

Letter Report

**DRAINAGE EASEMENT ANALYSIS
FOR
7950 MALLARD DRIVE**

August 2018

Prepared for:

Albert Wills
8605 Explorer Drive, #250
Colorado Springs, CO 80920

Prepared By:



**CATAMOUNT
ENGINEERING**
321 W. Henrietta Ave, Suite A
Woodland Park, CO 80863
719-426-2124

DRAINAGE EASEMENT ANALYSIS
7950 MALLARD DRIVE

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 the criteria established for drainage reports and said report is in conformity with the 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.

Certification Statement:

This report and plan for the preliminary and final drainage design for the 7950 MALLARD DRIVE was prepared by me (or under my direct supervision) in accordance with the provisions of City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2 Drainage Design and Technical Criteria for the owners thereof. I understand that El Paso County does not and will not assume liability for drainage facilities designed by others.

David L. Mijares, Colorado PE #40510
For and on behalf of Catamount Engineering

Date

Developer's Statement:

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

CHAD WOLF hereby certifies that the drainage facilities for 7950 MALLARD DRIVE shall be constructed according to the design presented in this report. I understand that El Paso County does not and will not assume liability for the drainage facilities designed and or certified by my engineer and that the El Paso County reviews drainage plans pursuant to Colorado Revised Statues, Title 30, Article 28; but cannot, on behalf of 7950 MALLARD DRIVE, guarantee that final drainage design review will absolve CHAD WOLF and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Chad James Wolf
Business Name

By: _____

Title: _____

Address: _____
7860 Old Brook Circle S.

Colorado Springs, CO 80917

Conditions:

If improvements are necessary
then construction drawings/GEC
plan are required.

DRAINAGE EASEMENT ANALYSIS for 7950 MALLARD DRIVE

PURPOSE

The purpose of this drainage report is to identify a drainage easement width within a tributary of the Bennet Ranch Basin through an existing residential lot. Zone A 'unstudied' floodplain was removed from the parcel with LOMR Case number 12-08-0659P effective July 12, 2013. The LOMR identified a diversion along the western roadway embankment of State Highway 24 conveying flows south to the main stem of the Bennet Ranch Basin limiting flows conveyed within the site. With removal of Zone A floodplain on the parcel El Paso County has requested that a drainage easement be established for the tributary reach within the parcel.

GENERAL LOCATION AND DESCRIPTION

The subject 5.30 acres is proposed to be replatted in order to remove the Zone A floodplain restrictions indicated in the original plat. The platted lot is located within a portion of Section 5, Township 13 South, Range 64 West of the 6th principal meridian El Paso County, Colorado. The parcel is bounded on the east by Mallard Drive (gravel roadway) and to north, south, and west by rural residential lots.

The site is sparsely vegetated with native grasses. The existing terrain generally slopes to the south and southeast at a 1.5% grade. The existing unimproved reach of the Bennet Ranch tributary runs through the central portion of the property from north to south. The site lies within the Bennet Ranch Basin.

Soils in the development parcel consist of Columbine gravelly sandy loam a Hydrologic Group 'A' soil, as determined by the Natural Resources Conservation Service Web Soil Survey. Hydrologic Group A soils were used in analysis.

No portion of the development lies within an F.E.M.A. designated floodplain, per FIRM 08041C0575 F, as revised to reflect LOMR Case No12-08-0659P. The revised F.E.M.A. Flood Insurance Rate Map and LOMR determination have been provided in the appendix.

DRAINAGE EASEMENT DEVELOPMENT

Existing conditions?

Upstream hydrology was developed utilizing USGS STREAMSTATS Application Version 4.2.1. The application identified a tributary drainage area of 0.22 square miles within the drainage basin tributary to the reach yielding a 100-YR peak flow of $Q_{100}=49.9$ cfs. The application indicated inclusion of the reach of the tributary north of State Highway 24. As a check a rational analysis was developed for the portion of the reach south of State Highway 24. The rational analysis for the 55 acres south of highway 24 indicated a peak flow of $Q_{100}=48.1$ cfs. Rational analysis was primarily developed for development of storm sewer system and peak flow analysis developed over large rural areas within natural streamways would yield

Why not for the contributing area to the north as well?

conservative results. A design flow of 50 CFS was utilized in developing easement width analysis.

A HEC-RAS model was developed to analyze flow within the reach crossing the property. The model indicated that the existing natural section is inadequate to convey modeled flow through the reach. A 6.0' bottom width section with 12:1 side slopes was modeled as adequate to convey the flows at a 0.8% longitudinal slope through the parcel. Flows will be conveyed in the main channel at a maximum depth of approximately 1.1'. Development of the excavated channel will require a 40' width drainage easement.

See Appendix for Calculations.

DRAINAGE FEE CALCULATION

The development proposes to replat 5.30 acres within El Paso County, all contained within the Bennet Ranch Drainage Basin. No fees are due with replat.

DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2, as revised May 2014.

USGS STREAMSTATS Application Version 4.2.1 was utilized in developing upstream flows within the reach of the Bennet Ranch Basin tributary. Rational method for drainage basin study areas of less than 100 acres was also developed in the analysis. For the Rational Method, flows were calculated for the 5 and 100-year recurrence intervals. The average runoff coefficients, 'C' values, are taken from Table 6-6 and the Intensity-Duration-Frequency curves are taken from Figure 6-5 of the City Drainage Criteria Manual. Time of concentration for overland flow and channel flow are calculated per Section 3.2 of the City Drainage Criteria Manual. Calculations for the Rational Method are shown in the Appendix of this report.

HEC-RAS Version 5.0.1 Was utilized in hydraulic analysis of the proposed developed reach through the property. Alignment and section geometry were developed from an existing conditions survey developed by Barron Land Surveys dated July 26, 2018. Roughness Coefficients were taken from the DCM Volume 1, Chapter 9, Table 12-2.

SUMMARY

Anticipated 100-YR flows can be conveyed in the proposed design section contained within a 40' drainage easement across the existing parcel. The 40' drainage/no-build easement will be indicated on the plat.

REFERENCES:

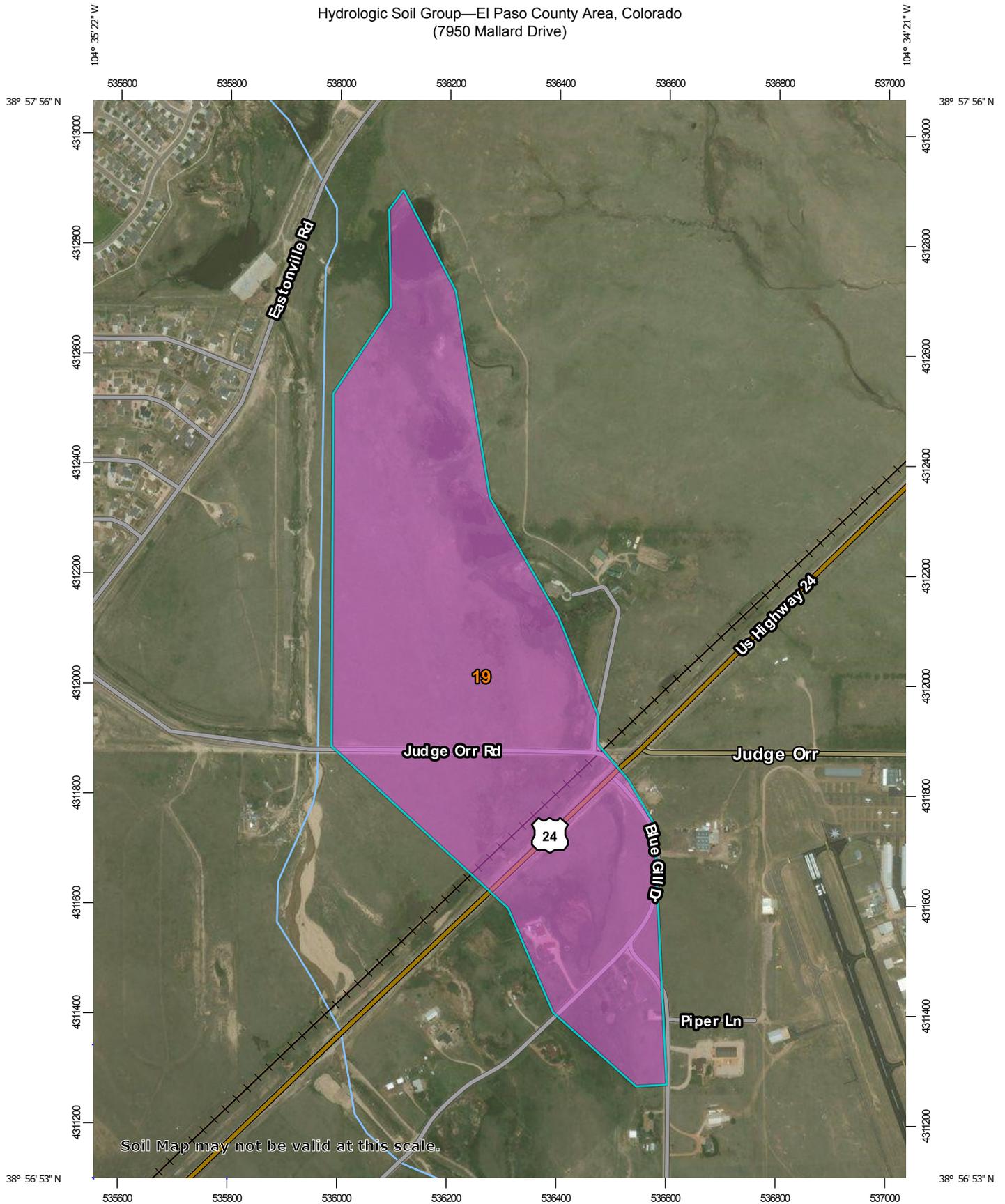
City of Colorado Springs Engineering Division Drainage Criteria Manual Volumes 1 and 2, revised May 2014

Flood Insurance rate map 08041C0575 F, as revised to reflect LOMR Case No. 16-08-1065P

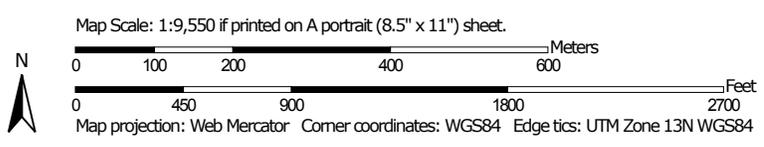
Natural Resources Conservation Service Web Soil Survey

APPENDIX

Hydrologic Soil Group—El Paso County Area, Colorado
(7950 Mallard Drive)



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 15, Oct 10, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	115.0	100.0%
Totals for Area of Interest			115.0	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CHANNELIZATION CULVERT DETENTION BASIN EXCAVATION	HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	State Highway 274 Channel Improvements	APPROXIMATE LATITUDE & LONGITUDE: 38.950, -104.584 SOURCE: Precision Mapping Streets DATUM: NAD 83	
ANNOTATED MAPPING ENCLOSURES		ANNOTATED STUDY ENCLOSURES	
TYPE: FIRM* NO.: 08041C0575F DATE: March 17, 1997		DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILE(S): 382P, 383P SUMMARY OF DISCHARGES TABLE: 3	

Enclosures reflect changes to flooding sources affected by this revision.

* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

Black Squirrel Creek West Fork Bennett Ranch Basin- from approximately 3,280 feet downstream of State Highway 24 to just upstream of Cadillac and Lake City Rail Road.

East Tributary to Black Squirrel Creek West Fork Bennett Ranch Basin - from the confluence to approximately 2,150 feet upstream of the confluence with Black Squirrel Creek West Fork Bennett Ranch Basin

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Black Squirrel Creek West Fork Bennett Ranch Basin	Zone A	Zone AE	YES	YES
	No BFEs*	BFEs	YES	NONE
East Tributary to Black Squirrel Creek West Fork Bennett Ranch Basin	Zone X (unshaded)	Zone AE	YES	NONE
	Zone A	Zone X (unshaded)	NONE	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

Erin E. Cobb

Erin E. Cobb, CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

132942 PT202.BKR.12080659PH20

102-I-A-C



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

East Tributary to Black Squirrel Creek West Fork Bennett Ranch Basin- from the confluence to approximately 2,150 feet upstream of the confluence with Black Squirrel Creek West Fork Bennett Ranch Basin

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
East Tributary to Black Squirrel Creek West Fork Bennett Ranch Basin	No BFEs*	BFEs	YES	NONE

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

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102-I-A-C



Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

Handwritten signature of Erin E. Cobb in cursive.

Erin E. Cobb, CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

A handwritten signature in cursive script that reads "Erin E. Cobb".

Erin E. Cobb, CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration



Federal Emergency Management Agency
Washington, D.C. 20472

**LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)**

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *The Gazette*
 Dates: March 7, 2013 and March 14, 2013

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at <http://www.fema.gov/business/nfip>.

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Erin E. Cobb, CFM, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

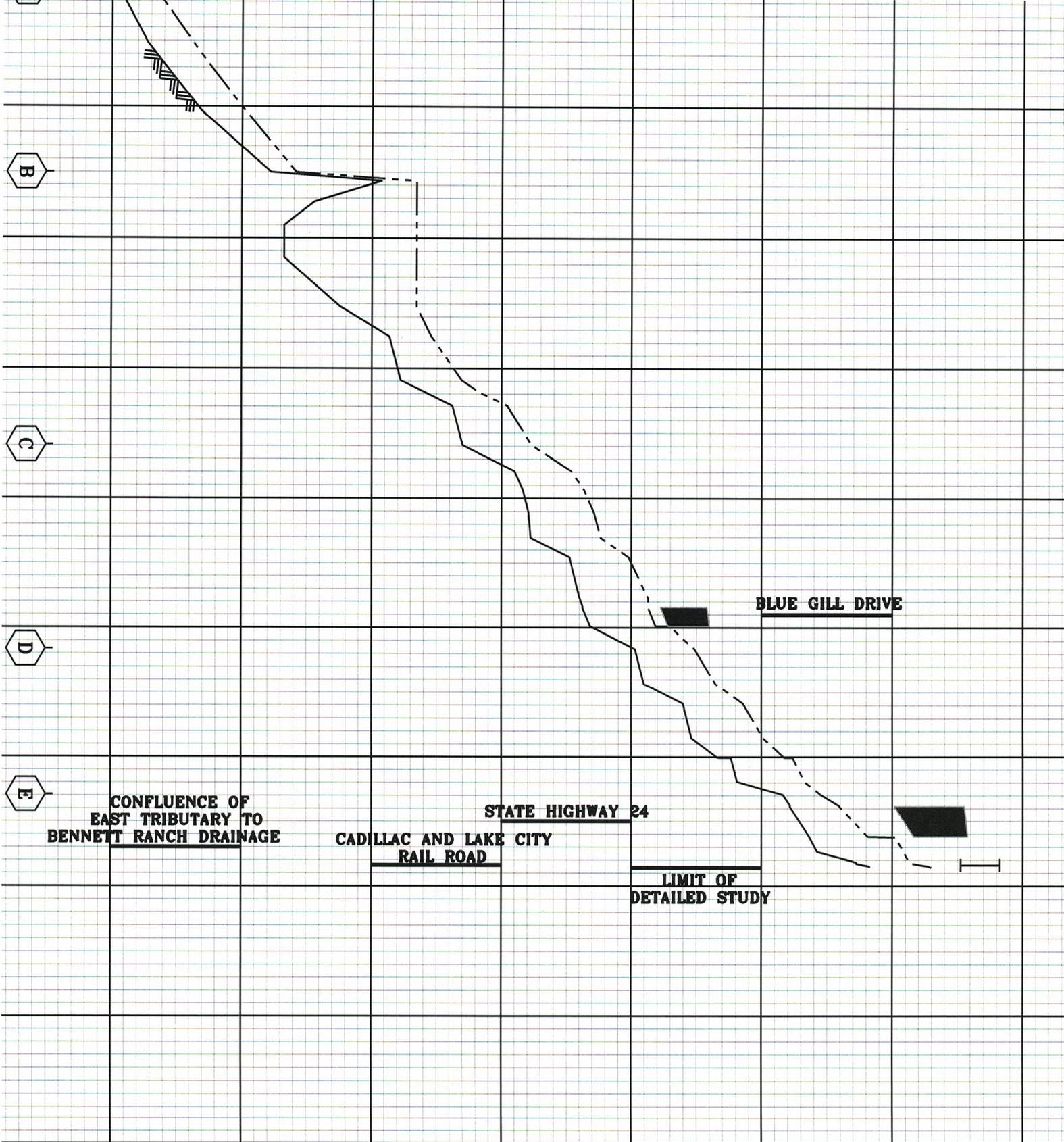
Table 3. Summary of Discharges

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second)		
		10-Year	50-Year	100-Year
Bear Creek				
At confluence with Fountain Creek	10.7	1,140	2,940	4,140
Beckers Lane Tributary				
At confluence with Fountain Creek	0.85	312	657	784
Big Valley				
Above Confluence with Dry Creek	0.29	-- ¹	-- ¹	529
Black Forest Creek				
At Interstate 25	1.97	-- ¹	-- ¹	2,090
Approximately 4,050 feet downstream of				
The confluence with Baptist Road Tributary	1.46	-- ¹	-- ¹	1,520
At Gleneagle Drive	0.57	-- ¹	-- ¹	630
Black Forest Creek – Baptist Road Tributary				
At confluence with Black Forest Creek	1.14	-- ¹	-- ¹	1,230
Black Forest Creek – Middle Tributary				
At confluence with Black Forest Creek	0.48	-- ¹	-- ¹	315
Black Forest Creek West Fork Bennett Ranch Basin				
Approximately 6,970 feet upstream of Falcon Drive	5.18	-- ¹	-- ¹	1,073
East Tributary to Black Forest Creek West Fork				
Bennett Ranch Basin at Black Forest Creek West				
Fork Bennett Ranch Basin	0.40	-- ¹	-- ¹	230
Butler Canyon ²	0.5	880	1,740	2,260
Calhan Main Channel				
At McLasky Road	3.04	706	1,508	1,862
At Highway 24	2.55	587	1,255	1,556
At confluence with Calhan East Tributary	2.15	491	1,052	1,305
Calhan East Tributary	0.28	71	151	186
Calhan Fairground Tributary	0.08	20	44	55
Camp Creek				
At confluence with Fountain Creek	10.26	30 ³	1,800 ³	2,680 ³
At Bijou Street	10.26	1,790	3,800	4,700
Upstream of north end of 31st Street	9.41	1,750	3,700	4,600

REVISED DATA

REVISED TO REFLECT LOMR EFFECTIVE: July 12, 2013

¹Data not available
²Location description not available
³Reduction in flow rate due to partial conveyance in storm drain



LEGEND

- 0.2% AN
- - - 1% ANNI
- - - 2% ANNI
- - - 10% ANI
- ▨ STREAM
- Y Y Y CROSS S

Legend

-  1% annual chance (100-Year) Floodplain
-  1% annual chance (100-Year) Floodway
-  0.2% annual chance (500-Year) Floodplain



APPROXIMATE SCALE IN FEET



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 575 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS,	080060	0575	F
CITY OF			
EL PASO COUNTY	080059	0575	F

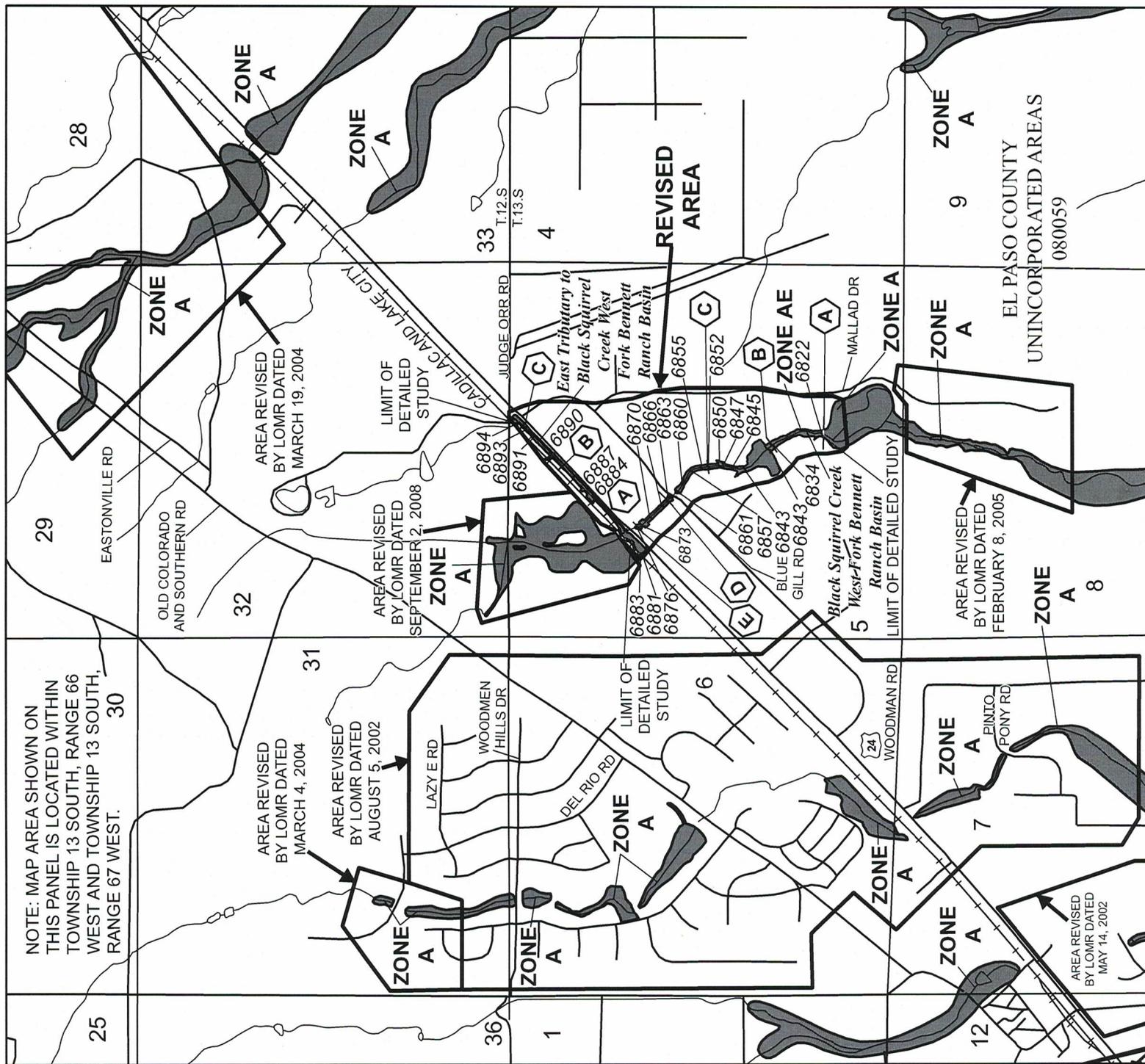
**REVISED TO
REFLECT LOMR
EFFECTIVE: July 12, 2013**
COMMUNITY-PANEL NUMBER
08041C0575 F

EFFECTIVE DATE:
MARCH 17, 1997



Federal Emergency Management Agency

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 66 WEST AND TOWNSHIP 13 SOUTH, RANGE 67 WEST.



HYDROLOGIC ANALYSIS

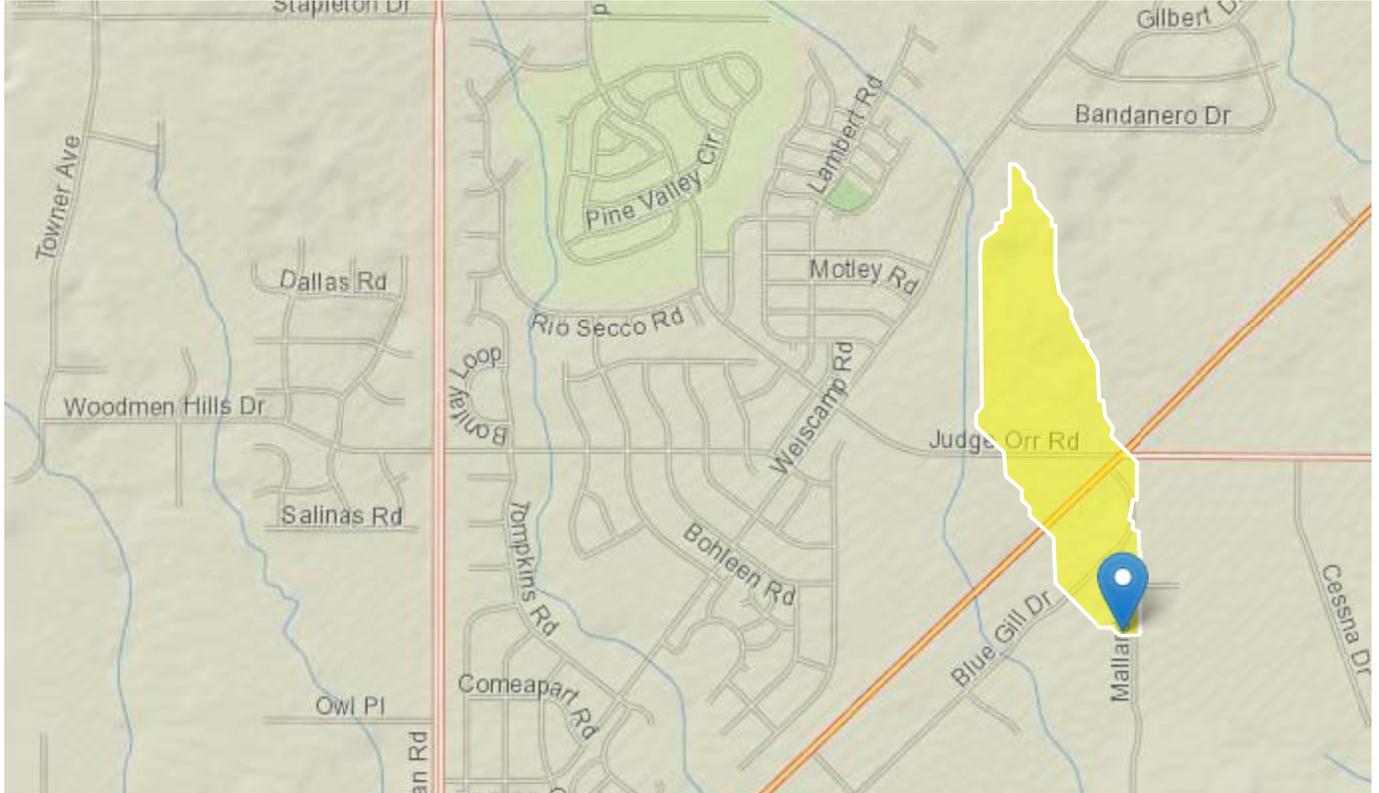
StreamStats Report-7950 Mallard Drive

Region ID: CO

Workspace ID: C020180823172302966000

Clicked Point (Latitude, Longitude): 38.94916, -104.57817

Time: 2018-08-23 11:23:09 -0600



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.22	square miles
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	3.9	inches
STATSCLAY	Percentage of clay soils from STATSGO	7.3	percent
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	6862	feet

Peak-Flow Statistics Parameters [Foothills Region Peak Flow 2016 5099]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.22	square miles	0.6	2850
I6H100Y	6 Hour 100 Year Precipitation	3.9	inches	2.38	4.89
STATSCLAY	STATSGO Percentage of Clay Soils	7.3	percent	9.87	37.5
OUTLETELEV	Elevation of Gage	6862	feet	4290	8270

Peak-Flow Statistics Disclaimers [Foothills Region Peak Flow 2016 5099]

Provide, verify CN value

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report [Foothills Region Peak Flow 2016 5099]

Statistic	Value	Unit
2 Year Peak Flood	2.8	ft ³ /s
5 Year Peak Flood	8.22	ft ³ /s
10 Year Peak Flood	14.1	ft ³ /s
25 Year Peak Flood	24.7	ft ³ /s
50 Year Peak Flood	35.4	ft ³ /s
100 Year Peak Flood	49.9	ft ³ /s
200 Year Peak Flood	66.4	ft ³ /s
500 Year Peak Flood	93.5	ft ³ /s

Peak-Flow Statistics Citations

Kohn, M.S., Stevens, M.R., Harden, T.M., Godaire, J.E., Klinger, R.E., and Mommandi, A., 2016, Paleoflood investigations to improve peak-streamflow regional-regression equations for natural streamflow in eastern Colorado, 2015: U.S. Geological Survey Scientific Investigations Report 2016–5099, 58 p. (<http://dx.doi.org/10.3133/sir20165099>)

USGS Data Disclaimer: Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for

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USGS Software Disclaimer: This software has been approved for release by the U.S. Geological Survey (USGS). Although the software has been subjected to rigorous review, the USGS reserves the right to update the software as needed pursuant to further analysis and review. No warranty, expressed or implied, is made by the USGS or the U.S. Government as to the functionality of the software and related material nor shall the fact of release constitute any such warranty. Furthermore, the software is released on condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from its authorized or unauthorized use.

USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.2.1

For undeveloped conditions?
See comment letter.

BASIN	AREA TOTAL (Acres)	CONVEYANCE TC						TT			INTENSITY						TOTAL FLOWS													
		C ₂	C ₅	C ₁₀	C ₂₅	C ₅₀	C ₁₀₀	Length (ft)	Height (ft)	TI (min)	Length (ft)	Height (ft)	C _v	Slope (%)	Velocity (fps)	TC (min)	TOTAL (min)	I ₂ (in/hr)	I ₅ (in/hr)	I ₁₀ (in/hr)	I ₂₅ (in/hr)	I ₅₀ (in/hr)	I ₁₀₀ (in/hr)	Q ₂ (c.f.s.)	Q ₅ (c.f.s.)	Q ₁₀ (c.f.s.)	Q ₂₅ (c.f.s.)	Q ₅₀ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
EX-A	55.00		0.08				0.35	200	4	20.7	730 1487	14.6 10	5 15	2.0% 0.7%	0.7 1.2	17.2 20.1	58.1	1.2	1.5	1.7	2.0	2.2	2.5	0.0	6.6	0.0	0.0	0.0	48.1	

Calculated by: DLM
Date: 6/24/2018

HYDRAULIC ANALYSIS

HEC-RAS HEC-RAS 5.0.1 April 2016
 U.S. Army Corps of Engineers
 Hydrologic Engineering Center
 609 Second Street
 Davis, California

```

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
XXXXXXXX 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       XXXXXX
  
```

PROJECT DATA

Project Title: MALLARD
 Project File : MALLARD.prj
 Run Date and Time: 8/26/2018 9:00:51 AM

Project in English units

PLAN DATA

Plan Title: Plan 01
 Plan File : m:\Catamount Dropbox\PROJECTS\18-164 Mallard Drive\Drainage Report\hecras\MALLARD.p01

Geometry Title: MALLARD
 Geometry File : m:\Catamount Dropbox\PROJECTS\18-164 Mallard Drive\Drainage Report\hecras\MALLARD.g01

Flow Title : Flow 01
 Flow File : m:\Catamount Dropbox\PROJECTS\18-164 Mallard Drive\Drainage Report\hecras\MALLARD.f01

Plan Summary Information:

Number of:	Cross Sections =	2	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
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Flow 01
Flow File : m:\Catamount Dropbox\PROJECTS\18-164 Mallard Drive\Drainage Report\hecras\MALLARD.f01

Flow Data (cfs)

River	Reach	RS	PF 1
MALLARD	1	350	49.9

Boundary Conditions

River	Reach	Profile	Upstream
MALLARD	1	PF 1	
Downstream			
Critical			

GEOMETRY DATA

Geometry Title: MALLARD
Geometry File : m:\Catamount Dropbox\PROJECTS\18-164 Mallard Drive\Drainage Report\hecras\MALLARD.g01

CROSS SECTION

RIVER: MALLARD
REACH: 1 RS: 350

INPUT

Description: STATION 350

Station Elevation Data		num= 6		Sta Elev		Sta Elev		Sta
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta
0	6858.51	8.5	6858.45	27	6856.91	33	6856.91	49.28
6858.27								
60	6858.21							

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val		
0	.042	8.5	.035	49.28	.042		
Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.
Expan.							
	8.5	49.28		100	100	100	.1
	.3						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	6858.12	Element	Left OB
Channel Right OB			
Vel Head (ft)	0.08	Wt. n-Val.	
0.035			
W.S. Elev (ft)	6858.04	Reach Len. (ft)	100.00
100.00	100.00		
Crit W.S. (ft)	6857.71	Flow Area (sq ft)	
21.96			
E.G. Slope (ft/ft)	0.004951	Area (sq ft)	
21.96			
Q Total (cfs)	49.90	Flow (cfs)	
49.90			
Top Width (ft)	33.01	Top Width (ft)	
33.01			
Vel Total (ft/s)	2.27	Avg. Vel. (ft/s)	
2.27			
Max Chl Dpth (ft)	1.13	Hydr. Depth (ft)	
0.67			
Conv. Total (cfs)	709.2	Conv. (cfs)	
709.2			
Length Wtd. (ft)	100.00	Wetted Per. (ft)	
33.10			
Min Ch El (ft)	6856.91	Shear (lb/sq ft)	
0.21			
Alpha	1.00	Stream Power (lb/ft s)	
0.47			
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	
0.04			
C & E Loss (ft)	0.02	Cum SA (acres)	
0.07			

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: MALLARD
REACH: 1

RS: 250

INPUT
Description: 2+50

Station Elevation Data	num=	6							
Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev	Sta Elev
0 6857.2	14.21 6857.19	27 6856.13	33 6856.13	45.43					
6857.16									
60 6857.07									

Manning's n Values	num=	3
Sta n Val	Sta n Val	Sta n Val
0 .042	14.21 .035	45.43 .042

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.
Expan.						
	14.21	45.43	0	0	0	.1
.3						

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	6857.18	Element	Left OB
Channel Right OB			
Vel Head (ft)	0.25	Wt. n-Val.	
0.035			
W.S. Elev (ft)	6856.93	Reach Len. (ft)	
Crit W.S. (ft)	6856.93	Flow Area (sq ft)	
12.54			
E.G. Slope (ft/ft)	0.022493	Area (sq ft)	
12.54			
Q Total (cfs)	49.90	Flow (cfs)	
49.90			
Top Width (ft)	25.32	Top Width (ft)	
25.32			
Vel Total (ft/s)	3.98	Avg. Vel. (ft/s)	
3.98			
Max Chl Dpth (ft)	0.80	Hydr. Depth (ft)	
0.50			
Conv. Total (cfs)	332.7	Conv. (cfs)	
332.7			
Length Wtd. (ft)		Wetted Per. (ft)	
25.39			
Min Ch El (ft)	6856.13	Shear (lb/sq ft)	
0.69			
Alpha	1.00	Stream Power (lb/ft s)	
2.76			
Frctn Loss (ft)		Cum Volume (acre-ft)	
C & E Loss (ft)		Cum SA (acres)	

SUMMARY OF MANNING'S N VALUES

River:MALLARD

Reach	River Sta.	n1	n2	n3
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1	350	.042	.035	.042
1	250	.042	.035	.042

SUMMARY OF REACH LENGTHS

River: MALLARD

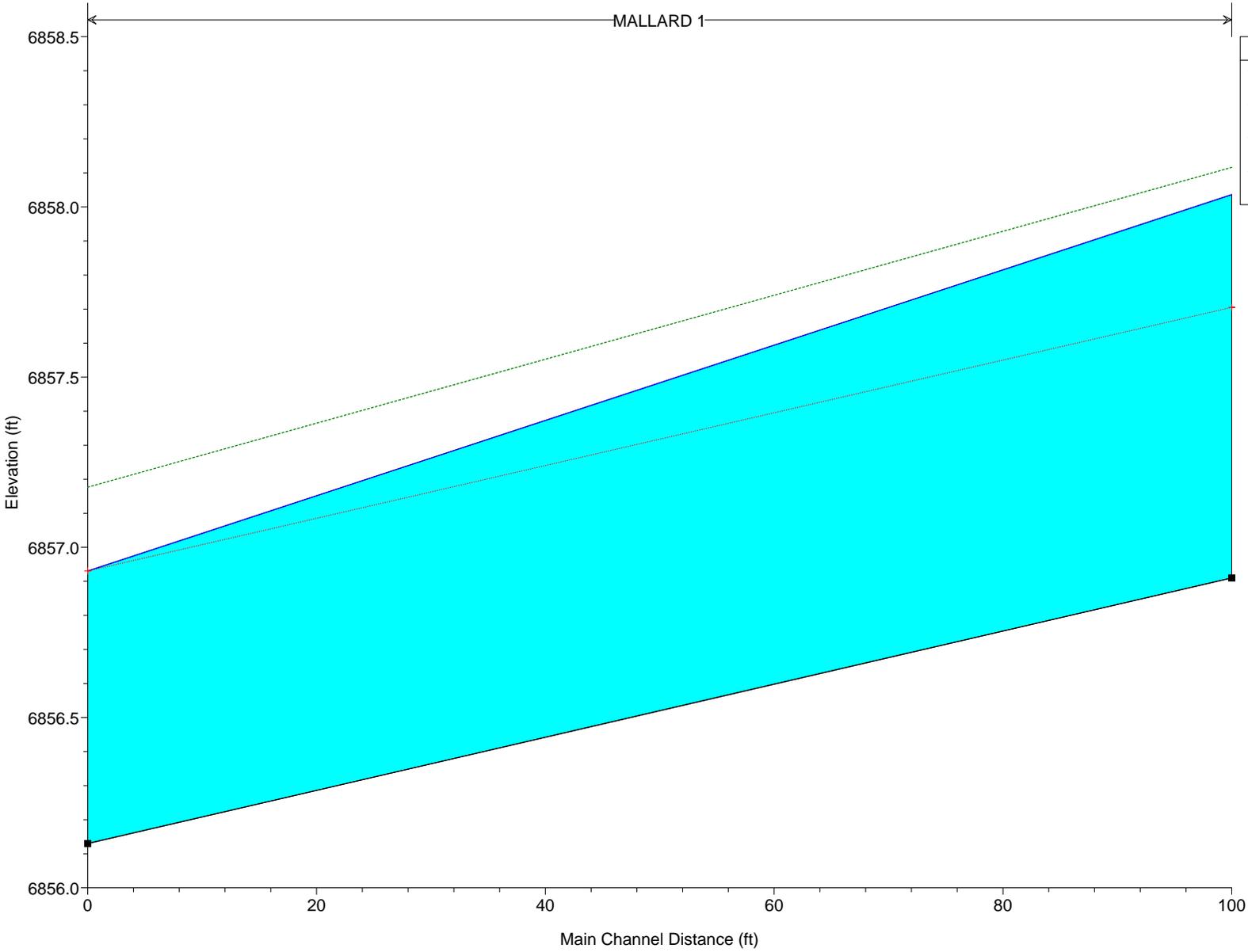
Reach	River Sta.	Left	Channel	Right
1	350	100	100	100
1	250	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

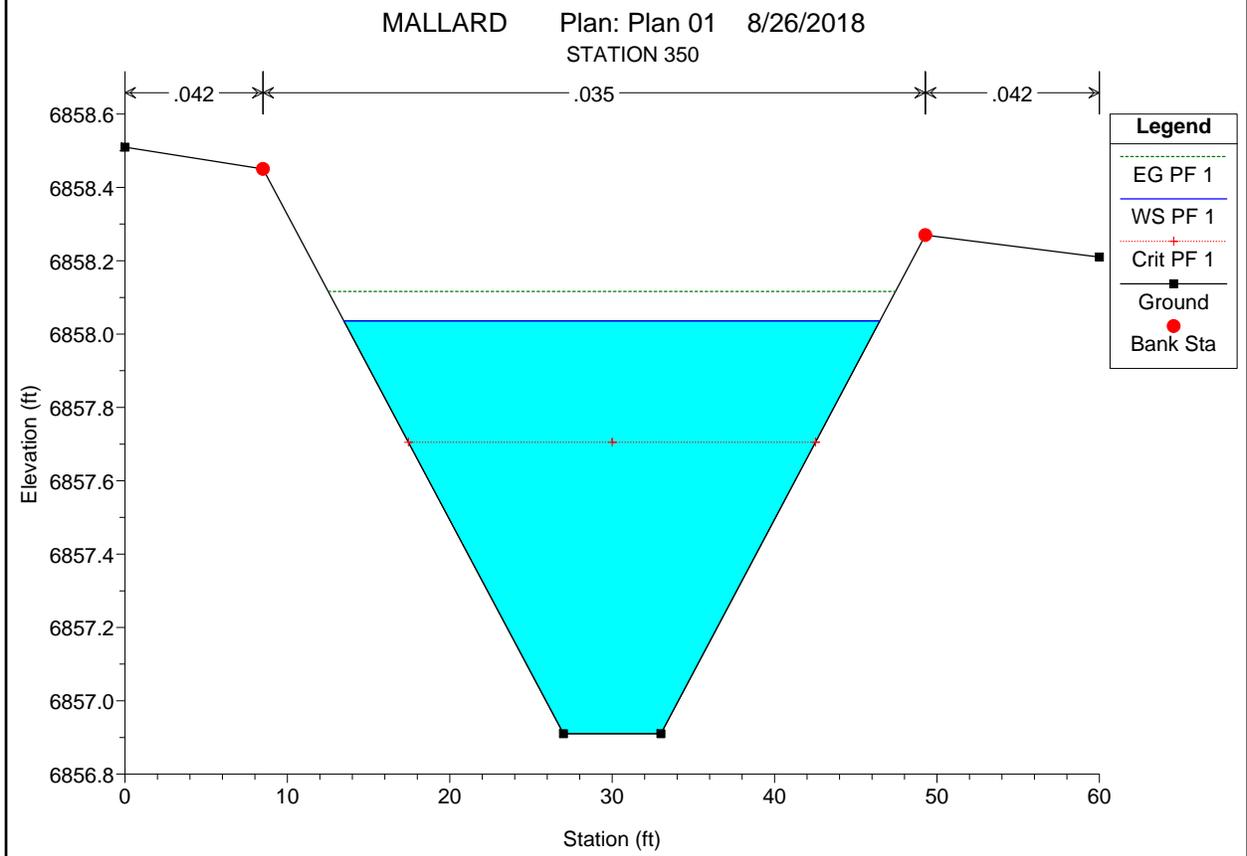
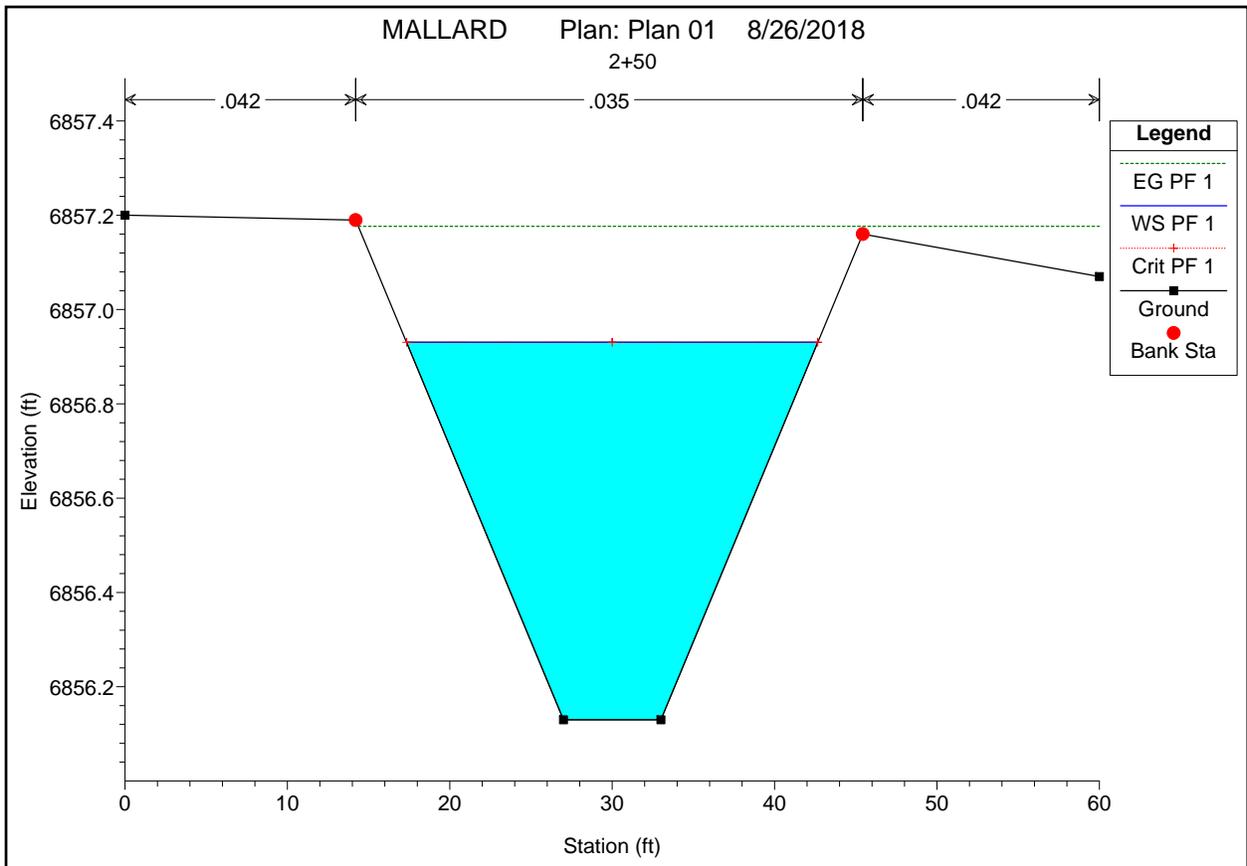
River: MALLARD

Reach	River Sta.	Contr.	Expan.
1	350	.1	.3
1	250	.1	.3

MALLARD 1



Legend	
EG PF 1	Green Dotted Line
WS PF 1	Blue Solid Line
Crit PF 1	Red Dotted Line
Ground	Black Solid Line



DRAINAGE MAP

