Drainage Letter/Report

for the

Replat of Manley Subdivision
El Paso County, Colorado

April, 2022

Revised: February, 2024

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
Cell: 719-246-4471
ksharrison5228@msn.com

El Paso County Project Number: VR2310

KCH Engineering Solutions: Job No: 2021-101

Table of Contents

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: _____

El Paso County
Filed in accordance with the requirements of the Drainage Criteria Manual, Volume 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

For El Paso County Engineer

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

Conditions

Flood Plain Statement

See Section V of this report

I. REPORT PURPOSE

Drainage from the Manley Subdivision site previously studied in 2000 with a Drainage Report entitled "Preliminary/ Final Drainage Report for Manly Subdivision, prepared by Law and Marrioti, September 2000 This report will be noted as **LM-Report 2** in this report. At that time the **LM-Report 2** was prepared the Manley subdivision consisted of seven (7) lots) *(Exhibit 6, Appendix*)

It is proposed to replat the current subdivision in order to reconfigure lot lines. In accordance with the current El Paso County Drainage Criteria, a Drainage Letter/Report is required. The drainage letter/report is entitled "Drainage Letter/Report for the Replat of Manley Subdivision El Paso County, Colorado April, 2022 Revised: February, 2024" **(KCH-3)**

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 **LM-Report 2**. The **(KCH-3)** report will be 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. The **(KCH-3)** will also address any change in criteria 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 **(KCH-3)**

The **(KCH-3)** report will show this replat will have **no impact** on the drainage characteristics as described in Report 2.

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 Solberg Ranch Drainage Basin.

Manley Subdivision presently consists of four (4) lots and an "out-parcel labelled as Future Phase 2. Several structures have been constructed on the Lot 2, Lot 3 and Lot 4 as shown on the **LM-Report 2** (*Exhibit 6, 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%.

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 6 in the Appendix*. There are currently no plans to add additional structures.

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

The project site is located in FEMA map 08041CO568G (*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)
- Stapleton Sandy loam (SCS No. 83)
- Tructon Loamy Sand (SCS No. 95)

VI. OFFSITE DRAINAGE CONDITIONS

General

OS1 is the only offsite area that impacts the Manning Subdivision. It has an area of approximately 208.5 acres as determined from USGS mapping for this report. 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 swales S1 and S7 **(KCH-3)** which functions as a borrow ditch along the westerly side of Curtis Road. The storm water is then routed southerly to DP1 **(KCH-3)** where a 24" CMP carries the water under Curtis Road. The upstream end of the existing 24" CMP culvert is approximately 200 feet north of the Curtis Road/ Jones Road intersection. Any other offsite runoff is collected by S3 and S4 **(KCH-3)** and is routed north of the northerly property line. At no location does stormwater in S3 and S4 enter the **Manley Subdivision**. Analysis of S3 and S4 is beyond the scope of this project. The estimated runoff at the upstream end of the 24" culvert at DP1**(KCH-3)** is discussed in the following three (3) drainage reports. Pertinent pages of each report are included in *Exhibit 6, Appendix*.

1. **Windmill Flats Final Drainage Report, prepared by Berge Brewer, November 21, 2002, (BB-Report 1); Design Point 3 (**upstream end of 24" CMP under Curtis Road)
   - Design Point: DP3 is at the same location as DP1 in both the LM-Report 2 and KCH-Report reports.
   - Area draining to DP3: not available in the narrative section of the drainage report
   - Runoff DP3: (Exhibit 6, Appendix)
     Q5: 30.4 cfs
     Q100: 79.1 cfs
     These runoff amounts were obtained from a table in the narrative section of this report.

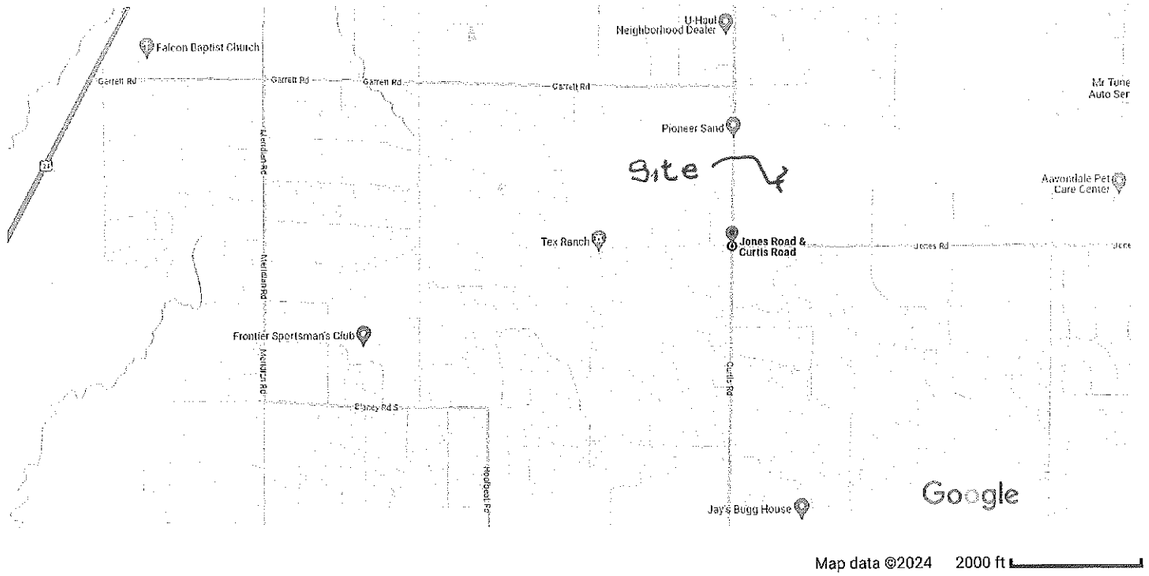
2. **Preliminary/Final Drainage Report for Manly Subdivision, prepared by Law and Marrioti, March 29,2000 (LM-Report 2); Design Point 1** (Exhibit 6, Appendix) (upstream end of 24" CMP under Curtis Road)
   - Design Point: DP1 as shown on the **LM-Report 2** is at the same location as DP3 on the BB-Report 1 drainage plan and DP1 on the KCH-Report 3 drainage plan.
   - Area draining to DP1:185 acres
   - Runoff at DP1
     The runoff at DP1 was determined with the use of the Rational Method. The current EPS design standard states that the upper limit for using the Report Rational Method is 110 acres. Runoff in the **(KCH-Report 3)** report used the TR55 method.
     Flow Rates at DP1
     Q5: 78.7 cfs
     Q100: 207 cfs

APPENDIX

Exhibit 1

Location Map

Google Maps



Map data ©2024 2000 ft

Delays

Light traffic in this area

No known road disruptions. Traffic incidents will show up here.

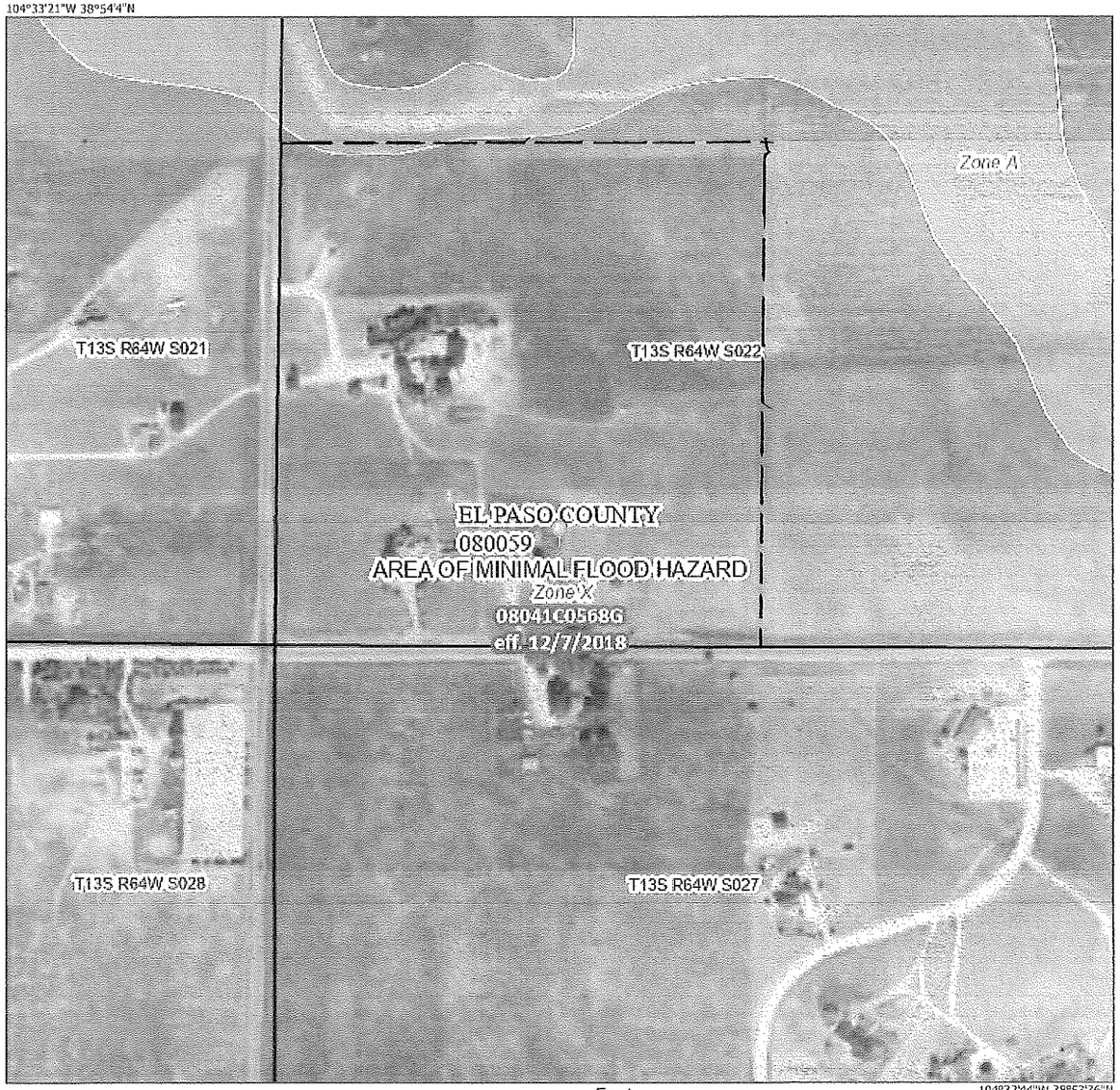
Exhibit 2

FEMA FIRM Map

National Flood Hazard Layer FIRMette

FEMA

104°33'21"W 38°54'4"N



104°32'44"W 38°53'36"N

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

1:6,000

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

Legel

SEE FIS REPOI

SPECIAL F
HAZARD A

OTHER ARE
FLOOD HA

OTHER A

GEN
STRUCT

C
FEAT

MAP P/

This m
digital
The ba
accura

The flo
authori
was ex
reflect
time. T
becom

This m
elemer
legend
FIRM p
unmap
regulat

Exhibit 3

SCS Soils Map and Data

United States Department of Agriculture

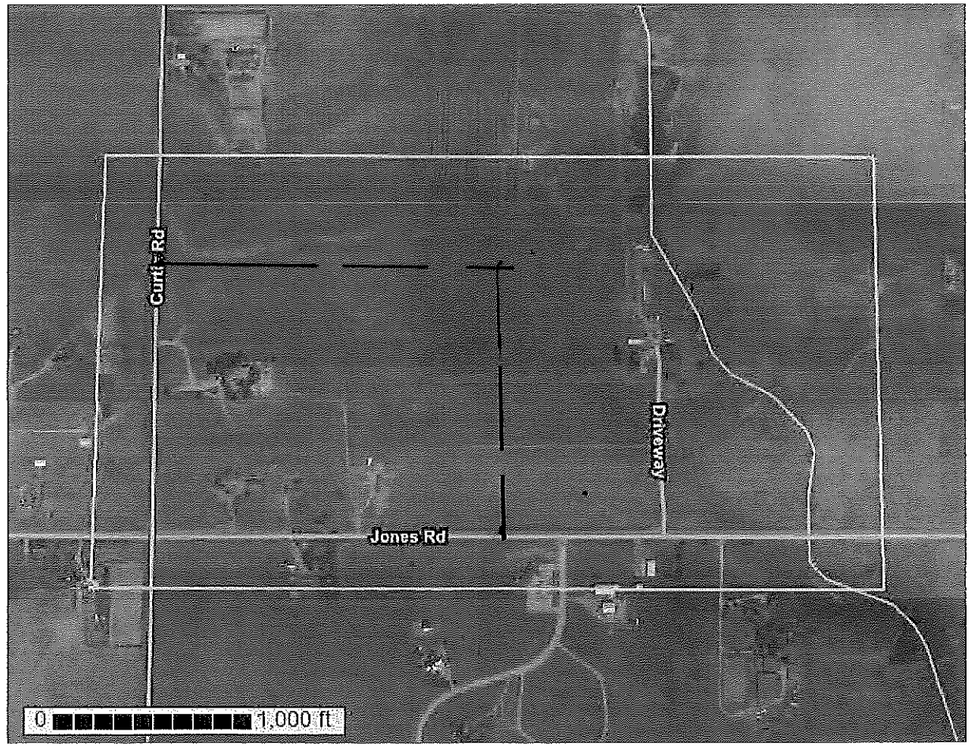
NRCS

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

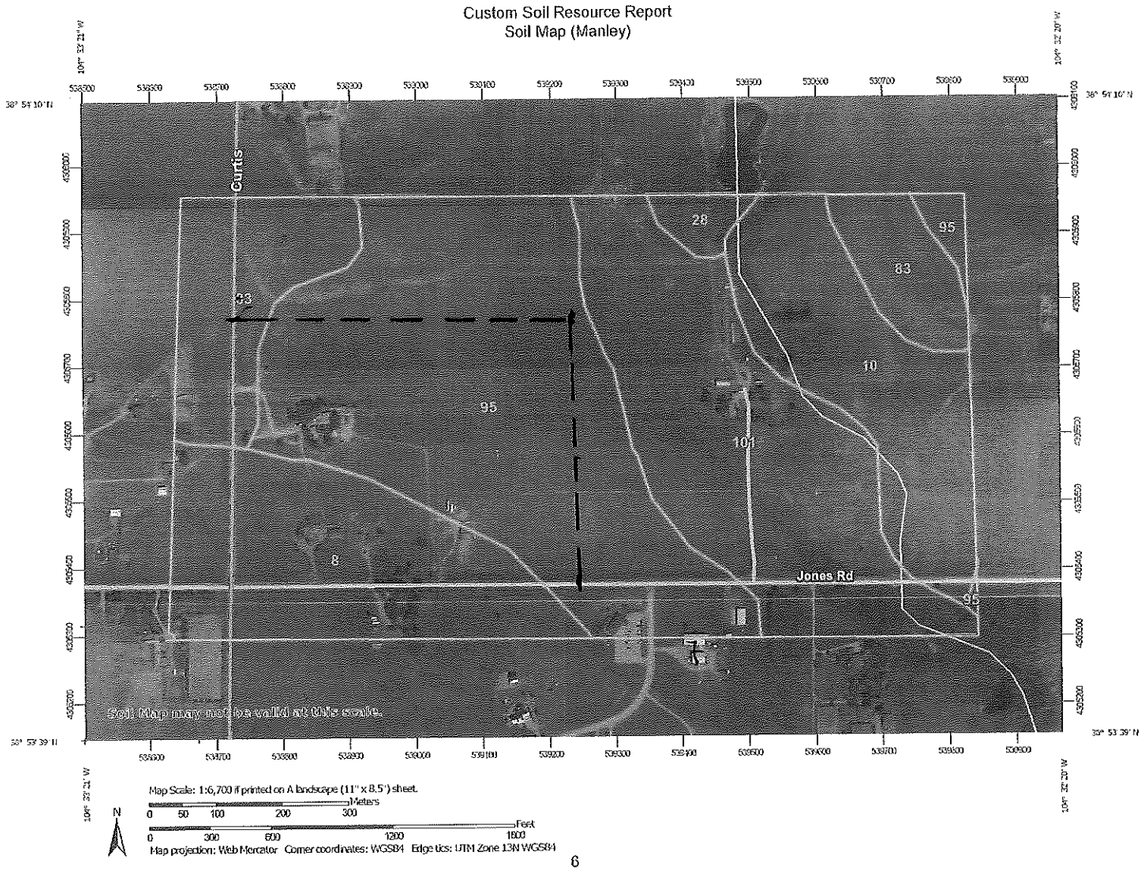
Custom Soil Resource Report for El Paso County Area, Colorado

Manley Subdivision



February 7, 2022

Custom Soil Resource Report
Soil Map (Manley)



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

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.

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%
36	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

about 4.1 inches)

e specified
'w

omland LRU's A and B
TOMLAND (069AY031CO)

pes

, *and transects of the mapunit.*

)e

:ose

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

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.

(Eq. 6-7)

n)

(Eq. 6-8)

n land uses, 100 ft maximum for

small because flows quickly

ration needs to be considered in
ılic properties of the swale, ditch,
timated with the help of Figure 6-

(Eq. 6-9)

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

ıs & Thunderstorms for

%I	Pre-Development CN			
	HSG A	HSG B	HSG C	HSG D
---	68	79	86	89
---	49	69	79	84
---	39	61	74	80
---	98	98	98	98
---	98	98	98	98
---	83	89	92	93
---	76	85	89	91
---	72	82	87	89
---	63	77	85	88
---	96	96	96	96
85	89	92	94	95
72	81	88	91	93
65	77	85	90	92
38	61	75	83	87
30	57	72	81	86
25	54	70	80	85
20	51	68	79	84
12	46	65	77	82
%I	HSG A	HSG B	HSG C	HSG D
--	77	86	91	94
%I	HSG A	HSG B	HSG C	HSG D
--	77	86	91	94
--	76	85	90	93
--	74	83	88	90
--	72	81	88	91
--	67	78	85	89
--	71	80	87	90
--	64	75	82	85
--	70	79	84	88
--	65	75	82	86
--	69	78	83	87
--	64	74	81	85
-	66	74	80	82
-	62	71	78	81
-	65	73	79	81
-	61	70	77	80
-	65	76	84	88
-	63	75	83	87
-	64	75	83	86
-	60	72	80	84
-	63	74	82	85
-	61	73	81	84
-	62	73	81	84
-	60	72	80	83
-	61	72	79	82
-	59	70	78	81
-	60	71	78	81
-	58	69	77	80

Most Conservative Case

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

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
(719) 520-6300 (Main)
(719) 520-6305 (Direct)
www.elpasoco.com

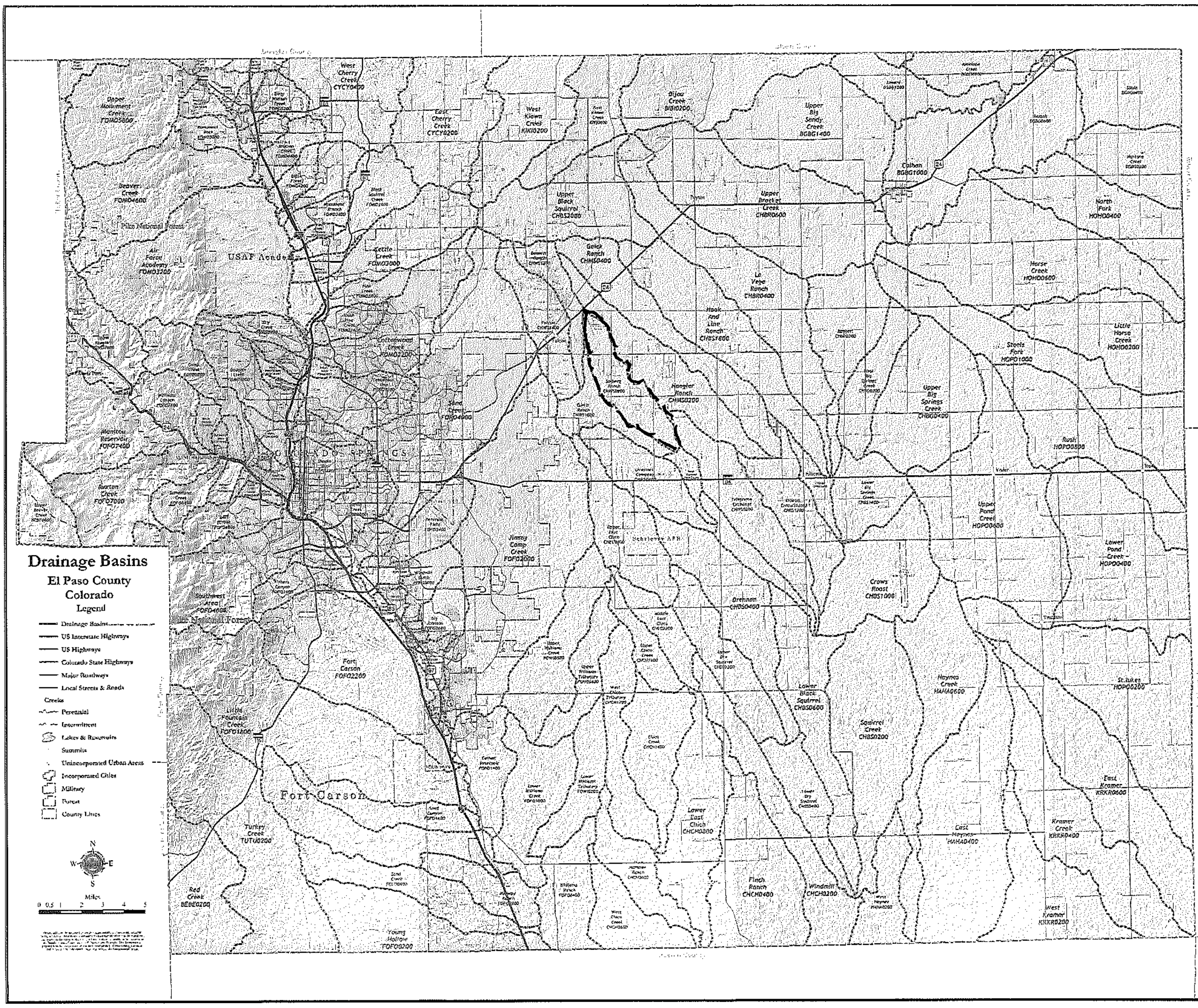
PERSONAL WORK SCHEDULE
Monday - Thursday, 7:00 am to 5:30 pm

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!

Exhibit 5

Drainage Basin Planning Study Exhibits



Drainage Basins
El Paso County
Colorado
Legend
Drainage Basins
US Interstate Highways
US Highways
Colorado State Highways
Major Roadways
Local Streets & Roads
Creeks
Perennial
Intermittent
Lakes & Reservoirs
Summits
Unincorporated Urban Areas
Incorporated Cities
Military
Forest
County Lines
N
S
E
W
Miles
0 0.5 1 2 3 4 5
Pike National Forest
USAF Academy
Fort Carson
Schriever AFB
Upper Monument Creek FOMO5000
Beaver Creek FOMO4600
Air Force Academy FOMO3200
Cottonwood Creek FOMO2200
Manitou Reservoir FOFO7400
Fort Carson FOFO2200
Jimmy Camp Creek FOFO2000
Turkey Creek TUTU0200
Red Creek BEBE0200
Young Hollow TOFO0200
West Cherry Creek CYCY0400
East Cherry Creek CYCY0200
West Kiowa Creek KIKI0200
Bijou Creek BIBI0200
Upper Big Sandy Creek BGBG1400
Calhan BGBG1000
North Fork HOHO0400
Horse Creek HOHO0600
Little Horse Creek HOHO0200
Upper Black Squirrel CHBS2000
Geick Ranch CHMS0400
Upper Brackett Creek CHBR0600
Le Vege Ranch CHBR0400
Hook And Line Ranch CHBS1600
Haegler Ranch CHMS0200
Upper Big Springs Creek CHBS0400
Steels Fork HOPO1000
Rush HOPO0500
Upper Pond Creek HOPO0600
Lower Pond Creek HOPO0400
Crows Roost CHBS1000
Brehnan CHBS0400
Lower Black Squirrel CHBS0600
Squirrel Creek CHBS0200
Haynes Creek HAHA0600
St.Lukes HOPO0200
East Kramer KRKR0600
Kramer Creek KRKR0400
West Kramer KRKR0200
East Haynes HAHA0400
Lower East Chico CHCH0200
Finch Ranch CHCH0400
Windmill CHCH0200
Little Fountain Creek FOFO1800
Southwest Area FOFO4000

El Paso County Drainage Basin Fees

Resolution No. 22-442

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2023 Drainage Fee (per Impervious Acre)	2023 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$12,985	$1,916
CHWS1200	Chico Creek	2001	Bennett Ranch	$14,536	$5,576
CHWS1400	Chico Creek	2013	Falcon	$37,256	$5,118
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$15,802	$4,675
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$23,078	$2,980
FOFO2800	Fountain Creek	1988*	Widefield	$23,078	$0
FOFO2900	Fountain Creek	1988*	Security	$23,078	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$23,078	$346
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$14,077	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$16,646	$1,262
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$23,078	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$23,821	$9,743
FOFO4200	Fountain Creek	1977	Spring Creek	$11,969	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$23,078	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$23,078	$1,262
FOFO5800	Fountain Creek	1964	Camp Creek	$2,557	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$14,514	$321
FOMO1200	Monument Creek	1977	Templeton Gap	$14,900	$346
FOMO2000	Monument Creek	1971	Pulpit Rock	$7,653	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$23,078	$1,262
FOMO2400	Monument Creek	1966	Dry Creek	$18,219	$660
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$10,478	$660
FOMO3700	Monument Creek	1987*	Middle Tributary	$19,259	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$23,078	$0
FOMO4000	Monument Creek	1996	Smith Creek	$9,409	$1,262
FOMO4200	Monument Creek	1989*	Black Forest	$23,078	$628
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$23,078	$1,262
FOMO5300	Fountain Creek	1993*	Crystal Creek	$23,078	$1,262
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$21,654	$3,135
CHEC0400	Chico Creek		Upper East Chico	$11,797	$342
CHWS0200	Chico Creek		Telephone Exchange	$12,962	$304
CHWS0400	Chico Creek		Livestock Company	$21,351	$254
CHWS0600	Chico Creek		West Squirrel	$11,129	$4,619
CHWS0800	Chico Creek		Solberg Ranch	$23,078	$0
FOFO1200	Fountain Creek		Crooked Canyon	$6,968	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$5,817	$339
FOFO1600	Fountain Creek		Sand Canyon	$4,203	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$23,078	$1,079
FOFO2200	Fountain Creek		Fort Carson	$18,219	$660
FOFO2700	Fountain Creek		West Little Johnson	$1,521	$0
FOFO3800	Fountain Creek		Stratton	$11,070	$495
FOFO5000	Fountain Creek		Midland	$18,219	$660
FOFO6000	Fountain Creek		Palmer Trail	$18,219	$660
FOFO6800	Fountain Creek		Black Canyon	$18,219	$660
FOMO4600	Monument Creek		Beaver Creek	$13,797	$0
FOMO3000	Monument Creek		Kettle Creek	$12,463	$0
FOMO3400	Monument Creek		Elkhorn	$2,094	$0
FOMO5000	Monument Creek		Monument Rock	$10,003	$0
FOMO5400	Monument Creek		Palmer Lake	$15,995	$0
FOMO5600	Monument Creek		Raspberry Mountain	$5,380	$0
PLPL0200	Monument Creek		Bald Mountain	$11,465	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,950	$0
FOMO4400	Monument Creek		Jackson Creek	$9,135	$0
FOMO4800	Monument Creek		Teachout Creek	$6,343	$953

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 *Joshua Palmer, P.E.*

Exhibit 6

Existing Drainage Reports

Exh 6.2

berge-brewer & associates, inc.

phone (719) 227-7181 - fax (719) 227-7186 - 711 north cascade avenue - colorado springs, co 80903

ENGINEERS
PLANNERS
SURVEYORS

FINAL DRAINAGE REPORT

WINDMILL FLATS

PREPARED FOR:

JOB LARRANAGA

4290 LOS RANCHITOS DRIVE

PEYTON, CO 80831

PREPARED BY:

BERGE-BREWER AND ASSOCIATES, INC.

711 N. CASCADE AVENUE

COLORADO SPRINGS, CO 80903

Prepared by: Anna C. Sparks, EIT
Reviewed by: Roger G. Berge, PE & PLS
May 15, 2002
Revised: June 27, 2002
Revised: August 15, 2002
Revised: September 25, 2002
Revised: November 21, 2002

Exh 6.1

CERTIFICATION:

Engineers Statement:

This attached drainage plan and report for "Windmill Flats" were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City of Colorado Springs\El Paso County for drainage reports and said report is in conformity with the master plan of the Solberg Ranch Drainage Basin. I accept responsibility for any liability caused by any acts, errors of omissions on my part in preparing this report.

Roger G. Berge, Professional Engineer No. 9646
For and on behalf of Berge, Brewer & Associates, Inc.

Developers Statement:

The developer has read and will comply with all of the requirements specified in this report and plan.

Windmill Flats
Business Name:

By: Joe Saucedo

Title: Owner

Address: 4290 Los Ranchitos Dr.
Falcon, Co. 80831

El Paso County:

Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

BY: John A. McCarty

1-13-03
DATE

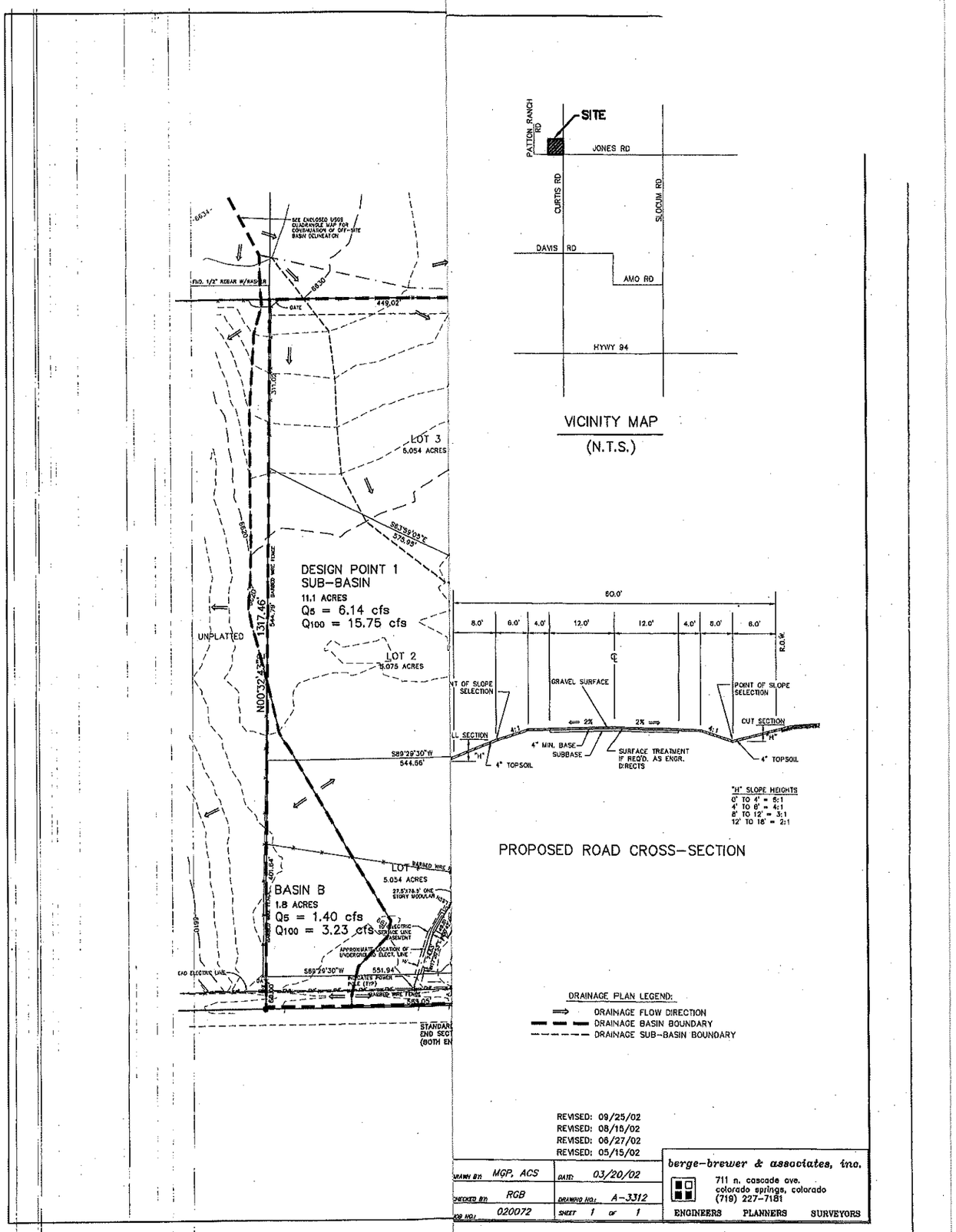
CONDITIONS:

Exh 6.1

Coyote Estates

Flowrate Summary Table

Description	Q_5 (cfs)	Q_{100} (cfs)
Off-site Basin	5.47	14.88
Basin A Developed Conditions	24.92	64.18
Basin A Current Conditions	21.60	57.76
Basin B	2.34	5.66
Design Point 1	7.55	19.33
Design Point 2	1.50	2.99
Design Point 3 Developed Conditions	30.39	79.06
Design Point 3 Current Conditions	27.07	72.64



VICINITY MAP
(N.T.S.)

PROPOSED ROAD CROSS-SECTION

DRAINAGE PLAN LEGEND:

- DRAINAGE FLOW DIRECTION
- DRAINAGE BASIN BOUNDARY
- DRAINAGE SUB-BASIN BOUNDARY

REVISED: 09/25/02
REVISED: 08/15/02
REVISED: 06/27/02
REVISED: 05/15/02

DRAWN BY: MGP, ACS	DATE: 03/20/02	
CHECKED BY: RGB	DRAWING NO.: A-3312	
JOB NO.: 020072	SHEET 1 OF 1	

berge-brewer & associates, inc.
711 n. cascade ave.
colorado springs, colorado
(719) 227-7181
ENGINEERS PLANNERS SURVEYORS

Exh 6
Exh 6.2

PRELIMINARY/FINAL DRAINAGE REPORT
FOR
MANLEY SUBDIVISION

March 29, 2000

Prepared for:

Jerry L. & Nancy Manley
4645 N. Curtis Road
Falcon, CO 80831

Prepared by:

Law & Mariotti Consultants, Inc.
619 North Cascade Avenue, Suite 206
Colorado Springs, CO 80903
(719) 442-1541

LMCI PN 00-021

Exh 6

LAW & 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

FILE NO. 00-021
CALC. BY BTR SHEET 1 OF 1
RETURN PERIOD 5 & 100 yr

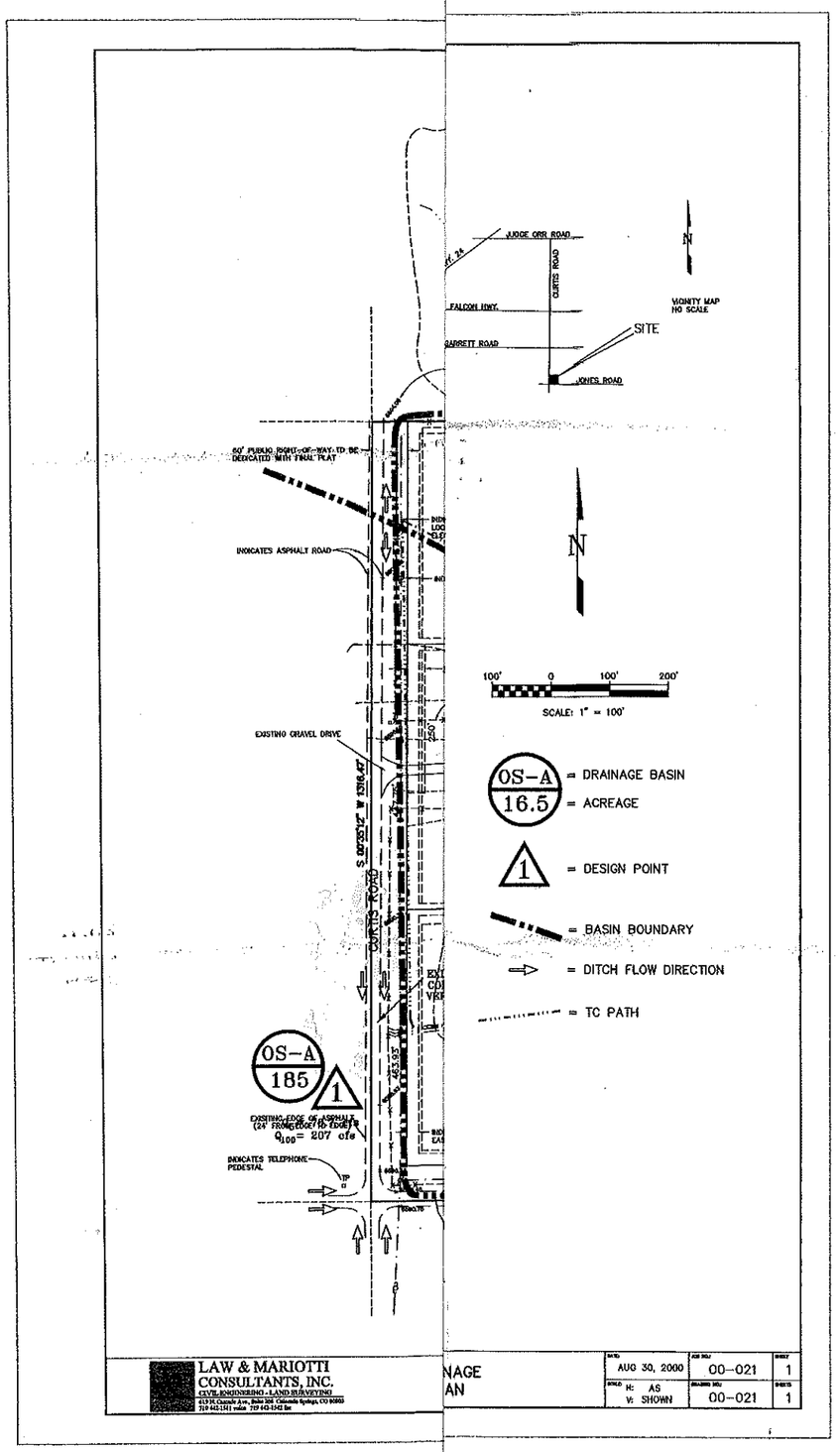
HYDROLOGIC COMPUTATIONS – RATIONAL METHOD

* $T_c = 1.87(1.1 - C_5)L^{0.5} S^{-0.33}$

POINT OF CONCENTRATION	SUBAREA(S) CONTRIBUTING	AREA ACRE	AREA SQ.MI.	FLOW PATH CHARACTERISTICS FLOW DESCRIPTION	LENGHT (FT)	HEIGHT (FT)	AVG. V (FPS)	Tc MIN.	C	C x A	I	Q	q FLOW (CFS) TOTAL	PIPE	STREET	REMARKS
DP 1	OS-A	185		O.L.	1000	20	–	40/35*								
				CHANNEL	3500	35	7	8								
		185				5	YR	48	0.25	46.3	1.7	78.7				
						100	YR	43	0.35	64.8	3.2	207				
DP 2	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	73.2	3.1	227				
DP 3	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				

Exh 6.2

Exh #6.2



LAW & MARIOTTI CONSULTANTS, INC.
CIVIL ENGINEERING • LAND SURVEYING
419 N. Cascade Ave., Suite 205, Colorado Springs, CO 80903
719 442-5181 voice 719 442-5182 fax

NAGE
AN

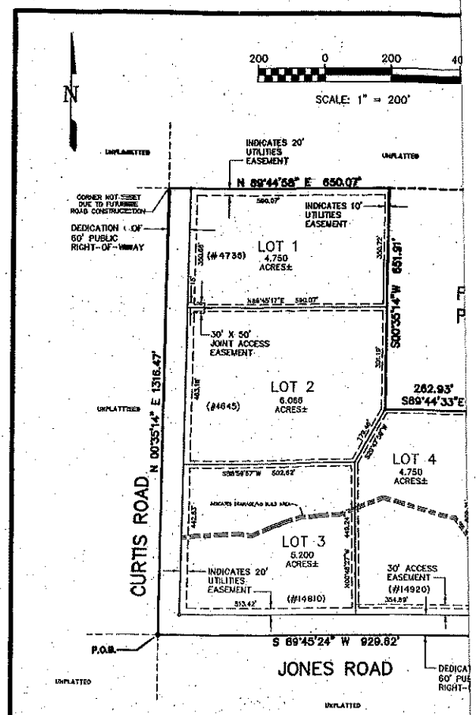
DATE: AUG 30, 2000	JOB NO.: 00-021	SHEET: 1
SCALE: H: AS V: SHOWN	DRAWING NO.: 00-021	SHEETS: 1

L:\00-021\00210mg2.dwg Fri Feb 23 14:52:14 2001 DSP

Exhibit 7

Existing Plat and Proposed Replat

Exhibit 1796



KNOW ALL MEN BY THESE PRESENTS:

That JERRY L. & NANCY MANLEY, being the owners of the following described

A Tract of Land Being a Portion of the Southwest 1/4 of the Southwest 1/4
Range 64 West, of the 6th P.M., El Paso County, Colorado, Described as foll

BEGINNING at the Southwest corner of said Section 22, Township 13 South, R

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

THENCE N 89°44'58" E along the north line of said Southwest 1/4 of the Sou

THENCE S 00°35'14" W, 651.91 feet;

THENCE S 89°44'33" E, 262.93 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, 929.82 feet

CONTAINING a computed area of 23.776 acres.

DEDICATION:

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

SURVEYOR'S CERTIFICATION:

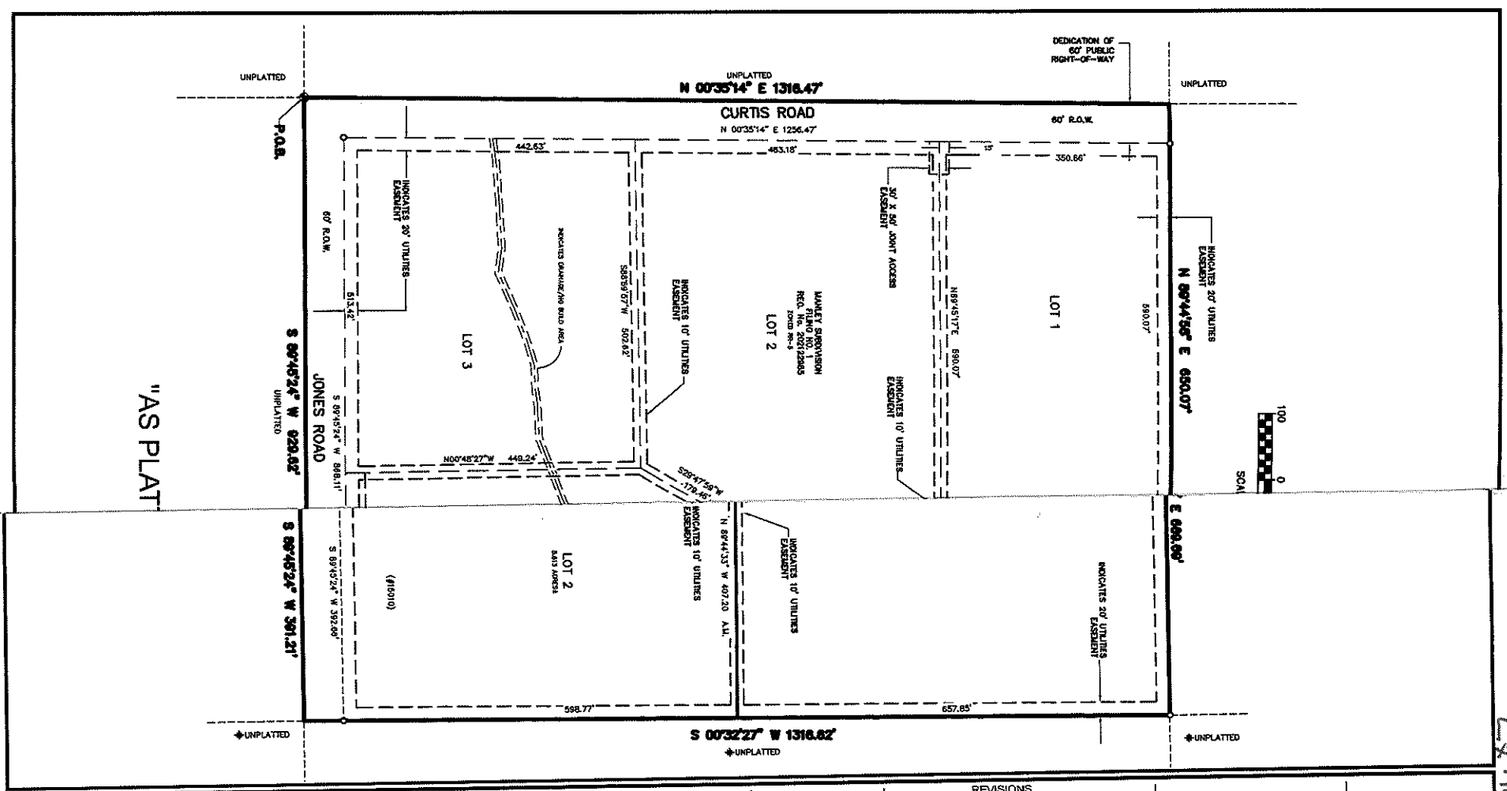
The undersigned Colorado Registered Professional Land Surveyor does hereby ce
accompanying plat was surveyed and drawn under his direct responsibility and s
accurately shows the described tract of land, and subdivision thereof, and that
requirements of Title 38 of the Colorado Revised Statutes, 1973,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

June 27, 2002

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

LDC, Inc.	REVISIONS	
PLANNING, SURVEYING, LAND SERVICES 3520 Austin Bluffs Parkway Colorado Springs, CO 80918 (719) 528-6133 FAX (719) 528-6848	NO.	DESCRIPTION
	1	COUNTY COMMENTS
	2	COUNTY COMMENTS

F:\99000\99158 - Manley Subdivision\99158P.dwg, Layout1, 6/27/2002 11:41:46 PM



"AS PLAT

Exhibit 7.2

MANLEY SUBDIVISION FILING NO.2

FINAL PLAT

Project No.: 99158

Sheet: 2 of 2

Land Development Consultants, Inc.

PLANNING • SURVEYING

www.ldc-inc.com • TEL: (719) 528-6133 • FAX: (719) 528-5848

3698 MAIZELAND ROAD • COLORADO SPRINGS, CO 80909

H Scale: 1" = 100'

V Scale: N/A

Designed By: DLK

Drawn By: JG

Checked By: DLK

Date: 8/30/2021

REVISIONS

No.	Description	By	Date

CALL BEFORE YOU DIG . . .

811

DIAL 811

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS FOR LOCATING AND MARKING GAS, ELECTRIC, WATER AND WASTEWATER

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 survey be commenced more than ten years from the date of the certification shown hereon.

F:\99000\99158 MANLEY SUB\MANLEY SUB NO 2\99158P-FIL2-2016 rev 9-27-2021.dwg

Exhibit 8

Hydrologic Summary for Existing Plat (per Law and Marrioti)

(see Exhibit 6)

Exhibit 9

Hydrologic Summary for Proposed Replat

EXHIBIT 9
Hydrology
STORM WATER RUNOFF
Manley Proposed Replat

Hydrology is the same for existing and developed conditions since construction is not proposed for the replat

AVG

		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***
OS1	208.53	0.00	0.59	0.70	0.00	0.73	0.81	208.53	0.08	0.35	***0.08***	***0.35***

Exhibit 9 - Design Point Summary

Existing and Proposed Conditions

Manley Subdivision Proposed Replat

21-Feb-2024

Design Point	Sub Basins	Total Acres	Existing/ proposed Runoff (see note)		Hydrologic Method
			Q5	Q100	
		(acres)	cfs	cfs	
1	OS1	208.56	19.2	88	TR55Rational and Method
2	OS1,A, D, E	231.6	20.4	92.5	TR55Rational and Method
3	B	13.82	3.7	27.3	Rational Method
4	OS1, A, D	229.4	23.4	116.1	TR55 and Rational Method

Notes

1 The quantity of runoff for both the existing and proposed runoff is the same since no development is or construction is to occur.

Exhibit 9 Hydrologic Summary

Existing and Proposed Conditions

Manley Subdivision Proposed Replat

21-Feb-2024

ID	Area	Runoff Coef		Runoff	
		5yr	100 Year	5yr	100 Year
OS1	208.5	0.08	0.35	19.20	88.00
A	14.3	0.08	0.35	2.90	19.30
B	13.8	0.08	0.35	3.70	27.30
C	2.19	0.08	0.35	0.50	3.50
D	6.6	0.08	0.35	1.30	8.80
E	2.2	0.08	0.35	0.40	3.00

EXHIBIT 9
Hydrology
STORM WATER RUNOFF
Manley Proposed Replat

Hydrology is the same for existing and developed conditions since construction is not proposed for the replat

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*
OS1	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.

3

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

Exhibit 9
KatiePE 3

Manley

Harrison

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 1	19.18 13.46	87.99 13.36
A	3.23 12.31	15.78 12.24
D	1.45 12.34	7.11 12.27
E	0.51 12.30	2.48 12.25
	24.4	113.36
REACHES		
OUTLET	20.44	92.50
	24.2	1

Include other runs in Exhibits
Check Tables

Design flows

Areas

OS-A	Acre	~~0.326~~
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

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

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

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)						
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)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow 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)						
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)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow 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)						
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

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

JOB E Exhibit 9
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Time of Concentration

Calc scale of each map

A. Main Tap map
Distance along Northerly P.L 650.07 + 669.69 = 1319.76
Distance (Ruler) $6\frac{3}{16}$ in = 6.1875
Scale 1" = 213.3 use 1" = 200'

11x17 map
Distance along northerly P.L = 1320
Distance = $6\frac{5}{16}$ = 6.3125"
Scale = 209 = use 210" 1" = 210'

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

C OS-A
1. Overland
$L \frac{1"}{455ft} \cdot \frac{x}{200'} = 200'/455 = 0.439$ in.

Fall = 6

2. Shallow Swale (To culvert under Curb, c
Actual on Paper = 10.2
Scaled Distance 455ft x 10.2 = 4614'

Elev. Fall: 6700 - 6590 = 110'

Scale 110/4614 = 2.6

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

Chris's

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

JOB Exhibit 9
SHEET NO. _____ OF _____
CALCULATED BY K. Harrison DATE 1/18/22
CHECKED BY _____ DATE _____
SCALE _____

T_c (Cont.)

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

- Shallow Swale To Eastern PL
  Length = 1,050
  Vert Drop - 6580 - 6554 =
  Slope - 26'/1050 = 26'/1050 = 2.5% good

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

- Shallow Channel Flow
  Distance to East PL = 860'
  V = (6592 - 6554) = 38'
  S = 38'/860' ≅ 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 = 200, Vert Drop = 20 S = 20/200 = 10%
- Shallow Channel to East PL
  Distance to East PL = 1400
  Drop: 6588 - 6562 = 26
  Slope: 2.4%

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 10

Hydraulic Summary for Swales and Culverts for Proposed Replat

Exhibit 10 - Hydraulic Summary

Existing and Proposed Conditions

Manley Subdivision Proposed Replat

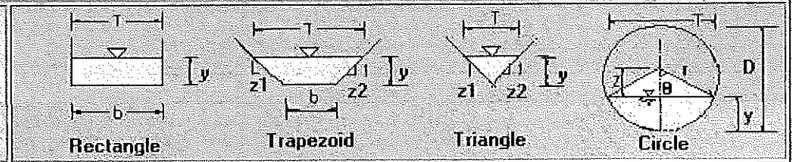
22-Feb-2024

Swale #	Contributing Subbasins	Location	Slope	Side Slopes	Design Flow		Depth of Flow		Velocity		Froude #	
					Q5	Q100	Q5	Q100	Q5	Q100		
			%		cfs	cfs	ft	ft	fps	fps	5 year	100 year
1	Outside scope of this study											
2	OS 1, A, D	see map	3.0		23.4	116.1	0.6	1.2	4.9	7.3	1.38	1.52
3	Outside scope of this study											
4	Outside scope of this study											
5	B	inside SB	3.5		3.7	27.3	0.3	0.7	3.2	5.6	1.29	1.49
6	Outside scope of this study											
7	Outside scope of this study											
8	OS1,A,D,E	DP4 to DP2	3.5		23.8	119.1	0.6	1.3	5.2	7.7	1.47	1.63

Swale #2 - 5yr

The open channel flow calculator

Select Channel Type: Trapezoid



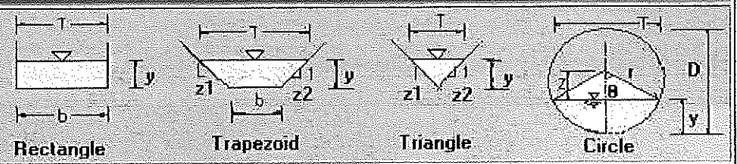
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.03 ft/ft	Water depth(y): 0.66 ft	Bottom width(b) 3 ft
Flow velocity 5.076 ft/s	LeftSlope (z1): 6 to 1 (H:V)	RightSlope (z2): 6 to 1 (H:V)
Flow discharge 23.4 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 11.05 ft	Flow area 4.61 ft^2	Top width(T) 10.94 ft
Specific energy 1.06 ft	Froude number 1.38	Flow status: Supercritical flow
Critical depth 0.78 ft	Critical slope 0.0145 ft/ft	Velocity head 0.4 ft

Swale #2 - 100yr

The open channel flow calculator

Select Channel Type: Trapezoid



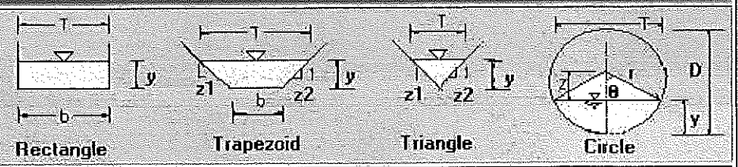
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.03 ft/ft	Water depth(y): 1.35 ft	Bottom width(b) 3 ft
Flow velocity 7.724 ft/s	LeftSlope (z1): 6 to 1 (H:V)	RightSlope (z2): 6 to 1 (H:V)
Flow discharge 116.1 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 19.45 ft	Flow area 15.03 ft^2	Top width(T) 19.23 ft
Specific energy 2.28 ft	Froude number 1.54	Flow status Supercritical flow
Critical depth 1.65 ft	Critical slope 0.0119 ft/ft	Velocity head 0.93 ft

Swale 5- 5yr

The open channel flow calculator

Select Channel Type: Trapezoid



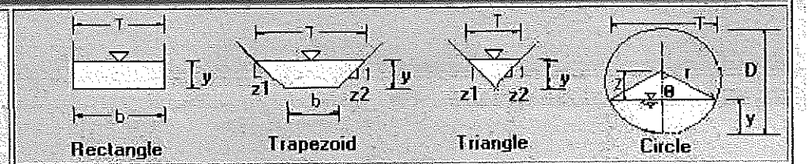
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.035 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

Scour5 100 year

The open channel flow calculator

Select Channel Type: Trapezoid



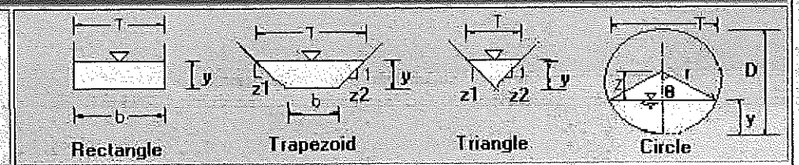
Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.035 ft/ft	Water depth(y): 0.69 ft	Bottom width(b) 3 ft
Flow velocity 5.592 ft/s	LeftSlope (z_1): 6 to 1 (H:V)	RightSlope (z_2): 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

Scale 8 - 5 year

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q

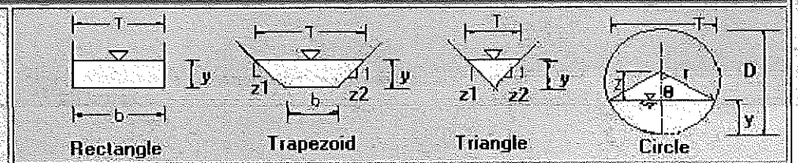
Select unit system: Feet(ft)

Channel slope: 0.035 ft/ft	Water depth(y): 0.64 ft	Bottom width(b) 3 ft
Flow velocity 5.412 ft/s	LeftSlope (z1): 6 to 1 (H:V)	RightSlope (z2): 6 to 1 (H:V)
Flow discharge 23.8 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 10.81 ft	Flow area 4.4 ft^2	Top width(T) 10.7 ft
Specific energy 1.1 ft	Froude number 1.49	Flow status Supercritical flow
Critical depth 0.78 ft	Critical slope 0.0146 ft/ft	Velocity head 0.45 ft

Swale 8 - 100year

The open channel flow calculator

Select Channel Type: Trapezoid



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

Channel slope: 0.035 ft/ft	Water depth(y): 1.32 ft	Bottom width(b) 3 ft
Flow velocity 8.23 ft/s	LeftSlope (z1): 6 to 1 (H:V)	RightSlope (z2): 6 to 1 (H:V)
Flow discharge 119.1 ft^3/s	Input n value 0.028 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 19.09 ft	Flow area 14.47 ft^2	Top width(T) 18.88 ft
Specific energy 2.37 ft	Froude number 1.66	Flow status Supercritical flow
Critical depth 1.67 ft	Critical slope 0.0118 ft/ft	Velocity head 1.05 ft

DP #1 = Culvert #1 - 24" CMP (Existing)
Q_5 = 19.2 cfs Q_{100} = 88 cfs

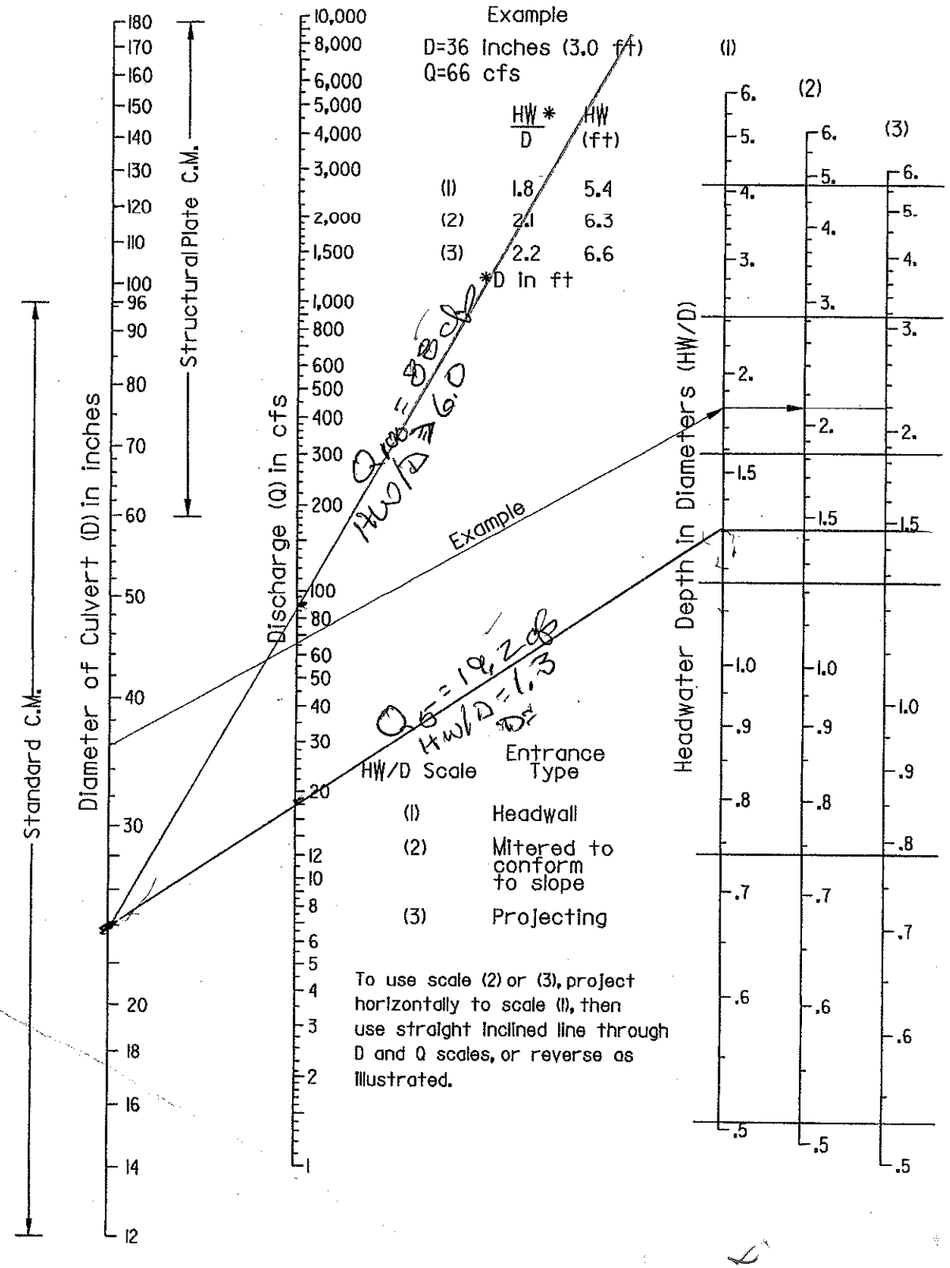


Exhibit F.2 Headwater Depth for CMP Culverts with Inlet Control (Source: Reference F.1)

Exhibit 11

Drainage Map for Proposed Replat

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

DESIGN POINT SUMMARY

DESIGN POINT	CONTRIB SUB BASINS	TOTAL AREA (acres)	EXISTING/PROP. RUNOFF Q5 (cfs)	EXISTING/PROP. RUNOFF Q100 (cfs)	HYDROLOGIC METHOD
1	OS 1	208.56	19.2	88.0	TR55 and Rational Method
2	OS 1, A, D, E	231.60	20.4	92.5	TR55 and Rational Method
3	B	13.82	3.7	27.3	Rational Method
4	OS 1, A, D	229.40	23.4	116.1	TR55 and Rational Method

NOTES: The quanity of runoff for both the existing and proposed runoff is the same since no development is, or construction is, to occur.

SWALE HYDRAULIC SUMMARY

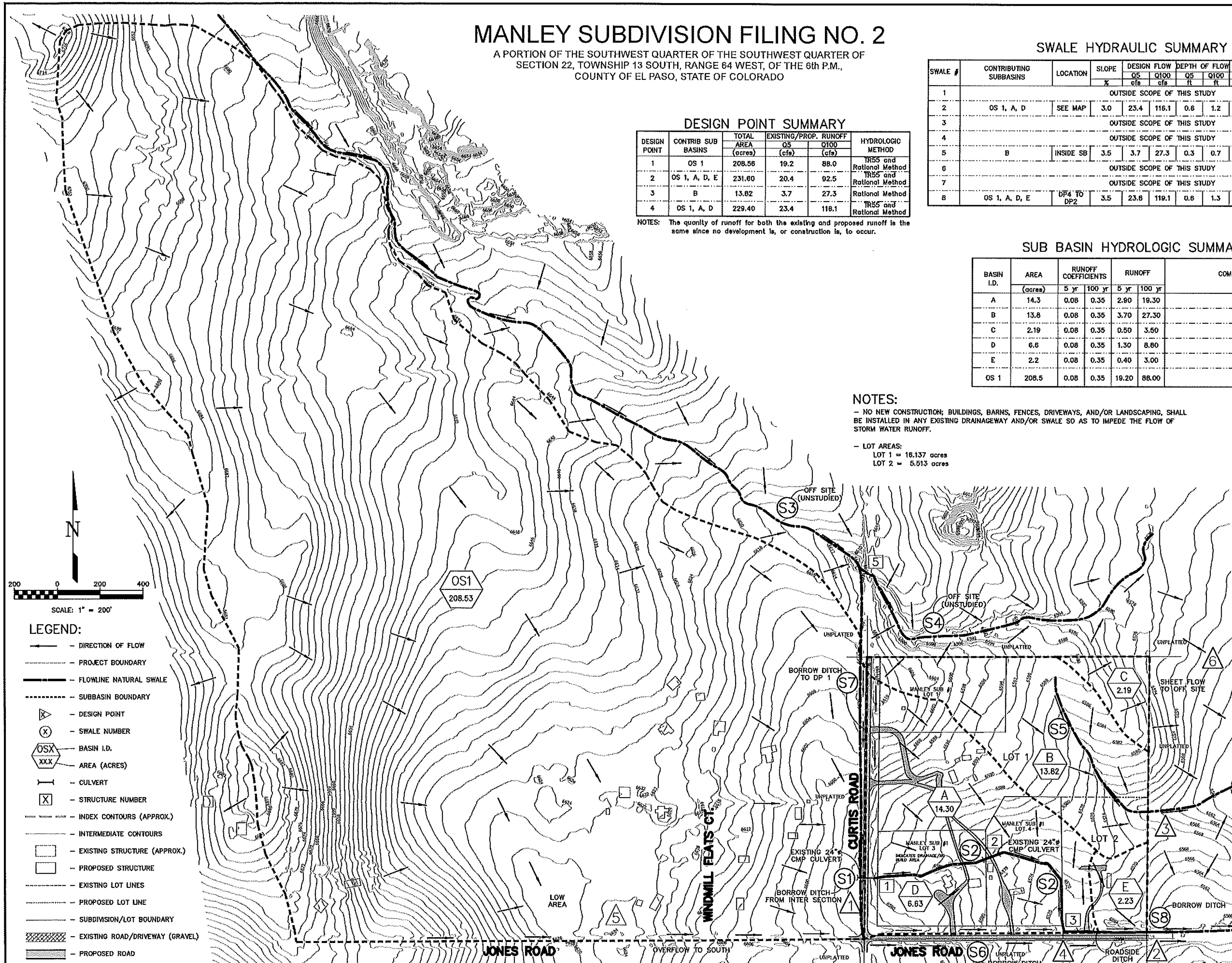
SWALE #	CONTRIBUTING SUBBASINS	LOCATION	SLOPE %	DESIGN FLOW Q5 cfs	DESIGN FLOW Q100 cfs	DEPTH OF FLOW Q5 ft	DEPTH OF FLOW Q100 ft	VELOCITY Q5 fps	VELOCITY Q100 fps	FROUDE # 5 year	FROUDE # 100 year
1	OUTSIDE SCOPE OF THIS STUDY										
2	OS 1, A, D	SEE MAP	3.0	23.4	116.1	0.6	1.2	4.9	7.3	1.38	1.52
3	OUTSIDE SCOPE OF THIS STUDY										
4	OUTSIDE SCOPE OF THIS STUDY										
5	B	INSIDE SB	3.5	3.7	27.3	0.3	0.7	3.2	5.6	1.29	1.49
6	OUTSIDE SCOPE OF THIS STUDY										
7	OUTSIDE SCOPE OF THIS STUDY										
8	OS 1, A, D, E	DP4 TO DP2	3.5	23.6	119.1	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	2.90	19.30	
B	13.8	0.08	0.35	3.70	27.30	
C	2.19	0.08	0.35	0.50	3.50	
D	6.6	0.08	0.35	1.30	8.80	
E	2.2	0.08	0.35	0.40	3.00	
OS 1	208.5	0.08	0.35	19.20	88.00	

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



MANLEY SUBDIVISION FILING NO. 2
DRAINAGE PLAN OF EXISTING CONDITIONS

Land Development Consultants, Inc.
PLANNING - SURVEYING
www.ldc-inc.com - TEL: (719) 528-6133 - FAX: (719) 528-6848
3898 MAIZELAND ROAD - COLORADO SPRINGS, CO 80909

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

REVISIONS

No.	Description	By	Date
1	UPDATED SUMMARY TABLES	DAS	03/01/24

CALL BEFORE YOU DIG . . .
811
DIAL 811
48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS FOR LOCATING AND MARKING GAS, ELECTRIC, WATER AND WASTEWATER

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.

Project No.: 99158

Sheet: 1 of 1