True West Co., LLC

FINAL DRAINAGE REPORT
Hotchkiss Commercial Offices, 2290 Old Ranch Road, Colorado Springs, Colorado
Lot 8, Block E, Amended Filing of Springs Crest Subdivision
El Paso County, Colorado

Prepared for:

John Hotchkiss
9161 Estebury Circle
Colorado Springs, Co 80920-7560

Prepared by:

True West Co, LLC
16352 E. Bates Drive
Aurora, CO 80013
truewest1@usa.net
303-523-3664
Attn: Connie Ellefson, P.E.

Revised August 8, 2020
Revised June 25, 2020
August 5, 2019

PCD File No. PPR203

Engineer's Statement

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

_____
Connie L. Ellefson, P.E. Colorado P.E. 23317

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 Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____
Jennifer Irvine, P.E. Date
County Engineer / ECM Administrator

_____ _____ _____

Conditions:

A. PURPOSE

The purpose of this letter is to demonstrate that the proposed drainage changes to Lot 8, Block E, Amended Filing of Springs Crest Subdivision will not adversely affect downstream properties, and conform to El Paso County drainage criteria.

This site was previously developed with a residence, storage shed, and garage, with a circular gravel driveway, landscape and utilities. With the proposed development, the existing house will be removed and replaced with a 5700--square foot office building (2-story). The existing garage will be remodeled into a studio/office, and the gravel drive replaced with paved drive and parking for the office building and studio. The new building will have a deck around much of the 2nd floor, but no concrete apron as shown on an earlier site development plan.

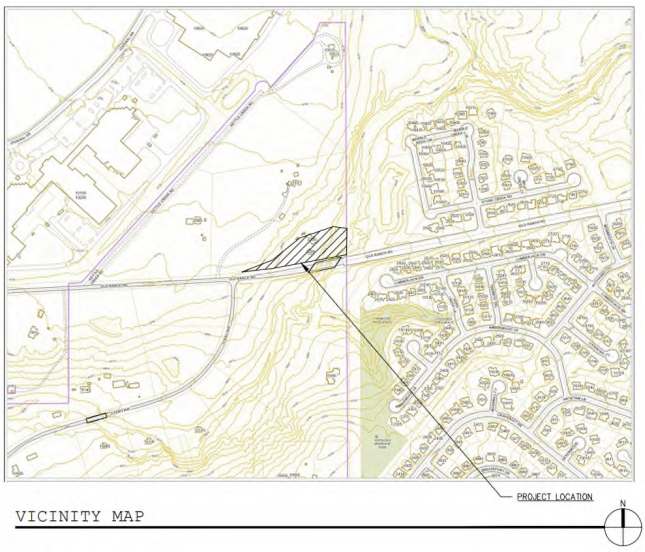
Parking areas will be asphalt with wheel stops only in order to maximize the opportunity for the impervious area to drain to open space and improve water quality, and in keeping with the more rural nature of the area this site is in. A small amount of concrete curb will be needed around the remodeled garage- to-studio to redirect new runoff away from the existing building.

B. GENERAL LOCATION AND DESCRIPTION

The site is located in the Kettle Creek drainage basin FOMO300.

It is a roughly triangular area north of Old Ranch Road, approximately 0.6 miles west of Voyager Parkway and one mile east of N. Powers Boulevard. Kettle Creek forms the southeast side of the site.

The lot contains 2.19 acres, of which approximately 0.5 acres along Kettle Creek is in the Zone AE floodplain (floodplain base flood elevation at 6671 adjacent to buildings, at least 10 below the finished floor elevations.)



VICINITY MAP

The existing entrance will be repaved with the redevelopment and the drive extended to parking spaces with asphalt paving.

Runoff will flow off the pavement as sheet flow, and via a shallow concrete pan, over riprap erosion protection to help return it to sheet flow, and flow into Kettle Creek.

C. EXISTING DRAINAGE CHARACTERISTICS

The existing site is sloped from the northwest to the southeast, with steep slopes, between 8 and 20% along the northwest side. The area in the middle of the lot, where the existing buildings and circular drive are located is much flatter, averaging 1.5% slope. The lot drops off steeply to the southeast beyond that, to Kettle Creek, within the floodplain area.

The drainageway appears stable, with mature vegetation throughout the area within the lot. A limited area of riprap exists near the bridge over Kettle Creek, presumably to stabilize the area after bridge construction. It appears to be stable as well, without signs of excessive erosion.

The slope along the northwest side is heavily wooded with evergreen trees, the floodplain contains several large deciduous trees, and other trees of both types are scattered more sparsely throughout the lot, with native grass, and a small amount of sod and landscaping around the existing residence.

Offsite runoff enters the site from the northwest (2.83 acres) part of an existing large-acreage residence (one residence on 11.9 acres) of primarily grassland, with the heavily wooded area adjacent to the northwest corner of the site as sheet flow (Design Point 1).

The existing onsite area corresponding to the proposed developed area of the lot has been divided into two basins. Basin H1 (0.72 acres) contains roof, gravel drive, concrete walk, and landscape. It drains, along with runoff from Basin O1 to the southeast around the south side of the house, and around the south side of the garage, to Kettle Creek (Design Point H1.)

Basin H2 (0.27 acres) contains roof, concrete patio, and landscape. It drains around the north end of the house, then southeast to Kettle Creek (Design Point H2).

Both Basins H1 and H2, as well as developed Basins A1 and A2, described below, include small areas along the north side of the site that are tributary to the rest of the basins, but will not be disturbed. Thus the total disturbed area is approximately 0.90 acres, even though the basin areas total to 0.99 acres.

The only drainage provisions are an existing 24” CMP culvert under the entrance drive, connecting the roadside swale that flows along the north side of Old Ranch

Road to Kettle Creek. On the east side of the drive the roadside swale angles more northeasterly towards the Creek, crossing a small area of Lot 8.

D. PROPOSED DRAINAGE CHARACTERISTICS

The developed area of the site has been divided into five small basins, and the flows from the total of these five areas was compared to the same area of the existing site, since existing and proposed development areas are roughly in the same part of the lot.

The wedge of land extending west along the right-of-way from the proposed parking lot, as well as the area of the floodplain for Kettle Creek, were both omitted from calculations. This is due to the fact that the land in both areas will remain unchanged, and any flows from offsite areas draining to those two areas will not be changed or redirected.

The existing culvert under the entrance drive will be cleaned of sediment, or replaced if damaged. The existing entrance drive will be repaved to the existing grade to the R.O.W. line, then regraded as needed on site to make the new drainage pattern work.

Onsite Basin A1 (0.14 acres) consists of the greenbelt area north of the parking lot. It will receive runoff from offsite Basin O1 (Design Point 1), and a swale will be graded in that basin to the direct the offsite runoff east (Design Point 2) around the new development, rather than letting it flow onto the proposed parking areas.

Basin A2 (0.29 acres) contains open space and the north half of the proposed new office building at the east side of the new development. A swale has been graded to continue directing offsite flow around the building and into Kettle Creek (Design Point 3).

Basin B1A (0.14 acres of parking lot along the northwest end of the developed area will sheet flow off the edge of the pavement towards the southeast (Design Point 4A). Basin B1B (0.26 acres of the remainder of the parking lot and parts of the roofs of both buildings) will drain, along with runoff from Basin B1A. to a small concrete crosspan south of the studio office (Design Point 4B), and across riprap erosion protection designed to help spread the flow. The runoff will continue across an approximate 60' buffer of open space before reaching the Kettle Creek top of bank.

Basin B2 (0.16 acres of roof, concrete walk, and open space) drains southeast towards Kettle Creek in a wide, shallow swale designed to help return flow to sheet flow.

The flows are as follows:

RUNOFF SUMMARY

DES. PT.	BASIN	AREA (AC.)	5-YR FLOW (cfs)	100-YR FLOW (cfs)
1	O1	2.83	1.05	6.54
	H1	0.72	0.73	2.63
H1	O1 + H1	3.55	1.53	8.42
H2	H2	0.27	0.16	0.75
	O1 + H1 + H2	3.82	1.65	9.06
	H1 - H2	0.99	0.75	2.95

RUNOFF SUMMARY

DES. PT.	BASIN	AREA (AC.)	5-YR FLOW (cfs)	100-YR FLOW (cfs)
1	O1	2.83	1.05	6.54
	A1	0.14	0.05	0.38
2	O1 +A1	2.97	1.00	6.26
	A2	0.29	0.24	1.05
3	O1 + A1 + A2	3.22	1.25	6.54
4A	B1A	0.14	0.53	1.05
	B1B	0.26	0.87	1.79
4B	B1A + B1B	0.40	1.40	2.82
	B2	0.16	0.28	0.76
5	B1A+B1B+B2	0.56	1.68	3.61
	A1 - B2	0.99	1.68	4.23
	O1 + A1 - B2	3.82	2.23	9.01

E. WATER QUALITY

No permanent water quality BMPs as the development will disturb less than 1.0 acre, and the site is not part of an overall development.

Water quality is improved by the fact that all the impervious areas drain to wide grass buffers before draining into Kettle Creek.

See “Four-Step Process” below for further information.

F. HYDROLOGY CALCULATIONS AND DRAINAGE FACILITY DESIGN

Drainage criteria was taken from the El Paso County Drainage Design Criteria Manual Volume 1 (DCM). This manual refers to the Urban Drainage and Flood Control District’s Criteria Manual, Volumes 1-3 (UD) for certain calculation methods, specifically in determining detention volume and Minimize Directly Connected Impervious Area.

The design rainfall for the minor storm (5-year) is a one-hour precipitation rate of 1.50 inches, and for the major storm (100-year), a one-hour rate of 2.60 inches. Runoff from all Basins was calculated using the rational method, as outlined in the DCM. Time of concentration was calculated using c-values from the El Paso County DCM Volume 1, Chapter 6. Design storm recurrence intervals used in this hydrologic analysis were the 5-year and the 100-year storms.

Flow rate calculations are shown in the Appendix for the Rational Method. The standard values used for the calculations, such as the rainfall intensity curves also appear in the Appendix.

Four Step Process for receiving water protection. The El Paso County requires discussion of how the “Four Step Process” as outlined in Appendix I.7.2 for “reducing runoff volumes, treating water quality capture volume (EURV), stabilizing drainageways, and implementing long-term source controls.”

The steps have been considered and incorporated in the drainage plan for this project as follows:

Step 1: Employ runoff reduction practices

The site is designed to provide only the required parking and circulation impervious areas, even though more parking might be possible. The amount of open space/landscape area on the overall site is more than 82%.

All of the existing and proposed impervious area will release into open space landscape buffers ranging from 30-70’ wide before reaching the Kettle Creek channel.

The parking areas will be constructed without curb and gutter, and are graded to drain as sheet flow to landscape/open space where possible. Almost all the roof area drains to landscape.

Step 2: Stabilize drainageways.

The swales will be grass-lined, and designed with low velocities. Riprap will protect the one location of concentrated flow (outfall of small crosspan south of studio) to help return it to sheet flow.

Step 3: Provide Water Quality Capture Volume

Detention and Water Quality Capture Volume is not required for this site, as it will disturb under 1.0 acre.

Flowrates will increase less than 1 cfs for the 5-year storm, and 1.3 cfs for the 100-year storm, for the developed area of the site. When combined with the offsite area runoff, the totals are only 0.6 cfs higher for the 5-year storm, and show no increase for the 100-year storm. This is because part of the lot will be graded with a more meandering flowpath than the existing ground.

Step 4: Consider Need for Industrial and Commercial BMP's.

Source pollutants are not expected to be a large problem with the proposed site use. No automotive servicing activities are anticipated other than parking. All parking areas will be routed through wide grass buffers.

G. FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA), as depicted on Flood Insurance Rate Map ((FIRM) No. 08041C0506G, Dec. 7, 2018, the southeastern 0.5 acres of the site is in Zone AE, the deep, defined channel for Kettle Creek. The floodplain won't be disturbed with this redevelopment, and the floodplain base flood elevation is at 6671 adjacent to buildings, at least 10 below the finished floor elevations.

H. EROSION CONTROL

Erosion control plans were not required for this small site, with its substantial grass buffers all around the developed areas.

I. DRAINAGE/BRIDGE FEES

No fees are due with site development plan applications.

J. CONSTRUCTION COST OPINION

Storm Sewer Cost Estimate
(All are non-reimbursable)

DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	COST
PRIVATE				
24"CMP - if needed	28	LF	$ 40	$ 1,120.00
			Private Storm Improvements Cost	$ 1,120.00
			Subtotal Cost $	1,120.00
			Contingency	112.00
			Total $	1,232.00

CONCLUSION

The redevelopment and proposed drainage patterns for Lot 8, Block E, Amended Filing of Springs Crest Subdivision, Hotchkiss Commercial Offices, will not negatively impact downstream properties. The flowrates will increase only slightly from existing to proposed conditions.

The existing stream, Kettle Creek is protected by grass buffers at least 30-70' wide from any proposed or existing impervious area, and the one new point of concentrated flow will be protected with riprap.

APPENDIX

National Flood Hazard Layer FIRMette

FEMA

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**
  - 20.2 Cross Sections with 1% Annual Chance
  - 17.5 Water Surface Elevation
  - 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 7/20/2019 at 12:03:47 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.

True West Co., LLC
Hotchkiss Commercial Offices
2290 Old Ranch Road

5/22/2020

Hydrologic Soil Type B

Existing Site

2.19 acres 95600

Existing Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	87,770	0.08	0.35	2%
Gravel Rd	3,725	0.59	0.70	80%
Roof	2,990	0.73	0.81	90%
Walks/Drives	1,115	0.90	0.96	100%
	95,600			

Proposed Imperviousness

I= 8.9%
C5 = 0.13
C100 = 0.39

Proposed Site 2.19 acres 95600

Proposed Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	78,217	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	3,951	0.73	0.81	90%
Walks/Drives	13,432	0.90	0.96	100%
	95,600			

Proposed Imperviousness

I= 19.4%
C5 = 0.22
C100 = 0.45

Basin O1 2.83 acres 123350 Soil Type A

Existing Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	118,490	0.08	0.35	2%
Gravel Rd	3,860	0.59	0.70	80%
Roof	1,000	0.73	0.81	90%
Walks/Drives	0	0.90	0.96	100%
	123,350			

Proposed Imperviousness

I= 5.2%
C5 = 0.10
C100 = 0.36

Basin H1 0.72 acres 31200 Soil Type B
(corresponding to developed area calculated)

Existing Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	24,590	0.08	0.35	2%
Gravel Rd	3,725	0.59	0.70	80%
Roof	1,837	0.73	0.81	90%
Walks/Drives	1,048	0.90	0.96	100%
	31,200			

Proposed Imperviousness

I= 19.8%
C5 = 0.21
C100 = 0.44

O1 and H1 weighted imperviousness and runoff coefficients

Imperviousness

O1	2.83	5.2	14.7
H	0.72	19.8	14.3
	3.55		29.0

Ave = 29.0/3.55 = 8.2 %

C5

O1	2.83	0.10	0.28
H	0.72	0.21	0.15
	3.55		0.43

Ave = 0.43/3.55 = 0.12

C100

O1	2.83	0.36	1.02
H	0.72	0.44	0.32
	3.55		1.34

Ave = 1.34/3.55 = 0.38

Basin H2 0.27 acres 11809 Soil Type B

Existing Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	10,589	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	1,153	0.73	0.81	90%
Walks/Drives	67	0.90	0.96	100%
	11,809			

Proposed Imperviousness

I= 11.1%
C5 = 0.15
C100 = 0.40

O1 and H1-H2 weighted imperviousness and runoff coefficients

Imperviousness

O1 + H1	3.55	8.2	29.1
H2	0.27	11.1	3.0
	3.82		32.1

Ave = 32.1/3.82 = 8.4 %

C5

O1 + H1	3.55	0.12	0.43
H2	0.27	0.15	0.04
	3.82		0.47

Ave = 0.47/3.82 = 0.12

C100

O1 + H1	3.55	0.38	1.35
H2	0.27	0.40	0.11
	3.82		1.46

Ave = 1.46/3.82 = 0.38

Basin H1 -H2 0.99 acres 43009 Soil Type B
(corresponding to developed area calculated)

Existing Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	35,179	0.08	0.35	2%
Gravel Rd	3,725	0.59	0.70	80%
Roof	2,990	0.73	0.81	90%
Walks/Drives	1,115	0.90	0.96	100%
	43,009			

Proposed Imperviousness

I= 17.4%
C5 = 0.19
C100 = 0.43

A1 0.14 acres 6043

Proposed Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	6,043	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	0	0.73	0.81	90%
Walks/Drives	0	0.90	0.96	100%
	6,043			

Proposed Imperviousness

I= 2.0%
C5 = 0.08
C100 = 0.35

O1 and A1 weighted imperviousness and runoff coefficients

Imperviousness

O1	2.83	5.2	14.7
A1	0.14	2.0	0.3
	2.97		15.0

Ave = 15.0/2.97 = 5.0 %

C5

O1	2.83	0.10	0.28
A1	0.14	0.08	0.01
	2.97		0.29

Ave = 0.29/2.97 = 0.10

C100

O1	2.83	0.36	1.02
A1	0.14	0.35	0.05
	2.97		1.07

Ave =1.07/2.97 = 0.36

A2 0.29 acres 12665

Proposed Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	11,033	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	1,581	0.73	0.81	90%
Walks/Drives	51	0.90	0.96	100%
	12,665			

Proposed Imperviousness

I= 13.4%
C5 = 0.16
C100 = 0.41

O1 + A1 + A2 weighted imperviousness and runoff coefficients

Imperviousness

O1+A1	2.97	5.0	14.9
+A2	0.29	13.4	3.9
	3.26		18.7

Ave = 18.7/3.26 = 5.7 %

C5

O1 + A1	2.97	0.10	0.36
+A2	0.29	0.16	0.05
	3.26		0.41

Ave = 0.41/3.26 = 0.12

C100

O1 + A1	2.97	0.36	1.07
+A2	0.29	0.41	0.12
	3.26		1.19

Ave = 1.19/3.26 = 0.36

B1A 0.14 acres 6025

Proposed Composite Coefficients of ch

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	1,075	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	0	0.73	0.81	90%
Walks/Drives	4,950	0.90	0.96	100%
	6,025			

Proposed Imperviousness

I= 82.5%
C5 = 0.75
C100 = 0.85

B1B 0.26 acres 11445

Proposed Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	3,240	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	367	0.73	0.81	90%
Walks/Drives	7,838	0.90	0.96	100%
	11,445			

Proposed Imperviousness

I= 71.9%
C5 = 0.66
C100 = 0.78

B1A and B1B weighted imperviousness and runoff coefficients

Imperviousness

B1A	0.14	82.5	11.6
+B1B	0.26	71.9	18.7
	0.40		30.2

Ave = 30.2/0.4 = 75.6 %

C5

B1A	0.14	0.75	0.1
+B1B	0.26	0.66	0.2
	0.40		0.28

Ave = 0.28/0.40 = 0.69

C100

B1A	0.14	0.85	0.1
+B1B	0.26	0.78	0.2
	0.40		0.32

Ave = 0.32/0.56 = 0.80

B2 0.16 acres 6831

Proposed Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	4,235	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	2,003	0.73	0.81	90%
Walks/Drives	593	0.90	0.96	100%
	6,831			

Proposed Imperviousness

I= 36.3%

C5 = 0.34

C100 = 0.54

B1A, B1B and B2 weighted imperviousness and runoff coefficients

Imperviousness

B1A + B1B	0.40	75.6	30.2
+B2	0.16	36.3	5.8
	0.56		36.0

Ave = 36.0/0.4 = 64.4 %

C5

B1A + B1B	0.40	0.69	0.3
+B2	0.16	0.34	0.1
	0.56		0.33

Ave = 0.33/0.56 = 0.59

C100

B1A + B1B	0.40	0.80	0.3
+B2	0.16	0.54	0.1
	0.56		0.41

Ave = 0.41/0.56 = 0.73

A1-B2

Imperviousness of redeveloped area - corresponding to H

Dev. Area-A1-B2 0.99 acres 43009

Proposed Composite Coefficients of Runoff

Cover type	Area (sf)	C5	C100	Imperviousness
Landscape	25,626	0.08	0.35	2%
Gravel Rd	0	0.59	0.70	80%
Roof	3,951	0.73	0.81	90%
Walks/Drives	13,432	0.90	0.96	100%
	43,009			

Proposed Imperviousness

I= 40.7%

C5 = 0.40

C100 = 0.58

O1 + A1-B2 weighted imperviousness and runoff coefficients

Imperviousness

O1	2.83	5.2	14.7
A1-B2	0.99	40.7	40.3
	3.82		55.0

Ave = 55.0/3.82 = 14.4 %

C5

O1	2.83	0.10	0.28
A1-B2	0.99	0.40	0.40
	3.82		0.68

Ave = 0.68/3.82 = 0.18

C100

O1	2.83	0.36	1.02
A1-B2	0.99	0.58	0.57
	3.82		1.59

Ave = 1.59/3.82 = 0.42

Calculation of Peak Runoff using Rational Method

Designer:
Company:
Date: 5/24/2020
Project: Hotchkiss Office Buildings
Location:

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

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Computed $t_c = t_i + t_t$

Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

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

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.19	1.50	1.80	2.00	2.25	2.60	3.35

Rainfall Intensity Equation Coefficients =	a	b	c
	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Site Historic	2.19	B	8.9	0.05	0.06	0.13	0.30	0.38	0.47	0.57	50.00			0.080	6.67	160.00			0.019	20	2.76	0.97	7.64	26.38	10.00	3.22	4.06	4.87	5.41	6.09	7.03	9.06	0.35	0.55	1.37	3.61	5.03	7.20	11.29
					0.13				0.39						6.23								7.20		6.69	3.71	4.68	5.61	6.24	7.02	8.11	10.45	0.40	1.33	1.58	4.16	5.80	6.93	13.01
Site Developed	2.19	B	19.4	0.12	0.14	0.21	0.37	0.44	0.52	0.61	30.00			0.140	3.96	170.00			0.028	20	3.35	0.85	4.80	24.15	10.00	3.22	4.06	4.87	5.41	6.09	7.03	9.06	0.87	1.28	2.28	4.39	5.82	7.95	12.05
					0.22				0.45						3.64								4.49		5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	1.09	2.45	2.86	5.51	7.29	8.69	15.10
O1	2.83	A	5.2	0.02	0.02	0.02	0.03	0.07	0.15	0.29	50.00			0.035	9.12	370.00			0.035	7	1.31	4.71	13.83	28.50	13.83	2.81	3.54	4.24	4.71	5.30	6.13	7.90	0.14	0.20	0.27	0.43	1.04	2.61	6.43
					0.10				0.36						8.44								13.15		12.48	2.94	3.70	4.44	4.94	5.55	6.42	8.27	0.15	1.05	0.29	0.45	1.09	6.54	6.73
H1	0.72	B	19.8	0.13	0.15	0.22	0.37	0.44	0.52	0.61	50.00			0.080	6.12	130.00			0.015	20	2.45	0.88	7.01	24.14	10.00	3.22	4.06	4.87	5.41	6.09	7.03	9.06	0.29	0.43	0.76	1.45	1.92	2.62	3.97
					0.21				0.44						5.72								6.61		6.16	3.81	4.80	5.76	6.40	7.20	8.32	10.72	0.34	0.73	0.90	1.72	2.27	2.63	4.69
O1 + H1	3.55		8.2													175.00			0.034	20	3.69	0.79		26.16															
					0.12				0.38																13.27	2.86	3.60	4.32	4.80	5.40	6.24	8.05		1.53				8.42	
H2	0.27	B	11.1	0.06	0.08	0.15	0.32	0.39	0.48	0.58	30.00			0.020	8.04	100.00			0.010	7	0.70	2.38	10.42	25.69	10.42	3.17	3.99	4.79	5.32	5.99	6.92	8.92	0.05	0.08	0.19	0.46	0.63	0.89	1.39
					0.15				0.40						7.47								9.85															0.75	
A1	0.14	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	45.00			0.150	5.39	170.00			0.021	7	1.01	2.79	8.18	27.77	10.00	3.22	4.06	4.87	5.41	6.09	7.03	9.06	0.00	0.01	0.05	0.20	0.29	0.43	0.69
					0.08				0.35						5.05								7.85		7.50	3.58	4.51	5.41	6.01	6.76	7.81	10.07	0.00	0.05	0.06	0.22	0.32	0.38	0.77
O1 + A1	2.97		5.0													170.00			0.021	7	1.01	2.79		27.17															
					0.10				0.36																15.27	2.68	3.38	4.05	4.50	5.07	5.85	7.54		1.00				6.26	
A2	0.29	B	13.4	0.08	0.10	0.17	0.33	0.40	0.49	0.59	30.00			0.083	4.94	175.00			0.012	20	2.19	1.33	6.27	26.17	10.00	3.22	4.06	4.87	5.41	6.09	7.03	9.06	0.07	0.11	0.23	0.52	0.71	1.00	1.54
					0.16				0.41						4.62								5.95		5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	0.09	0.24	0.29	0.66	0.89	1.05	1.93
O1 + A1 + A2	3.22		5.7													180.00			0.012	20	2.19	1.37		27.83															
					0.12				0.36																16.64	2.57	3.24	3.89	4.32	4.86	5.61	7.23		1.25				6.51	
B1A	0.14	B	82.5	0.67	0.70	0.72	0.77	0.79	0.81	0.84																													
					0.75				0.85																5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	0.38	0.53	0.62	0.73	0.84	1.05	1.33
B1B	0.26	B	71.9	0.57	0.60	0.64	0.70	0.73	0.76	0.80	30.00			0.140	2.08	140.00			0.013	20	2.24	1.04	3.12	14.87	5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	0.60	0.79	1.01	1.24	1.45	1.74	2.36
					0.66				0.78						1.82								2.86															1.79	
B1A + B1B	0.40	B	75.6	0.60	0.63	0.67	0.72	0.75	0.78	0.81																													
					0.69				0.80																5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	0.97	1.40	1.63	1.96	2.29	2.82	3.69
B2	0.16	B	36.3	0.26	0.28	0.35	0.48	0.53	0.59	0.67																													
					0.34				0.54																5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	0.16	0.28	0.34	0.52	0.65	0.76	1.22
B1A+B1B+B2	0.56	B	64.4	0.50	0.53	0.58	0.65	0.69	0.73	0.77																													
					0.59				0.73																5.00	4.04	5.09	6.11	6.78	7.63	8.82	11.36	1.13	1.68	1.97	2.48	2.94	3.61	4.91
O1	2.83	A	5.2	0.02	0.02	0.02	0.03	0.07	0.15	0.29	50.00			0.035	9.12	370.00			0.035	7	1.31	4.71	13.83	28.50	13.83	2.81	3.54	4.24	4.71	5.30	6.13	7.90	0.14	0.20	0.27	0.43	1.04	2.61	6.43
					0.10				0.36						8.44								13.15															6.24	
A1-B2	0.99	B	40.7	0.29	0.32	0.39	0.50	0.56	0.62	0.68						175.00			0.012	20	2.19	1.33		20.89																
					0.40				0.58																8.83	3.38	4.26	5.11	5.67	6.38	7.38	9.50	0.98	1.68	1.95	2.83	3.51	4.23	6.44
O1+A1-B2	3.82		14.4																																				
					0.18				0.42																16.64	2.57	3.24	3.89	4.32	4.86	5.61	7.23		2.23				9.01	
O1+H1+H2	3.82		8.4																																				
					0.12				0.38																13.27	2.86	3.60	4.32	4.80	5.40	6.24	8.05		1.65				9.06	
H1 + H2	0.99	B	17.4	0.11	0.13	0.20	0.36	0.43	0.51	0.60																													
					0.19				0.43																10.42	3.17	3.99	4.79	5.32	5.99	6.92	8.92	0.34	0.75	0.94	1.89	2.52	2.95	5.29

True West Co., LLC
Hotchkiss Commercial Offices
2290 Old Ranch Road

6/8/2020

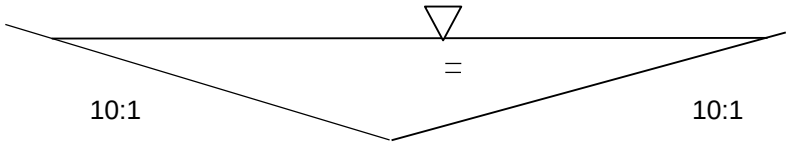
Swale A1 - for Basins O1 + A1 flow - Grass-lined

Q5 = 1.00 cfs, Q100 =6.26 cfs

S = 2.1 %

n = 0.035

$$Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$$



D =	N =	0.035	Q=	6.47	cfs
0.51	A =	2.60	sf.	V = 2.5	fps
10	WP =	10.25	ft.		
10	S =	0.021	%		

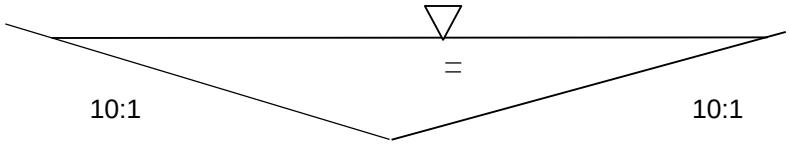
Swale A2-for Basins O1 + A1 + A2 flow - Grass-lined

Q5 = 1.25 cfs, Q100 =6.51 cfs

S = 1.2 %

n = 0.035

$$Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$$



D =	N =	0.035	Q=	6.58	cfs
0.57	A =	3.25	sf.	V = 2.0	fps
10	WP =	11.46	ft.		
10	S =	0.012	%		

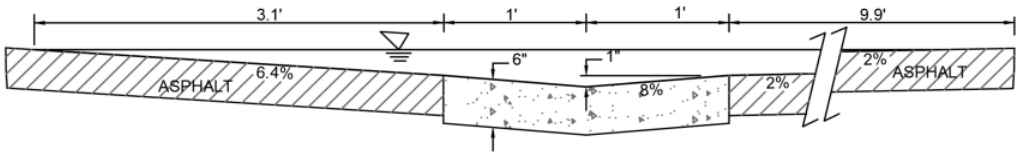
Swale B1 for Basin B1 - Concrete and Asphalt

Q100 =2.82 cfs

S = 0.7 %

n = 0.017

$$Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$$



D =	N =	0.017	Q=	3.13	cfs	
0.28'	A =	1.76	sf.	V =	1.8	fps
	WP =	15.00	ft.			
	S =	0.007	%			

Riprap B1 Swale

With outlet velocity at only 1.8 fps for the 100-year storm,
only minimal riprap erosion protection is proposed.

Use 5' W x 5' long x 1.5' deep buried Type L riprap

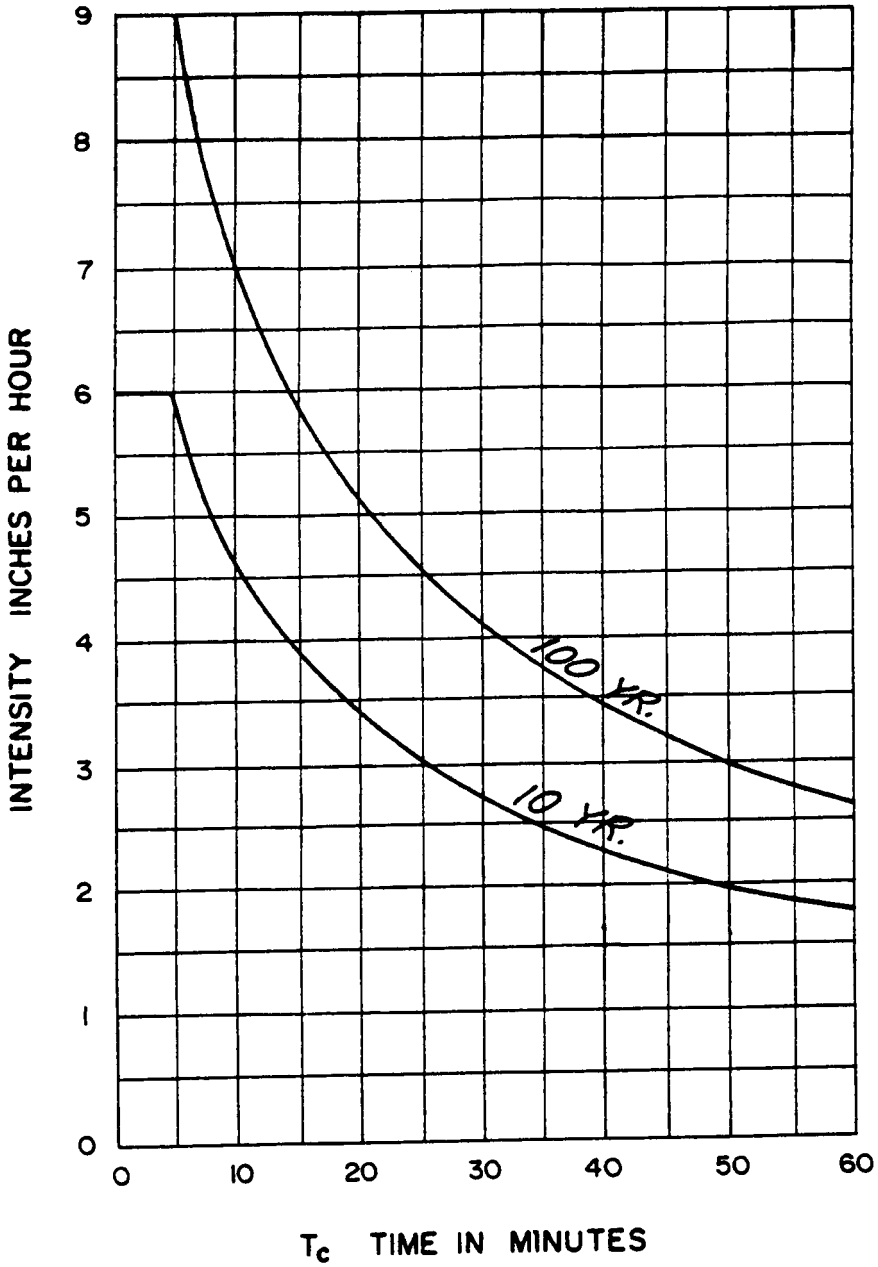
Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.



RE: Based upon Pikes Peak area council of governments/ areawide urban runoff control manual.

HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Storm Rainfall
Time Intensity-Frequency Curves

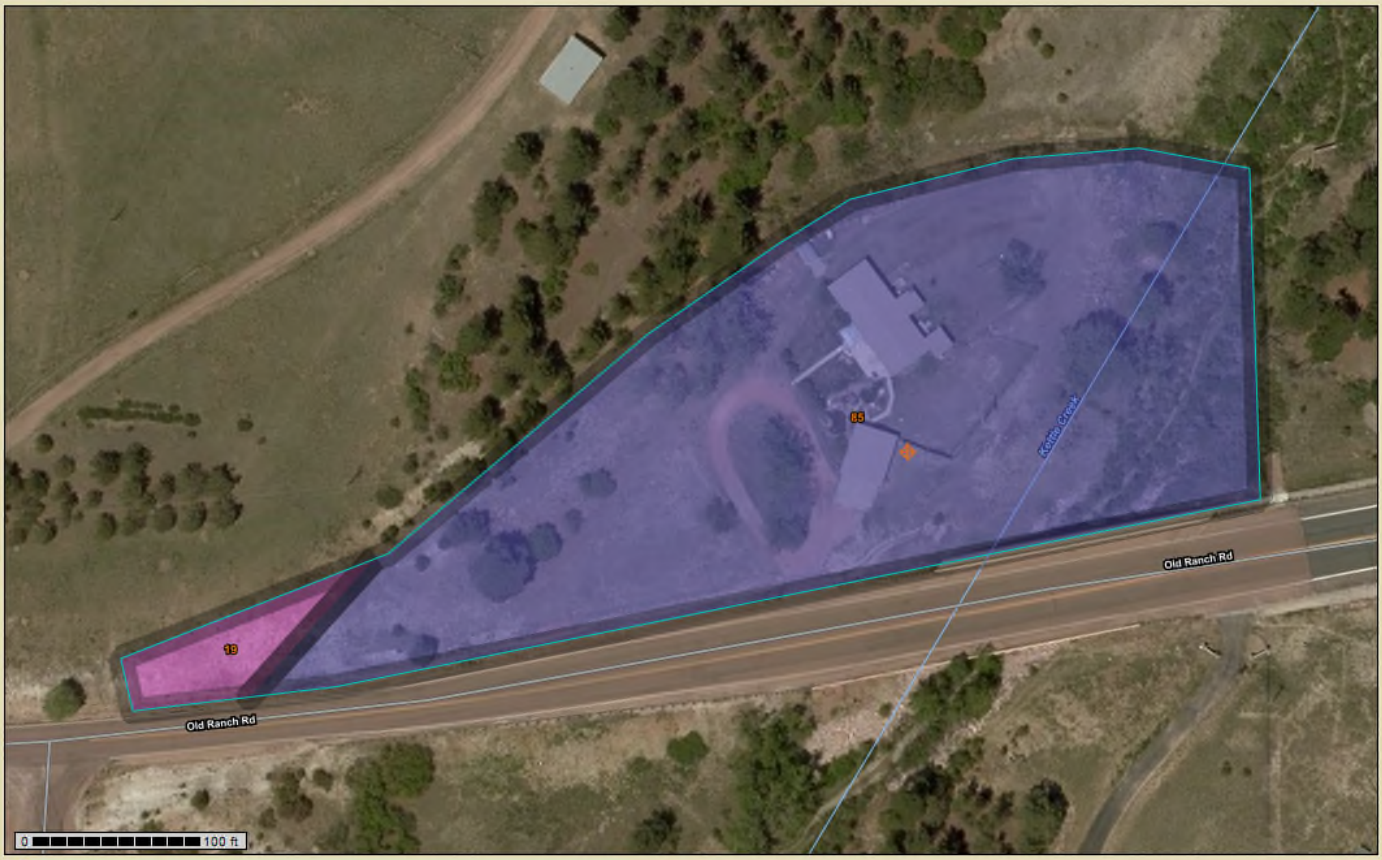
Date
OCT. 1987

Figure
5 - 1

Map — Hydrologic Soil Group

Legend

Scale (not to scale)



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

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of detail shown in the resulting soil map are dependent on that map 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.

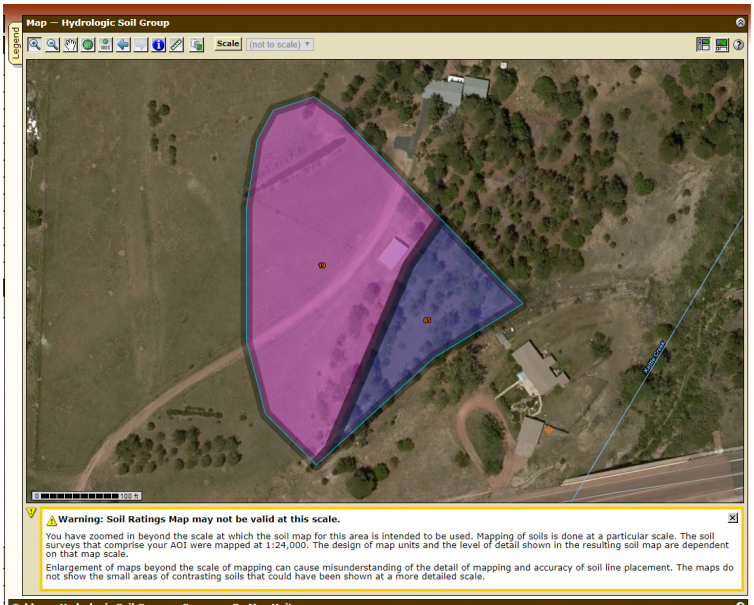
Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	0.1	4.8%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	2.3	95.2%
Totals for Area of Interest			**2.4**	**100.0%**

Description — Hydrologic Soil Group



Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	1.7	75.5%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	0.5	24.5%
Totals for Area of Interest			**2.2**	**100.0%**

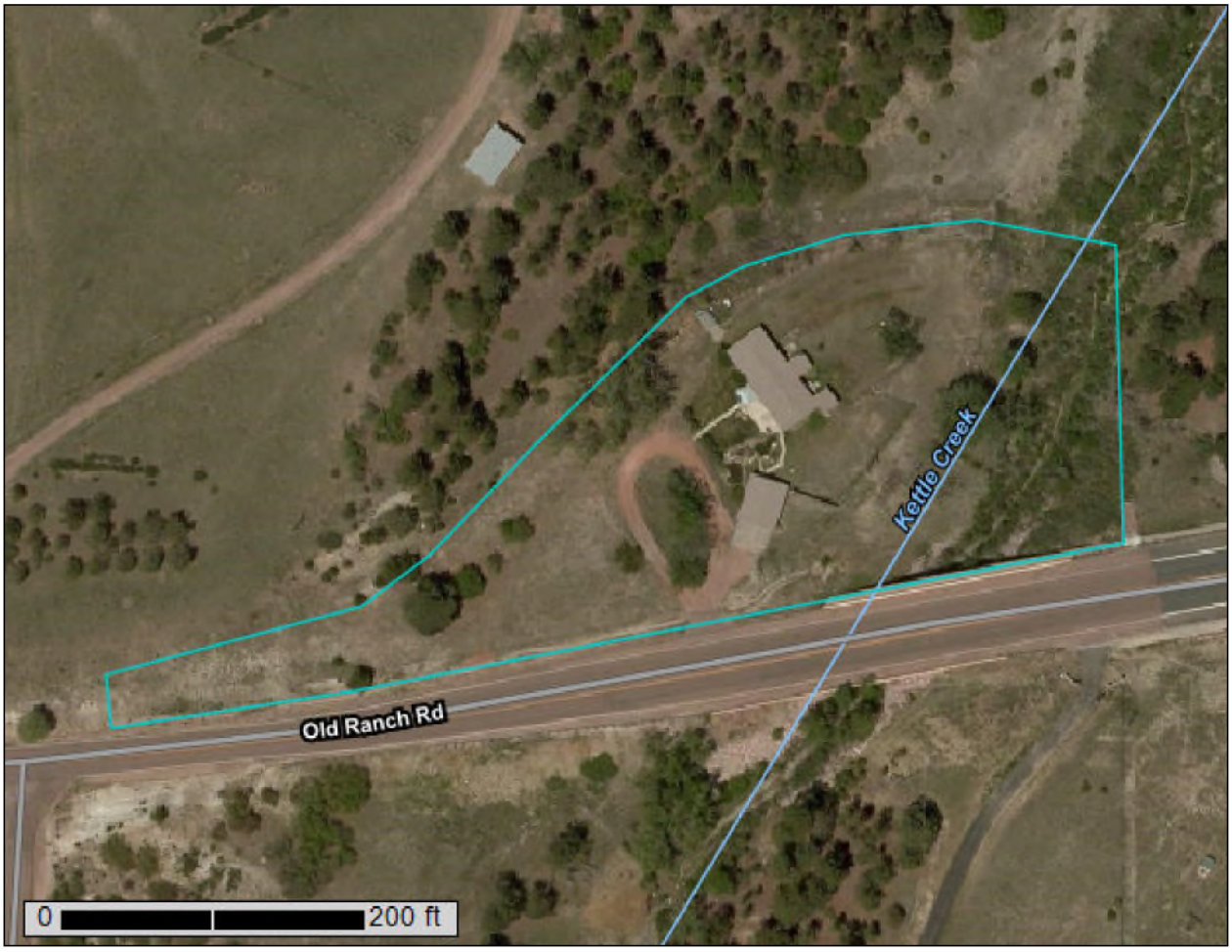
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

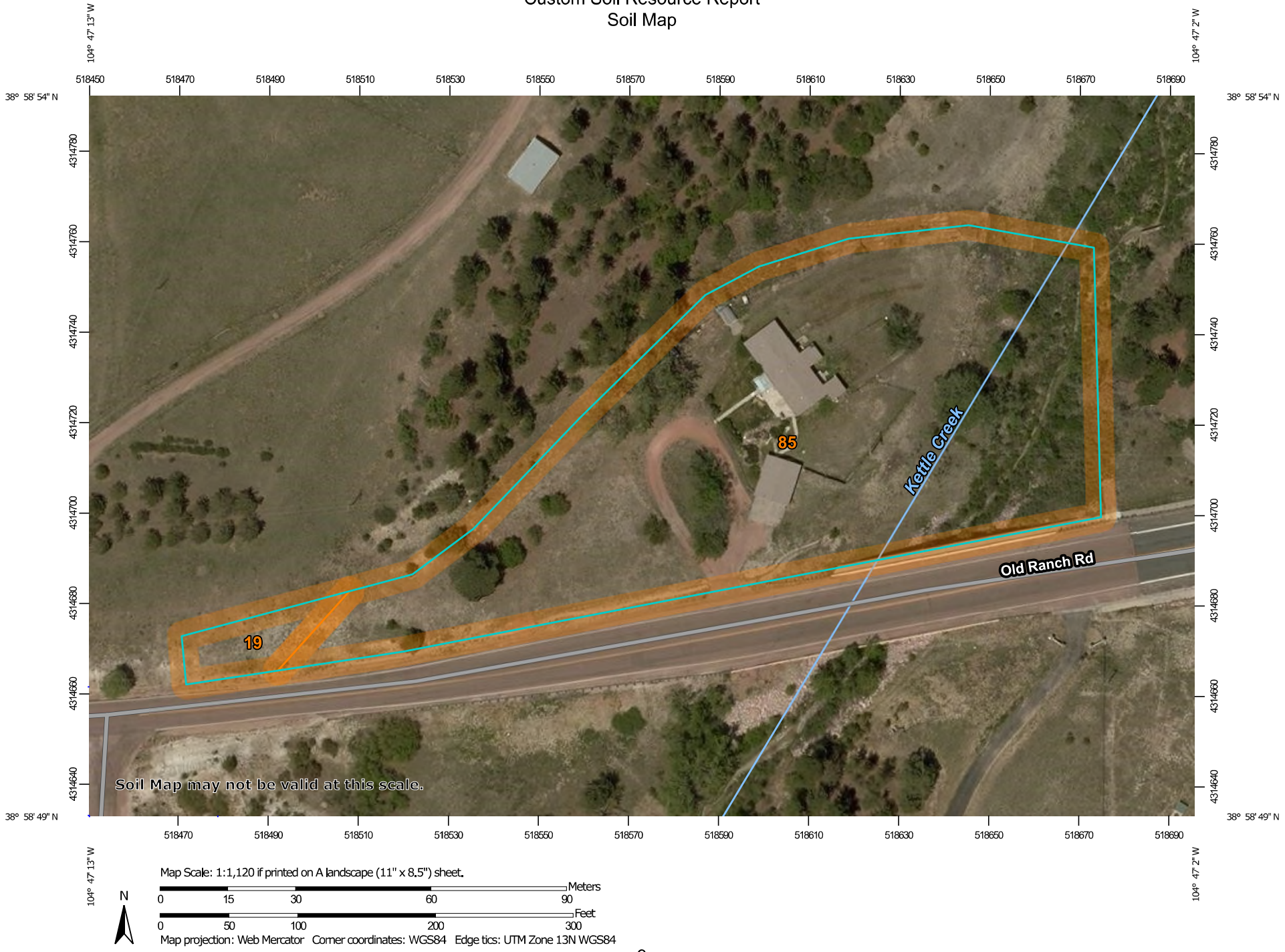
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado



July 20, 2019

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,120 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	0.1	3.9%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	2.2	96.1%
Totals for Area of Interest		**2.3**	**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,

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Columbine

Setting

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

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

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

Pleasant

Percent of map unit:

Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

85—Stapleton-Bernal sandy loams, 3 to 20 percent slopes

Map Unit Setting

National map unit symbol: 36b1
Elevation: 6,500 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 40 percent
Bernal and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B
Ecological site: Gravelly Foothill (R049BY214CO)
Hydric soil rating: No

Description of Bernal

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: sandy loam
Bt - 4 to 11 inches: sandy clay loam
C - 11 to 13 inches: sandy loam
R - 13 to 17 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 20 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R049BY204CO)
Hydric soil rating: No

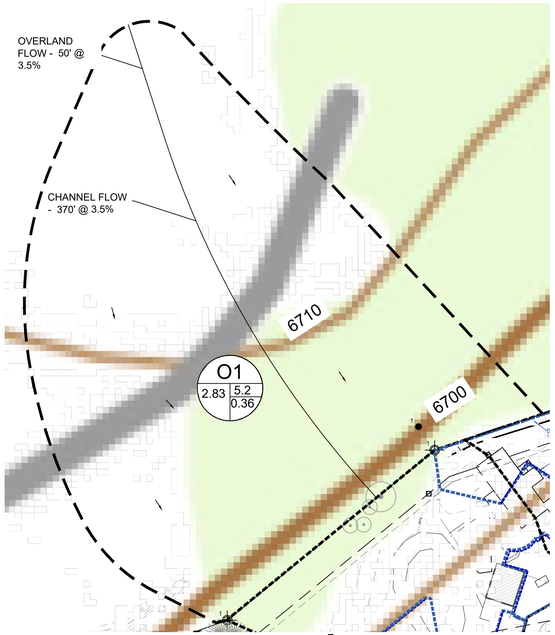
Minor Components

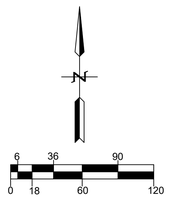
Other soils

Percent of map unit:
Hydric soil rating: No

2290 OLD RANCH ROAD

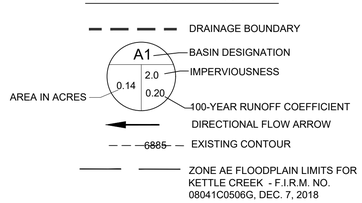
LOTS 8, BLOCK E, AMENDED FILING OF SPRINGS CREST SUBDIVISION
NW 1/4, SEC. 28, T.12 S., R. 66 W OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

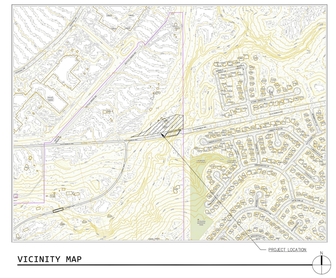




OFFSITE AREA

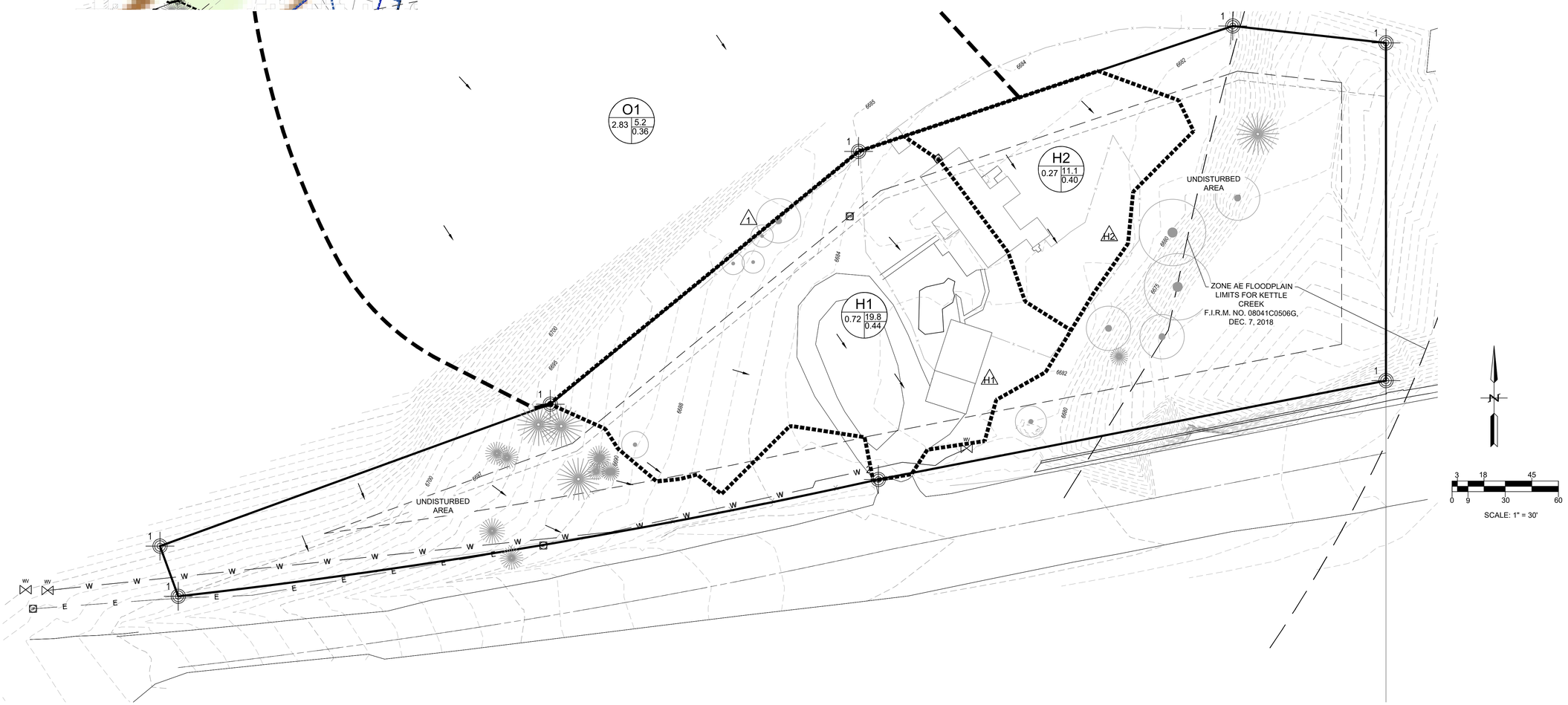
DRAINAGE LEGEND





RUNOFF SUMMARY

DES. PT.	BASIN	AREA (AC.)	5-YR FLOW (cfs)	100-YR FLOW (cfs)
1	O1	2.83	1.05	6.54
	H1	0.72	0.73	2.63
H1	O1 + H1	3.55	1.53	8.42
H2	H2	0.27	0.16	0.75
	O1 + H1 + H2	3.82	1.65	9.06
	H1 - H2	0.99	0.75	2.95



CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

BEFORE YOU DIG
CALL UTILITY NOTIFICATION CENTER OF COLORADO
811

REVISIONS

NO.	DESCRIPTION	DATE	BY

PREPARED BY:
TRUE WEST CO., LLC
1635 Ellsworth Drive
Aurora, CO 80013
303-523-3664
truewest1@usa.net

DESCRIPTION:
HISTORIC DRAINAGE
HOTCHKISS COMMERCIAL OFFICES
2290 OLD RANCH ROAD

PREPARED FOR:
JOHN HOTCHKISS
9161 ESTEBURY CIRCLE
GCOLORADO SPRINGS, CO 80920-7560

ENGINEERS SEAL:

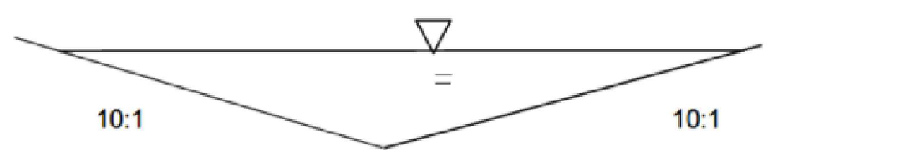
DESIGNED BY: CLE
DRAWN BY: CLE
CHECKED BY: CLE
DRAWER NUMBER:
DATE: 5/26/2020
SCALE: AS NOTED
SHEET NUMBER: 1 OF 2

2290 OLD RANCH ROAD

LOTS 8, BLOCK E, AMENDED FILING OF SPRINGS CREST SUBDIVISION
NW 1/4, SEC. 28, T.12 S., R. 66 W OF THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

Swale A1 - for Basins O1 + A1 flow - Grass-lined

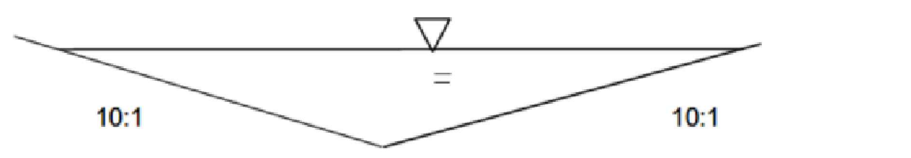
Q5 = 1.00 cfs, Q100 =6.26 cfs $Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$
S = 2.1 %
n = 0.035



D =	N =	0.035	Q=	6.47 cfs	
0.51	A =	2.60 sf.	V =	2.5	fps
10	WP =	10.25 ft.			
10	S =	0.021 %			

Swale A2-for Basins O1 + A1 + A2 flow - Grass-lined

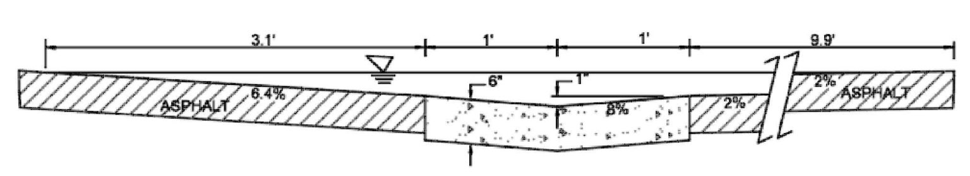
Q5 = 1.25 cfs, Q100 =6.51 cfs $Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$
S = 1.2 %
n = 0.035



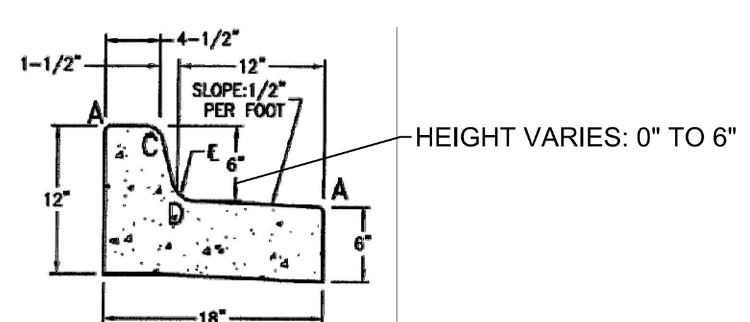
D =	N =	0.035	Q=	6.58 cfs	
0.57	A =	3.25 sf.	V =	2.0	fps
10	WP =	11.46 ft.			
10	S =	0.012 %			

Swale B1 for Basin B1 - Concrete and Asphalt

Q100 =2.82 cfs $Q = \frac{1.486AR^{2/3}S^{1/2}}{n}$
S = 0.7 %
n = 0.017



D =	N =	0.017	Q=	3.13 cfs	
0.28'	A =	1.76 sf.	V =	1.8	fps
	WP =	15.00 ft.			
	S =	0.007 %			



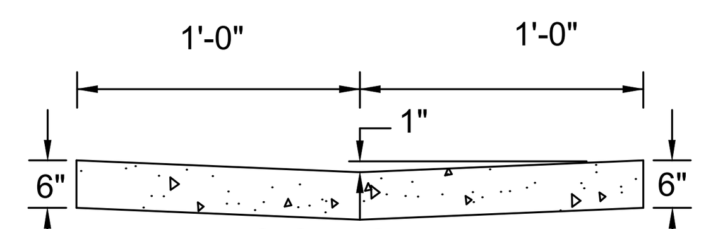
TYPE 3
STANDARD MEDIAN CURB AND GUTTER

RUNOFF SUMMARY

DES. PT.	BASIN	AREA (AC.)	5-YR FLOW (cfs)	100-YR FLOW (cfs)
1	O1	2.83	1.05	6.54
	A1	0.14	0.05	0.38
2	O1 +A1	2.97	1.00	6.26
	A2	0.29	0.24	1.05
3	O1 + A1 + A2	3.22	1.25	6.54
4A	B1A	0.14	0.53	1.05
	B1B	0.26	0.87	1.79
4B	B1A + B1B	0.40	1.40	2.82
	B2	0.16	0.28	0.76
5	B1A+B1B+B2	0.56	1.68	3.61
	A1 - B2	0.99	1.68	4.23
	O1 + A1 - B2	3.82	2.23	9.01

DRAINAGE LEGEND

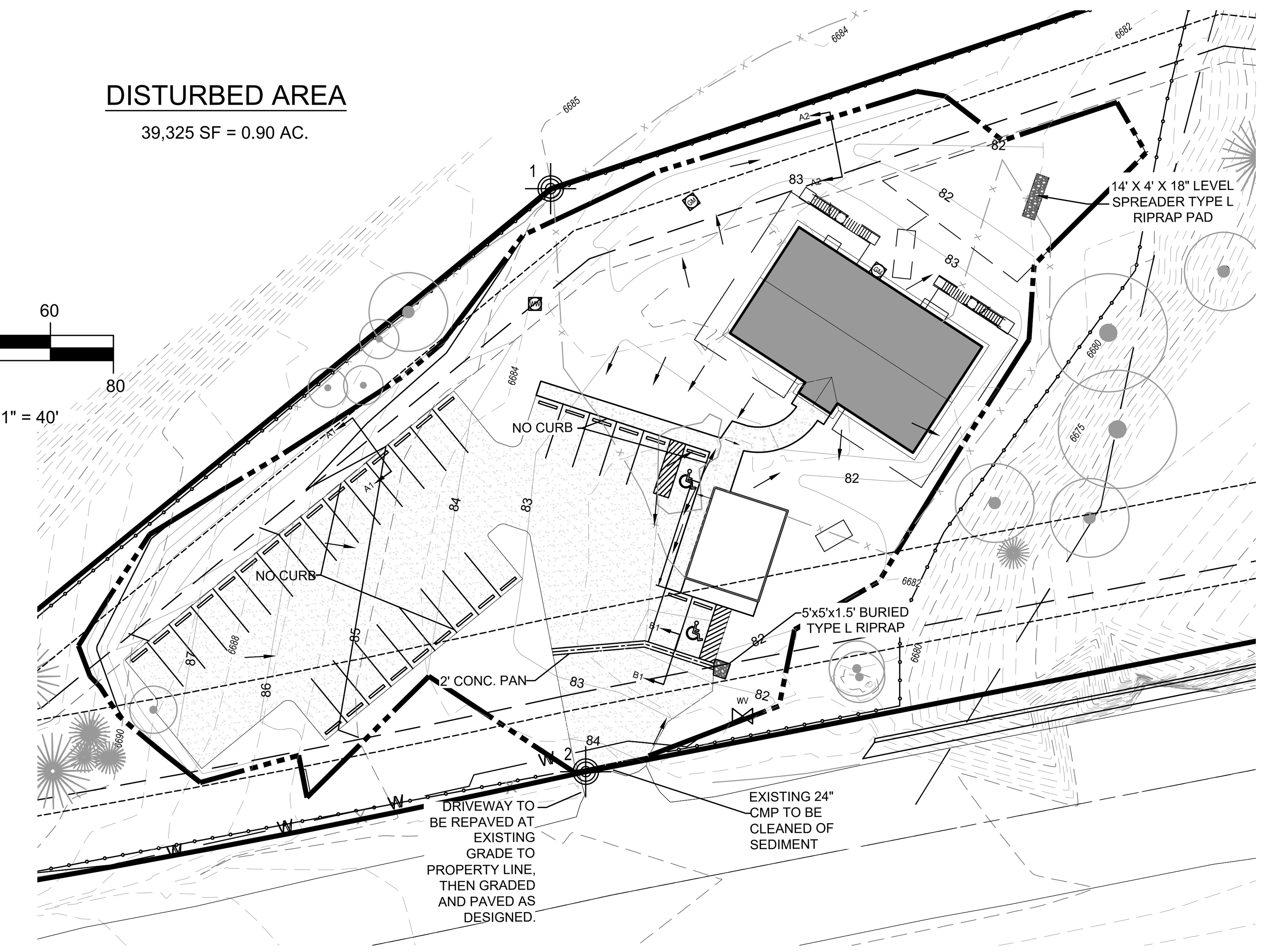
- DRAINAGE BOUNDARY
- A1 — BASIN DESIGNATION
- 2.0 — IMPERVIOUSNESS
- 0.14 — AREA IN ACRES
- 0.20 — 100-YEAR RUNOFF COEFFICIENT
- DIRECTIONAL FLOW ARROW
- 6885 — EXISTING CONTOUR
- 83 — PROPOSED CONTOUR
- x85.3 — PROPOSED SPOT ELEVATION
- ZONE AE FLOODPLAIN LIMITS FOR KETTLE CREEK - F.I.R.M. NO. 08041C0506G, DEC. 7, 2018



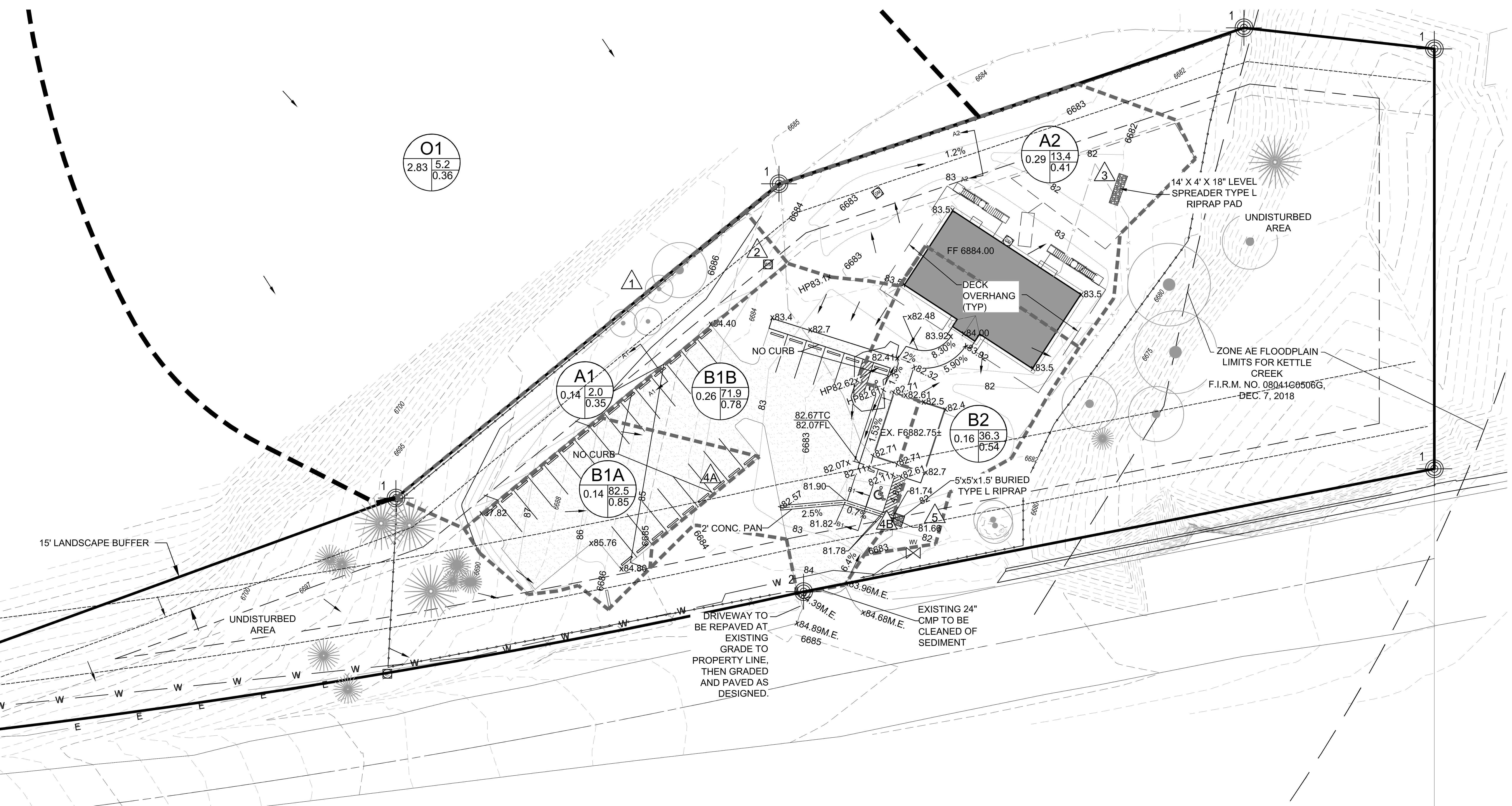
2'CONC PAN
NOT TO SCALE

DISTURBED AREA

39,325 SF = 0.90 AC.



SCALE: 1" = 40'



SCALE: 1" = 30'

BEFORE YOU DIG
CALL UTILITY NOTIFICATION CENTER OF COLORADO
811
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

REVISIONS

NO.	DESCRIPTION	DATE	BY
2	COUNTY COMMENTS	08-08-20	CLE
1	COUNTY COMMENTS	06-25-20	CLE

PREPARED BY:

TRUE WEST CO., LLC
16352 E Bates Drive
Aurora, CO 80013
303-523-3664
truewest1@usa.net

DESCRIPTION:
FINAL DRAINAGE PLAN
HOTCHKISS COMMERCIAL OFFICES
2290 OLD RANCH ROAD

PREPARED FOR:
JOHN HOTCHKISS
9161 ESTEBURY CIRCLE
GCOLORADO SPRINGS, CO 80920-7560

ENGINEERS SEAL:

DESIGNED BY: CLE
DRAWN BY: CLE
CHECKED BY: CLE
DRAWER NUMBER:
DATE: 8/5/2019
SCALE: AS NOTED
SHEET NUMBER: 2 OF 2