

ROCKINGHORSE FILING NO. 21  
PRELIMINARY DRAINAGE REPORT

Inspiration Trail Connector

City of Aurora, Colorado

Inspiration Subdivision

Prepared for:

Inspiration Metropolitan District

8400 S. Winnipeg Ct.

Aurora, Colorado 80016

Phone: 720-281-1395

Contact: Aaron Curtiss

Prepared by:

ICON Engineering, Inc.

7000 S. Yosemite St., Suite 120

Centennial, Colorado 80112

Phone: 303-221-0802 | Fax: 303-221-4019

Project No. 20-033

This Report was Prepared under My Direct Supervision.



---

For and Behalf of: ICON Engineering, Inc. Date: 9/23/2021  
Scott Reed, P.E.

APPROVED FOR ONE YEAR FROM THIS DATE

---

City Engineer

Date

---

Aurora Water Department

Date

September 23, 2021

Table of Contents

A. INTRODUCTION ..... 3

B. HISTORIC DRAINAGE..... 4

C. DESIGN CRITERIA ..... 5

D. DRAINAGE PLAN..... 7

E. CONCLUSIONS ..... 9

F. LIST OF REFERENCES..... 10

Appendices

- A. USDA Soil Survey Map
- B. Runoff Calculations
- C. Drainage Area Map and Referenced Previous Drainage Maps
- D. Water Quality Calculations
- E. Hydraulic Computations

## A. INTRODUCTION

### 1. Location

The Inspiration Trail Connector project will cross Piney Creek within the City of Aurora, just south of the Arapahoe and Douglas County line. Other parts of the trail will cross unincorporated Douglas County within undeveloped area near the Ponderosa Reserve and the Inspiration subdivision (previously platted as RockingHorse), located north of Inspiration Drive and east of North Gartrell Road. The surrounding area consists of single-family residential and undeveloped greenbelt. A vicinity map is shown in **Figure 1**.



**Figure 1 - Vicinity Map**

### 2. Proposed Development

#### a. Property Description

The project site consists of undeveloped rangeland with gently rolling hills populated with native grasses, shrubs, and trees. The slopes generally range from 5 to 25% draining towards

Piney Creek. However, there are some areas of 25 to 50% slopes along the banks of Piney Creek. Piney Creek flows from southeast to northwest. The soils within the site are Bresser sandy loam (BrB – soil group B), Kutch clay loam (KuD – soil group D), Renohill-Buick complex (RmE – soil group D), Sandy Alluvial Land (Sd – soil group A), and Stapleton-Bresser association (St – soil group A). See Appendix A for the soils report obtained from the National Resource Conservation Service (NRCS) (Reference 6). The existing impervious percentage within the contributing basin is 5%.

#### **b. Type of Development**

The project consists of a 10-foot wide by 1,500 linear foot concrete multi-use trail beginning at the boundary between Arapahoe County and Douglas County to the north and ending to the south across Piney Creek at an existing trail within Inspiration. The trail will be designed to maintain existing drainage patterns and meet regulatory floodplain permitting requirements for a No-Rise condition. Additionally, no stormwater infrastructure is proposed with this development. In the existing condition, a gravel utility access road traverses the site and a dirt path crosses Piney Creek at the proposed crossing. The proposed trail improvements will formalize the existing paths with a concrete trail constructed at existing grade across Piney Creek. The impervious percentage within the contributing basin in the proposed condition is 7.6%.

#### **c. Requested Variances**

A variance is requested to waive the stormwater detention requirement for new construction as shown in Section 3.60 of the *City of Aurora Storm Drainage Design & Technical Criteria Manual* (Reference 3). The reasons for requesting a variance to waive the stormwater detention requirement are presented below.

A variance is requested to waive the requirement for permanent water quality BMP's as described in Section 3.70 of the SDDTCM (Reference 3). The variance is requested for several reasons. These reasons are described below.

## **B. HISTORIC DRAINAGE**

### **1. Overall Basin Description**

#### **a. Off-Site Basins**

The project site lies within the Piney Creek drainage basin at the point where the tributary area to Piney Creek is approximately 3,011 tributary acres <sup>(1)</sup>. According to the Rockinghorse Subdivision Filing No.2, the project site lies within sub-basin 730 which is 602.5 acres <sup>(2)</sup>. Map excerpts from previous drainage reports are included in the Appendix.



Within the project area that drains directly to Piney Creek, smaller sub-basins have been delineated to evaluate the effect of the proposed improvements on peak runoff for the minor and major storm events. These smaller sub-basins are shown on the Drainage Area Map included in the Appendix.

**b. Major Drainage Ways**

The proposed project site drains into Piney Creek which is major drainageway with a FEMA regulated floodplain (Panel #0800490090C, Douglas County – Unincorporated Areas).

**2. Drainage Patterns Through Property**

The project site includes moderate to steeply sloping hillside with dense native vegetation as well as Piney Creek. Piney Creek is an ephemeral stream and is dry several months of the year. Piney Creek flows south to north where the proposed trail crosses the creek bottom. Steeper slopes are present along the portion of the trail that is south of Piney Creek (between 20-50%) whereas moderate slopes (between 5 – 15%) are located north of Piney Creek. Both southern and northern hillsides currently sheet flow directly into Piney Creek.

**3. Outfalls Downstream from Property**

The site drains into Piney Creek which outfalls into Cherry Creek approximately 7 miles downstream.

**C. DESIGN CRITERIA**

**1. References**

This Preliminary Drainage Report is prepared in accordance with the *City of Aurora Storm Drainage Design & Technical Criteria* (Reference 3) and the *Mile High Flood District Urban Storm Drainage Criteria Manual* (Reference 4).

**a. Existing Drainage Reports for Surrounding Properties**

Previously completed drainage studies that covered the proposed project site and Piney Creek include analyses include: *RockingHorse Subdivision Filing No. 2 Master Drainage Report* (Reference 1), and *RockingHorse Subdivision Filing No. 2 Final Drainage Report* (Reference 2), both of which were completed by Nolte Associates.

**b. USDCM**

Runoff calculations are based on the *Mile High Flood District Urban Storm Drainage Criteria Manual* (USDCM) (Reference 4).

**c. City Master Plan and Floodplain Studies**

*Flood Hazard Area Delineation for Piney Creek and Antelope Creek* (Reference 7).

**d. Aurora City Code**

*Aurora City Code Section 70-33.1 Regulatory Floodways* (Reference 8).

**2. Hydrologic Criteria**

**a. Rainfall Source and  $P_1$  Identified**

Rainfall and  $P_1$  data from the nearby Aurora Reservoir provided by the current *NOAA Atlas 14 Precipitation Frequency Data Server* (Reference 5) was used in runoff calculations. This data can be found in the Mile High Flood District Rational Calculations Spreadsheets in Appendix B.

**b. Calculation Method**

The Rational Method was used to calculate peak flows from the smaller local sub-basins, accounting for weighted C-Values based on City of Aurora drainage standards, as well as small increases to percent imperviousness in the proposed condition. The Mile High Flood District Rational Spreadsheet was used to complete these calculations. Additionally, previous studies by Nolte Associates (References 1 and 2) were referenced to evaluate the impact to peak flows within Piney Creek.

**c. Detention Volume Computation Method**

Detention volumes were not calculated because a detention pond is not recommended for this project. A variance is requested along with this report to waive the stormwater detention requirement for new construction. The reasons for requesting a variance to waive the stormwater detention requirement are presented below.

**d. Design Frequencies**

The design frequencies used in this drainage study are 10-year for the minor storm and 100-year for the major storm.

**3. Hydraulic Criteria**

The major drainageway within the project area is Piney Creek. Piney Creek is an ephemeral wash that generally flows from southeast to northwest until it outfalls into Cherry Creek. The watershed of Piney Creek is made up of low-density residential developments, agricultural areas, and undeveloped rangeland.

As the proposed project crosses Piney Creek, The City of Aurora requires demonstration that the project will not create a rise in the regulatory floodplain. Aurora City Code Section 70-33.1 indicates that “Encroachments are prohibited, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed by a licensed Colorado Professional Engineer and in accordance with standard engineering practice that the proposed encroachment would not result in any increase (requires a no-rise certification) in flood levels within the City during the occurrence of the base flood discharge.”

An analysis of the regulatory floodplain for existing and proposed conditions has been conducted. The proposed crossing of the Piney Creek floodway was evaluated using HEC-RAS. Additional information on this analysis is included in the Appendix.

## **D. DRAINAGE PLAN**

### **1. General Concept**

#### **a. Conveyance of Off-Site Drainage**

Runoff from the smaller local sub-basins will flow overland down the hillsides, cross the proposed trail, which will be sloped at 1.5% downhill, and continue overland into Piney Creek. Within Piney Creek, the proposed trail will be constructed at grade and will not impede flow. The proposed improvements will have negligible impact on the historic drainage pattern, impervious percentage within the basin, Time of Concentration, and Peak Runoff entering Piney Creek, and no adverse impacts to adjacent or downstream properties are anticipated. No drainage facilities or other drainage improvements are required for this project.

#### **b. Coordination with Surrounding Developments**

N/A

#### **c. Detention Ponding**

A variance is requested to waive the stormwater detention requirement for new construction as shown in Section 3.60 of the *City of Aurora Storm Drainage Design & Technical Criteria Manual* (Reference 3). A stormwater detention pond is not recommended for this project because the proposed/post-developed conditions will create a negligible increase in peak runoff locally, and regionally, there would be no measurable increase in peak flows or rise in the 100-yr water surface level within Piney Creek. In addition, construction of collection, conveyance and detention infrastructure would be difficult as the trail goes up and down relatively steep hillsides, thereby significantly increasing disturbance of native vegetation and overall project cost.

**d. Water Quality BMP Plan**

A variance is requested to waive the requirement for permanent water quality BMP's as described in Section 3.70 of the SDDTCM. The variance is requested for several reasons. Traditional stormwater pollutants found in runoff from roadways, parking lots, commercial and industrial developments are not anticipated to be present as the project consists of installing a trail for pedestrians and bicyclists. Construction of stormwater collection, conveyance and storage facilities would be difficult as the trail goes up and down on a relatively steep hillside, thereby significantly increasing disturbance of the native vegetation and overall project cost. Furthermore, The Cherry Creek Basin Authority allows for an exemption from requiring permanent water quality treatment for this type of project.

The project disturbance area is expected to be 1.5 acres. During construction, a stormwater management plan (SWMP), including phased construction BMPs, will required.

**e. Ownership and Maintenance Responsibilities**

The Inspiration Trail Connector will be owned and maintained by the Inspiration Metropolitan District.

**2. Specific Details**

**a. Hydrology**

Local sub-basin peak flows for the proposed/post-developed conditions for the 10- and 100-Year events were calculated using Rational Method, with results indicating slight increases in peak runoff rates in the proposed/post-developed condition. However, the slight increases in peak runoff are less than 1 cfs for both local sub-basins. Peak runoff rates for existing and proposed/post-developed conditions are summarized below and tabulated on the Drainage Area Map included in the Appendix.

**Sub-Basin A**

Pre-developed peak discharges for the 10- and 100-year storms were calculated to be 9.47 cfs and 18.31 cfs, respectively. The post-developed peak discharges for the 10- and 100-year storm were calculated to be 9.81 cfs and 18.90 cfs, respectively. The post-developed condition increase in peak runoff is 0.34 cfs and 0.59 cfs for the 10- and 100-year storms, respectively, and are considered negligible.

**Sub-Basin B**

Pre-developed peak discharges for the 10- and 100-year storms were calculated to be 1.58 cfs and 3.06 cfs, respectively. The post-developed peak discharges for the 10- and 100-year storm were calculated to be 1.77 cfs and 3.39 cfs, respectively. The post-

developed condition increase in peak runoff is 0.19 cfs and 0.34 cfs for the 10- and 100-year storms, respectively, and are considered negligible.

The total drainage area to Piney Creek at a point where all of the proposed project site drains into Piney Creek is approximately 3,011 acres, which contributes to a minor storm event flow of 812 cfs and a major storm event flow of 2,713 cfs. The dominant land uses within the watershed are large lot residential developments, agricultural areas and undeveloped areas.

#### **b. Hydraulics**

According to the FEMA Flood Insurance Rate Map, Panel Number 08035C0079G (17 February 2017), a portion of the trail will be constructed within a regulatory floodway. The portion of the trail to be constructed within Piney Creek will match existing creek bottom grades where the trail is within the effective floodway and floodplain. Hydraulic modeling has been completed to demonstrate that the portion of the trail constructed within Piney Creek results in no rise condition as compared to pre-project Base Flood Elevations. A no-rise certification letter including HEC-RAS model results and discussion for a corrected effective model and proposed condition model for the reach pertinent to this analysis is included in Appendix E.

## **E. CONCLUSIONS**

### **1. Compliance with Standards**

This Preliminary Drainage Report complies with the City of Aurora Storm Drainage Design & Technical Criteria and the Mile High Flood District Urban Storm Drainage Criteria Manual.

### **2. Summary of Concept**

#### **a. Degree of Protection to Existing Site**

The proposed project provides a path for pedestrians from the existing Piney Creek Trail to an existing trail system within the Inspiration subdivision south of Piney Creek without causing any negative impacts to existing drainage patterns.

#### **b. Measures Taken to Provide Adequate On-Site Drainage and Enhancement to Stormwater Quality**

On-site drainage will be negligibly impacted by the development of the project, and Stormwater quality will be maintained by existing grassy buffer zones between the proposed trail and the creek.

#### **c. Effect of Proposed Development on Surrounding Developments**

The proposed development has no impact on surrounding developments.

## F. LIST OF REFERENCES

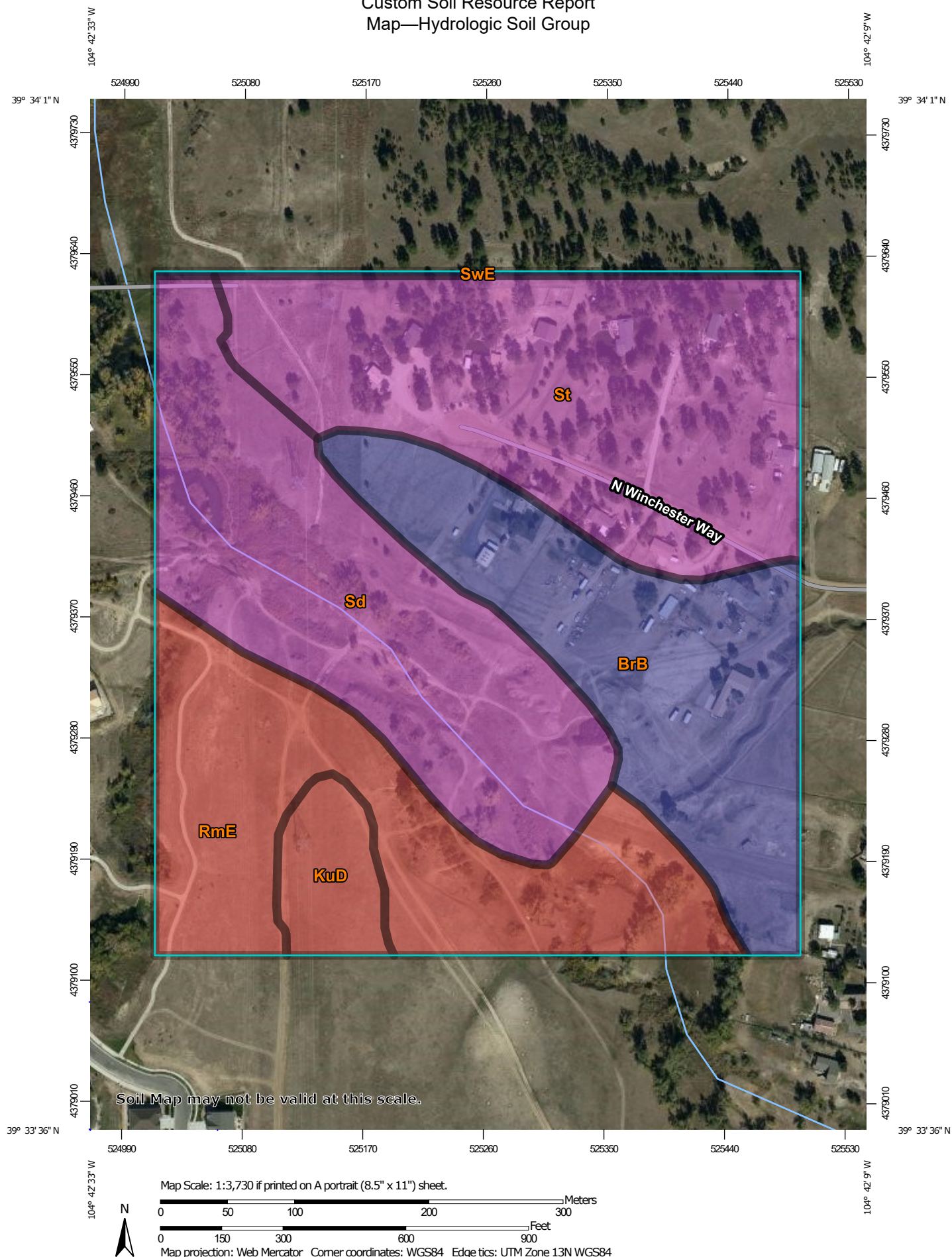
1. *RockingHorse Subdivision Filing No. 2 Master Drainage Report* by Nolte Associates, Inc., December 2002. (Engineering approval number: 202213)
2. *RockingHorse Subdivision Filing No. 2 Final Drainage Report* by Nolte Associates, Inc., April 2006. (Engineering approval number: 207072)
3. *City of Aurora. Storm Drainage Design and Technical Criteria. Effective October 11, 2010.*
4. *Mile High Flood District. Urban Storm Drainage Criteria Manual. Revised August 2018.*
5. NOAA Hydrometeorological Design Studies Center. "Atlas 14 Precipitation Frequency Data Server." [https://hdsc.nws.noaa.gov/hdsc/pfds/pfds\\_map\\_cont.html?bkmrk=co](https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=co). Accessed June 2021.
6. United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). "Web Soil Survey." <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>. Accessed June 2021
7. WRC Engineering, Inc. *Flood Hazard Area Delineation for Piney Creek and Antelope Creek. December 2011.*
8. *Aurora, Colorado Code of Ordinances: City Code Ch. 70 – Floods, Sec. 70-33 Regulatory Floodways (Supp. No. 71; February 24, 2020*

## **Appendix A: USDA Soil Survey Map**



# Custom Soil Resource Report

## Map—Hydrologic Soil Group



## Custom Soil Resource Report

### 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 1:20,000.

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: Arapahoe County, Colorado  
Survey Area Data: Version 16, Jun 4, 2020

Soil Survey Area: Castle Rock Area, Colorado  
Survey Area Data: Version 13, Jun 5, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

## MAP LEGEND

## MAP INFORMATION

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

Date(s) aerial images were photographed: Oct 3, 2018—Dec 4, 2018

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.

**Table—Hydrologic Soil Group**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
SwE	Stapleton sandy loam, 9 to 30 percent slopes	B	0.4	0.6%
<b>Subtotals for Soil Survey Area</b>			<b>0.4</b>	<b>0.6%</b>
<b>Totals for Area of Interest</b>			<b>60.8</b>	<b>100.0%</b>

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	B	12.9	21.2%
KuD	Kutch clay loam, 4 to 8 percent slopes	D	2.3	3.7%
RmE	Renohill-Buick complex, 5 to 25 percent slopes	D	13.0	21.3%
Sd	Sandy alluvial land	A	15.1	24.9%
St	Stapleton-Bresser association	A	17.2	28.2%
<b>Subtotals for Soil Survey Area</b>			<b>60.4</b>	<b>99.4%</b>
<b>Totals for Area of Interest</b>			<b>60.8</b>	<b>100.0%</b>

**Rating Options—Hydrologic Soil Group***Aggregation Method: Dominant Condition**Component Percent Cutoff: None Specified**Tie-break Rule: Higher*

## **Appendix B: Runoff Calculations**

Calculation of Peak Runoff using Rational Method									
--------------------------------------------------	--	--	--	--	--	--	--	--	--

$$Q(cfs) = CIA$$
[illegible]

## Area-Weighted Runoff Coefficient Calculations

**Version 2.00 released May 2017**

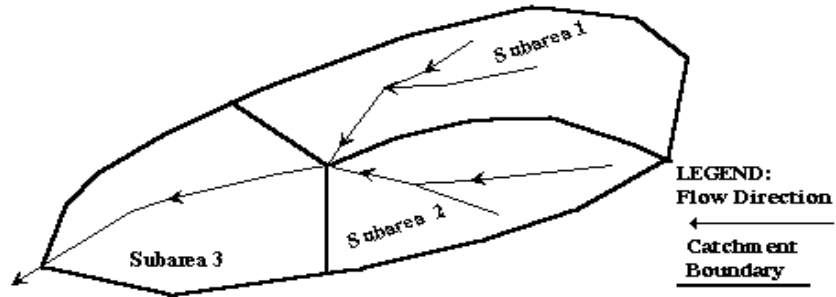
**Designer:** Taylor Domin

**Company:** ICON Engineering

**Date:** 9/10/2021

**Project:** Inspiration Trail - EXISTING

**Location:** Aurora, CO



Subcatchment Name
A

Cells of this color are for required user-input

Cells of this color are for optional override values

Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A1 - Large Lot Residential	14.70	B	20.0	0.13	0.15	0.22	0.37	0.44	0.52	0.61
A2 - Native Rangeland	8.46	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
Weighted Impervious =			13.4							
Total Area (ac)	23.16	Area-Weighted C Area-Weighted Override C		0.08	0.10	0.17	0.33	0.40	0.49	0.59
				0.14	0.15	0.20	0.33	0.40	0.40	0.59



# Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

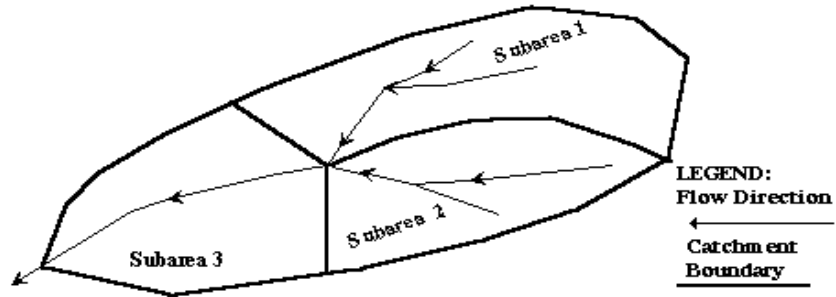
Designer: Taylor Domin

Company: ICON Engineering

Date: 9/10/2021

Project: Inspiration Trail - EXISTING

Location: Aurora, CO



Subcatchment  
Name  
B

Cells of this color are for required user-input  
Cells of this color are for optional override values  
Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
B - Native Rangeland	3.57	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
				0.15	0.16	0.18			0.20	
Total Area (ac)	3.57	Area-Weighted C		0.01	0.01	0.07	0.26	0.34	0.44	0.54
		Area-Weighted Override C		0.15	0.16	0.18	0.26	0.34	0.20	0.54

Calculation of Peak Runoff using Rational Method									
--------------------------------------------------	--	--	--	--	--	--	--	--	--

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$\text{Selected } t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

$Q(cfs) = CIA$

[illegible]

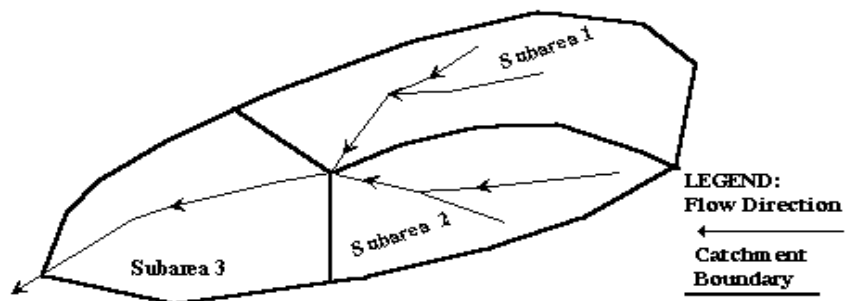
## Version 2.00 released May 2017

**Company:** ICON Engineering

Date: 9/10/2021

**Project:** Inspiration Trail - PROPOSED

**Location:** Aurora, CO



Subcatchment Name
A

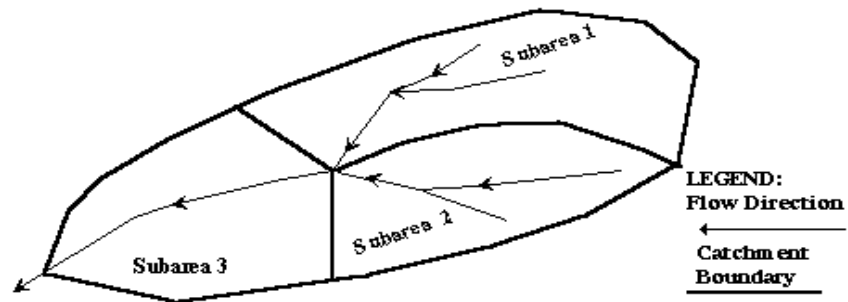
Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A1 - Large Lot Residential	14.70	B	20.0	0.13	0.15	0.22	0.37	0.44	0.52	0.61
A2 - Native Rangeland	8.25	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
A3 - Proposed Trail	0.21	B	96.0	0.80	0.82	0.83	0.85	0.86	0.87	0.89
Weighted Impervious =			14.3							
Total Area (ac)	23.16	Area-Weighted C Area-Weighted Override C		0.09	0.11	0.17	0.34	0.41	0.49	0.59
				0.14	0.16	0.21	0.34	0.41	0.41	0.59

## Version 2.00 released May 2017

<b>Designer:</b>	Taylor Domin
<b>Company:</b>	ICON Engineering
<b>Date:</b>	9/10/2021
<b>Project:</b>	Inspiration Trail - PROPOSED
<b>Location:</b>	Aurora, CO



Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
B1 - Native Rangeland	3.44	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54
				0.15	0.16	0.18			0.20	
B2 - Trail	0.13	B	96.0	0.80	0.82	0.83	0.85	0.86	0.87	0.89
				0.87	0.87	0.88			0.89	
Weighted Impervious =			5.5							
				</						

Values used in weighted-C calculation for Proposed Trail in proposed condition

**TABLE 1** (continued)

**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Streets:</u>					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
<u>Concrete Drive and Walks</u>	<u>96</u>	<u>.87</u>	<u>.87</u>	<u>.88</u>	<u>.89</u>
<u>Roofs</u>	90	.80	.85	.90	.90
<u>Lawns, Sandy Soil (A and B Soils):</u>	<u>2</u>				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
<u>&gt;7% Slope</u>		<u>.15</u>	<u>.16</u>	<u>.18</u>	<u>.20</u>
<u>Lawns, Clay Soil (C and D Soils):</u>	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

NOTE: These Rational Formula coefficients may not be valid for large basins

(\*)See Figures RO-3 through RO-5 of USDCM Volume 1 for percent impervious.

(\*\*)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

Values used in weighted-C calculation for Native Rangeland in existing and proposed conditions

Values used in weighted-C calculation for Large Lot Residential in existing and proposed conditions

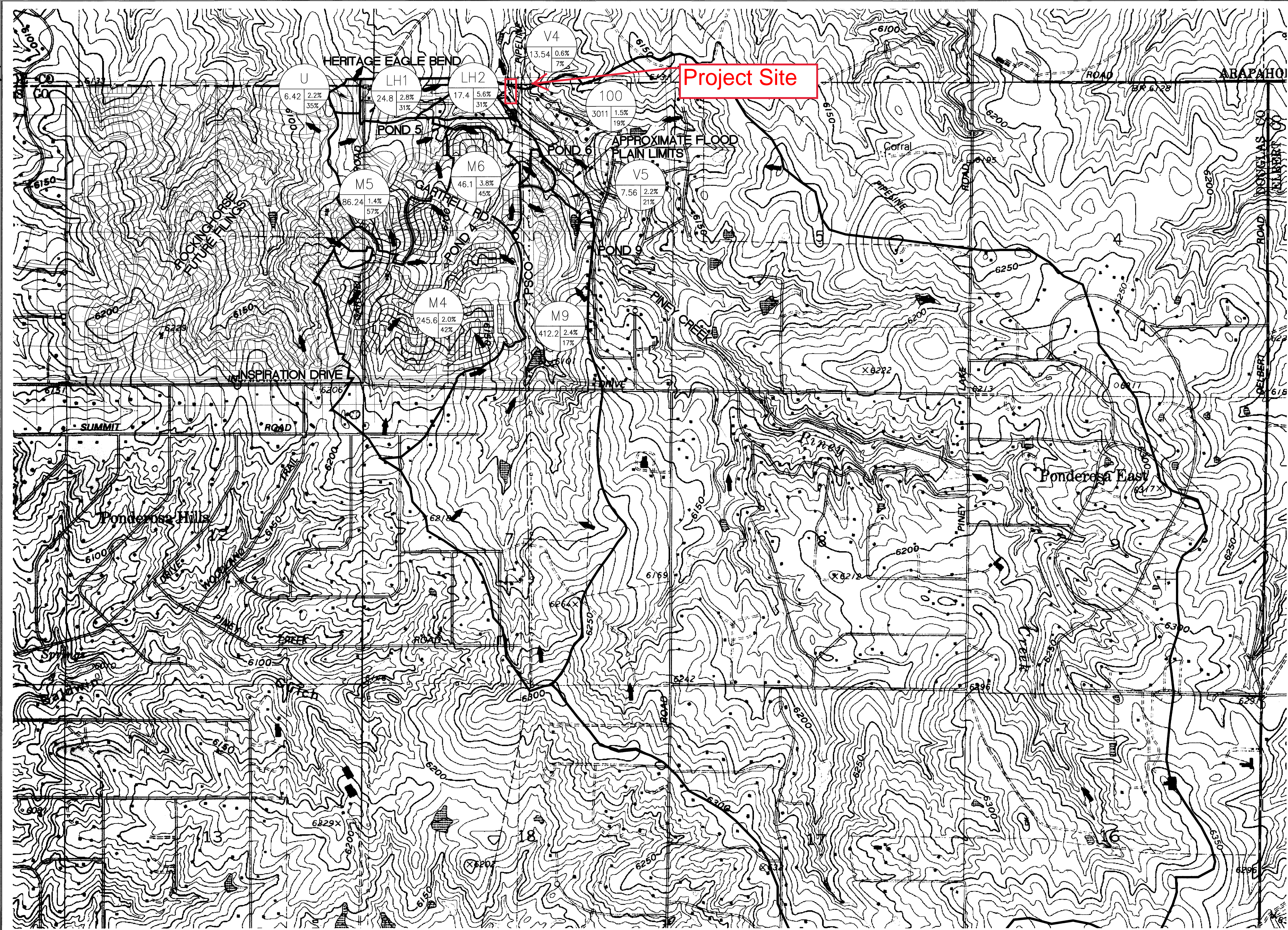
**Table 6-3. Recommended percentage imperviousness values**

Land Use or Surface Characteristics	Percentage Imperviousness (%)
<b>Business:</b>	
Downtown Areas	95
Suburban Areas	75
<b>Residential lots (lot area only):</b>	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
<b>Industrial:</b>	
Light areas	80
Heavy areas	90
<b>Parks, cemeteries</b>	10
<b>Playgrounds</b>	25
<b>Schools</b>	55
<b>Railroad yard areas</b>	50
<b>Undeveloped Areas:</b>	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
<b>Streets:</b>	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

## **Appendix C: Referenced Previous Drainage Maps**



204066 6/9



**LEGEND**

**A#**  
XX.X  
X.XX  
X.XX

— BASIN DESIGNATION  
— WEIGHTED SLOPE  
— PERCENT IMPERVIOUS  
— BASIN ACREAGE

— BASIN BOUNDARY  
— FLOW DIRECTION ARROW

**NOLTE**  
ENGINEERING, INC.

0 400 800 1600  
1 inch = 800 ft.

CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY OF THE DESIGN, DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

Approved For One Year From This Date  
**3-31-04**

*M.S. McCann* for P.O.  
City Engineer  
Date  
**3/15/04**

*Joseph S. Wieg*  
Utilities Department  
Date  
**3-22-04**

DATE: 03/13/04 TIME: 11:16 a.m.	NO.	BY	DATE	REVISIONS:
SERVICES: NONE SERVICE: NONE	1	JJM	02/04	COA COMMENTS
PATH: N:\DV1294\CADD\Civil\01\Draw\F1\				
DRAWING NAME: ET-CUHP.DWG				
PLOTTING VIEW: NONE				
DESIGNER: NONE PROJ. MGR: NONE				

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

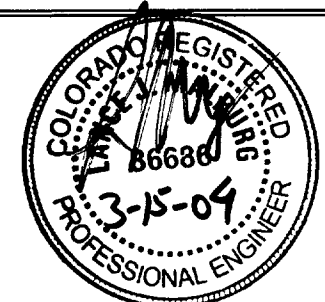
**NOLTE**  
BEYOND ENGINEERING

7000 SOUTH YOSEMITE ST., SUITE 200, ENGLEWOOD, CO. 80112  
303.220.1001 TEL 303.220.9001 FAX WWW.NOLTE.COM

**ROCKINGHORSE**  
**PRELIMINARY DRAINAGE REPORT**  
**CUHP/UDSWMM EXHIBIT**

PREPARED FOR: GARTREL INVESTMENT CO., LLC.

DATE SUBMITTED: 04/21/03

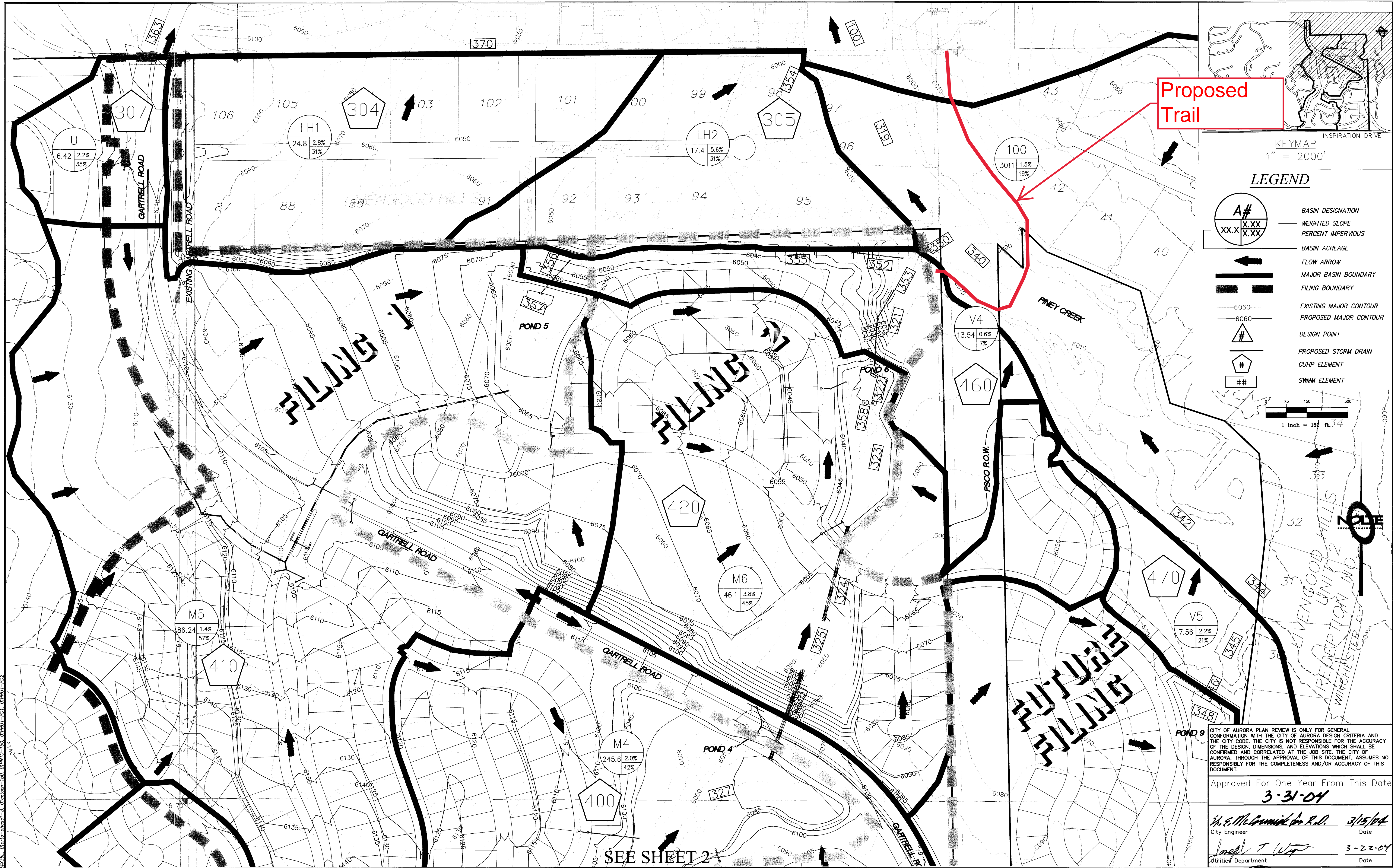


SHEET NUMBER  
68  
OF 98 SHEETS  
SCALE  
VERTICAL: 1"= XX  
HORIZONTAL: 1"= XX  
JOB NUMBER  
DV1294

204066 6/9



204066 8/9



Proposed Trail

**KEYMAP**  
1" = 2000'

**LEGEND**

- BASIN DESIGNATION
- WEIGHTED SLOPE
- PERCENT IMPERVIOUS
- BASIN ACREAGE
- FLOW ARROW
- MAJOR BASIN BOUNDARY
- FILING BOUNDARY
- EXISTING MAJOR CONTOUR
- PROPOSED MAJOR CONTOUR
- DESIGN POINT
- PROPOSED STORM DRAIN
- CUHP ELEMENT
- SWM ELEMENT

1 inch = 150 ft.

DATE: 03/13/04	TIME: 11:13 a.m.
SERVICE: NONE	SERVICE: NONE
PATH: N:\DV1294\CADD\GWL\01\DrainV1\	
DRAWING NAME: ET-CUHP3.DWG	
PLOTTING VIEW: NONE	
DESIGNER: NONE	PROJ. MGR: NONE
CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.	

NO.	BY	DATE	REVISIONS:
1	LJM	02/04	COA COMMENTS

**NOLTE**  
BEYOND ENGINEERING

7000 SOUTH YOSEMITE ST., SUITE 200, ENGLEWOOD, CO. 80112  
303.220.1001 TEL. 303.220.8001 FAX WWW.NOLTE.COM

**ROCKINGHORSE**  
PRELIMINARY DRAINAGE REPORT  
CUHP\UDSWM EXHIBIT

Approved For One Year From This Date  
**3-31-04**

*W. E. McQuinn Jr. P.E.* 3/15/04  
City Engineer Date

*Joel T. Wip* 3-22-04  
Utilities Department Date

**83**  
OF **94** SHEETS

SCALE  
VERTICAL: 1"= XX'  
HORIZONTAL: 1"= XX'

JOB NUMBER  
**DV1294**

DATE SUBMITTED: 04/21/03

204066 8/9



## ROCKINGHORSE DEVELOPMENT



## LEGEND

195 CUHP BASIN IDENTIFICATION

89	UDSWM CONVEYANCE ELEMENT
CULVERT	TYPE OF CONVEYANCE
D.P. 5	DESIGN POINT

DATE: 03/15/04 TIME: 6:57 a.m.  
SERVER: DVS1 SERVICE: PROJECT  
PATH: N:\DV1294\CADD\Civil\01\Drain\F  
DRAWING NAME: ET-CUHP4.DWG  
PLOTting VIEW: NONE  
DESIGNER: NONE PROJ. MGR: RJM

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

[illegible]

CUHP ELEMENT	BASIN	AREA (AC)	% IMP	PEAK FLOWS		TRIB. TO	ROCKINGHORSE MASTER DRAINAGE				
				10-YEAR (CFS)	100-YEAR (CFS)		BASIN	AREA	% IMP	10-YR	100-YR
400	M4	245.61	42	323	767	POND 4	910-950,970,0S4-0S5	212.60	45	375	794
410	M5	86.24	57	133	269	POND 5	900, 980, 1010-1020	127.82	40	193	458
420	M6	46.10	45	86	193	POND 6	990-1000,1030-1040	75.91	45	111	292
430	M9	412.20	17	130	433	POND 9	0S6-0S8, 960, 1050	382.36	13.6	188	610
460	V4	13.54	7	9	37	PINEY CR.	ASSUMED TO BE TRIB. TO POND 6				
470	V5	7.56	21	9	27	PINEY CR.	ASSUMED TO BE TRIB. TO POND 9				
307	U	6.42	35	11	28	EB POND B	H	1.93	26	3	8
304	LH1	24.80	31	32	83	PINEY CR.	I	22.15	31	29	75
305	LH2	17.40	31	23	61	PINEY CR.	J	16.68	31	23	59
100	100	3011.0	19	631	2099	PINEY CR.	100	3011	19	631	2099

	PEAK FLOWS	
UDSWMM ELEMENT	10-YEAR (CFS)	100-YEAR (CFS)
370	27	73
363	6	17
358	92	287
357	25	65
356	25	65
355	25	65
354	46	121
353	107	305
352	25	65
350	107	305
348	68	274
346	68	277
345	68	276
344	68	276
342	69	287
327	76	240
326	76	240
325	76	241
324	76	240
323	76	240
322	82	240
321	82	242
100	812	2713

## DETENTION/WATER QUALITY POND SUMMARY

DETENTION POND	TRIBUTARY AREA (ACRES)	PEAK FLOW INTO POND		WQCV (AC-FT)	DETENTION VOLUME		TOTAL VOLUME		RELEASE	
		10 YR (CFS)	100 YR (CFS)		10 YR (AC-FT)	100 YR (AC-FT)	10 YR (AC-FT)	100 YR (AC-FT)	10 YR (CFS)	100 YR (CFS)
POND 4	245.90 (BASIN M4)	323	767	*0.00	13.09	26.70	13.09	26.70	76.0	240.0
POND 5	85.90 (BASIN M5)	133	269	2.00	5.10	10.80	7.10	12.80	25.0	65.0
POND 6	46.10 (BASIN M6)	86	193	**5.40	3.10	6.40	8.50	11.80	82.0	241.0
POND 9	412.20 (BASIN M9)	130	433	4.20	7.00	16.46	11.20	20.66	68.0	274.0

\*WQCV FOR POND 4 PROVIDED IN POND 6 (4.6 AC-FT)

\*\*WQCV FOR POND 4 PROVIDED IN POND 6 (4.6 AC-FT + 0.90 AC-FT = 5.5 AC-FT)

## STUDY COMPARISON – 100 YEAR DEVELOPED

LOCATION	UDSWMM ELEMENT	RH PRELIM. DR. STUDY	RH MASTER DR. STUDY	EB MASTER DR. STUDY
PINEY CR.	100	2713 CFS	2710 CFS	2874 CFS
PINEY CR.	13	2683 CFS	2682 CFS	2831 CFS
EAGLE BEND	22	116 CFS	141 CFS	139 CFS
PINEY CR.	17	3178 CFS	3146 CFS	3340 CFS
PINEY CR.	86	3174 CFS	3140 CFS	3321 CFS
PINEY CR.	44	3355 CFS	3310 CFS	3491 CFS
EAGLE BEND	29	6.7 AC-FT	7.4 AC-FT	7.4 AC-FT

RH - ROCKINGHORSE  
FB - EAGLE BEND

CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY OF THE DESIGN, DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

Approved For One Year From This Date

3-31-04

*H. S. Mc Cormick for R.D.*  
City Engineer

\_\_\_\_\_  
Utilities Department

REC-11

DATE SUBMITTED: 04/21/03

204066 9/

# NOLTE

BEYOND ENGINEERING

7000 SOUTH YOSEMITE ST., SUITE 200, ENGLEWOOD, CO. 80112  
303.220.1001 TEL 303.220.9001 FAX WWW.NOLTE.COM

ENGLEWOOD, CO. 80112  
WWW.NOLTE.COM

**ROCKINGHORSE**  
**PRELIMINARY DRAINAGE REPORT**  
**CUHP/UDSWMM EXHIBIT**

PREPARED FOR: GARTREL INVESTMENT CO., LLC.

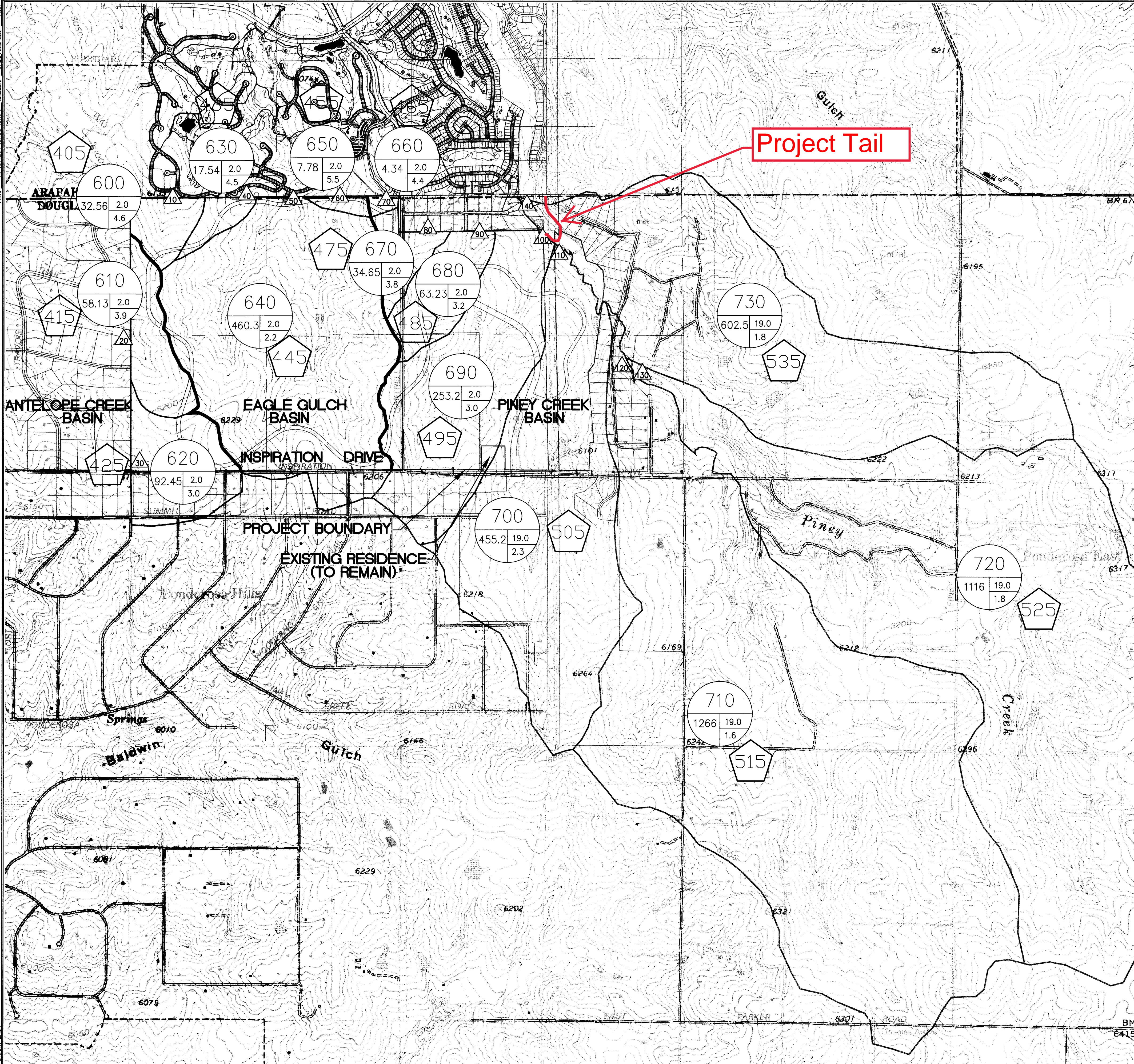
DATE SUBMITTED: 04/21/03

SHEET NUMBER  
94  
OF 98 SHEETS  
SCALE  
VERTICAL: 1" = XX  
HORIZONTAL: 1" = XX  
JOB NUMBER  
DV1294

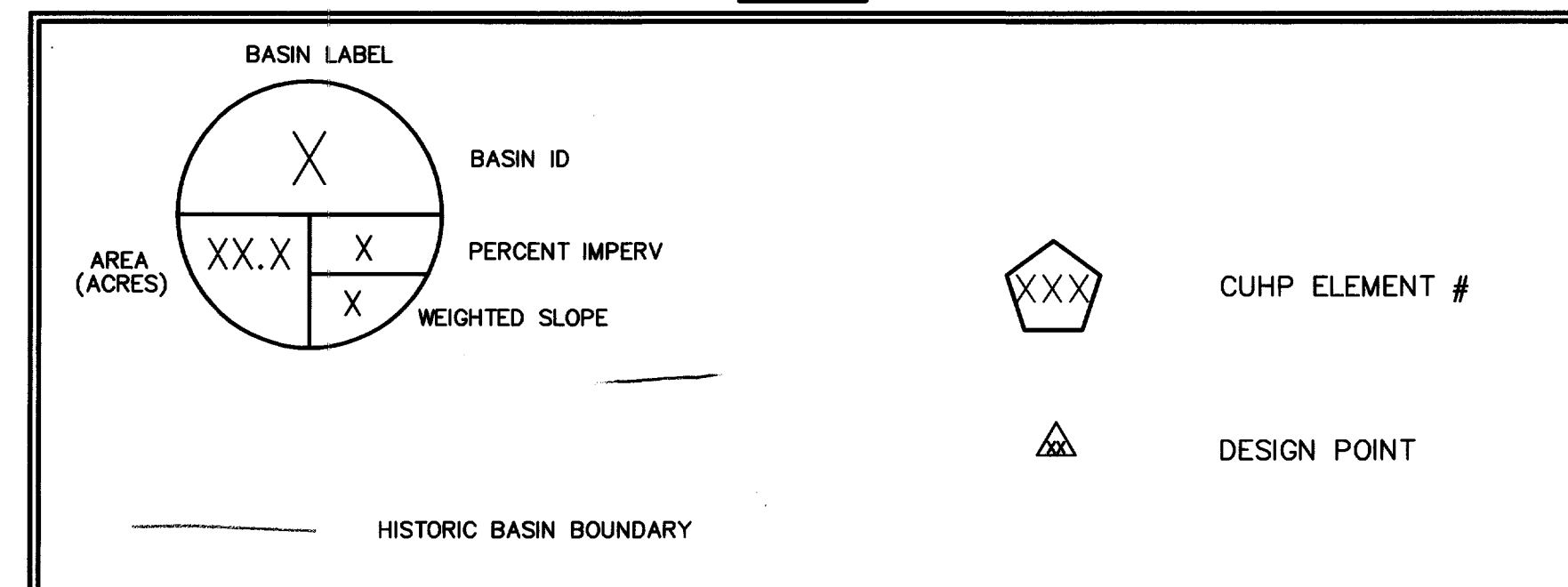
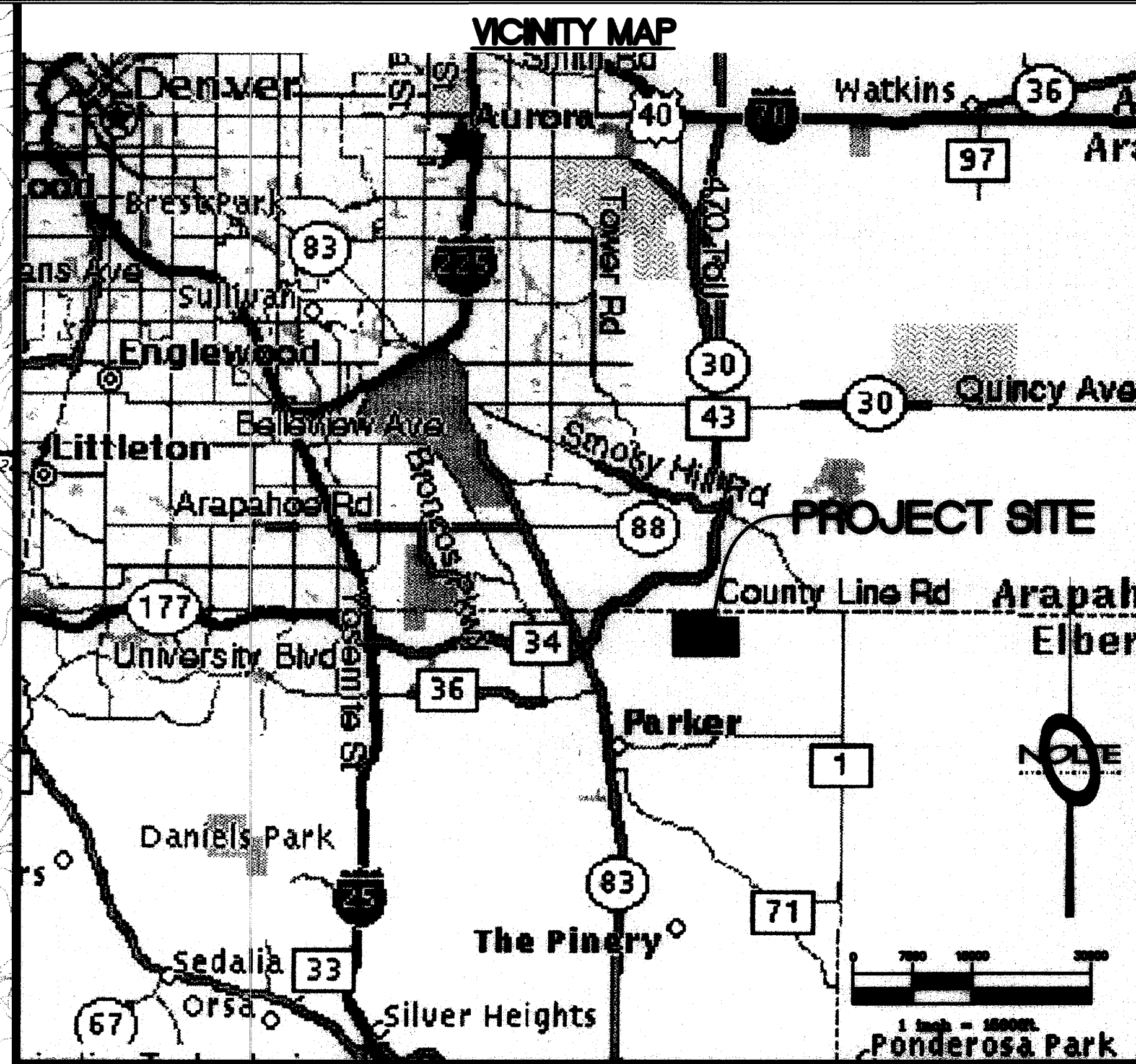


202213 1/14

DATE: 11/20/02 TIME: 11:30 A.M. DRAWING NAME: DR-HST-DWG  
SERIES: USFS, FWS, FWA, FWA-EG, TBRAS, DRAIN, EXHIBIT  
BY: JLM  
CHECKED: JLM  
DATE: 11/20/02  
PROJECT: ROCKINGHORSE HISTORIC DRAINAGE EXHIBIT  
SHEET: 1 OF 8  
SCALE: 1" = 1000'



Project Tail



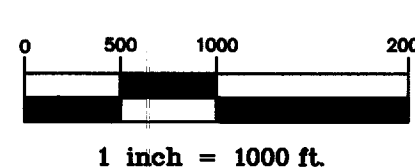
	CUHP ELEMENT	DESIGN POINT	BASIN I.D.	AREA (AC)	10 YEAR FLOW (CFS)	100 YEAR FLOW (CFS)
EAGLE GULCH TRIBUTARY	405	10	600	32.6	18.0	86.0
	435	40	630	17.5	9.0	41.0
	445	50	640	460.3	112.0	480.0
	455	60	650	7.8	5.0	22.0
	465	70	660	4.3	3.0	13.0
PINEY CREEK TRIBUTARY	475	80	670	34.7	17.0	82.0
	485	90	680	63.2	24.0	114.0
	495	100	690	253.2	64.0	260.0
	505	110	700	455.2	103.0	369.0
	515	120	710	1266.5	283.0	950.0
	525	130	720	1115.7	219.0	732.0
	535	140	730	602.5	134.0	458.0
ANTELOPE CREEK	415	20	610	58.1	29.0	139.0
	425	30	620	92.5	68.0	229.0

RICKY JAMES MOORE  
PROFESSIONAL ENGINEER  
STATE OF COLORADO NO. 30877  
NOLTE ASSOCIATES, INC.  
7000 S. YOSEMITE ST., SUITE 200  
ENGLEWOOD, CO 80112 (303) 220-1001

NOTES:  
1) THE PRELIMINARY STORM DRAIN SYSTEM AND DETENTION PONDS ARE SCHEMATIC IN NATURE. THE PRELIMINARY DRAINAGE IMPROVEMENTS SHOWN HEREIN ARE SUBJECT TO CHANGE DURING FINAL DESIGN PHASES (I.E. THE EXTENT OF IMPROVEMENTS COULD INCREASE OR DECREASE).  
2) THE PRELIMINARY GRADING SHOWN HEREIN IS FROM A PRELIMINARY LOT LAYOUT THAT HAS NOT YET BEEN FINALIZED. THE GRADING AND LAYOUT IS SUBJECT TO CHANGE DURING FINAL DESIGN PHASES.  
3) ADDITIONAL FACILITIES:  
4) THE CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS, AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOBSITE. THE CITY OF AURORA THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO OTHER RESPONSIBILITY OTHER THAN AS STATED ABOVE FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

BENCHMARK:  
CITY OF AURORA #19 145.8, 3" BRASS CAP, SE COR. CURB OPENING INLET STRUCTURE AT NW COR. E. HERTAG PARKWAY AND S. ADDISON WAY.  
ELEVATION = 5996.389 NAVD 1929

HORIZONTAL CONTROL:  
BASED ON THE CITY OF AURORA CONTROL NETWORK  
COLORADO COORDINATE SYSTEM OF 1927, CENTRAL ZONE  
CONTROL POINTS UTILIZED: #25A5S66, #23A5S66, #21A5S66



APPROVED FOR ONE YEAR FROM THIS DATE:  
12-18-2002  
CITY ENGINEER  
12-9-02  
UTILITIES DEPT.

ROCKINGHORSE HISTORIC DRAINAGE EXHIBIT

BEYOND ENGINEERING  
ENGLEWOOD, CO 80112  
7000 S. YOSEMITE ST., SUITE 200  
303.220.001 TEL. 303.220.9001 FAX

DATE SUBMITTED: 03/2002

PREPARED FOR: NEW CITIES DEVELOPMENT GROUP

NOTE

SHEET NUMBER 1 OF 8 SHEETS  
SCALE 1" = 1000'  
JOB NUMBER DV1294



## **Appendix D: Water Quality Calculations**

## **Appendix E: Hydraulic Computations**

## Memorandum

---

6/24/2021

Craig Perl, P.E.  
Senior Engineer – Floodplain Administrator | City of Aurora  
15151 E. Alameda Parkway  
Aurora, CO 80012

RE: No-Rise Certification, Inspiration Trail Connector

### **Background**

Aurora City Code Section 70-33.1 indicates that “Encroachments are prohibited, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed by a licensed Colorado Professional Engineer and in accordance with standard engineering practice that the proposed encroachment would not result in any increase (requires a no-rise certification) in flood levels within the city during the occurrence of the base flood discharge.”

The purpose of this letter is to provide documentation that the proposed Inspiration Trail Connector improvements meet the no-rise condition by not elevating pre-project base flood elevations.

Piney Creek is a FEMA regulated floodplain throughout the project limits. The effective floodplain is mapped on the Douglas County, Colorado and Incorporated Areas Flood Insurance Rate Map (FIRM) panel 08035C0079G; as well as Arapahoe County, Colorado and Incorporated Areas FIRM panel 08005C0504L. The FIRM panels were published February 2017 reflecting the incorporation of a FHAD for Piney Creek and Antelope Creek. The FHAD titled *Piney Creek and Antelope Creek FHAD*, was prepared by WCR Engineering and is dated December 2011.

The project is located in Section 6, Township 6, South Range 65 West. In this area, Piney Creek consists primarily of clayey sands. Upper Piney Creek is ephemeral and the channel can be characterized by a lack of a defined thalweg. Within the floodplain, sparse woody vegetation becomes more dense downstream of the project site.

In the existing condition, a dirt trail crosses the drainage at the project site. The proposed trail improvements project would formalize the dirt path with a concrete trail at existing grade. Proposed topography will minimize grading within the floodplain.



## **Topography**

The source of the additional cross-section topographic data and supporting information is a June 24, 2020 survey provided by the City of Aurora. The survey coordinates are in reference to horizontal datum: NAD 1983/1992, Colorado Central Zone and vertical datum: NAVD 1988. Conversion from project to state plane northing and easting utilizes a grid factor of 0.999680674166667.

## **Hydrologic**

The source of the effective flow data is the 2011 Piney Creek FHAD referenced above. Table 1 summarizes the effective discharges at cross-section 48175 in the effective Piney Creek FHAD HEC-RAS model, which is just upstream of the upstream project tie-in.

***Table 1: Effective Discharges for Piney Creek Downstream of the County Line***

<b>Cross-Section</b>	<b>10% A.C.</b>	<b>2% A.C.</b>	<b>1% A.C.</b>	<b>0.2% A.C.</b>
	<b>Discharge (cfs)</b>	<b>Discharge (cfs)</b>	<b>Discharge (cfs)</b>	<b>Discharge (cfs)</b>
48175	790	2,129	2,905	4,973

## **Hydraulic**

### **Effective Model**

The effective HEC-RAS model was prepared for the 2011 Piney Creek and Antelope Creek FHAD. The Inspiration Trail Connector project is located in the Piney Creek – Upper reach. Effective cross-sections 47259 and 47714 were used as the downstream and upstream tie-in locations, respectively.

### **Duplicate Effective**

The effective model was copied and re-ran using HEC-RAS version 5.0.7. As the Duplicate Effective Model is a copy and not a truncated model, the effective boundary conditions and input parameters were utilized in the Duplicate Effective Model. The BFE Comparison Table, Table 2 below, shows that the Duplicate Effective Model re-creates the results of the Effective Model.

### **Corrected Effective**

Starting from the Duplicate Effective hydraulic model, four additional cross-sections were added to the Corrected Effective Model to provide direct comparisons with the cross-sections added to model the proposed project improvements. The cross-sections were re-cut using the project existing conditions topography, and bank stations and downstream reach lengths were adjusted. Utilizing data collected from two different site visits, channel Manning's 'n' values were updated to better reflect existing roughness conditions.

## Proposed Conditions

The Proposed Conditions Model reflects the proposed grading involved with the trail connector project. As mentioned in the Corrected Effective Model, four cross sections were added to capture the at-grade trail crossing as well as overbank grading throughout the project limits. Outside the channel banks and areas disturbed by construction, the cross-sections reflect the pre-project topography.

## Results

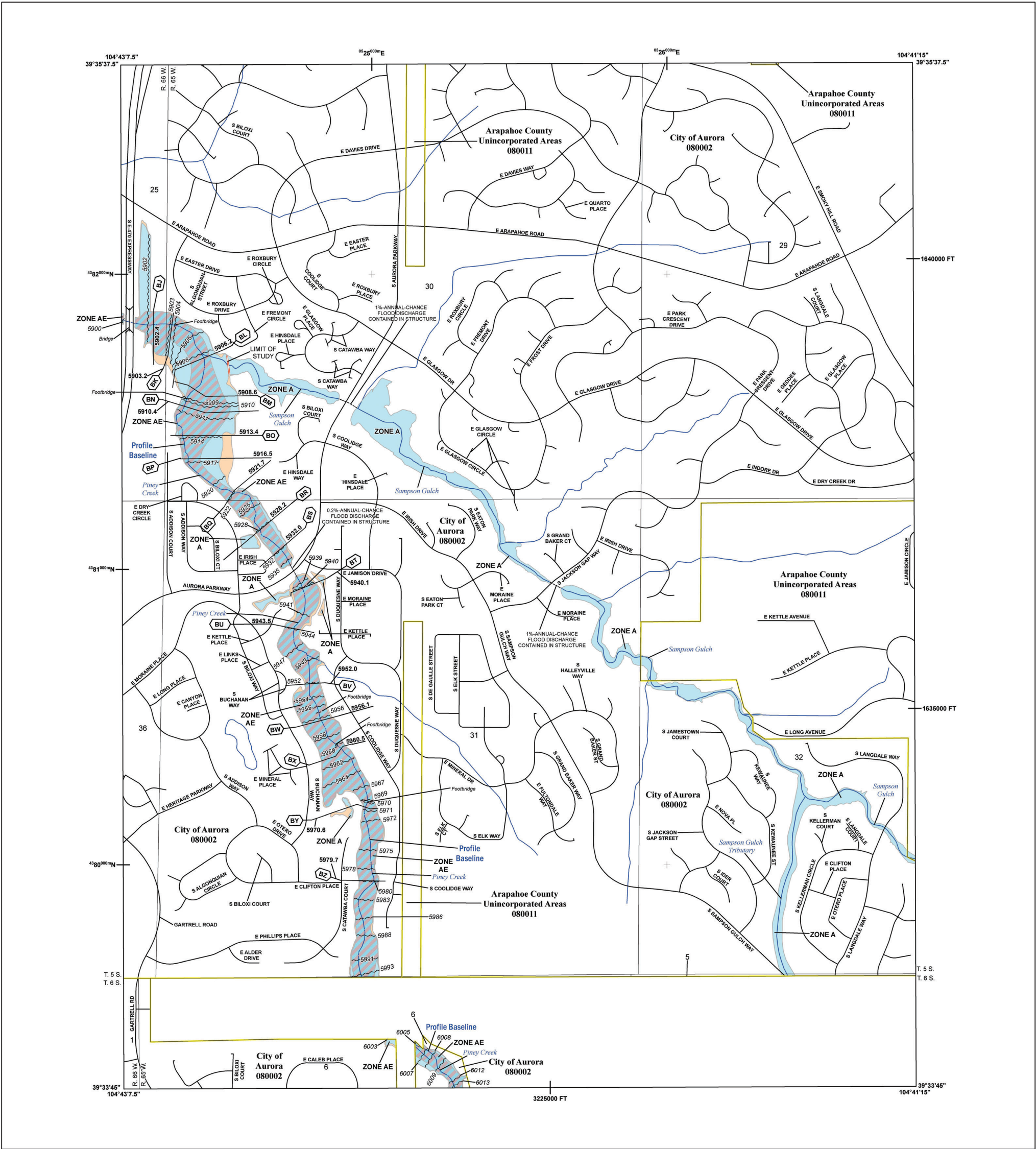
The modeled 100-year water surface elevation did not show an increase from the Corrected Effective to the Proposed condition, meeting the no-rise condition. Results are presented in the table below. Additional results data including cross-section plots and a summary output table are provided at the end of this letter.

**Table 2 – BFE Comparison Table**

Effective Cross-Section ID	Proposed Cross-Section ID	Base Flood Elevation (ft, NAVD 88)				Comparison		
		Effective	Duplicate Effective	Corrected Effective	Proposed	DE vs EFF	CE vs DE	PR vs CE
47259	47259	6002.72	6002.72	6002.65	6002.65	0	-0.07	0
47373	47373			6003.79	6003.79	-	-	0
47535	47535			6004.37	6004.37	-	-	0
47633	47633			6005.5	6005.48	-	-	-0.02
47682	47682			6006.48	6006.3	-	-	-0.18
47714	47714	6007.6	6007.6	6007.4	6007.16	0	-0.2	-0.24

## Conclusions

In compliance with the Aurora City Code, the findings of this study indicate that the proposed Inspiration Trail Connector project results in no-rise in modeled BFE levels.



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP  
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING  
DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT  
[HTTP://MSC.FEMA.GOV](http://MSC.FEMA.GOV)

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
OTHER AREAS	NO SCREEN Areas of Minimal Flood Hazard Zone X
	Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Accredited or Provisionally Accredited Levee, Dike, or Floodwall
	Non-accredited Levee, Dike, or Floodwall
OTHER FEATURES	Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction. To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-438-6620.

Base map information shown on this FIRM was provided by the Arapahoe County and Cities of Aurora and Littleton GIS depts. The coordinate system used for production of the digital FIRM is Universal Transverse Mercator, Zone 13N, referenced to the North American Datum of 1983 and the GRS 1980 spheroid, Western Hemisphere.

SCALE

Map Projection:  
NAD83 UTM Zone 13N  
Western Hemisphere; Vertical Datum: NAVD88

1 inch = 500 feet 1:6,000

0 1,000 2,000 Feet

0 250 500 Meters

PANEL LOCATOR

0484	0503	0502	0506	0507
		0504	0508	*0509
				0550
*0500	0515			*0520

\* PANEL NOT PRINTED

**FEMA**  
National Flood Insurance Program

**NATIONAL FLOOD INSURANCE PROGRAM**  
FLOOD INSURANCE RATE MAP

**ARAPAHOE COUNTY, COLORADO**  
And Incorporated Areas

PANEL 504 OF 725

Panel Contains:

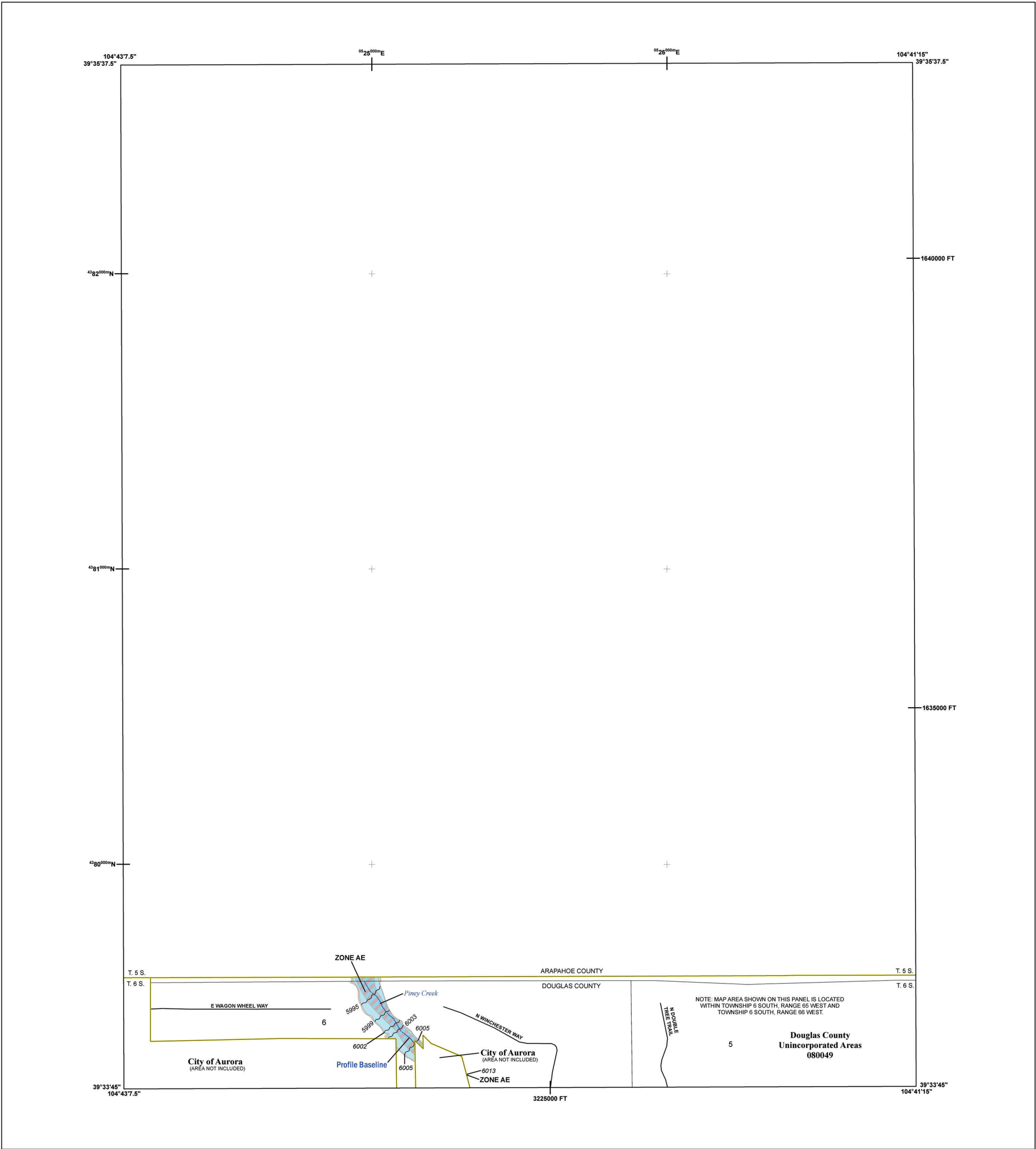
COMMUNITY	NUMBER	PANEL	SUFFIX
ARAPAHOE COUNTY	080011	0504	L
AURORA, CITY OF	080002	0504	L

VERSION NUMBER  
2.3.3.2

MAP NUMBER  
08005C0504L

MAP REVISED  
FEBRUARY 17, 2017





FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP  
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING  
DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT  
[HTTP://MSC.FEMA.GOV](http://MSC.FEMA.GOV)

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
OTHER AREAS OF FLOOD HAZARD		Regulatory Floodway
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
OTHER AREAS		Area with Reduced Flood Risk due to Levee See Notes. <i>Zone X</i>
		NO SCREEN Areas of Minimal Flood Hazard <i>Zone X</i>
GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
		Channel, Culvert, or Storm Sewer
		Accredited or Provisionally Accredited Levee, Dike, or Floodwall
OTHER FEATURES		Non-accredited Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
		Coastal Transect
OTHER FEATURES		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
OTHER FEATURES		Base Flood Elevation Line (BFE)
		Limit of Study
OTHER FEATURES		Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction. To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-438-6620.

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2003.

SCALE

Map Projection:  
NAD83 UTM Zone 13N  
Western Hemisphere; Vertical Datum: NAVD88

1 inch = 500 feet

0 1,000 2,000 Feet

0 250 500 Meters

PANEL LOCATOR

DOUGLAS COUNTY

\*0078 0079 \*0083

0086 0087 0091

0088 0089 0093

\* PANEL NOT PRINTED

FEMA  
National Flood Insurance Program

DOUGLAS COUNTY, COLORADO  
And Incorporated Areas

PANEL 79 OF 495


Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0079	G

VERSION NUMBER  
2.3.3.2

MAP NUMBER  
08035C0079G

MAP REVISED  
FEBRUARY 17, 2017

	FLOODPLAIN AND FLOODWAY DATA TABLE																
	PROJECT NAME:	Piney Creek Flood Hazard Area Delineation															
	COMPANY:	WRC Engineering, Inc.															
COMPLETED BY:		Nathan Torrey															

Community(ies): UD&FCD, SEMSWA, City of Aurora, Douglas County

Flooding Source(s): Piney Creek

Page: 4 of 5

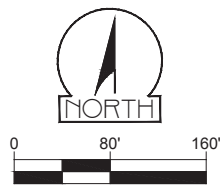
Date: December 2011

Reference	Stream	Cross	Thalweg	Peak Flow - Future Conditions (cfs)				Water Surface Elevation (ft NAVD 88)				100-yr Floodplain		100-year Floodway (0.5-ft Rise in EGL)					
Location	Station	Section #	Elevation	10-yr	50-yr	100-yr	500-yr	10-yr	50-yr	100-yr	500-yr	Width (ft)	EGL (ft)	Elev (ft)	Width (ft)	Area (sq ft)	Velocity (ft/s)	Comments	
	37816	37816	5,894.80	1,370	3,548	4,976	8,845	5,899.42	5,901.11	5,902.43	5,905.42	472	5,902.79	5,902.43	458	1,222	4.1		
	37868	37868	5,897.65	1,370	3,548	4,976	8,845	5,901.75	5,902.71	5,903.20	5,905.36	443	5,904.01	5,903.22	242	625	8.0		
D/S of Trail Crossing #13	37893	37893	5,897.92	1,370	3,548	4,976	8,845	5,902.13	5,903.36	5,903.82	5,905.44	477	5,904.25	5,904.10	268	1,010	5.9		
U/S of Trail Crossing #13	37911	37911	5,897.96	1,370	3,548	4,976	8,845	5,902.48	5,903.59	5,904.04	5,905.56	506	5,904.40	5,904.42	286	1,098	5.3		
	38013	38013	5,899.75	1,370	3,548	4,976	8,845	5,902.84	5,904.00	5,904.47	5,905.82	478	5,904.74	5,904.94	250	1,113	4.5		
	38421	38421	5,902.76	1,370	3,548	4,976	8,845	5,904.83	5,905.80	5,906.22	5,907.30	538	5,907.14	5,906.36	225	590	8.4		
	38808	38808	5,904.00	939	2,525	3,440	5,958	5,907.14	5,908.09	5,908.63	5,909.38	698	5,908.73	5,908.98	423	1,217	2.8		
D/S of Trail Crossing #14	38919	38919	5,906.33	939	2,525	3,440	5,958	5,907.34	5,908.14	5,908.63	5,909.34	596	5,909.15	5,908.97	470	685	6.1	Floodplain/Floodway top width includes high ground	
U/S of Trail Crossing #14	38974	38974	5,906.34	939	2,525	3,440	5,958	5,908.78	5,909.74	5,910.08	5,910.79	653	5,910.34	5,910.52	537	952	4.0	Floodplain/Floodway top width includes high ground	
	39033	39033	5,908.00	939	2,525	3,440	5,958	5,909.14	5,910.02	5,910.37	5,911.07	673	5,910.59	5,910.76	567	932	3.7	Floodplain/Floodway top width includes high ground	
	39426	39426	5,911.46	939	2,525	3,440	5,958	5,912.34	5,913.08	5,913.43	5,913.87	514	5,914.15	5,913.65	391	466	7.4	Floodplain/Floodway top width includes high ground	
	39699	39699	5,913.75	939	2,525	3,440	5,958	5,915.20	5,916.21	5,916.50	5,917.40	415	5,917.01	5,916.75	181	508	6.8		
	40361	40361	5,918.00	939	2,525	3,440	5,958	5,919.93	5,921.18	5,921.66	5,922.89	141	5,923.03	5,921.79	138	405	8.5		
	40973	40973	5,924.00	939	2,525	3,440	5,958	5,926.43	5,927.58	5,928.16	5,929.42	213	5,928.67	5,928.28	173	549	6.3	Adjacent detention pond	
	41299	41299	5,929.28	939	2,525	3,440	5,958	5,930.50	5,931.56	5,931.97	5,932.96	189	5,932.79	5,932.37	157	480	7.2		
D/S of Aurora Parkway	41461	41461	5,928.91	939	2,525	3,440	5,958	5,932.78	5,934.32	5,935.18	5,937.86	166	5,938.21	5,935.18	166	730	14.0		
U/S of Aurora Parkway	41711	41711	5,929.74	939	2,525	3,440	5,958	5,933.67	5,936.86	5,938.39	5,943.35	178	5,939.87	5,938.39	178	825	9.8	Floodway = Floodplain, Adjacent detention pond does not show in XS	
	41800	41800	5,934.00	937	2,504	3,404	5,870	5,935.89	5,938.33	5,940.10	5,945.30	258	5,940.27	5,940.10	258	1,176	3.1	Floodway = Floodplain, Adjacent detention pond	
	41871	41871	5,934.89	937	2,504	3,404	5,870	5,937.21	5,938.70	5,940.27	5,945.35	285	5,940.41	5,940.27	285	1,188	2.9	Floodway = Floodplain, Adjacent detention pond does not show in XS	
	42066	42066	5,936.00	937	2,504	3,404	5,870	5,938.56	5,939.68	5,940.52	5,945.34	170	5,941.36	5,940.52	170	510	6.7	Floodway = Floodplain, Adjacent detention pond does not show in XS	
	42291	42291	5,940.00	937	2,504	3,404	5,870	5,941.72	5,943.14	5,943.52	5,945.58	168	5,944.65	5,943.52	168	436	7.8	Floodway = Floodplain	
	42536	42536	5,942.00	937	2,504	3,404	5,870	5,945.16	5,946.44	5,947.10	5,948.08	236	5,947.70	5,947.10	236	632	5.4	Floodway = Floodplain	
	42987	42987	5,948.00	937	2,504	3,404	5,870	5,950.26	5,951.64	5,952.04	5,953.35	159	5,953.10	5,952.04	159	456	7.5	Floodway = Floodplain	
	43196	43196	5,950.00	916	2,433	3,300	5,632	5,952.33	5,953.90	5,954.58	5,955.98	338	5,954.93	5,954.58	338	831	4.0	Floodway = Floodplain	
D/S of Trail Crossing #15	43308	43308	5,949.31	916	2,433	3,300	5,632	5,953.16	5,954.62	5,955.18	5,956.43	312	5,955.63	5,955.18	312	710	4.7	Floodway = Floodplain	
U/S of Trail Crossing #15	43358	43358	5,948.72	916	2,433	3,300	5,632	5,954.10	5,955.35	5,955.81	5,956.90	319	5,956.12	5,955.81	319	883	3.7	Floodway = Floodplain	
	43428	43428	5,952.00	916	2,433	3,300	5,632	5,954.33	5,955.64	5,956.13	5,957.24	324	5,956.52	5,956.13	324	755	4.4	Floodway = Floodplain	
	43619	43619	5,954.00	916	2,433	3,300	5,632	5,956.48	5,957.52	5,957.98	5,958.87	310	5,958.79	5,957.98	310	565	5.8	Floodway = Floodplain	
D/S of Trail Crossing #16	43728	43728	5,952.89	916	2,433	3,300	5,632	5,957.94	5,959.27	5,959.71	5,960.59	298	5,960.19	5,959.71	298	734	4.6	Floodway = Floodplain	
U/S of Trail Crossing #16	43778	43778	5,952.73	916	2,433	3,300	5,632	5,958.53	5,959.80	5,960.28	5,961.28	304	5,960.64	5,960.28	304	800	4.1	Floodway = Floodplain	
	43825	43825	5,957.45	916	2,433	3,300	5,632	5,959.05	5,960.21	5,960.53	5,961.52	318	5,961.32	5,960.53	318	545	6.1	Floodway = Floodplain	
	44111	44111	5,960.00	916	2,433	3,300	5,632	5,962.65	5,963.49	5,963.89	5,964.62	440	5,964.22	5,963.89	440	865	3.8	Floodway = Floodplain	
	44348	44348	5,963.80	916	2,433	3,300	5,632	5,965.08	5,966.00	5,966.33	5,967.14	531	5,966.83	5,966.33	531	612	5.4	Floodway = Floodplain	
D/S of Trail Crossing #17	44472	44472	5,962.24	916	2,433	3,300	5,632	5,967.03	5,968.09	5,968.65	5,969.93	132	5,970.09	5,968.65	132	592	8.8	Floodway = Floodplain, Adjacent detention pond	
U/S of Trail Crossing #17	44522	44522	5,962.28	916	2,433	3,300	5,632	5,967.92	5,969.56	5,970.29	5,971.95	158	5,970.91	5,970.29	158	1,109	5.6	Floodway = Floodplain, Adjacent detention pond	
	44569	44569	5,966.00	916	2,433	3,300	5,632	5,968.23	5,969.88	5,970.61	5,972.23	150	5,971.25	5,970.61	150	1,322	6.1	Floodway = Floodplain, Adjacent detention pond	
	45004	45004	5,970.87	916	2,433	3,300	5,632	5,972.89	5,974.11	5,974.64	5,975.91	187	5,975.46	5,974.64	187	498	6.6	Floodway = Floodplain	
	45400	45400	5,976.00	899	2,379	3,219	5,440	5,978.01	5,979.22	5,979.71	5,980.76	211	5,980.35	5,979.71	211	558	5.8	Floodway = Floodplain	
	45875	45875	5,982.00	899	2,379	3,219	5,440	5,984.04	5,985.26	5,985.77	5,986.82	186	5,986.76	5,985.77	186	460	7.0	Floodway = Floodplain	
	46350	46350	5,986.05	899	2,379	3,219	5,440	5,988.99	5,990.24	5,990.77	5,991.92	293	5,991.08	5,990.77	293	796	4.0	Floodway = Floodplain	
	46820	46820	5,992.00	899	2,379	3,219	5,440	5,993.90	5,994.75	5,995.12	5,995.97	289	5,995.72	5,995.13	150	418	7.7		
	47259	47259	5,998.71	790	2,129	2,905	4,973	6,001.05	6,002.29	6,002.71	6,003.57	189	6,003.70	6,003.17	98	350	8.3		
	47714	47714	6,004.22	790	2,129	2,905	4,973	6,005.82	6,007.04	6,007.60	6,008.83	209	6,007.96	6,007.86	145	526	5.5		
	48175	48175	6,008.00	790	2,129	2,905	4,973	6,01											



CREEKSIDE  
EAGLE BEND  
SUBDIVISION

PONDEROSA  
PRESERVE



PROPOSED TRAIL AND  
GRADING

47259

47373

47535

47633

47682

47714

INSPIRATION  
SUBDIVISION

CALEB PLACE

ICON  
ENGINEERING

# INSPIRATION TRAIL CONNECTOR HYDRAULIC WORKMAP JUNE 2021

PREPARED FOR:  
INSPIRATION METROPOLITAN DISTRICT  
8400 S. WINNIPEG COURT  
AURORA, CO 80016

PREPARED FOR:  
ICON ENGINEERING, INC  
7000 S. YOSEMITE STREET, SUITE 120  
CENTENNIAL, CO 80112

- FWAY EFFECTIVE 100-YEAR FLOODWAY
- FPLN EFFECTIVE 100-YEAR FLOODPLAIN
- EFFECTIVE CROSS-SECTION
- PROPOSED CROSS-SECTION

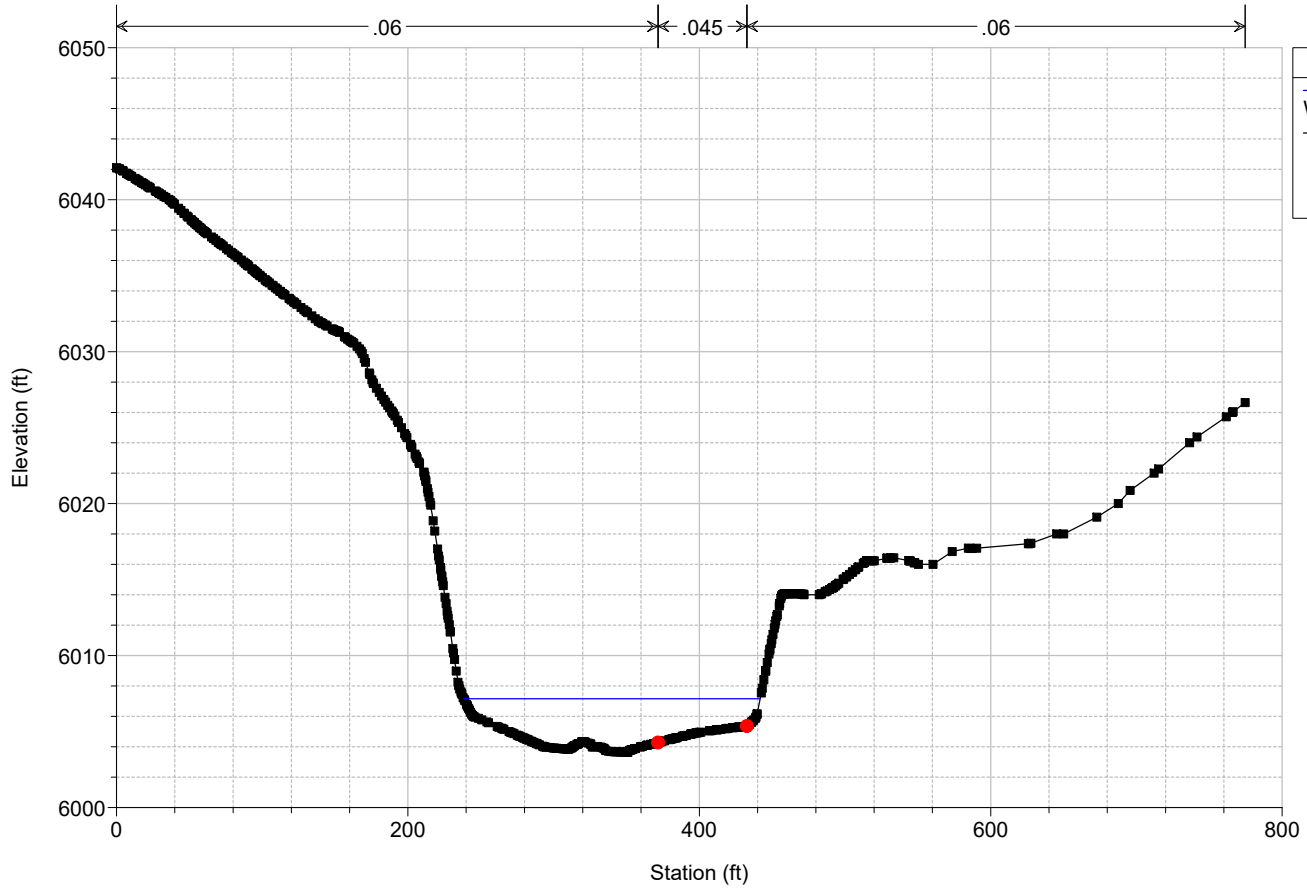


HEC-RAS Plan: Prop Locations: User Defined

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Piney Creek	Upper	47714	10-YR	790.00	6004.28	6005.73		6005.92	0.012641	3.24	225.87	185.33	0.63
Piney Creek	Upper	47714	50-YR	2129.00	6004.28	6006.72		6007.13	0.013112	5.61	419.60	200.22	0.74
Piney Creek	Upper	47714	100-YR	2905.00	6004.28	6007.16		6007.68	0.013120	6.49	508.61	203.41	0.76
Piney Creek	Upper	47714	500-YR	4973.00	6004.28	6008.13		6008.93	0.013147	8.25	708.95	209.11	0.81
Piney Creek	Upper	47682	10-YR	790.00	6003.98	6005.06	6004.99	6005.45	0.015968	4.18	161.11	167.47	0.73
Piney Creek	Upper	47682	50-YR	2129.00	6003.98	6005.91	6005.82	6006.66	0.014108	5.91	312.51	185.07	0.77
Piney Creek	Upper	47682	100-YR	2905.00	6003.98	6006.30	6006.22	6007.22	0.013355	6.52	384.29	189.07	0.77
Piney Creek	Upper	47682	500-YR	4973.00	6003.98	6007.15	6007.11	6008.47	0.012421	7.79	550.51	202.03	0.78
Piney Creek	Upper	47633	10-YR	790.00	6002.58	6004.11	6003.88	6004.45	0.022010	5.33	172.49	162.25	1.03
Piney Creek	Upper	47633	50-YR	2129.00	6002.58	6005.06	6004.82	6005.74	0.021220	7.79	336.81	183.97	1.03
Piney Creek	Upper	47633	100-YR	2905.00	6002.58	6005.48	6005.23	6006.33	0.020942	8.87	415.27	193.81	1.06
Piney Creek	Upper	47633	500-YR	4973.00	6002.58	6006.45	6006.23	6007.64	0.018488	10.67	614.07	210.85	1.06
Piney Creek	Upper	47535	10-YR	790.00	6000.00	6002.61		6002.93	0.009938	4.75	200.28	177.90	0.64
Piney Creek	Upper	47535	50-YR	2129.00	6000.00	6003.81		6004.30	0.008634	6.28	427.26	198.81	0.65
Piney Creek	Upper	47535	100-YR	2905.00	6000.00	6004.37		6004.93	0.007981	6.78	539.49	202.53	0.64
Piney Creek	Upper	47535	500-YR	4973.00	6000.00	6005.55		6006.30	0.007512	7.98	781.70	209.32	0.65
Piney Creek	Upper	47373	10-YR	790.00	5999.98	6001.71		6001.84	0.004350	2.96	276.42	197.69	0.41
Piney Creek	Upper	47373	50-YR	2129.00	5999.98	6003.21		6003.43	0.003059	3.87	594.10	221.31	0.39
Piney Creek	Upper	47373	100-YR	2905.00	5999.98	6003.79		6004.07	0.003102	4.37	724.98	228.75	0.40
Piney Creek	Upper	47373	500-YR	4973.00	5999.98	6004.97		6005.40	0.003408	5.52	1003.12	244.67	0.44
Piney Creek	Upper	47259	10-YR	790.00	5998.14	6000.73	6000.19	6001.03	0.013229	4.41	179.19	129.21	0.60
Piney Creek	Upper	47259	50-YR	2129.00	5998.14	6002.18	6001.38	6002.76	0.013320	6.11	357.75	188.98	0.65
Piney Creek	Upper	47259	100-YR	2905.00	5998.14	6002.65	6001.94	6003.37	0.013914	6.93	447.15	194.41	0.68
Piney Creek	Upper	47259	500-YR	4973.00	5998.14	6003.54	6003.23	6004.61	0.015692	8.67	647.37	247.95	0.75

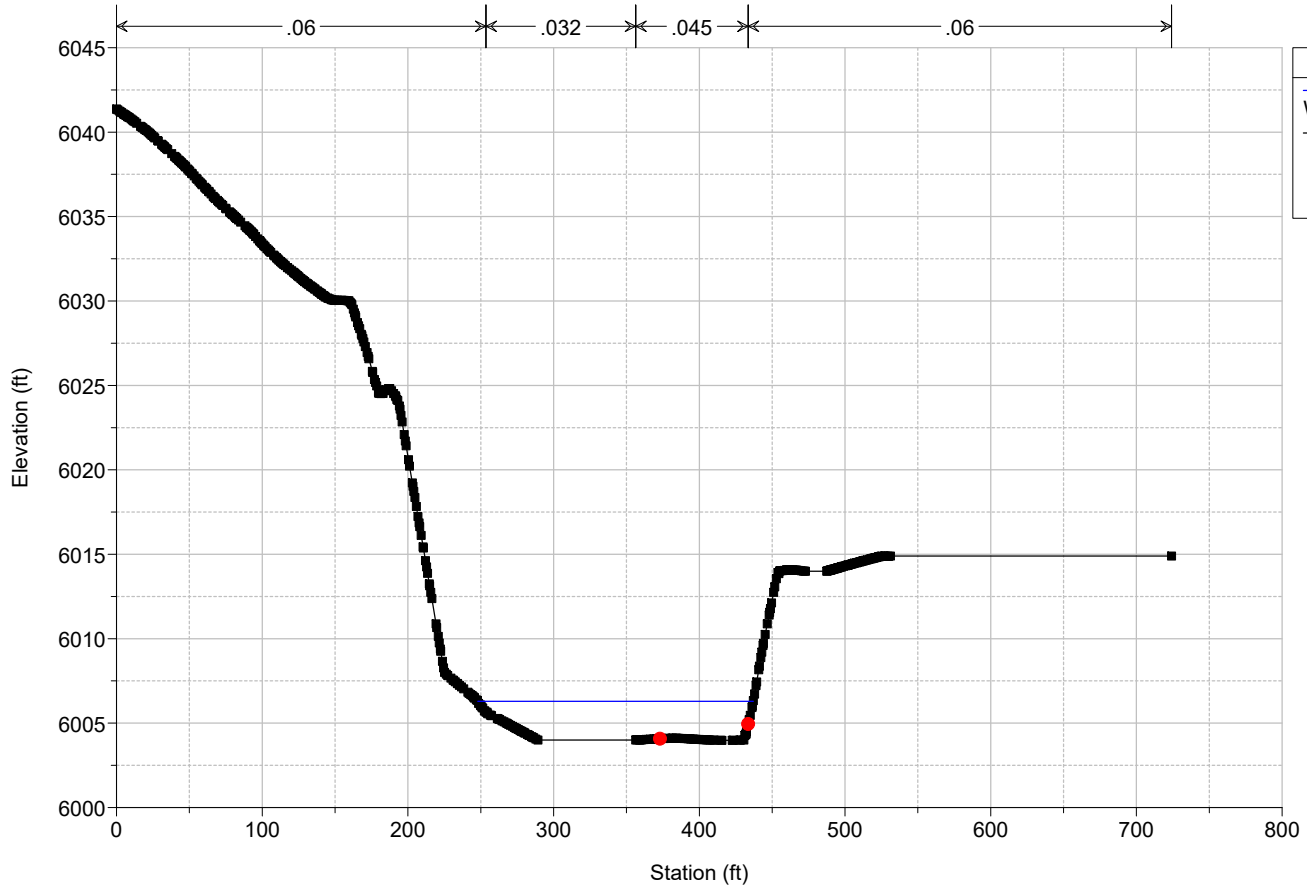
# Piney Creek at East Caley Drive Plan: Proposed 6/25/2021

River = Piney Creek Reach = Upper RS = 47714



# Piney Creek at East Caley Drive Plan: Proposed 6/25/2021

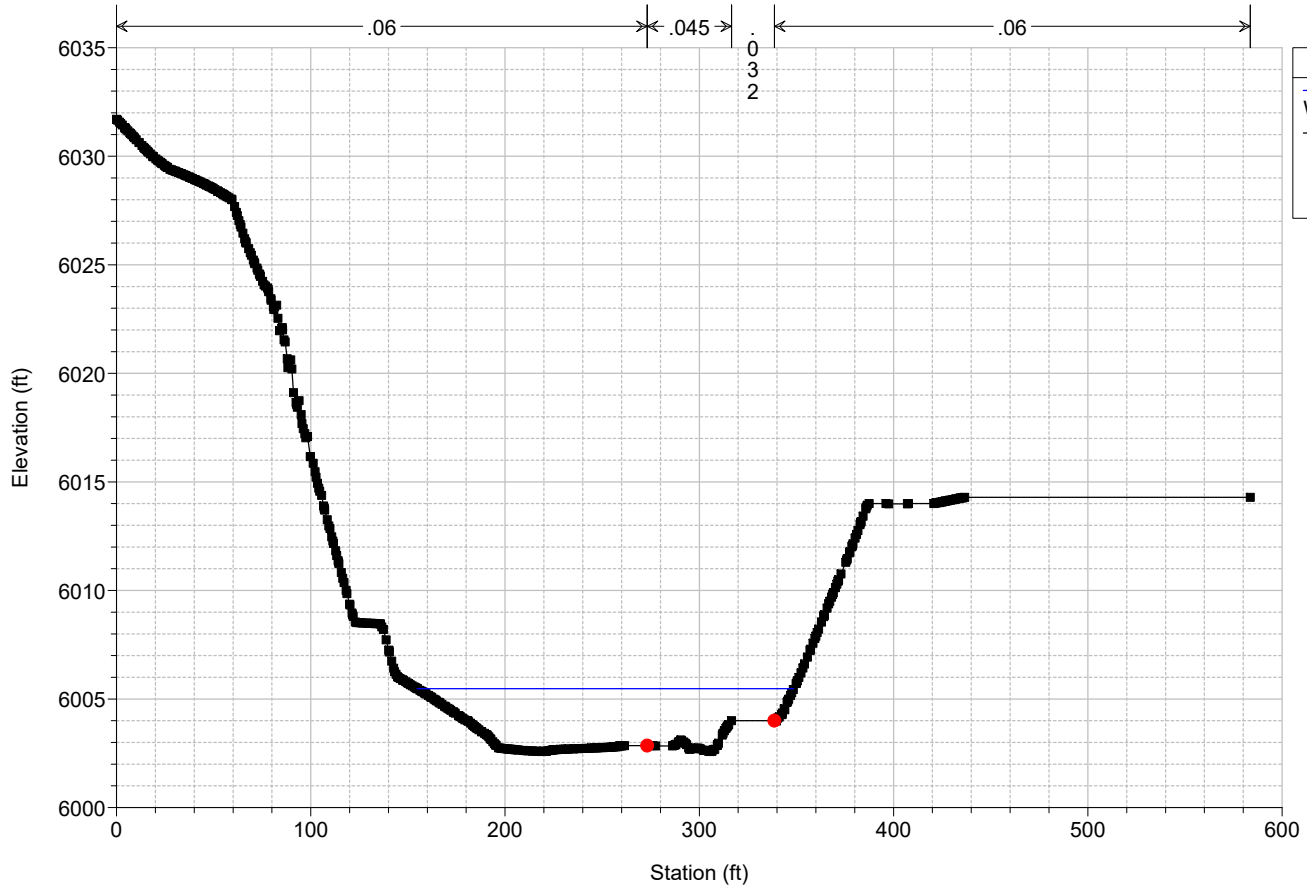
River = Piney Creek Reach = Upper RS = 47682





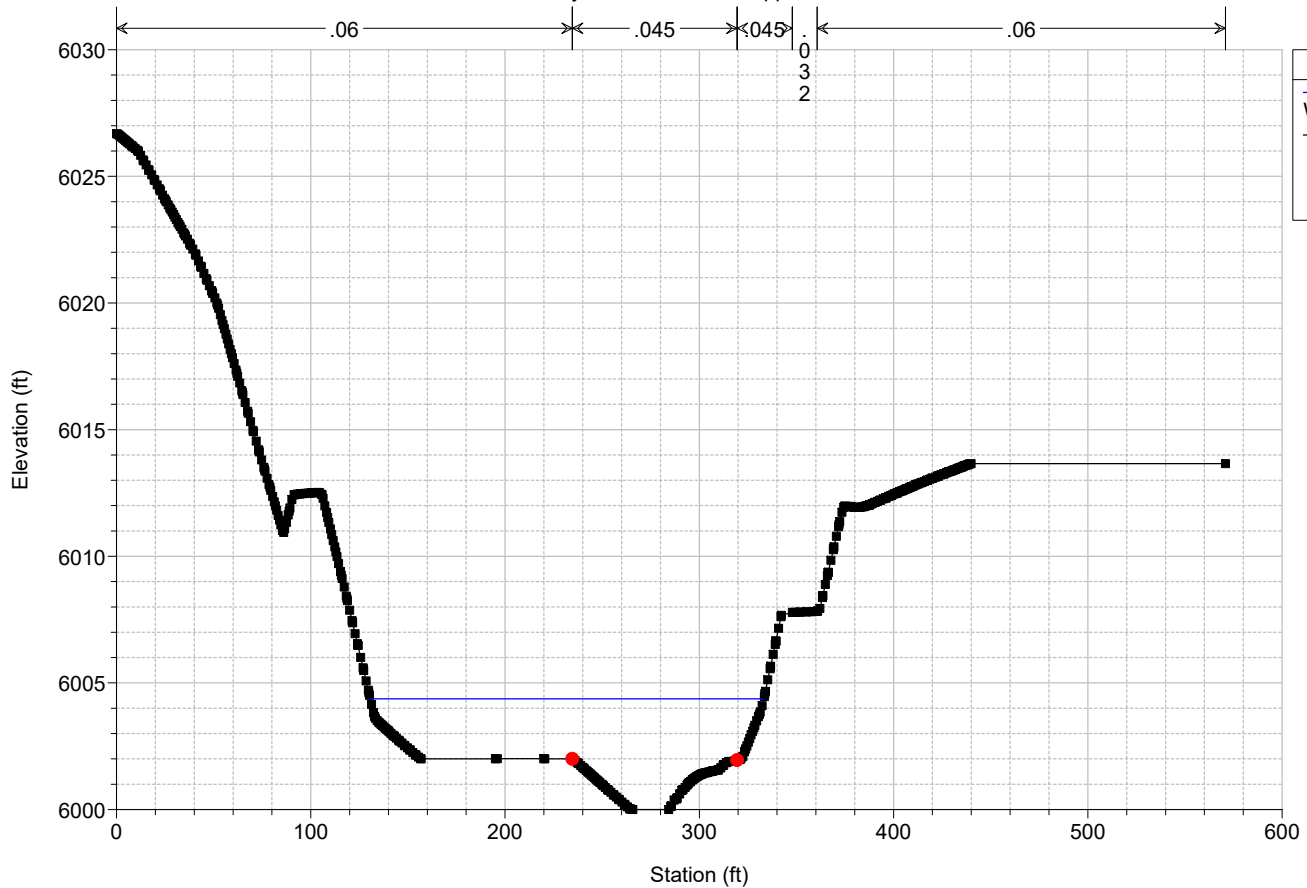
# Piney Creek at East Caley Drive Plan: Proposed 6/25/2021

River = Piney Creek Reach = Upper RS = 47633



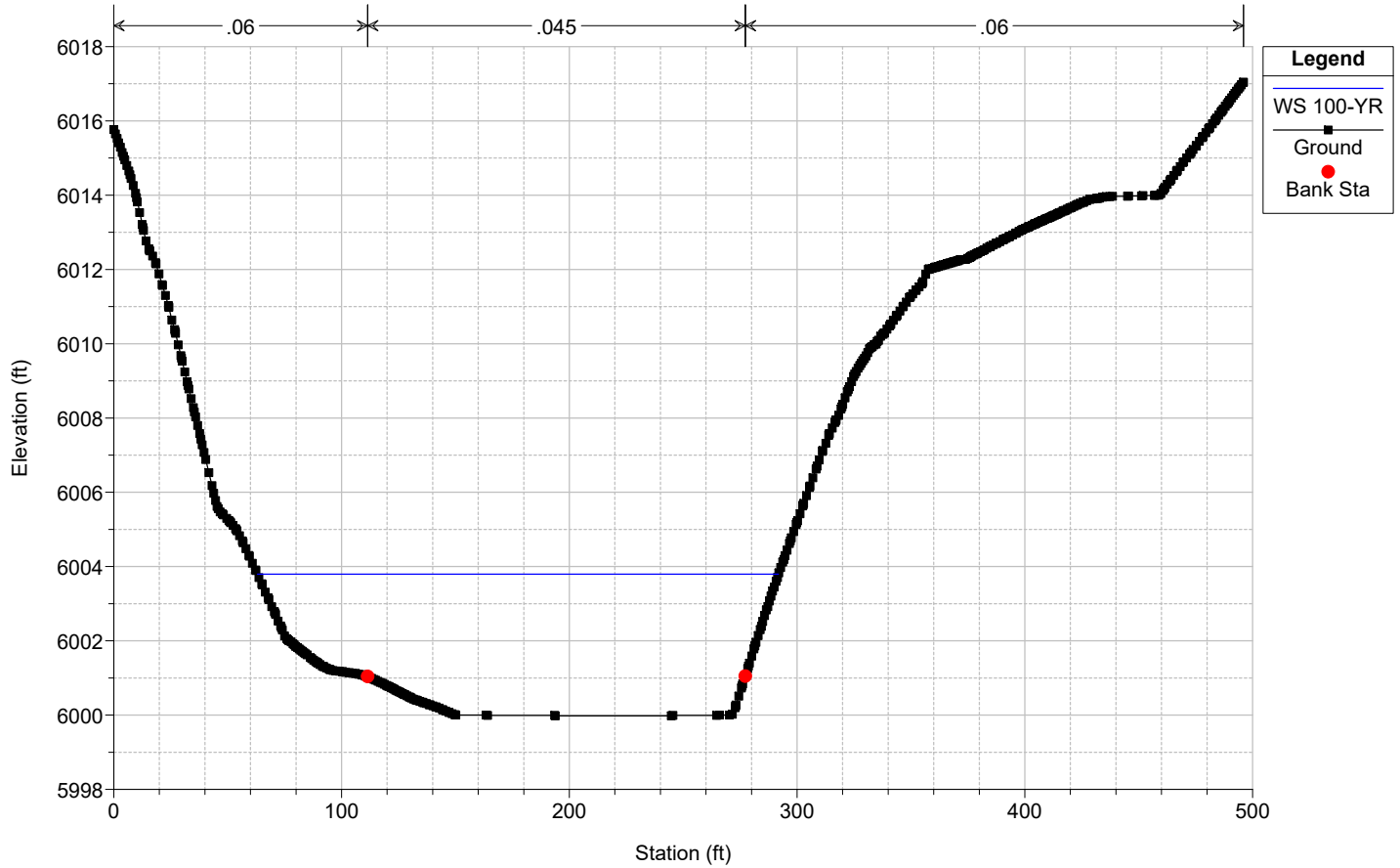
# Piney Creek at East Caley Drive Plan: Proposed 6/25/2021

River = Piney Creek Reach = Upper RS = 47535



# Piney Creek at East Caley Drive Plan: Proposed 6/25/2021

River = Piney Creek Reach = Upper RS = 47373



# Piney Creek at East Caley Drive Plan: Proposed 6/25/2021

River = Piney Creek Reach = Upper RS = 47259

