Drainage Letter/Report

for the

Manley Tract
El Paso County, Colorado

April, 2022

Prepared for:
Ms. Nancy Manley
4645 North Curtis Road
Falcon, Colorado 80831

Prepared by:

Kenneth C. Harrison, P.E.
KCH Engineering Solutions
5228 Cracker Barrel Circle
Colorado Springs, Colorado 80917
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ksharrison5228@msn.com

El Paso County Project Number Add "VR2310"

Job No: 2021-101

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APPENDIX

Certifications and Approvals

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 had been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparation this report

Signature _____ Seal
(Kenneth C. Harrison, P.E.)

Developer/Owner Statement

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

_____
(Business Name)

By: _____
(Signature) (Date)

Print Name and Title _____

Address: _____

Please revise EPC signature block to the following:

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.

_____ _____
Joshua Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

For El Paso County

_____
(Signature)

_____
(Print name)

Flood Plain Statement

See Section V of this report

I. REPORT PURPOSE

The purpose of this replat is to **only** modify the existing lot lines. No surface improvements are proposed. As a result, there will be **no changes** to the existing drainage patterns as described in the approved Drainage Report (September 2000) prepared by Law and Marrioti. This Letter/ Report is submitted as required by El Paso County for replats of previously platted parcels when there are to be **no** or only negligible changes to the drainage characteristics. This report will also address any criteria changes that have occurred since 2000. Included in the Appendix *(Exhibit 4)* is correspondence with El Paso County outlining the information that is to be addressed in this Letter/ Report.

The purpose of this project is to relocate lot lines only. **No** surface improvements are proposed. Therefore, there will be **no changes** to the current drainage conditions are

A Preliminary/ Final Drainage Report was prepared by Law and Marrioti Consultants Inc. The plat included four (4) lots and an out parcel labeled as Future Phase Two. The plat was recorded July 29, 2002. The report was filed by El Paso on September 20, 2000. Pertinent sections of this report are included in *Exhibit 5 of the Appendix*. The purpose of this Drainage Letter is to show that the replat will have **no impact** on the characteristics of the existing stormwater runoff as described in the approved Drainage Report. Greater detail for this report was required only to identify any impacts that the reduced flows from offsite areas (sub basin OS1) may have.

II. GENERAL PROPERTY DESCRIPTION AND ACREAGE

Manley Subdivision is located in the Southwest quarter of the Southwest quarter of Section 22, Township 13 south, Range 64 West, of the 6th PM in the County of El Paso, State of Colorado. More precisely , the parcel is located in the northeast corner of the Curtis Road/ Jones Road intersection (*Exhibit 1, Appendix*). The site is located in the Black Squirrel Creek Drainage Basin.

Revise to "Solberg Ranch"

Manley Subdivision presently consists of four (4) lots and an "out-parcel labelled as Future Phase 2 Several structures have been constructed on the property These structures were there when the Law and Marrioti report was prepared (*Exhibits 2, Appendix*). The development is covered with native grasses and weeds. General site topography is characterized by a gentle slope from the northwest to the southeast at an average slope of approximately 2.5%.

Topography

The topographic map was obtained from GIS mapping obtained from El Paso County. The site is gently rolling from an elevation of 6610.0 at the northwest corner and 6566.0 at the southwest corner over 2,700 feet in length resulting in an average slope of 1.6%.

Clarify the term property. Are you referring to the existing subdivision, lots 1-4, or the "out-parcel".

Structures

There are several single-family residential structures on the project site. They are located on Lots 2, 3, and 4 of the original plat. The approximate location is shown on *Exhibit 2 in the Appendix*. There are currently are no plans to add additional structures as part of this replat.

III. DESIGN CRITERIA AND METHODOGY

El Paso County Drainage Criteria Manual, Volume I.

City of Colorado Springs Drainage Criteria Manual (where included with the El Paso County Drainage Criteria Manual).

Soil Survey of El Paso County Area, Colorado United States Department Detention/ Water Quality

IV. FEMA FLOODPLAIN

Please revise FEMA Map Number to 08041C0568G effective 12/7/2018.

The project site is located in FEMA map 080059 (eff 10/2020) (*Exhibit 2, Appendix).* The entire site is located outside the 100-year floodplain in Zone X which is an "Area of Minimal Disturbance" for which there are no special requirements for the construction of commercial or industrial structures.

V. HYDROLOGIC SOILS INFORMATION

A Custom Soil Resource Report (*Exhibit 3, Appendix*) was obtained that shows the approximate location as well as a description of the soil associated groups. All of the soils are classified as either hydraulic group A or B. The soils are identified as follows:

- Blakeland loamy sand (SCS No. 8)
- Blendon Sandy Loam (Blendon Sandy Loam (SCS No, 10)
- Ellicot Loamy coarse Sam (SCS No. 28)
- Stapleton Sandy loam (SCS No. 83)
- Tructon Loamy Sand (SCS No. 98)
- Ustic Torrifluvents (SCS No. 101)

Please add "Existing" to the header if these are existing conditions.

VI. OFFSITE DRAINAGE CONDITIONS

All areas for offsite and onsite sub basins were determined using GIMS mapping provided by El Paso County. This mapping was also used to compare the technical sections of the Law and Marrioti report with similar sections of this report *(Exhibit 10*).

Offsite Areas North of the subdivision

Storm water from areas north of the Manley subdivision is collected by swales #1 and #3. At no point does water from these swales enter the project site. Analysis of these swales is beyond the scope of this project.

Offsite Sub Basin OS-1 and Swale 4 (adjacent to Curtis Road)

This area is located directly west of the Manley tract. OS1 has an area of approximately 208.5 acres. It has an average slope of 1.6%, and is vegetated with long prairie grasses and an occasional bush. The storm water from the west sheet flows east and then is collected by a roadside swale (S4) which functions as a borrow ditch along the westerly side of Curtis Road. The water is then routed southerly to DP1 where a 24" CMP has been installed to carry the water under Curtis Road. The water discharges into a natural swale with no distinction features. The water then is routed through the subdivision via a small grass lined nondescript swale.

This area has been described in two (2) other drainage reports. Each report has different areas and storm water flows. The following summarizes the area, method used to determine storm flow rates, and resulting flow rates. The Design point is the same for all three (3) and is located at the upstream end of the existing 24" CMP culvert installed under Curtis Road approximately 200 feet north of the Curtis Road/ Jones Road intersection.

1. **Law and Marrioti Report: Preliminary/ Final Drainage Report for Manly Subdivision**,
   Prepared by Law and Marrioti, approved by EPC September, 2000.
   - Design Point: DP1
   - Offsite area: 185 acres per the USGS mapping.
   - Method: Rational. The current EPS design standard states that the upper limit for using the Report Rational Method is 110 acres
   - Flow Rates at DP1
     Q5: 78.7 cfs
     Q100: 207 cfs

Clarify this is referring to the location of DP1 for this current drainage report and not from the referenced report.

2 **Windmill Flats Final Drainage Report ,**
Prepared by Berge-Brewer, March 2002

- Design Point: DP3
- Offsite area: 43 = (plus or minus) acres per the EPC GIS mapping.
- Method: TR55
- Flow Rates at DP1
  Q5: 20.4 cfs
  Q100: 92.5 cfs

Change to DP3

Area increased by over 2 times. Flow rates should not be the same with that big of a change.

eplat Report (this report): Preliminary/Final Drainage Letter/ report for e Manley Subdivision Replat:
repared by KCH Engineering Solutions, April 2022, to be reviewed and recorded by EPC.

- Design Point: DP1
- Offsite area: 208.5 acres per the EPC GIS mapping.
- Method: TR55
- Flow Rates at DP1
  Q5: 20.4 cfs
  Q100: 92.5 cfs

Copies of pertinent pages of each of the existing drainage reports are included in *Exhibit 5* of the Appendix

.

Please clarify statement. How are design flows being reduced?

VII. ONSITE DRAINAGE CHARACTERISTICS

It should be noted that the following hydrologic and hydraulic analyses were **only** done to determine the impact that the reduction in flows which is assume to be minimal.

This brief analysis was done only to note any impact that the reduction of the design flows would have on the existing drainage features. The **only** purpose for this replat is to change several lot lines and **not alter** or add to present drainage features. Therefore, there are no changes to any drainage facilities described in the Law and Marrioti report.

Onsite Drainage

The onsite subbasins shown on this Drainage Map are different than those shown on the Law and Marrioti Drainage Map. The Drainage Map developed for this report used the most up-to-date GIS Mapping to prepare a detailed and accurate location of hydrologic sub basins.

The following is a comparison of the stormwater generated by the **entire site** for both this report and the Law and Marrioti report;

Law and Marrioti Report (Exhibit 7, Appendix)

Contributing sub basins

Sub Basin OS-A (185 acres), sub basin A (23.4 acres) and subbasin B (16.5 acres)

Total Drainage Area: 224.90 acres

Law and Marrioti reports shows 6.8 cfs. Please revise.

Q5 Design Flows at DP2 and DP3

Q5: discharge at DP2 = 88.9 cfs, discharge at DP3 = 5.6 cfs;

Total Discharge from Onsite and offsite basins: 94.5 cfs: ,

Q100 Design Flows:

Q5: discharge at DP2 = 227 cfs, discharge at DP3 = 17.4 cfs;

Total Discharge from Onsite and offsite basins: 244.4 cfs: ,

Different maps should be different exhibit #'s

KCH Engineering Solutions (Exhibit 7, Appendix)

The following summarizes the area and storm discharge at pertinent Design Points

Drainage Areas

Area draining to DP2:

Sub Basin OS1 (208.50 acres), Sub basins A (14.3 acres), D (6.63 acres), and E (2.23 acres).

Total Drainage Area draining to DP2 231.66 acres..

Area draining to DP3:

Sub basin B (13.82 acres)

Total Drainage Area draining from DP3: 13.82 acres

Total area draining from the entire site: 245.48 acres

Design storm summary

The following summarizes the total runoff from the site *(Exhibit 8, Appendix}*

Q5 Design Flows at DP2 and DP3 and Sub basin C

The following combines storm water runoff amounts where the Rational Method was used (B and C) and amounts where the TR55 method was used (OS1, A, D, and E) *(Exhibit 8, Appendix).* It is assumed that the runoff amounts are additive.

This heading and paragraph is confusing, as DP3 and Basin C should not add to anything, as released flows are in different locations.

5-year storm

Sub basin B: 3.7 cfs (Rational)
Sub basin C:0.5 cfs (Rational)
Sub basins OS1, A, D, E (TR55)
Q5: 20.44 cfs

Total Q5: 24.64 cfs

100-year storm

Sub basin B: 27.3 cfs (Rational)
Sub basin C:3.5 cfs (Rational)
Sub basins OS1, A, D, E (TR55): 92.5 cfs

Total Q100: runoff: 123.3 cfs

The following is a summary of the estimated design flows at each design point. Since the location of the design points are different in the Law and Marrioti report only the total outflow from the site was compared. It should be noted the TR55 Method was used for drainage areas greater than 110 acres instead of the Rational Method used in the Law and Marrioti report.

Highlighted items do not match with summary table on drainage map in appendix. Please revise so both tables match.

Change basin name to OS-1 to match drainage map and text

Design Point	Sub Basins	Total Acres	Existing Runoff		
			Q5	100	
		(acres)	cfs	cfs	
1	OS-A	208.56	20.4	88	TR55 Method
2	OS- A, A, D, E	231.69	23.8	119.1	TR55/Rational Methods
3	B	13.82	3.7	27.3	Rational Method
4	OS- A, A, D,	229.4	23.4	116.10	TR55/Rational Methods

Please discuss swales 3,4,5,6,7, and 8. They are shown on the drainage map but are not discussed in the report.

Swales 4 & 7 do not need discussed as they are off but do include Swale 2.

Include discussion of existing 24" cmp. Does it overtop? If so, by how much? Outlet velocity? Does it have outlet protection, etc? Also include discussions for structures 2 and 3 which are labeled on the drainage map.

OS-A is not shown on the drainage map. Please revise map.

Design Point 4

Design Point 4 is located along the southerly boundary of the site adjacent to Jones Road at the location where the private driveway enters the site.

Hydrological Characteristics:

Drainage Area: 208.53 (OS-A, A, D)

Design Flow: OS-A: Q5= 23.9 cfs, Q100= 92.5cfs

Area and flows do not match with information on summary table on drainage map. Please revise accordingly.

Swale 2 (onsite):

Drainage Area: OS-A, A, D

Design Flow: 5yr 23.9:, 100yr: 92.5

Slope = 2.6%+/-

Depth of flow: 5yr= 0.6 ft, 100yr= 1.22 ft

Velocity: 5yr = 4.9 fps, 100yr = 7.3 fps

Max velocity for a natural swale per DCM table 10-4. Include discussion that current swale is stable, no signs of erosion, etc and no grading or changes to site, shall continue to remain stable. Include what overall depth of channel is and how much freeboard is provided, if any.

Please show design point 5 on the drainage map.

Design Point 5

DP 5 is located in a sump area located along the north side of Jones Road approximately 1,250 feet west of the southeast corner of the site. Currently, stormwater ponds in this area and then overtops the embankment and is routed to the Jones and Curtis Road intersection.

Please show design point 6 on the drainage map.

Design Point 6

DP 6 is located at the northeasterly corner of the site. Runoff from Sub basin C sheet flows offsite to a natural field. Not grading in this area is to be accomplished.

VIII. OFFSITE / ONSITE PROPOSED DRAINAGE CONDITIONS

The Proposed Conditions Map is the same as the Existing Conditions Map. Only one (1) map is required since the developed conditions is no different than the existing conditions.

IX. FULL SPECTRUM DETENTION POND

Criteria

El Paso County Engineering Criteria Manual, Appendix I, contains the policies and procedures for Stormwater Quality. Section I.7.1.B provides for exclusions to the requirements to provide Post Construction Stormwater Quality facilities. All areas of the ***Manley Subdivision*** project qualify for the allowed exemptions. No water quality or detention facilities are required for this site as discussed below.

The project consists of large single-family residential lots. No improvements are planned as part of this replat. There are no activities or improvements that require permanent water quality facilities for this project based on the exclusions found in Section I.7.1.5.B.2, Section I.7.1.5.B.3 and Section

Please clarify which exclusions are being referenced from the ECM. Provide the name of the exclusion for example ECM Appendix I.7.1.B.5 Large Lot Single Family Sites.

The total area of the site is 23.776 acres. All of the property is comprised of 5-acre (minimum), and greater, single-family residential lots. The total lot imperviousness for 5-acre rural residential lots is less than 10%. The Manley Tract will not need a detention pond since there will be no changes are proposed..

Please revise statement. Exclusions pertain to permanent water quality only.

X. FOUR STEP PROCESS

Since no physical changes are proposed from those described in the approved Law and Marrioti report. A discussion regarding the Four Step Process is not required.

XI. DRAINAGE/ BRIDGE FEE CALCULATIONS

Drainage Fees have already been paid and therefor none are due.

XII. SUMMARY

The initial Drainage Report for this site was prepared by Law and Marrioti and recorded by El Paso County in September of 2000. It was initially assumed that only a Drainage Letter would be required since the purpose of the replat was only to change a few the lot lines. However, since the runoff from the OS1 parcel was significantly lower than in the Law and Marrioti, a preliminary analysis of the downstream facilities was accomplished. Those changes are discussed in the above report.

The following was accomplished in this report;

a. Impacts due to changes in design flows and changes to the criteria.
b. The requirement for a FSD pond was also evaluated.
c. Additional preliminary analysis for the reduced offsite flow as it is routed through the Manley property. This routing is the same as the conditions when the Law and Marrioti report was approved.
d. This Drainage Letter was prepared in accordance with the current criteria.

.

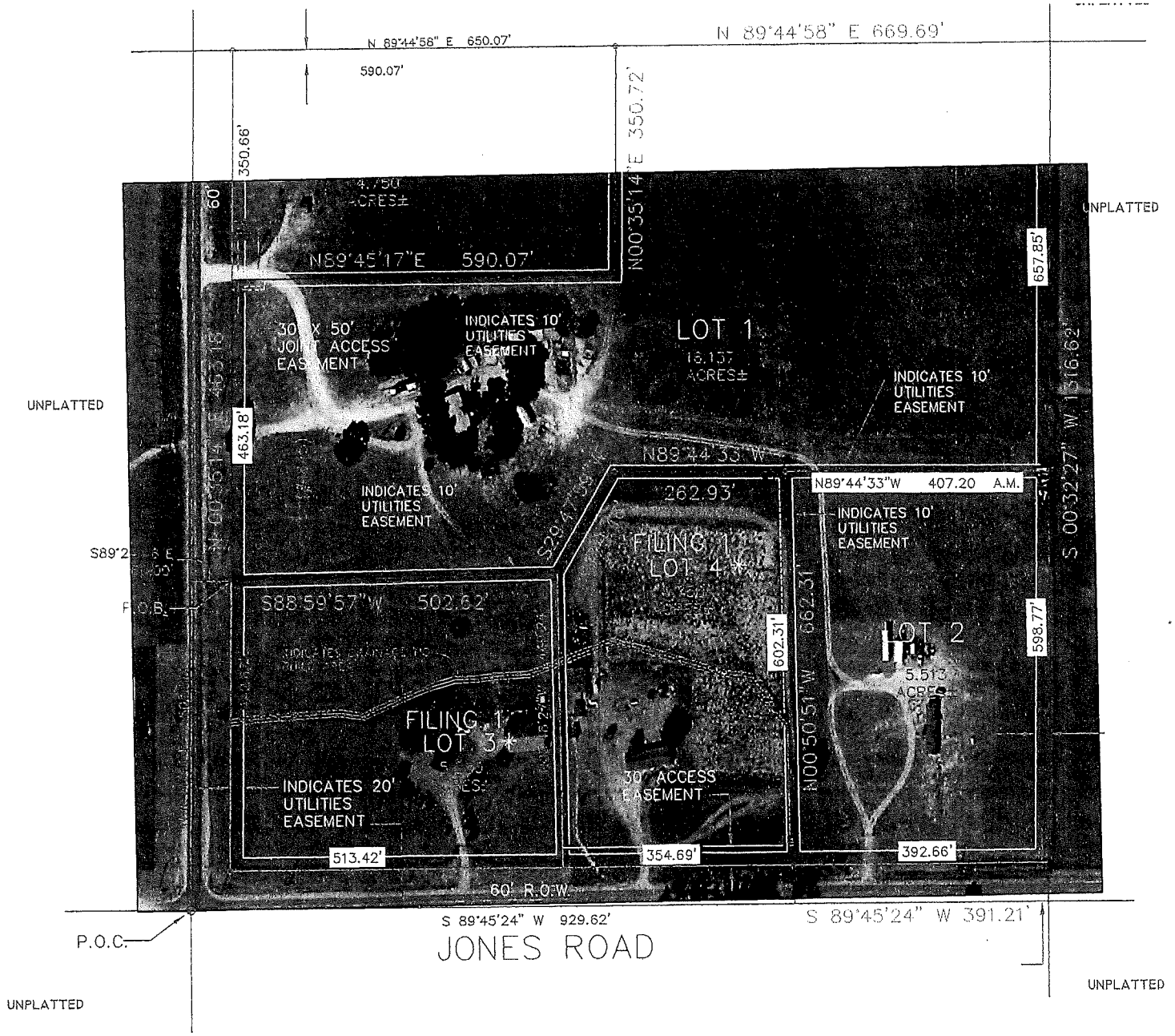
Even though this report was prepared in greater detail in order to meet current El Paso County Drainage criteria, **no drainage improvements** are required.

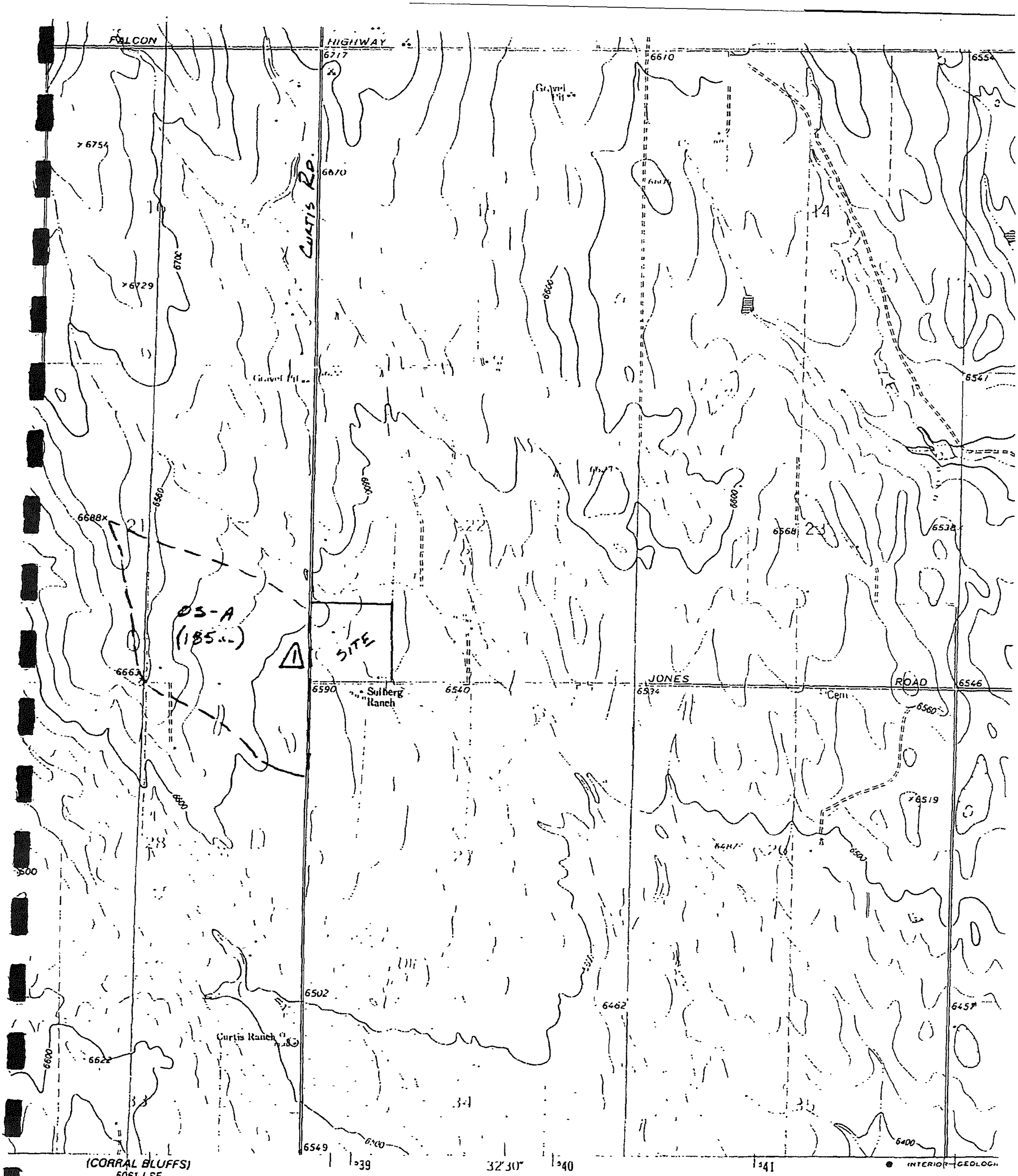
Please confirm there will be no adverse impacts to downstream properties or existing stormwater runoff patterns.

Specify drainage fees were paid with Manley Subdivision Filing No. 1. Please clarify if the drainage fees paid accounted for the "out parcel" per ECM Appendix L drainage fees are due if platting a tract. The drainage fees would be assessed only for the tract and impervious area if fees were not paid for the tract previously.

APPENDIX

Exhibit 1: Location Maps


N 89°44'58" E 650.07'
N 89°44'58" E 669.69'
590.07'
350.66'
N00°35'14"E 350.72'
4.750 ACRES±
N89°45'17"E 590.07'
60'
UNPLATTED
657.85'
30' X 50' JOINT ACCESS EASEMENT
INDICATES 10' UTILITIES EASEMENT
LOT 1
16.157 ACRES±
INDICATES 10' UTILITIES EASEMENT
UNPLATTED
463.18'
N89°44'33"W
N89°44'33"W 407.20 A.M.
INDICATES 10' UTILITIES EASEMENT
262.93'
FILING 1
LOT 4*
S89°2
F.O.B.
S88°59'57"W 502.62'
602.31'
LOT 2
5.513 ACRES±
598.77'
FILING 1
LOT 3*
INDICATES 20' UTILITIES EASEMENT
30' ACCESS EASEMENT
513.42'
354.69'
392.66'
60' R.O.W.
S 89°45'24" W 929.62'
S 89°45'24" W 391.21'
P.O.C.
JONES ROAD
UNPLATTED
UNPLATTED



SCALE 1:24 000

0 1 MILE

2000 3000 4000 5000 6000 7000 FEET

.5 0 1 KILOMETER

INTERVAL 20 FEET

RO

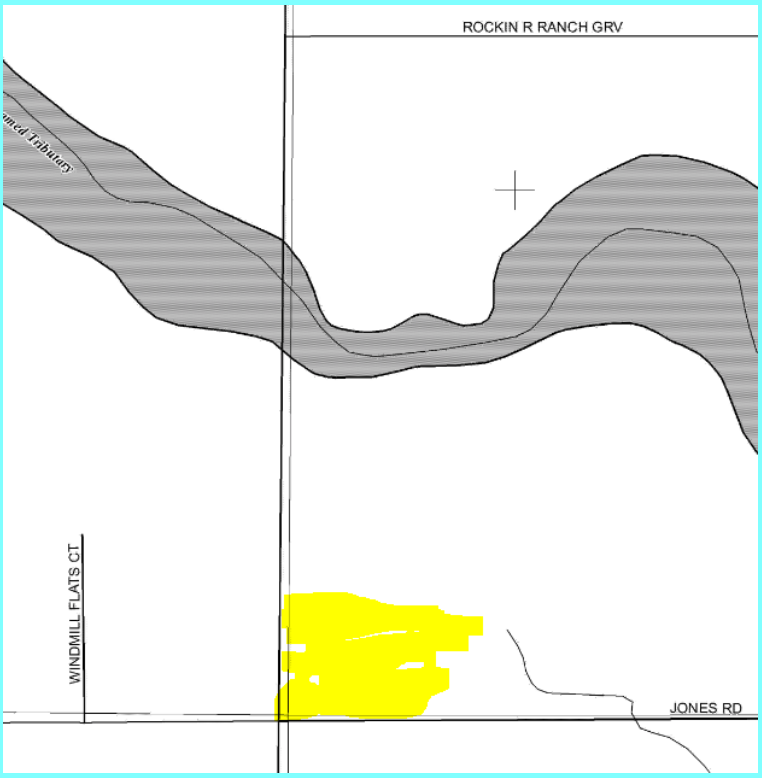
Heavy-duty

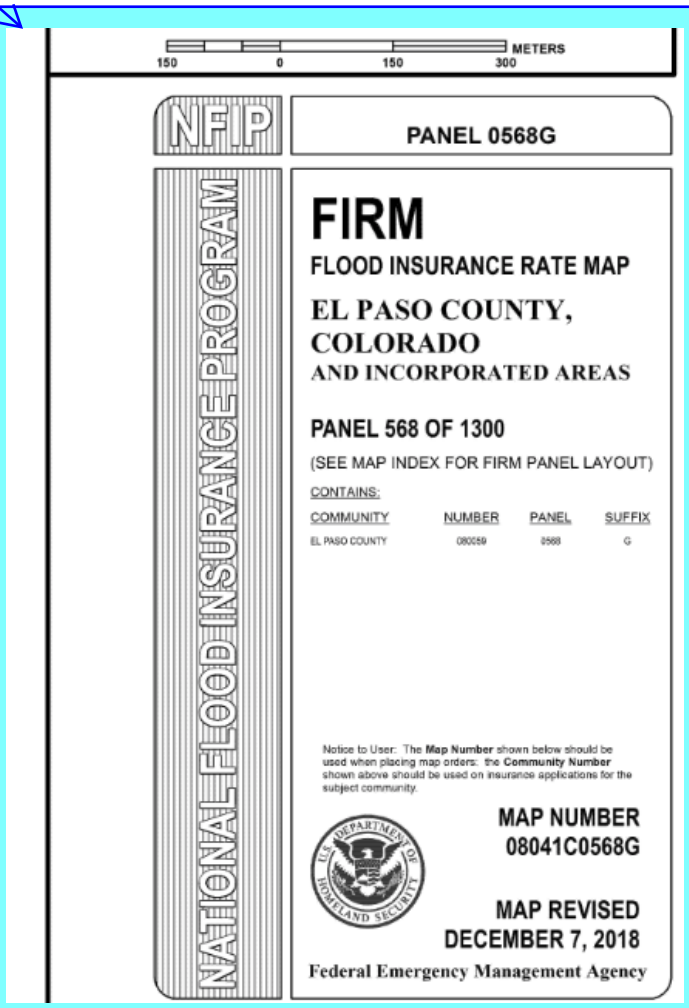
Unim

U.S. R

Exhibit 2: FEMA FIRM Map

Please verify the FEMA FIRM Map provided on page 18. The map does not appear to be the correct one or most recent FIRM Map. Please see attached images below showing the FIRM Map from FEMA.





NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 575 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

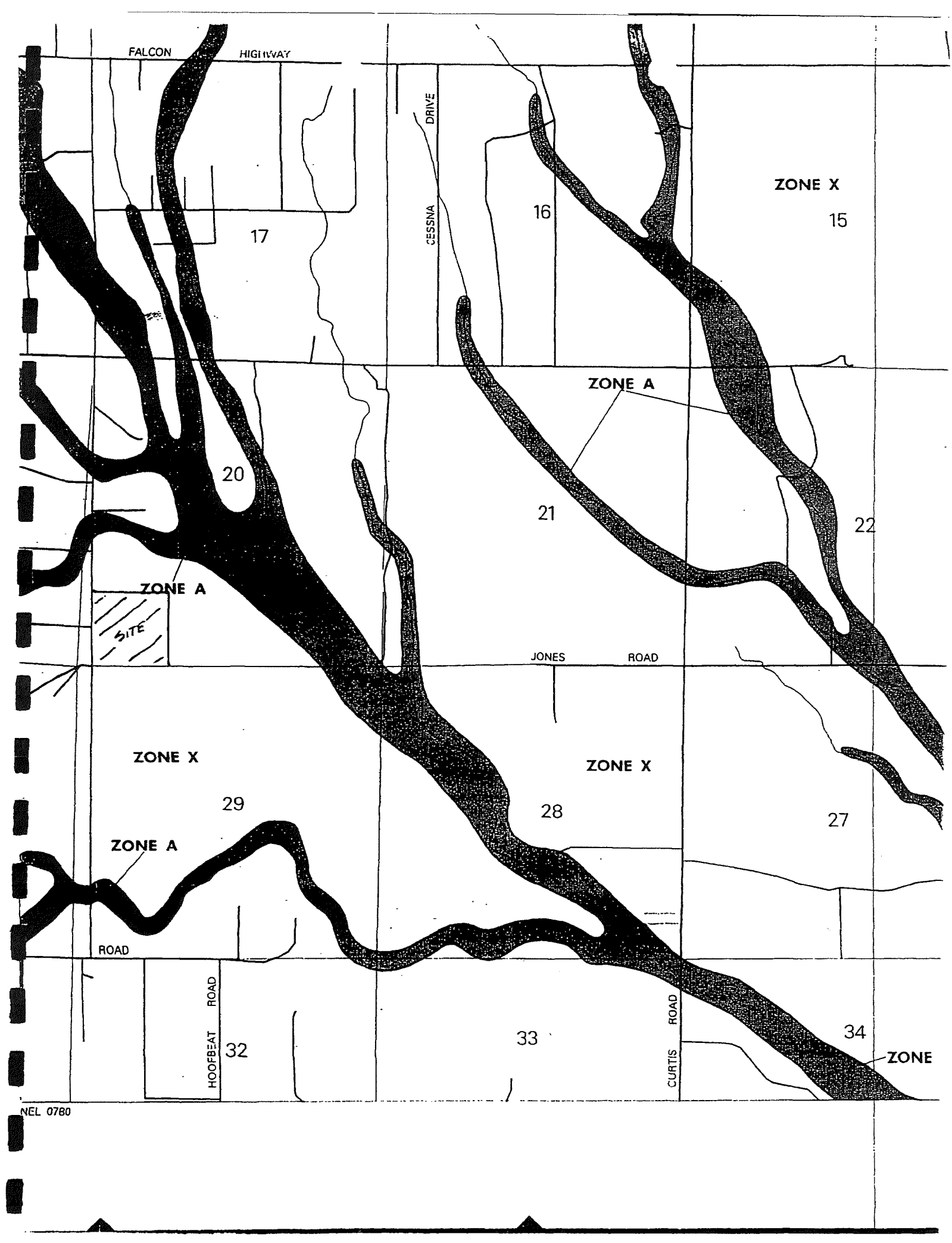
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080080	0575	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0575	F

MAP NUMBER
08041C0575 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

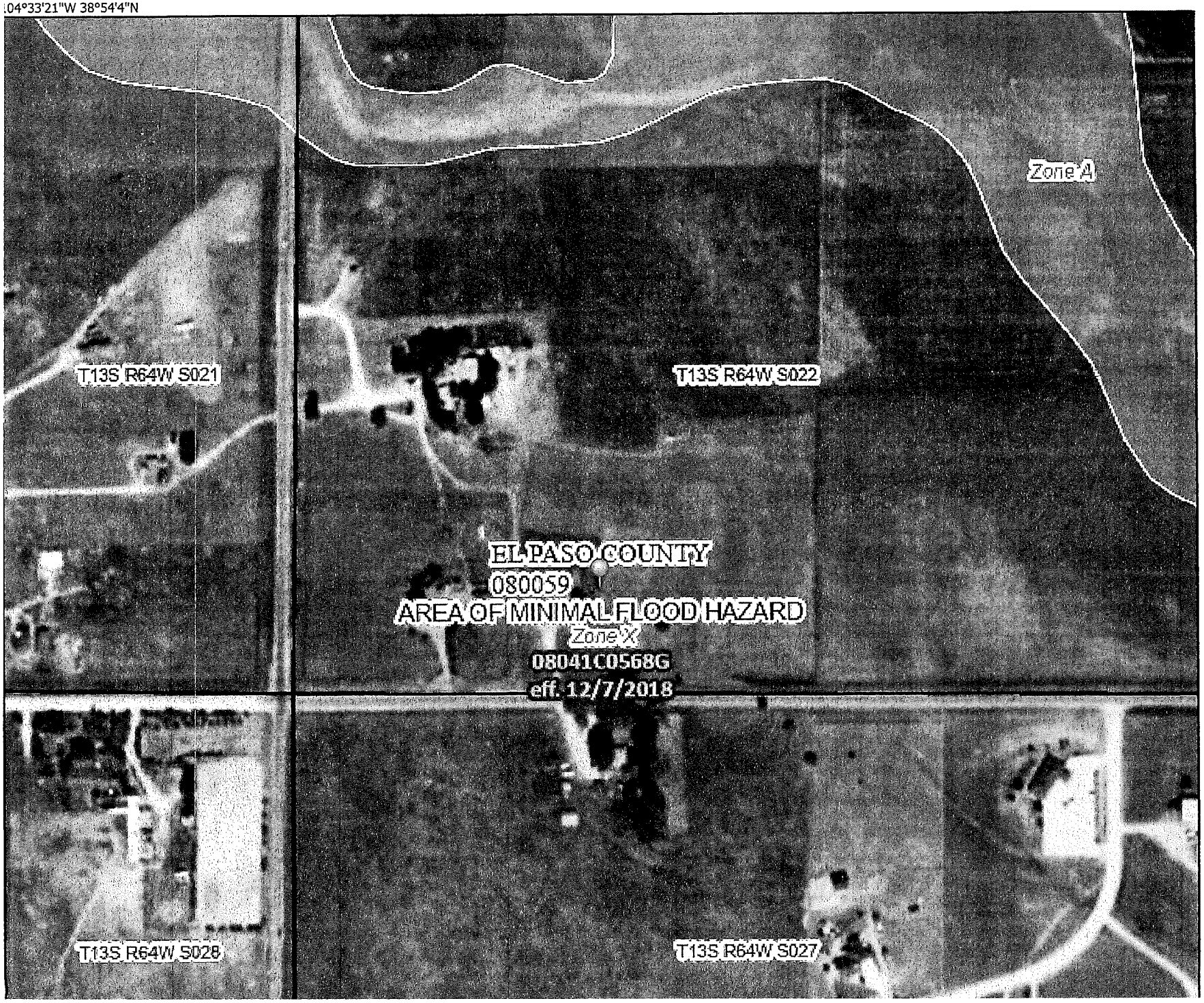
See comment from the last page. This does not seem to be the correct FIRM # or map.


FALCON
HIGHWAY
DRIVE
CESSNA
ZONE X
16
15
17
ZONE A
20
21
22
ZONE A
SITE
JONES
ROAD
ZONE X
ZONE X
29
28
27
ZONE A
ROAD
HOOFBEAT
ROAD
32
33
CURTIS
ROAD
34
ZONE
NEL 0780

National Flood Hazard Layer FIRMette

FEMA

104°33'21"W 38°54'4"N



Legend

SEE FIS REPORT FOR DETAILED LE

SPECIAL FLOOD HAZARD AREAS

OTHER AREAS OF FLOOD HAZARD

NO SCREE

OTHER AREAS

GENERAL STRUCTURES

OTHER FEATURES

MAP PANELS

The p
point
an a

This map complies with
digital flood maps if it i
The basemap shown co
accuracy standards

The flood hazard inform

Exhibit 3: SCS Soils Map and Data

United States Department of Agriculture

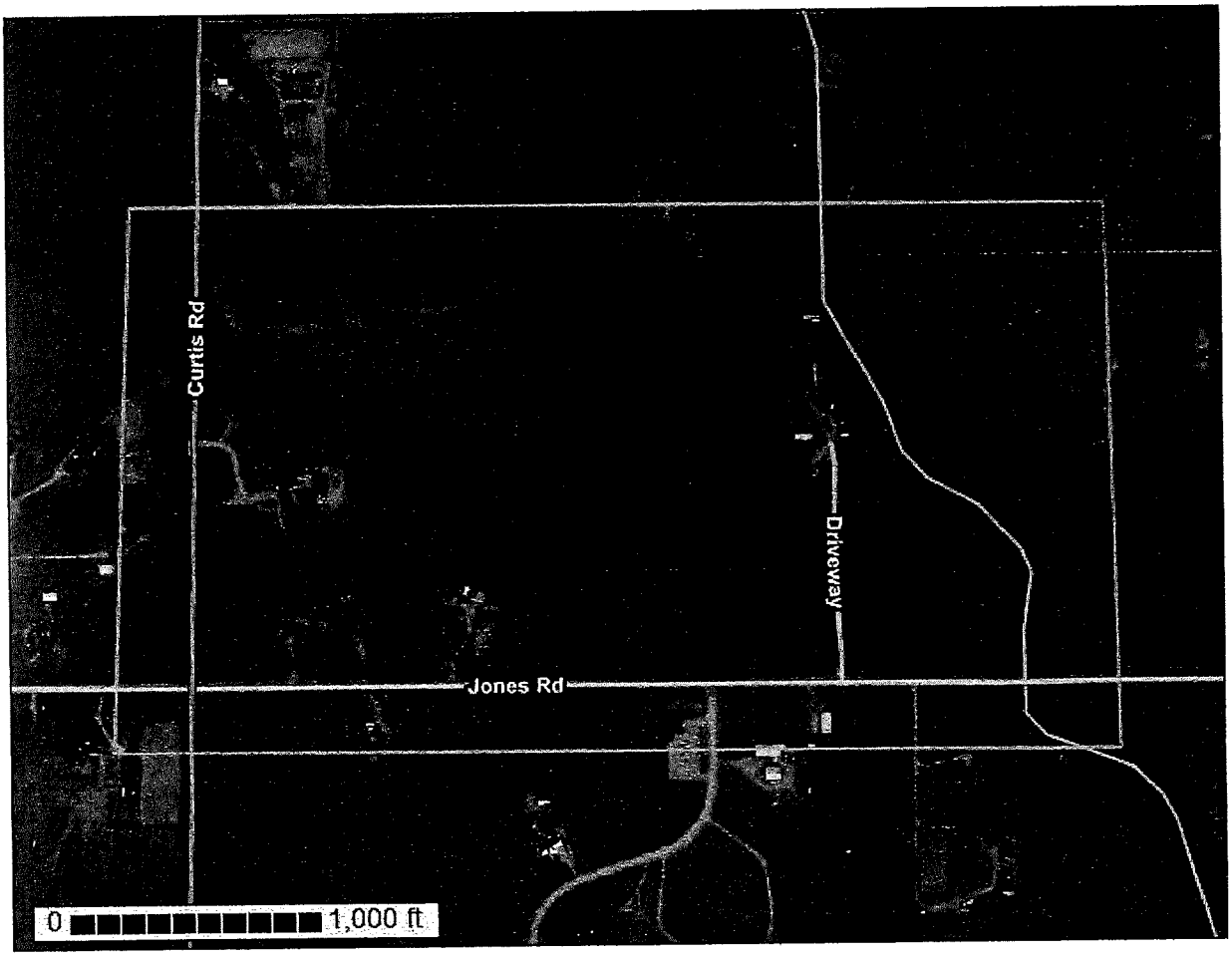
NRCS

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

Manley Subdivision



February 7, 2022

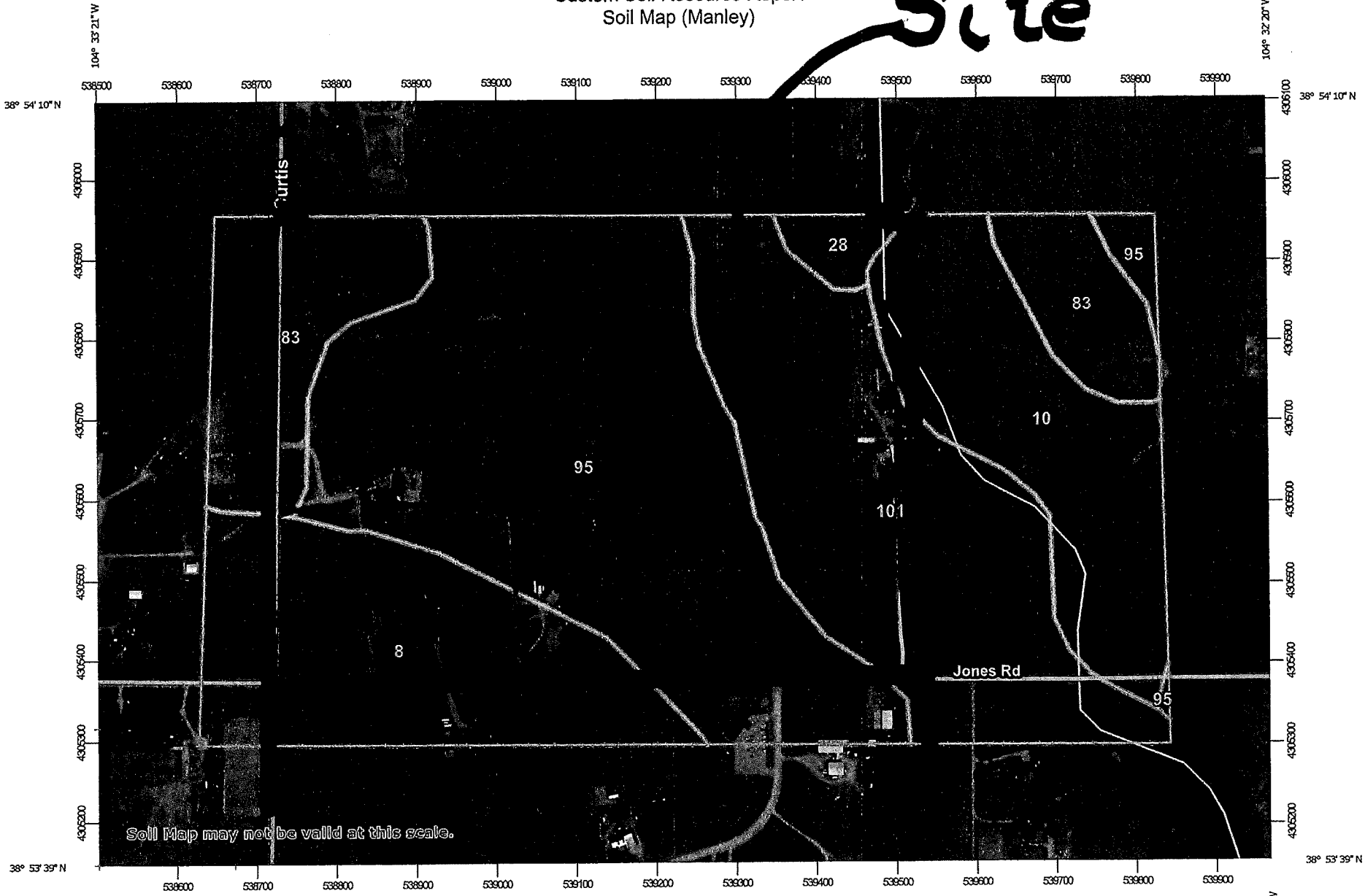
Contents

Soil Map

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

Custom Soil Resource Report
Soil Map (Manley)

Site



Map Scale: 1:6,700 if printed on A landscape (11" x 8.5") sheet.

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

N

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 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.

Map Unit Legend (Manley)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	31.9	16.3%
10	Blendon sandy loam, 0 to 3 percent slopes	25.9	13.3%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	2.5	1.3%
83	Stapleton sandy loam, 3 to 8 percent slopes	23.8	12.2%
95	Truckton loamy sand, 1 to 9 percent slopes	67.8	34.7%
101	Ustic Torrifluvents, loamy	43.5	22.3%
Totals for Area of Interest		**195.4**	**100.0%**

Map Unit Descriptions (Manley)

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

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

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

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 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

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: 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
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 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

Blendon and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Terraces, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting
National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition
Ellicott and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting
Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively 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: FrequentNone
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R069XY031CO - Sandy Bottomland LRU's A and B
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 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: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): 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 8 percent
Depth to restrictive feature: More than 80 inches
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 supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

95—Truckton loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2yvrm
Elevation: 5,800 to 7,100 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 90 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Fan remnants, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: loamy sand
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
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
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 5 percent
Landform: Hills, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 5 percent
Landform: Terraces, interfluves
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Urban land

Percent of map unit: 2 percent
Hydric soil rating: No

Ellicott, occasionally flooded

Percent of map unit: 1 percent
Landform: Drainageways, flood plains
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

101—Ustic Torrifluvents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torrifluvents and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torrifluvents

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R069XY037CO - Saline Overflow LRU's A and B
Other vegetative classification: OVERFLOW (069BY036CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

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Exhibit 4: Charts, Tables and Correspondence

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.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

*For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Table 6-10. NRCS Curve Numbers for Frontal Storms & Thunderstorms for Developed Conditions (ARCII)

Fully Developed Urban Areas (vegetation established)[1]	Treatment	Hydrologic Condition	%I	Pre-Development CN			
				HSG A	HSG B	HSG C	HSG D
Open space (lawns, parks, golf courses, cemeteries, etc.):							
Poor condition (grass cover < 50%)	-----	-----	---	68	79	86	89
Fair condition (grass cover 50% to 75%)	-----	-----	---	49	69	79	84
Good condition (grass cover > 75%)	-----	-----	---	39	61	74	80
Impervious areas:							
Paved parking lots, roofs, driveways, etc. (excluding right-of-way	-----	-----	---	98	98	98	98
Streets and roads:							
Paved; curbs and storm sewers (excluding right-of-way)	-----	-----	---	98	98	98	98
Paved; open ditches (including right-of-way)	-----	-----	---	83	89	92	93
Gravel (including right-of-way)	-----	-----	---	76	85	89	91
Dirt (including right-of-way)	-----	-----	---	72	82	87	89
Western desert urban areas:							
Natural desert landscaping (pervious areas only)	-----	-----	---	63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)	-----	-----	---	96	96	96	96
Urban districts:							
Commercial and business	-----	-----	85	89	92	94	95
Industrial	-----	-----	72	81	88	91	93
Residential districts by average lot size:							
1/8 acre or less (town houses)	-----	-----	65	77	85	90	92
1/4 acre	-----	-----	38	61	75	83	87
1/3 acre	-----	-----	30	57	72	81	86
1/2 acre	-----	-----	25	54	70	80	85
1 acre	-----	-----	20	51	68	79	84
2 acres	-----	-----	12	46	65	77	82
Developing Urban Areas[1]	**Treatment[2]**	**Hydrologic Condition[3]**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Newly graded areas (pervious areas only, no vegetation)	-----	-----	---	77	86	91	94
Cultivated Agricultural Lands[1]	**Treatment**	**Hydrologic Condition**	**%I**	**HSG A**	**HSG B**	**HSG C**	**HSG D**
Fallow	Bare soil	-----	---	77	86	91	94
	Crop residue cover (CR)	Poor	---	76	85	90	93
		Good	---	74	83	88	90
Row crops	Straight row (SR)	Poor	---	72	81	88	91
		Good	---	67	78	85	89
	SR + CR	Poor	---	71	80	87	90
		Good	---	64	75	82	85
	Contoured (C)	Poor	---	70	79	84	88
		Good	---	65	75	82	86
	C + CR	Poor	---	69	78	83	87
		Good	---	64	74	81	85
	Contoured & terraced (C&T)	Poor	---	66	74	80	82
		Good	---	62	71	78	81
	C&T+ CR	Poor	---	65	73	79	81
		Good	---	61	70	77	80
Small grain	SR	Poor	---	65	76	84	88
		Good	---	63	75	83	87
	SR + CR	Poor	---	64	75	83	86
		Good	---	60	72	80	84
	C	Poor	---	63	74	82	85
		Good	---	61	73	81	84
	C + CR Poor	Poor	---	62	73	81	84
		Good	---	60	72	80	83
	C&T	Poor	---	61	72	79	82
		Good	---	59	70	78	81
	C&T+ CR	Poor	---	60	71	78	81
		Good	---	58	69	77	80

Table 4B-6 Values of the roughness coefficient, "n."

Type of Channel and Description	Manning's "n" (Normal)	Type of Channel and Description	Manning's "n" (Normal)
A. Constructed Channels		6. Sluggish reaches, weedy	
a. *Earth, straight and uniform*		deep pools	0.070
1. Clean, recently completed	0.018	7. Very weedy reaches, deep	
2. Gravel, uniform selection,	0.025	pools, or floodways with	
clean		heavy stand of timber and	
3. With short grass, few	0.027	underbrush	0.100
weeds		b. *Mountain streams, no vegetation*	
b. *Earth, winding and sluggish*		*in channel, banks usually steep,*	
1. No vegetation	0.025	*trees and brush along banks*	
2. Grass, some weeds	0.030	*submerged at high stages*	
3. Dense weeds or aquatic		1. Bottom: gravel, cobbles, and	
plants in deep channels	0.035	few boulders	0.040
4. Earth bottom and rubble		2. Bottom: cobbles with large	
sides	0.030	boulders	0.050
5. Stony bottom and weedy		B-2 Flood plains	
banks	0.035	a. *Pasture, no brush*	
6. Cobble bottom and clean		1. Short grass	0.030
sides	0.040	2. High grass	0.035
c. *Rock-lined*		b. *Cultivated areas*	
1. Smooth and uniform	0.035	1. No crop	0.030
2. Jagged and irregular	0.040	2. Mature row crops	0.035
d. *Channels not maintained,*		3. Mature field crops	0.040
weeds and brush uncut		c. *Brush*	
1. Dense weeds, high as flow		1. Scattered brush, heavy	
depth	0.080	weeds	0.050
2. Clean bottom, brush on		2. Light brush and trees	0.060
sides	0.050	3. Medium to dense brush	0.070
3. Same, highest stage of		4. Heavy, dense brush	0.100
flow	0.070	d. *Trees*	
4. Dense brush, high stage	0.100	1. Dense willows, straight	0.150
B. Natural Streams		2. Cleared land with tree	
B-1 Minor streams (top width at		stumps, no sprouts	0.040
flood stage < 100 ft.)		3. Same as above, but with	
a. *Streams on plain*		heavy growth of sprouts	0.060
1. Clean, straight, full stage,		4. Heavy stand of timber, a few	
no rifts or deep pools	0.030	downed trees, little	
2. Same as above, but more		undergrowth, flood stage	
stones and weeds	0.035	below branches	0.100
3. Clean, winding, some		5. Same as above, but with	
pools and shoals	0.040	flood stage reaching	
4. Same as above, but some		branches	0.120
weeds	0.040		
5. Same as 4, but more stones	0.050		

*Note: These "n" values are "normal" values for use in analysis of channels. For conservative design for channel capacity, the maximum values listed in other references should be considered. For channel bank stability, the minimum values should be considered.

From: Daniel Torres
Sent: Thursday, March 18, 2021 8:22 AM
To: 'KEN HARRISON'
Subject: RE: Rural Road Construction Document examples

Hi Ken,

I have provided answers to your questions below in blue:

Does the Drainage Letter need to address the updated criteria? Yes. The drainage letter should be done per the current criteria. There are also several mistakes in the report. It uses the Rational Method for 185 acres which is currently limited to less than 100 acres. Does this need to be addressed in the Drainage Letter? Any previous errors should be noted/addressed in the report. Nothing was stated in the report about a FSD pond either. Will this have to be addressed even though the Drainage Report was approved? Yes. Detention should be addressed for the site in question. Whether detention is needed depends on your analysis of the site and development proposed. Also does El Paso County have similar requirements for Drainage Letters since they have adopted the majority of the C/CS Drainage Criteria Manuals? Our drainage criteria manual can be found on the County website (Engineering - El Paso County Planning Development). DCM vol. 1 Chapter 4 has the requirements for drainage letters and reports.

If this is for a specific project that you have submitted for review in the County, I can get you in touch with the review engineer that has been assigned the project to better answer any of your questions. Additionally, the review engineer would know the specifics of the project and can tell you what you will need to provide. My answers above are for most projects in general.

Respectfully,

Daniel Torres, P.E.
Engineer II
El Paso County
Planning and Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910
(719) 520-6300 (Main)
(719) 520-6305 (Direct)
www.elpasoco.com

PERSONAL WORK SCHEDULE
Monday - Thursday, 7:00 am to 5:30 pm

DEPARTMENT HOURS
Monday - Friday, 7:30 am to 4:30 pm

NOTE: In an effort to be respectful of the health of our employees, family, and all citizens in El Paso County, we are limiting our face-to-face public interactions. During this timeframe we will be making every effort to operate "business as usual". All phone calls and emails will be returned, projects reviewed, and necessary meetings held via conference call. Thank you for your patience. Be safe!

WE NEED YOUR HELP! The Planning and Community Development Department has been working on revising the Master Plan for El Paso County. Once adopted, this plan will help guide development for the next 20 years. The draft version of this plan is now available for public review and we are seeking public comments on the draft plan until April 9, 2021. You may do so here: https://elpaso.hlplanning.com/pages/draft-plan-outreach Thank you in advance for your feedback!

From: KEN HARRISON <ksharrison5228@msn.com>
Sent: Friday, March 12, 2021 4:18 PM
To: Daniel Torres <DanielTorres@elpasoco.com>
Subject: RE: Rural Road Construction Document examples

Thanks Daniel. I have another issue that I would like to discuss with you. An existing tract was platted in 2001 with a Drainage Report submitted and approved. The owners wish to replat the property and need a Drainage Letter. The purpose of the replat is only to reconfigure lots and not change anything about the development. The proposed development will stay the same. However, the current approved report was prepared using the 2001 criteria. The current criteria has a significant revisions. Does the Drainage Letter need to address the updated criteria? There are also several mistakes in the report. It uses the Rational Method for 185 acres which is currently limited to less than 100 acres. Does this need to be addressed in the Drainage Letter? Nothing was stated in the report about a FSD pond either. Will this have to be addressed even though the Drainage Report was approved? Also does El Paso County have similar requirements for Drainage Letters since they have adopted the majority of the C/CS Drainage Criteria Manuals?

Thanks for you time!

Kenneth Harrison
KCH Engineering Solutions, LLC
719-246-4471
ksharrison5228@msn.com

From: Daniel Torres
Sent: Tuesday, March 9, 2021 1:20 PM
To: KEN HARRISON
Subject: Rural Road Construction Document examples

Hi Ken,

I have provided a few projects that have a rural local roadways within their construction documents. They can be found on EDARP by searching the following file numbers or clicking on the link provided.

SF207: Project Details - EDARP (epcdevplanreview.com)
SF1911: Project Details - EDARP (epcdevplanreview.com)
SF1824: Project Details - EDARP (epcdevplanreview.com)

Respectfully,

Daniel Torres, P.E.
Engineer II
El Paso County
Planning and Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910
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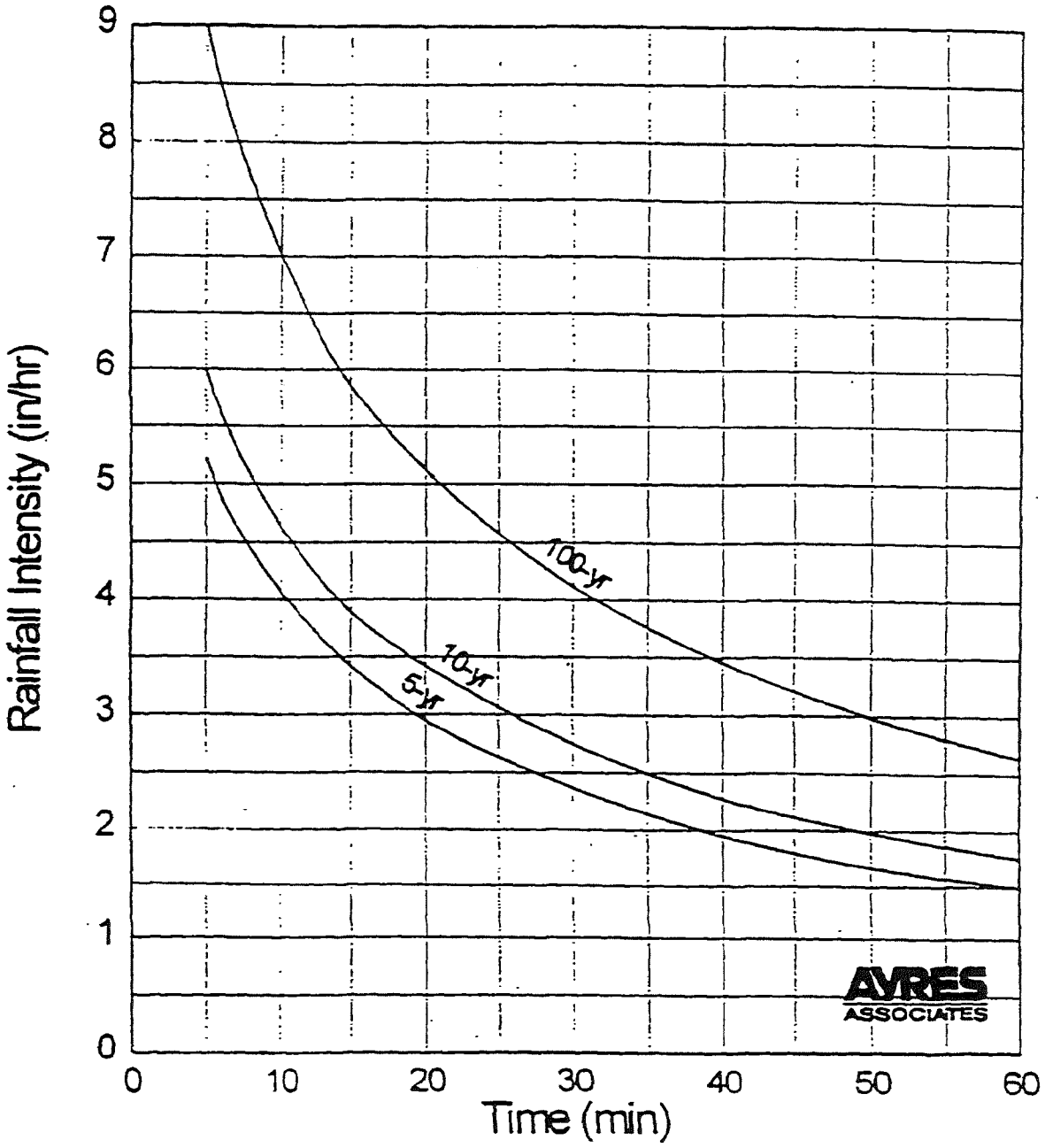


Interim Release October 12, 1994 , Rainfall Intensity Curves
City Of Colorado Springs Drainage Criteria Manual

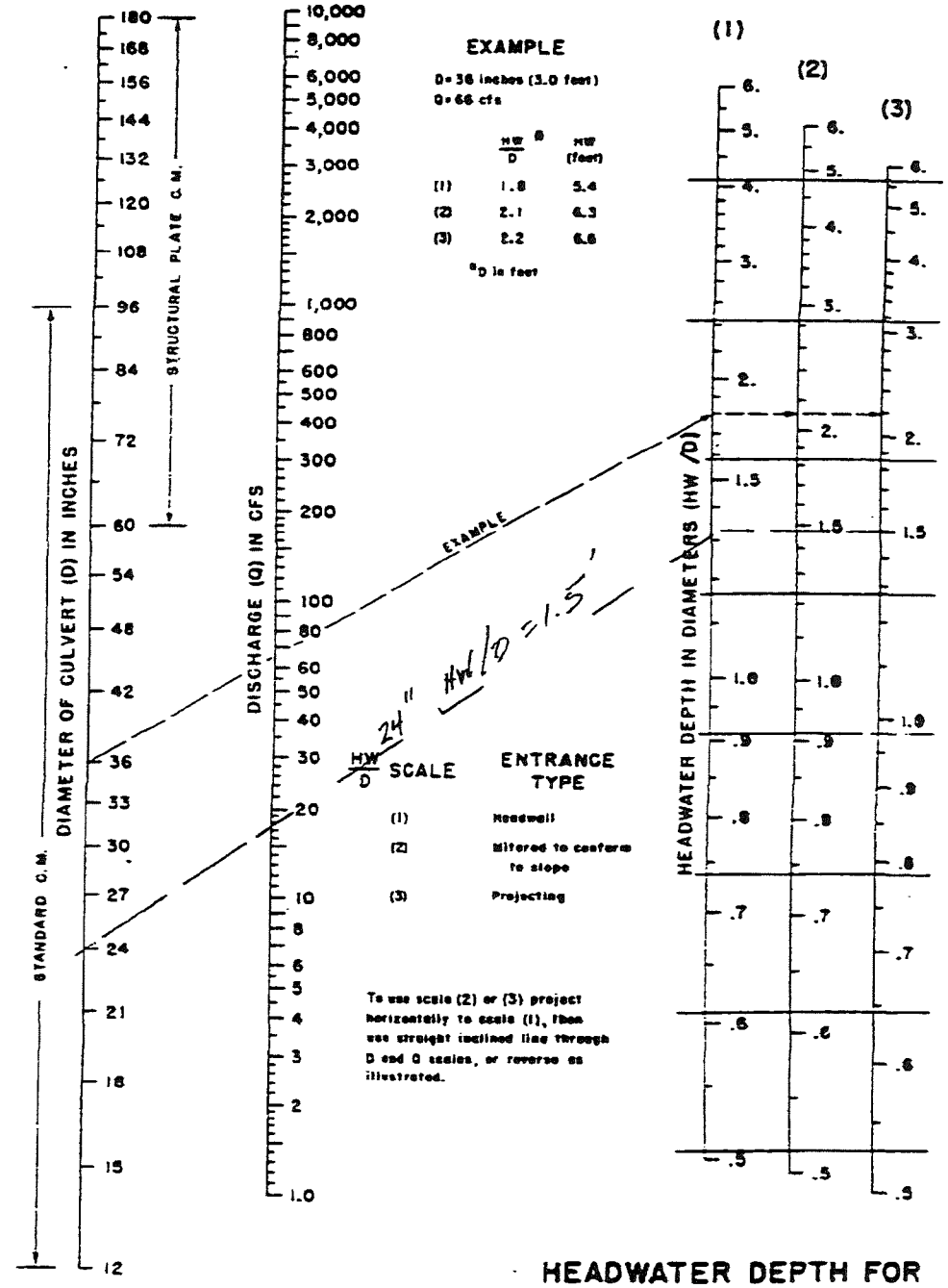
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

Exhibit 5: Drainage Basin Planning Study Exhibits

El Paso County Drainage Basin Fees

Resolution No. 21-468

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2022 Drainage Fee (per Impervious Acre)	2022 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$11,891	$1,755
CHWS1200	Chico Creek	2001	Bennett Ranch	$13,312	$5,106
CHWS1400	Chico Creek	2013	Falcon	$34,117	$4,687
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$14,470	$4,281
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$21,134	$2,729
FOFO2800	Fountain Creek	1988*	Widefield	$21,134	$0
FOFO2900	Fountain Creek	1988*	Security	$21,134	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$21,134	$317
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$12,891	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$15,243	$1,156
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$21,134	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$21,814	$8,923
FOFO4200	Fountain Creek	1977	Spring Creek	$10,961	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$21,134	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$21,134	$1,156
FOFO5800	Fountain Creek	1964	Camp Creek	$2,342	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$13,291	$294
FOMO1200	Monument Creek	1977	Templeton Gap	$13,644	$317
FOMO2000	Monument Creek	1971	Pulpit Rock	$7,008	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$21,134	$1,156
FOMO2400	Monument Creek	1966	Dry Creek	$16,684	$604
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$9,595	$604
FOMO3700	Monument Creek	1987*	Middle Tributary	$17,636	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$21,134	$0
FOMO4000	Monument Creek	1996	Smith Creek	$8,616	$1,156
FOMO4200	Monument Creek	1989*	Black Forest	$21,134	$575
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$21,134	$1,156
FOMO5300	Fountain Creek	1993*	Crystal Creek	$21,134	
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$19,830	
CHEC0400	Chico Creek		Upper East Chico	$10,803	$313
CHWS0200	Chico Creek		Telephone Exchange	$11,870	$278
CHWS0400	Chico Creek		Livestock Company	$19,552	$233
CHWS0600	Chico Creek		West Squirrel	$10,192	$4,229
CHWS0800	Chico Creek		Solberg Ranch	$21,134	$0
FOFO1200	Fountain Creek		Crooked Canyon	$6,381	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$5,327	$310
FOFO1600	Fountain Creek		Sand Canyon	$3,849	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$21,134	$989
FOFO2200	Fountain Creek		Fort Carson	$16,684	$604
FOFO2700	Fountain Creek		West Little Johnson	$1,392	$0
FOFO3800	Fountain Creek		Stratton	$10,137	$453
FOFO5000	Fountain Creek		Midland	$16,684	$604
FOFO6000	Fountain Creek		Palmer Trail	$16,684	$604
FOFO6800	Fountain Creek		Black Canyon	$16,684	$604
FOMO4600	Monument Creek		Beaver Creek	$12,635	$0
FOMO3000	Monument Creek		Kettle Creek	$11,413	$0
FOMO3400	Monument Creek		Elkhorn	$1,917	$0
FOMO5000	Monument Creek		Monument Rock	$9,160	$0
FOMO5400	Monument Creek		Palmer Lake	$14,647	$0
FOMO5600	Monument Creek		Raspberry Mountain	$4,927	$0
PLPL0200	Monument Creek		Bald Mountain	$10,500	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,702	$0
FOMO4400	Monument Creek		Jackson Creek	$8,365	$0
FOMO4800	Monument Creek		Teachout Creek	$5,809	$873

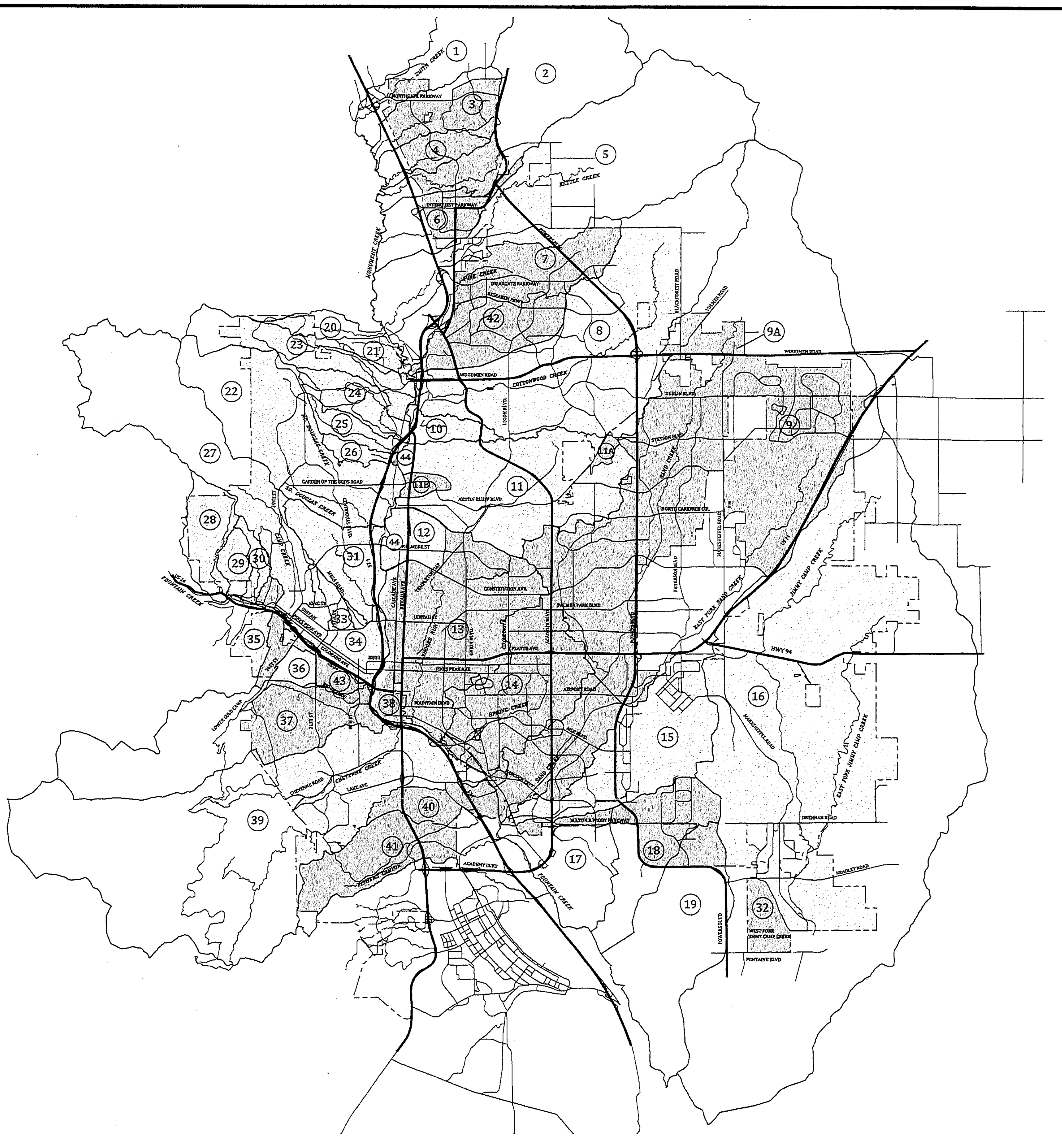
Area falls within Solbert Ranch drainage basin not Black Squirrel Creek

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of $7,285 per impervious acre shall be provided to secure payment of additional fees in the event that the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (9/14/06) and Resolution 16-320 (9/07/16).

EPC Stormwater Management *Jennifer Irvine, P.E.*



LEGEND

- CITY LIMITS
- BASIN BOUNDARY
- 2014 DCM
- POST-1987 DCM
- PRE-1987 DCM
- UNSTUDIED
- (1) BASIN NUMBER

BASIN NUMBER	BASIN NAME
1	SMITH CREEK
2	BLACK SQUIRREL CREEK
3	MONUMENT BRANCH
4	MIDDLE TRIBUTARY
5	KETTLE CREEK
6	ELKHORN
7	PINE CREEK
8	COTTONWOOD CREEK
9	SAND CREEK
9A	UPPER SAND CREEK
10	PULPIT ROCK
11	NORTH SHOOKS RUN TEMPLETON GAP BASIN
11A	SHOOKS RUN NORTH TEMPLETON GAP BASIN A
11B	ADDENDUM NORTH SHOOKS RUN TEMPLETON GAP BASIN
12	UNSTUDIED MISCELLANEOUS BASIN
13	SHOOKS RUN
14	SPRING CREEK
15	PETERSON FIELD
16	JIMMY CAMP CREEK
17	LITTLE JOHNSON RESERVOIR
18	WINDMILL GULCH
19	BIG JOHNSON RESERVOIR CREWS GULCH
20	UNSTUDIED

BASIN NUMBER	BASIN NAME
21	UNSTUDIED
22	DOUGLAS CREEK
23	DRY CREEK
24	ROCKRIMMON NORTH
25	ROCKRIMMON SOUTH
26	POPES BLUFF
27	CAMP CREEK
28	BLACK CANYON
29	BALANCED ROCK
30	COLUMBIA ROAD
31	MESA DRAINAGE BASIN
32	WEST FORK JIMMY CAMP CREEK
33	NINETEENTH STREET
34	WESTSIDE BASIN
35	MIDLAND BASIN
36	TWENTY-FIRST STREET SOUTH
37	BEAR CREEK
38	MONUMENT CREEK
39	SOUTHWEST AREA UPPER CHEYENNE CREEK, CHEYENNE RUN, AND SPRING RUN
40	STRATTON BASIN
41	FISHERS CANYON
42	SOUTH PINE CREEK
43	FOUNTAIN CREEK
44	ROSWELL

0 4000' 8000'
SCALE: 1"=4000'

Project No.:	17002
Date:	7/13/17
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	

DRAINAGE BASIN PLANNING STUDY INVENTORY

CITY OF COLORADO SPRINGS, COLORADO

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

Remove any exhibits from Black Squirrel DBPS as project site is not within that basin.

DESIGN POINT	10-YEAR * (cfs)	100-YEAR * (cfs)	COMMENT
1	86	307	A
2	182	773	A,B
3	194	686	C
4	405	1825	A,B,C,D,E
5	496	1832	F
6	1118	4158	A thru H
7	1154	4389	A thru I
8	1129	4051	A thru J
9	1104	3956	A thru K
10	1098	3950	A thru L

* 24 HOUR STORM

EXISTING STOCK POND

2-60" CMP's

END FEMA FLOODPLAIN - SEE F.I.R.M. PANEL 40-B DEC. 16, 1986

POND PERMITTED BY STATE ENGINEER

HYDROLOGICAL SOIL GROUP C BOUNDARY

HYDROLOGICAL SOIL GROUP A BOUNDARY

ODH 2 PIER BRIDGE
SPAN 84'-0" WIDTH 100'-0"
DECK 4'-0" HEIGHT 18'-0"

TWIN HORSESHOE CULVERTS AT RAILROAD CROSSING
20'-0" x 20'-0" w/ 10'-0" RADIUS

CORRUGATED METAL UNDERPASS PIPE
RISE 15'-0" SPAN 15'-8"

ARKANSAS RIVER BASIN

B 435 | D 396 | E 348 | F 2115 | G 243 | H 790 | I 601 | J 554 | K 592 | L 92

GLENEAGLE | NORTHGATE | BRIARGATE | AFA

BLACK SQUIRREL CREEK

Exhibit 6: Existing Plat and Replat

Replat

N 89°44'58" E 650.07'

N 89°44'58" E 669.69'

590.07'

350.66'

N00°35'14"E 350.72'

4.750 ACRES±

60'

15'

N89°45'17"E 590.07'

UNPLATTED

657.85'

UNPLATTED

30' X 50' JOINT ACCESS EASEMENT

INDICATES 10' UTILITIES EASEMENT

LOT 1

16.137 ACRES±

INDICATES 10' UTILITIES EASEMENT

463.18'

N89°44'33"W

INDICATES 10' UTILITIES EASEMENT

262.93'

N89°44'33"W 407.20 A.M.

INDICATES 10' UTILITIES EASEMENT

S29°47'59"E

FILING 1 LOT 4*

4.750 ACRES±

S89°24'46"E 60.00'

P.O.B.

S88°59'57"W 502.62'

INDICATES DRAINAGE/NO BUILD AREA

442.63'

449.24'

602.31'

662.31'

N00°50'51"W

598.77'

LOT 2

5.513 ACRES±

FILING 1 LOT 3*

5.290 ACRES±

INDICATES 20' UTILITIES EASEMENT

30' ACCESS EASEMENT

513.42'

354.69'

392.66'

60' R.O.W.

S 89°45'24" W 929.62'

S 89°45'24" W 391.21'

P.O.C.

JONES ROAD

UNPLATTED

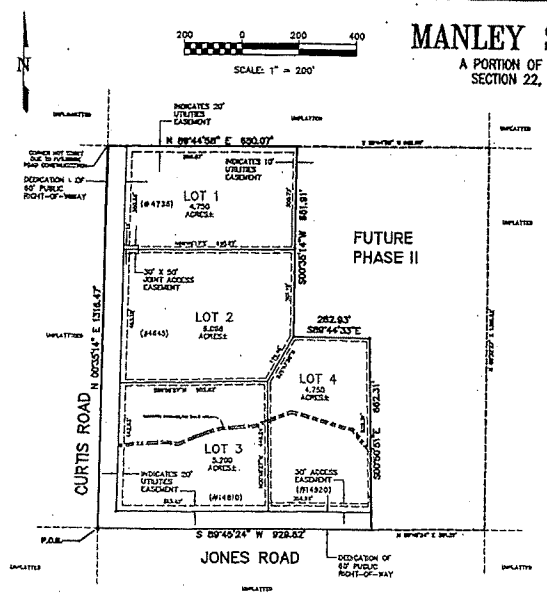
UNPLATTED

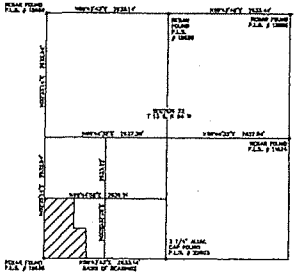
1296

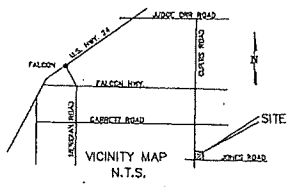
MANLEY SUBDIVISION FILING NO. 1

11223

A PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 13 SOUTH, RANGE 64 WEST, OF THE 6th P.M., COUNTY OF EL PASO, STATE OF COLORADO







KNOW ALL MEN BY THESE PRESENTS:

That JERRY L. & NANCY MANLEY, being the owners of the following described tract of land to wit:

A Tract of Land Being a Portion of the Southwest 1/4 of the Southwest 1/4 of Section 22, Township 13 South, Range 64 West, of the 6th P.M., El Paso County, Colorado, Described as follows:

BEGINNING at the Southwest corner of said Section 22, Township 13 South, Range 64 West, of the 6th P.M.;

THENCE N 00°35'14" E along the Westerly line of said Section 22, 1316.47 feet to the Northwest corner of the Southwest 1/4 of the Southwest 1/4 of said Section 22;

THENCE N 89°44'56" E along the north line of said Southwest 1/4 of the Southwest 1/4, 650.07 feet;

THENCE S 00°35'14" W, 651.91 feet;

THENCE S 89°44'33" E, 282.93 feet;

THENCE S 00°50'51" E, 662.31 feet to the South line of said Section 22;

THENCE along said South line of said Section 22, S 89°45'24" W, 929.62 feet to the POINT OF BEGINNING.

CONTAINING a computed area of 23.778 acres.

DEDICATION:

The above owner has caused said tract of land to be surveyed and platted into lots, road right-of-way and easements as shown on the accompanying plat, which plat is drawn to a fixed scale as indicated thereon and accurately sets forth the boundaries and dimensions of said tract and the locations of said lots, road right-of-way and easements, and which tract so platted shall be known as MANLEY SUBDIVISION FILING NO. 1, El Paso County, Colorado. All road right-of-way as platted are hereby dedicated to public use. Upon acceptance by resolution, all road right-of-way as dedicated will become matters of maintenance by El Paso County, Colorado.

SURVEYOR'S CERTIFICATION:

The undersigned Colorado Registered Professional Land Surveyor does hereby certify that the accompanying plat was surveyed and drawn under his direct responsibility and supervision and accurately shows the described tract of land, and subdivision thereof, and that the requirements of Title 38 of the Colorado Revised Statutes, 1973, as amended, have been met to the best of his professional knowledge, belief and opinion.

DANIEL LEE KUPFERER — REGISTERED — PROFESSIONAL LAND SURVEYOR — COLORADO

June 27, 2002

Daniel L. Kupferer — Date
Colorado Professional Land Surveyor, No. 18465

School $960.00
District 49
Park - $ 1,778.00
Regional
Drainage - $20,218.53
Bridge
Solbay

IN WITNESS WHEREOF:

The aforementioned, JERRY L. MANLEY, has executed this instrument this 28 day of June 2002 A.D.

JERRY L. MANLEY

By: Jerry L. Manley
by Nancy Manley 6017
JERRY L. MANLEY

NOTARIAL:

STATE OF COLORADO }
COUNTY OF EL PASO } ss

The above and aforementioned was acknowledged before me this 28 day of June 2002 A.D. by JERRY L. MANLEY.

Witness my hand and seal

ADAM STANCIN — NOTARY PUBLIC — STATE OF COLORADO

Address 3520 AUSTIN BLUFFS PKWY
COLORADO SPRINGS, CO 80918

My commission expires 08/27/2004

IN WITNESS WHEREOF:

The aforementioned, NANCY MANLEY, has executed this instrument this 28 day of June 2002 A.D.

NANCY MANLEY

By: Nancy Manley
NANCY MANLEY

NOTARIAL:

STATE OF COLORADO }
COUNTY OF EL PASO } ss

The above and aforementioned was acknowledged before me this 28 day of June 2002 A.D. by NANCY MANLEY.

Witness my hand and seal

ADAM STANCIN — NOTARY PUBLIC — STATE OF COLORADO

Address 3520 AUSTIN BLUFFS PKWY
COLORADO SPRINGS, CO 80918

My commission expires 08/27/2004

NOTES:

- ● — Indicates survey monument set with a #4 rebar with Surveyor's Cap, P.L.S. #18465.
- ⊙ — Indicates recovered survey monument as noted.

1. Basis of Bearings . . . the south line of the southwest 1/4 of Section 22, Township 13 South, Range 64 West, 6th P.M. monumented as shown and assumed to bear North 89°45'43" East, a distance of 2833.14 feet.
2. This survey does not constitute a title search by LDC, Inc. to determine ownership or easements of record. For all information regarding easements, rights-of-way and title of record, LDC, Inc. relied upon a Commitment for Title Insurance, prepared by LAWYERS TITLE INSURANCE CORPORATION, Commitment No. 170142TR dated February 21, 2001 at 7:30 A.M.

   SCHEDULE B — 2 EXCEPTIONS:

   Item 8 — Right of Way and/or Easement, given to MOUNTAIN VIEW ELECTRIC for electrical purposes recorded August 27, 1955 in Book 2250 at Page 687 . . . "blanket easement condition".

   Item 10 — Right of Way and/or Easement, given to EL PASO COUNTY MUTUAL TELEPHONE COMPANY for communication purposes recorded August 17, 1973 in Book 2814 at Page 372 . . . "blanket easement condition".

   Items 1 through 7, and Items 11 through 13, were not examined or addressed by LDC, Inc.

   Item 9 does not affect Lots 1 thru 4.
3. The addresses exhibited on this plat (4643) are for informational purposes only. They are not the legal description and are subject to change.
4. The El Paso County Department of Transportation must be contacted prior to the establishment of any driveway.

   Vehicular access to Curtis Road and Jones Road is restricted to the Joint Access Easements as shown hereon.
5. The following reports have been submitted and are on file at the County Planning Department: Soils and Geological Study; Water Availability Study; Drainage Report; Wildfire Hazard Report; Natural Features Report; Percolation Test Results; Erosion Control Report.
6. FEDERAL EMERGENCY MANAGEMENT AGENCY, Flood Insurance Rate Map Number 0804100575 F, effective date, March 17, 1997, indicates the area in the vicinity of this parcel of land to be a Zone X (area determined to be out of the 500 year flood plain).
7. Sewage treatment is the responsibility of each individual property owner. The El Paso County Health Department must approve each system and, in some cases, the Department may require a specially designed system prior to permit approval.
8. Individual wells are the responsibility of each property owner. Permits for individual domestic wells must be obtained from the State Engineer who by law has the authority to set conditions for the issuance of these permits.
9. Easements are as shown hereon with sole responsibility for maintenance hereby vested with the individual property owners.
10. All structural foundations shall be located and designed by a Professional Engineer, currently registered in the State of Colorado.
11. Access and maintenance rights and responsibilities pertaining to the joint access easements are as defined and recorded in the records of the El Paso County Clerk at reception number 202182986
12. The drainage way and culvert may be reconfigured with future construction of Jones Road.
13. The culvert at the low water crossing is not designed to carry the 5-year flow and inundation of the driveway is expected.
14. Water in the Denver Basin Aquifers is allocated based on a 100 year aquifer life; however, for El Paso County planning purposes, water in the Denver Basin Aquifers is evaluated based on a 300 year aquifer life. Applicants, the Home Owners Association, and all future owners in the subdivision should be aware that the economic life of a water supply based on wells in a given Denver basin aquifer may be less than either the 100 years or 300 years indicated due to anticipated water level declines. Furthermore, the water supply plan should not rely solely upon non-renewable aquifers. Alternative renewable water resources should be acquired and incorporated in a permanent water supply plan that provides future generations with a water supply.
15. The property owner, its successors and assigns, and all future lot owners in this development are hereby on notice that they may be required to comply with applicable rules, if any, of the Colorado Groundwater Commission and/or the upper Black Squirrel Creek Ground Water Management District, which compliance may result in a reduction of well withdrawal limits, and thus a reduction in water availability.

APPROVALS:

This subdivision was approved by the El Paso County Planning Department this 8th day of November 2002

Planning Director

Approved by the Board of County Commissioners of El Paso County, Colorado, this 8th day of November 2002

Chairman

RECORDING:

STATE OF COLORADO }
COUNTY OF EL PASO } ss

I hereby certify that this instrument was filed for record in my office at 1141 o'clock P.M., this 29th day of July 2003 A.D., and is duly recorded under Reception No. 202182985 of the records of El Paso County, Colorado.

J. PATRICK KELLY, RECORDER

SURCHARGE: NA
FEE: 10.00

By: Deputy

LDC, Inc.
PLANNING, SURVEYING, LAND SERVICES
3520 Austin Bluffs Parkway
Colorado Springs, CO 80918
(719) 528-6133 FAX (719) 528-6848

REVISIONS			
NO.	DESCRIPTION	BY	DATE
1	COUNTY COMMENTS	JPB	11/01/01
2	COUNTY COMMENTS	JPB	5/22/02

Notice: According to Colorado law you must commence any legal action based upon any defect in this survey within three years after you first discover such defect. In no event may any action based upon any defect in this survey be commenced more than ten years from the date of the certification shown hereon.

FINAL PLAT
MANLEY SUBDIVISION FILING NO. 1

PROJECT NO. 99158	Drawn By: JPB	Date: 2/22/01
	Checked By:	Sheet: 1 of 1

P:\99000\99158 - Manley Subdivision\99158FP.dwg, Layout1, 6/27/2002 1:41:46 PM

Exhibit 7: Hydrologic Summary per Existing Plat

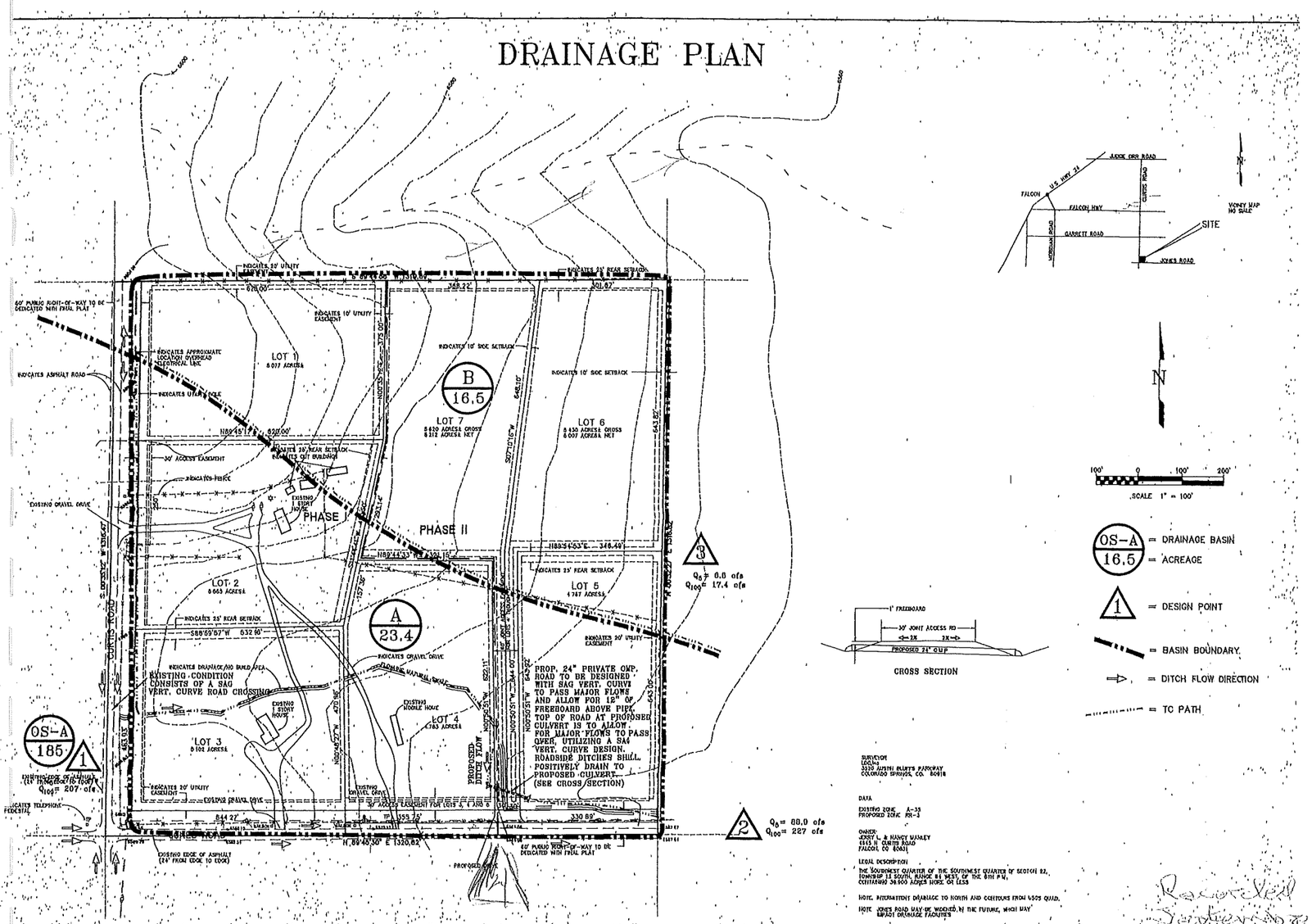
Exhibit 7: Hydrologic Summary per Existing Plat

Remove duplicate page

Indicate which report the various pieces in this section came from.

Indicate which drainage report this map came from.

DRAINAGE PLAN



CROSS SECTION

N

SCALE 1" = 100'

OS-A / 16,5 = DRAINAGE BASIN / ACREAGE

1 = DESIGN POINT

= BASIN BOUNDARY

= DITCH FLOW DIRECTION

= TO PATH

SURVEYOR
LEGEND
3330 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, CO. 80918

DATA
EXISTING ZONE A-35
PROPOSED ZONE PUD-2

OWNER
JERRY L. & NANCY MANLEY
4845 N. CURTIS ROAD
FALCON, CO 80831

LEGAL DESCRIPTION
THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 13 SOUTH, RANGE 65 WEST, OF THE 6TH P.M., CONTAINING 39.600 ACRES MORE OR LESS

NOTE: INTERMITTENT DRAINAGE TO NORTH AND CONTOURS FROM USGS QUAD.

NOTE: JONES ROAD MAY BE WIDENED IN THE FUTURE, WHICH MAY IMPACT DRAINAGE FACILITIES

Received September 2000

AW & MARIOTTI ONSULTANTS, INC. E BUSINESS/CIVIL LAND PLANNING	JERRY L. & NANCY MANLEY 4845 N. CURTIS RD. FALCON, CO. 80831	MANLEY SUBDIVISION	REVISIONS: NO. / REVISION / DATE / BY / CONSTRUCTION ACTIVITY / PLAN CONTROL / BOARD DATE	DRAINAGE PLAN	DATE: AUG 30, 2000	JOB NO.: 00-021
					SCALE: 1" = AS SHOWN	SHEET NO.: 00-021

LAW A. MARIOTTI
CONSULTANTS, INC.
CIVIL ENGINEERING * LAND SURVEYING
619 N. Cascade Ave., Suite 206 Colorado Springs, CO 80903 719-442-1541 voice 719-442-1542 fax

CALC. BY BT SHEET 1 OF 1

RETURN PERIOD 5 & 100 yr

HYDROLOGIC COMPUTATIONS – RATIONAL METHOD

* $T_c = 1.87(1.1 - C_f)L^{0.5}S^{-0.33}$

POINT OF CONCENTRATION	SUBAREA(S) CONTRIBUTING	AREA		FLOW PATH CHARACTERISTICS				Tc	C	C x A	I	Q	q FLOW (CFS)			REMARKS
		ACRE	SQ.MI.	FLOW DESCRIPTION	LENGHT (FT)	HEIGHT (FT)	AVG. V (FPS)	MIN.					TOTAL	PIPE	STREET	
DP 1	OS-A	185		O.L.	1000	20	–	40/35*								
				CHANNEL	3500	35	7	8								
		155				5	YR	48	0.25	46.3	1.7	78.7				
						100	YR	43	0.35	64.8	3.2	207				
DP2	OS-H +	209		O.L.	1000	20	–	40/35*								
	A			channel	5000	55	7	12								
						5	YR	52	0.25	52.3	1.7	88.9				
						100	YR	47	0.35	77.2	3.1	227				
DP3	B	16		O.L.	1000	30	–	51/45*								
					500	10	5	2								
						5 yr		53	0.25	4.0	1.7	6.8				
						100 yr		47	0.35	5.6	3.1	17.4				

Exhibit 8: Hydrologic Summary per Re-plat

KCH Engineering Solutions
5228 Cracker Barrel Circle
Colorado Springs, CO 80917
(719) 246-4471

JOB
SHEET NO. OF
CALCULATED BY DATE
CHECKED BY DATE
SCALE

Time of Concentration

Calc scale of each map

A. Main Top map
Distance along Northerly P.L 650.07 + 669.69 = 1319.8
Distance (ruled) 6 3/16 in = 6.1875
Scale 1" = 213.3 use 1" = 200'

11x17 map
Distance along northerly P.L - 1320
Distance = 6 5/16 = 6.3125"
Scale = 209 = use 210" 1" = 210'

B. OS-A
- 300' @ 10' Fall (Overland)
- Then to Chase to Culvert under Curbic
Distance along Northerly P.L - 1320'
Linear inches 2.9"
Scale 2.9"
Scale 1320/2.9 = 455.2' .: 1" = 455'

C OS-A
1. Overland
L 1" x = 200'/455 = 0.43 in.
455ft 200

Fall = 6'
2. Shallow Swale (To culvert under Curbic
Actual on Paper = 10.2
Scaled distance 455ft x 10.2 = 4614'

C/L to C/L Fall: 6700 - 6590 = 110'

Scale 110/4614 = 2.6

3. Shallow to Easterly P.L
L = another 1200ft = Total
4614 + 1200 = 5806 Dsep = 6700 - 6554 = 146' S = 146/5800 = 2.5%

Chris "

KCH Engineering Solutions
5228 Cracker Barrel Circle
Colorado Springs, CO 80917
(719) 246-4471

JOB
SHEET NO. OF
CALCULATED BY K. Harrison DATE 1/18/22
CHECKED BY DATE
SCALE

T_c (Cont'd)

D. Subbasin A
- Sheet Flow - 100 ft
  Fall = 3' Slope = 3%

- Shallow Swale to Easterly PL
  Length = 1,050
  Vert Drop = 6580 - 6554 =
  Slope = 26'/1050 = 26'/1050 = 2.5% 7009

E. Subbasin B
- Shallow Sheet Flow = 100ft V = 6" S = 6/100 = 6%

- Shallow Channel Flow
  Distance to East PL = 850'
  V = (6592 - 6554) = 38'
  S = 38'/850' ≅ 4.47

F. Subbasin C
- Shallow Sheet = (0.6") * 210'/inch = 126'
- Shallow Swale
  6592 - 6568 = 24'; S = 24/
  Distance: 4.3" (paper) * 210'/inch = 903ft
  Slope = 24/903 = 2.7%

G. Subbasin D (SB)
- Shallow Sheet: L200, Vert D. = 20 S = 20/200 = 10%
- Shallow Channel to East:
  Distance to East PL = 1150
  Drop: 6588 - 6562 = ;
  Slope: 2.4%

Manley Subdivision
Drainage Calculations
Developed Conditions
(Area Runoff Coefficient Summary)

		Gravel Road			*Buildings*			*NATURAL*			*RUNOFF COEFFICIENT*	
BASIN	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
A	14.30	0.13	0.59	0.70	0.09	0.73	0.81	14.08	0.08	0.35	***0.09***	***0.36***
B	13.82	0.00	0.59	0.70	0.00	0.73	0.81	13.82	0.08	0.35	***0.08***	***0.35***
C	2.19	0.00	0.59	0.70	0.00	0.73	0.81	2.19	0.08	0.35	***0.08***	***0.35***
D	6.63	0.05	0.59	0.70	0.07	0.73	0.81	6.51	0.08	0.35	***0.09***	***0.36***
E	2.23	0.00	0.59	0.70	0.00	0.73	0.81	2.23	0.08	0.35	***0.08***	***0.35***
F	1.50	0.60	0.59	0.70	0.00	0.73	0.81	0.90	0.08	0.35	***0.28***	***0.49***
OS-A	208.53	0.00	0.59	0.70	0.00	0.73	0.81	208.53	0.08	0.35	***0.08***	***0.35***

Manley Subdivision
FINAL DRAINAGE REPORT
Existing and Developed conditions
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*SHALLOW CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
A	14.30	0.09	0.36	0.09	100	3	12.7	1050	2.5%	0.8	22.1	34.8	2.3	3.8	*2.9*	*19.3*
B	13.82	0.08	0.35	0.08	100	2	14.7	126	4.5%	1.1	2.0	16.6	3.4	5.6	*3.7*	*27.3*
C	2.19	0.08	0.35	0.08	100	14	7.7	903	2.7%	0.8	18.3	26.0	2.7	4.5	*0.5*	*3.5*
D	6.63	0.09	0.36	0.09	200	20	12.1	1100	2.4%	0.8	23.7	35.7	2.2	3.7	*1.3*	*8.8*
E	2.23	0.08	0.35	0.08	200	2	26.0	400	3.0%	0.9	7.7	33.7	2.3	3.9	*0.4*	*3.0*
OS-A	208.53	0.08	0.35	0.08	100	10	8.6	5800	2.6%	0.8	119.9	128.5	0.3	0.5	*5.0*	*36.3*

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: Ken H
Date: 1/20/2022
Checked by: _____

Manley

Harrison

Manley

El Paso County, Colorado

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 5-Yr (cfs) (hr)	100-Yr (cfs) (hr)
SUBAREAS		
OS A	19.18	87.99
	13.46	13.36
A	3.23	15.78
	12.31	12.24
D	1.45	7.11
	12.34	12.27
E	0.51	2.48
	12.30	12.25
	24.4	113.36
REACHES		
OUTLET	20.44	92.50

Design flows

Areas

OS-A	Acre	
A	208.5	~~0.326~~ ~~0.325284~~ 0.32334
B	13.8	
C	2.2	
D	6.6	~~0.01386~~ 0.01036
E	2.2	0.003

~~1 mile * Acre~~ $\frac{1 \text{ mile}^2}{640 \text{ A}}$

$\frac{640 \text{ Acres}}{1 \text{ mile}^2}$

WinTR-20 Printed Page File Beginning of Input Data List
TR20.inp

WinTR-20: Version 1.10 0 0 0.05
Manley
no project subtitle provided

SUB-AREA:

OS A	Outlet	.32583	66.	2.1
A	Outlet	.02234	66.	.57
D	Outlet	.01036	66.	.595
E	Outlet	.00348	66.	.56

STREAM REACH:

STORM ANALYSIS:

5-Yr	2.7	Type II	2
100-Yr	4.6	Type II	2

STRUCTURE RATING:

GLOBAL OUTPUT:

2	0.05	YYYYN	YYYYNN

WinTR-20 Printed Page File End of Input Data List

Manley
no project subtitle provided

Name of printed page file:
TR20.out

STORM 5-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
OS A	0.326		0.409		13.46	19.18	58.87

Line Start Time (hr)	Flow Values @ time increment of 0.133 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.868	0.10	0.57	1.51	2.84	4.70	7.18	10.06
12.797	12.79	15.12	16.91	18.17	18.97	19.18	19.08
13.725	18.64	17.80	16.66	15.59	14.67	13.79	13.00
14.654	12.30	11.63	11.00	10.42	9.91	9.44	9.02
15.582	8.63	8.28	7.95	7.65	7.38	7.13	6.89
16.510	6.66	6.45	6.25	6.06	5.88	5.72	5.57
17.439	5.44	5.31	5.20	5.09	4.98	4.89	4.79
18.367	4.70	4.61	4.54	4.47	4.39	4.32	4.26
19.296	4.19	4.12	4.06	3.99	3.93	3.86	3.79
20.224	3.73	3.66	3.60	3.53	3.47	3.41	3.36
21.152	3.31	3.26	3.22	3.18	3.14	3.11	3.08
22.081	3.06	3.04	3.01	3.00	2.98	2.96	2.94
23.009	2.93	2.92	2.90	2.89	2.87	2.86	2.85
23.938	2.84	2.82	2.80	2.75	2.69	2.60	2.47
24.866	2.31	2.13	1.93	1.72	1.51	1.31	1.13
25.795	0.96	0.81	0.68	0.58	0.49	0.42	0.35
26.723	0.30	0.26	0.22	0.18	0.16	0.13	0.11
27.651	0.09	0.08	0.07	0.06			

WinTR-20: Version 1.10 0 0 0.05

Y

(continued)

no project subtitle provided

STORM 5-Yr

SUB-AREA:				
	OS A	Outlet	.32583	66.	2.1
	A	Outlet	.02234	66.	.57
	D	Outlet	.01036	66.	.595

no project subtitle provided

Line Start Time (hr)	Flow Values @ time increment of 0.035 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
27.899	0.07	0.07	0.06	0.06	0.06	0.05	0.05

STORM 100-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
OS A	0.326		1.461		13.36	87.99	270.06

Line Start Time (hr)	Flow Values @ time increment of 0.133 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.370	0.08	0.18	0.42	1.10	3.16	7.48	13.98
12.298	22.71	34.00	47.29	60.49	71.60	79.88	85.16
13.226	87.87	87.99	85.98	82.56	77.59	71.27	64.80
14.155	59.24	54.45	50.16	46.42	43.08	39.96	37.13
15.083	34.65	32.45	30.46	28.69	27.11	25.67	24.38
16.012	23.24	22.19	21.23	20.35	19.53	18.77	18.06
16.940	17.41	16.82	16.26	15.77	15.32	14.91	14.52
17.869	14.15	13.81	13.47	13.16	12.86	12.59	12.36
18.797	12.14	11.92	11.71	11.51	11.31	11.11	10.92
19.725	10.72	10.53	10.34	10.15	9.96	9.77	9.58
20.654	9.40	9.23	9.06	8.91	8.76	8.63	8.51
21.582	8.40	8.30	8.21	8.13	8.06	7.99	7.93
22.511	7.87	7.82	7.77	7.72	7.68	7.63	7.59
23.439	7.55	7.51	7.47	7.43	7.39	7.34	7.26
24.367	7.13	6.95	6.69	6.34	5.90	5.40	4.87
25.296	4.33	3.79	3.29	2.82	2.39	2.01	1.70
26.224	1.44	1.22	1.04	0.88	0.75	0.63	0.54
27.153	0.46	0.39	0.33	0.28	0.23	0.20	0.17
28.081	0.14	0.12	0.10	0.08	0.07	0.06	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
A	0.022		1.460		12.24	15.78	706.47

Line Start Time (hr)	Flow Values @ time increment of 0.036 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.271	0.05	0.07	0.09	0.11	0.13	0.16	0.19
11.523	0.22	0.26	0.31	0.38	0.47	0.60	0.79
11.775	1.06	1.44	1.99	2.76	3.78	5.07	6.64
12.027	8.42	10.27	12.05	13.59	14.78	15.51	15.78

WinTR-20 Printed Page File Beginning of Input Data List
TR20.inp

WinTR-20: Version 1.10 0 0 0.05
y (continued)
no project subtitle provided

STORM 100-Yr

SUB-AREA:

OS A	Outlet	.32583	66.	2.1
A	Outlet	.02234	66.	.57
D	Outlet	.01036	66.	.595

Exhibit 9: Hydraulic Summary for Re-plat

Manley Subdivision

Swale Summary

Swale #	Contributing Subbasins	Location	Slope	Design Flow		Depth of Flow		Velocity		Froude #	
				Q5	Q100	Q5	Q100	Q5	Q100		
			%	cfs	cfs	ft	ft	fps	fps	5 year	100 year
1 at DP1	OS 1	along west side of curtis	2.4	19.2	88.0	0.6	1.3	4.5	6.6	1.24	1.36
2	OS 1, A, D	see map	3.0	20.4	92.5	0.6	1.2	4.9	7.3	1.38	1.52
3	OS1	for reference									
4	Swale north of site	for reference									
5	B	inside SB	3.5	3.7	27.3	0.3	0.7	3.2	5.6	1.29	1.49
6	Borrow ditch along no. side of Jones fromSW corner to DP4	for reference									
7	Borrow ditch along west. side of Jones	for reference									
8	OS1,A,D,E	DP4 to DP2	3.5	20.4	92.5	0.6	1.3	5.2	7.7	1.47	1.63

Design Point Summary

Design Point	Sub Basins	Total Acres	Existing Runoff		
			Q5	Q100	
		(acres)	cfs	cfs	
1	OS-A	208.53	19.2	88	TR55 Method
2	OS- A, A, D, E	231.69	20.4	92.5	TR55Rational and Method
3	B	13.82	3.7	19.3	Rational Method
4	OS- A, A, D, E	231.5	20.4	92.5	TR55 and Rational Method

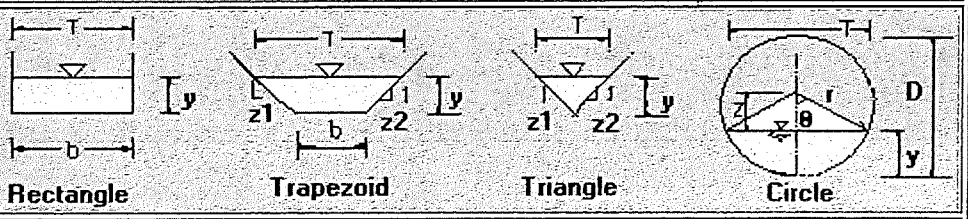
Highlighted values do not match with values shown in summary table in report. Please revise so same information is shown in all locations.

Swale 1 @ DP1

The open channel flow calculator

5 year Along Center R

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.024 ft/ft	Water depth(y): 0.63 ft	Bottom width(b) 3 ft
Flow velocity 4.472 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 19.2 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.69 ft	Flow area 4.29 ft^2	Top width(T) 10.59 ft
Specific energy 0.94 ft	Froude number 1.24	Flow status Supercritical flow
Critical depth 0.71 ft	Critical slope 0.015 ft/ft	Velocity head 0.31 ft

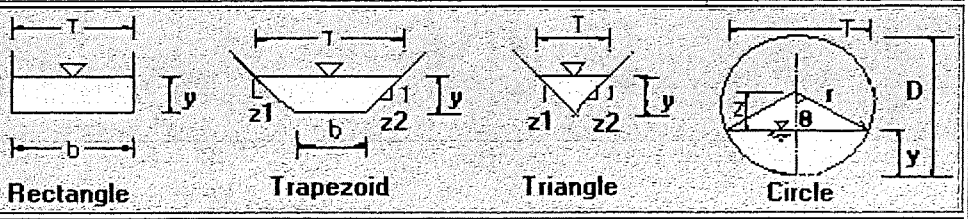
Per DCM Section 10.7, Fr # should be less than 0.9. Address this in the report and explain if existing swales appear to be stable, sufficient vegetation, no erosion, etc and reiterate that flows will not change as no additional improvements are being made. (For all swales)

Swale 1 @ DP 1

The open channel flow calculator

100yr Along Portion R

Select Channel Type: Trapezoid



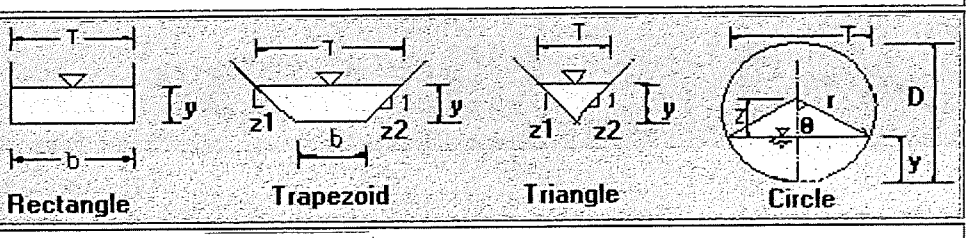
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.024 ft/ft	Water depth(y): 1.26 ft	Bottom width(b) 3 ft
Flow velocity 6.62 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 88 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 18.32 ft	Flow area 13.29 ft^2	Top width(T) 18.11 ft
Specific energy 1.94 ft	Froude number 1.36	Flow status Supercritical flow
Critical depth 1.46 ft	Critical slope 0.0122 ft/ft	Velocity head 0.68 ft

Swale 2 @ DP4
~~100~~ yr. storm
5

The open channel flow calculator

Select Channel Type: Trapezoid



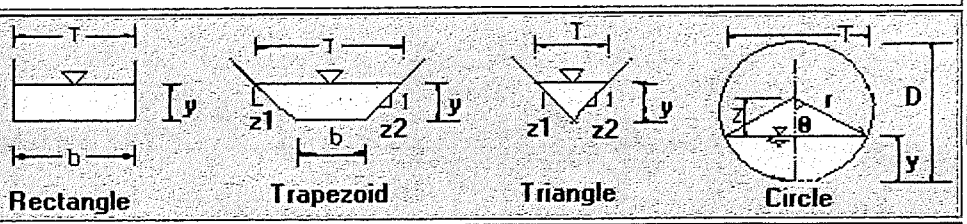
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.030 ft/ft	Water depth(y): 0.62 ft	Bottom width(b) 3 ft
Flow velocity 4.928 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 20.4 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.51 ft	Flow area 4.14 ft^2	Top width(T) 10.41 ft
Specific energy 0.99 ft	Froude number 1.38	Flow status Supercritical flow
Critical depth 0.73 ft	Critical slope 0.015 ft/ft	Velocity head 0.38 ft

Swale 2 @ DP4
100yr storm

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

Select unit system: Feet(ft)

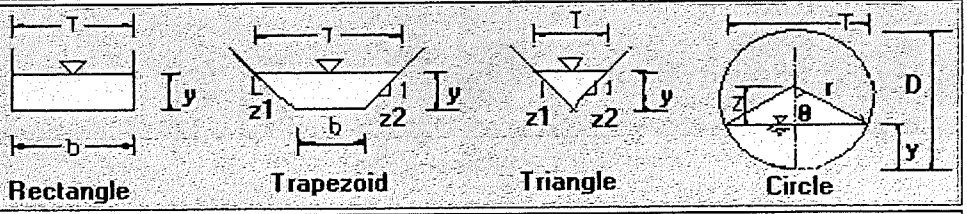
Channel slope: 0.030 ft/ft	Water depth(y): 1.22 ft	Bottom width(b) 3 ft
Flow velocity 7.296 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 92.5 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 17.9 ft	Flow area 12.68 ft^2	Top width(T) 17.7 ft
Specific energy 2.05 ft	Froude number 1.52	Flow status Supercritical flow
Critical depth 1.49 ft	Critical slope 0.0121 ft/ft	Velocity head 0.83 ft

Swale 5

The open channel flow calculator @ DP 3

5 10 YR

Select Channel Type: Trapezoid



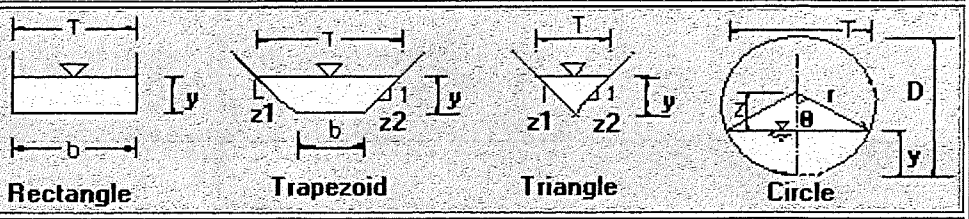
Depth from Q | Select unit system: Feet(ft)

Channel slope: .035 ft/ft	Water depth(y): 0.25 ft	Bottom width(b) 3 ft
Flow velocity 3.206411 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 3.7 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 6.1 ft	Flow area 1.15 ft^2	Top width(T) 6.06 ft
Specific energy 0.41 ft	Froude number 1.29	Flow status Supercritical flow
Critical depth 0.3 ft	Critical slope 0.0183 ft/ft	Velocity head 0.16 ft

Swale 5
Type DP-3
100

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

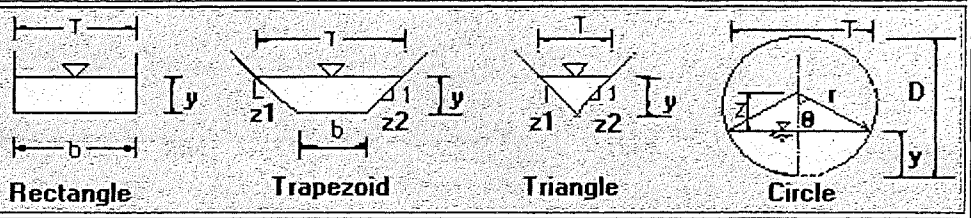
Channel slope: .035 ft/ft	Water depth(y): 0.69 ft	Bottom width(b) 3 ft
Flow velocity 5.592 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 27.3 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 11.35 ft	Flow area 4.88 ft^2	Top width(T) 11.23 ft
Specific energy 1.17 ft	Froude number 1.49	Flow status Supercritical flow
Critical depth 0.84 ft	Critical slope 0.0144 ft/ft	Velocity head 0.49 ft

Swale C
along no. side of Jones

The open channel flow calculator

100Y
DP 4 to DP 2

Select Channel Type: Trapezoid



Depth from Q

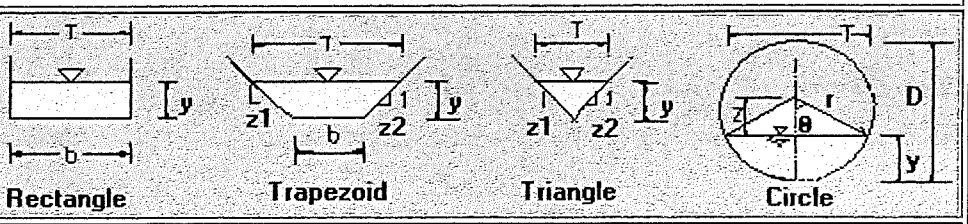
Select unit system: Feet(ft)

Channel slope: .035 ft/ft	Water depth(y): 1.25 ft	Bottom width(b) 2 ft
Flow velocity 7.741 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 92.5 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 17.26 ft	Flow area 11.95 ft^2	Top width(T) 17.05 ft
Specific energy 2.18 ft	Froude number 1.63	Flow status Supercritical flow
Critical depth 1.56 ft	Critical slope 0.0122 ft/ft	Velocity head 0.93 ft

Label what swale this is for and which storm event

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: .035 ft/ft	Water depth(y): 0.6 ft	Bottom width(b) 3 ft
Flow velocity 5.181 ft/s	LeftSlope (Z1): 6 to 1 (H:V)	RightSlope (Z2): 6 to 1 (H:V)
Flow discharge 20.4 ft^3/s	Input n value .028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.27 ft	Flow area 3.94 ft^2	Top width(T) 10.17 ft
Specific energy 1.01 ft	Froude number 1.47	Flow status Supercritical flow
Critical depth 0.73 ft	Critical slope 0.015 ft/ft	Velocity head 0.42 ft

Culvert #3 - 24" CMP (Existing)
Q_5=19.2 cfs Q_{100}=88 cfs

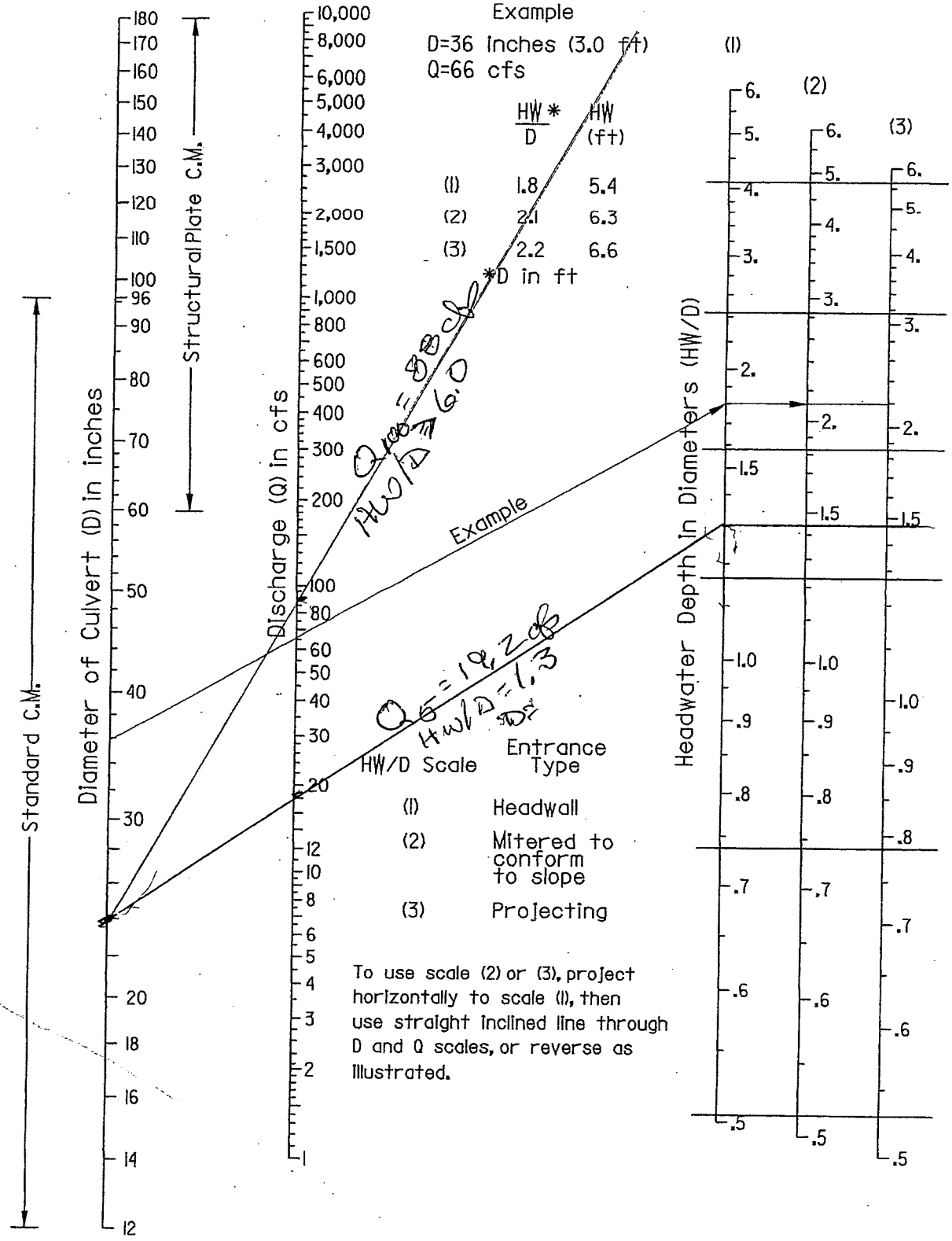


Exhibit F.2 Headwater Depth for CMP Culverts with Inlet Control (Source: Reference F.1)

Culvert Structure #2
Use values for DP #2 & 3

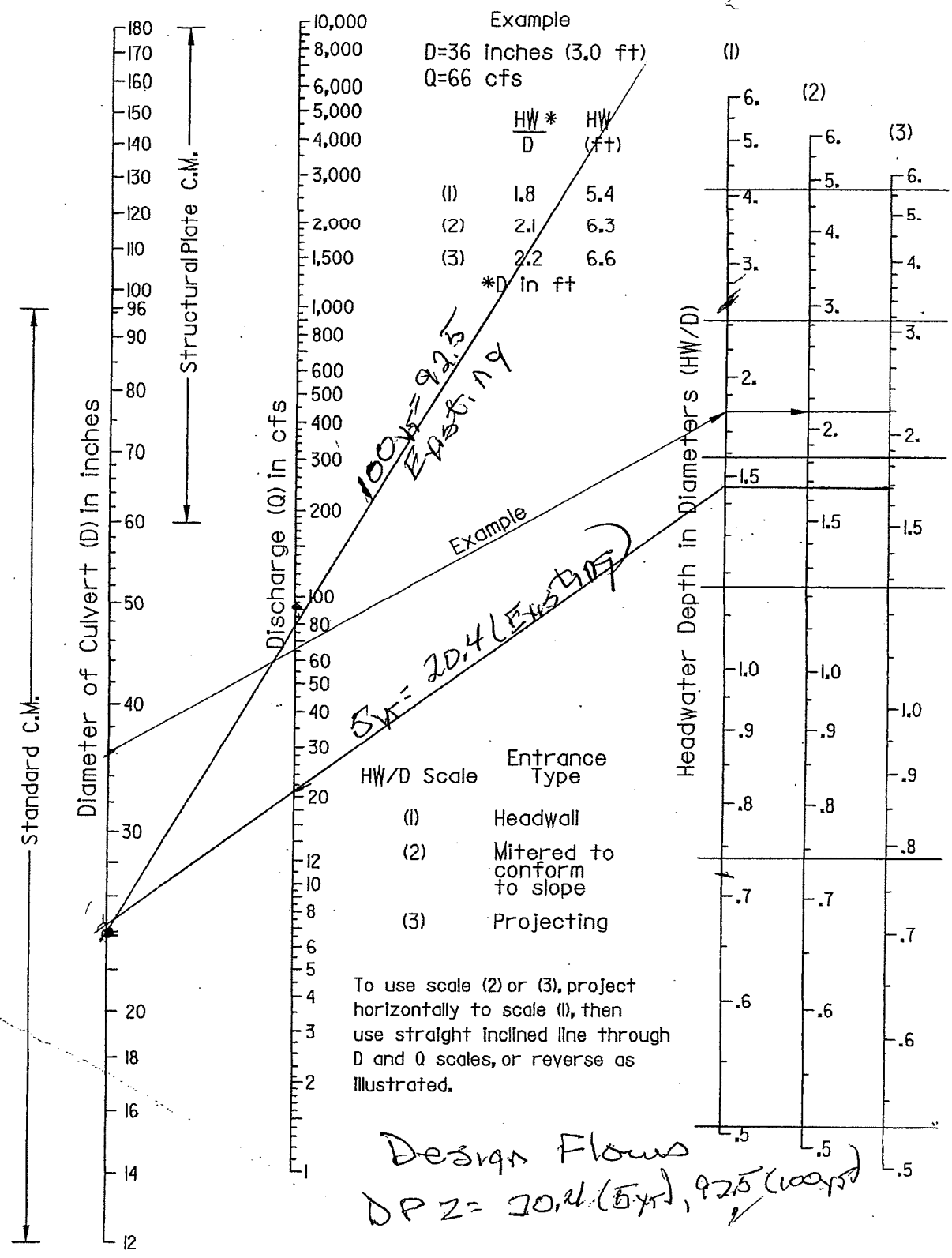


Exhibit F.2 Headwater Depth for CMP Culverts with Inlet Control (Source: Reference F.1)

Exhibit 10: Drainage Conditions (map pocket)

Exhibit 10 Drainage Conditions (map pocket)

MANLEY SUBDIVISION FILING NO. 2

A PORTION OF THE SOUTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 22, TOWNSHIP 13 SOUTH, RANGE 64 WEST, OF THE 6th P.M., COUNTY OF EL PASO, STATE OF COLORADO

Highlighted items do not match with summary table in report. Please revise accordingly

DESIGN POINT

DESIGN POINT	CONTRIB SUB BASINS	TOTAL AREA (acres)	(cfs)	(cfs)	
1	OSA	208.53	19.2	88.0	TR55 Method
2	OS-A, A, D, E	231.69	20.4	92.5	TR55 and Rational Method
3	B	13.82	3.7	19.3	Rational Method
4	OS-A, A, D, E	231.50	20.4	92.5	TR55 and Rational Method

Include DP-5 & DP-6 in table

Change to OS-1 to match map

SWALE SUMMARY

SWALE #	CONTRIBUTING SUBBASINS	LOCATION	SLOPE	DESIGN FLOW Q5	DESIGN FLOW Q100	DEPTH OF FLOW Q5	DEPTH OF FLOW Q100	VELOCITY Q5	VELOCITY Q100	FROUDE # 5 year	FROUDE # 100 year
			%	cfs	cfs	ft	ft	fps	fps		
1 AT DP1	OS 1	W. SIDE OF CURTIS RD.	2.4	19.2	88.0	0.6	1.3	4.5	6.6	1.24	1.36
2	OS 1, A, D	SEE MAP	3.0	3.0	92.5	0.6	1.2	4.9	7.3	1.38	1.52
3	OS 1	FOR REFERENCE ONLY									
4	SWALE NORTH OF SITE	FOR REFERENCE ONLY									
5	B	INSIDE SB	3.5	3.5	27.3	0.3	0.7	3.2	5.6	1.29	1.49
6	BORROW DITCH ALONG N. SIDE OF JONES RD. FROM S.W. CORNER TO DP4	FOR REFERENCE ONLY									
7	BORROW DITCH ALONG WEST SIDE OF CURTIS RD.	FOR REFERENCE ONLY									
8	OS 1, A, D, E	DP4 TO DP2	3.5	20.4	92.5	0.6	1.3	5.2	7.7	1.47	1.63

SUB BASIN HYDROLOGIC SUMMARY

BASIN I.D.	AREA (acres)	RUNOFF COEFFICIENTS 5 yr	RUNOFF COEFFICIENTS 100 yr	RUNOFF 5 yr	RUNOFF 100 yr	COMMENTS
A	14.3	0.08	0.35	2.9	19.3	
B	13.8	0.08	0.35	3.7	27.8	
C	2.19	0.08	0.35	0.5	3.5	
D	6.63	0.08	0.35	1.3	8.8	
E	2.23	0.08	0.35	0.4	3.0	
OS 1	208.5	0.08	0.35	19.2	88.0	The TR55 method is used since the total acreage is greater than 130 acres.

NOTES:

- NO NEW CONSTRUCTION; BUILDINGS, BARNS, FENCES, DRIVEWAYS, AND/OR LANDSCAPING, SHALL BE INSTALLED IN ANY EXISTING DRAINAGEWAY AND/OR SWALE SO AS TO IMPEDE THE FLOW OF STORM WATER RUNOFF.

- LOT AREAS:
  LOT 1 = 16.137 acres
  LOT 2 = 5.513 acres

Please label all culverts and show them on the map.

Please identify this symbol.

SCALE: 1" = 200'

LEGEND:

- DIRECTION OF FLOW
- PROJECT BOUNDARY
- FLOWLINE NATURAL SWALE
- SUBBASIN BOUNDARY
- DESIGN POINT
- SWALE NUMBER
- BASIN I.D.
- AREA (ACRES)
- CULVERT
- STRUCTURE NUMBER
- INDEX CONTOURS (APPROX.)
- INTERMEDIATE CONTOURS
- EXISTING STRUCTURE (APPROX.)
- PROPOSED STRUCTURE
- EXISTING LOT LINES
- PROPOSED LOT LINE
- SUBDIVISION/LOT BOUNDARY
- EXISTING ROAD/DRIVEWAY (GRAVEL)
- PROPOSED ROAD

REVISIONS

No.	Description	By	Date

H Scale: 1" = 200'
V Scale: N/A
Designed By: KCH
Drawn By: DAS
Checked By: KCH
Date: 02/15/2022

Land Development Consultants, Inc.
PLANNING · SURVEYING
www.ldc-inc.com · TEL: (719) 528-5133 · FAX: (719) 528-5849
3898 MAIZELAND ROAD · COLORADO SPRINGS, CO 80909

MANLEY SUBDIVISION FILING NO.2
DRAINAGE PLAN OF EXISTING CONDITIONS

Project No.: 99158
Sheet: 1 of 1

F:\99000\99158 MANLEY SUB\MANLEY SUB NO 2\99158P-FIL2-DRAINAGE.dwg