SPRINGS AT WATERVIEW
DRAINAGE LETTER
EL PASO COUNTY, COLORADO

January 2021

PREPARED FOR:

SWV, LLC
31 N. Tejon, Suite 500
Colorado Springs, CO 80903

PREPARED BY:

Dakota Springs Engineering
31 N. Tejon Street, Suite 518
Colorado Springs, CO 80903
719.227.7388

PROJECT NO.16-01

PCD No. SP-16-005
PCD No. SF-16-017

CERTIFICATIONS

Design Engineer's Statement:

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

COLORADO REGISTERED CHARLES K. COTHERN 24997 PROFESSIONAL ENGINEER

1/28/21

Charles K. Cothern, P.E. #24997

Seal

Owner/Developer's Statement:

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

By (signature): _____

Title: Manager (s)

Address: 31 N. Tejon St #500
Colorado Springs, CO 80921

Date: 1-28-21

El Paso County:

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

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

APPROVED
Engineering Department
02/18/2021 10:24:50 AM
dsdnijkamp
EPC Planning & Community Development Department

Table of Contents

Appendix

1.0 INTRODUCTION

This report is an amendment to the Preliminary & Final Drainage report prepared by Dakota Springs Engineering and approved October 16, 2018.

Purpose

The purpose of this report is to present revisions to the preliminary and final drainage improvements associated with the construction of Springs at Waterview. Revisions are associated with previously proposed storm sewer, specifically reduction in pipe size on the western end of the main trunk line storm sewer that primarily conveys offsite flows through the property. And conveyance of the Bradley Road discharge will remain in the Grinnell Boulevard roadside ditch and then routed into the Springs at Waterview drainage easement for collection by a Type D inlet. No changes have been made concerning onside or offsite hydrology or acceptance of offsite storm water through the site.

In addition, Appendix C of this report contains amendment information specifically related to lots 10 through 14 of Springs at Waterview and the addition of retaining walls for these lots as requested by the lot owners; these walls are shown on the Grading Plan as Revision to associated with this submittal.

2.0 General Location and Description

Location

Springs at Waterview is a planned 85-unit single family residential development within the north half of the northeast quarter of Section 7, Township 15 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. It is located south of Goldfield Drive, east of Grinnell Boulevard, north of Bradley Road and west of Painted Sky at Waterview Filing No. 1. This portion of the Waterview development is in the Windmill Gulch Drainage Basin. Refer to Vicinity map, Appendix A Figure 1.

Description of Property

The proposed site encompasses 15.68 acres. The topography of the site and surrounding area is typical of a high desert; short prairie grass and weeds with slopes generally ranging from 1% to 9%. The area generally drains to the west.

The site is comprised of several different soil types. From the Soil Survey of El Paso County, the site falls into the following soil types:

1. "3" Ascalon sandy loam, 3 to 9 percent slopes.
2. "8" Blakeland loamy sand, 1 to9 percent slopes.
3. "97" Truckton sandy loam, 3 to 9 percent slopes.

The Blakeland and Truckton soils are classified at Hydrological Group A and the Ascalon soil is classified as Hydrological Group B. Note: "#" indicates Soil Conservation Survey soil classification number. Hydrologic Soil Group B was used in the preparation of this report. See Appendix A Figure 2: Soils Data.

3.0 Drainage Basins and Sub-Basins

Major Basin Description

Springs at Waterview residential development is located within the Windmill Gulch Drainage Basin. This report complies with the Windmill Gulch Drainage Basin Planning Study (DBPS) by Wilson and Company, the Master Development Drainage Plan for Waterview by Merrick and Company, the Preliminary Drainage Report for Waterview Phase II, also by Merrick and Company and Painted Sky at Waterview Filing 1 and 2 Final Drainage Report by Merrick and Company and the Approved Springs at Waterview PDR/FDR. All developed runoff will meet El Paso County standards for discharge rates.

Floodplains

The Flood Insurance Rate Map (FIRM No. 08041C0764-G dated 12/7/2018) indicates that there is no floodplain in the vicinity of the proposed site. See Appendix A Figure 3: FIRM Panel

4.0 DRAINAGE BASINS

Existing Drainage Analysis

Please refer to the Preliminary and Final Drainage Report for Springs at Waterview, Approved on October 16, 2018, for existing drainage analysis.

Proposed Drainage Analysis

Please refer to the Preliminary and Final Drainage Report for Springs at Waterview, Approved on October 16, 2018, for proposed drainage analysis.

Proposed Storm System

The proposed storm water conveyance system presented in the approved Preliminary and Final Drainage Report of Springs at Waterview remains unchanged except for the following exceptions:

1. The Main Trunk Line Storm Sewer has been downsized on the western end up to the 72-inch existing CMP under Grinnell Boulevard.
2. Bradley Road storm water discharge remains in the Grinnell Boulevard roadside ditch until a point about 115 ft. south of the 72-inch existing crossing where grading modifications allow the flow to enter the drainage easement and be collected by a Type D inlet for conveyance under Grinnell Boulevard. Existing shallow utilities do not allow this storm water to access the drainage easement any sooner.
3. Other minor changes are reflected on the eastern end of the main trunk line primarily related to final slopes and manhole locations.

The proposed revision to the Main Trunk Line (Storm Line B) storm sewer is a reduction in the last leg of the pipe to 48-inch just upstream of the connection with the existing 72-inch pipe under Grinnell Boulevard. In addition, the eastern end of the storm sewer was modified to eliminate disturbance of Escanaba Drive and an addition of a manhole and changes to related pipe slopes. Location of the additional manhole located just west of the western curb of Escanaba Drive was the result of discussion

in the field with El Paso County field staff; the primary discussion point was eliminating the need to excavate a large portion of Escanaba Drive. Instead it was determined that use of the previously approved storm sewer stub to the east of Escanaba would be a better construction approach. The alternative was discussed with the design engineer and approved based on similar hydraulic characteristics and agreement that the approach was better to reduce interference with the neighborhood. StormCAD analysis and hydraulic grade line calculations are in Appendix A of this letter.

The proposed revision to the Bradley Road discharge to remain in the Grinnell Boulevard roadside ditch is to leave conditions as they exist. Grading modifications have taken place near the low point in Grinnell Boulevard approximately 115 ft. south of the 72-inch crossing to allow storm water flows from the Grinnell Boulevard roadside ditch to drain to the drainage easement and be collected in a Type D inlet for conveyance under Grinnell Boulevard. This grading modification will help reduce the existing flooding conditions on Grinnell Boulevard as acknowledged and described in the approved FDR.

Hydraulic computations for the proposed storm sewers are contained in Appendix A of this letter.

Storm Sewer Surcharge

The storm sewer modifications in this letter do result in some minor hydraulic surcharging just upstream of the existing 72-inch pipe. When Grinnell Boulevard is improved including curb and gutter, inlets and storm sewer conveying Grinnell Boulevard flow to the west side there will be no surcharging during the 100-year event; basin flow from Grinnell Boulevard that currently enters this proposed storm sewer (portions of D-17, D-18 and D-19) will be captured in the Grinnell Boulevard storm sewer and routed to other facilties.

Current surcharging does not negatively affect any development and all ponding above the inlets stays within the drainage easement.

5.0 DRAINAGE FEES, COST ESTIMATE & MAINTENANCE

There are no additional fees required for this development as a result of the amendments to the approved Preliminary and Final Drainage Report for Springs at Waterview, presented in this Drainage Letter. Those portions of the approved drainage report that established fees for this development remain unchanged. The amendment only addresses changes in conveyance along Grinnell Blvd.

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6.0 REFERENCE MATERIALS

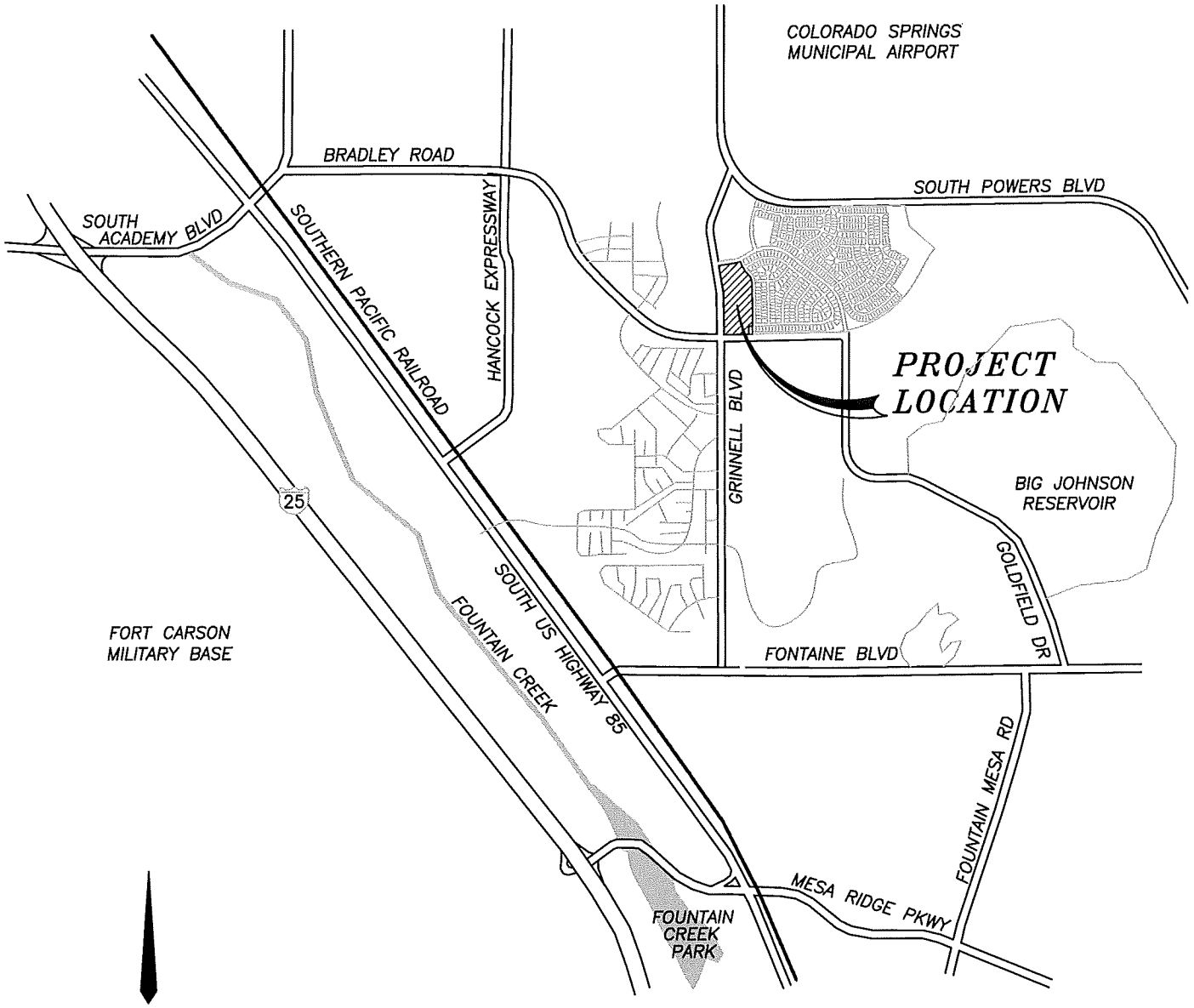
1. "City of Colorado Springs/El Paso County Drainage Criteria Manual" May 2014.
2. "Windmill Gulch Drainage Basin Planning Study", Wilson and Company, February 1992.
3. Master Development Drainage Plan for Waterview, May 2006. Prepared by Merrick & Co.
4. Preliminary Drainage Report for Waterview Phase II, January 2007. Prepared by Merrick & Co.
5. Final Drainage Report for Painted Sky at Waterview Filings 1 and 2, January 2007. Prepared by Merrick & Co.
6. Soils Survey of El Paso County Area, Natural Resources Conservation Services of Colorado.

7. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

8. "City of Colorado Springs/El Paso County Drainage Criteria Manual, Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices" May 2014.

9. Springs at Waterview Preliminary and Final Drainage Report, October 2018, Prepared by Dakota Springs Engineering.

Figure 1: Vicinity Map



THE SPRINGS AT WATERVIEW
VICINITY MAP

DSE Dakota Springs Engineering
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EXHIBIT

PROJECT NO. 0001-02-16-01

Figure 2: Soils Data

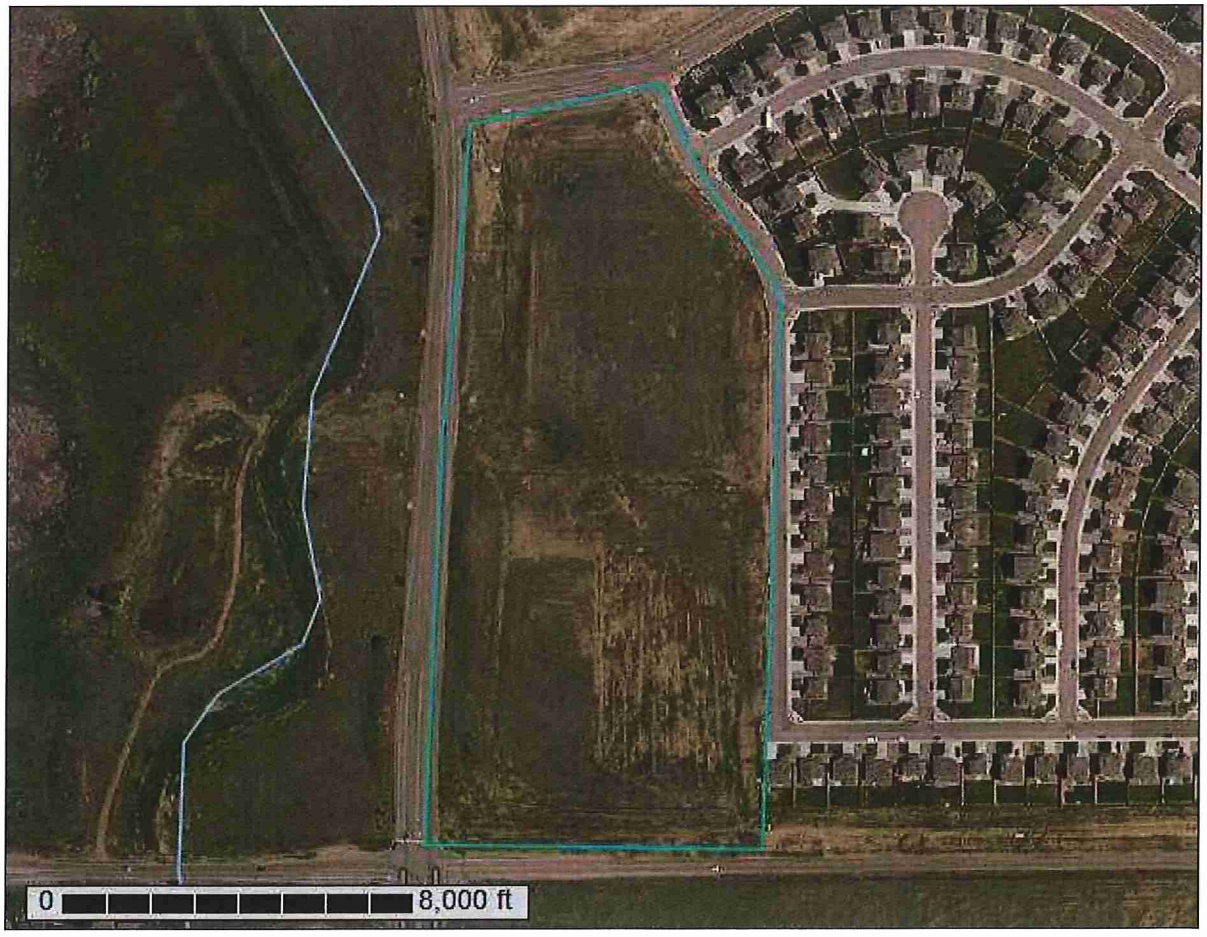
United States Department of Agriculture

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



July 31, 2016

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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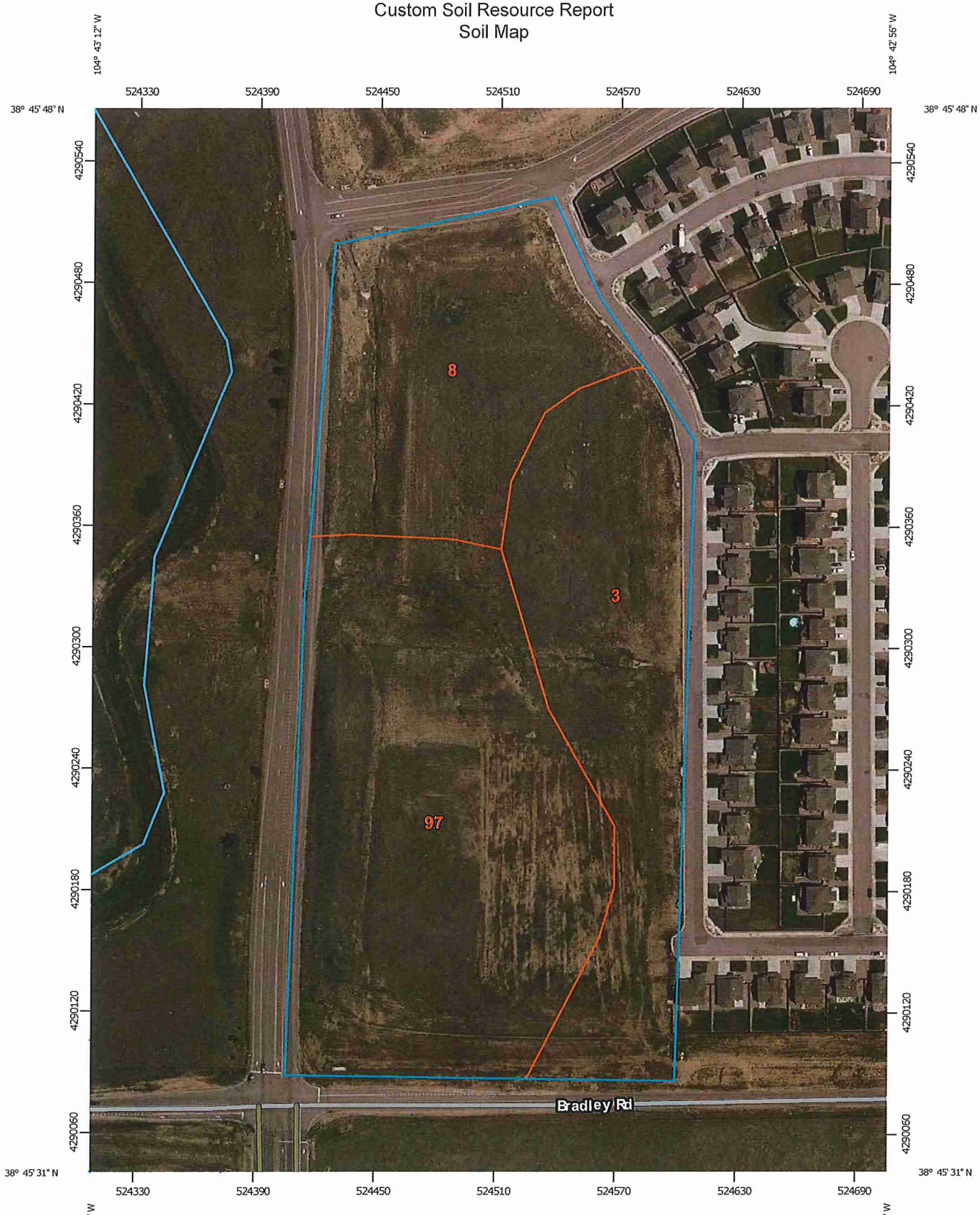
Contents

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



Map Scale: 1:2,560 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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 13, Sep 22, 2015

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
3	Ascalon sandy loam, 3 to 9 percent slopes	5.5	28.7%
8	Blakeland loamy sand, 1 to 9 percent slopes	4.7	24.8%
97	Truckton sandy loam, 3 to 9 percent slopes	8.9	46.5%
Totals for Area of Interest		**19.0**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments

on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

3—Ascalon sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlny
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 13 to 18 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 95 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk1 - 19 to 35 inches: fine sandy loam
Bk2 - 35 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline (0.1 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R067BY024CO)

Minor Components

Olnest

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)

Vona

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)

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

Description of Blakeland

Setting

Landform: Flats, hills
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
Natural 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 in profile: 5 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

97—Truckton sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 36bg
Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 24 inches: sandy loam
C - 24 to 60 inches: coarse sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)

Minor Components

Haplaquolls

Percent of map unit:
Landform: Marshes

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

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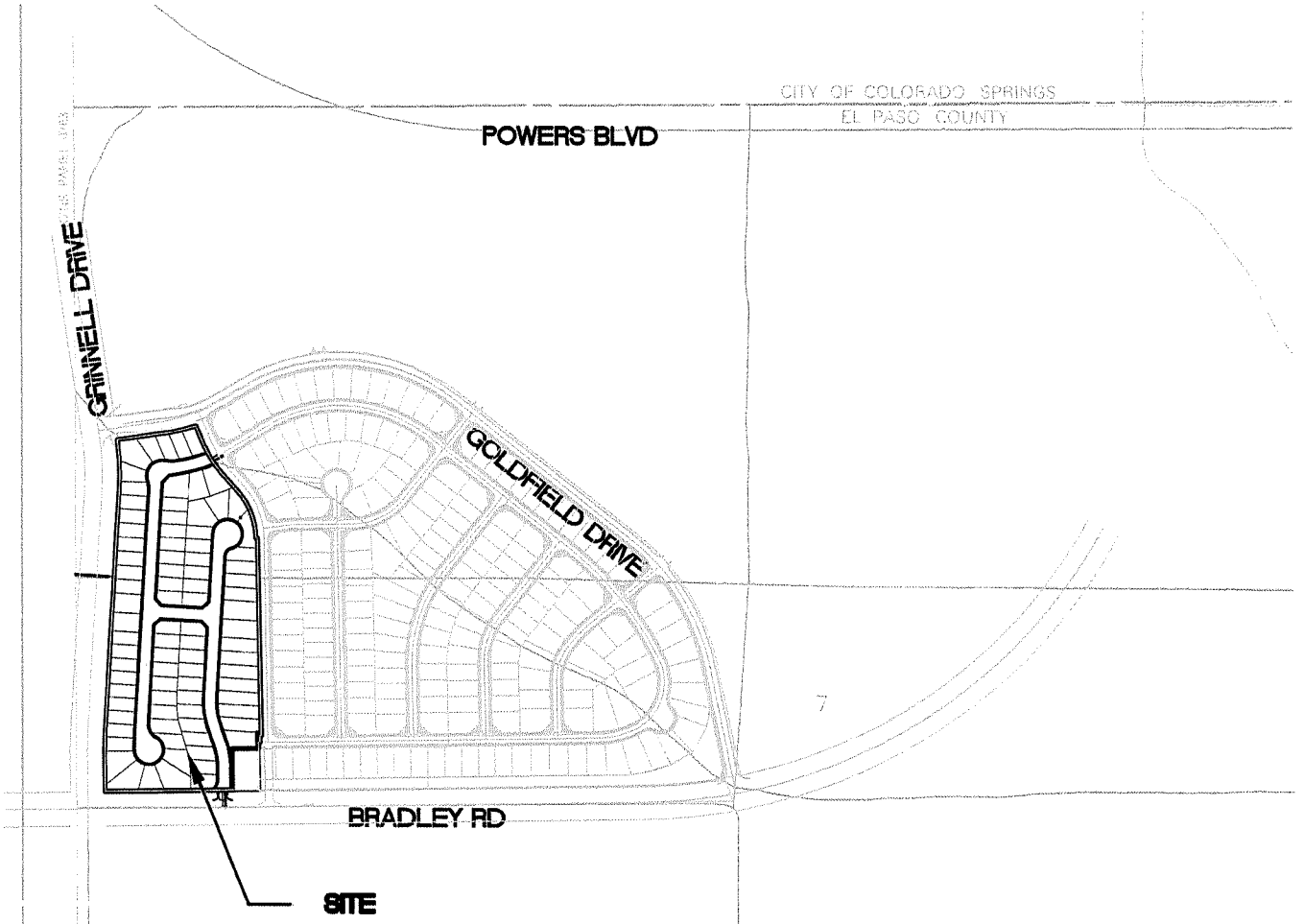
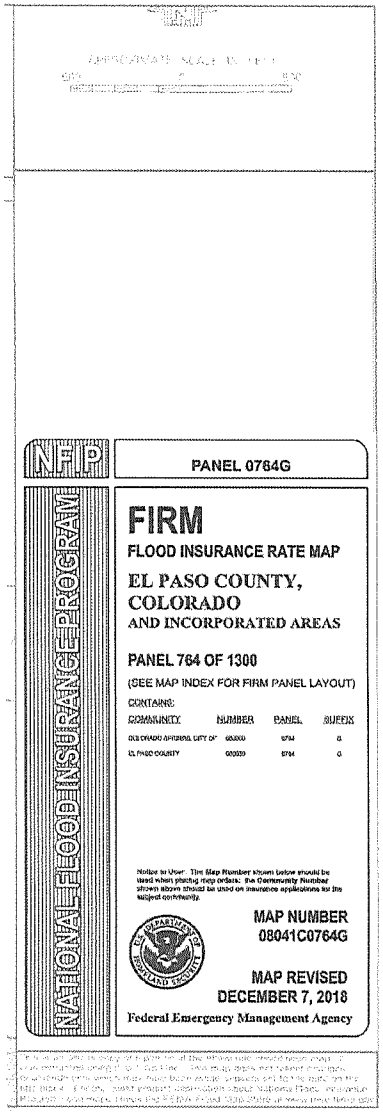
Figure 1: FIRM Panel





SE Springs Engineering
31 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903
TEL: (719) 227-7388
FAX: (719) 227-7392

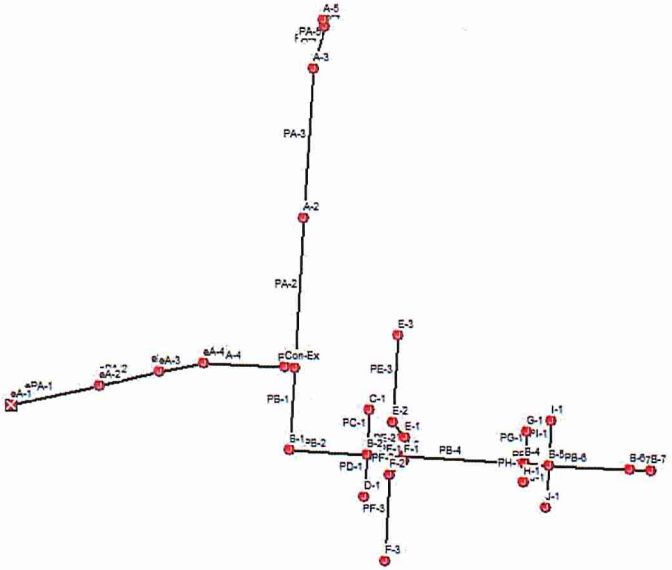
PROJECT NO. 12-005

SPRINGS AT WATERVIEW
PDR

FLOOD INSURANCE RATE MAP

FIGURE 2

Appendix A: StormCAD Analysis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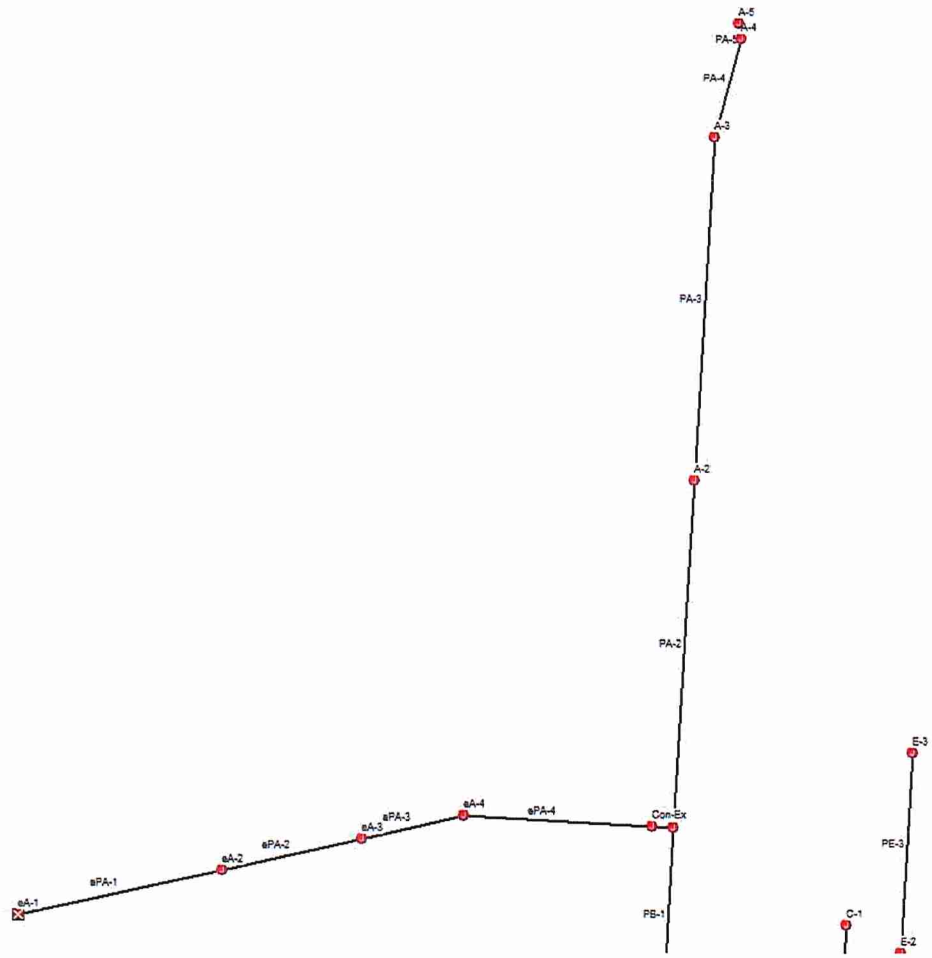
PA-3
A-2
PA-2
E-3
PE-3
C-1
E-2
E-1
PC-1
B-1
PB-2
PB-1
PD-1
D-1
PF-3
F-3
PB-4
G-1
I-1
PG-1
PI-1
PH-1
J-1
B-5
PB-6
B-6
PB-7
B-7
ePA-1
eA-1
eA-2
eA-3
eA-4
A-4
pCon-Ex


ePK-1
eK-1
eMH 6671 (EX)
ePK-2
INLET 6642 & 6643
SDMH 6472 (EX)
K-1
PK-2
SDMH 6015 (EX)
ePK-4
ePK-5
eK-2
eK-3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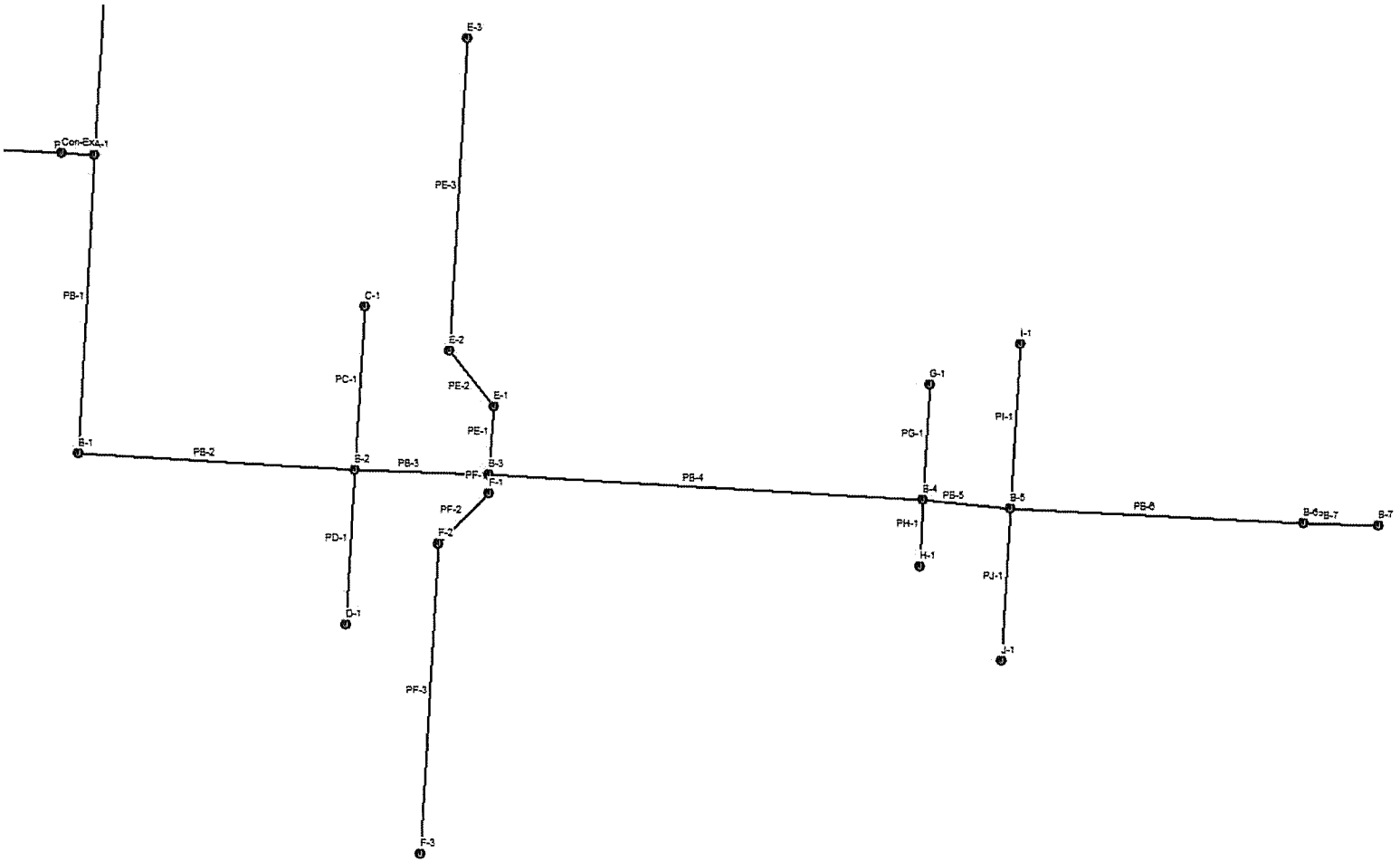
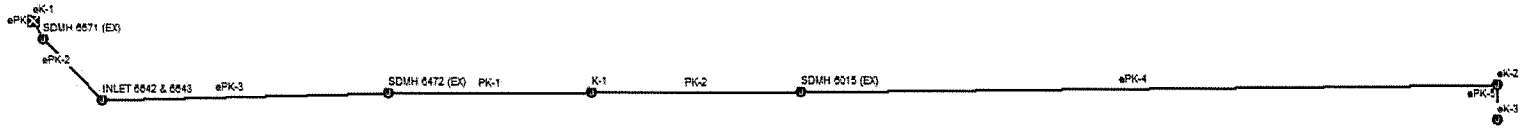
PA-5
PA-4
A-3
PA-3
A-2
PA-2
E-3
PE-3
eA-4
ePA-4
ePA-3
Con-Ex
eA-3
ePA-2
eA-2
ePA-1
eA-1
PB-1
C-1
E-2



Autodesk Storm and Sanitary Analysis


eK-1
ePK-1
SDMH 6571 (EX)
ePK-2
INLET 6642 & 6643
ePK-3
SDMH 6472 (EX)
PK-1
K-1
PK-2
SDMH 6015 (EX)
ePK-4
eK-2
ePK-5
eK-3

Project Description

File Name	2020amend20200730full.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	EPA SWMM
EPA SWMM Infiltration Method	Horton
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jul 30, 2020	00:00:00
End Analysis On	Jul 31, 2020	00:00:00
Start Reporting On	Jul 30, 2020	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	0
Nodes	37
Junctions	35
Outfalls	2
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	35
Channels	0
Pipes	35
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A-1	Junction	5856.40	5865.07	5856.40	5865.07	0.00	223.93	5862.40	0.00	2.67	0 00:00	0.00	0.00
2	A-2	Junction	5859.62	5865.23	5859.62	5865.23	0.00	100.72	5862.84	0.00	2.40	0 00:00	0.00	0.00
3	A-3	Junction	5862.80	5867.71	5862.80	5867.71	0.00	97.55	5866.14	0.00	1.57	0 00:00	0.00	0.00
4	A-4	Junction	5863.35	5872.83	5863.35	5872.83	0.00	89.43	5870.03	0.00	2.81	0 00:00	0.00	0.00
5	A-5	Junction	5867.16	5872.58	5867.16	5872.58	0.00	86.10	5869.99	0.00	2.59	0 00:00	0.00	0.00
6	B-1	Junction	5859.29	5864.20	5859.29	5864.20	0.00	155.95	5864.20	0.00	0.00	0 00:02	667.83	1440.00
7	B-2	Junction	5861.25	5871.99	5861.25	5871.99	0.00	141.56	5867.87	0.00	4.11	0 00:00	0.00	0.00
8	B-3	Junction	5865.59	5872.30	5865.59	5872.30	0.00	133.24	5868.36	0.00	3.95	0 00:00	0.00	0.00
9	B-4	Junction	5869.04	5879.34	5869.04	5879.34	0.00	111.63	5873.24	0.00	6.10	0 00:00	0.00	0.00
10	B-5	Junction	5869.53	5880.07	5869.53	5880.07	0.00	109.23	5880.07	0.00	0.00	0 00:01	0.06	1.00
11	B-6	Junction	5878.05	5893.27	5878.05	5893.27	0.00	89.43	5889.08	0.00	4.19	0 00:00	0.00	0.00
12	B-7	Junction	5887.07	5899.57	5887.07	5899.57	0.00	82.70	5889.28	0.00	10.29	0 00:00	0.00	0.00
13	C-1	Junction	5868.79	5872.50	5868.79	5872.50	0.00	2.50	5869.21	0.00	3.29	0 00:00	0.00	0.00
14	Con-Ex	Junction	5856.33	5863.27	5856.33	5863.27	0.00	224.89	5860.21	0.00	3.06	0 00:00	0.00	0.00
15	D-1	Junction	5868.79	5872.50	5868.79	5872.50	0.00	3.60	5869.29	0.00	3.21	0 00:00	0.00	0.00
16	E-1	Junction	5868.12	5872.78	5868.12	5872.78	0.00	12.71	5869.62	0.00	3.16	0 00:00	0.00	0.00
17	E-2	Junction	5868.81	5872.32	5868.81	5872.32	0.00	11.50	5870.04	0.00	2.28	0 00:00	0.00	0.00
18	E-3	Junction	5870.00	5873.70	5870.00	5873.70	0.00	5.90	5870.92	0.00	2.78	0 00:00	0.00	0.00
19	eA-2	Junction	5838.41	5856.93	5838.41	5856.93	0.00	227.02	5842.31	0.00	14.62	0 00:00	0.00	0.00
20	eA-3	Junction	5840.06	5858.52	5840.06	5858.52	0.00	228.72	5849.32	0.00	9.20	0 00:00	0.00	0.00
21	eA-4	Junction	5847.60	5862.48	5847.60	5862.48	0.00	228.18	5857.79	0.00	4.69	0 00:00	0.00	0.00
22	eK-2	Junction	5913.66	5918.10	5913.66	5918.10	0.00	14.10	5916.46	0.00	1.64	0 00:00	0.00	0.00
23	eK-3	Junction	5915.43	5918.69	5915.43	5918.69	0.00	14.10	5918.69	0.00	0.00	0 00:01	0.54	1441.00
24	F-1	Junction	5867.40	5872.73	5867.40	5872.73	0.00	11.59	5868.76	0.00	3.97	0 00:00	0.00	0.00
25	F-2	Junction	5868.09	5872.10	5868.09	5872.10	0.00	10.00	5869.20	0.00	2.90	0 00:00	0.00	0.00
26	F-3	Junction	5869.79	5873.50	5869.79	5873.50	0.00	5.90	5870.59	0.00	2.91	0 00:00	0.00	0.00
27	G-1	Junction	5876.86	5880.56	5876.86	5880.56	0.00	3.50	5877.19	0.00	3.38	0 00:00	0.00	0.00
28	H-1	Junction	5876.33	5880.04	5876.33	5880.04	0.00	2.30	5876.57	0.00	3.47	0 00:00	0.00	0.00
29	I-1	Junction	5877.49	5881.20	5877.49	5881.20	0.00	4.90	5877.92	0.00	3.28	0 00:00	0.00	0.00
30	INLET 6642 & 664	Junction	5869.21	5874.13	5869.21	5874.13	0.00	14.09	5870.35	0.00	3.78	0 00:00	0.00	0.00
31	J-1	Junction	5876.81	5880.52	5876.81	5880.52	0.00	7.90	5877.36	0.00	3.15	0 00:00	0.00	0.00
32	K-1	Junction	5880.27	5887.38	5880.27	5887.38	0.00	14.09	5884.54	0.00	2.85	0 00:00	0.00	0.00
33	SDMH 6015 (EX)	Junction	5886.78	5893.78	5886.78	5893.78	0.00	14.09	5887.91	0.00	5.87	0 00:00	0.00	0.00
34	SDMH 6472 (EX)	Junction	5873.99	5878.89	5873.99	5878.89	0.00	14.09	5875.10	0.00	3.79	0 00:00	0.00	0.00
35	SDMH 6671 (EX)	Junction	5867.28	5872.36	5867.28	5872.36	0.00	14.10	5868.11	0.00	4.26	0 00:00	0.00	0.00
36	eA-1	Outfall	5837.69					228.43	5841.61					
37	eK-1	Outfall	5866.81					14.11	5867.64					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	ePA-1	Pipe	eA-2	eA-1	143.41	5838.41	5837.69	0.5000	72.000	0.0130	228.43	300.08	0.76	11.80	3.82	0.65	0.00	Calculated
2	ePA-2	Pipe	eA-3	eA-2	97.50	5840.06	5838.60	1.5000	72.000	0.0130	227.02	518.25	0.44	17.71	2.73	0.46	0.00	Calculated
3	ePA-3	Pipe	eA-4	eA-3	71.44	5847.60	5846.53	1.5000	72.000	0.0130	228.72	518.30	0.44	17.77	2.73	0.46	0.00	Calculated
4	ePA-4	Pipe	Con-Ex	eA-4	129.48	5856.33	5854.80	1.1800	72.000	0.0130	228.18	460.37	0.50	16.33	2.92	0.50	0.00	Calculated
5	ePK-1	Pipe	SDMH 6671 (EX)	eK-1	15.41	5867.28	5866.81	3.0500	24.000	0.0130	14.11	39.51	0.36	11.52	0.83	0.41	0.00	Calculated
6	ePK-2	Pipe	INLET 6642 & 6643	SDMH 6671 (EX)	62.87	5869.21	5863.16	9.6300	24.000	0.0130	14.10	39.67	0.36	11.55	0.82	0.41	0.00	Calculated
7	ePK-3	Pipe	SDMH 6472 (EX)	INLET 6642 & 6643	212.28	5873.99	5869.24	2.2400	18.000	0.0130	14.09	15.71	0.90	10.10	1.11	0.74	0.00	Calculated
8	ePK-4	Pipe	eK-2	SDMH 6015 (EX)	516.14	5913.66	5886.78	5.2100	18.000	0.0130	14.09	23.97	0.59	14.10	0.83	0.55	0.00	Calculated
9	ePK-5	Pipe	eK-3	eK-2	26.17	5915.43	5914.96	1.8000	18.000	0.0130	14.10	14.08	1.00	7.98	1.50	1.00	1.00	SURCHARGED
10	PA-1	Pipe	A-1	Con-Ex	14.68	5856.40	5856.33	0.5000	72.000	0.0130	224.89	299.47	0.75	11.65	3.82	0.65	0.00	Calculated
11	PA-2	Pipe	A-2	A-1	239.26	5859.62	5858.40	0.5100	48.000	0.0130	97.00	102.45	0.95	9.56	3.00	0.75	0.00	Calculated
12	PA-3	Pipe	A-3	A-2	236.67	5862.80	5859.82	1.2600	48.000	0.0130	93.62	161.18	0.58	13.92	2.08	0.53	0.00	Calculated
13	PA-4	Pipe	A-4	A-3	69.56	5863.35	5863.00	0.5000	48.000	0.0130	97.55	101.57	0.96	9.55	2.83	0.76	0.00	Calculated
14	PA-5	Pipe	A-5	A-4	10.63	5867.16	5867.11	0.5000	48.000	0.0130	89.43	101.57	0.88	9.26	2.83	0.72	0.00	Calculated
15	PB-1	Pipe	B-1	A-1	132.05	5859.29	5858.40	0.6700	48.000	0.0130	117.73	117.73	1.00	9.37	4.00	1.00	1440.00	SURCHARGED
16	PB-2	Pipe	B-2	B-1	121.58	5861.25	5859.49	1.4500	48.000	0.0130	141.75	172.97	0.82	15.36	2.61	0.69	0.00	Calculated
17	PB-3	Pipe	B-3	B-2	58.81	5865.59	5864.84	1.2600	48.000	0.0130	135.76	161.47	0.84	14.50	2.65	0.70	0.00	Calculated
18	PB-4	Pipe	B-4	B-3	191.08	5869.04	5865.89	1.6500	48.000	0.0130	108.98	184.54	0.59	15.86	2.12	0.54	0.00	Calculated
19	PB-5	Pipe	B-5	B-4	38.49	5869.53	5869.34	0.5000	48.000	0.0130	105.29	101.57	1.04	9.28	3.08	0.99	0.00	> CAPACITY
20	PB-6	Pipe	B-6	B-5	128.71	5878.05	5869.83	6.3800	48.000	0.0130	94.85	362.93	0.26	24.81	1.30	0.34	0.00	Calculated
21	PB-7	Pipe	B-7	B-6	32.92	5887.07	5886.76	0.9500	48.000	0.0130	89.43	139.99	0.64	12.16	2.21	0.57	0.00	Calculated
22	PC-1	Pipe	C-1	B-2	72.50	5868.79	5867.34	2.0000	18.000	0.0130	2.86	14.84	0.19	6.79	0.42	0.29	0.00	Calculated
23	PD-1	Pipe	D-1	B-2	68.07	5868.79	5867.34	2.1300	18.000	0.0130	4.13	15.34	0.27	7.73	0.49	0.34	0.00	Calculated
24	PE-1	Pipe	E-1	B-3	30.17	5868.12	5866.84	4.2600	18.000	0.0130	12.70	21.67	0.59	12.74	0.83	0.55	0.00	Calculated
25	PE-2	Pipe	E-2	E-1	31.58	5868.81	5868.42	1.2500	18.000	0.0130	11.51	11.74	0.98	7.58	1.20	0.80	0.00	Calculated
26	PE-3	Pipe	E-3	E-2	137.79	5870.00	5869.11	0.6400	18.000	0.0130	5.90	8.40	0.70	5.15	0.93	0.62	0.00	Calculated
27	PF-1	Pipe	F-1	B-3	8.19	5867.40	5866.84	6.8600	18.000	0.0130	11.59	27.52	0.42	14.90	0.68	0.45	0.00	Calculated
28	PF-2	Pipe	F-2	F-1	31.47	5868.09	5867.70	1.2500	18.000	0.0130	9.99	11.74	0.85	7.49	1.06	0.71	0.00	Calculated
29	PF-3	Pipe	F-3	F-2	137.40	5869.79	5868.39	1.0200	18.000	0.0130	6.00	10.59	0.57	6.22	0.80	0.54	0.00	Calculated
30	PG-1	Pipe	G-1	B-4	51.07	5876.86	5871.84	9.8200	18.000	0.0130	3.86	32.92	0.12	12.91	0.33	0.23	0.00	Calculated
31	PH-1	Pipe	H-1	B-4	29.26	5876.33	5871.84	15.3500	18.000	0.0130	2.48	41.15	0.06	13.16	0.24	0.16	0.00	Calculated
32	PI-1	Pipe	I-1	B-5	72.50	5877.49	5872.33	7.1200	18.000	0.0130	5.55	28.03	0.20	12.88	0.42	0.29	0.00	Calculated
33	PJ-1	Pipe	J-1	B-5	67.50	5876.81	5872.33	6.6300	18.000	0.0130	8.83	27.05	0.33	14.24	0.56	0.38	0.00	Calculated
34	PK-1	Pipe	K-1	SDMH 6472 (EX)	150.45	5880.27	5873.99	4.1700	18.000	0.0130	14.09	21.46	0.66	12.98	0.89	0.59	0.00	Calculated
35	PK-2	Pipe	SDMH 6015 (EX)	K-1	156.08	5886.78	5883.41	2.1600	18.000	0.0130	14.09	15.44	0.91	9.90	1.13	0.75	0.00	Calculated

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	A-1	5856.40	5865.07	8.67	5856.40	0.00	5865.07	0.00	0.00	0.00
2	A-2	5859.62	5865.23	5.62	5859.62	0.00	5865.23	0.00	0.00	0.00
3	A-3	5862.80	5867.71	4.92	5862.80	0.00	5867.71	0.00	0.00	0.00
4	A-4	5863.35	5872.83	9.49	5863.35	0.00	5872.83	0.00	0.00	0.00
5	A-5	5867.16	5872.58	5.42	5867.16	0.00	5872.58	0.00	0.00	0.00
6	B-1	5859.29	5864.20	4.92	5859.29	0.00	5864.20	0.00	0.00	0.00
7	B-2	5861.25	5871.99	10.74	5861.25	0.00	5871.99	0.00	0.00	0.00
8	B-3	5865.59	5872.30	6.72	5865.59	0.00	5872.30	0.00	0.00	0.00
9	B-4	5869.04	5879.34	10.30	5869.04	0.00	5879.34	0.00	0.00	0.00
10	B-5	5869.53	5880.07	10.54	5869.53	0.00	5880.07	0.00	0.00	0.00
11	B-6	5878.05	5893.27	15.23	5878.05	0.00	5893.27	0.00	0.00	0.00
12	B-7	5887.07	5899.57	12.50	5887.07	0.00	5899.57	0.00	0.00	0.00
13	C-1	5868.79	5872.50	3.71	5868.79	0.00	5872.50	0.00	0.00	0.00
14	Con-Ex	5856.33	5863.27	6.94	5856.33	0.00	5863.27	0.00	0.00	0.00
15	D-1	5868.79	5872.50	3.71	5868.79	0.00	5872.50	0.00	0.00	0.00
16	E-1	5868.12	5872.78	4.66	5868.12	0.00	5872.78	0.00	0.00	0.00
17	E-2	5868.81	5872.32	3.51	5868.81	0.00	5872.32	0.00	0.00	0.00
18	E-3	5870.00	5873.70	3.71	5870.00	0.00	5873.70	0.00	0.00	0.00
19	eA-2	5838.41	5856.93	18.52	5838.41	0.00	5856.93	0.00	0.00	0.00
20	eA-3	5840.06	5858.52	18.46	5840.06	0.00	5858.52	0.00	0.00	0.00
21	eA-4	5847.60	5862.48	14.88	5847.60	0.00	5862.48	0.00	0.00	0.00
22	eK-2	5913.66	5918.10	4.44	5913.66	0.00	5918.10	0.00	0.00	0.00
23	eK-3	5915.43	5918.69	3.26	5915.43	0.00	5918.69	0.00	0.00	0.00
24	F-1	5867.40	5872.73	5.33	5867.40	0.00	5872.73	0.00	0.00	0.00
25	F-2	5868.09	5872.10	4.01	5868.09	0.00	5872.10	0.00	0.00	0.00
26	F-3	5869.79	5873.50	3.71	5869.79	0.00	5873.50	0.00	0.00	0.00
27	G-1	5876.86	5880.56	3.71	5876.86	0.00	5880.56	0.00	0.00	0.00
28	H-1	5876.33	5880.04	3.71	5876.33	0.00	5880.04	0.00	0.00	0.00
29	I-1	5877.49	5881.20	3.71	5877.49	0.00	5881.20	0.00	0.00	0.00
30	INLET 6642 & 664	5869.21	5874.13	4.91	5869.21	0.00	5874.13	0.00	0.00	0.00
31	J-1	5876.81	5880.52	3.71	5876.81	0.00	5880.52	0.00	0.00	0.00
32	K-1	5880.27	5887.38	7.11	5880.27	0.00	5887.38	0.00	0.00	0.00
33	SDMH 6015 (EX)	5886.78	5893.78	7.00	5886.78	0.00	5893.78	0.00	0.00	0.00
34	SDMH 6472 (EX)	5873.99	5878.89	4.90	5873.99	0.00	5878.89	0.00	0.00	0.00
35	SDMH 6671 (EX)	5867.28	5872.36	5.08	5867.28	0.00	5872.36	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	A-1	223.93	9.20	5862.40	6.00	0.00	2.67	5862.40	6.00	0 00:01	0 00:00	0.00	0.00
2	A-2	100.72	7.10	5862.84	3.22	0.00	2.40	5862.61	2.99	0 00:01	0 00:00	0.00	0.00
3	A-3	97.55	0.00	5866.14	3.34	0.00	1.57	5865.83	3.03	0 00:01	0 00:00	0.00	0.00
4	A-4	89.43	0.00	5870.03	6.68	0.00	2.81	5869.94	6.59	0 00:01	0 00:00	0.00	0.00
5	A-5	86.10	86.10	5869.99	2.83	0.00	2.59	5869.99	2.83	0 00:00	0 00:00	0.00	0.00
6	B-1	155.95	14.20	5864.20	4.91	0.00	0.00	5864.20	4.91	0 00:01	0 00:02	667.83	1440.00
7	B-2	141.56	0.00	5867.87	6.62	0.00	4.11	5867.84	6.59	0 00:01	0 00:00	0.00	0.00
8	B-3	133.24	0.00	5868.36	2.77	0.00	3.95	5868.24	2.65	0 00:01	0 00:00	0.00	0.00
9	B-4	111.63	0.00	5873.24	4.20	0.00	6.10	5872.42	3.38	0 00:01	0 00:00	0.00	0.00
10	B-5	109.23	0.00	5880.07	10.54	0.00	0.00	5872.89	3.36	0 00:01	0 00:01	0.06	1.00
11	B-6	89.43	0.00	5889.08	11.03	0.00	4.19	5888.97	10.92	0 00:01	0 00:00	0.00	0.00
12	B-7	82.70	82.70	5889.28	2.21	0.00	10.29	5889.28	2.21	0 00:00	0 00:00	0.00	0.00
13	C-1	2.50	2.50	5869.21	0.42	0.00	3.29	5869.21	0.42	0 00:00	0 00:00	0.00	0.00
14	Con-Ex	224.89	0.00	5860.21	3.88	0.00	3.06	5860.15	3.82	0 00:02	0 00:00	0.00	0.00
15	D-1	3.60	3.60	5869.29	0.50	0.00	3.21	5869.29	0.50	0 00:00	0 00:00	0.00	0.00
16	E-1	12.71	1.20	5869.62	1.50	0.00	3.16	5869.62	1.50	0 00:02	0 00:00	0.00	0.00
17	E-2	11.50	5.60	5870.04	1.23	0.00	2.28	5870.04	1.23	0 00:06	0 00:00	0.00	0.00
18	E-3	5.90	5.90	5870.92	0.92	0.00	2.78	5870.92	0.92	0 00:00	0 00:00	0.00	0.00
19	eA-2	227.02	0.00	5842.31	3.90	0.00	14.62	5842.23	3.82	0 00:02	0 00:00	0.00	0.00
20	eA-3	228.72	0.00	5849.32	9.26	0.00	9.20	5849.26	9.20	0 00:02	0 00:00	0.00	0.00
21	eA-4	228.18	0.00	5857.79	10.19	0.00	4.69	5857.72	10.12	0 00:02	0 00:00	0.00	0.00
22	eK-2	14.10	0.00	5916.46	2.80	0.00	1.64	5916.46	2.80	0 00:01	0 00:00	0.00	0.00
23	eK-3	14.10	14.10	5918.69	3.26	0.00	0.00	5918.69	3.26	0 00:00	0 00:01	0.54	1441.00
24	F-1	11.59	1.60	5868.76	1.36	0.00	3.97	5868.75	1.35	0 00:01	0 00:00	0.00	0.00
25	F-2	10.00	4.00	5869.20	1.11	0.00	2.90	5869.19	1.10	0 00:01	0 00:00	0.00	0.00
26	F-3	5.90	5.90	5870.59	0.80	0.00	2.91	5870.59	0.80	0 00:00	0 00:00	0.00	0.00
27	G-1	3.50	3.50	5877.19	0.33	0.00	3.38	5877.19	0.33	0 00:00	0 00:00	0.00	0.00
28	H-1	2.30	2.30	5876.57	0.24	0.00	3.47	5876.57	0.24	0 00:00	0 00:00	0.00	0.00
29	I-1	4.90	4.90	5877.92	0.43	0.00	3.28	5877.92	0.43	0 00:00	0 00:00	0.00	0.00
30	INLET 6642 & 664	14.09	0.00	5870.35	1.14	0.00	3.78	5870.35	1.14	0 00:02	0 00:00	0.00	0.00
31	J-1	7.90	7.90	5877.36	0.55	0.00	3.15	5877.36	0.55	0 00:00	0 00:00	0.00	0.00
32	K-1	14.09	0.00	5884.54	4.27	0.00	2.85	5884.54	4.27	0 00:05	0 00:00	0.00	0.00
33	SDMH 6015 (EX)	14.09	0.00	5887.91	1.13	0.00	5.87	5887.91	1.13	0 00:04	0 00:00	0.00	0.00
34	SDMH 6472 (EX)	14.09	0.00	5875.10	1.11	0.00	3.79	5875.10	1.11	0 00:06	0 00:00	0.00	0.00
35	SDMH 6671 (EX)	14.10	0.00	5868.11	0.83	0.00	4.26	5868.10	0.82	0 00:05	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	ePA-1	143.41	5838.41	0.00	5837.69	0.00	0.72	0.5000	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
2	ePA-2	97.50	5840.06	0.00	5838.60	0.19	1.46	1.5000	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
3	ePA-3	71.44	5847.60	0.00	5846.53	6.47	1.07	1.5000	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
4	ePA-4	129.48	5856.33	0.00	5854.80	7.20	1.53	1.1800	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
5	ePK-1	15.41	5867.28	0.00	5866.81	0.00	0.47	3.0500	CIRCULAR	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
6	ePK-2	62.87	5869.21	0.00	5863.16	-4.12	6.05	9.6300	CIRCULAR	24.000	24.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
7	ePK-3	212.28	5873.99	0.00	5869.24	0.03	4.75	2.2400	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
8	ePK-4	516.14	5913.66	0.00	5886.78	0.00	26.88	5.2100	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
9	ePK-5	26.17	5915.43	0.00	5914.96	1.30	0.47	1.8000	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
10	PA-1	14.68	5856.40	0.00	5856.33	0.00	0.07	0.5000	CIRCULAR	72.000	72.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
11	PA-2	239.26	5859.62	0.00	5858.40	2.00	1.22	0.5100	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
12	PA-3	236.67	5862.80	0.00	5859.82	0.20	2.98	1.2600	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
13	PA-4	69.56	5863.35	0.00	5863.00	0.20	0.35	0.5000	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
14	PA-5	10.63	5867.16	0.00	5867.11	3.77	0.05	0.5000	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
15	PB-1	132.05	5859.29	0.00	5858.40	2.00	0.89	0.6700	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
16	PB-2	121.58	5861.25	0.00	5859.49	0.20	1.76	1.4500	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
17	PB-3	58.81	5865.59	0.00	5864.84	3.59	0.74	1.2600	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
18	PB-4	191.08	5869.04	0.00	5865.89	0.30	3.15	1.6500	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
19	PB-5	38.49	5869.53	0.00	5869.34	0.30	0.19	0.5000	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
20	PB-6	128.71	5878.05	0.00	5869.83	0.30	8.22	6.3800	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
21	PB-7	32.92	5887.07	0.00	5886.76	8.71	0.31	0.9500	CIRCULAR	48.000	48.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
22	PC-1	72.50	5868.79	0.00	5867.34	6.09	1.45	2.0000	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
23	PD-1	68.07	5868.79	0.00	5867.34	6.09	1.45	2.1300	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
24	PE-1	30.17	5868.12	0.00	5866.84	1.25	1.28	4.2600	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
25	PE-2	31.58	5868.81	0.00	5868.42	0.30	0.39	1.2500	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
26	PE-3	137.79	5870.00	0.00	5869.11	0.30	0.88	0.6400	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
27	PF-1	8.19	5867.40	0.00	5866.84	1.25	0.56	6.8600	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
28	PF-2	31.47	5868.09	0.00	5867.70	0.30	0.39	1.2500	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
29	PF-3	137.40	5869.79	0.00	5868.39	0.30	1.40	1.0200	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
30	PG-1	51.07	5876.86	0.00	5871.84	2.80	5.02	9.8200	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
31	PH-1	29.26	5876.33	0.00	5871.84	2.80	4.49	15.3500	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
32	PI-1	72.50	5877.49	0.00	5872.33	2.80	5.16	7.1200	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
33	PJ-1	67.50	5876.81	0.00	5872.33	2.80	4.47	6.6300	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
34	PK-1	150.45	5880.27	0.00	5873.99	0.00	6.28	4.1700	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1
35	PK-2	156.08	5886.78	0.00	5883.41	3.14	3.37	2.1600	CIRCULAR	18.000	18.000	0.0130	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	ePA-1	228.43	0 00:02	300.08	0.76	11.80	0.20	3.82	0.65	0.00		Calculated
2	ePA-2	227.02	0 00:02	518.25	0.44	17.71	0.09	2.73	0.46	0.00		Calculated
3	ePA-3	228.72	0 00:02	518.30	0.44	17.77	0.07	2.73	0.46	0.00		Calculated
4	ePA-4	228.18	0 00:02	460.37	0.50	16.33	0.13	2.92	0.50	0.00		Calculated
5	ePK-1	14.11	0 00:04	39.51	0.36	11.52	0.02	0.83	0.41	0.00		Calculated
6	ePK-2	14.10	0 00:05	39.67	0.36	11.55	0.09	0.82	0.41	0.00		Calculated
7	ePK-3	14.09	0 00:02	15.71	0.90	10.10	0.35	1.11	0.74	0.00		Calculated
8	ePK-4	14.09	0 00:04	23.97	0.59	14.10	0.61	0.83	0.55	0.00		Calculated
9	ePK-5	14.10	0 00:01	14.08	1.00	7.98	0.05	1.50	1.00	1.00		SURCHARGED
10	PA-1	224.89	0 00:02	299.47	0.75	11.65	0.02	3.82	0.65	0.00		Calculated
11	PA-2	97.00	0 00:02	102.45	0.95	9.56	0.42	3.00	0.75	0.00		Calculated
12	PA-3	93.62	0 00:01	161.18	0.58	13.92	0.28	2.08	0.53	0.00		Calculated
13	PA-4	97.55	0 00:01	101.57	0.96	9.55	0.12	2.83	0.76	0.00		Calculated
14	PA-5	89.43	0 00:01	101.57	0.88	9.26	0.02	2.83	0.72	0.00		Calculated
15	PB-1	117.73	0 00:01	117.73	1.00	9.37	0.23	4.00	1.00	1440.00		SURCHARGED
16	PB-2	141.75	0 00:01	172.97	0.82	15.36	0.13	2.61	0.69	0.00		Calculated
17	PB-3	135.76	0 00:01	161.47	0.84	14.50	0.07	2.65	0.70	0.00		Calculated
18	PB-4	108.98	0 00:01	184.54	0.59	15.86	0.20	2.12	0.54	0.00		Calculated
19	PB-5	105.29	0 00:01	101.57	1.04	9.28	0.07	3.08	0.99	0.00		> CAPACITY
20	PB-6	94.85	0 00:01	362.93	0.26	24.81	0.09	1.30	0.34	0.00		Calculated
21	PB-7	89.43	0 00:01	139.99	0.64	12.16	0.05	2.21	0.57	0.00		Calculated
22	PC-1	2.86	0 00:01	14.84	0.19	6.79	0.18	0.42	0.29	0.00		Calculated
23	PD-1	4.13	0 00:01	15.34	0.27	7.73	0.15	0.49	0.34	0.00		Calculated
24	PE-1	12.70	0 00:03	21.67	0.59	12.74	0.04	0.83	0.55	0.00		Calculated
25	PE-2	11.51	0 00:02	11.74	0.98	7.58	0.07	1.20	0.80	0.00		Calculated
26	PE-3	5.90	0 00:06	8.40	0.70	5.15	0.45	0.93	0.62	0.00		Calculated
27	PF-1	11.59	0 00:01	27.52	0.42	14.90	0.01	0.68	0.45	0.00		Calculated
28	PF-2	9.99	0 00:01	11.74	0.85	7.49	0.07	1.06	0.71	0.00		Calculated
29	PF-3	6.00	0 00:01	10.59	0.57	6.22	0.37	0.80	0.54	0.00		Calculated
30	PG-1	3.86	0 00:01	32.92	0.12	12.91	0.07	0.33	0.23	0.00		Calculated
31	PH-1	2.48	0 00:01	41.15	0.06	13.16	0.04	0.24	0.16	0.00		Calculated
32	PI-1	5.55	0 00:01	28.03	0.20	12.88	0.09	0.42	0.29	0.00		Calculated
33	PJ-1	8.83	0 00:01	27.05	0.33	14.24	0.08	0.56	0.38	0.00		Calculated
34	PK-1	14.09	0 00:06	21.46	0.66	12.98	0.19	0.89	0.59	0.00		Calculated
35	PK-2	14.09	0 00:05	15.44	0.91	9.90	0.26	1.13	0.75	0.00		Calculated

Appendix B: Rip Rap Sizing

Rip Rap Sizing @ Asphalt Run Down

1/28/21

See attached Run down Sheet

$V = 6.57$ ft/s

depth = 0.59 ft

slope = 0.0143 ft/ft = 1.43 %

Froude = 1.51 Super critical flow

Multiple Methods reviewed for Calcs

USGS $D_{50} = 0.01 V^{2.44}$

$= 0.01 (6.57)^{2.44}$

$= 0.98' = 11.76'' \simeq 12''$ Type M

Ishash $D_{50} = \frac{V^2}{2g C^2 (G-1)}$

$g = 32.2$ ft/s^2

$C = 0.86 \rightarrow 1.2$ used 0.86 turbulent

G = Specific gravity → used 2.68

$D_{50} = \frac{(6.57)^2}{2 \cdot 32.2 \cdot (0.86)^2 \cdot (2.68-1)}$

$= 0.54' = 6.5'' \Rightarrow$ Use Type M

USBR $D_{50} = 0.0122 V^{2.06}$

$= 0.0122 (6.57)^{2.06}$

$= 0.59' = 7.1'' \Rightarrow$ Use Type M.

Recomend Type M Rip Rap

Worksheet for Ex Asphalt Rundown

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.01430	ft/ft
Bottom Width	4.00	ft
Discharge	15.50	ft^3/s

Results

Normal Depth	0.59	ft
Flow Area	2.36	ft^2
Wetted Perimeter	5.18	ft
Hydraulic Radius	0.46	ft
Top Width	4.00	ft
Critical Depth	0.78	ft
Critical Slope	0.00629	ft/ft
Velocity	6.57	ft/s
Velocity Head	0.67	ft
Specific Energy	1.26	ft
Froude Number	1.51	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.59	ft
Critical Depth	0.78	ft
Channel Slope	0.01430	ft/ft
Critical Slope	0.00629	ft/ft

Appendix C: FDL Lots 10 through 14 Retaining Wall

SPRINGS AT WATERVIEW
DRAINAGE LETTER
EL PASO COUNTY, COLORADO

December 2020

PREPARED FOR:

SWV, LLC
31 N. Tejon, Suite 500
Colorado Springs, CO 80903

PREPARED BY:

Dakota Springs Engineering
31 N. Tejon Street, Suite 518
Colorado Springs, CO 80903
719.227.7388

PROJECT NO.16-01

PCD No. SP-16-005
PCD No. SF-16-017

CERTIFICATIONS

Design Engineer's Statement:

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

Charles K. Cothern, P.E. #24997

Seal

Owner/Developer's Statement:

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

By (signature): _____ Date: 1/28/21

Title: V.P of Construction

Address: 4350 S Monaco

Denver CO 80237

El Paso County:

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

_____ _____

Jennifer Irvine, P.E., Date

County Engineer / ECM Administrator

Table of Contents

Appendix

List of Exhibits

Vicinity Map
Soils Data
FIRM Map
Referenced Existing Drainage Map
Referenced Proposed Drainage Map
Updated Proposed Drainage Map

1.0 INTRODUCTION

This report is an amendment to the Preliminary & Final Drainage Report for Springs at Waterview prepared by Dakota Springs Engineering and approved October 16, 2018.

Purpose

The purpose of this report is to present revisions to the final grading associated with construction of Springs at Waterview. Revisions to the final grading will accommodate proposed retaining walls on Lots 10, 11, 12, 13, & 14. These Lots are located along the east side of Wolf Moon Drive. Two retaining walls are proposed in tiered fashion at the rear of the above-mentioned Lots and serve to retain the fill slope from Escanaba Drive. Changes to the originally approved grading are confined to the above mentioned Lots and will not affect any of the surrounding roadway profiles. Construction of the retaining walls in the manner proposed will not result in significant changes to or deviate from the post development drainage patterns established with the originally approved drainage study.

2.0 General Location and Description

Location

Springs at Waterview is a planned 85-unit single family residential development within the north half of the northeast quarter of Section 7, Township 15 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. It is located south of Goldfield Drive, east of Grinnell Boulevard, north of Bradley Road and west of Painted Sky at Waterview Filing No. 1. This portion of the Waterview development is in the Windmill Gulch Drainage Basin. Refer to the Vicinity map located in Appendix A.

Description of Property

The proposed site encompasses 15.68 acres. The topography of the site and surrounding area is typical of a high desert; short prairie grass and weeds with slopes generally ranging from 1% to 9%. The area generally drains to the west.

The site is comprised of several different soil types. From the Soil Survey of El Paso County, the site falls into the following soil types:

1. "3" Ascalon sandy loam, 3 to 9 percent slopes.
2. "8" Blakeland loamy sand, 1 to9 percent slopes.
3. "97" Truckton sandy loam, 3 to 9 percent slopes.

The Blakeland and Truckton soils are classified as Hydrological Group A. Soils that underly the proposed retaining walls are Ascolon sandy loam, characterized as Hydrologic Soil Group B. Note: "#" indicates Soil Conservation Survey soil classification number. Please refer to the Soils Report, located in Appendix A.

3.0 Drainage Basins and Sub-Basins

Major Basin Description

Springs at Waterview residential development is located within the Windmill Gulch Drainage Basin. This report complies with the Windmill Gulch Drainage Basin Planning Study (DBPS) by Wilson and Company, the Master Development Drainage Plan for Waterview by Merrick and Company, the Preliminary Drainage Report for Waterview Phase II, also by Merrick and Company and Painted Sky at Waterview Filing 1 and 2 Final Drainage Report by Merrick and Company and the Approved Springs at Waterview PDR/FDR. All developed runoff will meet El Paso County standards for discharge rates.

Floodplains

Per the referenced Flood Insurance Rate Map (FIRM No. 08041C0764-G dated 12/7/2018), the site is not impacted by a SFHA (Special Flood Hazard Zone). Refer to the annotated FIRM Panel located in Appendix A.

4.0 DRAINAGE BASINS

Existing Drainage Analysis

Please refer to the Preliminary and Final Drainage Report for Springs at Waterview, Approved on October 16, 2018, for existing drainage analysis. The referenced Existing Drainage Basin Map from this study is included in Appendix A at the back of the report.

Proposed Drainage Analysis

Please refer to the Preliminary and Final Drainage Report for Springs at Waterview, Approved on October 16, 2018, for the proposed drainage analysis. The referenced Proposed Drainage Basin Map from this study is included in Appendix A at the back of the report. Wolf Moon Drive is referred to as Road A on the referenced Drainage Exhibit.

Proposed Retaining Wall

A series of two (2) retaining walls are proposed on Lots 10, 11, 12, 13, & 14. With the exception of a very small piece (<0.03Ac.), all of these lots are located within Sub Basin D-8 on the referenced Proposed Drainage Basin Map. Please refer to the referenced and updated Proposed Drainage Basin Maps, located in Appendix A at the back of the report. The updated Proposed Drainage Basin Map was created by adding the proposed walls and modified grading to the referenced, approved Proposed Drainage Basin Map from the Preliminary and Final Drainage Report for Springs at Waterview. Delineation of Sub Basins does not change between exhibits. Runoff generated over the area that separates the back of curb for Escanaba Drive from the high side of the proposed walls is captured by a series of area drains. Area drains are proposed to coincide with each of the separating lot lines. The area drains will capture and discharge flows at the base of the walls, where the flows will convey into Wolf Moon Drive via lot line swales. Note, What is now known as Wolf Moon Drive was referred to as Road A on the referenced drainage exhibits.

5.0 DRAINAGE FEES, COST ESTIMATE & MAINTENANCE

This drainage letter serves as an amendment to the approved Preliminary and Final Drainage Report for Springs at Waterview. No additional costs or fees are incurred by this letter. Those portions of the approved drainage report that established fees for this development remain unchanged. The amendment only addresses changes in grading for Lots 10, 11, 12, 13, & 14.

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6.0 REFERENCE MATERIALS

1. "City of Colorado Springs/El Paso County Drainage Criteria Manual" May 2014.

2. "Windmill Gulch Drainage Basin Planning Study", Wilson and Company, February 1992.

3. Master Development Drainage Plan for Waterview, May 2006. Prepared by Merrick & Co.

4. Preliminary Drainage Report for Waterview Phase II, January 2007. Prepared by Merrick & Co.

5. Final Drainage Report for Painted Sky at Waterview Filings 1 and 2, January 2007. Prepared by Merrick & Co.

6. Soils Survey of El Paso County Area, Natural Resources Conservation Services of Colorado.

7. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

8. "City of Colorado Springs/El Paso County Drainage Criteria Manual, Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices" May 2014.

9. Springs at Waterview Preliminary and Final Drainage Report, October 2018, Prepared by Dakota Springs Engineering.

Vicinity Map

see Fig 1

Soils Data

See Fig 2

FIRM Panel

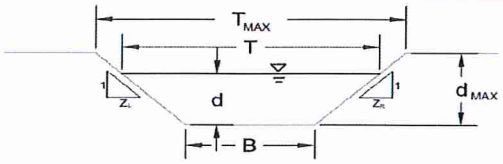
See Fig 3

Appendix D Area Inlet Calculation/100-year Inundation

AREA INLET CALCULATIONS

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

SWV - Amended Storm Drain - North Grinell Channel
A1 - Double Type D - sump - DP43



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	C	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	6.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One: (●) Sandy ( ) Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	18.50	27.50	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.50	3.50	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	28.11	298.92	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.50	3.50	ft

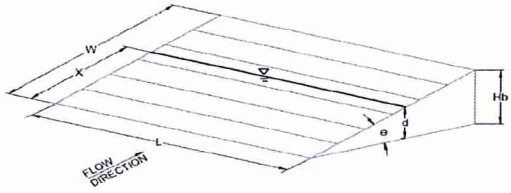
Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	15.90	35.50	cfs
Water Depth	d =	1.29	1.60	feet

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Inlet Design Information (Input)

Type of Inlet — Inlet Type = CDOT TYPE D (Parallel)



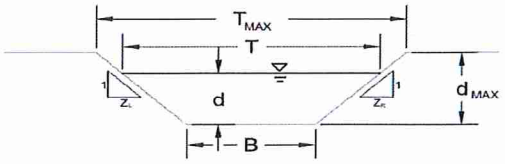
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	6.00	feet
Length of Grate	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.38	
Grate Discharge Coefficient	C_d =	0.76	
Orifice Coefficient	C_o =	0.50	
Weir Coefficient	C_w =	1.62	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.29	1.60	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	36.20	40.25	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	Bypassed Flow, Q_b =	0.00	0.00	cfs
	Capture Percentage = Q_a/Q_o = C%	100	100	%

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

SWV - Amended Storm Drain - North Grinell Channel

A2



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	C	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	6.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One:
- (●) Sandy
- ( ) Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	18.50	27.50	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.50	3.50	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	28.11	298.92	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.50	3.50	ft

Water Depth in Channel Based On Design Peak Flow

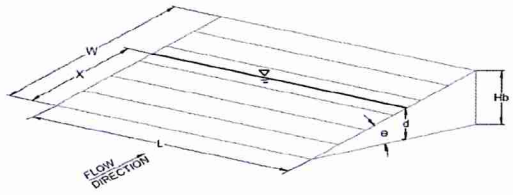
Design Peak Flow	Q_o =	4.00	9.20	cfs
Water Depth	d =	0.96	1.15	feet

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Inlet Design Information (Input)

Type of Inlet — Inlet Type = CDOT TYPE D (Parallel)



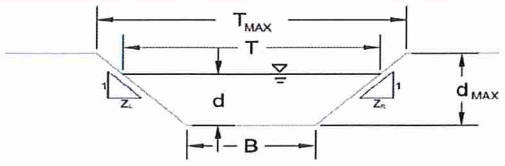
Angle of Inclined Grate (must be <= 30 degrees)	θ =	10.00 degrees
Width of Grate	W =	6.00 feet
Length of Grate	L =	3.00 feet
Open Area Ratio	A_{RATIO} =	0.70
Height of Inclined Grate	H_B =	0.52 feet
Clogging Factor	C_f =	0.38
Grate Discharge Coefficient	C_d =	0.55
Orifice Coefficient	C_o =	0.37
Weir Coefficient	C_w =	1.18

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.96	1.15	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	14.85	20.07	cfs
	Bypassed Flow, Q_b =	0.00	0.00	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	Capture Percentage = Q_a/Q_o = C%	100	100	%

AREA INLET IN A TRAPEZOIDAL GRASS-LINED CHANNEL

SWV - Amended Storm Drain - North Grinell Channel

A3



Grass Type	Limiting Manning's n
A	0.06
B	0.04
C	0.033
D	0.03
E	0.024

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	C	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0126	ft/ft
Bottom Width	B =	6.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Sandy	5.0 fps	0.50
Non-Sandy	7.0 fps	0.80

Choose One: (●) Sandy ( ) Non-Sandy

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	18.50	27.50	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.50	3.50	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	64.40	495.59	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.50	3.50	ft

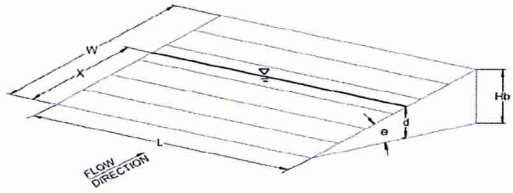
Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	3.10	7.10	cfs
Water Depth	d =	0.67	0.81	feet

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Inlet Design Information (Input)

Type of Inlet — Inlet Type = CDOT TYPE D (Parallel)



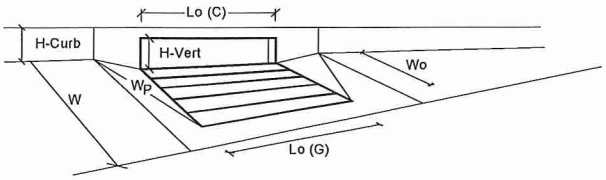
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00 degrees
Width of Grate	W =	6.00 feet
Length of Grate	L =	3.00 feet
Open Area Ratio	A_{RATIO} =	0.70
Height of Inclined Grate	H_B =	0.00 feet
Clogging Factor	C_f =	0.38
Grate Discharge Coefficient	C_g =	0.76
Orifice Coefficient	C_o =	0.50
Weir Coefficient	C_w =	1.62

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.67	0.81	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	14.18	18.83	cfs
	Bypassed Flow, Q_b =	0.00	0.00	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (> Q PEAK)	Capture Percentage = Q_a/Q_o = C%	100	100	%

INLET IN A SUMP OR SAG LOCATION

Project = SWV - Amended Storm Drain - North Grinell Channel

Inlet ID = B1 - Double Type D - sump - DP42a

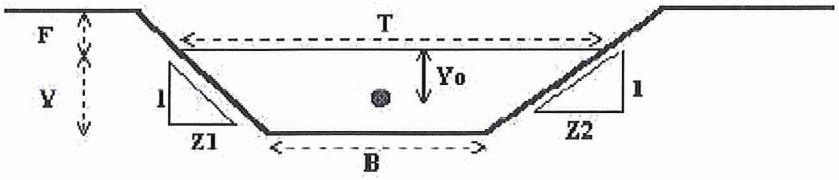


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	1-7/8" Bar Grate, Crossbars @ 4"		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	12.00	12.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.0	12.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	3.00	3.00	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.70	0.70	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.00	3.00	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.67	0.67	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	N/A	N/A	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.50	1.50	
Clogging Factor for Multiple Units	Clog =	0.38	0.38	
Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	35.81	53.69	cfs
Interception with Clogging	Q_{wa} =	22.38	33.56	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	87.99	98.70	cfs
Interception with Clogging	Q_{oa} =	55.00	61.69	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	54.45	70.61	cfs
Interception with Clogging	Q_{ma} =	34.03	44.13	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**22.38**	**33.56**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**N/A**	**N/A**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	6.00	6.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	14.3	31.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	3.8	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**22.4**	**33.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	11.9	26.3	cfs

HYDRAULIC SECTION CALCULATIONS

Normal Flow Analysis - Trapezoidal Channel

Project: Springs at Waterview Hydraulic Section H-1
Channel ID: North Grinell Channel

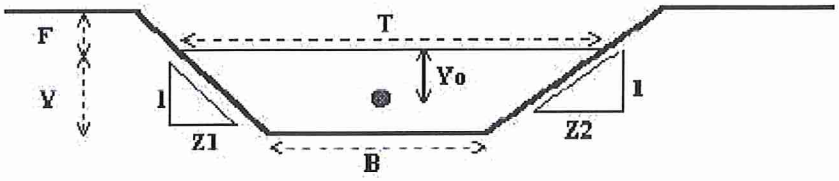


Design Information (Input)			
Channel Invert Slope	So =	0.0126	ft/ft
Manning's n	n =	0.033	
Bottom Width	B =	6.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**0.81**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**25.00**	cfs
Froude Number	**Fr =**	**0.81**	
Flow Velocity	**V =**	**3.66**	fps
Flow Area	A =	6.83	sq ft
Top Width	T =	10.86	ft
Wetted Perimeter	P =	11.12	ft
Hydraulic Radius	R =	0.61	ft
Hydraulic Depth	D =	0.63	ft
Specific Energy	Es =	1.02	ft
Centroid of Flow Area	Yo =	0.37	ft
Specific Force	Fs =	0.33	kip

Normal Flow Analysis - Trapezoidal Channel

Project: Springs at Waterview Hydraulic Section H-2
Channel ID: North Grinell Channel



Design Information (Input)			
Channel Invert Slope	So =	0.0051	ft/ft
Manning's n	n =	0.033	
Bottom Width	B =	6.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	1.00	ft
Design Water Depth	Y =	**1.15**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**30.67**	cfs
Froude Number	**Fr =**	**0.54**	
Flow Velocity	**V =**	**2.82**	fps
Flow Area	A =	10.87	sq ft
Top Width	T =	12.90	ft
Wetted Perimeter	P =	13.27	ft
Hydraulic Radius	R =	0.82	ft
Hydraulic Depth	D =	0.84	ft
Specific Energy	Es =	1.27	ft
Centroid of Flow Area	Yo =	0.50	ft
Specific Force	Fs =	0.51	kip

Summary for Reach 1R: Section H-3

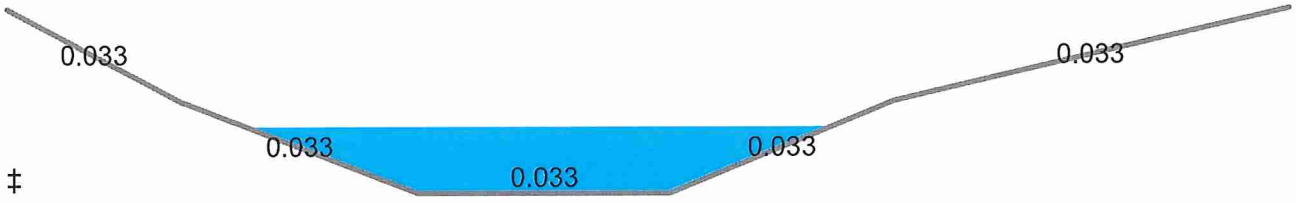
[89] Warning: Qout>Qin may require smaller dt

Inflow = 26.30 cfs @ 0.00 hrs, Volume= 0.022 af, Incl. 26.30 cfs Base Flow
Outflow = 32.85 cfs @ 0.01 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 0.00-0.01 hrs, dt= 0.01 hrs
Max. Velocity= 3.47 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.47 fps, Avg. Travel Time= 0.5 min

Peak Storage= 947 cf @ 0.01 hrs
Average Depth at Peak Storage= 0.72' , Surface Width= 18.40'
Bank-Full Depth= 2.00' Flow Area= 46.8 sf, Capacity= 277.73 cfs

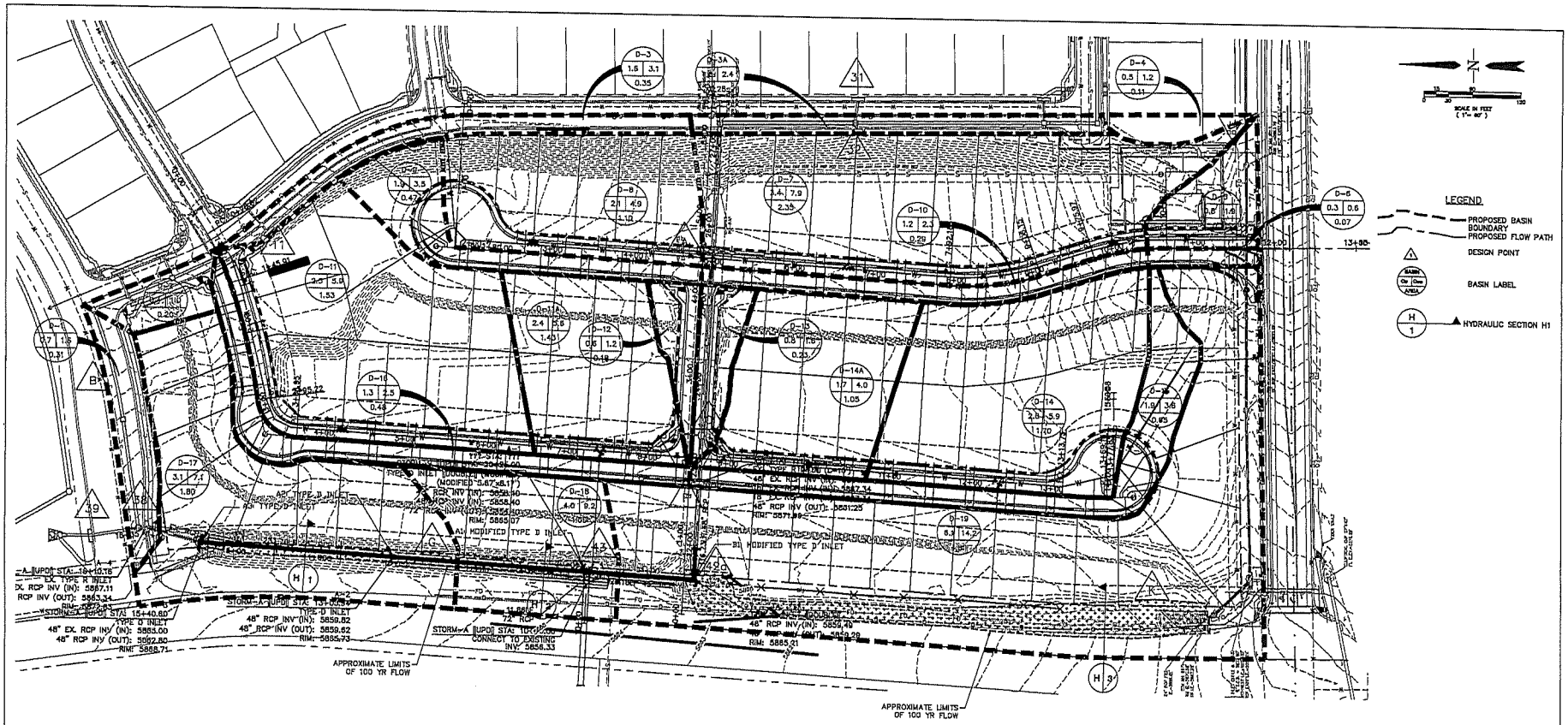
Custom cross-section, Length= 100.0' Slope= 0.0145 '/'
Flow calculated by Manning's Subdivision method
Inlet Invert= 10.00', Outlet Invert= 8.55'



Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
0.00	10.00	0.00		
5.50	9.00	1.00	0.033	
13.00	8.00	2.00	0.033	
21.00	8.00	2.00	0.033	
28.00	9.00	1.00	0.033	
40.50	10.00	0.00	0.033	

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	8.0	0.0	0	0.00
1.00	15.3	22.6	22.5	1,525	63.55
2.00	46.8	40.8	40.5	4,675	277.73

DRAINAGE EXHIBIT



HYDRAULIC SECTION SUMMARY TABLE

SECTION ID	Q100 (cfs)	SLOPE (%)	VELOCITY (FPS)	DEPTH (FT)	SPREAD (FT)
H1	7.1	1.26	3.66	0.81	10.9
H2	9.2	0.51	2.82	1.15	12.9
H3	28.3	1.45	3.47	0.72	15.4

HYDRAULIC SECTION CALCULATIONS PERFORMED USING UD_CHANNELS v.1.04
Section H3 calculated using Mannings

AREA INLET SUMMARY TABLE

INLET ID	TYPE OF AREA DRAIN	DESIGN FLOW (cfs)	SLOPE (%)	MAX. VELOCITY (FPS)	DEPTH (FT)
A3	TYPE D	7.1	1.26	5.0	0.81
A2	TYPE D	9.2	0.51	5.0	1.15
A1	MODIFIED TYPE D	35.5	SUMP	0	1.80
B1	MODIFIED TYPE D	14.2	SUMP	0	1.25

AREA DRAIN CALCULATIONS PERFORMED USING UD_INLET v.3.14

DESIGN POINT	Q (5)	Q (100)
11	1.0	3.1
32	1.3	2.4
A	0.3	4.3
B	0.8	2.3
C	0.8	2.1
D	2.4	6.7
E	1.6	4.7
F	0.2	3.1
G	3.1	7.1
K	11.5	24.1
39	1.1	2.5
31	0.5	1.0
42a	11.9	28.3
43	4.0	9.2

PLEASE NOTE:
VALUES INCLUDED ON THIS TABLE HAVE BEEN REFERENCED FROM THE APPROVED FINAL DRAINAGE REPORT FOR SPRINGS AT WATERVIEW, MAY 2018.

REVISIONS:

NO.	DESCRIPTION	DATE

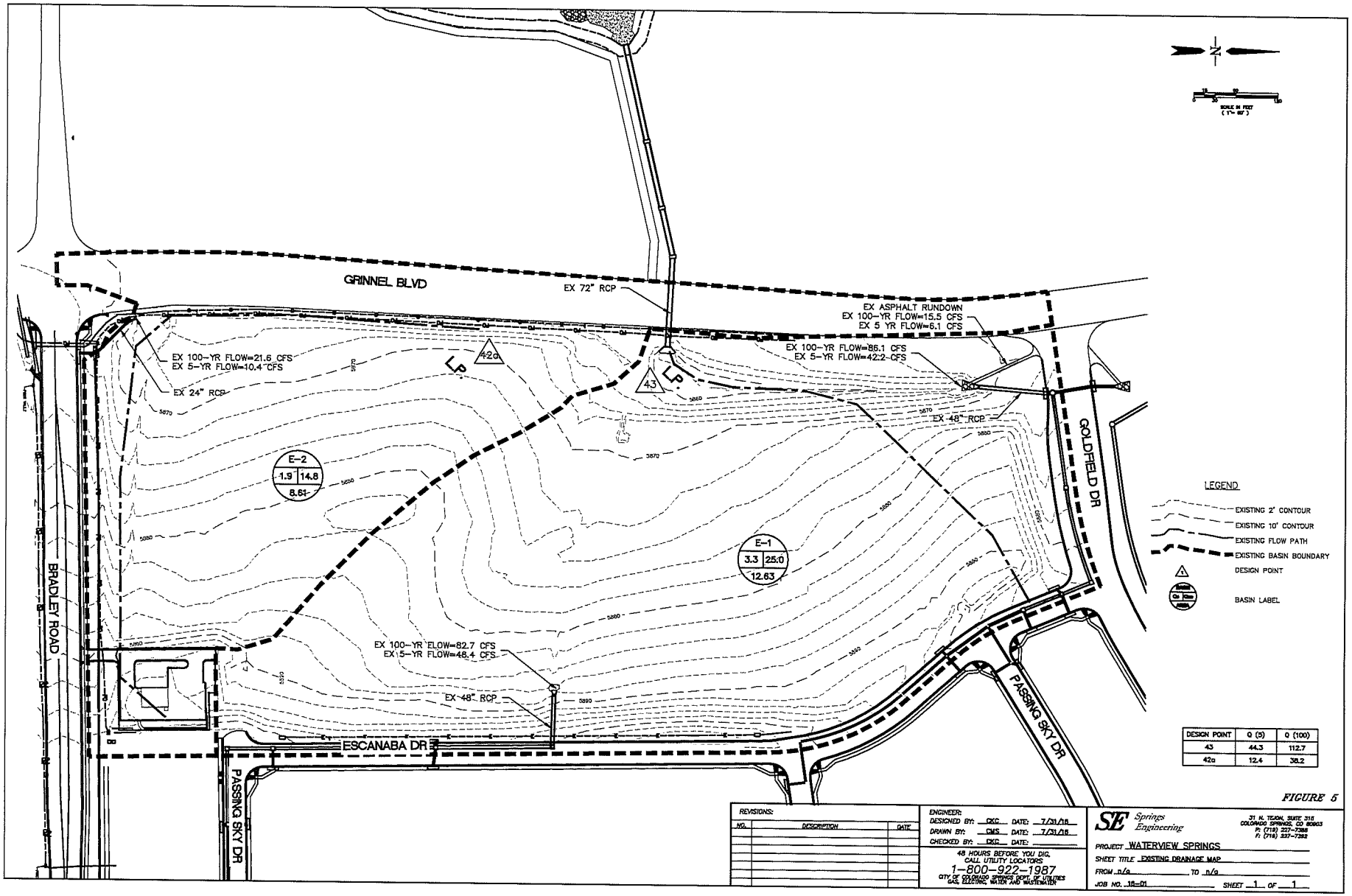
ENGINEER:
DESIGNED BY: CKC DATE: 12-09-20
DRAWN BY: CEB DATE: 12-09-20
CHECKED BY: CKC DATE: 12-09-20

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987

DSE Dakota Springs Engineering
31 N. TEJON, SUITE 300
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT SPRINGS AT WATERVIEW
SHEET TITLE PROPOSED DRAINAGE MAP
FROM n/a TO n/a
JOB NO. 16-01 SHEET 1 OF 1

Figure 2: Existing Drainage Plan



DESIGN POINT	Q (5)	Q (100)
43	44.3	112.7
42a	12.4	38.2

FIGURE 5

REVISIONS:

NO.	DESCRIPTION	DATE

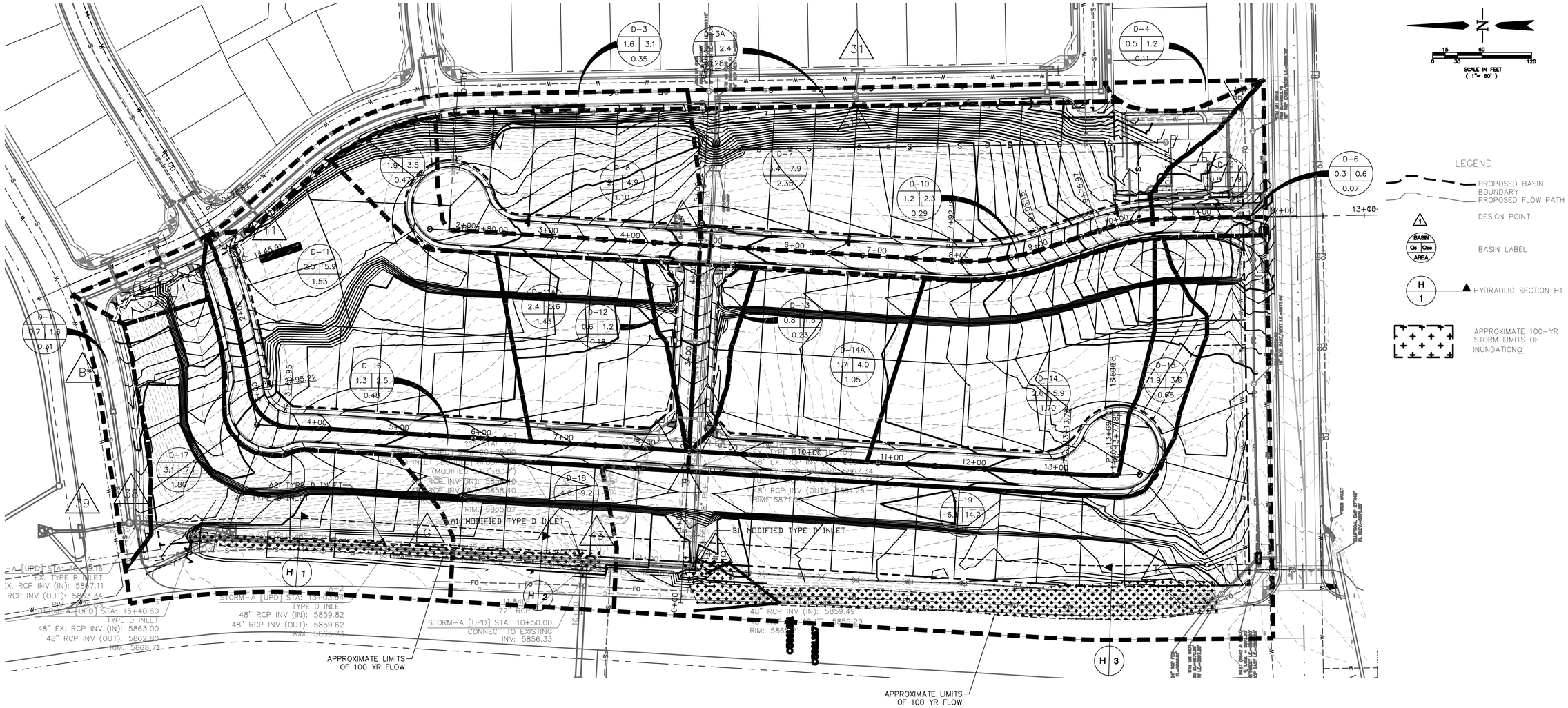
ENGINEER:
DESIGNED BY: DKC DATE: 7/31/18
DRAWN BY: CMS DATE: 7/31/18
CHECKED BY: DKC DATE:

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES GAS, ELECTRIC, WATER AND WASTEWATER

SE Springs Engineering
31 N. TEJON, SUITE 315
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT WATERVIEW SPRINGS
SHEET TITLE EXISTING DRAINAGE MAP
FROM n/a TO n/a
JOB NO. 18-01 SHEET 1 OF 1

Figure 5: Proposed Drainage Map



HYDRAULIC SECTION SUMMARY TABLE					
SECTION ID	Q_{100} (cfs)	SLOPE (%)	VELOCITY (FPS)	DEPTH (FT)	SPREAD (FT)
H1	7.1	1.26	3.66	0.81	10.9
H2	9.2	0.51	2.82	1.15	12.9
H3	26.3	1.45	3.47	0.72	18.4

HYDRAULIC SECTION CALCULATIONS PERFORMED USING UD_CHANNELS v.1.04
Section H3 calculated using Mannings

AREA INLET SUMMARY TABLE					
INLET ID	TYPE OF AREA DRAIN	DESIGN FLOW (cfs)	SLOPE (%)	MAX. VELOCITY (FPS)	DEPTH (FT)
A3	TYPE D	7.1	1.26	5.0	0.81
A2	TYPE D	9.2	0.51	5.0	1.15
A1	MODIFIED TYPE D	35.5	SUMP	0	1.60
B1	MODIFIED TYPE D	14.2	SUMP	0	1.25

AREA DRAIN CALCULATIONS PERFORMED USING UD_INLET v.3.14

DESIGN POINT	Q (5)	Q (100)
11	1.6	3.1
32	1.3	2.4
A	0.3	4.3
B	0.8	2.3
C	0.8	2.1
D	2.4	6.7
E	1.6	4.7
F	0.2	3.1
G	3.1	7.1
K	11.5	24.1
39	1.1	2.5
31	0.5	1.0
42a	11.9	26.3
43	4.0	9.2

PLEASE NOTE:
VALUES INCLUDED ON THIS TABLE HAVE BEEN REFERENCED FROM THE APPROVED FINAL DRAINAGE REPORT FOR SPRINGS AT WATERVIEW, MAY 2018.

REVISIONS:

NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: CKC DATE: 12-09-20
DRAWN BY: CEB DATE: 12-09-20
CHECKED BY: CKC DATE: 12-09-20

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COLORADO SPRINGS, CO 80903
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PROJECT SPRINGS AT WATERVIEW
SHEET TITLE PROPOSED DRAINAGE MAP
FROM n/a TO n/a
JOB NO. 16-01 SHEET 1 OF 1

PDF: