PRELIMINARY/FINAL DRAINAGE REPORT
FOR
RAPSON SUBDIVISION

FEBRUARY 2021

Prepared for:

ANDREA and WILLIAM RAPSON
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Prepared By:

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MS-21-003

PCD FILE NO's: SP-21-___
SF-21-___

Please add: established by the County for drainage.....

PRELIMINARY/FINAL DRAINAGE REPORT
RAPSON SUBDIVISION

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 RAPSON SUBDIVISION 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.

FYI: this is not necessary.

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

Please replace with the following text:

Owner/Developer's Statement:

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

_____ _____
[Name, Title] Date
[Business Name]
[Address]

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 RAPSON SUBDIVISION

Replace "no build/ storage of materials" text with "drainage easement" throughout report contents and other documents.

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 19.344 acres consists of unplatted land to be developed into 2 rural residential lots (RR-5 zoning) located within the SE ¼ of Section 14, Township 11 South, Range 65 West of the 6th principal meridian in unincorporated El Paso County. The parcel is bounded to the north by Hardy Road right-of-way, to the east by Country Squire Estates Filing No. 1 lots 17 and 18, and to the south and west by unplatted land.

The parcel is located within the West Kiowa Creek drainage basin. An unnamed tributary to West Kiowa Creek (hereinafter referred to as the "creek") bisects the parcel and flows from southwest to northeast. The northerly portion of the parcel sheet flows south to the creek within the RR-5 zoned parcel at slopes between 4% and 18%. The southerly portion of the parcel sheet flows north to the creek within the parcel at slopes between 3% and 8%.

Existing soils on the site consist of Alamosa loam, hydrologic soil group D, and Elbeth sandy loam, hydrologic soil group B as determined by the Natural Resources Conservation Service Web Soil Survey. The site is vegetated with native grasses. Shrub and tree cover are evident.

No portion of the site lies within an F.E.M.A. designated floodplain per FIRM 08041C0310 G effective December 7, 2018. A FEMA Firmette exhibiting the parcel has been included in the appendix of this report.

Include the Note that is on Page 3 (once it is revised per my comments) of the PBMP form about the proposed acreage of the roadway impervious area.

DRAINAGE CONDITIONS

No existing studies on the site have been identified. The parcel exists along a 990lf reach of an unnamed tributary to West Kiowa Creek which bisects the parcel. For the purposes of this study, the sub-basins are essentially the same with the exception of adding two proposed homesites. The majority of the area within developed basins was modeled as agricultural and forest land. A 4,000sf developed lot area was assumed for each lot located in

Please update drainage report to include a proposed conditions drainage map.

To define a "no build" boundary, a HEC-RAS model of the creek through the site has been prepared utilizing flows computed with the use of HydroCad (TR-20) and USGS (Regression Equations) StreamStats hydrologic models. The models yielded peak flow values of 88cfs and 70cfs for the 100yr storm respectively. Velocities in the channel are lower than 5.0ft/s (actual velocities are in the range of 2.1ft/s to 3.5ft/s) and are therefore considered non-erosive (i.e. – 5.0ft/s or lower for sandy material). Froude numbers are generally lower than 1.0 (with the

Please provide a brief description of the physical characteristics of the creek, i.e. vegetation, erosion, grades.

exception of one section with a value of 1.02) which further substantiates the erosiveness of the channel is minimal. It is noteworthy to mention that the flows computed by both models are lower than you would expect if you used the rational method. However, since the watershed is ~416acres, the SCS method and the regression equation method is more applicable. Therefore the higher of the two values (88cfs) was used.

Basin A (7.45 Acres) represents portions of the proposed residential lots 1 and 2. Runoff generated within the basin will sheet flow northerly to the creek.

Basin B (4.36 Acres) represents portions of the proposed residential lots 1 and 2. Runoff generated within the basin will sheet flow south and easterly to the Creek.

Basin C (5.27 Acres) represents portions of the proposed residential lots 1 and 2 the southerly half of the existing Hardy Road gravel street. Runoff generated within the basin will sheet flow southerly to the creek.

Basin D (2.85 Acres) represents portions of the proposed residential lots 1 and 2. Runoff generated within the basin will sheet flow northerly to the creek.

The rational methodology was utilized in analyzing on-site basins for development of on-site improvements. The minor increase in impervious area due to the addition of one small homesite development on each of the two lots within the 20-acre subdivision would not substantially impact historic drainage patterns. 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 sheet flow into undeveloped and vegetated portions of lots and infiltrates into the ground.

See Appendix for Calculations.

WATER QUALITY/4-STEP PROCESS

The development addresses Low Impact Development strategies primarily through the utilization of large impervious areas.

Please clarify this statement. A rural 2 lot subdivision has little impervious area.

Step 1-Employ Runoff Reduction Practices
Impervious areas generated within the development will flow across pervious disconnected areas prior to discharging into the creek located within the site.

Step2-Stabilize Drainageway
The unnamed tributary to the creek which runs through the site and reduced runoff due to substantial conveyance across both onsite and offsite pervious area at relatively flat grades will mitigate minor increases in impervious area with development prior to affecting the receiving drainageways.

Step3-Provide Water Quality Capture Volume

Permanent water quality facility is not proposed for development of large lot (2.5acre or larger lots) construction per the requirements of El Paso County Engineering Criteria Manual Section I.7.1B.

Please include a brief statement regarding impervious percentage for both lots.

Step4-Consider Need for Industrial and Commercial BMP's
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 as defined overall site management practices for the construction period. No industrial or Commercial density development is proposed.

COST ESTIMATE

No drainage improvements are proposed with development of the low-density (rural) housing lots.

Please revise to West Kiowa Creek

DRAINAGE FEE CALCULATION

The development proposes to plat 19.344 acres within El Paso County, all contained within the Kiowa Creek Drainage Basin. The Kiowa Creek Drainage Basin has not been studied and no drainage or bridge fees have been adopted.

Suggest removing text. EPC DCM Vol 1 and 2 were not revised in 2014.

DRAINAGE METHODOLOGY

Please update calculations to use CSDCM table 6-6 for runoff coefficients.

This drainage report was prepared in accordance with the criteria established in 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 10 and 100-year recurrence intervals. The average runoff coefficients, 'C' values, are taken from Table 5-1 and the Intensity-Duration-Frequency curves are taken from Figure 5-1 of the Drainage Criteria Manual. Time of concentration for overland flow and channel flow are calculated per Section 5.2.3 of the Drainage Criteria Manual. Calculations for the Rational Method are shown in the Appendix of this report.

Update to 5 yr.

SUMMARY

The RAPSON SUBDIVISION development consists of large lot development with minor increases in impervious areas consistent with surrounding development. The development will not adversely affect downstream properties or facilities.

Please include a statement that determines whether developed runoff values are significantly higher than historic values, or if increase is negligible.

Please update the reference as the County DCMV1 was revised in 1994, DCMV2 was adopted in 2002. The County adopted CH6 of the Citys DCMV1 2014 criteria in 2015.

REFERENCES:

County of El Paso Drainage Criteria Manual Volumes 1 and 2, October 2018

Engineering Criteria Manual, El Paso County, December 2016

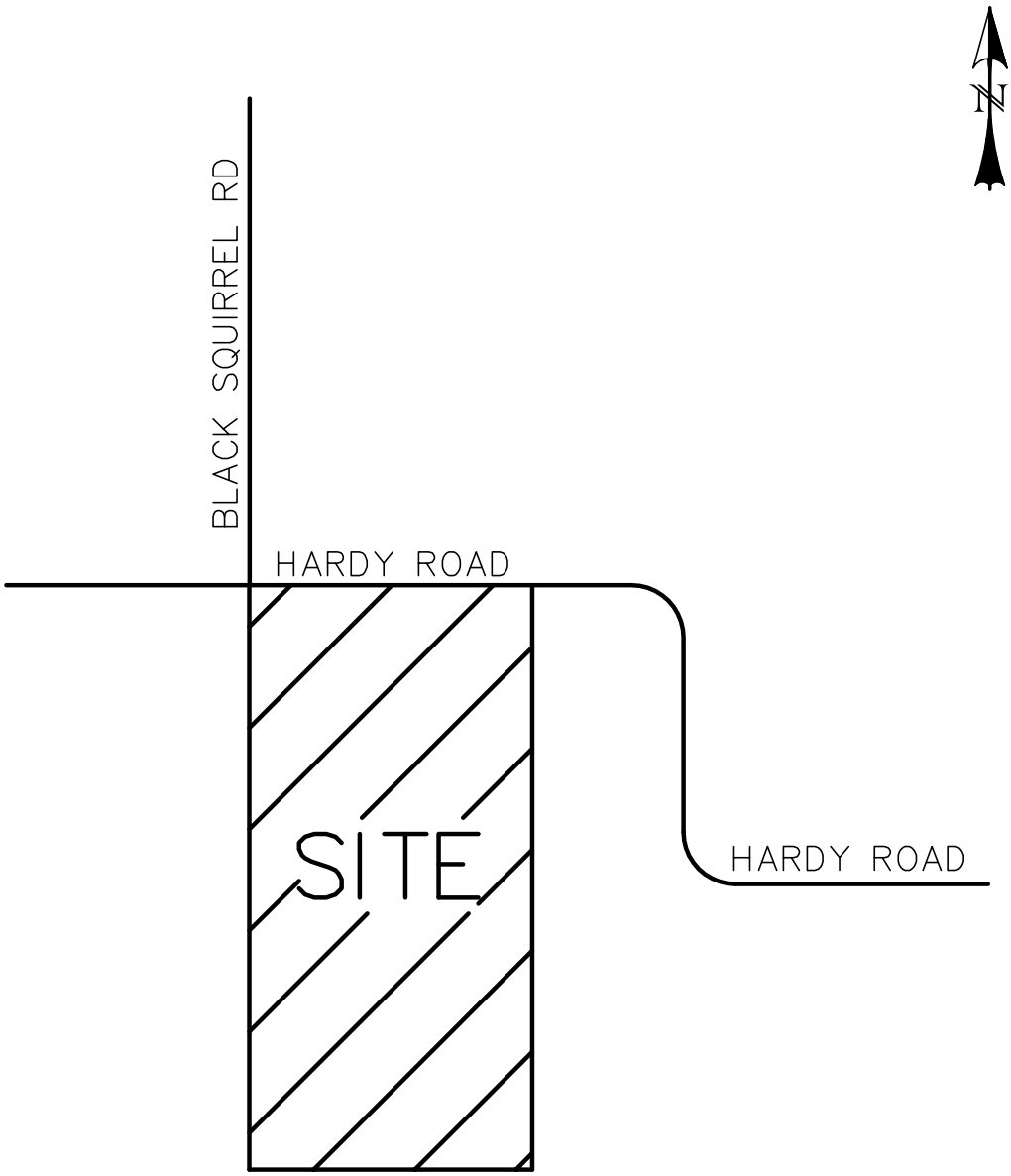
Update to latest revision 2020.

Federal Emergency Management Agency (FEMA): National Flood Hazard Layer FIRMette - Flood Insurance Rate map 08041C00310 G, December 7, 2018

Natural Resources Conservation Service (NRCS) Web Soil Survey

Update reference list to include 2014 CSDCM.

APPENDIX

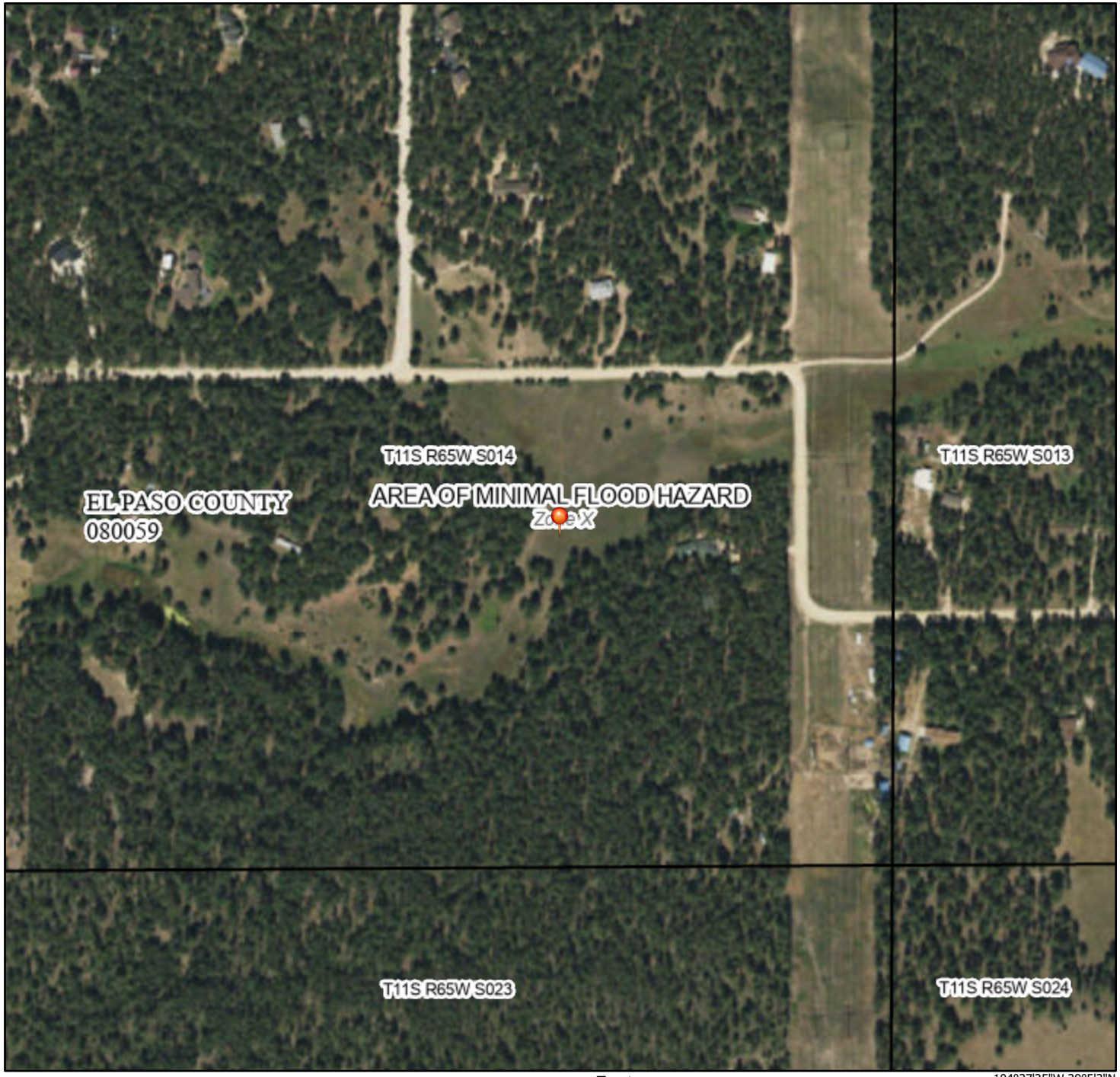


CATAMOUNT ENGINEERING PO BOX 692 DIVIDE, CO 80814 (719) 426-2124	RAPSON SUBDIVISION	SCALE: NOT TO SCALE	DATE: 2/9/21
	VICINITY MAP	JOB NO.: 20-289	SHEET: 1 OF 1

National Flood Hazard Layer FIRMette

FEMA

104°38'3"W 39°5'31"N



104°37'25"W 39°5'3"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/7/2021 at 3:04 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

United States Department of Agriculture

NRCS

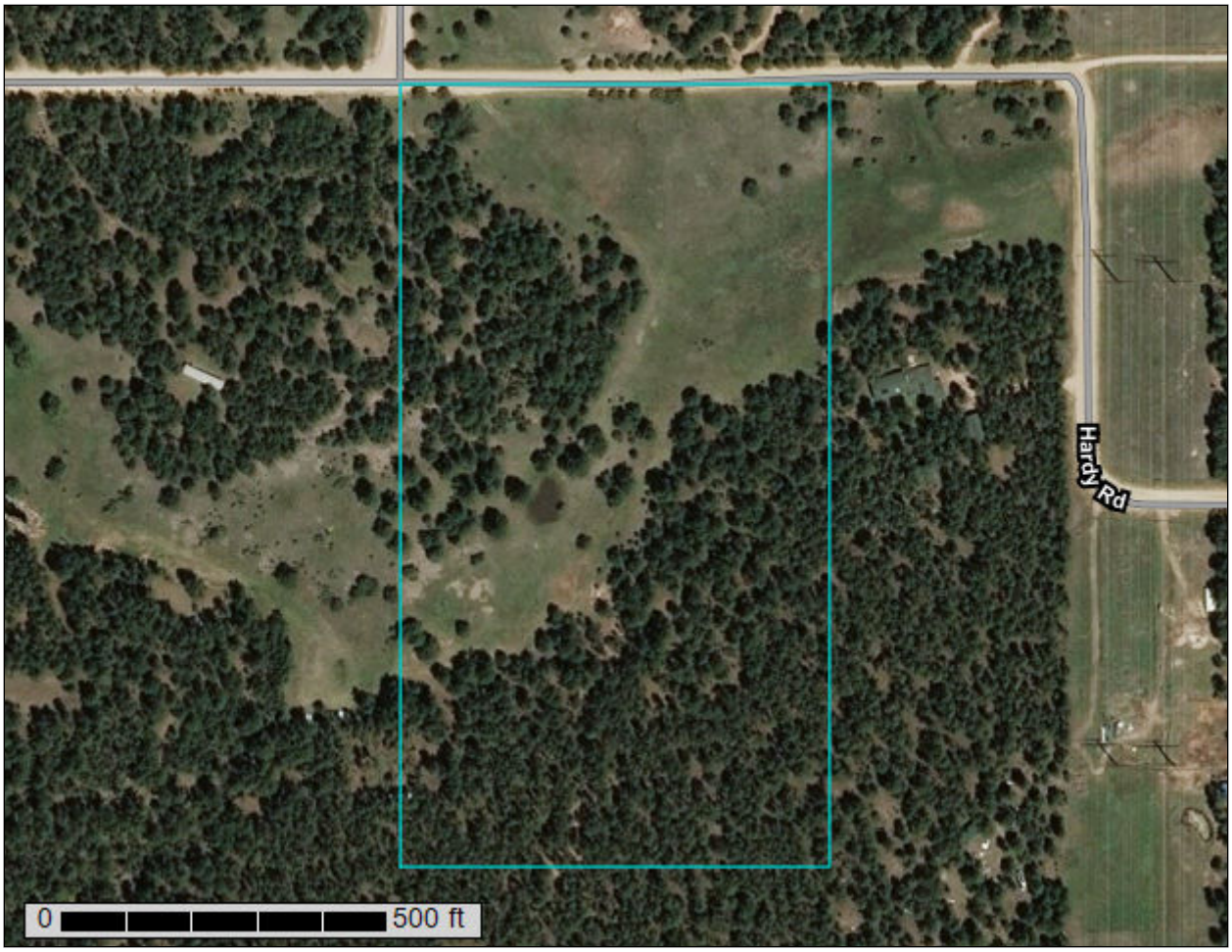
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado

RAPSON SUBDIVISION



February 7, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,140 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	5.5	30.3%
25	Elbeth sandy loam, 3 to 8 percent slopes	12.4	68.5%
26	Elbeth sandy loam, 8 to 15 percent slopes	0.2	1.2%
Totals for Area of Interest		**18.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

1—Alamosa loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3670
Elevation: 7,200 to 7,700 feet
Farmland classification: Prime farmland if irrigated and reclaimed of excess salts and sodium

Map Unit Composition

Alamosa and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alamosa

Setting

Landform: Flood plains, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 6 inches: loam
Bt - 6 to 14 inches: clay loam
Btk - 14 to 33 inches: clay loam
Cg1 - 33 to 53 inches: sandy clay loam
Cg2 - 53 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 18 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Available water capacity: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: R048AY241CO
Hydric soil rating: Yes

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

25—Elbeth sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 367x
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Elbeth and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elbeth

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose

Typical profile

A - 0 to 3 inches: sandy loam
E - 3 to 23 inches: loamy sand
Bt - 23 to 68 inches: sandy clay loam
C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

26—Elbeth sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 367y
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Elbeth and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Elbeth

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose

Typical profile

A - 0 to 3 inches: sandy loam
E - 3 to 23 inches: loamy sand
Bt - 23 to 68 inches: sandy clay loam
C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:

Hydric soil rating: No

BASIN HYDROLOGY

Please revise runoff coefficients for minor storm. The minor storm is the 5 yr.

Please update calculations to use CSDCM table 6-6 for runoff coefficients.

Please update calculations to include runoff values for developed conditions.

BASIN RATIONAL CALCULATIONS

							CONVEYANCE TC						TT				
BASIN	**AREA TOTAL (Acres)**	**C_{10}**	**C_{100}**	**Length (ft)**	**Height (ft)**	**TI (min)**	**Length (ft)**	**Height (ft)**	**C_V**	**Slope (%)**	**Velocity (fps)**	**TC (min)**	**TOTAL (min)**	**I_{10} (in/hr)**	**I_{100} (in/hr)**	**Q_{10} (c.f.s.)**	**Q_{100} (c.f.s.)**
A	7.45	**0.25**	**0.30**	465	30	22.1	425	8	20	1.9%	2.7	2.6	24.7	3.2	4.7	**6.0**	**10.4**
FOREST	0.00	0.15	0.20														
AGRICULTURE	7.45	0.25	0.30														
B	4.36	**0.21**	**0.26**	371	28	14.8	470	8	20	1.7%	2.6	3.0	17.8	3.8	5.5	**3.5**	**6.3**
RES - 1AC+	0.09	0.40	0.50														
FOREST	1.74	0.15	0.20														
AGRICULTURE	2.53	0.25	0.30														
C	5.27	**0.24**	**0.29**	310	19	15.5	110	2	20	1.8%	2.7	0.7	16.2	4.0	5.7	**5.1**	**8.9**
RES - 1AC+	0.09	0.40	0.50														
GRAVEL	0.20	0.80	0.85														
FOREST	1.58	0.15	0.20														
AGRICULTURE	3.40	0.25	0.30														
D	2.85	**0.17**	**0.22**	275	18	9.4	330	7	20	2.1%	2.9	1.9	11.3	4.6	6.6	**2.2**	**4.1**
FOREST	2.42	0.15	0.20														
AGRICULTURE	0.43	0.25	0.30														

Calculated by: DLM

Date: 2/17/2021

Please update minor storm calculations, the minor storm is the 5yr.

SURFACE ROUTING CALCULATIONS

DESIGN POINT	AREA TOTAL (Acres)	C_{10}	C_{100}	TT TOTAL (min)	I_{10} (in/hr)	I_{100} (in/hr)	Q_{10} (c.f.s.)	Q_{100} (c.f.s.)
DP-1	**19.93**	**0.23**	**0.28**	29.5	2.9	4.2	**13.3**	**23.3**
A	7.45	0.25	0.30					
B	4.36	0.21	0.26					
C	5.27	0.24	0.29					
D	2.85	0.17	0.22					

Calculated by: DLM

Date: 2/17/21

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Summary for Subcatchment 1S: Rapson Subdivision

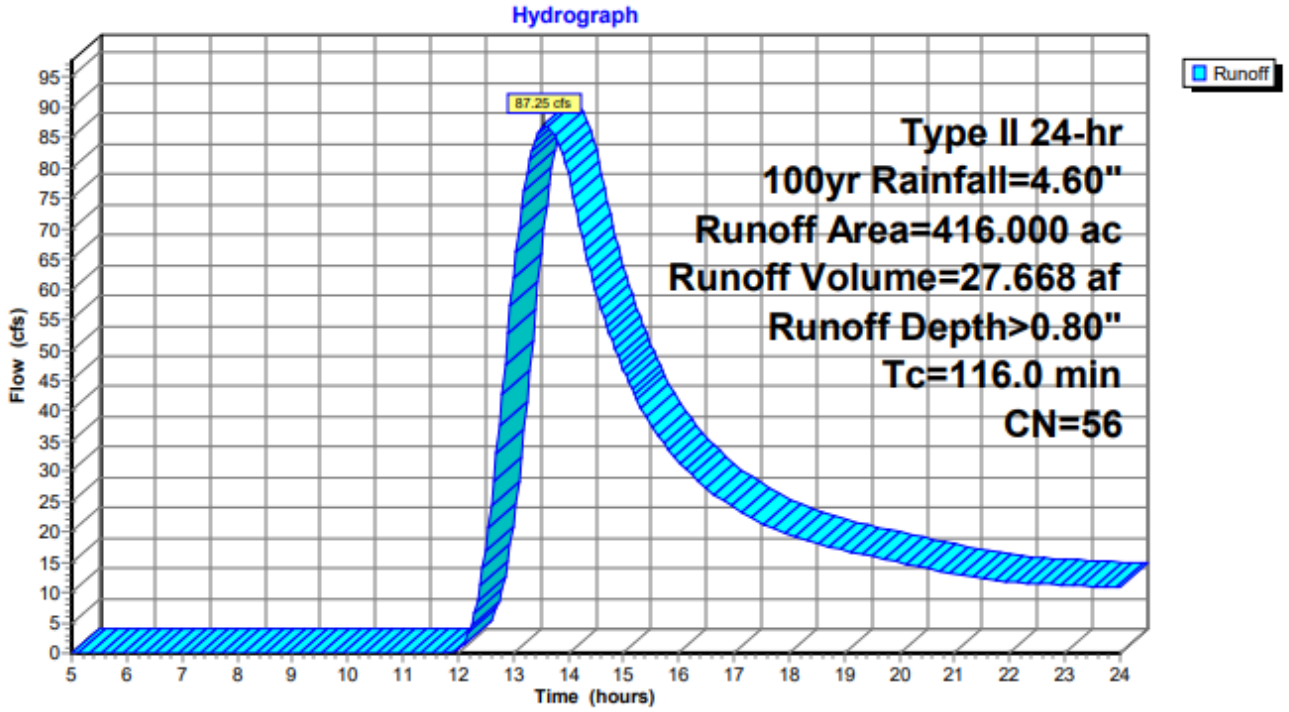
Runoff = 87.25 cfs @ 13.56 hrs, Volume= 27.668 af, Depth> 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100yr Rainfall=4.60"

	Area (ac)	CN	Description
*	416.000	56	
	416.000		100.00% Pervious Area

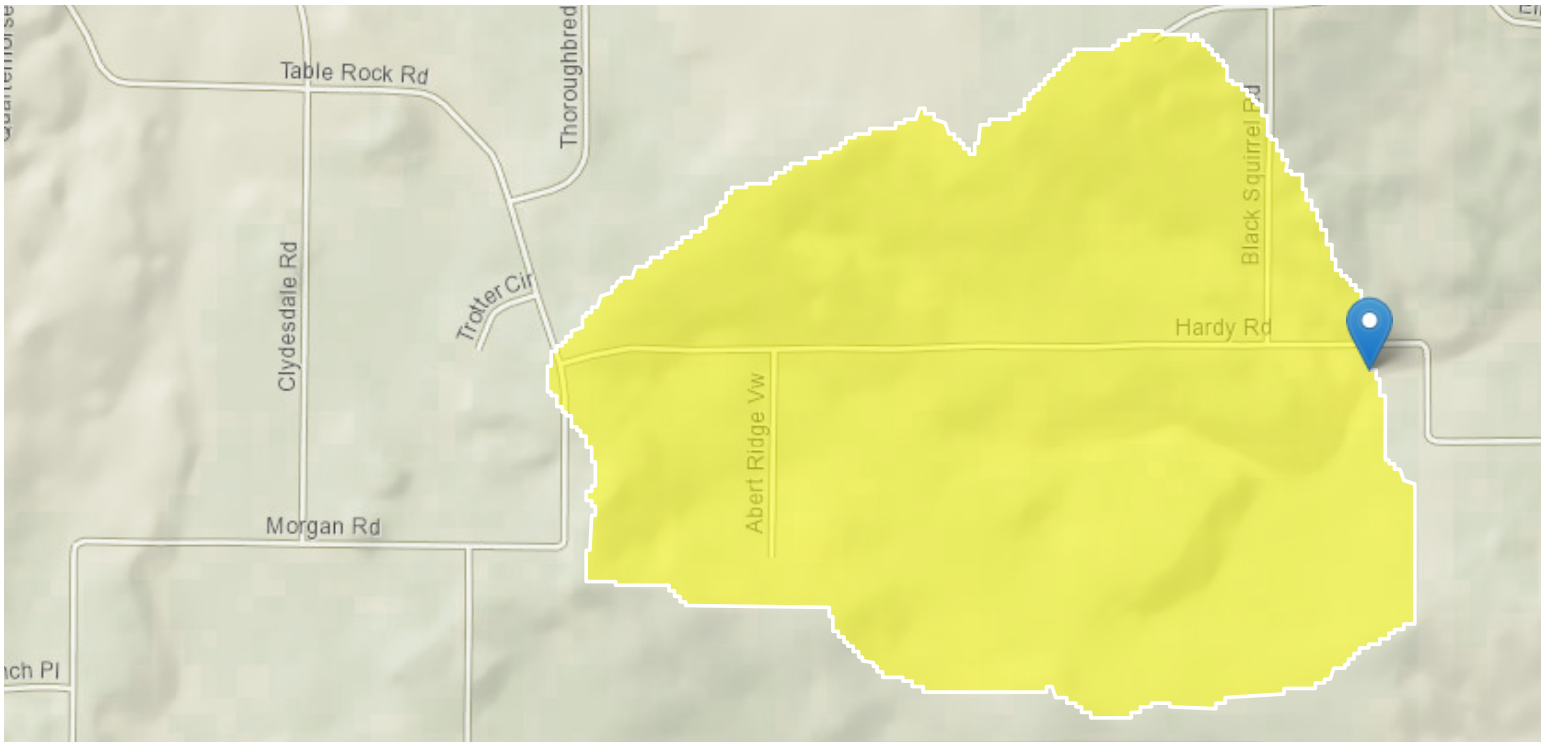
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
116.0					**Direct Entry,**

Subcatchment 1S: Rapson Subdivision



StreamStats Report

Region ID: CO
Workspace ID: CO20210207173404046000
Clicked Point (Latitude, Longitude): 39.08882, -104.62790
Time: 2021-02-07 10:34:22 -0700



10675 Hardy Road - Rapson

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	6	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	143.5	feet per mi
DRNAREA	Area that drains to a point on a stream	0.65	square miles
EL7500	Percent of area above 7500 ft	28	percent
ELEV	Mean Basin Elevation	7474	feet
ELEVMAX	Maximum basin elevation	7570	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	4.97	inches

Parameter Code	Parameter Description	Value	Unit
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	1.89	inches
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	3	inches
I6H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	1.38	inches
LAT_OUT	Latitude of Basin Outlet	39.088784	degrees
LC11BARE	Percentage of barren from NLCD 2011 class 31	0	percent
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	4	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	92.6	percent
LC11GRASS	Percent of area covered by grassland/herbaceous using 2011 NLCD	0	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	3.9	percent
LC11SHRUB	Percent of area covered by shrubland using 2011 NLCD	3.2	percent
LC11SNOIC	Percent snow and ice from NLCD 2011 class 12	0	percent
LC11WATER	Percent of open water, class 11, from NLCD 2011	0	percent
LC11WETLND	Percentage of wetlands, classes 90 and 95, from NLCD 2011	0.1	percent
LFPLENGTH	Length of longest flow path	1.3	miles
LONG_OUT	Longitude of Basin Outlet	-104.627964	degrees
MINBELEV	Minimum basin elevation	7370	feet
OUTLETELEV	Elevation of the stream outlet in feet above NAVD88	7374	feet
PRECIP	Mean Annual Precipitation	20.64	inches
RCN	Runoff-curve number as defined by NRCS (http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17758.wba)	56.16	dimensionless
RUNCO_CO	Soil runoff coefficient as defined by Verdin and Gross (2017)	0.47	dimensionless
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	98	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	0.0837	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	1.89	percent
STATSCLAY	Percentage of clay soils from STATSGO	16.3	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.1	percent

/

Parameter Code	Parameter Description	Value	Unit
TOC	Time of concentration in hours	1.93	hours

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.65	square miles	0.6	2850
I6H100Y	6 Hour 100 Year Precipitation	3	inches	2.38	4.89
STATSCLAY	STATSGO Percentage of Clay Soils	16.3	percent	9.87	37.5
OUTLETELEV	Elevation of Gage	7374	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
50_percent_AEP_flood	6.13	ft^3/s	117
20_percent_AEP_flood	15.4	ft^3/s	87
10_percent_AEP_flood	24.4	ft^3/s	80
4_percent_AEP_flood	39.3	ft^3/s	80
2_percent_AEP_flood	52.8	ft^3/s	83
1_percent_AEP_flood	69.7	ft^3/s	88
0_5_percent_AEP_flood	88.4	ft^3/s	94
0_2_percent_AEP_flood	117	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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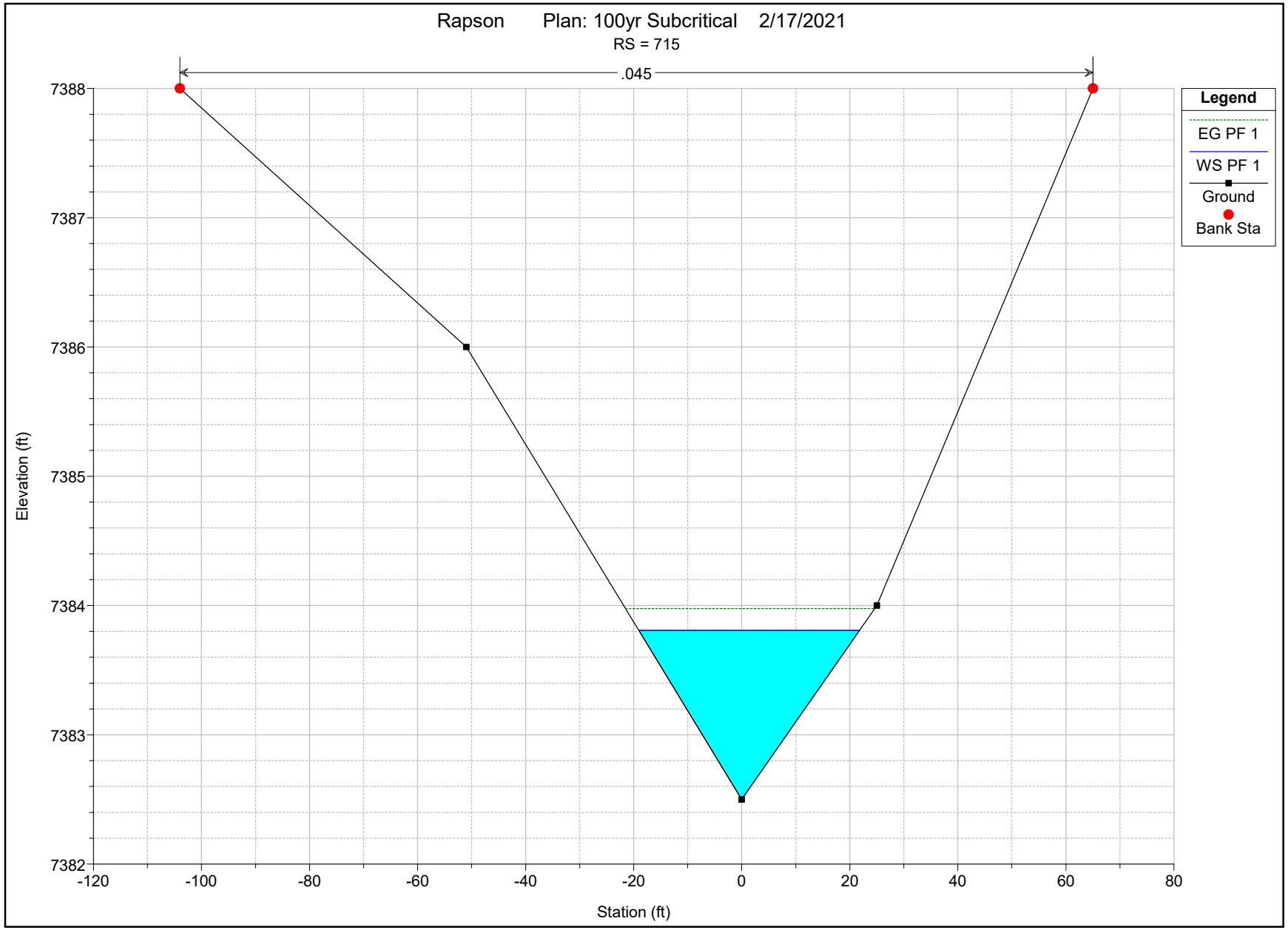
Application Version: 4.4.0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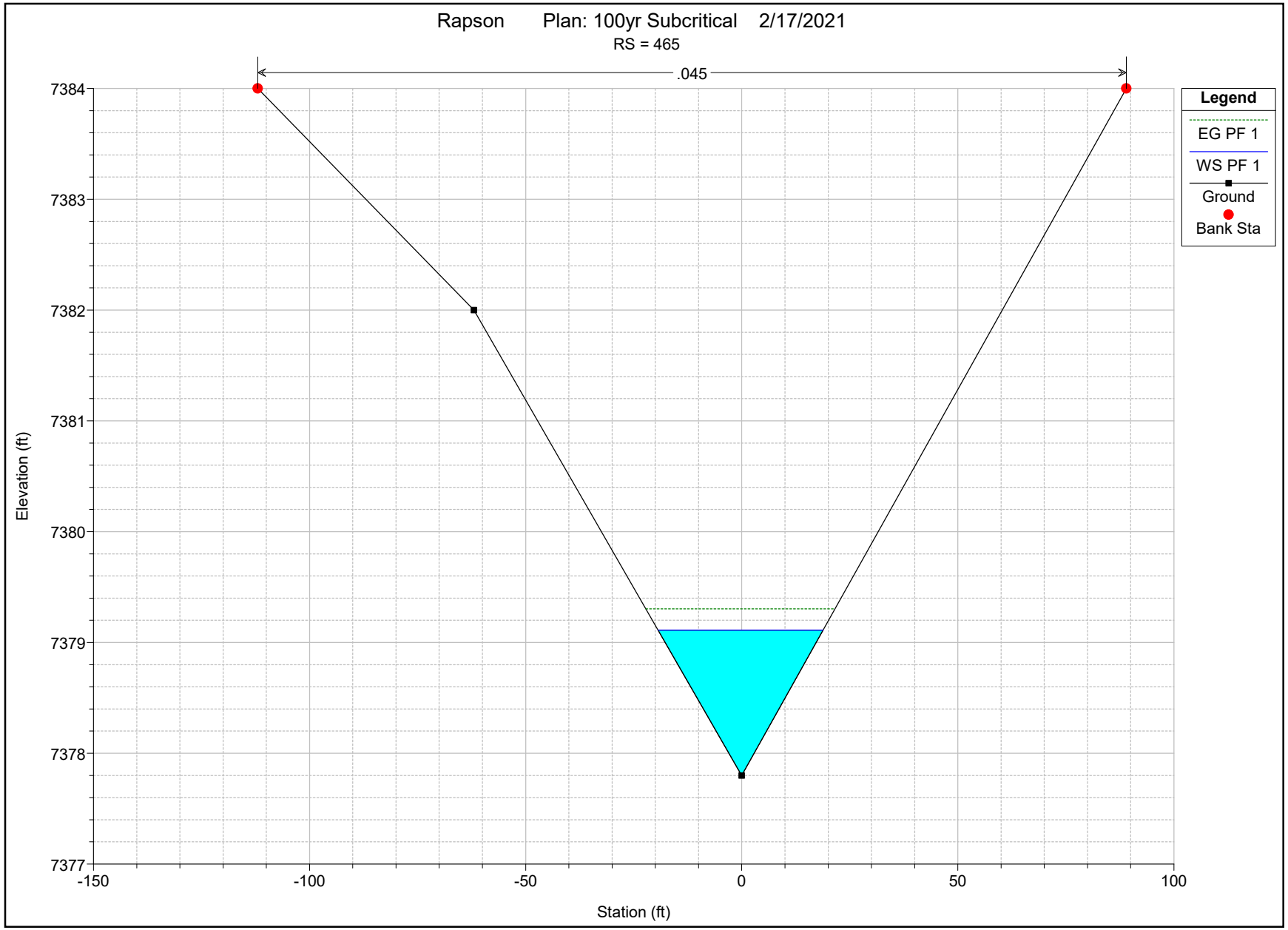
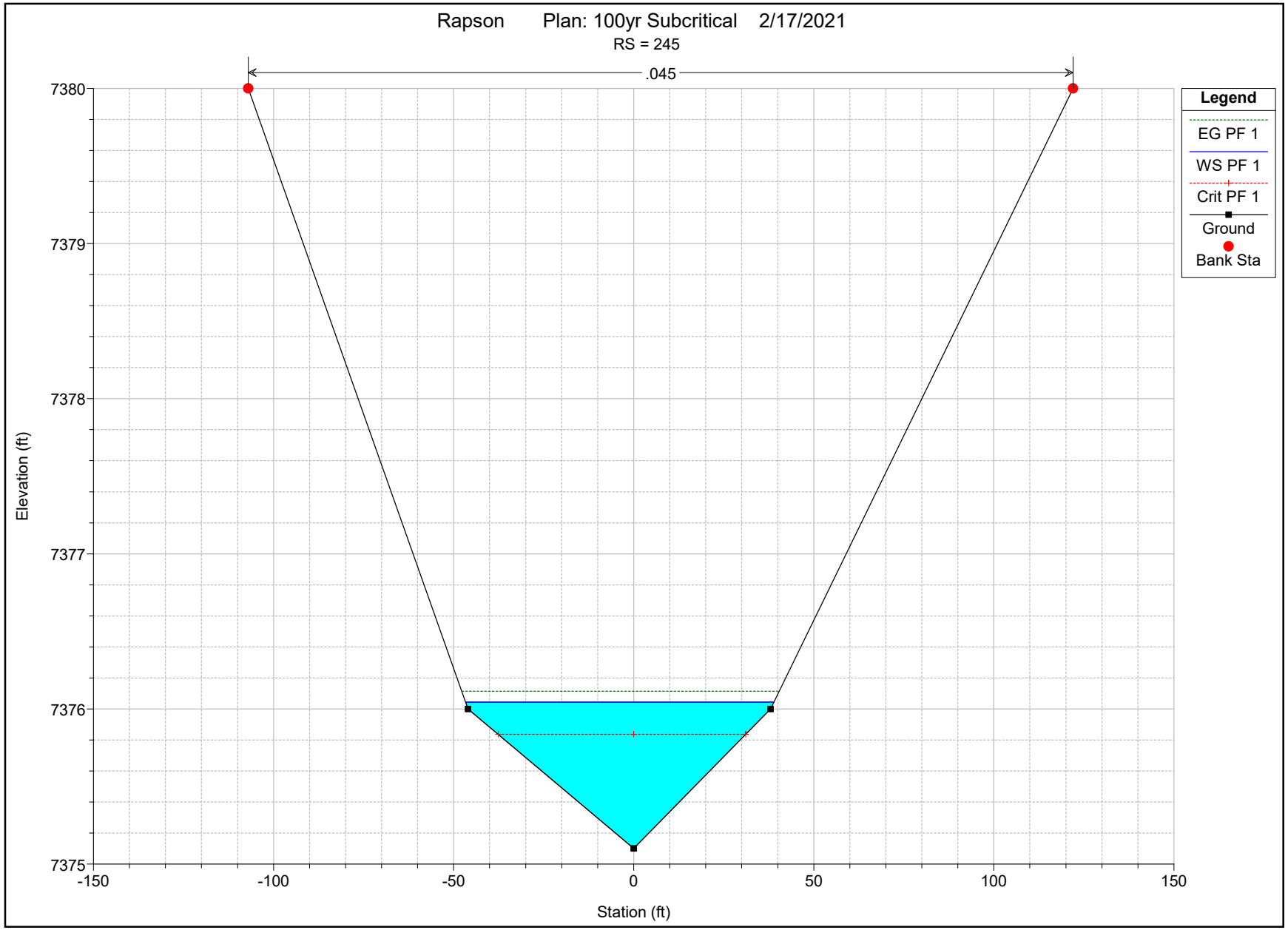
RS = 715
.045
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
7388
7387
7386
7385
7384
7383
7382
-120
-100
-80
-60
-40
-20
0
20
40
60
80
Station (ft)


Rapson Plan: 100yr Subcritical 2/17/2021
RS = 465
.045
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
7384
7383
7382
7381
7380
7379
7378
7377
-150
-100
-50
0
50
100
Station (ft)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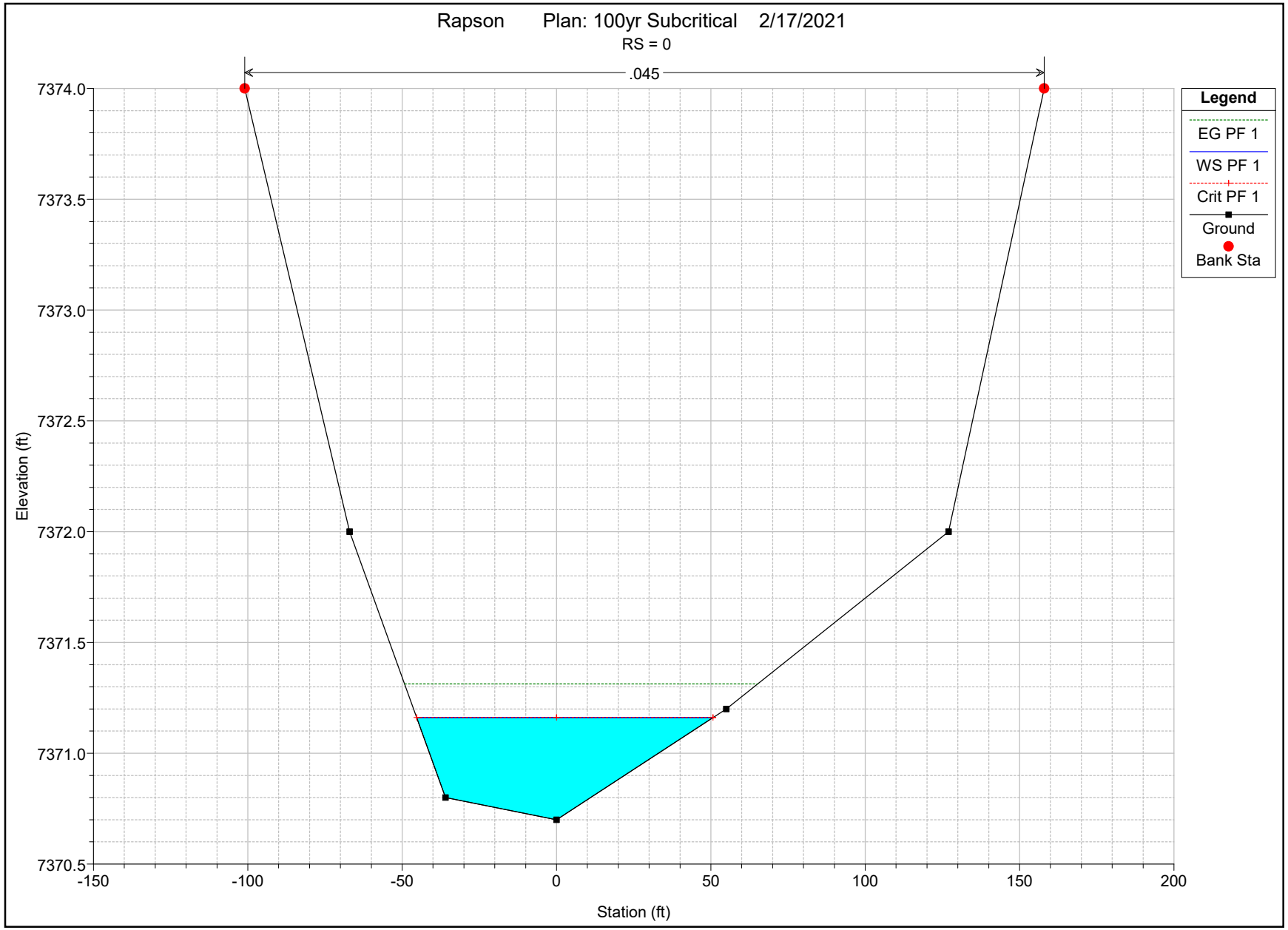
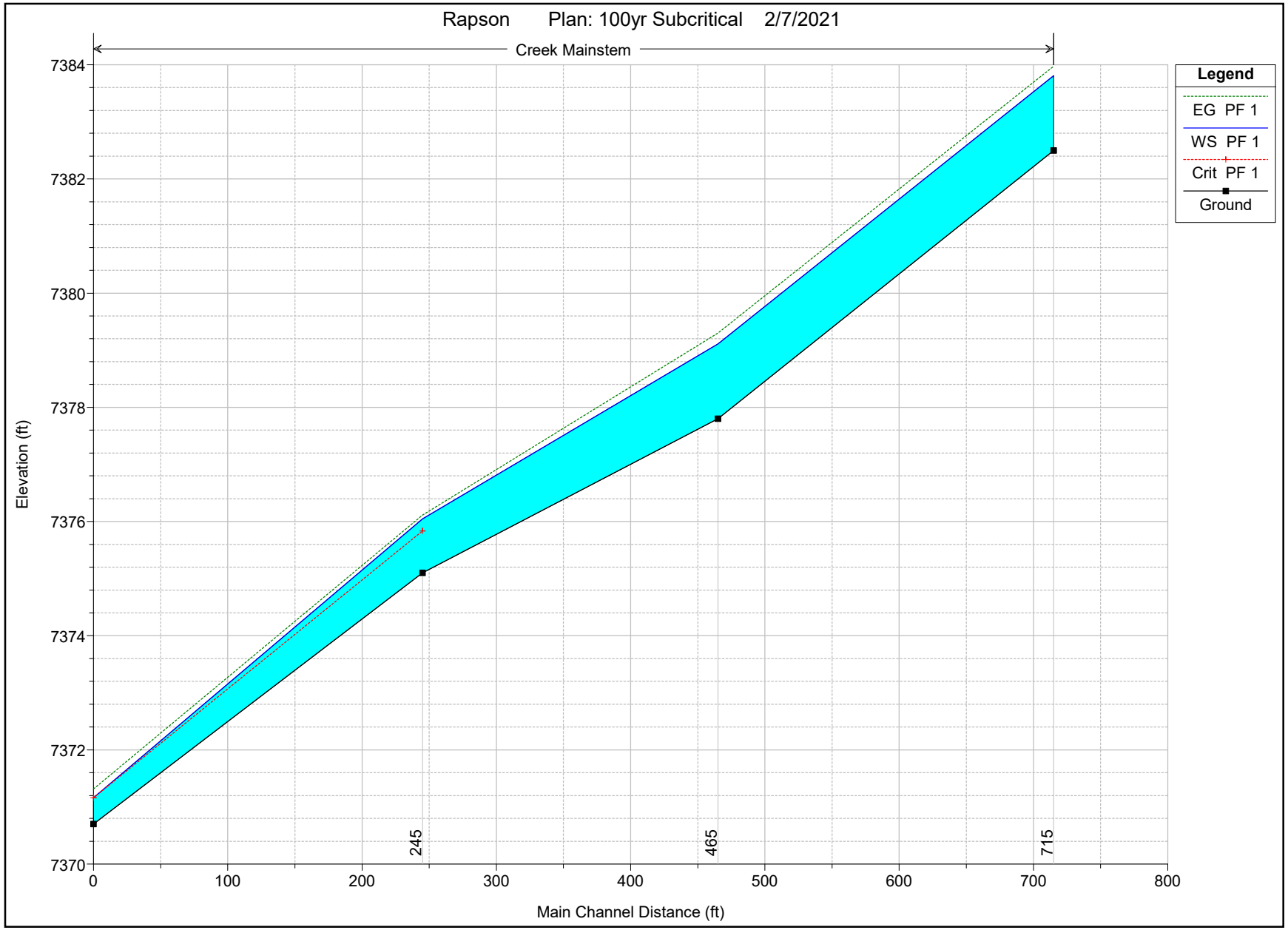
RS = 245
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
7380
7379
7378
7377
7376
7375
-150
-100
-50
0
50
100
150
Station (ft)

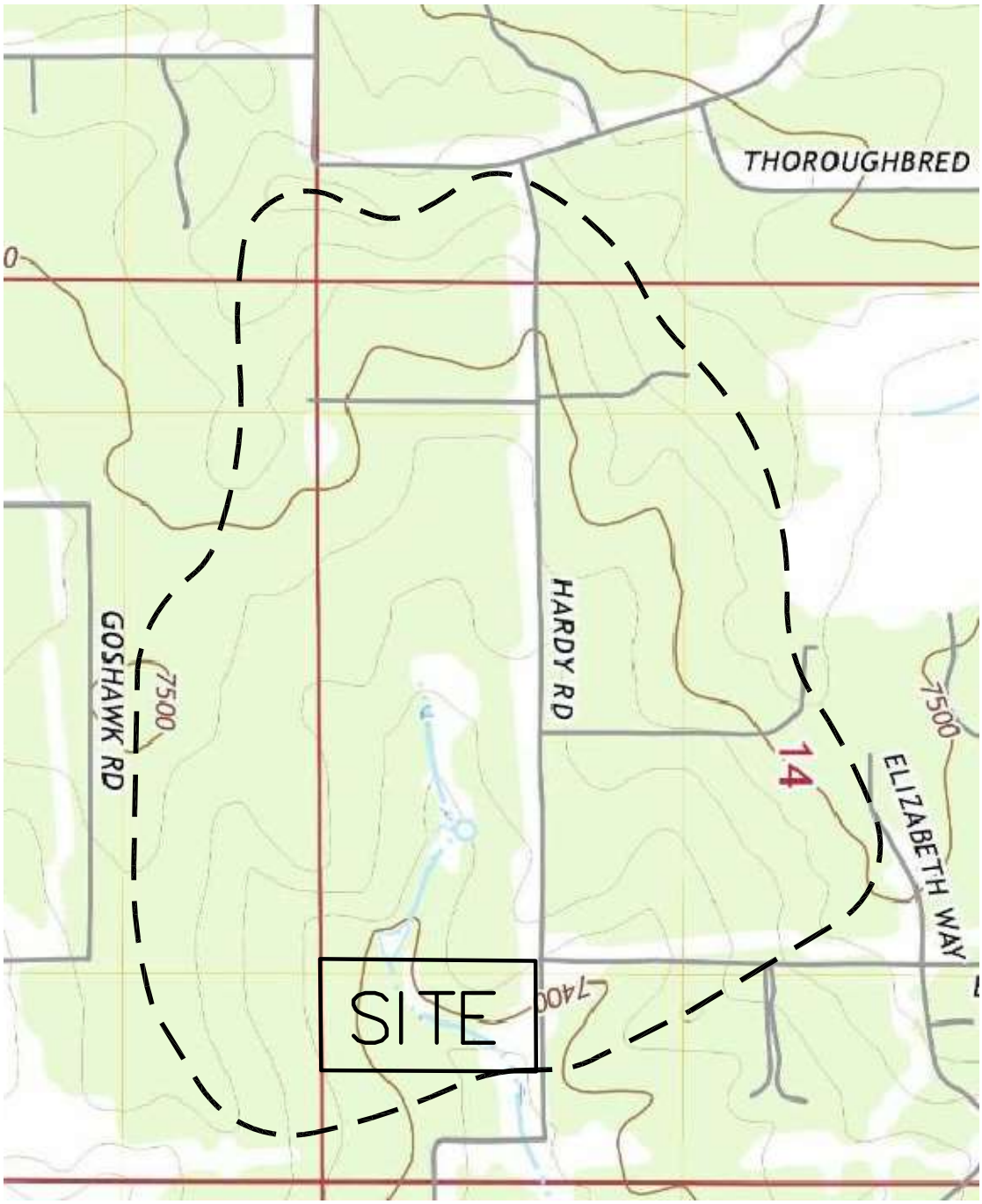

Rapson Plan: 100yr Subcritical 2/17/2021
RS = 0
.045
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
7374.0
7373.5
7373.0
7372.5
7372.0
7371.5
7371.0
7370.5
-150
-100
-50
0
50
100
150
200
Station (ft)

HEC-RAS Plan: 100Yr Sub River: Creek Reach: Mainstem 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)	
Mainstem	715	PF 1	88.00	7382.50	7383.81		7383.98	0.017596	3.30	26.71	40.85	0.72
Mainstem	465	PF 1	88.00	7377.80	7379.11		7379.30	0.019944	3.51	25.04	38.19	0.77
Mainstem	245	PF 1	88.00	7375.10	7376.04	7375.84	7376.11	0.010778	2.12	41.56	85.61	0.54
Mainstem	0	PF 1	88.00	7370.70	7371.16	7371.16	7371.31	0.045915	3.12	28.17	96.04	1.02


Rapson Plan: 100yr Subcritical 2/7/2021
Creek Mainstem
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
7384
7382
7380
7378
7376
7374
7372
7370
0
100
200
300
400
500
600
700
800
245
465
715
Main Channel Distance (ft)

DRAINAGE PLAN

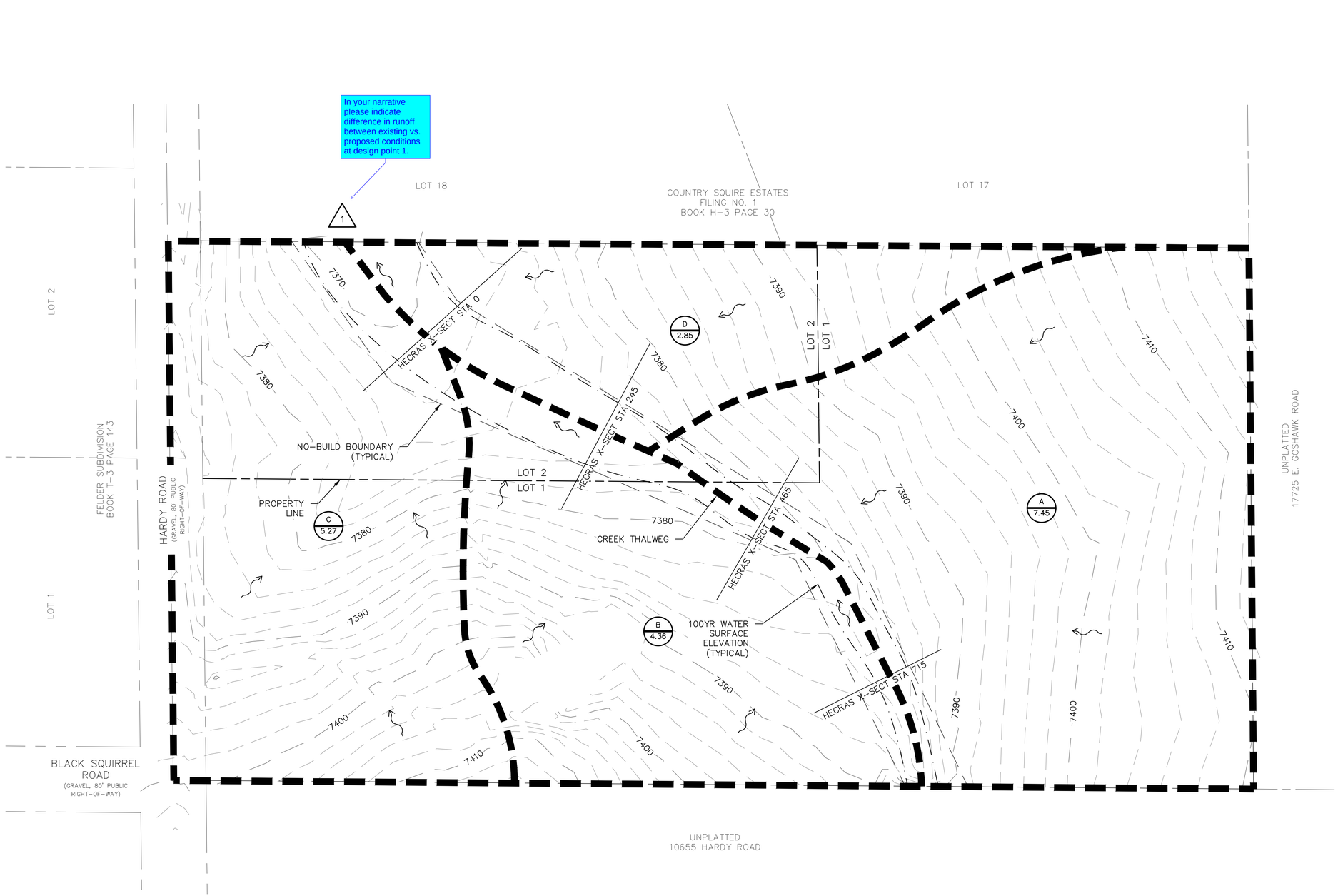


UNNAMED TRIBUTARY
TO WEST KIOWA CREEK

N

CATAMOUNT ENGINEERING PO BOX 692 DIVIDE, CO 80814 (719) 426-2124	RAPSON SUBDIVISION	SCALE: 1"=1000'	DATE: 2/9/21
	USGS WATERSHED MAP	JOB NO.: 20-289	SHEET: 1 OF 1

In your narrative please indicate difference in runoff between existing vs. proposed conditions at design point 1.



Please provide a proposed drainage map with updated runoff values placed after this sheet.

Please update the drainage map to include offsite basins that surround the property and update runoff values to include offsite runoff.

SCALE: 1" = 60'

DRAINAGE BASINS			
BASIN	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
A	7.45	6.0	10.4
B	4.36	3.5	6.2
C	5.27	5.0	8.8
D	5.27	2.2	4.1

DESIGN POINTS			
DESIGN POINT	DESCRIPTION	Q5 (CFS)	Q100 (CFS)
1	OUTFLOW LOCATION	13.2	23.2

Design point 1 values should include runoff that drain through the site originating from offsite basins. Per drainage conditions narrative and streamstats exhibit, 88 cfs drain to outfall point (design point 1) at property. Update design point 1 to show entire flow at that outfall for both storm events.

DRAINAGE LEGEND

BASIN IDENTIFIER / BASIN AREA [AC]	F / 0.36
DESIGN POINT IDENTIFIERS	3
DRAINAGE BASIN BOUNDARY	
SURFACE SHEET FLOW DIRECTION	
EXISTING MAJOR CONTOUR (10')	6930
EXISTING MINOR CONTOUR (2')	
(P) BOUNDARY	
EXISTING	(E)
PROPOSED	(P)
FUTURE	(F)

Label as existing drainage map.

REV.	DESCRIPTION	DATE

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

PREPARED FOR:
ANREA JAYNE RAPSON & WILLIAM CLARK RAPSON

PREPARED UNDER MY DIRECT SUPERVISION FOR AND BEHALF OF CATAMOUNT ENGINEERING.

DAVID L. MIJARES, COLORADO PE #40510 DATE

CATAMOUNT ENGINEERING
321 W. HENRIETTA AVE WOODLAND PARK, CO 80866
PO BOX 221 (719)426-2124

RAPSON SUBDIVISION

DRAINAGE PLAN

DESIGNED BY: DLM	DRAWN BY: DLM
SCALE: 1" = 60'	DATE: 2/17/21
JOB NUMBER 20-289	SHEET 1 OF 1