Vel Total (ft/s)	0.47	Avg. Vel. (ft/s)	0.47		
Max Chl Dpth (ft)	2.84	Hydr. Depth (ft)	1.69		
Conv. Total (cfs)	2085.5	Conv. (cfs)	2085.5		
Length Wtd. (ft)	100.00	Wetted Per. (ft)	22.06		
Min Ch El (ft)	5860.22	Shear (lb/sq ft)	0.01		
Alpha	1.00	Stream Power (lb/ft s)	0.00		
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	0.07		
C & E Loss (ft)	0.07	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.

CROSS SECTION

RIVER: South Ditch
REACH: South 2 RS: 100

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
05864.977	7.185864.977	21.515864.977	24.075864.977	29.95864.978					
31.925864.978	47.675859.736	49.735859.715	51.735859.715	59.67 5862.36					

59.685862.363

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	31.92	.045	59.68	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
31.92	59.68	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5862.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.045		
W.S. Elev (ft)	5861.95	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	5861.95	Flow Area (sq ft)	23.84		
E.G. Slope (ft/ft)	0.028635	Area (sq ft)	23.84		
Q Total (cfs)	160.00	Flow (cfs)	160.00		
Top Width (ft)	17.40	Top Width (ft)	17.40		
Vel Total (ft/s)	6.71	Avg. Vel. (ft/s)	6.71		
Max Chl Dpth (ft)	2.23	Hydr. Depth (ft)	1.37		
Conv. Total (cfs)	945.5	Conv. (cfs)	945.5		
Length Wtd. (ft)	100.00	Wetted Per. (ft)	18.12		
Min Ch El (ft)	5859.72	Shear (lb/sq ft)	2.35		
Alpha	1.00	Stream Power (lb/ft s)	15.79		
Frctn Loss (ft)	0.93	Cum Volume (acre-ft)	0.08		
C & E Loss (ft)	0.16	Cum SA (acres)	0.05		

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: South Ditch
REACH: South 2 RS: 000

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	5865.91	2	5865.91	4	5865.5	6	5856	52	5856.5

53.545857.012 715863.582

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	19.01	.045	71	.045

Bank Sta: Left	Right	Coeff Contr.	Expan.
19.01	71	.1	.3

CROSS SECTION OUTPUT Profile #100 Yr

E.G. Elev (ft)	5860.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.045		
W.S. Elev (ft)	5859.83	Reach Len. (ft)	0.00	0.00	0.00
Crit W.S. (ft)		Flow Area (sq ft)	46.71		
E.G. Slope (ft/ft)	0.004562	Area (sq ft)	46.71		
Q Total (cfs)	160.00	Flow (cfs)	160.00		
Top Width (ft)	23.29	Top Width (ft)	23.29		
Vel Total (ft/s)	3.43	Avg. Vel. (ft/s)	3.43		
Max Chl Dpth (ft)	3.83	Hydr. Depth (ft)	2.01		
Conv. Total (cfs)	2368.8	Conv. (cfs)	2368.8		
Length Wtd. (ft)	0.00	Wetted Per. (ft)	24.54		
Min Ch El (ft)	5856.00	Shear (lb/sq ft)	0.54		
Alpha	1.00	Stream Power (lb/ft s)	1.86		
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)			
C & E Loss (ft)	0.05	Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:East Ditch

Reach	River Sta.	n1	n2	n3
East	028	.045	.045	.045
East	025	.045	.045	.045

River:North Ditch

Reach	River Sta.	n1	n2	n3
North	460	.035	.035	.035
North	400	.035	.035	.035
North	200	.035	.035	.035
North	001	.045	.045	.045

River:Outlet

Reach	River Sta.	n1	n2	n3
Outlet	5500	.045	.045	.045
Outlet	5000	.045	.045	.04

River:South Ditch

Reach	River Sta.	n1	n2	n3
South	750	.035	.035	.035
South	600	.035	.035	.035
South	400	.035	.035	.035
South	200	.035	.035	.035
South 2	100	.045	.045	.045
South 2	000	.045	.045	.045

SUMMARY OF REACH LENGTHS

River: East Ditch

Reach	River Sta.	Left	Channel	Right
East	028	10	10	10
East	025	25	25	25

River: North Ditch

Reach	River Sta.	Left	Channel	Right
North	460	60	60	60
North	400	200	200	200
North	200	200	200	200
North	001			

River: Outlet

Reach	River Sta.	Left	Channel	Right
Outlet	5500	5	5	5
Outlet	5000			

River: South Ditch

Reach	River Sta.	Left	Channel	Right
South	750	150	150	150
South	600	200	200	200
South	400	200	200	200
South	200	100	100	100
South 2	100	100	100	100
South 2	000			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: East Ditch

Reach	River Sta.	Contr.	Expan.
East	028	.1	.3
East	025	.1	.3

River: North Ditch

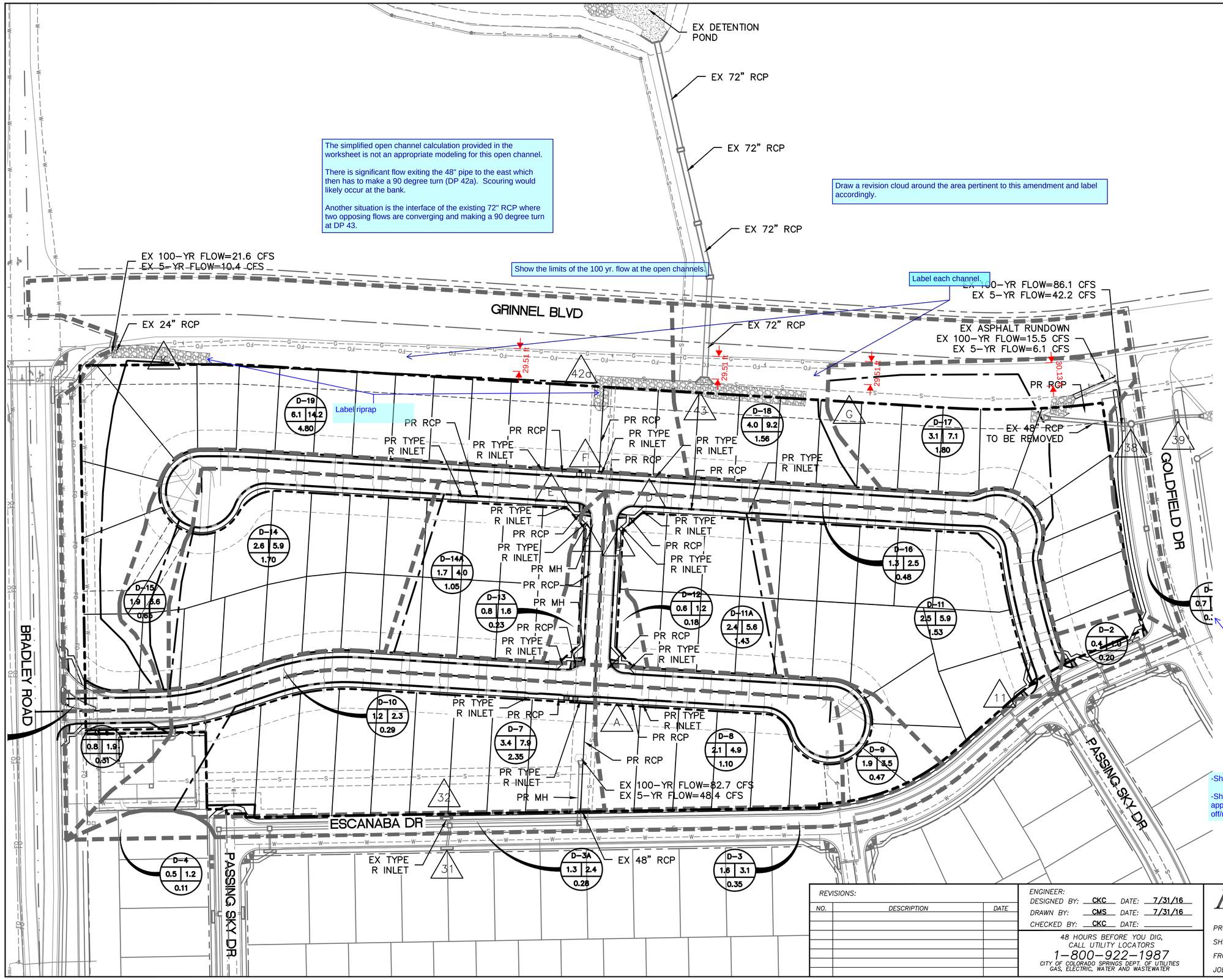
Reach	River Sta.	Contr.	Expan.
North	460	.1	.3
North	400	.1	.3
North	200	.1	.3
North	001	.1	.3

River: Outlet

Reach	River Sta.	Contr.	Expan.
Outlet	5500	.1	.3
Outlet	5000	.1	.3

River: South Ditch

Reach	River Sta.	Contr.	Expan.
South	750	.1	.3
South	600	.1	.3
South	400	.1	.3
South	200	.1	.3
South 2	100	.1	.3
South 2	000	.1	.3



LEGEND

- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- DITCH CENTERLINE
- PROPOSED 2' CONTOUR
- PROPOSED 10' CONTOUR
- PROPOSED BASIN BOUNDARY
- PROPOSED FLOW PATH
- DESIGN POINT
- BASIN / Cs / Cwa / AREA — BASIN LABEL

DESIGN POINT	Q (5)	Q (100)
11	1.6	3.1
32	1.3	2.4
A	0.3	4.3
B	0.8	2.3
C	0.8	2.1
D	2.4	6.7
E	1.6	4.7
F	0.2	3.1
G	3.1	7.1
K	11.5	24.1
39	1.1	2.5
41	0.5	1.0
42a	11.9	26.3
43	4.0	9.2

Update to provide the combined flow at the design points.

Add a footnote on the table referencing the approved FDR for detailed calculations. Asterisk any DP that's changed and provide the calculation.

Fix viewport so that basin label is visible.

-Show the existing and proposed contours.

-Show and label all storm sewers. It appears that they have been turned off/removed.

FIGURE 4

REVISIONS:

NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: CKC DATE: 7/31/16
DRAWN BY: CMS DATE: 7/31/16
CHECKED BY: CKC DATE:

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES GAS, ELECTRIC, WATER AND WASTEWATER

DSE Dakota Springs Engineering
31 N. TEJON, SUITE 315
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT SPRINGS AT WATERVIEW
SHEET TITLE PROPOSED DRAINAGE MAP
FROM n/a TO n/a
JOB NO. 16-01 SHEET 1 OF 1