FINAL DRAINAGE REPORT FOR SHILOH MESA RETAIL SOUTH FIL #1 COLORADO SPRINGS, COLORADO

APRIL 2022

Prepared For:

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Job No. 2214.00

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COLORADO SPRINGS, COLORADO

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APPENDIX

FINAL DRAINAGE REPORT FOR
SHILOH MESA RETAIL SOUTH FIL #1
COLORADO SPRINGS, COLORADO

ENGINEER'S STATEMENT:

This report and plan for the drainage design of "SHILO MESA RETAIL SOUTH FIL #1" was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_____

L Ducett, P.E. 32339 Seal

DEVELOPER'S STATEMENT:

COLORADO COMMERCIAL BUILDERS hereby certifies that the drainage facilities for SHILOH MESA RETAIL SOUTH FIL #1 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of SHILOH MESA RETAIL SOUTH FIL #1 guarantee that final drainage design review will absolve COLORADO COMMERCIAL BUILDERS and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

COLORADO COMMERCIAL BUILDERS

_____

Authorized Signature Date

_____

Printed Name

_____

Title

_____

Address

City of Colorado Springs Statement:

Filed in accordance with Section 7-7-906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____

For City Engineer Date

Conditions:

FINAL DRAINAGE REPORT FOR
SHILOH MESA RETAIL SOUTH FIL #1
COLORADO SPRINGS, COLORADO

PURPOSE AND JUSTIFICATION

The purpose of this Final Drainage Report is to identify and analyze the existing drainage patterns, determine existing runoff quantities, and analyze the proposed development of this site as a commercial site (small retail). This site is a single parcel that has not been previously platted. This site was previously studied in:

"Master Development Drainage Plan Amendment For Shiloh Mesa at Woodmen Heights and Final Drainage Report for Shiloh Mesa Commercial Filing No. 1" dated July 2019 by Matrix Design Group.

GENERAL DESCRIPTION

This Final Drainage Report for "SHILOH MESA RETAIL SOUTH FIL #1", located northeast of the intersection of Marksheffel Road and Geraldine Point, is an analysis of an approximately 3.18 ac site. The site is currently a vacant parcel. The proposed development is a commercial retail complex, utility lines, storm water facilities, and the associated modifications to the site. The site it proposed to be subdivided into two lots, Lot 1 is x acres and Lot 2 is x acres.

The site is in the southwest quarter of Section 4, Township 13 South, Range 65 West of the 6th Principal Meridian within the City of Colorado Springs El Paso County, Colorado. The parcel is bounded to the west by N Marksheffel Road, to the north by Geraldine Point, a private ROW, to the north east by Carmella Grove a private ROW, to the east by an existing private detention facility Tract A Shiloh Mesa Commercial Filing No. 1 (see vicinity map in appendix).

The site lies within the Sand Creek Drainage Basin, with storm runoff draining to the west. The property is not in a streamside zone.

The site consists of 66.9% Blakeland loamy sand (8) and 33.1% Pring coarse sandy loam (71) per the USDA, NRCS web soil survey. The hydrologic group "B" was used to represent the soil types and determine the onsite basin overland flow. (see map in appendix)

The study area consists of undeveloped land, which is currently a vacant parcel, with mostly grass and dirt surfaces. Some earthwork appears to have been done on the site previously. The northly portion of the site has been improved with a private road (Geraldine Point) and the rest of the site is impervious. The site currently drains toward the west, with slopes ranging from 2% to 6%.

EXISTING DRAINAGE CONDITIONS

Existing runoff on the site, and adjacent areas to the east, flows west, before flowing into the Woodmen Road and Marksheffel Road gutters. The following is a description of the existing Basins, Design Points, and the overall existing drainage characteristics for the site. (see Existing Drainage Map in the appendix).

Basin EX-A's 2.9 acres consists of undeveloped land and pavement on Geraldine Point. Runoff (Q_5 = 0.1 cfs, Q_{100} = 0.7 cfs) sheet flows west to design point A and into the Marksheffel Road right of way.

Basin EX-B's 0.14 acres consists of undeveloped land. Runoff (Q_5 = 0.1 cfs, Q_{100} = 0.4 cfs) sheet flows east to design point EX2 and into the existing private extended detention pond to the east of the site in Tract A of the Shiloh Mesa Commercial Filing No. 1 site.

Basin EX-C's 0.14 acres consists of undeveloped land. Runoff (Q_5 = 0.1 cfs, Q_{100} = 0.4 cfs) sheet flows south to design point EX3 and into the Woodmen Road Right of Way.

PROPOSED DRAINAGE CONDITIONS

In the proposed condition the overall drainage pattern for the site changes quite a bit, with runoff being collected and channeled along gutter and through storm sewers. Drainage will generally be to the southwest, with the site draining to the proposed private extended detention basin, before runoff leaves the site via storm sewer. The changes to the site include constructing the building,

utility lines, parking facilities, storm water facilities, grading, paving, and the associated modifications to the site.

Basin A (0.31 acres) is on the west side of the site and includes building, parking, and landscaping areas that sheet and channel flow south to a curb inlet at Design Point 4. Basin A flow is 0.9 cfs for the 5 year event and 2.0 cfs for the 100 year event.

Basin B (0.55 acres) is on the south side of the site and includes building, landscaping, and the EDB areas that sheet flows west to the EDB at Design Point 8. Basin B flow is 0.5 cfs for the 5 year event and 1.7 cfs for the 100 year event.

Basin C (1.60 acres) is on the bulk of the site and includes building, parking, landscaping areas that sheet flow north and west off the site to a curb inlet at Design Point 2. Basin C flow is 5.7 cfs for the 5 year event and 11.6 cfs for the 100 year event.

Basin D (0.08 acres) is on the east side of the site and includes landscaping area that sheet flows east off the site at Design Point 5. Basin D flow is 0.4 cfs for the 5 year event and 0.7 cfs for the 100 year event.

Basin E (0.20 acres) is on the west side of the site and includes landscaping area that sheet flows west off the site at Design Point 3. Basin E flow is 1.1 cfs for the 5 year event and 2.2 cfs for the 100 year event.

Basin F (0.08 acres) is on the south side of the site and includes landscaping area that sheet flows south off the site at Design Point 7. Basin F flow is 0.4 cfs for the 5 year event and 0.8 cfs for the 100 year event.

Basin G (0.18 acres) is north of the site and includes Geraldine Point and part of the property to the north that sheet and channel flows west to a curb inlet at Design Point 1. Basin G flow is 0.4 cfs for the 5 year event and 1.0 cfs for the 100 year event.

Basin H (0.23 acres) is on the west side of the site and includes building, parking, and landscaping areas that sheet and channel flow north and west to a curb inlet at Design Point 6. Basin H flow is 0.9 cfs for the 5 year event and 2.0 cfs for the 100 year event.

At Design Point 8 is the proposed private full spectrum extended detention basin that will provide full spectrum detention. Based upon the 3.18 acres of area tributary (Basins A,B,C,G,H) and consisting of 75% impervious area, the required volume is 0.396 ac-ft. The bottom of the EDB is set at 6902.0, while the top is at 6909.0. The pond design has a WQCV storage requirement of 0.079 ac-ft. The corresponding water surface elevation is 6904.36. The required EURV storage volume of 0.214 ac-ft on top of the WQCV gives an elevation of 6906.79. The required 100-year storage volume of 0.103 ac-ft for a total of 0.396 ac-ft gives a 100-year elevation of 6907.60. The proposed forebay is 96 cu-ft in volume and meet the required 2% of the WQCV (see appendix for calculations). A metal plate over the outlet with one column containing three rows of 7/8" diameter holes spaced 18.1" apart will act as a water quality and EURV outlet. The release of the EURV is 0.1 cfs and will take 70 hours. A 2.0' x 2.0' inlet riser acts as the outlet structure, it is set at a grate elevation of 6906.80 and will route allowable runoff for the 100 year event. The proposed 18" outlet has a restrictor plate 3.80" above the invert giving a release of Q_{100} = 2.8 cfs. This is in conformance with the allowable release rate of 2.8 cfs. A 3' emergency weir set at 6908.00 will also be installed per the city standards with d50 = 12"rip rap and will safely pass the 100-year developed flow downstream. The pond outlet drains to an existing public storm manhole that the site currently drains to. Flow in the emergency overflow situation will flow into the ROW of Woodmen Road with a 100 year runoff spillway flow depth of 0.72'.

In an effort to protect receiving water and as part of the "four step process to minimize adverse impacts of urbanization" this site was analyzed in the following manner:

1. Reduce Runoff- Runoff from some of the impervious areas on the site is directed to landscaping areas where a portion of the runoff can infiltrate. See the IRF spreadsheet in the appendix for areas.
2. Treat Slowly Release WQCV- The proposed private full spectrum EDB will provide the required WQCV and slowly release it, thereby allowing solids and contaminants to settle out.

3. Stabilize Stream Channel- Drainage fees will be paid when this site is platted, which can be used to stabilize the Sand Creek channels. Also, there is no channel adjacent to this property and flows are primarily conveyed offsite via storm pipes.
4. Source Controls- As no materials storage or industrial operations are proposed for the site, no source controls have been proposed.

Please see detailed calculations in the appendix.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 & 2 January 2021. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals. The Rational Method was used because it is the simplest method, that is applicable to the site, and allowed by the Drainage Criteria Manual.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the City of Colorado Springs Storm Drainage Design Criteria Manual Volumes 1 and 2 January 2021 and the Urban Drainage and Flood Control District (UDFCD) Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3. The hydraulic calculations include open channel flow (for gutter capacities), inlet sizing calculations, and storm sewer sizing calculations. The pertinent data sheets are included in the appendix of this report. It is requested that the HGL calculations and plots be provided in an addendum at the time of storm sewer plan submittal. The HGL calculations will be performed using the software UD-SEWER (or similar).

WATER QUALITY

Water quality for this development is being address by the proposed private full spectrum extended detention basin. Calculations can be found in the appendix.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain, as determined by Flood Insurance Rate Map No. 08041C0533 G dated December 7, 2018 (see appendix).

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. At this time, Terra Nova Engineering, Inc. respectfully requests that the erosion control plan be submitted in conjunction with the final grading plan. Rock socks, sediment control logs, silt fence, and inlet protection are currently proposed as erosion control measures.

CONSTRUCTION COST OPINION

Private Drainage Facilities Improvements (non Reimbursable)

	Item	Quantity	Unit Cost	Cost
1.	12" RCP Storm	30 LF	$ 30	$ 900
2.	12" HDPE Storm	181 LF	$ 30	$ 5,430
3.	24" HDPE Storm	330 LF	$ 60	$ 19,800
4.	4' Storm Manhole	4 EA	$ 6,000	$ 24,000
5.	Storm Inlet, 4' D-10-R	3 EA	$ 6,000	$ 18,000
6.	Storm Inlet, 8' D-10-R	1 EA	$ 8,000	$ 8,000
			Total	**$ 76,130**

Public Drainage Facilities Improvements (non Reimbursable)

None.

Private Permanent BMPs (non-Reimbursable)

	Description	Quantity	Unit Price	Cost
1.	Extended Detention Basin			
	- Earthwork	1,300 CY	$ 12	$ 15,600
	- Forebays	1 EA	$ 1,500	$ 1,500
	- Trickle Channel	80 LF	$ 32	$ 2,560
	- Outlet Structures (2'x2')	1 EA	$ 4,000	$ 4,000

- Emergency Spillways	1 EA	$ 2,000	$ 2,000
- Access Roads	1 EA	$ 1,000	$ 1,000
- Stabilization	1 EA	$ 5,000	$ 5,000
		Subtotal	$ 31,660
	10% Contingency		$ 3,166
		Total	**$ 34,826**

DRAINAGE FEES

The site is being platted as part of this development. The site is located in the Sand Creek Drainage Fee Basin. 2022 fees for this site will be calculated as follows and are due prior to plat recordation:

Sand Creek Drainage Fee Basin 2022

Drainage	$20,160/acre	x	2.87 acres	=	$ 57,957.13
				Total $	**57,957.13**

*Fees are due prior to plat recordation

MAINTENANCE

The proposed sand filter will be privately maintained. The proposed storm sewers that are private will be privately maintained.

SUMMARY

Development of this site will not adversely affect the downstream and surrounding developments. Proposed onsite collection and piping will drain into the proposed private full spectrum sand filter, before flowing offsite via storm sewer. Water quality and detention will be addressed by the proposed sand filter. This Final Drainage Report is in general conformance with the previously approved reports/studies for this site.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

L Ducett, P.E.
President

BIBLIOGRAPHY

"City of Colorado Springs Drainage Criteria Manual Volumes 1 & 2", January 2021

"NRCS Soil Map for El Paso County Area, Colorado"

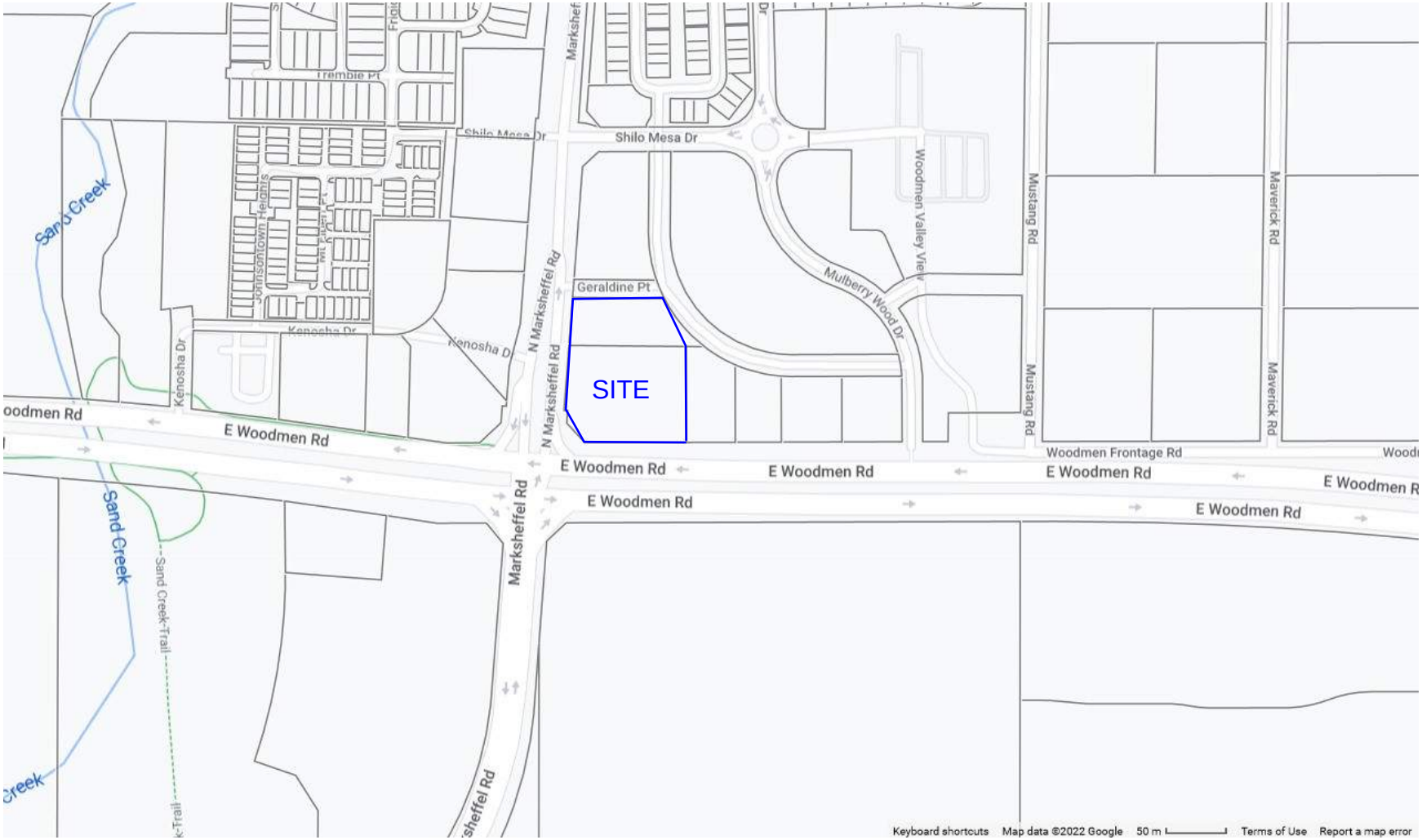
"FEMA Floodplain Map"

"Master Development Drainage Plan Amendment For Shiloh Mesa at Woodmen Heights and Final Drainage Report for Shiloh Mesa Commercial Filing No. 1" dated July 2019 by Matrix Design Group.

VICINITY MAP

El Paso County - Community: Area Overview

Shilo Mesa South
Vicinity Map



North is up ^^^

GENERAL LOCATION MAP


Shiloh Mesa South
Image Dated Oct 2019
Carmela Grove
Geraldine Pt
N Marksheffel Rd
SITE
E Woodmen Rd
N
Google Earth
200 ft

NRCS SOIL MAP

Map Scale: 1:762 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	1.9	66.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	0.9	33.1%
Totals for Area of Interest		**2.8**	**100.0%**

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Blakeland

Setting

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

Typical profile

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

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

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

Minor Components

Other soils

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

Pleasant

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

Data Source Information

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

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Pring

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

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

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 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

Data Source Information

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

FEMA FIRM MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

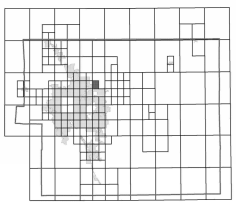
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

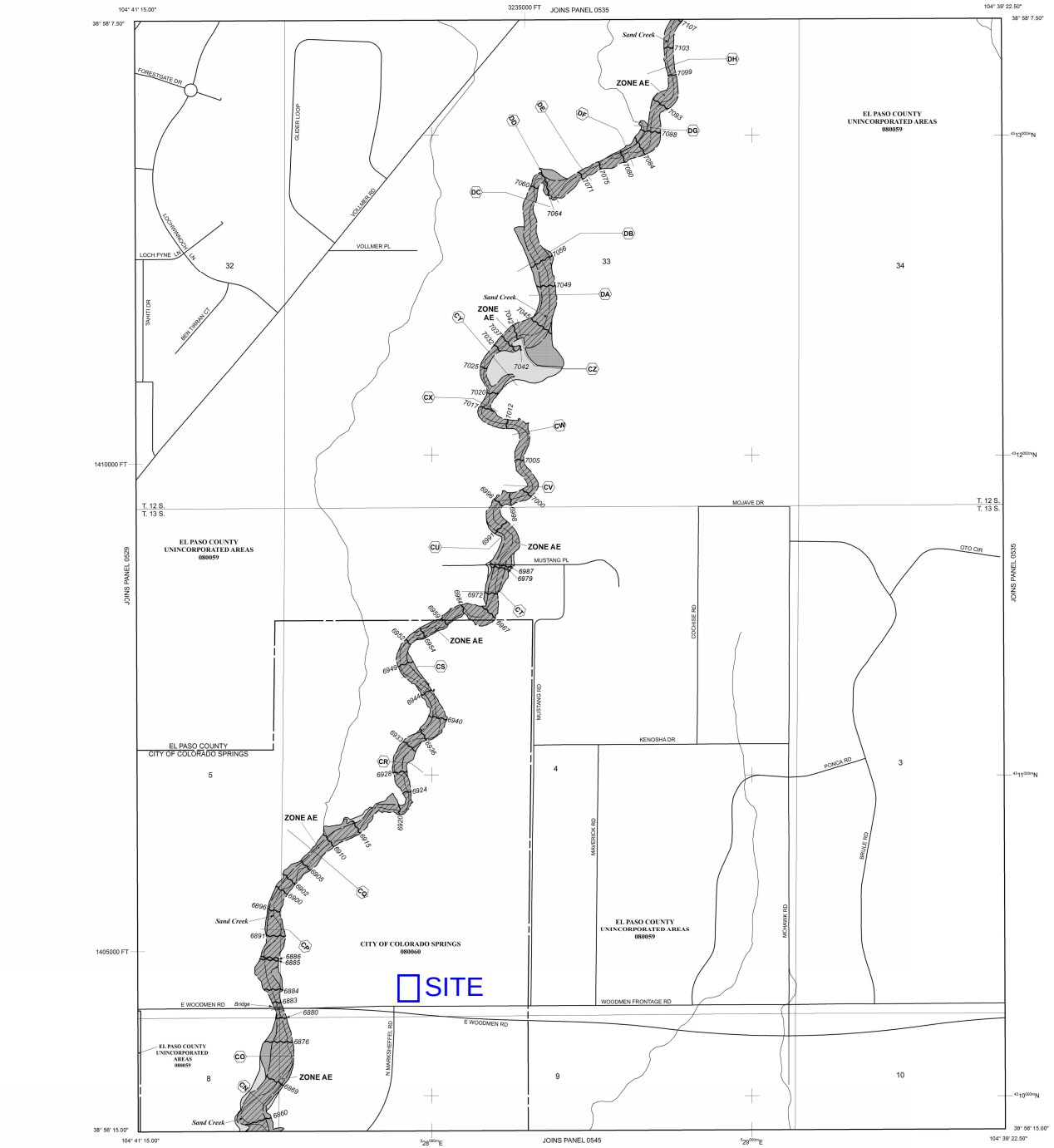
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A Cross section line
23 — 23 Transect line
97° 07' 30.00" / 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0533G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0533	G
EL PASO COUNTY	080059	0533	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER 08041C0533G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

SHILOH MESA RETAIL SOUTH FILING NO. 1
AREA RUNOFF AND COEFFICIENT (C) SUMMARY

EXISTING

	DEVELOPED / IMPERVIOUS				*UNDEVELOPED / NON-IMPERVIOUS*			*WEIGHTED*		*WEIGHTED CA*	
BASIN	**TOTAL AREA**	**AREA**	**C5**	**C100**	**AREA**	**C5**	**C100**	**C5**	**C100**	**CA5**	**CA100**
	(Acres)	*(Acres)*			*(Acres)*						
A	2.90	0.17	0.81	0.88	2.73	0.08	0.35	0.12	0.38	0.36	1.11
B	0.14	0.00	0.81	0.88	0.14	0.08	0.35	0.08	0.35	0.01	0.05
C	0.14	0.00	0.81	0.88	0.14	0.08	0.35	0.08	0.35	0.01	0.05
Total	3.18	0.17									

Calculated by: LD
Date: 4/26/2022
Checked by:

DEVELOPED

		DEVELOPED / IMPERVIOUS			*UNDEVELOPED / NON-IMPERVIOUS*			*WEIGHTED*		*WEIGHTED CA*	
BASIN	**TOTAL AREA**	**AREA**	**C5**	**C100**	**AREA**	**C5**	**C100**	**C5**	**C100**	**CA5**	**CA100**
	(Acres)	*(Acres)*			*(Acres)*						
A	0.31	0.20	0.81	0.88	0.11	0.08	0.35	0.55	0.69	0.17	0.21
B	0.55	0.13	0.81	0.88	0.42	0.08	0.35	0.25	0.48	0.14	0.26
C	1.60	1.45	0.81	0.88	0.15	0.08	0.35	0.74	0.83	1.19	1.33
D	0.08	0.08	0.81	0.88	0.00	0.08	0.35	0.81	0.88	0.06	0.07
E	0.20	0.20	0.81	0.88	0.00	0.08	0.35	0.81	0.88	0.16	0.18
F	0.08	0.08	0.81	0.88	0.00	0.08	0.35	0.81	0.88	0.06	0.07
G	0.18	0.09	0.81	0.88	0.09	0.08	0.35	0.45	0.62	0.08	0.11
H	0.23	0.15	0.81	0.88	0.08	0.08	0.35	0.56	0.70	0.13	0.16
Total	3.23	2.38									

Calculated by: LD
Date: 4/26/2022
Checked by:

SHILOH MESA RETAIL SOUTH FILING NO. 1
RUNOFF SUMMARY

EXISTING

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_C	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Slope** *(ft/ft)*	T_t *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
EXA	2.90	0.12	0.38	0.12	100	0.02	14.0	250	3.0%	4.0	1.0	15.1	3.5	5.9	1.2	6.5
EXB	0.14	0.08	0.35	0.08	20	0.02	6.6	0	2.0%	3.0	0.0	6.6	4.7	8.3	0.1	0.4
EXC	0.14	0.08	0.35	0.08	20	0.02	6.6	435	2.0%	3.0	2.4	9.0	4.2	7.4	0.0	0.4

Calculated by: LD
Date: 4/26/2022
Checked by:

DEVELOPED

		WEIGHTED		*OVERLAND*				*STREET / CHANNEL FLOW*				T_C	*INTENSITY*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{100}	C_5	**Length** *(ft)*	**Slope** *(ft/ft)*	T_t *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		** For Calcs See Runoff Summary*														
A	0.31	0.55	0.69	0.55	20	0.02	3.5	180	3.0%	4.0	0.8	4.3	5.2	9.5	0.9	2.0
B	0.55	0.25	0.48	0.25	100	0.02	12.2	100	2.0%	3.0	0.6	12.7	3.7	6.4	0.5	1.7
C	1.60	0.74	0.83	0.74	40	0.02	3.3	435	2.0%	3.0	2.4	5.7	4.8	8.7	5.7	11.6
D	0.08	0.81	0.88	0.81	50	0.02	2.9	0	60.0%	10.0	0.0	2.9	5.6	10.4	0.4	0.7
E	0.20	0.81	0.88	0.81	20	0.33	0.7	0	20.0%	6.0	0.0	0.7	6.6	12.7	1.1	2.2
F	0.08	0.81	0.88	0.81	12	0.02	1.4	0	60.0%	10.0	0.0	1.4	6.2	11.8	0.4	0.8
G	0.18	0.45	0.62	0.45	12	0.02	3.3	0	60.0%	10.0	0.0	3.3	5.5	10.2	0.4	1.1
H	0.23	0.56	0.70	0.56	18	0.02	3.3	180	4.3%	6.0	0.5	3.8	5.3	9.8	0.7	1.6

Calculated by: LD
Date: 4/26/2022
Checked by:

SHILOH MESA FILING NO. 2 LOT 1 SCHOOL
SURFACE ROUTING SUMMARY

Design Point(s)	*Contributing Basins*	*Area (ac)*	*Flow (cfs)*	
			Q_5	Q_{100}
1	**G**	0.18	0.4	1.1
2	**C**	1.60	5.7	11.6
3	**E**	0.20	1.1	2.2
4	**A**	0.31	0.9	2.0
5	**D**	0.08	0.4	0.7
6	**H**	0.23	0.7	1.6
7	**F**	0.08	0.4	0.8
8	**A,B,C,G,H**	2.87	8.3	18.0

Calculated by: LD

Date: 4/26/2022

Checked by: _____

ST GABRIELS SCHOOL
PIPE ROUTING SUMMARY

Pipe Run #	*Inlet #*	*Contributing Flow Sources*	*5 Year Flow (cfs)*	*100 Year Flow (cfs)*	*Slope*	*Pipe Size & Type*	*Owner*
PR1	***1***	G	0.4	1.1	1%	12" HDPE	Private
PR2	***2***	G,C	6.2	12.7	0.5%	24" HDPE	Private
PR3	***3***	G,C,H	6.9	14.3	0.5%	24" HDPE	Private
PR4	***-***	G,C,H	6.9	14.3	0.5%	24" HDPE	Private
PR5	***-***	G,C,H	6.9	14.3	0.5%	24" HDPE	Private
PR6	***-***	G,C,H	6.9	14.3	0.5%	24" HDPE	Private
PR7	***4***	A	0.9	2.0	10%	12" HDPE	Private
PR8	***-***	Pond Outlet	0.1	2.8	3%	12" HDPE	Private
PR9	***-***	Pond Outlet	0.1	2.8	3%	12" HDPE	Private

Calculated by: LD

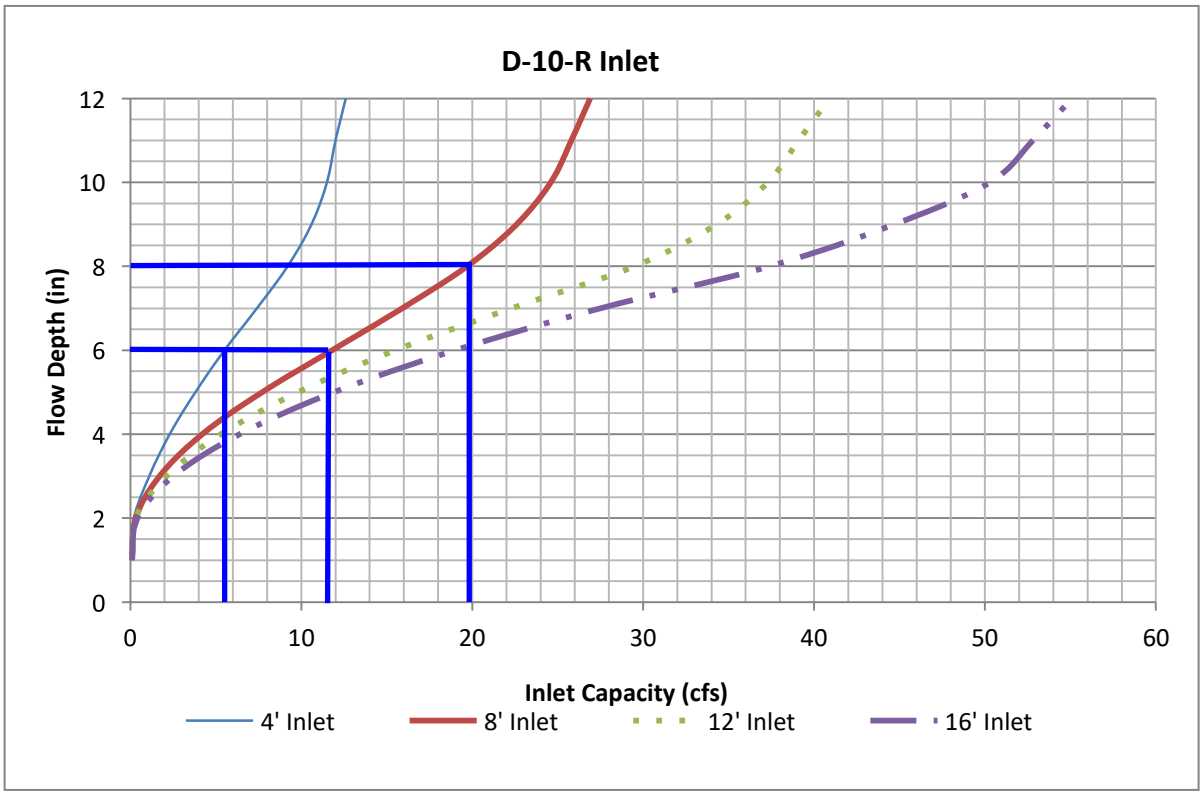
Date: 4/26/2022

Checked by: _____

HYDRAULIC CALCULATIONS

2214.00

Figure 8-12. Inlet Capacity Chart Sump Conditions, Curb Opening (D-10-R) Inlet



MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Shiloh Mesa Retail - South** Location: Geraldine Point South Gutter - Capacity

By: Dane Frank Date: 4/27/2022

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

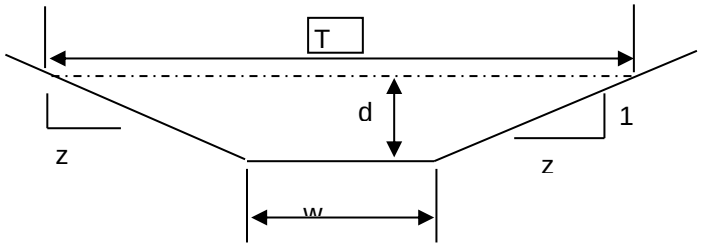
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	25
b (btm width, ft)=	0
d (depth, ft)=	0.5
S (slope, ft/ft)	0.023
n_{low} =	0.013
n_{high} =	0.013

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	3.13	13.01	0.24	6.69834173	20.9323	6.698342	20.9323	T =	12.5
								Dm =	0.250
				Sc low =	0.0041	Sc high =	0.0041		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0029	0.0054	0.0029	0.0054		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

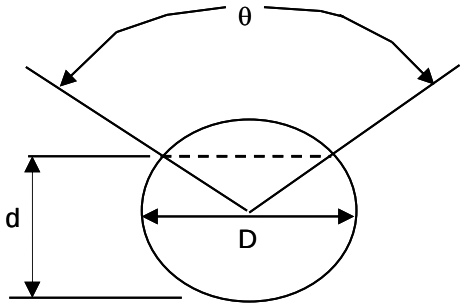
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #1 (Q100=1.1 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	12	inches
d=	12	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation

Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
0.79	3.14	0.25	4.54	3.56

Manning's n-values

PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

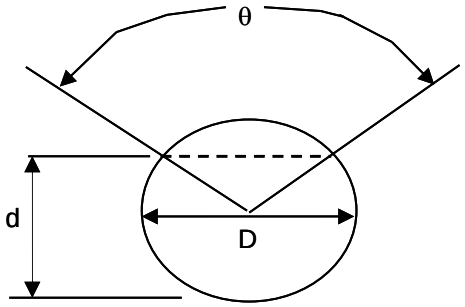
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #2 (Q100=12.7 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	24	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.14	6.28	0.50	5.52	17.33

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

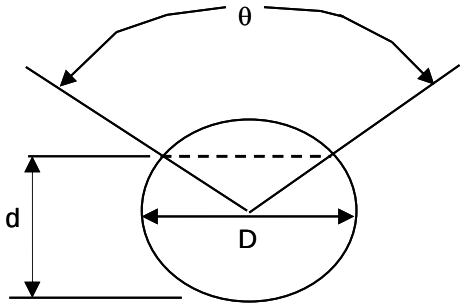
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #3 (Q100=14.7 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	24	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.14	6.28	0.50	5.52	17.33

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

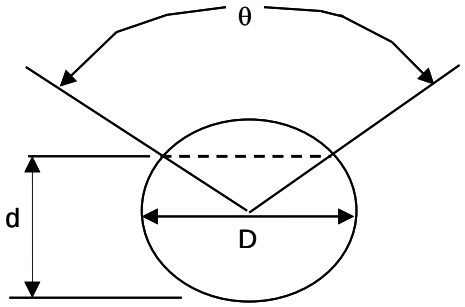
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #4 (Q100=14.7 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	24	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.14	6.28	0.50	5.52	17.33

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

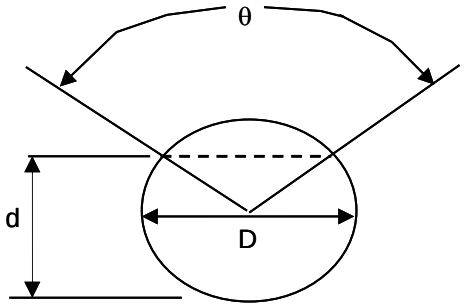
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #5 (Q100=14.7 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	24	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.14	6.28	0.50	5.52	17.33

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

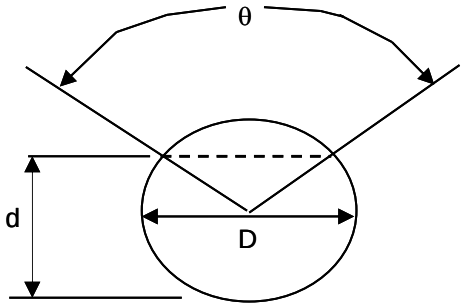
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #6 (Q100=14.7 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	24	inches
d=	24	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
3.14	6.28	0.50	5.52	17.33

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

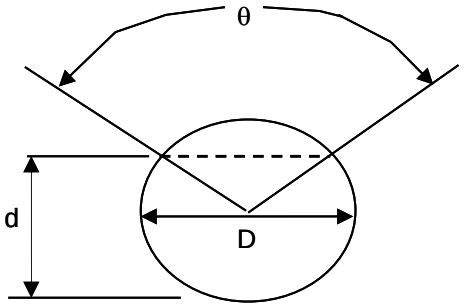
MANNING'S EQUATION FOR PIPE FLOW

Project: Shilo Mesa Retail South Location: Pipe Run #7 (Q100=2.0 cfs)

By: Dane Frank Date: 4/27/2022

Chk. By: Date: mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	12	inches
d=	12	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.1	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
0.79	3.14	0.25	15.54	12.20

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

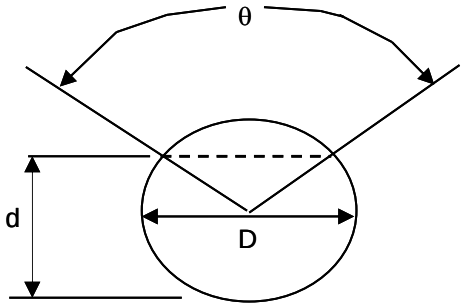
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #8 (Q100=2.8 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	12	inches
d=	12	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.03	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
0.79	3.14	0.25	8.51	6.68

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

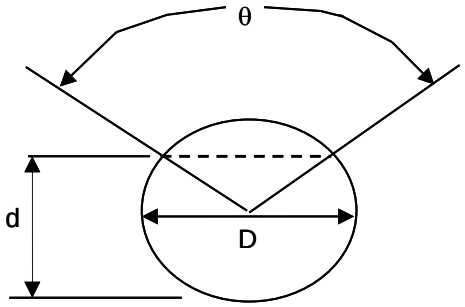
Created by: Mike O'Shea

MANNING'S EQUATION FOR PIPE FLOW

Project:	Shilo Mesa Retail South	Location:	Pipe Run #9 (Q100=2.8 cfs)
By:	Dane Frank	Date:	4/27/2022
Chk. By:		Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

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d=	12	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.03	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation				
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
0.79	3.14	0.25	8.51	6.68

Manning's n-values	
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PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

DETENTION BASIN DESIGN CALCULATIONS

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

				Designer:	**Dane Frank**
				Company:	**Terra Nova Engineering**
***Design Storm: 1-Hour Rain Depth	2-Year Event	1.19	inches	**Date:**	**April 26, 2022**
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches	**Project:**	**Shilo Mesa North**
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches	**Location:**	**Sand Filter**
Optional User Defined Storm	CUHP				
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event				
Max Intensity for Optional User Defined Storm	0				

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A	B	C	G	H									
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam									
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.310	0.550	1.600	0.180	0.230									
Directly Connected Impervious Area (DCIA, acres)	0.200	0.130	1.450	0.090	0.150									
Unconnected Impervious Area (UIA, acres)	0.000	0.000	0.000	0.000	0.000									
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.000	0.000									
Separate Pervious Area (SPA, acres)	0.110	0.420	0.150	0.090	0.080									
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C									

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.310	0.550	1.600	0.180	0.230									
Directly Connected Impervious Area (DCIA, %)	64.5%	23.6%	90.6%	50.0%	65.2%									
Unconnected Impervious Area (UIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%									
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	0.0%	0.0%									
Separate Pervious Area (SPA, %)	35.5%	76.4%	9.4%	50.0%	34.8%									
A_R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000									
I_a Check	1.000	1.000	1.000	1.000	1.000									
f / I for 2-Year Event:	0.9	0.9	0.9	0.9	0.9									
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5									
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3									
f / I for Optional User Defined Storm CUHP:														
IRF for 2-Year Event:	1.00	1.00	1.00	1.00	1.00									
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00									
IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00									
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	64.5%	23.6%	90.6%	50.0%	65.2%									
Effective Imperviousness for 2-Year Event:	64.5%	23.6%	90.6%	50.0%	65.2%									
Effective Imperviousness for 5-Year Event:	64.5%	23.6%	90.6%	50.0%	65.2%									
Effective Imperviousness for 100-Year Event:	64.5%	23.6%	90.6%	50.0%	65.2%									
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

This line only for WQCV Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.2%	0.0%	0.2%	0.1%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**70.4%**
Total Site Effective Imperviousness for 2-Year Event:	**70.4%**
Total Site Effective Imperviousness for 5-Year Event:	**70.4%**
Total Site Effective Imperviousness for 100-Year Event:	**70.4%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.

** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.

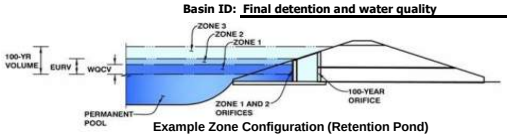
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Shiloh Mesa Retail South Filing No. 1

Basin ID: Final detention and water quality



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	3.18	acres
Watershed Length =	411	ft
Watershed Length to Centroid =	206	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	75.00%	percent
Percentage Hydrologic Soil Group A =	66.9%	percent
Percentage Hydrologic Soil Group B =	33.1%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.079	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.293	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.83 in.) =	0.138	acre-feet	inches
5-yr Runoff Volume (P1 = 1.09 in.) =	0.191	acre-feet	inches
10-yr Runoff Volume (P1 = 1.33 in.) =	0.239	acre-feet	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	0.325	acre-feet	inches
50-yr Runoff Volume (P1 = 1.99 in.) =	0.398	acre-feet	inches
100-yr Runoff Volume (P1 = 2.31 in.) =	0.482	acre-feet	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.695	acre-feet	inches
Approximate 2-yr Detention Volume =	0.141	acre-feet	
Approximate 5-yr Detention Volume =	0.194	acre-feet	
Approximate 10-yr Detention Volume =	0.246	acre-feet	
Approximate 25-yr Detention Volume =	0.315	acre-feet	
Approximate 50-yr Detention Volume =	0.355	acre-feet	
Approximate 100-yr Detention Volume =	0.396	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.079	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.214	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.103	acre-feet
Total Detention Basin Volume =	0.396	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.25 ft

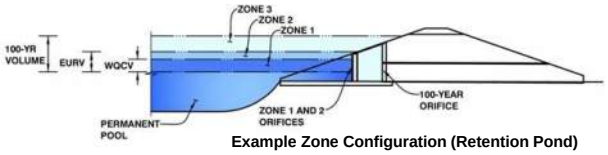
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	549	0.013		
	--	0.25	--	--	--	717	0.016	158	0.004
	--	0.50	--	--	--	886	0.020	359	0.008
	--	0.75	--	--	--	1,054	0.024	601	0.014
	--	1.00	--	--	--	1,222	0.028	885	0.020
	--	1.25	--	--	--	1,472	0.034	1,222	0.028
	--	1.50	--	--	--	1,723	0.040	1,622	0.037
	--	1.75	--	--	--	1,973	0.045	2,084	0.048
	--	2.00	--	--	--	2,223	0.051	2,608	0.060
	--	2.25	--	--	--	2,485	0.057	3,197	0.073
	--	2.50	--	--	--	2,748	0.063	3,851	0.088
	--	2.75	--	--	--	3,010	0.069	4,570	0.105
	--	3.00	--	--	--	3,272	0.075	5,355	0.123
	--	3.25	--	--	--	3,521	0.081	6,205	0.142
	--	3.50	--	--	--	3,771	0.087	7,116	0.163
	--	3.75	--	--	--	4,020	0.092	8,090	0.186
	--	4.00	--	--	--	4,269	0.098	9,126	0.210
	--	4.25	--	--	--	4,519	0.104	10,225	0.235
	--	4.50	--	--	--	4,770	0.109	11,386	0.261
	--	4.75	--	--	--	5,020	0.115	12,609	0.289
	--	5.00	--	--	--	5,339	0.123	13,904	0.319
	--	5.25	--	--	--	5,601	0.129	15,272	0.351
	--	5.50	--	--	--	5,864	0.135	16,705	0.383
	--	5.75	--	--	--	6,126	0.141	18,203	0.418
	--	6.00	--	--	--	6,497	0.149	19,781	0.454
	--	6.25	--	--	--	6,746	0.155	21,437	0.492
	--	6.50	--	--	--	6,996	0.161	23,154	0.532
	--	6.75	--	--	--	7,245	0.166	24,934	0.572
	--	7.00	--	--	--	7,704	0.177	26,803	0.615

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Shiloh Mesa Retail South Filing No. 1**

Basin ID: **Final detention and water quality**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.36	0.079	Orifice Plate
Zone 2 (EURV)	4.79	0.214	Orifice Plate
Zone 3 (100-year)	5.60	0.103	Weir&Pipe (Restrict)
Total (all zones)		0.396	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	4.236E-03	ft^2
Depth at top of Zone using Orifice Plate =	4.79	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	18.10	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.61	sq. inches (diameter = 7/8 inch)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.60	3.19					
Orifice Area (sq. inches)	0.61	0.61	0.61					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.80	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.80	N/A	feet
Overflow Weir Front Edge Length =	2.00	N/A	feet	Overflow Weir Slope Length =	2.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	14.82	N/A	
Horiz. Length of Weir Sides =	2.00	N/A	feet	Overflow Grate Open Area w/o Debris =	3.16	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	1.58	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.21	N/A	ft^2
Outlet Pipe Diameter =	12.00	N/A	inches	Outlet Orifice Centroid =	0.19	N/A	feet
Restrictor Plate Height Above Pipe Invert =	3.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.20	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.72	feet
Spillway Crest Length =	3.00	feet	Stage at Top of Freeboard =	7.72	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.18	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.62	acre-ft

Calculated Parameters for Spillway

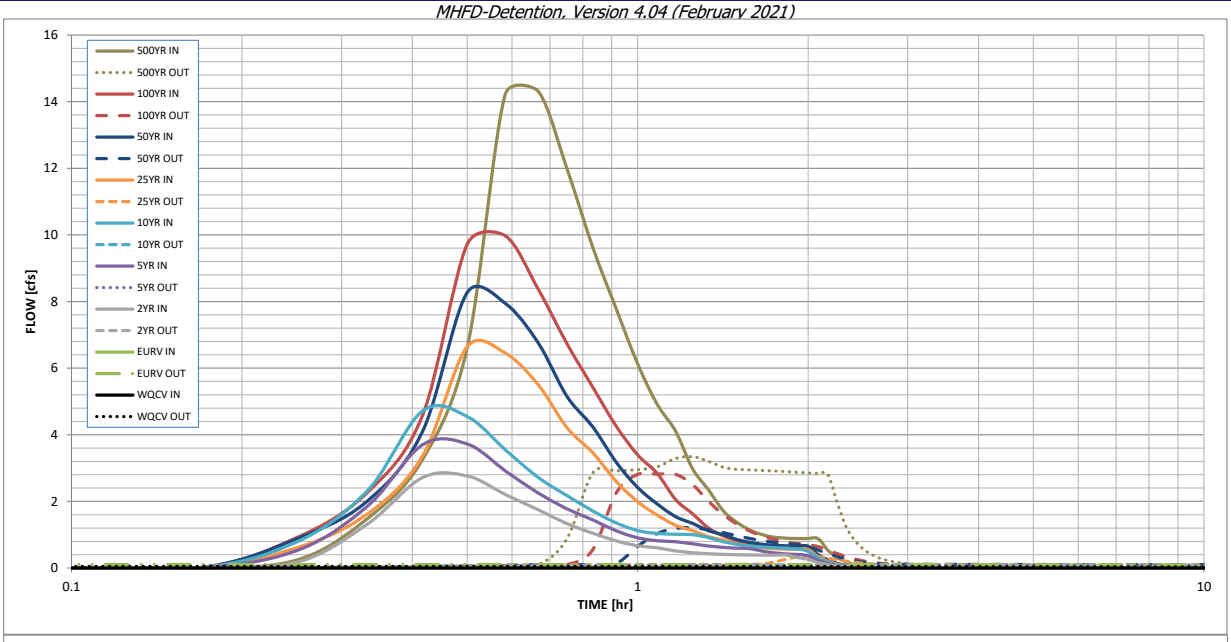
Routed Hydrograph Results

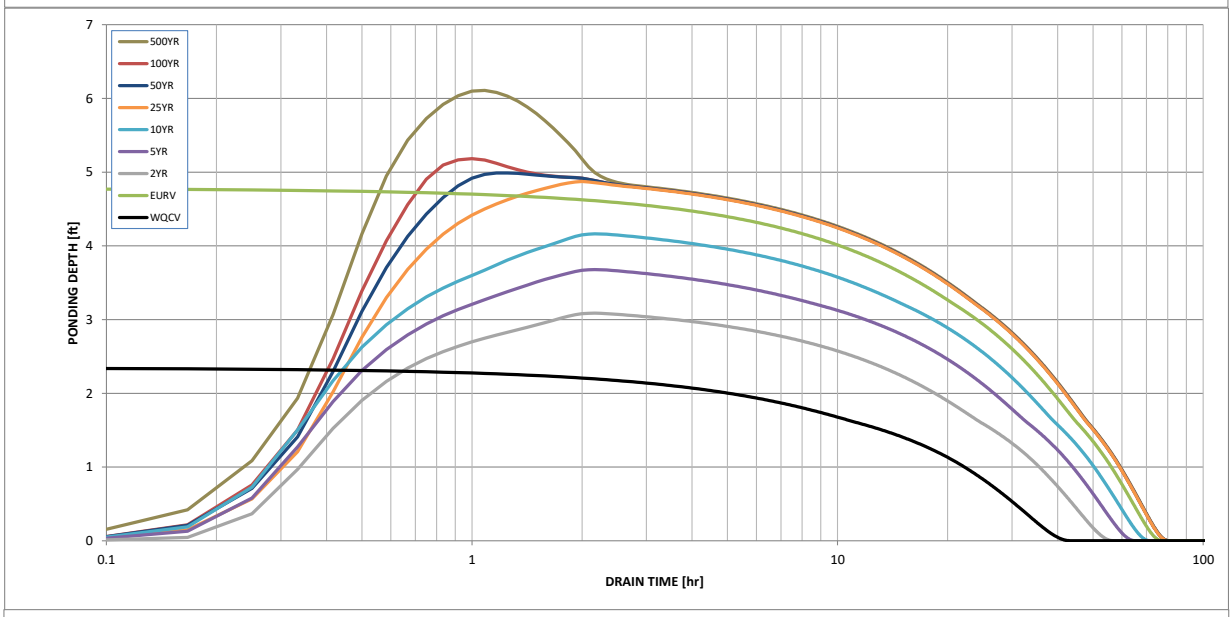
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

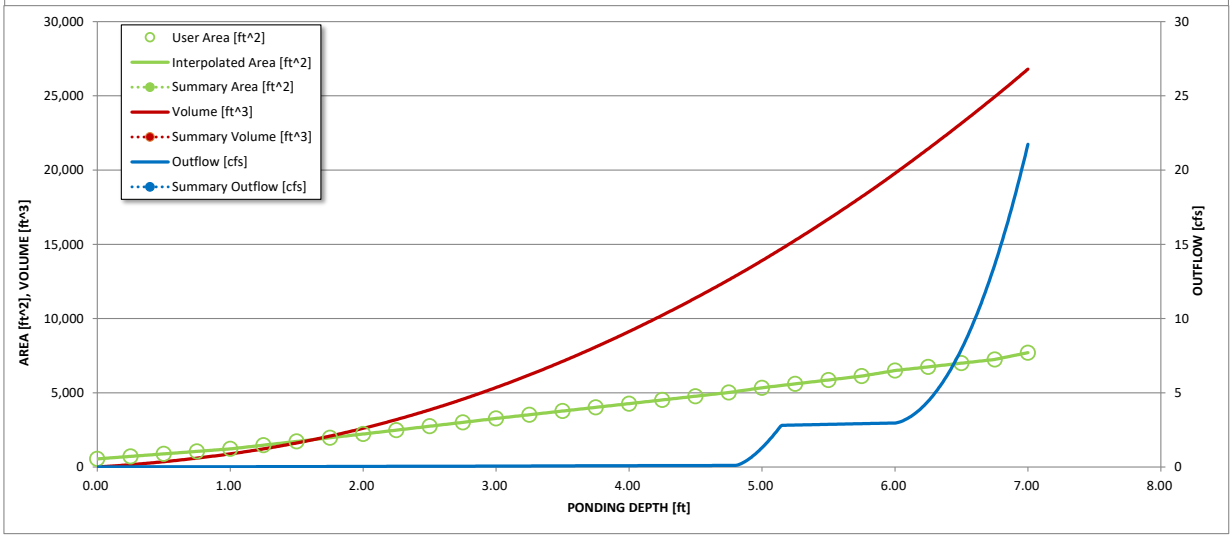
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.83	1.09	1.33	1.69	1.99	2.31	3.14
CUHP Runoff Volume (acre-ft) =	0.079	0.293	0.138	0.191	0.239	0.325	0.398	0.482	0.695
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.138	0.191	0.239	0.325	0.398	0.482	0.695
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.1	0.9	1.8	2.8	5.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.02	0.29	0.56	0.89	1.73
Peak Inflow Q (cfs) =	N/A	N/A	2.8	3.7	4.7	6.6	8.3	10.0	14.3
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.1	0.4	1.2	2.8	3.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.4	1.7	0.4	0.7	1.0	0.6
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.3	0.9	0.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	64	48	55	60	66	65	63	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	70	52	59	65	72	72	71	69
Maximum Ponding Depth (ft) =	2.35	4.79	3.09	3.68	4.16	4.87	4.99	5.18	6.11
Area at Maximum Ponding Depth (acres) =	0.06	0.12	0.08	0.09	0.10	0.12	0.12	0.13	0.15
Maximum Volume Stored (acre-ft) =	0.079	0.294	0.129	0.178	0.225	0.304	0.317	0.342	0.469

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

FORBAY VOLUMES

FORBAY VOLUME

Required Forbay Volume = 2% of WQCV

WQCV =	0.079	ac-ft
WQCV =	3,441	cu-ft
2% of WQCV =	34	cu-ft

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6902.00	64				
		64	1.5	96	
6903.50	64				96

Design Volume: 96 C.F.
0.002 A.F.

PROPOSED MICROPOOL VOLUME

ELEV	*AREA*	*AREA AVG.*	*DELTA ELEV.*	*VOLUME*	*VOLUME TOTAL*
6898.50	24				
		24	3	72	
6901.50	24				72

End Area Method: 72 C.F.
0.002 A.F.

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Shiloh Mesa Retail South** Location: EDB Forebay Notch - Q=10.0 cfs * 2% = 0.20 cfs

By: Dane Frank Date: 4/28/2022

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

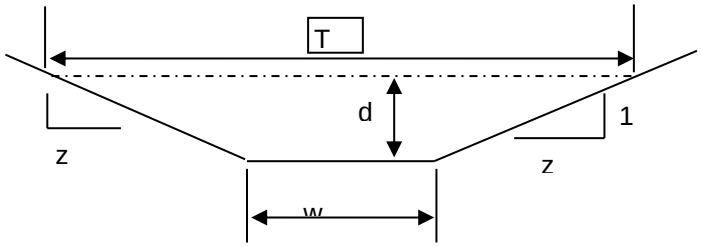
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	0.12
d (depth, ft)=	1.5
S (slope, ft/ft)	0.005
n_{low} =	0.013
n_{high} =	0.013

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
1.5	0.18	3.12	0.06	1.20669572	0.21721	1.206696	0.21721	T =	0.12
								Dm =	1.500
				Sc low =	0.1656	Sc high =	0.1656		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.1159	0.2152	0.1159	0.2152		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

MANNING'S EQUATION for OPEN CHANNEL FLOW

Project: **Shiloh Mesa Retail South** Location: EDB Trickle Channels (need Q= 0.2 cfs)

By: Dane Frank Date: 4/28/2022

Chk By: Date: version 12-2004

Mannings Formula

$Q = (1.486/n)AR_h^{2/3}S^{1/2}$

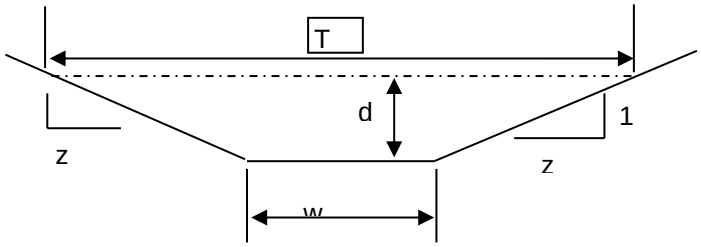
R = A/P

A = cross sectional area

P= wetted perimeter

S = slope of channel

n = Manning's roughness coefficient



$V = (1.49/n)R_h^{2/3}S^{1/2}$

Q = V x A

INPUT	
z (sideslope)=	0
z (sideslope)=	0
b (btm width, ft)=	0.24
d (depth, ft)=	0.5
S (slope, ft/ft)	0.005
n_{low} =	0.013
n_{high} =	0.013

Clear Data Entry Cells

				Low N		High N			
Depth, ft	Area, sf	Wetted Perimeter, ft	Hydraulic Radius, ft	Velocity, fps	Flow, cfs	Velocity, fps	Flow, cfs		
0.5	0.12	1.24	0.10	1.70359501	0.20443	1.703595	0.20443	T =	0.24
								Dm =	0.500
				Sc low =	0.0277	Sc high =	0.0277		
				.7 Sc	1.3 Sc	.7 Sc	1.3 Sc		
				0.0194	0.0360	0.0194	0.0360		

s_c = critical slope ft / ft

T = top width of the stream

d_m = a/T = mean depth of flow

Created by: Mike O'Shea

2214.00

Figure 13-12c. Emergency Spillway Protection

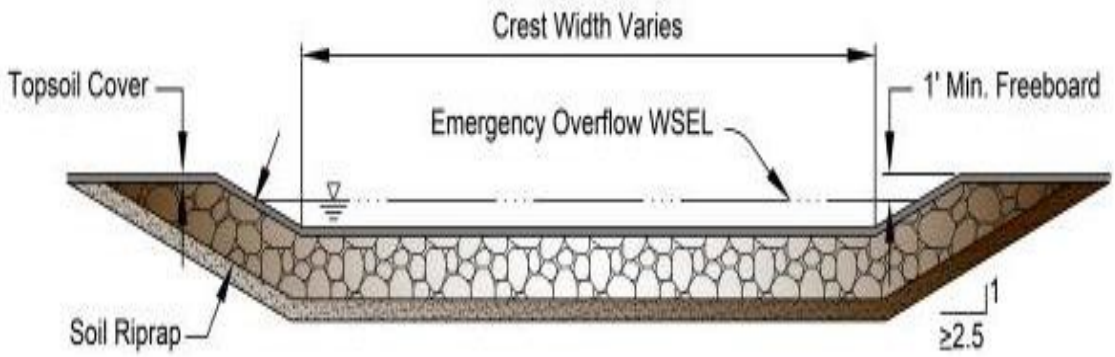
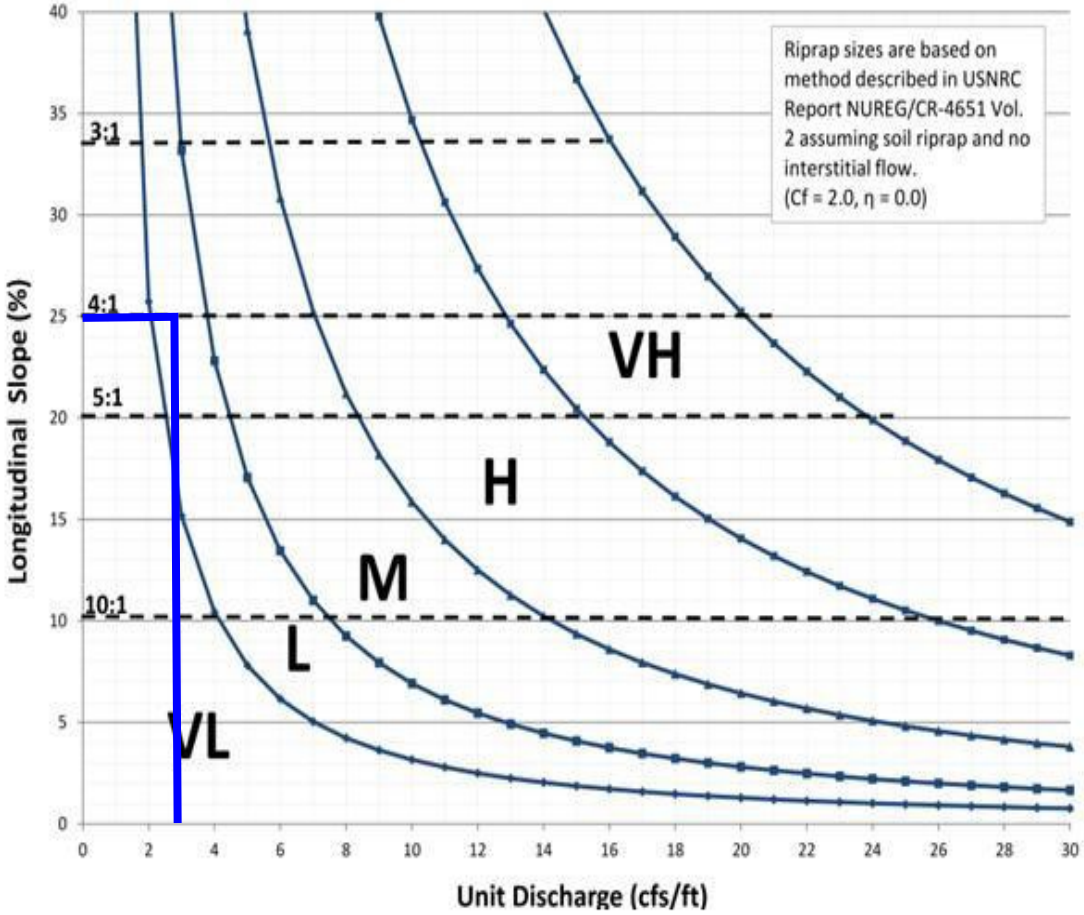
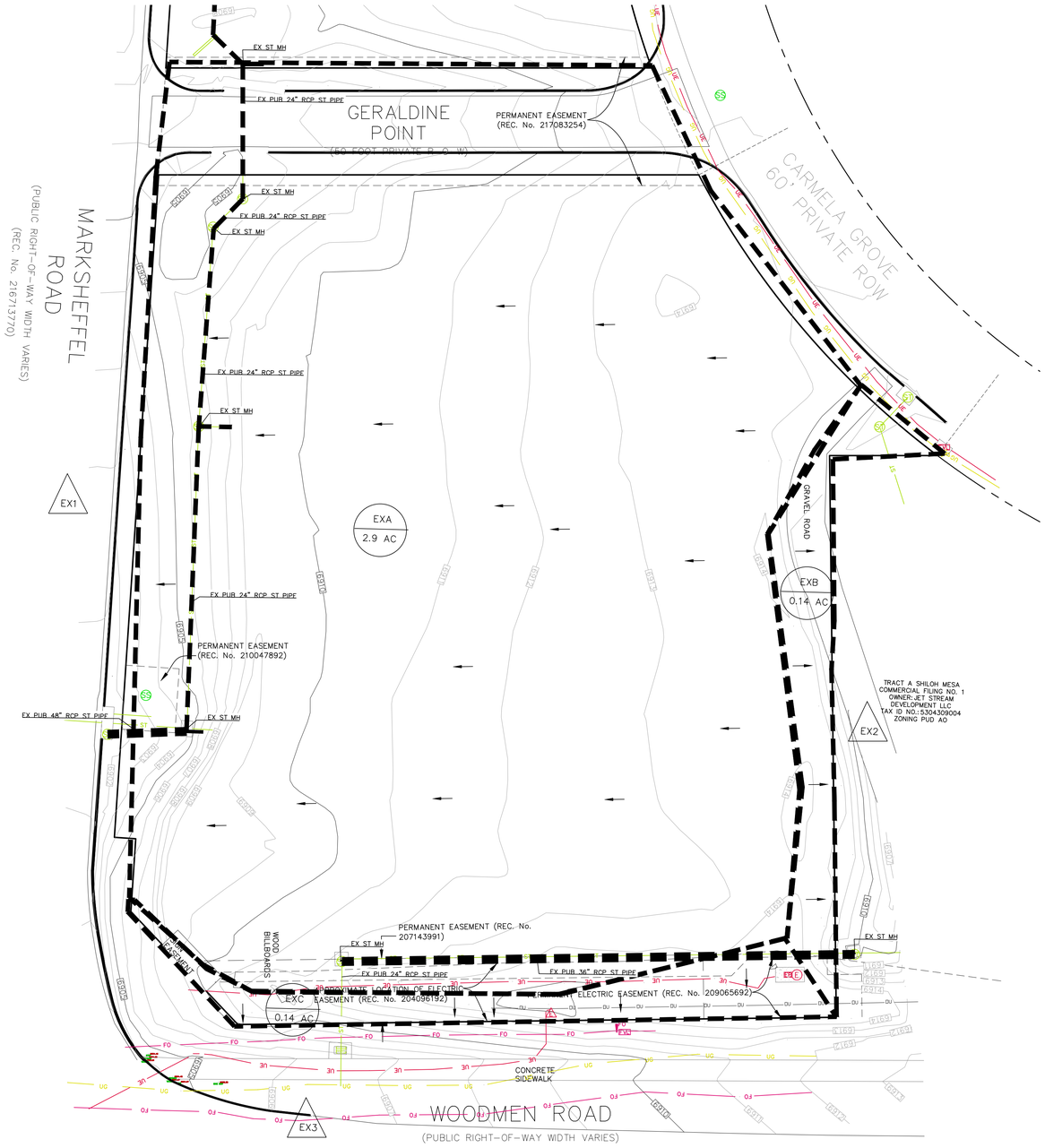


Figure 13-12d. Riprap Types for Emergency Spillway Protection



DRAINAGE MAP



EXISTING

BASIN	AREA TOTAL (Acres)	TOTAL FLOWS Q_5 (c.f.s.)	TOTAL FLOWS Q_{100} (c.f.s.)
EXA	2.90	1.2	6.5
EXB	0.14	0.1	0.4
EXC	0.14	0.1	0.4

LEGEND

- P-7 / 12.22 — BASIN DESIGNATION / AREA IN BASIN (AC)
- D — DESIGN POINT
- BASIN BOUNDARY
- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- ROAD AND DITCH FLOW DIRECTION

GRADING LEGEND

EXISTING CONTOURS – MAJOR	6130
EXISTING CONTOURS – MINOR	6132
PROPOSED CONTOURS – MAJOR	6130
PROPOSED CONTOURS – MINOR	6132
PROPERTY LINE	
FLOW DIRECTION	3:1
TOP OF WALL	TW
FINISHED GROUND	FG
FLOWLINE	FL
TOP OF STAIRS	TS
BOTTOM OF STAIRS	BS

NOTE:

1. EXISTING VEGETATION CONSISTS OF NATIVE PRAIRIE GRASSES AND SHRUBS WITH GOOD TO EXCELLENT COVERAGE OF 75% TO 90%
2. AT THE TIME OF FINAL CONSTRUCTION EROSION CONTROL BLANKETS WILL NEED TO BE INSTALLED ON ALL 3:1 SLOPES

N

30' 0 30' 60'

SCALE: 1"=30'

AR DP 22-

REVISIONS

NO.	DESCRIPTION	DATE

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OFFICE: 719-635-6422
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www.tneinc.com

SHILOH MESA RETAIL SOUTH FIL NO. 1

DEVELOPMENT PLAN
EXISTING DRAINAGE MAP

DESIGNED BY LD
DRAWN BY LD
CHECKED BY
H-SCALE
V-SCALE
JOB NO. 2214.00
DATE ISSUED 04/28/22
SHEET NO. 1 OF 2

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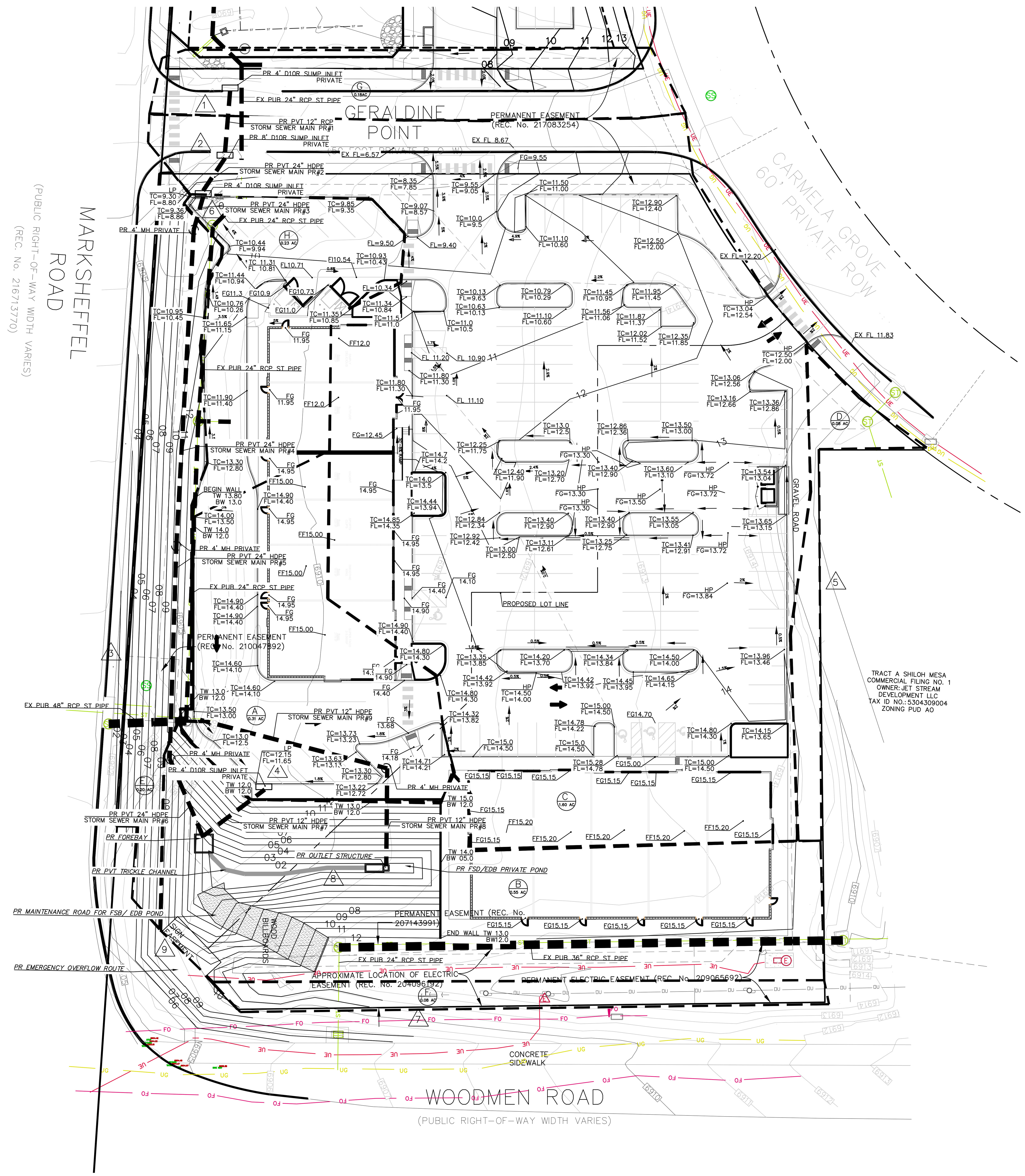


DEVELOPED

BASIN	AREA TOTAL (Acres)	TOTAL FLOWS Q_5 (c.f.s.)	Q_{100} (c.f.s.)
A	0.31	0.9	2.0
B	0.55	0.5	1.7
C	1.60	5.7	11.6
D	0.08	0.4	0.7
E	0.20	1.1	2.2
F	0.08	0.4	0.8
G	0.18	0.4	1.1
H	0.23	0.9	2.0

LEGEND

P-7 / 12.22 — BASIN DESIGNATION / AREA IN BASIN (AC)

D — DESIGN POINT

BASIN BOUNDARY

EXISTING 2' CONTOUR

EXISTING 10' CONTOUR

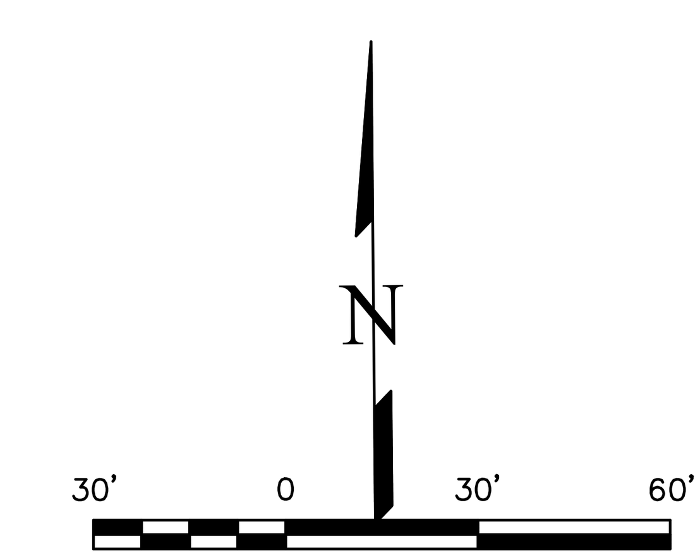
ROAD AND DITCH FLOW DIRECTION

GRADING LEGEND

EXISTING CONTOURS – MAJOR	6130
EXISTING CONTOURS – MINOR	6132
PROPOSED CONTOURS – MAJOR	6130
PROPOSED CONTOURS – MINOR	6132
PROPERTY LINE	
FLOW DIRECTION	3:1
TOP OF WALL	TW
FINISHED GROUND	FG
FLOWLINE	FL
TOP OF STAIRS	TS
BOTTOM OF STAIRS	BS

NOTE:

1. EXISTING VEGETATION CONSISTS OF NATIVE PRAIRIE GRASSES AND SHRUBS WITH GOOD TO EXCELLENT COVERAGE OF 75% TO 90%
2. AT THE TIME OF FINAL CONSTRUCTION EROSION CONTROL BLANKETS WILL NEED TO BE INSTALLED ON ALL 3:1 SLOPES



SCALE: 1"=30'

AR DP 22–

REVISIONS

NO.	DESCRIPTION	DATE

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SHILOH MESA RETAIL SOUTH FIL NO. 1

DEVELOPMENT PLAN
PROPOSED DRAINAGE MAP

DESIGNED BY LD
DRAWN BY LD
CHECKED BY
H-SCALE
V-SCALE
JOB NO. 2214.00
DATE ISSUED 04/28/22
SHEET NO. 2 OF 2

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