PRELIMINARY/FINAL DRAINAGE REPORT
FOR
HIGH PLAINS FILING NO. 1

July 2018

Prepared for:

Savage Development, Inc.
835 Diamond Rim Drive
Colorado Springs, CO 80921

Prepared By:

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

PCD FILE NO's: SP-18-003
SF-18-024

PRELIMINARY/FINAL DRAINAGE REPORT
HIGH PLAINS FILING NO. 1

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 HIGH PLAINS FILING NO. 1 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 Date
For and on behalf of Catamount Engineering

Developer's Statement:

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

Savage Development, Inc. hereby certifies that the drainage facilities for HIGH PLAINS FILING NO. 1 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 HIGH PLAINS FILING NO. 1, guarantee that final drainage design review will absolve Savage Development, Inc. 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.

Savage Development, Inc.
Business Name

By: Jordan Savage

Title: President

Address: 835 Diamond Rim Drive

Colorado Springs, CO 80921

El Paso County:

Filed in accordance with the requirements of the El Paso County land Development Code and the Drainage Criteria manual Volumes 1 and 2, and the El Paso County Engineering Criteria Manual, latest revision.

Jennifer Irvine, PE Date
County Engineer/ECM Administrator

Conditions:

PRELIMINARY/FINAL DRAINAGE REPORT for HIGH PLAINS FILING NO. 1

PURPOSE

The purpose of this drainage report is to identify existing drainage patterns, quantify developed storm water runoff, and establish outfall scenarios from the proposed development.

GENERAL LOCATION AND DESCRIPTION

The subject 38.49 acres consists of unplatted land to be developed into 7 rural residential lots (RR-5 zoning) located within the SE ¼ of Section 19, Township 11 South, Range 65 West of the 6th principal meridian in unincorporated El Paso County. The parcel is bounded to the north by unplatted land zoned RR-5, to the east and west by platted RR-5 residential lots, and to the south by Hodgen Road.

The parcel contains an unnamed tributary of the east fork of East Cherry Creek that flows from a dual culvert crossing of Hodgen Road at the southern limits of the parcel to the northeast and exits the parcel along the easterly property line. The site drains directly to the reach of Cherry Creek at slopes between 4% and 25%.

Existing soils on the site consist of Peyton sandy loam, hydrologic soil group B (51%), and Peyton -Pring complex, hydrologic soil group B (49%) as determined by the Natural Resources Conservation Service Web Soil Survey. The site is located within the East Cherry Creek Basin.

The site is sparsely vegetated with native grasses. Some volunteer shrubs and trees are evident within the existing drainage. A swale along the south edge of the project running from west to east and outfalls to the unnamed tributary of East Cherry Creek. The site lies within the East Cherry Creek Basin.

Existing soils on the site consist of Peyton sandy loam, hydrologic soil group B (51%), and Peyton -Pring complex, hydrologic soil group B (49%) as determined by the Natural Resources Conservation Service Web Soil Survey. Hydrologic Group B soils were used in analysis.

A portion of the site lies within an F.E.M.A. designated zone ‘A’ (unstudied) floodplain per FIRM 08041C0325 F, effective March 17, 1997. A LOMR is in process to develop base flood elevations for the reach and has been included in the appendix. Analysis of the floodplain indicates significant reduction in effective zone ‘A’ (unstudied) floodplain. The area currently identified as Zone ‘A’ (unstudied) has been included in a no build easement to be dedicated to El Paso County with plat recordation.

EXISTING DRAINAGE CONDITIONS

No existing studies on the site or overall basin have been identified. The parcel contains two unnamed tributaries to the Cherry Creek Basin. The westerly reach identified as design point SS3 (Q_{100}=153 cfs) enters the westerly boundary of the property within an unimproved swale and conveys flows to a confluence with the southerly unnamed tributary within the property. The southerly reach identified as design point SS2 (Q_{100}=295 cfs) enters the property through a dual 48" crossing of Hodgen Road installed by El Paso County. No hydrologic or hydraulic analysis was available for the crossing information. Combined flows are conveyed through the property northeasterly to the easterly property boundary (design point SS1, Q_{100}=357 cfs). USGS Streamstats modeling developed for the LOMR submittal was utilized in obtaining approximate flows within the reaches.

Basin E1 (22.00 Acres, Q_2=0.8 cfs, Q_5=2.8 cfs, Q_{10}=6.2 cfs, Q_{25}=10.9 cfs, Q_{50}=14.6 cfs, and Q_{100}=18.9 cfs) consists of that portion tributary to the westerly lot line of the parcel and sheetflow directly to the unnamed reach of East Cherry Creek within the parcel.

Basin E2 (5.46 Acres, Q_2=0.3 cfs, Q_5=1.3 cfs, Q_{10}=2.8 cfs, Q_{25}=4.8 cfs, Q_{50}=6.5 cfs, and Q_{100}=8.4 cfs) consists of that portion tributary to the northerly lot line of the parcel and sheetflow directly to the unnamed reach of East Cherry Creek within the parcel.

Basin E3 (1.62 Acres, Q_2=1.0 cfs, Q_5=1.5 cfs, Q_{10}=2.2 cfs, Q_{25}=3.1 cfs, Q_{50}=3.8 cfs, and Q_{100}=4.6 cfs) consists of that portion tributary to the southerly lot line of the parcel west of the channel and sheetflow directly to the unnamed reach of East Cherry Creek within the parcel.

Basin E4 (3.53 Acres, Q_2=0.9 cfs, Q_5=1.6 cfs, Q_{10}=2.8 cfs, Q_{25}=4.3 cfs, Q_{50}=5.5 cfs, and Q_{100}=6.9 cfs) consists of that portion tributary to the southerly lot line of the parcel east of the channel and sheetflow directly to the unnamed reach of East Cherry Creek within the parcel.

Basin E5 (38.49 Acres, Q_2=2.4 cfs, Q_5=9.1 cfs, Q_{10}=20.0 cfs, Q_{25}=34.9 cfs, Q_{50}=46.8 cfs, and Q_{100}=60.8 cfs) consists of the majority of the development parcel which sheetflow directly to the reach of East Cherry Creek within the parcel.

DEVELOPED DRAINAGE BASINS

The majority of the area within basins was modeled as 1-acre residential. Areas identified as no-build were modeled as agricultural land. Roadways and shoulders were modeled as pavement and gravel roadways where proposed.

Basin A1 (5.91 Acres, Q_2=2.9 cfs, Q_5=5.1 cfs, Q_{10}=7.3 cfs, Q_{25}=10.3 cfs, Q_{50}=12.9 cfs, and Q_{100}=15.6 cfs) represents the northwesterly portion of proposed residential lots and the central cul-de-sac. Runoff generated within the basin will sheet flow to the roadside ditch adjacent to the proposed cul-de-sac and be conveyed to a lowpoint at a common lot line within the cul-de-sac bulb at Design Point 3. Flows from Design Point 3 will be conveyed in a swale directly to the reach of East Cherry Creek.

Basin A2 (0.88 Acres, Q_2=2.5 cfs, Q_5=3.1 cfs, Q_{10}=3.7 cfs, Q_{25}=4.3 cfs, Q_{50}=4.9 cfs, and Q_{100}=5.6 cfs) consists of the westerly half of the proposed north-south roadway. The roadway was modeled assuming ultimate construction to the northerly property line rather than the interim condition of termination at connection with the cul-de-sac connection to allow for appropriate southerly culvert analysis. Sheet flow from the roadway is conveyed south to the proposed culvert triple 30" culvert crossing at Design Point 1. Design point 1 (Q_{100}=173.9 cfs) represents the confluence of Basins A2, Basin E1, and Stream Stats Design Point SS3. Flows are conveyed in a 3.5' deep, 5' bottom width channel with a 1% longitudinal slope to the reach of East Cherry Creek.

Basin A3 (3.48 Acres, Q_2=0.7 cfs, Q_5=1.5 cfs, Q_{10}=2.6 cfs, Q_{25}=4.0 cfs, Q_{50}=5.2 cfs, and Q_{100}=6.5 cfs) consists of the southeasterly portion of the residential lots directly tributary to the existing Hodgen Roadside ditch. Combined flows from Basin A-3 and existing Basin E3 are conveyed within the existing roadside ditch directly to the Reach of the East Fork of Cherry Creek at Design Point 2 (Q_2=2.5 cfs, Q_5=3.4 cfs, Q_{10}=4.3 cfs, Q_{25}=5.5 cfs, Q_{50}=6.4 cfs, and Q_{100}=7.5 cfs).

Basin A4 (28.21 Acres, Q_2=6.8 cfs, Q_5=15.0 cfs, Q_{10}=24.9 cfs, Q_{25}=38.0 cfs, Q_{50}=49.3 cfs, and Q_{100}=61.4 cfs) consists of residential, no-build, and roadway areas in the center of the property directly tributary to the Reach of the East Fork of Cherry Creek.

The rational methodology was utilized in analyzing on-site basins for development of on-site improvements not tributary to large off-site basins utilized in channel analysis. The minor increase in impervious area due to roadway and homesite development within the 38.49 acre subdivision would not substantially impact overall channel flows within the 3 square miles contributing to design point SS1. The impact on flow rate at design point SS1 would also be mitigated by substantial increase in time of concentration for runoff calculations within the channel. The rational analysis estimated peak is 60 minutes while the unit hydrograph exhibits a 3.6 hour time of concentration.

Detention is not typically pursued in rural development scenarios unless undetained upstream development would negatively affect the development. A significant portion of runoff generated within typical rural development does not flow directly into County stormwater systems, but leaves improved areas as sheetflow into undeveloped and vegetated portions of lots and infiltrates into the ground. A large pond exists upstream of the development on the main branch of east Cherry Creek further negating the need for on-site detention.

See Appendix for Calculations.

PRUDENT LINE ESTABLISHMENT

As mentioned prior, the owner proposes to leave the channel in a natural state to preserve the channel and vegetation as site amenities. In addition, from an runoff and channel stability standpoint it is preferable to keep existing vegetation within the channel and the accompanying natural ecosystems preserved to the maximum extent possible. In order to accomplish this goal, the "Prudent Line" approach is proposed in lieu of constructed channel stabilization techniques being used (e.g. - riprap lining, reconstruction of the channel, drop structure placement). This approach is applicable because large lot development will not greatly impact the hydrology within the reach and the existing upstream detention pond upstream of Hodgen road. No DBPS improvements have been recommended for the East Cherry Creek drainage.

Per the Prudent Line Addendum (PLA), the channel must meet certain criteria for use of the concept (refer to Table 1 in the PLA.

Applicability

1. *Does basin have a DBPS?*
No, No DBPS has been developed for the East Cherry Creek Basin. Therefore, discussions with the County must be conducted to determine if the prudent line approach is acceptable.

2. *Has a County discussion taken place with regards to PLA applicability?*
Yes, County staff has determined that prudent line application is applicable for the reach within teh development..

3. *Is the development density greater than 1 unit per acre? (If yes, a PLA is not applicable)*
No, existing and proposed land use density in the watershed is less than 1 unit per acre.

4. *Is the channel capacity greater than or equal to the 10 yr storm flow? (If no, a PLA is not applicable)*
Yes, the channel has adequate capacity for the 100 yr storm.

5. *Is the watershed imperviousness value in less than 15%? (If no, a PLA must be discussed with County engineering staff regarding transition issues)*
The existing and future contributing basin imperviousness value is less than 15%. The ECM estimates impervious values for 5-acre lots at 7%.

Transition Issues

Case 1 - Transition between an improved channel reach and a prudent line reach, or vice versa.
This case is not applicable for this site as there is no proposed improved channel reaches upstream or downstream of the limits of this study. If at such a time in the future upstream development requires improvements along their reach; consideration shall be given that this project is being developed with the prudent line concept.

Case 2 - Transition that is necessary at road crossings on a prudent line reach.
As stated in the PLA, considerations must be given to situations where road crossings occur. The existing County installed crossing of Hodgen Road was incorporated in the analysis. Upstream

deposition will be minimized due to presence of existing Franktown parker FPE-2 Reservoir directly upstream of the crossing.

Defining the Prudent Line

The prudent line for the High Plains development was defined considering the 100 yr floodplain boundary, the erosion during a 100 yr event, and the long-term anticipated erosion over a 30 year period.

Maintenance Line

A maintenance line is a way of monitoring the amount of lateral migration from erosion a streambed has incurred. If a channel begins to encroach on the maintenance line from significant hydrologic events or from long-term erosion, corrective measures should be evaluated to ensure the prudent line as proposed in this study is still valid. Such measures include riprap, regarding, revegetation, or other channel stability remedial approaches. The prudent line addendum does not provide a basis for establishing a maintenance line with regards to the prudent line setback. However, it is the recommendation of this study that the line be located at the top of bank where the main channel is basically defined.

Maintenance Access

The PLA requires that maintenance access be provided at each lot line. 20' width easements exist along each property line within the development providing adequate access.

Calculating the Prudent Line

The prudent line calculations performed as a part of this analysis was based on the "Sandy Soil" methodology. A prudent line was developed from the calculations found in the appendix of this report and is shown on the drainage map. In typical scenarios the prudent line is defined as either from the top of the bank of the low flow channel or the 10-YR water surface. Conservatively, the easterly prudent line setback was established from the toe of the channel bank from station 3+50 to station 10+00 where areas of significant slope defined the channel, providing additional buffer.

See Appendix for Prudent Line Calculations.

WATER QUALITY/4-STEP PROCESS

The development addresses Low Impact Development strategies primarily through the utilization of large impervious areas and utilization of landscape swales receiving runoff generated within impervious roadways.

Step 1-

Impervious areas generated within the development will flow across pervious disconnected areas prior to offsite discharge. Runoff generated within roadway improvements will be directed to grassed roadside ditches and conveyed to grassed channels no curb or storm sewer improvements are proposed with the development.

Step2-
Proposed channel improvements are designed at sizes and grades allowing development as grass lined swales rather than hard-sided improvements. The reach of East Cherry Creek that runs through the project is proposed as prudent line setback per the requirements of Appendix J of the El Paso County Engineering Criteria Manual.

Step3-
Permanent water quality facility is not proposed for development of 5 acre lots per the requirements of El Paso County Engineering Criteria Manual section I.7.1B.

Step4-
A Grading, Erosion Control, and Stormwater Quality Plan and narrative have been submitted concurrently for the development and will be subject to county approval prior to any soil disturbance. The erosion control plan included specific source control BMP's as well defined overall site management practices for the construction period.

COST ESTIMATE

Public Improvements Non-reimbursable

30" RCP	156 LF	@$	75/LF	$	11,700
30" FES	6 EA	@$	350/EA	$	2,100
30" RCP	85 LF	@$	75/LF	$	6,375
30" FES	2 EA	@$	350/EA	$	700
Rip Rap Outfall	3 EA	@$	500/EA	$	1,500
	SUBTOTAL			**$**	**22,375**
	15% CONTINGENCY			*$*	*3,356*
	TOTAL			**$**	**25,731**

DRAINAGE FEE CALCULATION

The development proposes to plat 38.49 acres within El Paso County, all contained within the East Cherry Creek Drainage Basin. The East Cherry Creek Drainage Basin has not been studied and no drainage or bridge fees have been adopted.

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.

The rational method for drainage basin study areas of less than 100 acres was utilized in the on-site analysis. For the Rational Method, flows were calculated for the 2, 5, 10, 25, 50, 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 storm drain or gutter 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.

StreamStats version 4 (USGS) was utilized in development of hydrology for off-site basins in floodplain development for FEMA submittal. HEC-RAS version 5.0.1 was utilized in channel and existing culvert modeling developing base flood elevations refining the existing Zone 'A' unstudied floodplain within the development.

SUMMARY

The High Plains Filing No. 1 project consists of large lot development with minor increases in impervious areas consistent with surrounding rural development. The development proposes no development and a setback approach in regards to the reach of the East Cherry Creek drainage within the parcel. A no-build easement has been established outside of the limits of the existing jurisdictional zone 'A' unstudied 100-YR floodplain. A LOMR is in process developing base flood elevations through the reach. Development of the parcel is in conformance of current El Paso County criteria and will not adversely affect downstream properties or facilities.

REFERENCES:

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

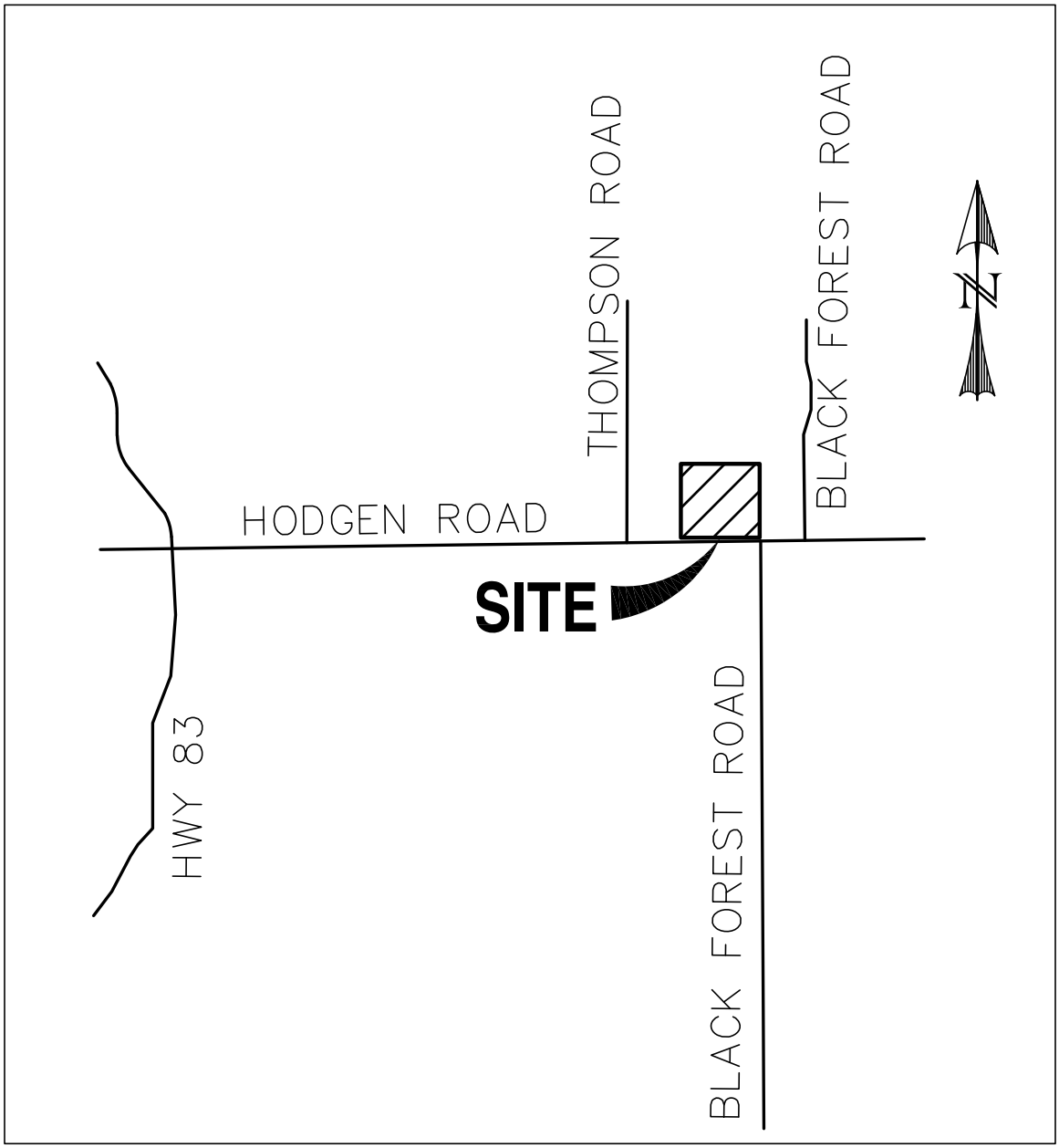
“Drainage Study Rockin’ Four-ESE Subdivision El Paso County, Colorado”, prepared by E.L.B. & Asso. Inc., dated April 24, 1980.

“LOMR Case # 18-08-072”, prepared by Catamount Engineering, DRAFT

Flood Insurance rate map 08041C0325 F

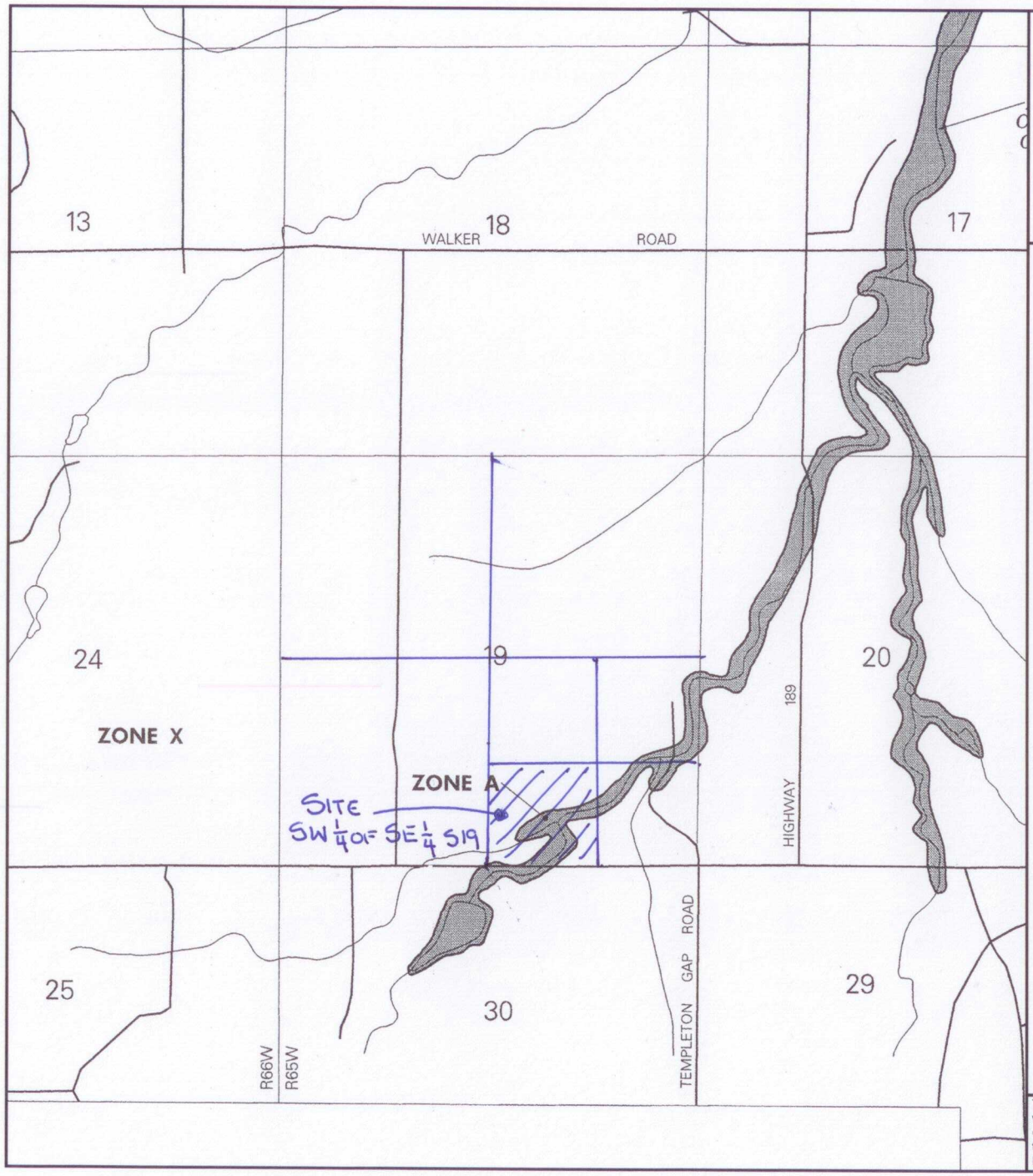
Natural Resources Conservation Service Web Soil Survey

APPENDIX



VICINITY MAP

SCALE: N.T.S.



APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 325 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

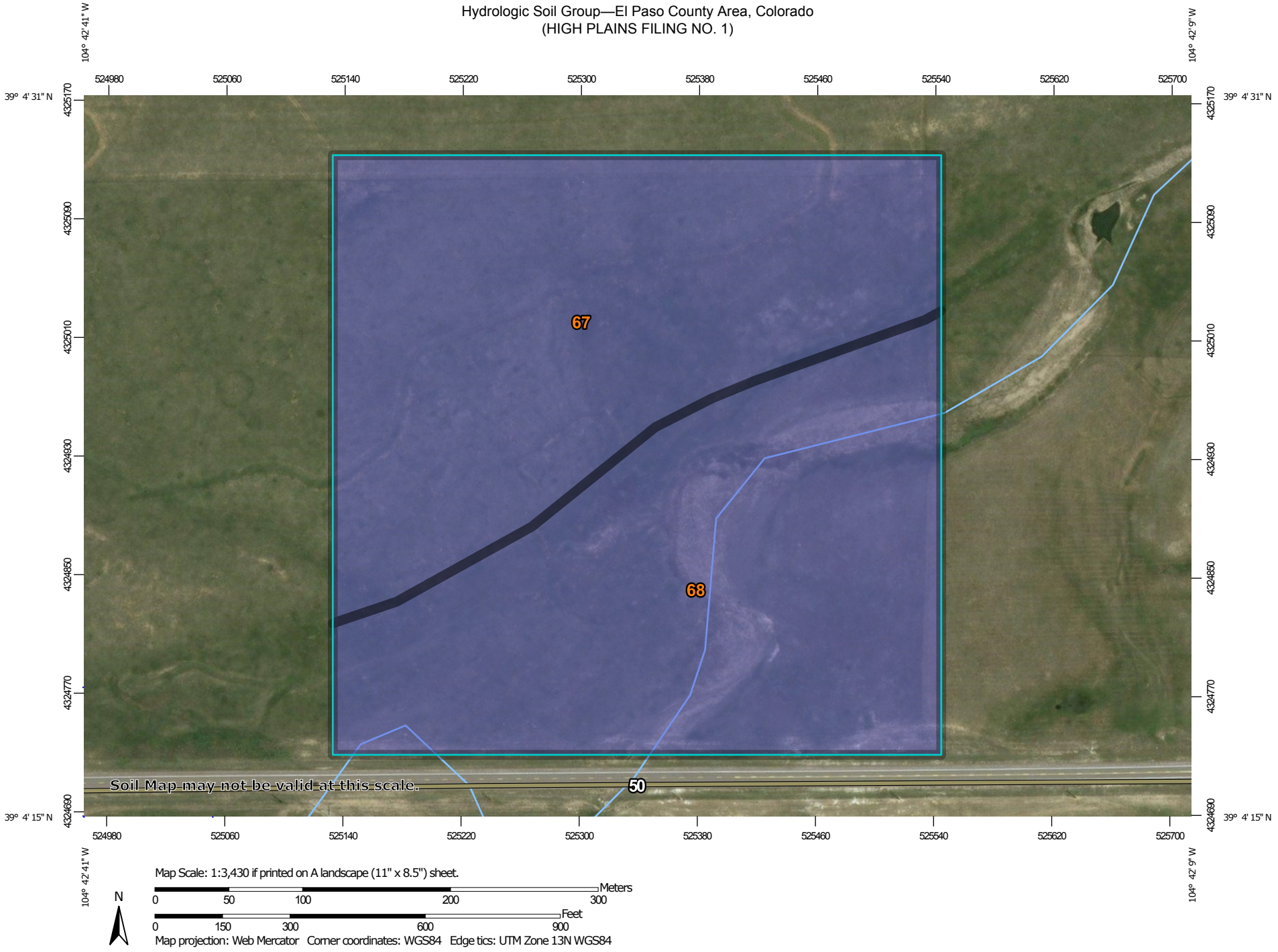
CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0325	F

MAP NUMBER 08041C0325 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

Hydrologic Soil Group—El Paso County Area, Colorado
(HIGH PLAINS FILING NO. 1)



Map Scale: 1:3,430 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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
67	Peyton sandy loam, 5 to 9 percent slopes	B	20.9	50.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	20.4	49.4%
Totals for Area of Interest			**41.4**	**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

EXISTING HYDROLOGY

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	**AREA TOTAL (Acres)**	**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.)**
E1 *AGRICULTURE*	22.00	**0.03**	**0.09**	**0.17**	**0.26**	**0.31**	**0.36**	200	8	17.3	1597	24	5	1.5%	0.6	43.4	60.7	1.1	1.4	1.7	1.9	2.1	2.4	**0.8**	**2.8**	**6.2**	**10.9**	**14.6**	**18.9**
E2 *AGRICULTURE*	5.46	**0.03**	**0.09**	**0.17**	**0.26**	**0.31**	**0.36**	200	12	15.1	834	35	5	4.2%	1.0	13.6	28.7	2.0	2.5	3.0	3.4	3.8	4.3	**0.3**	**1.3**	**2.8**	**4.8**	**6.5**	**8.4**
E3	1.62	**0.23**	**0.28**	**0.34**	**0.42**	**0.46**	**0.50**	100	3	11.0	186	3	5	1.6%	0.6	4.9	15.9	2.7	3.4	4.0	4.6	5.2	5.8	**1.0**	**1.5**	**2.2**	**3.1**	**3.8**	**4.6**
ACRICULTURE	1.25	0.03	0.09	0.17	0.26	0.31	0.36																						
ROADWAY	0.37	0.89	0.90	0.92	0.94	0.95	0.96																						
E4	3.53	**0.11**	**0.17**	**0.24**	**0.32**	**0.37**	**0.42**	200	7	16.7	610	43	5	7.0%	1.3	7.7	24.4	2.2	2.8	3.3	3.7	4.2	4.7	**0.9**	**1.6**	**2.8**	**4.3**	**5.5**	**6.9**
ACRICULTURE	3.20	0.03	0.09	0.17	0.26	0.31	0.36																						
ROADWAY	0.33	0.89	0.90	0.92	0.94	0.95	0.96																						
E5 *ACRICULTURE*	38.49	**0.03**	**0.09**	**0.17**	**0.26**	**0.31**	**0.36**	200	9	16.6	790	47	5	5.9%	1.2	10.8	27.4	2.1	2.6	3.1	3.5	3.9	4.4	**2.4**	**9.1**	**20.0**	**34.9**	**46.8**	**60.8**

Calculated by: DLM

Date: 7/16/2018

PROPOSED HYDROLOGY

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	**AREA TOTAL (Acres)**	**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.)**
E1	22.00	**0.03**	**0.09**	**0.17**	**0.26**	**0.31**	**0.36**	200	8	17.3	1597	24	5	1.5%	0.6	43.4	60.7	1.1	1.4	1.7	1.9	2.1	2.4	**0.8**	**2.8**	**6.2**	**10.9**	**14.6**	**18.9**
AGRICULTURE																													
E2	5.46	**0.03**	**0.09**	**0.17**	**0.26**	**0.31**	**0.36**	200	12	15.1	834	35	5	4.2%	1.0	13.6	28.7	2.0	2.5	3.0	3.4	3.8	4.3	**0.3**	**1.3**	**2.8**	**4.8**	**6.5**	**8.4**
AGRICULTURE																													
E3	1.62	**0.23**	**0.28**	**0.34**	**0.42**	**0.46**	**0.50**	100	3	11.0	186	3	5	1.6%	0.6	4.9	15.9	2.7	3.4	4.0	4.6	5.2	5.8	**1.0**	**1.5**	**2.2**	**3.1**	**3.8**	**4.6**
ACRICULTURE	1.25	0.03	0.09	0.17	0.26	0.31	0.36																						
ROADWAY	0.37	0.89	0.90	0.92	0.94	0.95	0.96																						
E4	3.53	**0.11**	**0.17**	**0.24**	**0.32**	**0.37**	**0.42**	200	7	16.7	610	43	5	7.0%	1.3	7.7	24.4	2.2	2.8	3.3	3.7	4.2	4.7	**0.9**	**1.6**	**2.8**	**4.3**	**5.5**	**6.9**
ACRICULTURE	3.20	0.03	0.09	0.17	0.26	0.31	0.36																						
ROADWAY	0.33	0.89	0.90	0.92	0.94	0.95	0.96																						
A1	5.91	**0.19**	**0.27**	**0.33**	**0.41**	**0.45**	**0.49**	100	4	10.4	740	35	7	4.7%	1.5	8.1	18.5	2.6	3.2	3.7	4.3	4.8	5.4	**2.9**	**5.1**	**7.3**	**10.3**	**12.9**	**15.6**
RESIDENTIAL	5.35	0.12	0.20	0.27	0.35	0.40	0.44																						
ROADWAY	0.56	0.89	0.90	0.92	0.94	0.95	0.96																						
A2	0.88	**0.89**	**0.90**	**0.92**	**0.94**	**0.95**	**0.96**	40	0.7	2.0	1053	36	10	3.4%	1.8	9.5	11.5	3.1	3.9	4.6	5.2	5.9	6.6	**2.5**	**3.1**	**3.7**	**4.3**	**4.9**	**5.6**
ROADWAY																													
A3	3.48	**0.09**	**0.16**	**0.23**	**0.32**	**0.37**	**0.41**	100	3	12.7	509	9	5	1.8%	0.7	12.8	25.5	2.2	2.7	3.2	3.6	4.1	4.6	**0.7**	**1.5**	**2.6**	**4.0**	**5.2**	**6.5**
RESIDENTIAL	2.16	0.12	0.20	0.27	0.35	0.40	0.44																						
NO BUILD	1.32	0.03	0.09	0.17	0.26	0.31	0.36																						
A4	28.21	**0.10**	**0.17**	**0.24**	**0.32**	**0.37**	**0.42**	100	6	10.0	693	40	5	5.8%	1.2	9.6	19.6	2.5	3.1	3.6	4.2	4.7	5.2	**6.8**	**15.0**	**24.9**	**38.0**	**49.3**	**61.4**
RESIDENTIAL	20.92	0.12	0.20	0.27	0.35	0.40	0.44																						
NO BUILD	7.02	0.03	0.09	0.17	0.26	0.31	0.36																						
ROADWAY	0.27	0.89	0.90	0.92	0.94	0.95	0.96																						

Calculated by: DLM

Date: 7/16/2018

		WEIGHTED						TT	INTENSITY						TOTAL FLOWS					
DESIGN POINT	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**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.)**
DP-1	**22.88**	**0.06**	**0.12**	**0.20**	**0.29**	**0.33**	**0.38**	140.0	0.2	0.2	0.2	0.2	0.3	0.3						**155.5**
BASIN E1	22.00	0.03	0.09	0.17	0.26	0.31	0.36													
BASIN A2	0.88	0.89	0.90	0.92	0.94	0.95	0.96													
DP-SS3	448.00																			153
DP-2	**2.50**	**0.46**	**0.50**	**0.55**	**0.60**	**0.63**	**0.66**	25.5	2.2	2.7	3.2	3.6	4.1	4.6	**2.5**	**3.4**	**4.3**	**5.5**	**6.4**	**7.5**
BASIN E3	1.62	0.23	0.28	0.34	0.42	0.46	0.50													
BASIN A3	0.88	0.89	0.90	0.92	0.94	0.95	0.96													
DP-3	**5.91**	**0.19**	**0.27**	**0.33**	**0.41**	**0.45**	**0.49**	18.5	2.6	3.2	3.7	4.3	4.8	5.4	**2.9**	**5.1**	**7.3**	**10.3**	**12.9**	**15.6**
BASIN A1	5.91	0.19	0.27	0.33	0.41	0.45	0.49													
SS1	**1894.00**							216.0												**357.0**

Calculated by: DLM

Date: 7/16/2018

David Mijares

From: Martin, Casey
Sent: Monday, October 15, 2018 8:15 AM
To: Ben Sheets
Cc: David Mijares
Subject: RE: Case 18-08-0702P Re-submittal 101318

Hello Mr. Sheets,

All comments have been addressed; thank you for resolving them so quickly! A second AD will not be necessary.

The next step is sending out notifications. The draft which you sent me indicates that the area will be upgraded to Zone AE and BFEs established. According to FEMA regulations, you could leave the reach as Zone A if you would like, so I wanted to check to confirm that you wanted to go from Zone A to Zone AE.

Thanks,
Casey Martin, E.I., CFM
Water Resources Engineer
CDM Smith, a member of **Compass PTS JV**
303-383-2333
cdmsmith.com

From: Ben Sheets <sheetseng@gmail.com>
Sent: Sunday, October 14, 2018 5:14 PM
To: Martin, Casey <martinc@cdmsmith.com>
Cc: David Mijares <david@catamounteng.com>
Subject: Case 18-08-0702P Re-submittal 101318

Ms. Martin,
I believe I have addressed all of your comments. Please see the attached response letter and files for your use.
Thank you,
Ben Sheets

CATAMOUNT ENGINEERING
321 W. HENRIETTA AVE SUITE A
PO BOX 221
WOODLAND PARK, CO 80866

SAVAGE SUBDIVISION: L.O.M.R. REQUEST – PROJECT NARRATIVE

The Savage Subdivision development project is a one filing subdivision located in the northern portion of El Paso County, Colorado. This subdivision is located entirely within the NFIP FIRM Map for El Paso County, Colorado and Incorporated Areas, panel 325 of 1300, map number 08041C0325F, with an effective date of March 17, 1997.

The project is bisected by an unnamed tributary of the East Fork of Cherry Creek and it is in this section of the East Fork of Cherry Creek that this LOMR relates. The current zone designation for this reach is Zone A with no existing FIS model. It is our intent to establish Base Flood Elevations for this portion of the unnamed tributary of the East Fork of Cherry Creek.

Documents supporting this application include hydrologic analysis calculations using the Regional Regression methodology equations within the USGS StreamStats computer program. Hydraulic analysis calculations were performed using the USACE HEC-RAS computer program. A certified topographic work map has been included showing the subdivision with 1-foot contours generated from field work conducted by a land surveyor. This map shows the current Zone A boundary as well as the proposed floodplain boundary with Base Flood Elevations.

Hydrologic electronic data files from the USGS StreamStats program as well as hydraulic data files from the HEC-RAS model have been included with this submittal.

This application is exempt from a review fee as it is establishing Base Flood Elevations for an area where no current data exists. This reach of the unnamed tributary of the East Fork of Cherry Creek is well established and no changes are being made to the existing channel, as such, sediment transport was not considered in this analysis.

Please direct any questions concerning this application to Catamount Engineering.

Dave Mijares, P.E.
Catamount Engineering
321 W. Henrietta Ave. Suite ‘A’
P.O. Box 221
Woodland Park, CO 80866
(719) 426-2124
david@catamounteng.com

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Example: 480301 480287	City of Katy Harris County	TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
080059	El Paso County - Unincorporated Areas	CO	08041C	0325F	03/17/97

2. a. Flooding Source: East Cherry Creek

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH)
   ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Savage Subdivision

4. FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5. Basis for Request and Type of Revision:

   a. The basis for this revision request is (check all that apply)

   ☐ Physical Change ☒ Improved Methodology/Data ☐ Regulatory Floodway Revision ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☒ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☒ New Topographic Data ☐ Other (Attach Description)

   Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☐ Levee/Floodwall ☒ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $_____

☒ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Jordan Savage	Company: Savage Development, Inc.	
Mailing Address: 1125 Diamond Rim Drive Colorado Springs, Colorado 80921	Daytime Telephone No.: (719) 649-5266	Fax No.:
	E-Mail Address: jsavage@goodwinknight.com	
Signature of Requester (required):	Date:	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Keith Curtis - Floodplain Administrator	Community Name: El Paso County	
Mailing Address: 2880 International Circle Colorado Springs, Colorado 80910	Daytime Telephone No.: (719) 327-2898	Fax No.: N/A
	E-Mail Address: keith@pprbd.org	
Community Official's Signature (required):	Date:	

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: David Mijares	License No.: 40510		Expiration Date: October 31, 2019
Company Name: Catamount Engineering	Telephone No.: (719) 426-2124		Fax No.: N/A
Signature:	Date:	E-Mail Address: david@catamounteng.com	

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if …
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (Optional)

U.S. DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

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DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: East Cherry Creek

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section B) ☒ No existing analysis ☐ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☐ Precipitation/Runoff Model → Specify Model: _____
☒ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit*	1564' North of the Hodgen Rd. Centerline	0+00		7413.90
Upstream Limit*	916' South of the Hodgen Road Centerline	24+80		7438.21

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS v5.03

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

Models Submitted	Natural Run File Name:	Natural Run Plan Name:	Floodway Run File Name:	Floodway Run Plan Name:	Datum
Duplicate Effective Model*					
Corrected Effective Model*					
Existing or Pre-Project Conditions Model					
Revised or Post-Project Conditions Model	Savage	100Yr Subcritical			NAVD88
Other - (attach description)					

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

☐ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: Field survey

Source: Barron Land Date: January 22, 2018

Accuracy: 1' Contour Interval

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☐ No

   a. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:

   - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
   - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☐ Yes ☐ No

   If Yes, please attach **proof of property owner notification and acceptance (if available)**. Elements of and examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☒ Yes ☐ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being established. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

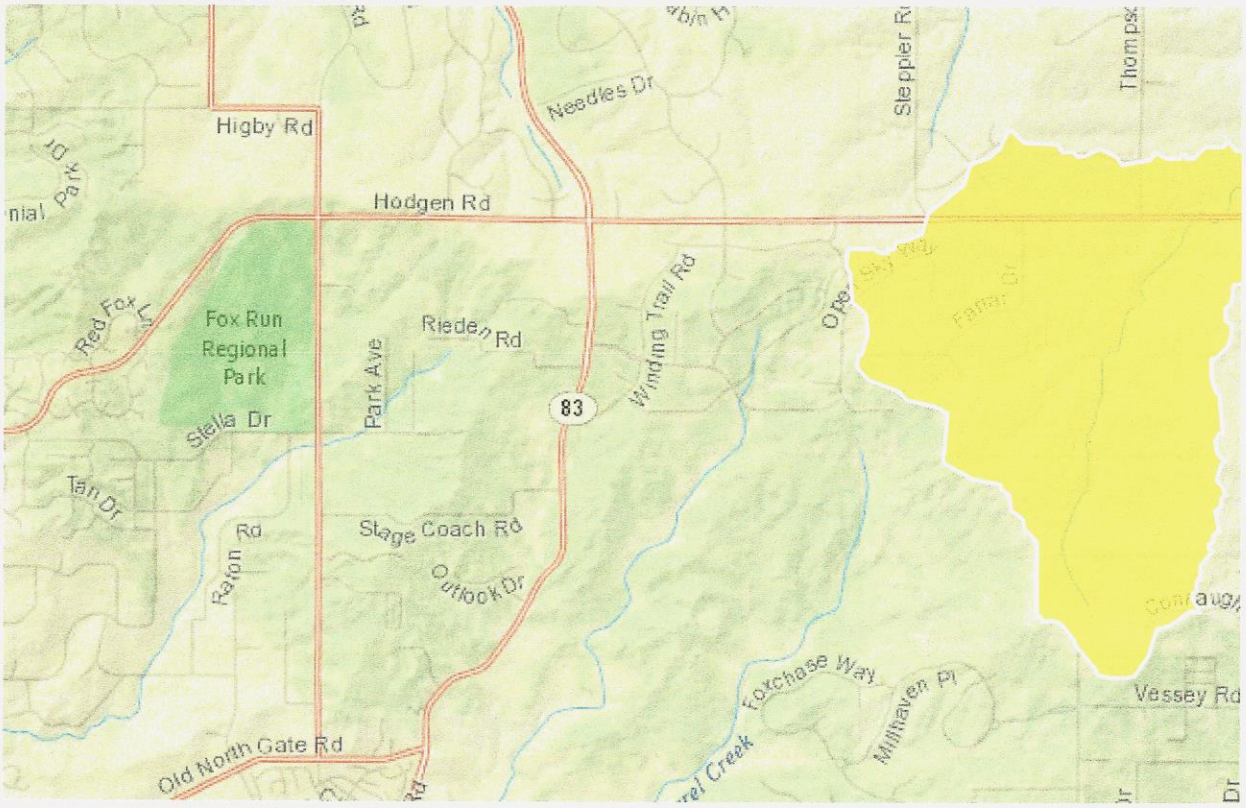
4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

SAVAGE PROJECT - StreamStats Report 1

Region ID: CO
Workspace ID: CO20180218171329262000
Clicked Point (Latitude, Longitude): 39.07488, -104.70275
Time: 2018-02-18 10:13:45 -0700



Design Point Above Minor Trib TGap

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.96	square miles
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	3.84	inches
STATSCLAY	Percentage of clay soils from STATSGO	16.3	percent
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	7416	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	4.99	inches

Parameter Code	Parameter Description	Value	Unit
RCN	Runoff-curve number as defined by NRCS (http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17758.wba)	60.68	
TOC	Time of concentration in hours	3.6	
RUNCO_CO	Soil runoff coefficient as defined by Verdin and Gross (2017)	0.25	
LFPLENGTH	Length of longest flow path	3.41	miles
BSLDEM10M	Mean basin slope computed from 10 m DEM	6.42	percent
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	68	feet per mi
EL7500	Percent of area above 7500 ft	83	percent
ELEV	Mean Basin Elevation	7557	feet
ELEVMAX	Maximum basin elevation	7690	feet
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precitation intensity index	1.92	inches
I6H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	1.38	
LAT_OUT	Latitude of Basin Outlet	4325125	degrees
LC11BARE	Percentage of barren from NLCD 2011 class 31	0	
LC11CRPHAY	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	3.1	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	2.1	percent
LC11GRASS	Percent of area covered by grassland/herbaceous using 2011 NLCD	76.1	
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	3.1	percent
LC11SHRUB	Percent of area covered by shrubland using 2011 NLCD	18.7	
LC11SNOIC	Percent snow and ice from NLCD 2011 class 12	0	
LC11WATER	Percent of open water, class 11, from NLCD 2011	0	
LC11WETLND	Percentage of wetlands, classes 90 and 95, from NLCD 2011	0	
LONG_OUT	Longitude of Basin Outlet	525705	degrees
MINBELEV	Minimum basin elevation	7410	feet
PRECIP	Mean Annual Precipitation	20.83	inches
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	91.2	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	7.1	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	1.65	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.9	percent

General Disclaimers

Upstream regulation was checked for this watershed.

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.96	square miles	0.6	2850
I6H100Y	6 Hour 100 Year Precipitation	3.84	inches	2.38	4.89
STATSCLAY	STATSGO Percentage of Clay Soils	16.3	percent	9.87	37.5
OUTLETELEV	Elevation of Gage	7416	feet	4290	8270

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

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
2 Year Peak Flood	22	ft^3/s	117
5 Year Peak Flood	61.8	ft^3/s	87
10 Year Peak Flood	104	ft^3/s	80
25 Year Peak Flood	181	ft^3/s	80
50 Year Peak Flood	257	ft^3/s	83
100 Year Peak Flood	357	ft^3/s	88
200 Year Peak Flood	474	ft^3/s	94
500 Year Peak Flood	661	ft^3/s	104

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)

High Plains Subdivision Filing No. 1

Region ID: CO
Workspace ID: CO20181017225213162000
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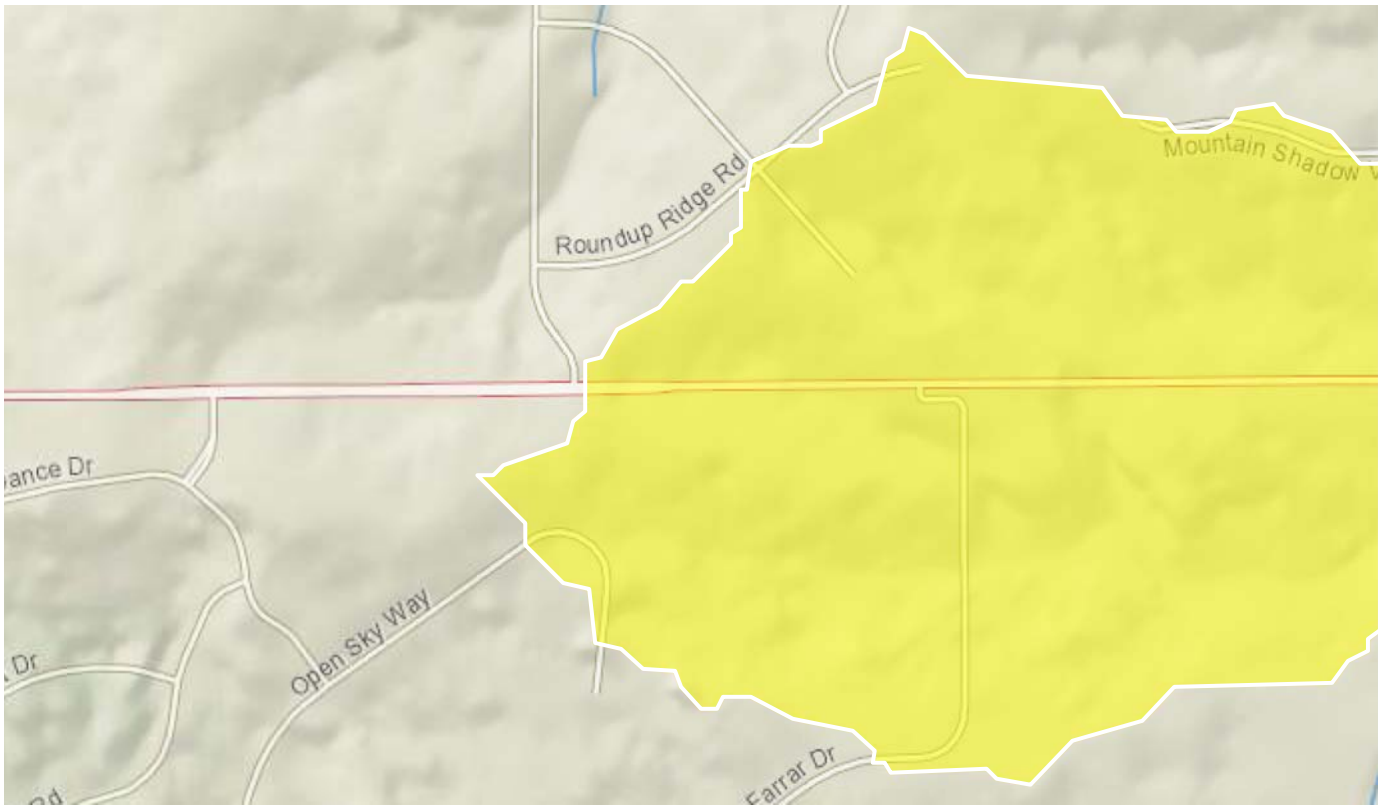
Time: 2018-10-17 16:52:24 -0600



Design Point SS3

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.7	square miles
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	3.83	inches
STATSCLAY	Percentage of clay soils from STATSGO	16.3	percent
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	7441	feet

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.7	square miles	0.6	2850
I6H100Y	6 Hour 100 Year Precipitation	3.83	inches	2.38	4.89
STATSCLAY	STATSGO Percentage of Clay Soils	16.3	percent	9.87	37.5
OUTLETELEV	Elevation of Gage	7441	feet	4290	8270

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

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
2 Year Peak Flood	8.82	ft^3/s	117
5 Year Peak Flood	25.8	ft^3/s	87
10 Year Peak Flood	44.2	ft^3/s	80
25 Year Peak Flood	77.3	ft^3/s	80
50 Year Peak Flood	110	ft^3/s	83
100 Year Peak Flood	153	ft^3/s	88
200 Year Peak Flood	204	ft^3/s	94
500 Year Peak Flood	286	ft^3/s	104

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)

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Application Version: 4.2.1

SAVAGE PROJECT - StreamStats Report3

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Workspace ID: CO20180218175120980000
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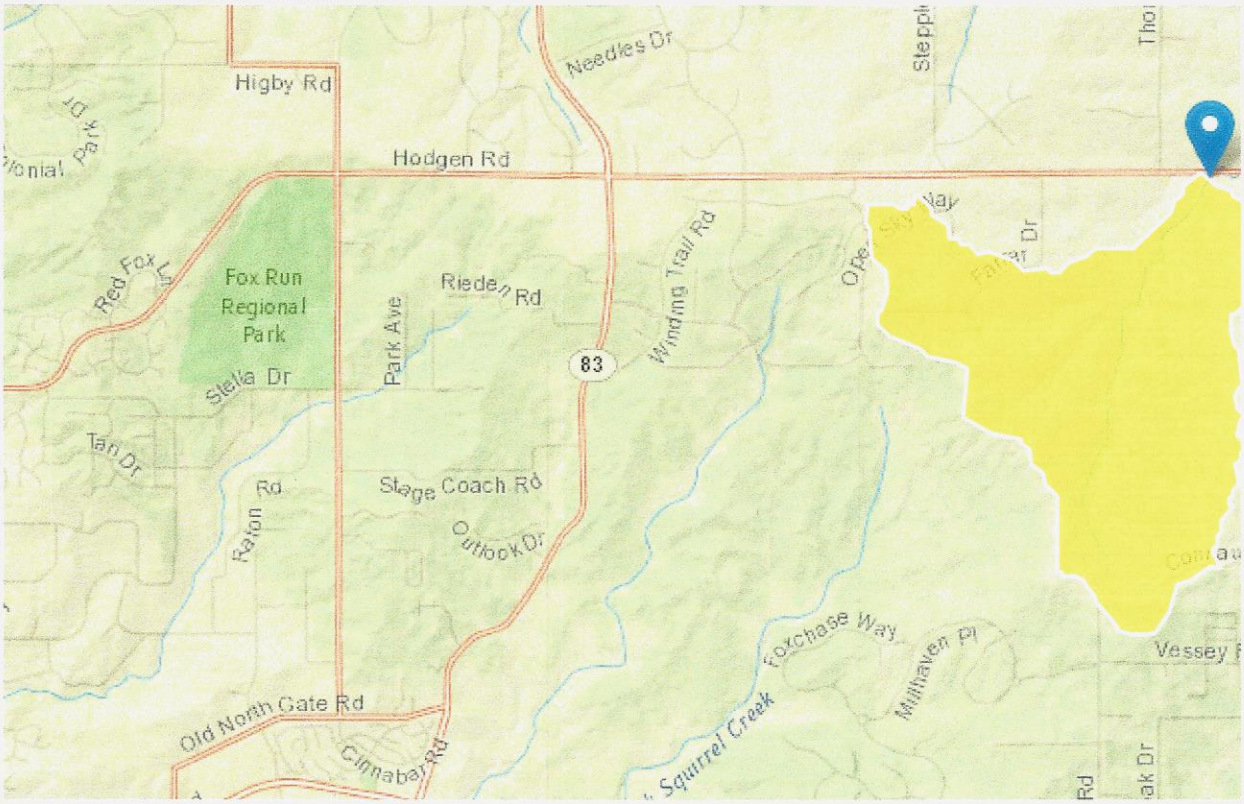


Design Point Above Hodgen

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.07	square miles
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	3.84	inches
STATSCLAY	Percentage of clay soils from STATSGO	16.3	percent
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	7445	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	6.52	percent

Parameter Code	Parameter Description	Value	Unit
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	73.1	feet per mi
EL7500	Percent of area above 7500 ft	90	percent
ELEV	Mean Basin Elevation	7568	feet
ELEVMAX	Maximum basin elevation	7690	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	5	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precitation intensity index	1.92	inches
I6H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	1.38	
LAT_OUT	Latitude of Basin Outlet	4324655	degrees
LC11BARE	Percentage of barren from NLCD 2011 class 31	0	
LC11CRPHAY	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	1.1	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	3.1	percent
LC11GRASS	Percent of area covered by grassland/herbaceous using 2011 NLCD	74	
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	1.2	percent
LC11SHRUB	Percent of area covered by shrubland using 2011 NLCD	21.7	
LC11SNOIC	Percent snow and ice from NLCD 2011 class 12	0	
LC11WATER	Percent of open water, class 11, from NLCD 2011	0	
LC11WETLND	Percentage of wetlands, classes 90 and 95, from NLCD 2011	0	
LFPLENGTH	Length of longest flow path	2.79	miles
LONG_OUT	Longitude of Basin Outlet	525085	degrees
MINBELEV	Minimum basin elevation	7440	feet
PRECIP	Mean Annual Precipitation	20.73	inches
RCN	Runoff-curve number as defined by NRCS (http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17758.wba)	61.04	
RUNCO_CO	Soil runoff coefficient as defined by Verdin and Gross (2017)	0.25	
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	92.2	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	6.25	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	1.5	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	1.2	percent

Parameter Code	Parameter Description	Value	Unit
TOC	Time of concentration in hours	3.01	

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.07	square miles	0.6	2850
I6H100Y	6 Hour 100 Year Precipitation	3.84	inches	2.38	4.89
STATSCLAY	STATSGO Percentage of Clay Soils	16.3	percent	9.87	37.5
OUTLETELEV	Elevation of Gage	7445	feet	4290	8270

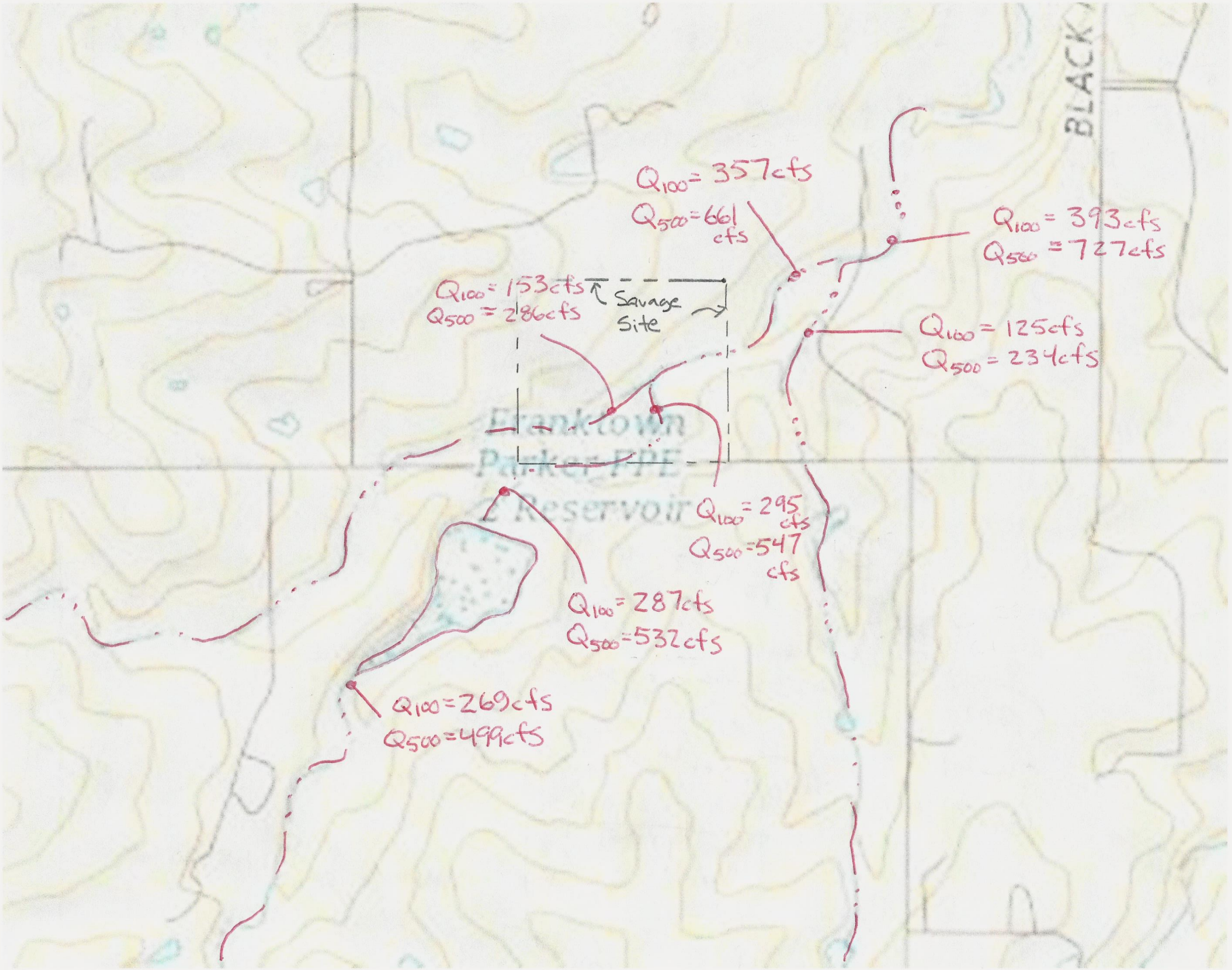
Peak-Flow Statistics Flow Report [Foothills Region Peak Flow 2016 5099]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
2 Year Peak Flood	17.4	ft^3/s	117
5 Year Peak Flood	49.4	ft^3/s	87
10 Year Peak Flood	83.6	ft^3/s	80
25 Year Peak Flood	145	ft^3/s	80
50 Year Peak Flood	207	ft^3/s	83
100 Year Peak Flood	287	ft^3/s	88
200 Year Peak Flood	381	ft^3/s	94
500 Year Peak Flood	532	ft^3/s	104

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)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Q500 = 661 cfs
Q100 = 393cfs
Q500 = 727cfs
Q100 = 153cfs
Q500 = 286cfs
Savage Site
Q100 = 125cfs
Q500 = 234cfs
Frankstown
Parker PRE
Reservoir
Q100 = 295 cfs
Q500 = 547 cfs
Q100 = 287cfs
Q500 = 532cfs
Q100 = 269cfs
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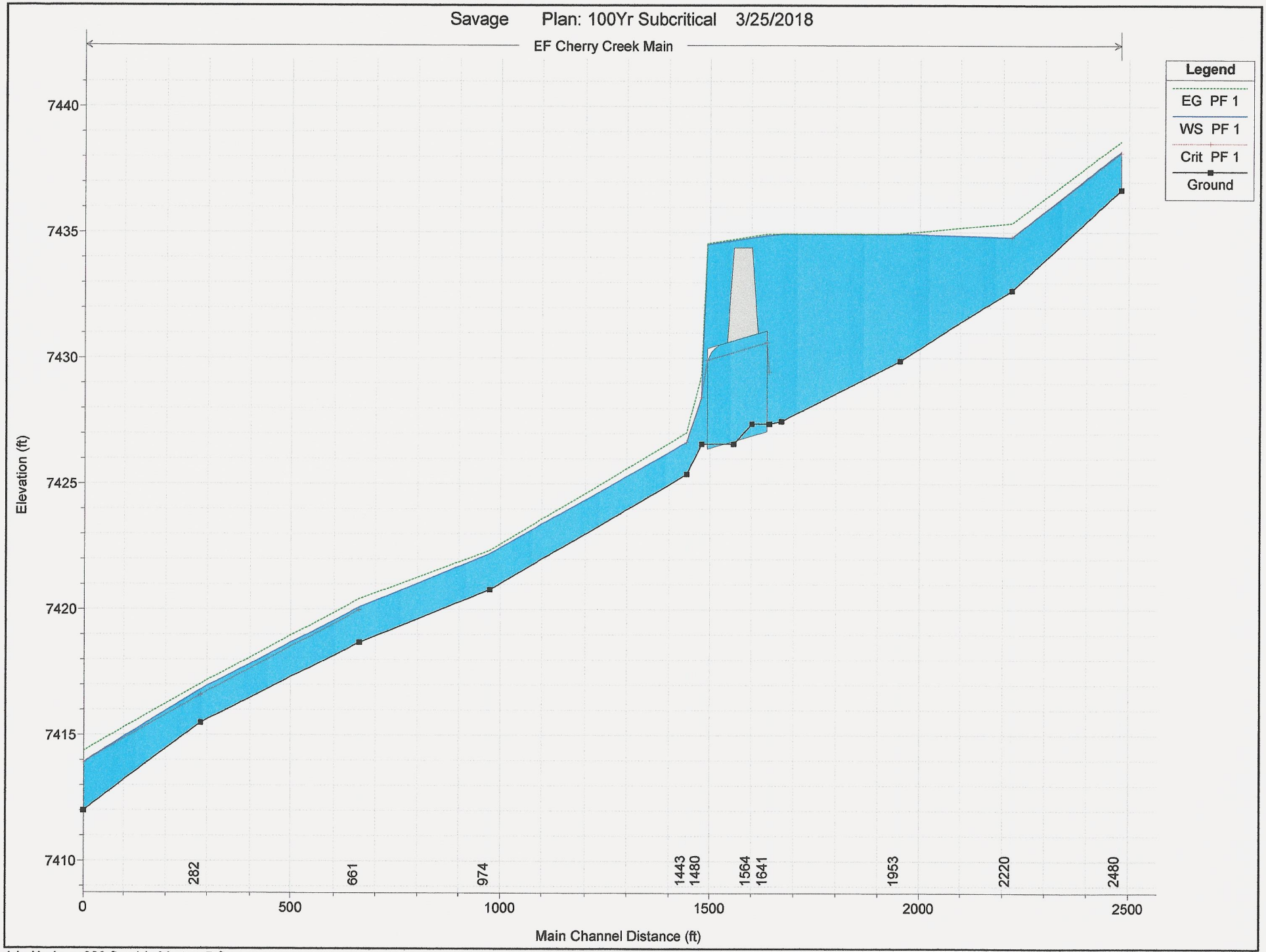


1 in Horiz. = 300 ft 1 in Vert. = 5 ft

HEC-RAS Plan: 100Yr sub River: EF Cherry Creek Reach: Main 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)	
Main	2480	PF 1	287.00	7436.70	7438.21	7438.15	7438.61	0.011766	5.11	56.19	60.48	0.93
Main	2220	PF 1	287.00	7432.70	7434.81	7434.81	7435.37	0.013130	6.03	47.62	43.24	1.01
Main	1953	PF 1	287.00	7429.90	7434.94		7434.95	0.000035	0.78	588.61	301.20	0.07
Main	1669	PF 1	287.00	7427.50	7434.93		7434.94	0.000014	0.64	552.90	136.25	0.04
Main	1641	PF 1	287.00	7427.40	7434.87	7429.44	7434.93	0.000114	1.99	144.55	195.32	0.13
Main	1564		Culvert									
Main	1480	PF 1	287.00	7426.60	7428.44	7428.44	7429.35	0.010743	7.62	37.67	148.77	1.00
Main	1443	PF 1	295.00	7425.40	7426.65	7426.65	7427.05	0.014357	5.04	58.55	74.76	1.00
Main	974	PF 1	295.00	7420.80	7422.21		7422.34	0.003321	2.93	100.89	97.83	0.51
Main	661	PF 1	357.00	7418.70	7420.09	7419.98	7420.42	0.012088	4.57	78.03	101.03	0.92
Main	282	PF 1	357.00	7415.50	7416.81	7416.59	7417.03	0.006782	3.77	94.57	106.09	0.70
Main	0	PF 1	357.00	7412.00	7413.90	7413.90	7414.35	0.013968	5.39	66.28	74.89	1.01

Plan: 100Yr sub EF Cherry Creek Main RS: 2480 Profile: PF 1

E.G. Elev (ft)	7438.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.		0.030	
W.S. Elev (ft)	7438.21	Reach Len. (ft)	305.00	260.00	132.00
Crit W.S. (ft)	7438.15	Flow Area (sq ft)		56.19	
E.G. Slope (ft/ft)	0.011766	Area (sq ft)		56.19	
Q Total (cfs)	287.00	Flow (cfs)		287.00	
Top Width (ft)	60.48	Top Width (ft)		60.48	
Vel Total (ft/s)	5.11	Avg. Vel. (ft/s)		5.11	
Max Chl Dpth (ft)	1.51	Hydr. Depth (ft)		0.93	
Conv. Total (cfs)	2645.9	Conv. (cfs)		2645.9	
Length Wtd. (ft)	260.00	Wetted Per. (ft)		60.61	
Min Ch El (ft)	7436.70	Shear (lb/sq ft)		0.68	
Alpha	1.00	Stream Power (lb/ft s)		3.48	
Frctn Loss (ft)	3.23	Cum Volume (acre-ft)	1.49	6.71	0.99
C & E Loss (ft)	0.02	Cum SA (acres)	1.21	4.51	0.97

Plan: 100Yr sub EF Cherry Creek Main RS: 2220 Profile: PF 1

E.G. Elev (ft)	7435.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.		0.030	
W.S. Elev (ft)	7434.81	Reach Len. (ft)	249.00	267.00	235.00
Crit W.S. (ft)	7434.81	Flow Area (sq ft)		47.62	
E.G. Slope (ft/ft)	0.013130	Area (sq ft)		47.62	
Q Total (cfs)	287.00	Flow (cfs)		287.00	
Top Width (ft)	43.24	Top Width (ft)		43.24	
Vel Total (ft/s)	6.03	Avg. Vel. (ft/s)		6.03	
Max Chl Dpth (ft)	2.11	Hydr. Depth (ft)		1.10	
Conv. Total (cfs)	2504.7	Conv. (cfs)		2504.7	
Length Wtd. (ft)	264.11	Wetted Per. (ft)		43.51	
Min Ch El (ft)	7432.70	Shear (lb/sq ft)		0.90	
Alpha	1.00	Stream Power (lb/ft s)		5.41	
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	1.49	6.40	0.99
C & E Loss (ft)	0.17	Cum SA (acres)	1.21	4.20	0.97

Plan: 100Yr sub EF Cherry Creek Main RS: 1953 Profile: PF 1

E.G. Elev (ft)	7434.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	7434.94	Reach Len. (ft)	213.00	284.00	321.00
Crit W.S. (ft)		Flow Area (sq ft)	220.79	271.19	96.63
E.G. Slope (ft/ft)	0.000035	Area (sq ft)	220.79	271.19	96.63
Q Total (cfs)	287.00	Flow (cfs)	57.10	210.24	19.66
Top Width (ft)	301.20	Top Width (ft)	146.09	63.40	91.71
Vel Total (ft/s)	0.49	Avg. Vel. (ft/s)	0.26	0.78	0.20
Max Chl Dpth (ft)	5.04	Hydr. Depth (ft)	1.51	4.28	1.05
Conv. Total (cfs)	48194.0	Conv. (cfs)	9588.9	35303.4	3301.7
Length Wtd. (ft)	276.05	Wetted Per. (ft)	146.38	63.65	91.80
Min Ch El (ft)	7429.90	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.92	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.86	5.43	0.73
C & E Loss (ft)	0.00	Cum SA (acres)	0.79	3.87	0.72

Plan: 100Yr sub EF Cherry Creek Main RS: 1669 Profile: PF 1

E.G. Elev (ft)	7434.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.045	0.030	0.045
W.S. Elev (ft)	7434.93	Reach Len. (ft)	23.00	28.00	62.00
Crit W.S. (ft)		Flow Area (sq ft)	104.14	400.16	48.60
E.G. Slope (ft/ft)	0.000014	Area (sq ft)	104.14	400.16	48.60
Q Total (cfs)	287.00	Flow (cfs)	21.63	257.33	8.04
Top Width (ft)	136.25	Top Width (ft)	46.00	59.90	30.35
Vel Total (ft/s)	0.52	Avg. Vel. (ft/s)	0.21	0.64	0.17

Plan: 100Yr sub EF Cherry Creek Main RS: 1669 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	7.43	Hydr. Depth (ft)	2.26	6.68	1.60
Conv. Total (cfs)	77909.3	Conv. (cfs)	5872.4	69853.9	2183.1
Length Wtd. (ft)	28.29	Wetted Per. (ft)	46.67	60.48	30.63
Min Ch El (ft)	7427.50	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.39	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.06	3.24	0.19
C & E Loss (ft)	0.01	Cum SA (acres)	0.32	3.47	0.27

Plan: 100Yr sub EF Cherry Creek Main RS: 1641 Profile: PF 1

E.G. Elev (ft)	7434.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.		0.030	
W.S. Elev (ft)	7434.87	Reach Len. (ft)	202.00	161.00	164.00
Crit W.S. (ft)	7429.44	Flow Area (sq ft)		144.55	
E.G. Slope (ft/ft)	0.000114	Area (sq ft)	92.06	387.48	221.85
Q Total (cfs)	287.00	Flow (cfs)		287.00	
Top Width (ft)	195.32	Top Width (ft)	49.40	57.90	88.02
Vel Total (ft/s)	1.99	Avg. Vel. (ft/s)		1.99	
Max Chl Dpth (ft)	7.47	Hydr. Depth (ft)		7.30	
Conv. Total (cfs)	26922.6	Conv. (cfs)		26922.6	
Length Wtd. (ft)	161.00	Wetted Per. (ft)		19.82	
Min Ch El (ft)	7427.40	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)		0.10	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.01	2.98	0.00
C & E Loss (ft)		Cum SA (acres)	0.29	3.43	0.19

Plan: 100Yr sub EF Cherry Creek Main RS: 1480 Profile: PF 1

E.G. Elev (ft)	7429.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.		0.030	
W.S. Elev (ft)	7428.44	Reach Len. (ft)	23.00	37.00	62.00
Crit W.S. (ft)	7428.44	Flow Area (sq ft)		37.67	
E.G. Slope (ft/ft)	0.010743	Area (sq ft)	38.63	117.45	2.22
Q Total (cfs)	287.00	Flow (cfs)		287.00	
Top Width (ft)	148.77	Top Width (ft)	68.91	74.59	5.27
Vel Total (ft/s)	7.62	Avg. Vel. (ft/s)		7.62	
Max Chl Dpth (ft)	1.84	Hydr. Depth (ft)		1.81	
Conv. Total (cfs)	2769.0	Conv. (cfs)		2769.0	
Length Wtd. (ft)	37.00	Wetted Per. (ft)		20.84	
Min Ch El (ft)	7426.60	Shear (lb/sq ft)		1.21	
Alpha	1.00	Stream Power (lb/ft s)		9.24	
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	0.01	2.85	0.00
C & E Loss (ft)	0.15	Cum SA (acres)	0.02	3.19	0.01

Plan: 100Yr sub EF Cherry Creek Main RS: 1443 Profile: PF 1

E.G. Elev (ft)	7427.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.		0.030	
W.S. Elev (ft)	7426.65	Reach Len. (ft)	268.00	469.00	453.00
Crit W.S. (ft)	7426.65	Flow Area (sq ft)		58.55	
E.G. Slope (ft/ft)	0.014357	Area (sq ft)		58.55	
Q Total (cfs)	295.00	Flow (cfs)		295.00	
Top Width (ft)	74.76	Top Width (ft)		74.76	
Vel Total (ft/s)	5.04	Avg. Vel. (ft/s)		5.04	
Max Chl Dpth (ft)	1.25	Hydr. Depth (ft)		0.78	
Conv. Total (cfs)	2462.0	Conv. (cfs)		2462.0	
Length Wtd. (ft)	469.00	Wetted Per. (ft)		74.86	
Min Ch El (ft)	7425.40	Shear (lb/sq ft)		0.70	
Alpha	1.00	Stream Power (lb/ft s)		3.53	
Frctn Loss (ft)	2.84	Cum Volume (acre-ft)	0.00	2.77	0.00
C & E Loss (ft)	0.08	Cum SA (acres)	0.00	3.12	0.01

Plan: 100Yr sub EF Cherry Creek Main RS: 974 Profile: PF 1

E.G. Elev (ft)	7422.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.		0.030	0.045
W.S. Elev (ft)	7422.21	Reach Len. (ft)	278.00	313.00	173.00
Crit W.S. (ft)		Flow Area (sq ft)		100.81	0.08
E.G. Slope (ft/ft)	0.003321	Area (sq ft)		100.81	0.08
Q Total (cfs)	295.00	Flow (cfs)		294.97	0.03
Top Width (ft)	97.83	Top Width (ft)		97.04	0.79
Vel Total (ft/s)	2.92	Avg. Vel. (ft/s)		2.93	0.42
Max Chl Dpth (ft)	1.41	Hydr. Depth (ft)		1.04	0.11
Conv. Total (cfs)	5118.7	Conv. (cfs)		5118.1	0.6
Length Wtd. (ft)	312.99	Wetted Per. (ft)		97.14	0.82
Min Ch El (ft)	7420.80	Shear (lb/sq ft)		0.22	0.02
Alpha	1.00	Stream Power (lb/ft s)		0.63	0.01
Frctn Loss (ft)	1.90	Cum Volume (acre-ft)	0.00	1.91	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	2.20	0.00

Plan: 100Yr sub EF Cherry Creek Main RS: 661 Profile: PF 1

E.G. Elev (ft)	7420.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.030	
W.S. Elev (ft)	7420.09	Reach Len. (ft)	390.00	379.00	189.00
Crit W.S. (ft)	7419.98	Flow Area (sq ft)		78.03	
E.G. Slope (ft/ft)	0.012088	Area (sq ft)		78.03	
Q Total (cfs)	357.00	Flow (cfs)		357.00	
Top Width (ft)	101.03	Top Width (ft)		101.03	
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)		4.57	
Max Chl Dpth (ft)	1.39	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	3247.1	Conv. (cfs)		3247.1	
Length Wtd. (ft)	379.00	Wetted Per. (ft)		101.34	
Min Ch El (ft)	7418.70	Shear (lb/sq ft)		0.58	
Alpha	1.00	Stream Power (lb/ft s)		2.66	
Frctn Loss (ft)	3.36	Cum Volume (acre-ft)	0.00	1.27	
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	1.49	

Plan: 100Yr sub EF Cherry Creek Main RS: 282 Profile: PF 1

E.G. Elev (ft)	7417.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.030	
W.S. Elev (ft)	7416.81	Reach Len. (ft)	294.00	282.00	256.00
Crit W.S. (ft)	7416.59	Flow Area (sq ft)		94.57	
E.G. Slope (ft/ft)	0.006782	Area (sq ft)	0.00	94.57	
Q Total (cfs)	357.00	Flow (cfs)		357.00	
Top Width (ft)	106.09	Top Width (ft)	0.03	106.06	
Vel Total (ft/s)	3.77	Avg. Vel. (ft/s)		3.77	
Max Chl Dpth (ft)	1.31	Hydr. Depth (ft)		0.89	
Conv. Total (cfs)	4334.9	Conv. (cfs)		4334.9	
Length Wtd. (ft)	282.00	Wetted Per. (ft)		106.24	
Min Ch El (ft)	7415.50	Shear (lb/sq ft)		0.38	
Alpha	1.00	Stream Power (lb/ft s)		1.42	
Frctn Loss (ft)	2.66	Cum Volume (acre-ft)	0.00	0.52	
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.59	

Plan: 100Yr sub EF Cherry Creek Main RS: 0 Profile: PF 1

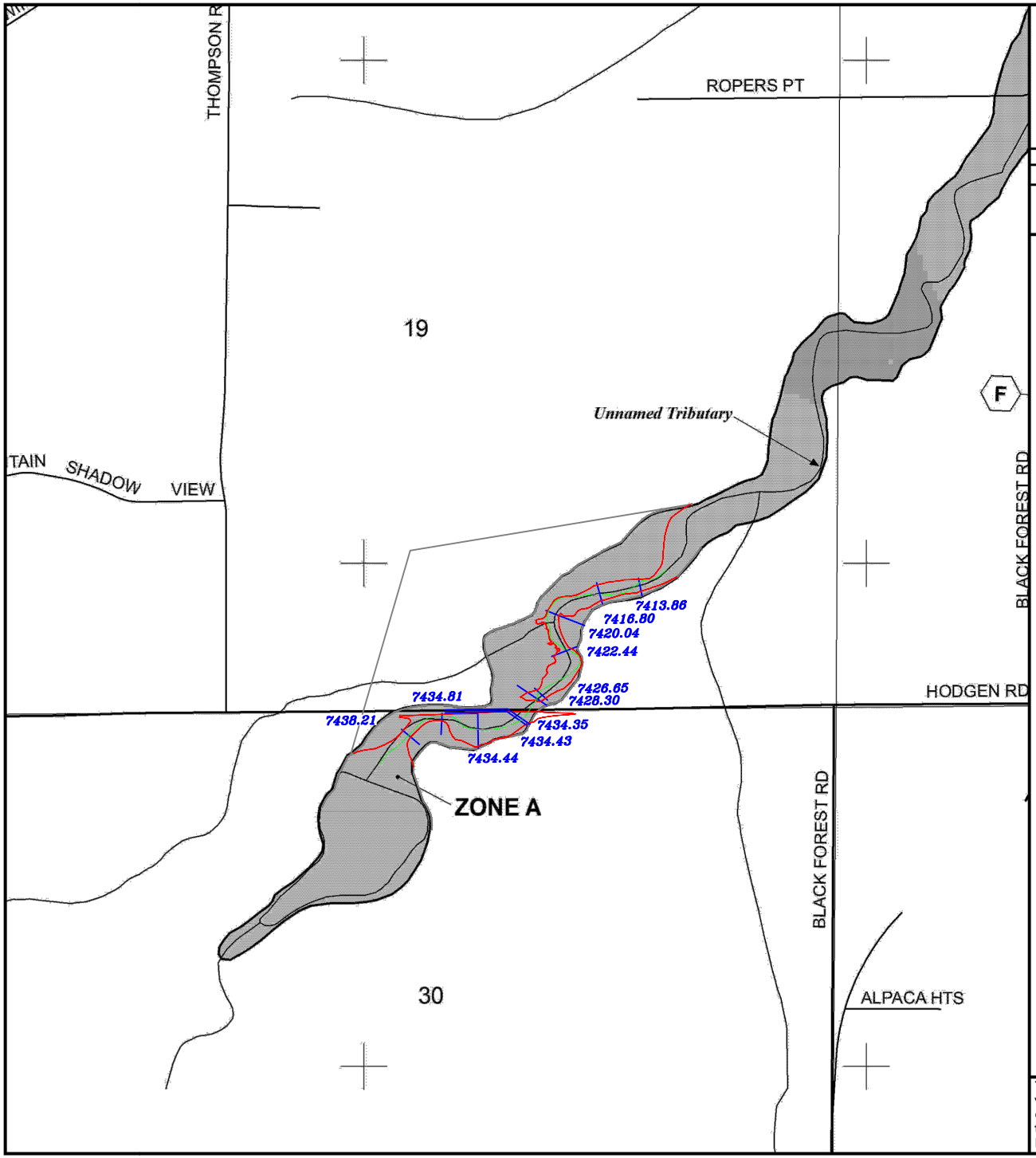
E.G. Elev (ft)	7414.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.		0.030	
W.S. Elev (ft)	7413.90	Reach Len. (ft)			
Crit W.S. (ft)	7413.90	Flow Area (sq ft)		66.28	
E.G. Slope (ft/ft)	0.013968	Area (sq ft)		66.28	
Q Total (cfs)	357.00	Flow (cfs)		357.00	
Top Width (ft)	74.89	Top Width (ft)		74.89	
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)		5.39	

Plan: 100Yr sub EF Cherry Creek Main RS: 0 Profile: PF 1 (Continued)

Max Chl Dpth (ft)	1.90	Hydr. Depth (ft)		0.89	
Conv. Total (cfs)	3020.6	Conv. (cfs)		3020.6	
Length Wtd. (ft)		Wetted Per. (ft)		75.09	
Min Ch El (ft)	7412.00	Shear (lb/sq ft)		0.77	
Alpha	1.00	Stream Power (lb/ft s)		4.15	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Plan: 100Yr sub EF Cherry Creek Main RS: 1564 Culv Group: 48inch Dual Profile: PF 1

Q Culv Group (cfs)	281.57	Culv Full Len (ft)	114.75
# Barrels	2	Culv Vel US (ft/s)	11.20
Q Barrel (cfs)	140.78	Culv Vel DS (ft/s)	12.03
E.G. US. (ft)	7434.93	Culv Inv El Up (ft)	7427.10
W.S. US. (ft)	7434.87	Culv Inv El Dn (ft)	7426.40
E.G. DS (ft)	7429.35	Culv Frctn Ls (ft)	1.47
W.S. DS (ft)	7428.44	Culv Exit Loss (ft)	2.82
Delta EG (ft)	5.59	Culv Entr Loss (ft)	0.98
Delta WS (ft)	6.43	Q Weir (cfs)	5.43
E.G. IC (ft)	7433.86	Weir Sta Lft (ft)	170.13
E.G. OC (ft)	7434.93	Weir Sta Rgt (ft)	189.93
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	7431.10	Weir Max Depth (ft)	0.26
Culv WS Outlet (ft)	7429.92	Weir Avg Depth (ft)	0.22
Culv Nml Depth (ft)	4.00	Weir Flow Area (sq ft)	4.42
Culv Crt Depth (ft)	3.52	Min El Weir Flow (ft)	7434.68



MAP SCALE 1" = 1000'

0 1000 2000 FEET

NFIP

PANEL 0305G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 305 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0305	G

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

MAP NUMBER
08041C0305G

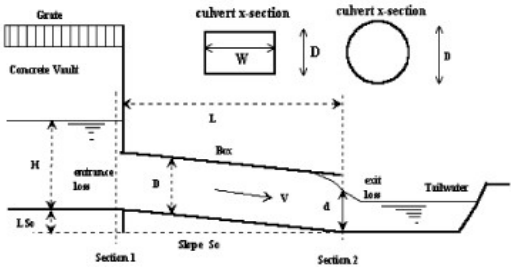
MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDRAULIC CALCULATIONS

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: High Plains Filing no. 1
Basin ID: Design Point 1
Status:



1. Resolved.

2. Submit the outlet protection calculation **Review 2: Unresolved.**

3. Provide the Hw/D. Per DCM Hw/D must be less than 1.5. **Review 2: Unresolved.**

4. Resolved.

Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	30	inches
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Beveled Edge	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 30-78 deg. Flared Wingwall	
	Number of Barrels	No =	3	
	Inlet Elevation at Culvert Invert	Inlet Elev =	7430.5	ft. elev.
	Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	7428.46	ft. elev.
	Culvert Length in Feet	L =	61.59	ft.
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.48
Sum of All Loss Coefficients	K_s =	1.68
Orifice Inlet Condition Coefficient	C_d =	1.03
Minimum Energy Condition Coefficient	KE_{low} =	-0.1599

Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
7432.00		32.40	113.18	**32.40**	Regression Eqn.	INLET
7432.25		41.70	117.67	**41.70**	Regression Eqn.	INLET
7432.50		52.50	122.03	**52.50**	Regression Eqn.	INLET
7432.75		63.60	126.16	**63.60**	Regression Eqn.	INLET
7433.00		75.00	130.28	**75.00**	Regression Eqn.	INLET
7433.25		86.10	138.05	**86.10**	Regression Eqn.	INLET
7433.50		96.30	145.32	**96.30**	Regression Eqn.	INLET
7433.75		105.90	152.36	**105.90**	Regression Eqn.	INLET
7434.00		114.90	159.03	**114.90**	Regression Eqn.	INLET
7434.25		123.30	165.34	**123.30**	Regression Eqn.	INLET
7434.50		131.10	171.53	**131.10**	Regression Eqn.	INLET
7434.75		138.90	177.47	**138.90**	Regression Eqn.	INLET
7435.00		146.10	183.29	**146.10**	Regression Eqn.	INLET
7435.25		153.00	188.87	**153.00**	Regression Eqn.	INLET
7435.50		159.60	194.21	**159.60**	Regression Eqn.	INLET
7435.75		166.20	199.55	**166.20**	Regression Eqn.	INLET
7436.00		172.50	204.64	**172.50**	Regression Eqn.	INLET
7436.25		178.50	209.74	**178.50**	Regression Eqn.	INLET
7436.50		184.50	214.59	**184.50**	Regression Eqn.	INLET
7436.75		190.20	219.32	**190.20**	Regression Eqn.	INLET
7437.00		195.60	224.05	**195.60**	Regression Eqn.	INLET
7437.25		201.00	228.66	**201.00**	Regression Eqn.	INLET
7437.50		206.10	233.15	**206.10**	Regression Eqn.	INLET
7437.75		210.90	237.52	**210.90**	Regression Eqn.	INLET
7438.00		215.70	241.88	**215.70**	Regression Eqn.	INLET
7438.25		220.20	246.13	**220.20**	Orifice Eqn.	INLET
7438.50		224.40	250.37	**224.40**	Orifice Eqn.	INLET
7438.75		228.30	254.50	**228.30**	Orifice Eqn.	INLET
7439.00		232.50	258.50	**232.50**	Orifice Eqn.	INLET
7439.25		236.40	262.50	**236.40**	Orifice Eqn.	INLET

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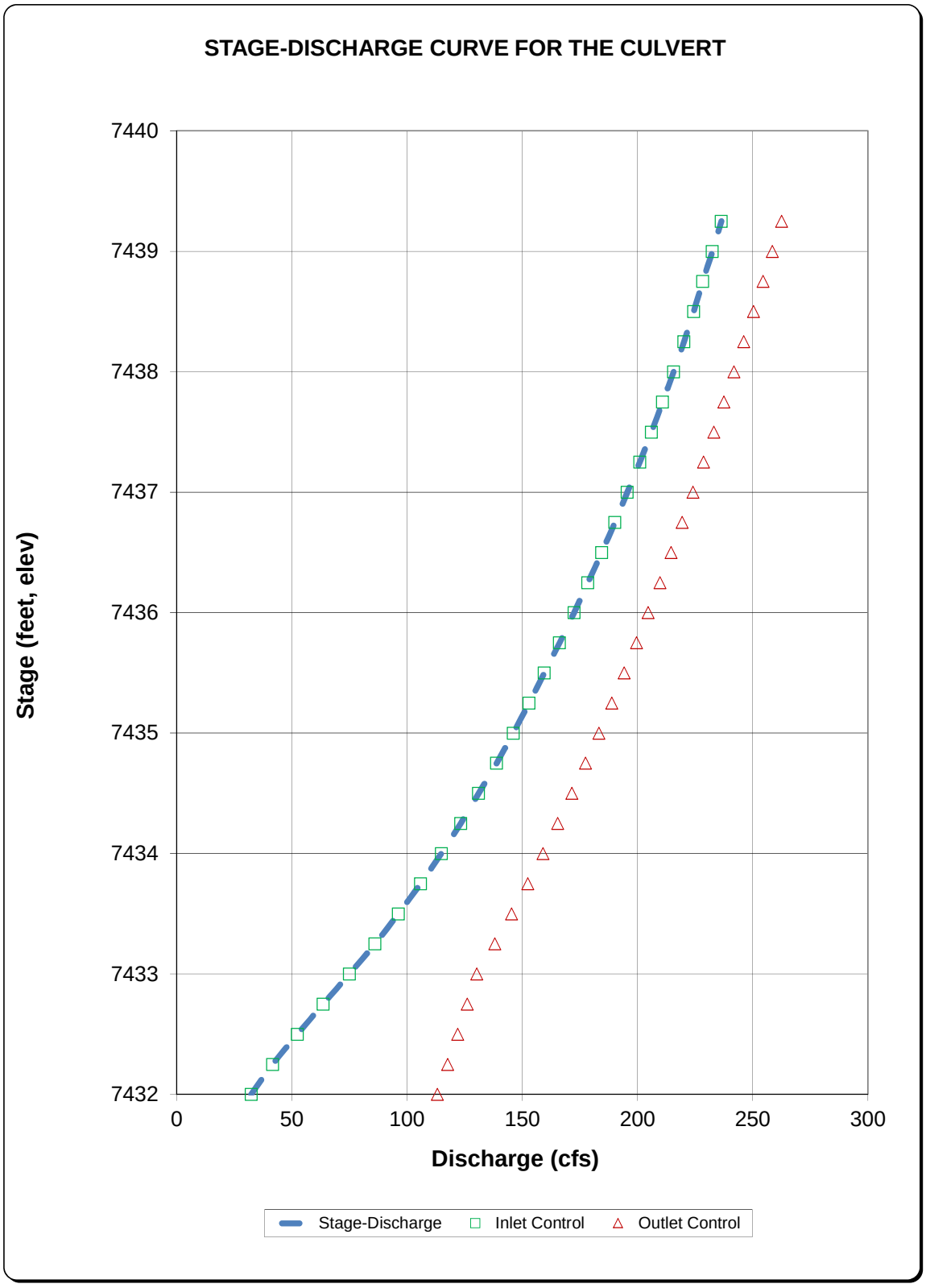
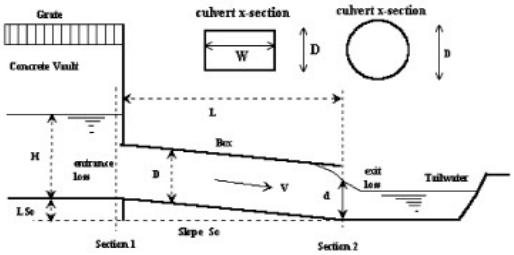
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: High Plains Filing no. 1
Basin ID: Design Point 1



CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: HIGH PLAINS SUBDIVISION FILING NO. 1
Basin ID: BASIN E-3
Status:



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches — D = 30 inches
Inlet Edge Type (choose from pull-down list) — 1.5 : 1 Beveled Edge

OR:

Box Culvert: Barrel Height (Rise) in Feet — Height (Rise) = ft.
Barrel Width (Span) in Feet — Width (Span) = ft.
Inlet Edge Type (choose from pull-down list) — Square Edge w/ 30-78 deg. Flared Wingwall

Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	Inlet Elev =	7431.87	ft. elev.
Outlet Elevation at Culvert Invert **OR** Slope of Culvert (ft v./ft h.)	Outlet Elev =	7431.61	ft. elev.
Culvert Length in Feet	L =	51.86	ft.
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	K_b =	0	
Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.41
Sum of All Loss Coefficients	K_s =	1.61
Orifice Inlet Condition Coefficient	C_d =	1.03
Minimum Energy Condition Coefficient	KE_{low} =	-0.0628

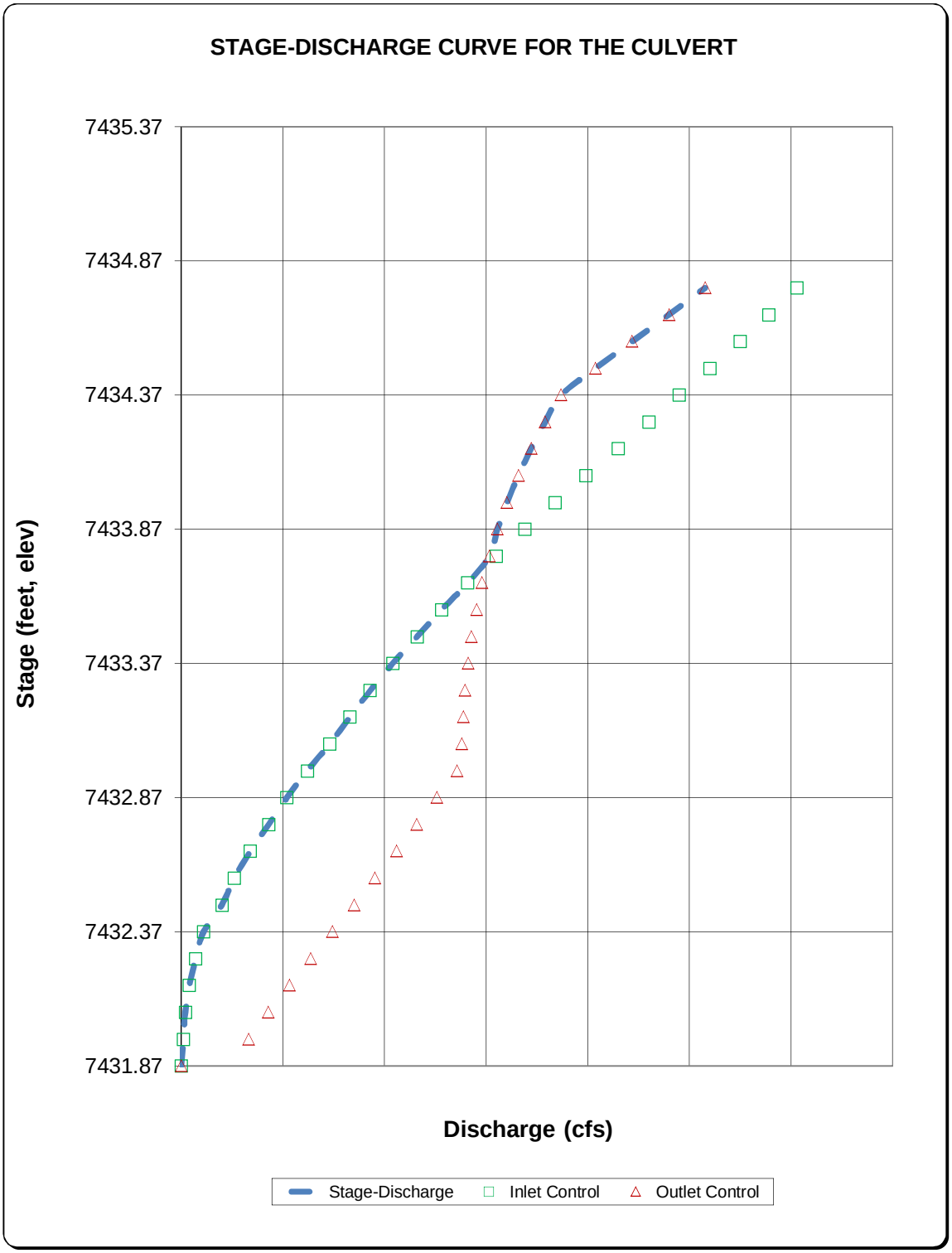
Calculations of Culvert Capacity (output):

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
7431.87		0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
7431.97		0.10	3.30	**0.10**	Min. Energy. Eqn.	INLET
7432.07		0.20	4.28	**0.20**	Min. Energy. Eqn.	INLET
7432.17		0.40	5.32	**0.40**	Min. Energy. Eqn.	INLET
7432.27		0.70	6.37	**0.70**	Min. Energy. Eqn.	INLET
7432.37		1.10	7.44	**1.10**	Min. Energy. Eqn.	INLET
7432.47		2.00	8.50	**2.00**	Min. Energy. Eqn.	INLET
7432.57		2.60	9.53	**2.60**	Min. Energy. Eqn.	INLET
7432.67		3.40	10.59	**3.40**	Min. Energy. Eqn.	INLET
7432.77		4.30	11.59	**4.30**	Min. Energy. Eqn.	INLET
7432.87		5.20	12.59	**5.20**	Min. Energy. Eqn.	INLET
7432.97		6.20	13.56	**6.20**	Min. Energy. Eqn.	INLET
7433.07		7.30	13.81	**7.30**	Min. Energy. Eqn.	INLET
7433.17		8.30	13.88	**8.30**	Regression Eqn.	INLET
7433.27		9.30	13.97	**9.30**	Regression Eqn.	INLET
7433.37		10.40	14.11	**10.40**	Regression Eqn.	INLET
7433.47		11.60	14.28	**11.60**	Regression Eqn.	INLET
7433.57		12.80	14.52	**12.80**	Regression Eqn.	INLET
7433.67		14.10	14.80	**14.10**	Regression Eqn.	INLET
7433.77		15.50	15.15	**15.15**	Regression Eqn.	OUTLET
7433.87		16.90	15.56	**15.56**	Regression Eqn.	OUTLET
7433.97		18.40	16.03	**16.03**	Regression Eqn.	OUTLET
7434.07		19.90	16.58	**16.58**	Regression Eqn.	OUTLET
7434.17		21.50	17.21	**17.21**	Regression Eqn.	OUTLET
7434.27		23.00	17.90	**17.90**	Regression Eqn.	OUTLET
7434.37		24.50	18.69	**18.69**	Regression Eqn.	OUTLET
7434.47		26.00	20.37	**20.37**	Regression Eqn.	OUTLET
7434.57		27.50	22.18	**22.18**	Regression Eqn.	OUTLET
7434.67		28.90	23.99	**23.99**	Regression Eqn.	OUTLET
7434.77		30.30	25.77	**25.77**	Regression Eqn.	OUTLET

Processing Time: 01.09 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: HIGH PLAINS SUBDIVISION FILING NO. 1
Basin ID: BASIN E-3

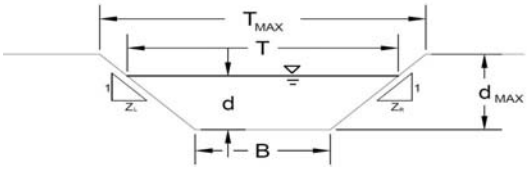


Version 4.05 Released March 2017

AREA INLET IN A SWALE

Enter Your Project Name Here

Swale DP-1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	C	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	5.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Slope	Z2 =	4.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- ( ) Non-Cohesive
- (•) Cohesive
- ( ) Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	22.00	30.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	2.00	2.50	feet

Maximum Channel Capacity Based On Allowable Top Width

		Minor Storm	Major Storm	
Max. Allowable Top Width	T_{MAX} =	22.00	30.00	ft
Water Depth	d =	2.13	3.13	ft
Flow Area	A =	28.69	54.69	sq ft
Wetted Perimeter	P =	22.52	30.77	ft
Hydraulic Radius	R =	1.27	1.78	ft
Manning's n based on NRCS Vegetal Retardance	n =	0.037	0.033	
Flow Velocity	V =	4.74	6.70	fps
Velocity-Depth Product	VR =	6.03	11.91	ft^2/s
Hydraulic Depth	D =	1.30	1.82	ft
Froude Number	Fr =	0.73	0.87	
Max. Flow Based On Allowable Top Width	Q_T =	135.9	366.6	cfs

Maximum Channel Capacity Based On Allowable Water Depth

		Minor Storm	Major Storm	
Max. Allowable Water Depth	d_{MAX} =	2.00	2.50	feet
Top Width	T =	21.00	25.00	feet
Flow Area	A =	26.00	37.50	square feet
Wetted Perimeter	P =	21.49	25.62	feet
Hydraulic Radius	R =	1.21	1.46	feet
Manning's n based on NRCS Vegetal Retardance	n =	0.038	0.035	
Flow Velocity	V =	4.41	5.50	fps
Velocity-Depth Product	VR =	5.34	8.05	ft^2/s
Hydraulic Depth	D =	1.24	1.50	feet
Froude Number	Fr =	0.70	0.79	
Max. Flow Based On Allowable Water Depth	Q_d =	114.8	206.1	cfs

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	114.8	206.1	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	2.00	2.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	50.0	173.9	cfs
Water Depth	d =	1.50	2.34	feet

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

PRUDENT LINE CALCULATIONS FOR SANDY SOILS

West Bank Calculations

1. Calculate the sediment transport capacity for different return period events:
VOLi = 6*Qp*d

Return Period	Qp(cfs)	d(hr)	Voli(cf)
100	356	24	51264
50	256	24	36864
25	181	24	26064
10	104	24	14976
5	62	24	8928
2	22	24	3168

2. Calculate the potential sediment deficit in any given reach of the study area:
Yi = 0.25*VOLi

Return Period	Voli(cf)	Yi(cf)
100	51264	12816
50	36864	9216
25	26064	6516
10	14976	3744
5	8928	2232
2	3168	792

3. Calculate the average annual sediment deficit:
Ym = 0.015*Y100+0.015*Y50+0.04*Y25+0.08*Y10+0.2*Y5+0.4*Y2

Ym = 1653.84 cf

Provide a footnote explaining/showing how the set back was calculated.

4. Convert the calculated sediment deficit to a long-term lateral migration distance:

a. Average Annual Deficit (assume BF=1.67)

Ym*1.67 = 2762 cf

b. Estimate the potential lateral migration with variable length reaches

Station	Side (looking US)	US Reach(ft)	Bank Ht(ft)	Setback Dist (ft)
0+00	RT	282	4	1.4
2+82	RT	379	4.5	1.2
6+61	RT	313	6	0.9
9+74	RT	469	8.5	0.6
14+43	RT	37	3.5	1.6
14+80	RT	53	3.5	1.6

c. Calculate setback distance over a 30yr period

Station	Setback Dist (ft)	HECRAS Sect. 10Yr WS Sta	Prudent Line Sta.
0+00	41	113	72
2+82	37	137	100
6+61	28	112	84
9+74	19	165	146
14+43	47	120	73
14+80	47	192	145

5. Calculate the short-term lateral migration distance:

a. 100 yr erosion deficit times the bulking factor (assume BF=1.67)

Yi(cf)	Erosion Deficit(cf)
12816	21403

b. Estimate the potential lateral migration assuming a right triangle w/variable length legs

Station	Side	Bank Ht(ft)	Setback Dist (ft)
0+00	RT	4	71
2+82	RT	4.5	63
6+61	RT	6	48
9+74	RT	8.5	34
14+43	RT	3.5	82
14+80	RT	3.5	82

6. Prudent line establishment (larger of setback distances, 50' or 100 yr floodplain)

Station	100 Yr F.Plain(ft)[1]	Long-term S.Back(ft)	Shrt-term S.Back(ft)	50'(ft)	**S. Back Selected**	W. Bank 100yr Sta	W. Bank 10yr Sta
0+00	-4	41	71	50	**71**	109	113
2+82	-21	37	63	50	**63**	116	137
6+61	0	28	48	50	**50**	112	112
9+74	-8	19	34	50	**50**	157	165
14+43	-4	47	82	50	**82**	116	120
14+80	-12	47	82	50	**82**	180	192

NOTE:

1. 100 yr floodplain setbacks that are negative because confined within TOB.

HECRAS Station	S. Back Selected	W. Bank 10yr Sta	Prudent Line H. RAS Sta	
0+00	71	113	-58	
2+82	63	137	-26	
6+61	50	112	-38	
9+74	50	165	15	
14+43	82	120	-62	
14+80	82	192	130	*

* Denotes adjustment made on drawing, 50' further west to be conservative.

PRUDENT LINE CALCULATIONS FOR SANDY SOILS

East Bank Calculations

1. Calculate the sediment transport capacity for different return period events:
VOLi = 6*Qp*d

Return Period	Qp(cfs)	d(hr)	Voli(cf)
100	356	24	51264
50	256	24	36864
25	181	24	26064
10	104	24	14976
5	62	24	8928
2	22	24	3168

2. Calculate the potential sediment deficit in any given reach of the study area:
Yi = 0.25*VOLi

Return Period	Voli(cf)	Yi(cf)
100	51264	12816
50	36864	9216
25	26064	6516
10	14976	3744
5	8928	2232
2	3168	792

3. Calculate the average annual sediment deficit:
Ym = 0.015*Y100+0.015*Y50+0.04*Y25+0.08*Y10+0.2*Y5+0.4*Y2

Ym = 1653.84 cf

4. Convert the calculated sediment deficit to a long-term lateral migration distance:

a. Average Annual Deficit (assume BF=1.67)

Ym*1.67 = 2762 cf

b. Estimate the potential lateral migration with variable length reaches

Station	Side (looking US)	US Reach(ft)	Bank Ht(ft)	Setback Dist (ft)
0+00	LT	282	9	0.6
2+82	LT	379	7	0.8
6+61	LT	313	6	0.9
9+74	LT	469	8.5	0.6
14+43	LT	37	9	0.6
14+80	LT	53	7	0.8

c. Calculate setback distance over a 30yr period

Station	Setback Dist (ft)	HECRAS Sect. 10Yr WS Sta	Prudent Line Sta.
0+00	18	181	199
2+82	24	216	240
6+61	28	188	216
9+74	19	236	255
14+43	18	191	209
14+80	24	270	294

5. Calculate the short-term lateral migration distance:

a. 100 yr erosion deficit times the bulking factor (assume BF=1.67)

Yi(cf)	Erosion Deficit(cf)
12816	21403

b. Estimate the potential lateral migration assuming a right triangle w/variable length legs

Station	Side	Bank Ht(ft)	Setback Dist (ft)
0+00	LT	9	32
2+82	LT	7	41
6+61	LT	6	48
9+74	LT	8.5	34
14+43	LT	9	32
14+80	LT	7	41

6. Prudent line establishment (larger of setback distances, 50' or 100 yr floodplain)

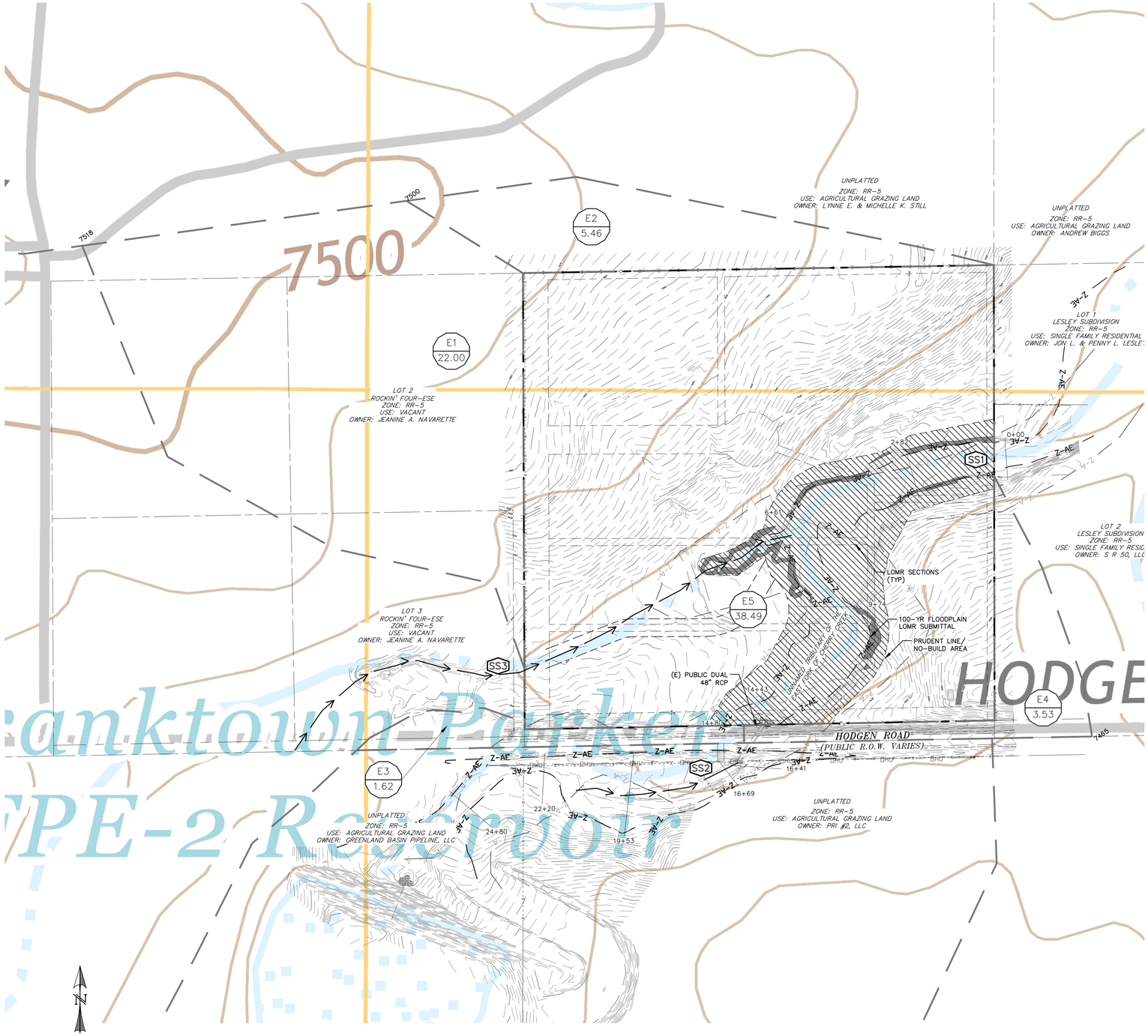
Station	100 Yr F.Plain(ft)[1]	Long-term S.Back(ft)	Shrt-term S.Back(ft)	50'(ft)	**S. Back Selected**	E. Bank 100yr Sta	E. Bank 10yr Sta
0+00	7	18	32	50	**50**	188	181
2+82	4	24	41	50	**50**	220	216
6+61	2	28	48	50	**50**	190	188
9+74	-1	19	34	50	**50**	235	236
14+43	4	18	32	50	**50**	195	191
14+80	10	24	41	50	**50**	280	270

NOTE:

1. 100 yr floodplain setbacks that are negative because confined within TOB.

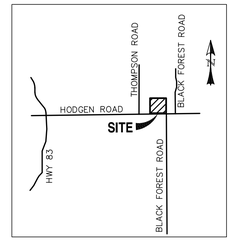
HECRAS Station	S. Back Selected	E. Bank 10yr Sta	Prudent Line H. RAS Sta
0+00	50	181	231
2+82	50	216	266
6+61	50	188	238
9+74	50	236	286
14+43	50	191	241
14+80	50	270	320

DRAINAGE MAPS



0 150 300

SCALE: 1" = 150'



VICINITY MAP
SCALE: N.T.S.

EXISTING DRAINAGE BASINS

BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
E1	22.00	0.8	2.8	6.2	10.9	14.6	18.9
E2	5.46	0.3	1.3	2.8	4.8	6.5	8.4
E3	1.62	1.0	1.5	2.2	3.1	3.8	4.6
E4	3.53	0.9	1.6	2.8	4.3	5.5	6.9
E5	38.49	2.4	9.1	20.0	34.9	46.8	60.8

EXISTING DESIGN POINTS

DESIGN POINT	Q100 (CFS)	Q500 (CFS)
SS1	357	661.0
SS2	295.0	547.0
SS3	153.0	286.0

LEGEND

EXISTING	(E)
PROPOSED	(P)
BOUNDARY	
RIGHT-OF-WAY	
LOT LINE	
EASEMENT	
(E) CONTOUR, INDEX	6820
(E) CONTOUR	
(P) CONTOUR, INDEX	6820
(P) CONTOUR	

REV.	DESCRIPTION	DATE

Know what's below. Call 72 hours before you dig.
For more details visit: www.call811.com

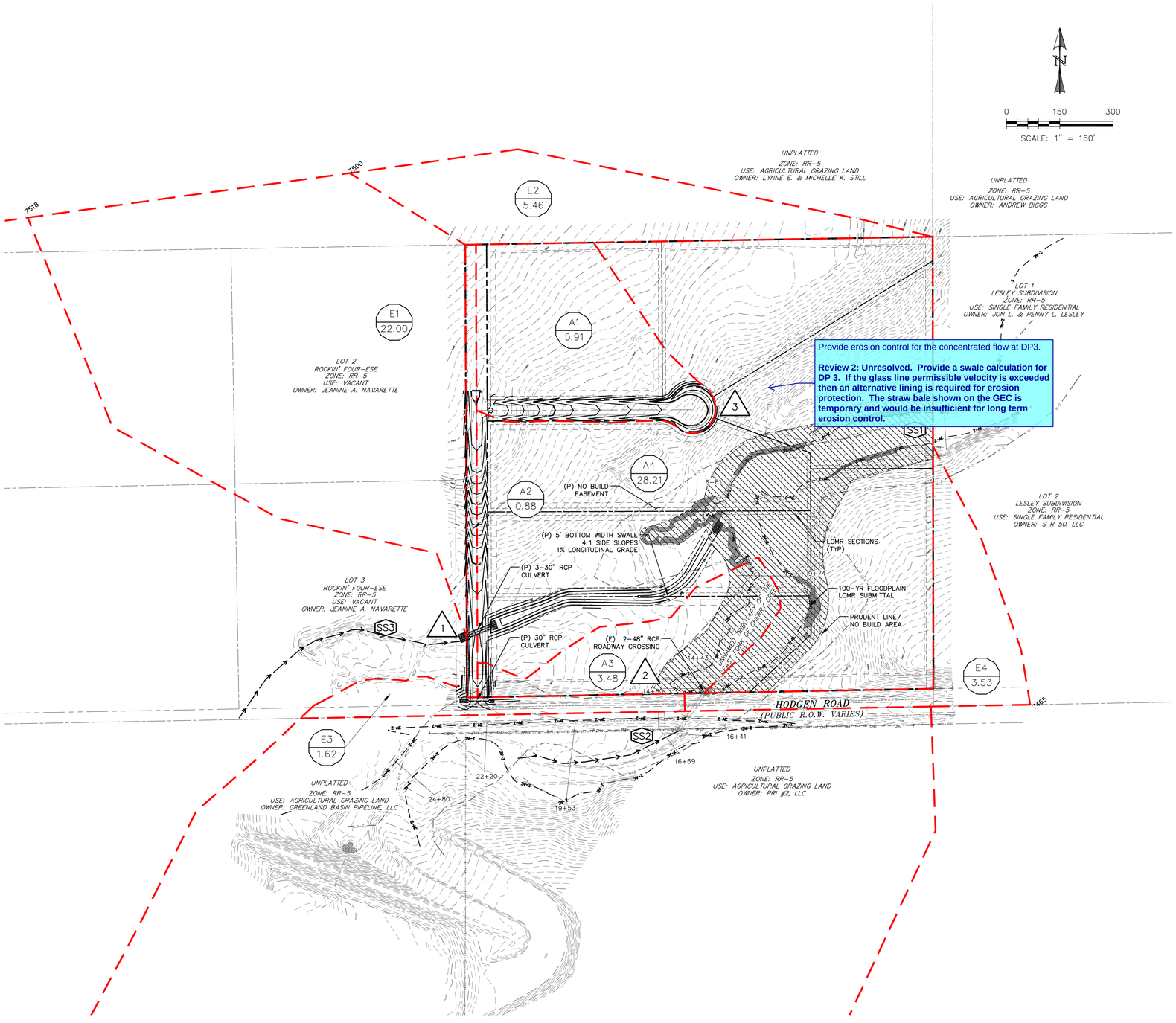
PREPARED FOR:
SAVAGE DEVELOPMENT INC
1125 DIAMOND RIM DR.
COLORADO SPRINGS, CO 80921

CATAMOUNT ENGINEERING
PO BOX 221 WOODLAND PARK, CO 80866 (719) 426-2124

HIGH PLAINS FILING NO. 1

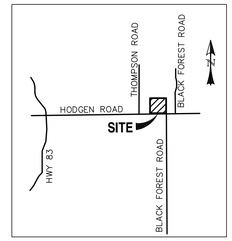
EXISTING CONDITIONS

DESIGNED BY:	DRAWN BY:
DLM	
SCALE: 1"=150'	DATE: 07/09/18
JOB NUMBER: 17-135	SHEET: 1 OF 1



Provide erosion control for the concentrated flow at DP3.

Review 2: Unresolved. Provide a swale calculation for DP 3. If the glass line permissible velocity is exceeded then an alternative lining is required for erosion protection. The straw bale shown on the GEC is temporary and would be insufficient for long term erosion control.



VICINITY MAP
SCALE: N.T.S.

PROPOSED DRAINAGE BASINS

BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
E1	22.00	0.8	2.8	6.2	10.9	14.6	18.9
E2	5.46	0.3	1.3	2.8	4.8	6.5	8.4
E3	1.62	1.0	1.5	2.2	3.1	3.8	4.6
E4	3.53	0.9	1.6	2.8	4.3	5.5	6.9
A1	5.91	2.9	5.1	7.3	10.3	12.9	15.6
A2	0.88	2.5	3.1	3.7	4.3	4.9	5.6
A3	3.48	0.7	1.5	2.6	4.0	5.2	6.5
A4	28.21	6.8	15.0	24.9	38.0	49.3	61.4

PROPOSED DESIGN POINTS

DESIGN POINT	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)	Q500 (CFS)
SS1						357.0	661.0
SS2						295.0	547.0
SS3						153.0	286.0
1						155.6	
2	2.5	3.4	4.3	5.5	6.4	7.5	
3	2.9	5.1	7.3	10.3	12.9	15.6	

LEGEND

EXISTING	(E)
PROPOSED	(P)
BOUNDARY	
RIGHT-OF-WAY	
LOT LINE	
EASEMENT	
(E) CONTOUR, INDEX	6820
(E) CONTOUR	
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