Drainage Report
For
Hawk Eye Self Storage II
1288 Santa Fe Dr.
Pueblo, CO 81006

Property Owner:
Hawk Eye Enterprises LLC
9 Courtney Pl.
Pueblo CO 81001

Prepared For:
Hawk Eye Enterprises LLC
1288 Santa Fe Dr.
Pueblo, CO 81006

Prepared By:
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August 2022

I, Joseph V. Gagliano, a registered professional engineer in the State of Colorado, do hereby certify that the attached Drainage Report was prepared under my direct supervision and in accordance with the *Storm Drainage Criteria Manual* established by the City of Pueblo, dated June 9, 1997.

Gagliano Engineering, Inc.

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APPENDICES

1. INTRODUCTION

Gagliano Engineering, Inc. has been retained to prepare a Drainage Report for the proposed Hawk Eye Self Storage II.

1.1 Scope

The scope of this Drainage Report includes the analysis of existing drainage conditions, the development of proposed grades, the design of storm water detention and/or retention facilities and the analysis of proposed conditions to assure compliance with the *Storm Drainage Design Criteria and Drainage Policies for City of Pueblo, Colorado, June 1997*.

1.2 Methodology

The format for analysis generally follows the Minimum Storm Drainage Design Criteria for the City of Pueblo, June 1997. For those instances where additional guidance is needed beyond the City manual, the Urban Storm Drainage Criteria (USDC) manual by Mile High Flood District (MHFD) is referenced. The calculation of storm water flow rates and detention facility design is by the Rational Method using MHFD spreadsheets. Rainfall data from City of Pueblo criteria has been supplemented with NOAA Atlas 14 Point data for the 2-, 50-, and 500-year events.

The Storm Drainage Design Criteria for the City of Pueblo, June 1997, has been adopted for the use within Pueblo County. The following report analyzes the design storm return periods for water quality capture volume (WQCV), 10-year events, and 100-year events only per the design criteria set forth by Pueblo County.

2. GENERAL PROJECT INFORMATION

2.1 Location

The subject parcel of land is Parcel “A” of LLV 2021-003, Pueblo, Colorado containing 7.10± acres with a physical address of 1288 Santa Fe Dr., Pueblo, Colorado 81006. (See Vicinity Map)

2.2 Project Description

The site is currently zoned '*Community Business District*' (B-4), SUP No. 2021-005 and is located within '*Arterial Commercial Mixed Use*' designation in the County's Comprehensive Plan. The lot is currently vacant. Four self storage buildings, are planned to be constructed on the lot; 17,550 sf, 13,275 sf, 15,850 sf, and 16,100 sf respectively. New paved parking, driveway, and buildings will result in a total impervious area of approximately 121,500 sf.

US Highway 50 borders the property on the north. Fountain Sand and Gravel Subdivision, and San Mateo St., border the property on the east. Stanton and Vroman

Subdivision, and Roselawn Rd., border the property to the south. Stanton and Vroman Subdivision border the property to the west. The surrounding properties are mainly zoned '*Single Family Residential District*' (R-2).

Based on the soil survey of Pueblo Area, Colorado conducted by the United States Department of Agriculture Soil Conservation Service, the subject site consists of a Cascajo-Midway Complex, 5 to 35 percent slopes, dry (CsE). Surrounding sites consists of MaA and OdA soils with 0 to 4 percent slopes.

The Cascajo soil is classified as excessively drained with a low runoff classification. The Midway soil is classified as well drained with a high runoff classification. The hydrologic soil group for the subject site is a mixture of soil types “A” and “D”.

Existing elevations across the site vary from 4734 feet to 4694 feet (local survey datum), generally sloping to the south-west with varying slopes.

2.3 Floodplain

This site lies outside the 100 yr flood zone according to the Flood Insurance Rate Map - Community Panel Number 080147 Map Number 08101C0727D effective August 15, 2019 (See Appendix).

3. MAJOR DRAINAGE BASINS AND SUB-BASINS

Surface water on the subject site generally flows overland in a south-westerly direction to multiple low points located in the south and west portions of the parcel.

The 7.10± acre developed site has been divided into seven basins for analysis. Drainage Basin A is 0.84± acres and will be detained on site in Drainage Basin P1. Drainage Basin B is 3.90± acres and will be detained on site in Drainage Basin P2. Drainage Basin P1 is 0.33± acres and will contain the Extended Detention Basin (EDB) P1 Drainage Basin P2 is 1.12± acres and will contain EDB P2. Drainage Basin X is 0.14± acres and will flow undetained to the U.S. Highway 50 right-of-way. Drainage Basin Y is 0.62± acres and will continue to match its historic flow, undetained, to the adjacent properties to the southwest of the basin. Drainage Basin Z is 0.15± acres and will flow undetained to the U.S. Highway 50 right-of-way.

The detained flow from EDB P1 will discharge to the north into the U.S. Highway 50 right-of-way. The detained flow from EDB P2 will discharge to the south into the Roselawn Rd. right-of-way.

The existing Roselawn Rd. right-of-way, south of the subject parcel, drains in a westerly direction to a storm sewer inlet located within the right-of-way. The existing U.S. Highway 50 right-of-way, north of the subject parcel, drains in a westerly direction. Existing historic flows from the subject parcel drain to both the Roselawn Rd. right-of-way and the U.S. Highway 50 right-of-way.

The existing properties to the east, Lots 3 & 4 of Fountain Sand and Gravel Subdivision First Filing, drains to the south with ultimate discharge into the Roselawn right-of-way via an existing concrete storm sewer system. The existing properties to the west, Lots 77, 81-85. 130, and 131 of Stanton and Vroman Subdivision, drains to the south with ultimate discharge into the Roselawn right-of-way.

4. EXISTING DRAINAGE STUDIES AND REPORTS

Gagliano Engineering, Inc. is not aware of any existing drainage reports or studies for this property.

5. UPSTREAM DRAINAGE CONSIDERATIONS

There are no upstream basins contributing storm-water flows to the property.

6. ONSITE DRAINAGE CONSIDERATIONS

6.1 General

On site drainage considerations involve the hydrologic modeling of developed conditions. (See Drainage / Erosion Control Plan in Map Pocket)

6.2 Existing Conditions

The existing site generally flows in a westerly direction with slopes ranging from 2% to 35%. The site is divided into one historic basin for analysis. The site contains a mixture of sandy and clayey soils. Runoff coefficients used for the historic basin was categorized as undeveloped land on Hydrologic Soil Groups "A" and "D". Hydrologic Soil Group "D" has the larger of the two runoff coefficients, and was used for the calculation of the historic undeveloped area. The City of Pueblo Storm Drainage Design Criteria Sheet No. A-6 is utilized for the individual runoff coefficient values.

Historic Coefficient Table

BASIN	TYPE	SIZE (AC)	C 10-YR	C 100-YR
Hist A	Historic	7.10	0.25	0.50

For analytical purposes, Historic Design Point 1 is identified as a location of interest to compare historic and developed flow rates. Historical conditions at the referenced Design Point are as follows (See Drainage / Erosion Control Plan in Map Pocket):

HISTORIC DESIGN POINTS TABLE

DESIGN POINT	CONTRIBUTING BASIN	Q10 (cfs)	Q100 (cfs)
1	Hist A	3.07	9.48

6.3 Developed Conditions

Developed conditions accommodate the proposed structures and will utilize full-spectrum detention techniques to manage storm-water flows (See Drainage / Erosion Control Plan in Map Pocket).

Basin A's flows are delivered to the proposed detention facility in Basin P1, through overland flow and shallow concentrated flow in swales. Ultimate discharge of Basin P1 is to the US Highway 50 right-of-way. Basin B's flows are delivered to the proposed detention facility in Basin P2, through overland flow and shallow concentrated flow in swales. Ultimate discharge of Basin P2 is to the existing storm sewer located on the subject parcel. The storm sewer discharges at the southern end of the property into Roselawn right-of-way.

Drainage Basin W is 2.06± acres and will flow undetained in its histroic flow to the Roselawn right-of-way. Drainage Basin X is 0.14± acres and will flow undetained to the U.S. Highway 50 right-of-way. Drainage Basin Y is 0.62± acres and will maintain its historic flow to the neighboring properties to the southwest. Drainage Basin Z is 0.15± acres and will flow undetained to the U.S. Highway 50 right-of-way. (See Drainage / Erosion Control Plan in Map Pocket).

The developed site has slopes ranging from 1% to 35%. The runoff flow rates for the developed site were calculated using the percent impervious values of Commercial Business Area land use as well as Undeveloped Areas. Runoff coefficients used for the developed site are categorized as Commercial Business and Undeveloped on Hydrologic Soil Groups "A" and "D". The larger runoff coefficient from Hydrologic Soil Group "D" was used for calculating the runoff for undeveloped basins of the subject site. The City of Pueblo Storm Drainage Design Criteria Sheet No. A-6 is utilized for individual runoff coefficient values.

Runoff Coefficient Table

BASIN	SIZE (AC)	% IMPERVIOUS	C 10-YR	C 100-YR
A	0.84	95.0	0.88	0.89
B	3.90	95.0	0.88	0.89
P1	0.33	2.0	0.25	0.50
P2	1.12	2.0	0.25	0.50
X	0.14	2.0	0.25	0.50
Y	0.62	2.0	0.25	0.50
Z	0.15	2.0	0.25	0.50

The below required storage volume and allowable release rates were calculated using the coefficients of Hydrologic Soil Group "A", to minimize the total allowable release rate of the site compared to Hydrologic Soil Group "D". (See Required Storage Volume and Release Rates calculation tables in the Appendix)

Required Volume & Allowable Release Rate Summary Table

BASIN	SIZE (ac)	Q10 (cfs)	V10 (ac-ft)	Q100 (cfs)	V100 (ac-ft)
A	0.84	0.109	0.074	0.420	0.124
B	1.98	0.257	0.175	0.990	0.292
P1	0.33	0.043	0.000	0.165	0.000
P2	0.97	0.126	0.000	0.485	0.000
W	2.06	0.268	0.000	1.030	0.000
X	0.14	0.018	0.000	0.070	0.000
Y	0.62	0.081	0.000	0.310	0.000
Z	0.15	0.020	0.000	0.075	0.000

The total allowable release rate to the U.S. Highway 50 right-of-way is determined using the calculated release rates of Basins A, P1, X, and Z:

Q10 = 0.109 + 0.043 + 0.018 + 0.020 = 0.190 cfs

Q100 = 0.420 + 0.165 + 0.070 + 0.075 = 0.730 cfs

The total allowable release rate to the Roselawn right-of-way is determined using the calculated release rates of Basins B, P2, and W:

Q10 = 0.257 + 0.126 + 0.268 = 0.651 cfs

Q100 = 0.990 + 0.485 + 1.030 = 2.505 cfs

The total allowable release rate of Basin Y:

Q10 = 0.081 cfs

Q100 = 0.310 cfs

See Standard Form SF-5 included in the Appendix for the calculated developed runoff rates.

Basins A, B, P1, and P2 will be detained onsite including the required WQCV.

Design Point 1 (DP1) is the outflow from Basin A to the onsite detention pond P1, located within basin P1.

Design Point 2 (DP2) is the outflow from Basin B to the onsite detention pond P2, located within basin P2.

Design Point 3 (DP3) is the undetained discharge from Basin X to the U.S. Highway 50 right-of-way.

Design Point 4 (DP4) is the undetained historic discharge from Basin Y to the neighboring west properties.

Design Point 5 (DP5) is the undetained discharge from Basin Z to the U.S. Highway 50 right-of-way.

Design Point 6 (DP6) is the undetained historic discharge from Basin W to the Roselwan right-of-way.

Design Point 7 (DP7) is the controlled discharge from the onsite detention pond, located within basin P1, to the U.S. Highway 50 right-of-way.

Design Point 8 (DP8) is the controlled discharge from the onsite detention pond, located within basin P2, to the Roselawn Rd. right-of-way.

Design Point Runoff Rate Summary Table

Design Point	Q10 (cfs)	Q100 (cfs)
DP1	3.46	5.38
DP2	7.06	10.93
DP3	0.16	0.48
DP4	0.70	2.14
DP5	0.17	0.52
DP6	0.03	0.34
DP7	0.06	0.38
DP8	0.14	0.57

The detention pond for Basins A and P1 is designed as a Sand-Filter Basin to provide required Water Quality Capture Volume as well as required flood control though the 100-yr storm (full spectrum). The pond contains filtration media with an underdrain. The outlet structure is a reinforced concrete pipe with a restrictor plate as well as an overflow weir. See Drainage Plan for construction details.

The detention pond for Basins B and P2 is designed as a Sand-Filter Basin to provide required Water Quality Capture Volume as well as required flood control though the 100-yr storm (full spectrum). The pond contains filtration media with an underdrain. The outlet structure is a reinforced concrete pipe with a restrictor plate as well as an overflow weir. See Drainage Plan for construction details.

The following tables are from the MHFD-Detention spreadsheet are used to calculate the runoff conditions and design the full spectrum pond. The full print-out is found in the Calculations section of this report and the spreadsheet program file is available upon request. The Predevelopment Unit Peak flow for 10-yr and 100-yr events have been overridden with the allowable release rates calculated based on the City of Pueblo design criteria.

STORAGE AND RELEASE RATES TABLE
POND #1 – SAND-FILTER (BASIN P1)
FROM MHFD-DETENTION v4.04 SPREADSHEET

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	0.93	1.50	1.73	2.23	2.24	2.67	3.59
CUHP Runoff Volume (acre-ft) =	0.035	0.153	0.077	0.130	0.152	0.200	0.201	0.242	0.332
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.077	0.130	0.152	0.200	0.201	0.242	0.332
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.000	0.019	0.026	0.448	0.458	0.908	1.845
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A			0.152			0.585	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.02	0.13	0.38	0.39	0.50	1.58
Peak Inflow Q (cfs) =	N/A	N/A	1.5	2.5	2.9	3.9	3.9	4.7	6.3
Peak Outflow Q (cfs) =	0.023	0.4	0.042	0.052	0.055	0.365	0.366	0.377	1.374
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.7	0.4	0.8	0.8	0.6	0.7
Structure Controlling Flow =	Filtration Media	Outlet Plate 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	N/A	N/A	0.0	0.0	0.0	0.0
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) =	20	49	34	47	51	51	51	51	50
Time to Drain 99% of Inflow Volume (hours) =	**20**	51	36	48	53	53	53	54	55
Maximum Ponding Depth (ft) =	1.39	2.60	1.86	2.35	2.52	2.66	2.67	2.90	3.19
Area at Maximum Ponding Depth (acres) =	0.06	0.14	0.09	0.12	0.13	0.14	0.14	0.16	0.18
Maximum Volume Stored (acre-ft) =	0.035	0.154	0.071	0.122	0.142	0.163	0.163	0.197	0.248

Within the MHFD-Detention spreadsheet the time to peak discharge can be found. Based on the design, the 10-yr peak discharge is 0.055 cfs at 115 minutes. The 100-yr peak discharge is 0.377 cfs at 95 minutes.

STORAGE AND RELEASE RATES TABLE
POND #2 – SAND-FILTER (BASIN P2)
FROM MHFD-DETENTION v4.04 SPREADSHEET

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	0.93	1.50	1.73	2.23	2.24	2.67	3.59
CUHP Runoff Volume (acre-ft) =	0.088	0.387	0.201	0.339	0.395	0.520	0.522	0.631	0.863
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.201	0.339	0.395	0.520	0.522	0.631	0.863
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.001	0.034	0.046	0.845	0.863	1.709	3.552
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A			0.383			1.475	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.13	0.29	0.29	0.50	1.20
Peak Inflow Q (cfs) =	N/A	N/A	3.2	5.3	6.0	8.2	8.2	10.2	13.9
Peak Outflow Q (cfs) =	0.086	0.2	0.113	0.130	0.135	0.557	0.558	0.573	1.539
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.8	0.4	0.7	0.6	0.4	0.4
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.02	N/A	N/A	N/A	0.0	0.0	0.0	0.0
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) =	13	42	26	39	44	46	46	47	49
Time to Drain 99% of Inflow Volume (hours) =	**13**	44	27	40	45	48	48	50	51
Maximum Ponding Depth (ft) =	0.96	1.67	1.24	1.53	1.63	1.78	1.79	1.94	2.17
Area at Maximum Ponding Depth (acres) =	0.27	0.57	0.39	0.52	0.55	0.61	0.61	0.67	0.73
Maximum Volume Stored (acre-ft) =	0.090	0.391	0.179	0.315	0.369	0.456	0.456	0.558	0.712

Buried within the MHFD-Detention spreadsheet the time to peak discharge can be found. Based on the design, the 10-yr peak discharge is 0.135 cfs at 125 minutes. The 100-yr peak discharge is 0.573 cfs at 75 minutes.

7. MAINTENANCE RESPONSIBILITIES OF DRAINAGE FACILITIES

Maintenance of the ponds, channels, and outlet structures to the connection with right-of-way shall be the responsibility of the property owner. There are no planned drainage improvements within the US Highway 50 and Roselawn right-of-ways.

An Operation and Maintenance manual has been provided for the Extended Detention Basins.

8. DOWNSTREAM DRAINAGE CONSIDERATIONS

Developed storm water flows from the project will be detained by the two proposed extended detention basins and released in a controlled manner to the existing public drainage system. The extended detention basins located on the subject site shall release at a rate less than that determined from the historic basin. The remaining undetained flows will follow historic flow rates. The excess runoff to the Roselawn right-of-way and U.S. Highway 50 right of way has been mitigated by both of the proposed on site extended detention basins.

9. EROSION CONTROL AND WATER QUALITY TREATMENT

Construction activity will disturb a major portion of the subject site. Both temporary and permanent on site erosion control measures will be constructed and maintained by the owner(s). As shown on the plans permanent erosion control features include concrete surfaces and the proposed detention ponds.

Permanent water quality treatment will be provided by two extended detention basins with full-spectrum release rate control.

HAWK EYE SELF STORAGE
1288 SANTA FE DR.
PUEBLO, CO 81006

VICINITY MAP
NTS

SOILS INFORMATION

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 Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

June 23, 2020

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 (https://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.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

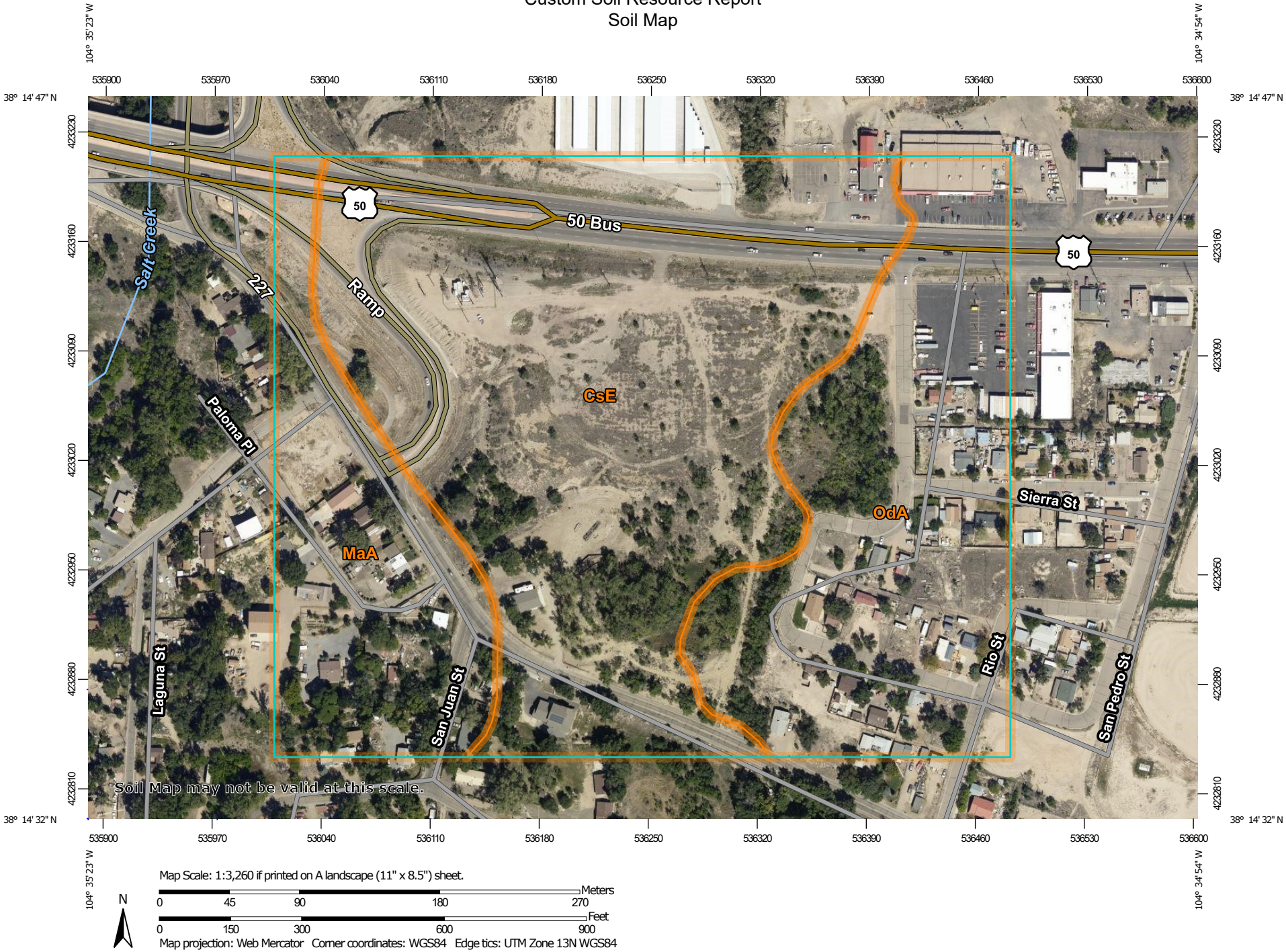
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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 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: Pueblo Area, Colorado, Parts of Pueblo and Custer Counties
Survey Area Data: Version 18, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 14, 2018—Sep 13, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

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
CsE	Cascajo-Midway complex, 5 to 35 percent slopes	24.2	53.6%
MaA	Manvel silt loam, dry, 0 to 2 percent slopes	7.8	17.4%
OdA	Oterodry sandy loam, dry, 1 to 4 percent slopes	13.1	29.0%
Totals for Area of Interest		**45.1**	**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.

Pueblo Area, Colorado, Parts of Pueblo and Custer Counties

CsE—Cascajo-Midway complex, 5 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2t513
Elevation: 4,260 to 5,900 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Cascajo and similar soils: 55 percent
Midway and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cascajo

Setting

Landform: Terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Old alluvium

Typical profile

A - 0 to 4 inches: very gravelly sandy loam
Bk - 4 to 22 inches: very gravelly loam
2C1 - 22 to 39 inches: extremely gravelly sand
2C2 - 39 to 79 inches: extremely gravelly sand

Properties and qualities

Slope: 5 to 35 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Very slightly saline (2.0 to 3.9 mmhos/cm)
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravel Breaks LRU's A & B (R069XY064CO)
Hydric soil rating: No

Description of Midway

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 3 inches: clay
Bw - 3 to 10 inches: clay
Bk - 10 to 13 inches: clay
Cr - 13 to 79 inches: bedrock

Properties and qualities

Slope: 20 to 35 percent
Depth to restrictive feature: 11 to 15 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 14 percent
Gypsum, maximum in profile: 15 percent
Salinity, maximum in profile: Slightly saline (4.0 to 7.9 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shale Breaks LRU's A & B (R069XY048CO)
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Kimera

Percent of map unit: 5 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains LRU's A & B (R069XY026CO)

Hydric soil rating: No

MaA—Manvel silt loam, dry, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2rgqh
Elevation: 3,700 to 6,400 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manvel, dry, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manvel, Dry

Setting

Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess

Typical profile

A - 0 to 7 inches: silt loam
Bk1 - 7 to 25 inches: silt loam
Bk2 - 25 to 49 inches: silt loam
Bk3 - 49 to 79 inches: silt loam

Properties and qualities

Slope: 0 to 2 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): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Gypsum, maximum in profile: 3 percent
Salinity, maximum in profile: Very slightly saline (2.0 to 3.9 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6c

Hydrologic Soil Group: B
Ecological site: Loamy Plains, LRU's A & B 10-14 Inches, P.Z. (R069XY006CO)
Hydric soil rating: No

Minor Components

Minnequa, dry
Percent of map unit: 5 percent
Landform: Pediments, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Ecological site: Loamy Plains, LRU's A & B 10-14 Inches, P.Z. (R069XY006CO)
Hydric soil rating: No

Wilid, dry
Percent of map unit: 5 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Plains, LRU's A & B 10-14 Inches, P.Z. (R069XY006CO)
Hydric soil rating: No

OdA—Oterodry sandy loam, dry, 1 to 4 percent slopes

Map Unit Setting
National map unit symbol: 2rh0z
Elevation: 3,800 to 6,000 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 175 days
Farmland classification: Not prime farmland

Map Unit Composition
Oterodry, dry, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Oterodry, Dry

Setting
Landform: Paleoterraces, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Eolian deposits and/or alluvium

Typical profile
A1 - 0 to 4 inches: sandy loam

A2 - 4 to 12 inches: sandy loam
Bk - 12 to 42 inches: sandy loam
C - 42 to 79 inches: fine sandy loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: A
Ecological site: Sandy Plains LRU's A & B (R069XY026CO)
Hydric soil rating: No

Minor Components

Kimera, dry

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: Loamy Plains, LRU's A & B 10-14 Inches, P.Z. (R069XY006CO)
Hydric soil rating: No

Cascajo, dry

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: Gravel Breaks LRU's A & B (R069XY064CO)
Hydric soil rating: No

Olney, dry

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains LRU's A & B (R069XY026CO)
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Hawk Eye II)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Pueblo Area, Colorado, Parts of Pueblo and Custer Counties														
Map unit symbol and soil name	**Pct. of map unit**	**Hydrologic group**	**Depth**	**USDA texture**	**Classification**		**Pct Fragments**		**Percentage passing sieve number—**				**Liquid limit**	**Plasticity index**
					Unified	**AASHTO**	**>10 inches**	**3-10 inches**	**4**	**10**	**40**	**200**		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
CsE—Cascajo-Midway complex, 5 to 35 percent slopes														
Cascajo	55	A	0-4	Very gravelly sandy loam	SC	A-2-6	0- 0- 1	4- 6- 16	56-64-67	33-49-53	23-38-42	10-19-22	21-30-34	5-11-13
			4-22	Very gravelly loam, very gravelly sandy loam	GC	A-2-6	0- 0- 1	4-12- 14	61-63-67	33-41-53	26-37-49	18-27-36	19-29-33	3-12-15
			22-39	Extremely gravelly sand	SW	A-1-a	0- 0- 1	14-17-21	51-58-63	17-30-35	13-23-29	1- 2- 5	0-0 -20	NP-0 -4
			39-79	Extremely gravelly sand	GW	A-1-a	0- 0- 1	5-11- 15	42-49-56	16-24-31	12-18-26	1- 2- 4	0-0 -20	NP-0 -4
Midway	35	D	0-3	Clay	CH	A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	94-99-100	73-81-86	51-53-64	27-28-36
			3-10	Clay, silty clay	CH	A-7-6	0- 0- 0	0- 0- 0	94-96-100	89-92-100	83-91-100	70-77-89	47-55-64	26-31-37
			10-13	Clay, silty clay	CH	A-7-6	0- 0- 0	0- 0- 0	94-96-100	89-92-100	81-91-100	68-78-90	47-56-66	26-32-39
			13-79	Bedrock	—	—	—	—	—	—	—	—	—	—

Engineering Properties–Pueblo Area, Colorado, Parts of Pueblo and Custer Counties														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
MaA—Manvel silt loam, dry, 0 to 2 percent slopes														
Manvel, dry	90	B	0-7	Silt loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	94-100-100	90-99-100	81-93-99	30-35-41	11-15-19
			7-25	Silt loam, silty clay loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	94-100-100	90-100-100	84-96-100	26-35-46	7-15-24
			25-49	Silt loam, loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	94-100-100	89-99-100	80-93-100	26-32-38	7-13-18
			49-79	Silt loam, loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	91-98-100	85-97-100	71-85-96	23-31-37	5-12-18
OdA—Oterodry sandy loam, dry, 1 to 4 percent slopes														
Oterodry, dry	80	A	0-4	Sandy loam	SC-SM	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	73-77-83	34-40-48	20-24-32	4-6 -12
			4-12	Sandy loam	SC-SM	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	73-77-83	34-40-48	20-24-32	4-6 -12
			12-42	Sandy loam	SC-SM	A-4	0- 0- 0	0- 0- 0	100-100-100	92-100-100	67-77-83	31-40-48	18-21-29	3-5 -12
			42-79	Fine sandy loam, sandy loam	SC-SM	A-4	0- 0- 0	0- 0- 0	100-100-100	92-100-100	79-91-96	32-43-51	18-22-29	3-6 -12

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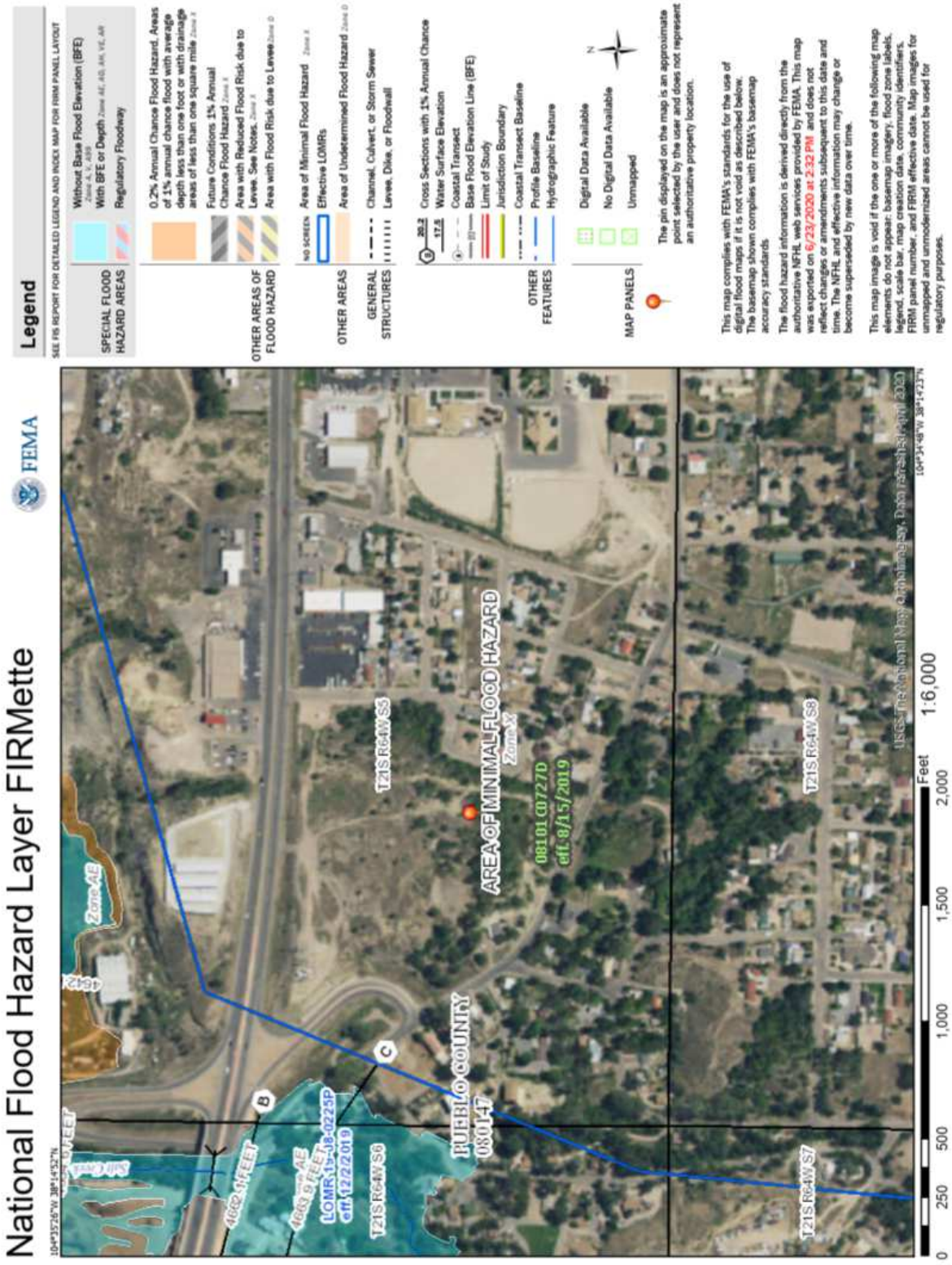
FEMA FLOOD MAP



CALCULATIONS

REQUIRED VOLUME AND ALLOWABLE RELEASE RATE CALCULATIONS

Developed Basin A

Acerage (acres)	0.84			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Commercial Business	95%	36591	34761	95%		
Total		36591	34761	95%	0.088	0.147

Developed Basin A	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.074	3,232.81	0.109	0.124	5,396.81	0.420

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

Developed Basin P1

Acerage (acres)	0.33			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Landscape	2%	14375	287	2%		
Total		14375	287	2%	0.000	-8.00E-06

Developed Basin P1	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.000	0.000	0.043	0.000	-0.115	0.165

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

Developed Basin B

Acerage (acres)	1.98			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Commercial Business	95%	86249	81936	95%		
Total		86249	81936	95%	0.088	0.147

Developed Basin B	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.175	7,620.081	0.257	0.292	12,720.84	0.990

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

Developed Basin P2

Acerage (acres)	0.97			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Landscape	2%	42253	845	2%		
Total		42253	845	2%	0.000	-8.00E-06

Developed Basin P2	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.000	0.000	0.126	0.000	-0.338	0.485

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

REQUIRED VOLUME AND ALLOWABLE RELEASE RATE CALCULATIONS

Developed Basin W

Acerage (acres)	2.06			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Landscape	2%	89734	1795	2%		
Total		89734	1795	2%	0.000	-8.00E-06

Developed Basin W	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.000	0.000	0.268	0.000	-0.718	1.030

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

Developed Basin Y

Acerage (acres)	0.62			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Landscape	2%	27007	540	2%		
Total		27007	540	2%	0.000	-8.00E-06

Developed Basin Y	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.000	0.000	0.081	0.000	-0.216	0.310

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

Developed Basin X

Acerage (acres)	0.14			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Landscape	2%	6098	122	2%		
Total		6098	122	2%	0.000	-8.00E-06

Developed Basin X	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.000	0.000	0.018	0.000	-0.049	0.070

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

Developed Basin Z

Acerage (acres)	0.15			SCS Soil Type*		A
Land Use	Percent Impevious	Area (sf)	Impervious Area (sf)	Weighted Percent Impevious	K_{10}	K_{100}
Landscape	2%	6534	131	2%		
Total		6534	131	2%	0.000	-8.00E-06

Developed Basin Z	V_{10} ** (acre*ft)	V_{10} (ft^3)	Q_{10} *** (cfs)	V_{100} ** (acre*ft)	V_{100} (ft^3)	Q_{100} *** (cfs)
	0.000	0.000	0.020	0.000	-0.052	0.075

* Use predominant soil group for all basins per page 27 in the Pueblo Drainage Design Criteria & Drainage Policies Manual

** Volumes calculated using the empirical equation V=KA from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

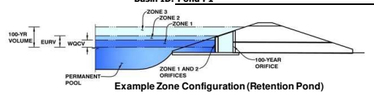
*** Allowable release rates calculated using factors from page 27 in the Pueblo Storm Drainage Design Criteria & Drainage Policies Manual

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Hawkeye Self Storage II

Basin ID: Pond P1



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	SF	
Watershed Area =	1.17	acres
Watershed Length =	230	ft
Watershed Length to Centroid =	100	ft
Watershed Slope =	0.005	ft/ft
Watershed Imperviousness =	95.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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) =	0.035 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.153 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.93 in.) =	0.077 acre-feet	0.93	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.130 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.73 in.) =	0.152 acre-feet	1.73	inches
25-yr Runoff Volume (P1 = 2.23 in.) =	0.200 acre-feet	2.23	inches
50-yr Runoff Volume (P1 = 2.24 in.) =	0.201 acre-feet	2.24	inches
100-yr Runoff Volume (P1 = 2.67 in.) =	0.242 acre-feet	2.67	inches
500-yr Runoff Volume (P1 = 3.59 in.) =	0.332 acre-feet	3.59	inches
Approximate 2-yr Detention Volume =	0.079 acre-feet		
Approximate 5-yr Detention Volume =	0.131 acre-feet		
Approximate 10-yr Detention Volume =	0.154 acre-feet		
Approximate 25-yr Detention Volume =	0.204 acre-feet		
Approximate 50-yr Detention Volume =	0.198 acre-feet		
Approximate 100-yr Detention Volume =	0.224 acre-feet		

Define Zones and Basin Geometry

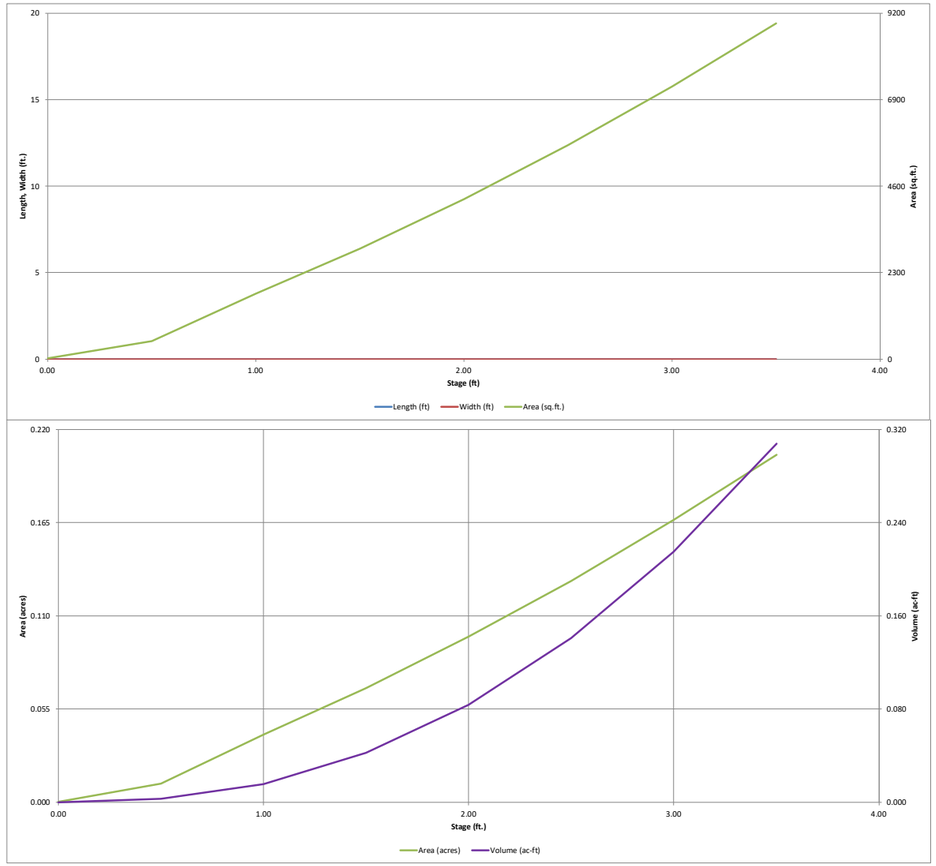
Zone 1 Volume (WQCV) =	0.035	acre-feet
Zone 2 Volume (10-year - Zone 1) =	0.119	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.071	acre-feet
Total Detention Basin Volume =	0.224	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	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 = 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)
Media Surface	--	0.00	--	--	--	19	0.000		
	--	0.50	--	--	--	481	0.011	125	0.003
		1.00	--	--	--	1,743	0.040	681	0.016
		1.50	--	--	--	2,936	0.067	1,850	0.042
		2.00	--	--	--	4,251	0.098	3,647	0.084
		2.50	--	--	--	5,689	0.131	6,132	0.141
		3.00	--	--	--	7,250	0.166	9,367	0.215
		3.50	--	--	--	8,934	0.205	13,413	0.308

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

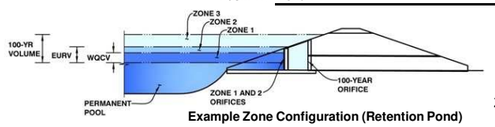


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Hawkeye Self Storage II**

Basin ID: **Pond P1**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.39	0.035	Filtration Media
Zone 2 (10-year)	2.60	0.119	Circular Orifice
Zone 3 (100-year)	3.06	0.071	Weir&Pipe (Restrict)
Total (all zones)		0.224	

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

Underdrain Orifice Invert Depth =	1.00	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.75	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.03	feet

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 =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	1.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.01	N/A	ft^2
Vertical Orifice Centroid =	0.04	N/A	feet

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	
Overflow Weir Front Edge Height, Ho =	2.52	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.52	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	289.99	N/A	
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.20	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	1.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.04	N/A	ft^2
Outlet Orifice Centroid =	0.05	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.48	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.06	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	4.00	feet
Spillway End Slopes =	25.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.29	feet
Stage at Top of Freeboard =	4.35	feet
Basin Area at Top of Freeboard =	0.21	acres
Basin Volume at Top of Freeboard =	0.31	acre-ft

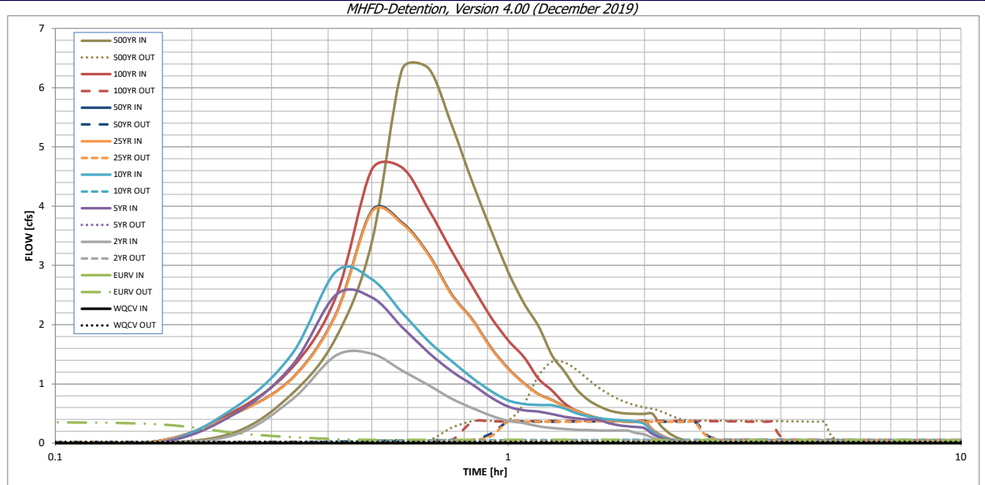
Routed Hydrograph Results

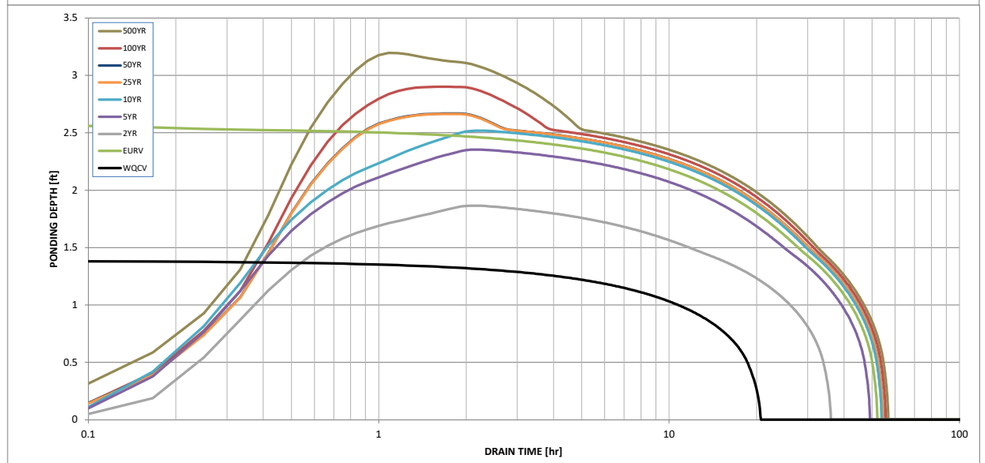
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

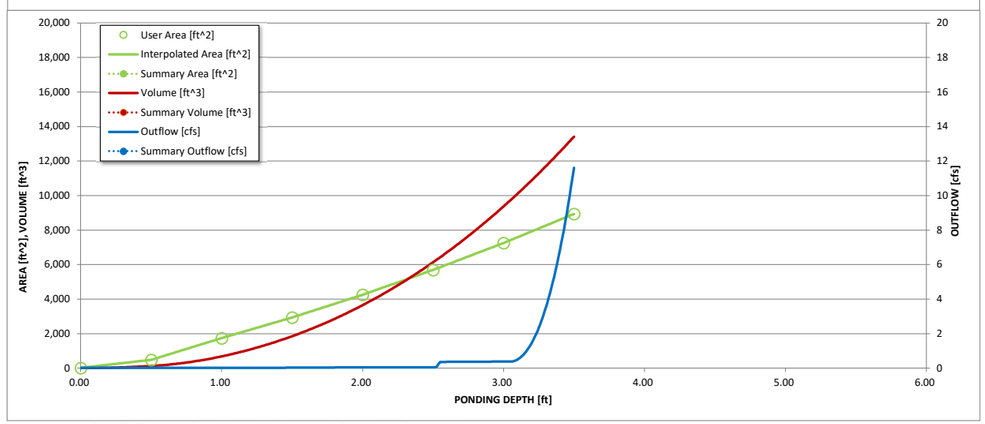
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.93	1.50	1.73	2.23	2.24	2.67	3.59
CUHP Runoff Volume (acre-ft) =	0.035	0.153	0.077	0.130	0.152	0.200	0.201	0.242	0.332
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.077	0.130	0.152	0.200	0.201	0.242	0.332
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.000	0.019	0.026	0.448	0.458	0.908	1.845
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A			0.152			0.585	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.02	0.13	0.38	0.39	0.50	1.58
Peak Inflow Q (cfs) =	N/A	N/A	1.5	2.5	2.9	3.9	3.9	4.7	6.3
Peak Outflow Q (cfs) =	0.023	0.4	0.042	0.052	0.055	0.365	0.366	0.377	1.374
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.7	0.4	0.8	0.8	0.6	0.7
Structure Controlling Flow =	Filtration Media	Outlet Plate 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	N/A	N/A	0.0	0.0	0.0	0.0
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) =	20	49	34	47	51	51	51	51	50
Time to Drain 99% of Inflow Volume (hours) =	**20**	51	36	48	53	53	53	54	55
Maximum Ponding Depth (ft) =	1.39	2.60	1.86	2.35	2.52	2.66	2.67	2.90	3.19
Area at Maximum Ponding Depth (acres) =	0.06	0.14	0.09	0.12	0.13	0.14	0.14	0.16	0.18
Maximum Volume Stored (acre-ft) =	0.035	0.154	0.071	0.122	0.142	0.163	0.163	0.197	0.248

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.19
	0:15:00	0.00	0.00	0.15	0.50	0.61	0.50	0.51	0.55	0.84
	0:20:00	0.00	0.00	0.74	1.31	1.51	1.09	1.10	1.28	1.78
	0:25:00	0.00	0.00	1.48	2.50	2.89	2.17	2.18	2.47	3.39
	0:30:00	0.00	0.00	1.51	2.46	2.77	3.90	3.92	4.62	6.31
	0:35:00	0.00	0.00	1.22	1.96	2.20	3.70	3.72	4.65	6.33
	0:40:00	0.00	0.00	0.98	1.53	1.72	3.18	3.19	3.95	5.38
	0:45:00	0.00	0.00	0.75	1.21	1.39	2.50	2.51	3.25	4.41
	0:50:00	0.00	0.00	0.59	0.99	1.10	2.08	2.09	2.65	3.60
	0:55:00	0.00	0.00	0.46	0.77	0.88	1.60	1.61	2.13	2.89
	1:00:00	0.00	0.00	0.38	0.62	0.72	1.26	1.26	1.73	2.36
	1:05:00	0.00	0.00	0.34	0.55	0.66	1.01	1.01	1.45	1.97
	1:10:00	0.00	0.00	0.28	0.53	0.65	0.82	0.83	1.09	1.48
	1:15:00	0.00	0.00	0.25	0.49	0.64	0.73	0.73	0.89	1.20
	1:20:00	0.00	0.00	0.24	0.45	0.58	0.61	0.62	0.67	0.91
	1:25:00	0.00	0.00	0.23	0.42	0.50	0.55	0.55	0.54	0.74
	1:30:00	0.00	0.00	0.22	0.40	0.45	0.47	0.47	0.46	0.63
	1:35:00	0.00	0.00	0.22	0.39	0.42	0.42	0.42	0.41	0.56
	1:40:00	0.00	0.00	0.21	0.34	0.40	0.39	0.39	0.38	0.52
	1:45:00	0.00	0.00	0.21	0.31	0.39	0.37	0.38	0.37	0.50
	1:50:00	0.00	0.00	0.21	0.29	0.38	0.36	0.37	0.37	0.49
	1:55:00	0.00	0.00	0.17	0.27	0.36	0.36	0.36	0.37	0.49
	2:00:00	0.00	0.00	0.15	0.25	0.32	0.36	0.36	0.37	0.49
	2:05:00	0.00	0.00	0.09	0.16	0.20	0.22	0.22	0.23	0.31
	2:10:00	0.00	0.00	0.05	0.09	0.12	0.14	0.14	0.14	0.19
	2:15:00	0.00	0.00	0.03	0.05	0.07	0.08	0.08	0.08	0.11
	2:20:00	0.00	0.00	0.02	0.03	0.04	0.05	0.05	0.05	0.06
	2:25:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	2:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

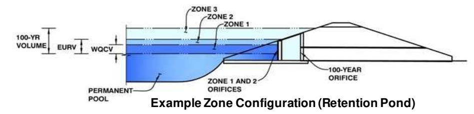
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **Hawkeye Self Storage II**

Basin ID: **Pond P2**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**	
Watershed Area =	2.95	acres
Watershed Length =	556	ft
Watershed Length to Centroid =	207	ft
Watershed Slope =	0.005	ft/ft
Watershed Imperviousness =	95.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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) =	0.088	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.387	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.93 in.) =	0.201	acre-feet	0.93	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.339	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.73 in.) =	0.395	acre-feet	1.73	inches
25-yr Runoff Volume (P1 = 2.23 in.) =	0.520	acre-feet	2.23	inches
50-yr Runoff Volume (P1 = 2.24 in.) =	0.522	acre-feet	2.24	inches
100-yr Runoff Volume (P1 = 2.67 in.) =	0.631	acre-feet	2.67	inches
500-yr Runoff Volume (P1 = 3.59 in.) =	0.863	acre-feet	3.59	inches
Approximate 2-yr Detention Volume =	0.200	acre-feet		
Approximate 5-yr Detention Volume =	0.331	acre-feet		
Approximate 10-yr Detention Volume =	0.388	acre-feet		
Approximate 25-yr Detention Volume =	0.514	acre-feet		
Approximate 50-yr Detention Volume =	0.498	acre-feet		
Approximate 100-yr Detention Volume =	0.566	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.088	acre-feet
Zone 2 Volume (10-year - Zone 1) =	0.300	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.178	acre-feet
Total Detention Basin Volume =	0.566	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	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 = 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)
Media Surface	--	0.00	--	--	--	0	0.000		
	--	0.25	--	--	--	805	0.018	101	0.002
	--	0.50	--	--	--	3,222	0.074	604	0.014
	--	0.75	--	--	--	7,249	0.166	1,913	0.044
	--	1.00	--	--	--	12,516	0.287	4,383	0.101
	--	1.25	--	--	--	17,495	0.402	8,134	0.187
	--	1.50	--	--	--	22,022	0.506	13,074	0.300
	--	1.75	--	--	--	26,096	0.599	19,089	0.438
	--	2.00	--	--	--	29,907	0.687	26,089	0.599
	--	2.25	--	--	--	33,030	0.758	33,956	0.780
	--	2.50	--	--	--	34,716	0.797	42,424	0.974
	--	2.75	--	--	--	36,653	0.841	51,346	1.179
	--	3.00	--	--	--	38,899	0.893	60,789	1.396
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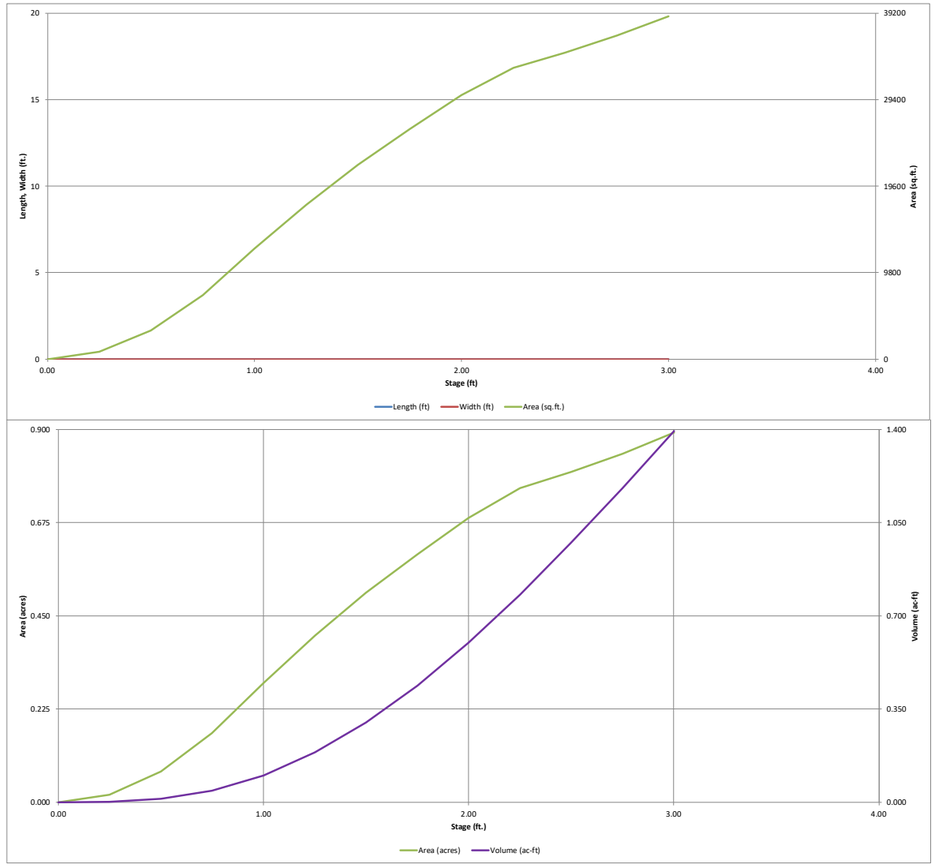
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

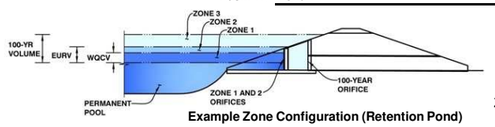


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Hawkeye Self Storage II**

Basin ID: **Pond P2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.96	0.088	Filtration Media
Zone 2 (10-year)	1.67	0.300	Circular Orifice
Zone 3 (100-year)	1.96	0.178	Weir&Pipe (Restrict)
Total (all zones)		0.566	

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

Underdrain Orifice Invert Depth =	0.67	ft (distance below the filtration media surface)	
Underdrain Orifice Diameter =	1.62	inches	

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.07	feet

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 =	N/A	ft (relative to basin bottom at Stage = 0 ft)	
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)	
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	
Orifice Plate: Orifice Area per Row =	N/A	inches	

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (optional)	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	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)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	0.96	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.62	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	1.25	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.01	N/A	ft^2
Vertical Orifice Centroid =	0.05	N/A	feet

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	
Overflow Weir Front Edge Height, Ho =	1.65	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.65	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	159.23	N/A	
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.20	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	1.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.07	N/A	ft^2
Outlet Orifice Centroid =	0.07	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.59	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	2.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	4.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.77	feet
Stage at Top of Freeboard =	3.77	feet
Basin Area at Top of Freeboard =	0.89	acres
Basin Volume at Top of Freeboard =	1.40	acre-ft

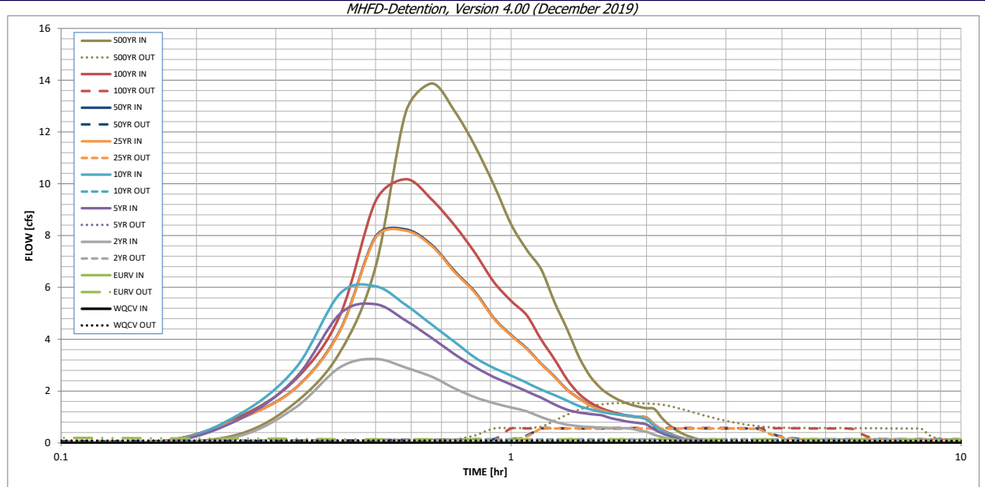
Routed Hydrograph Results

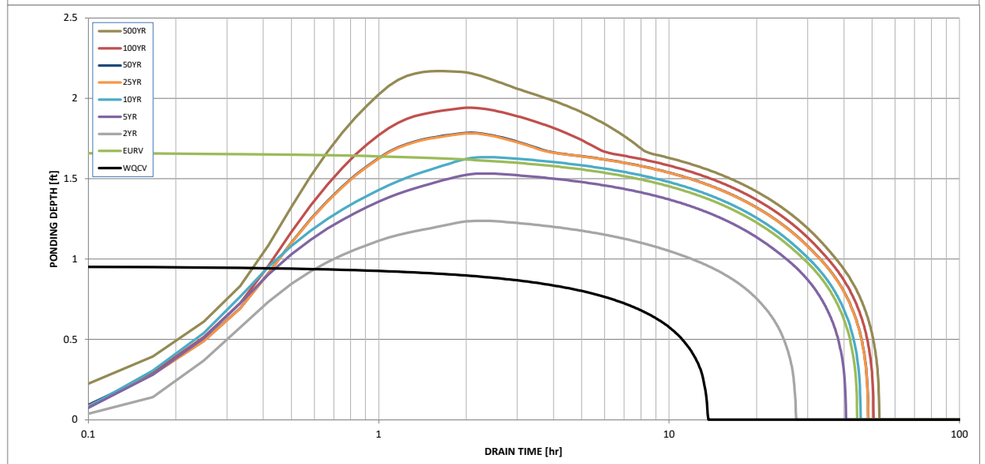
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

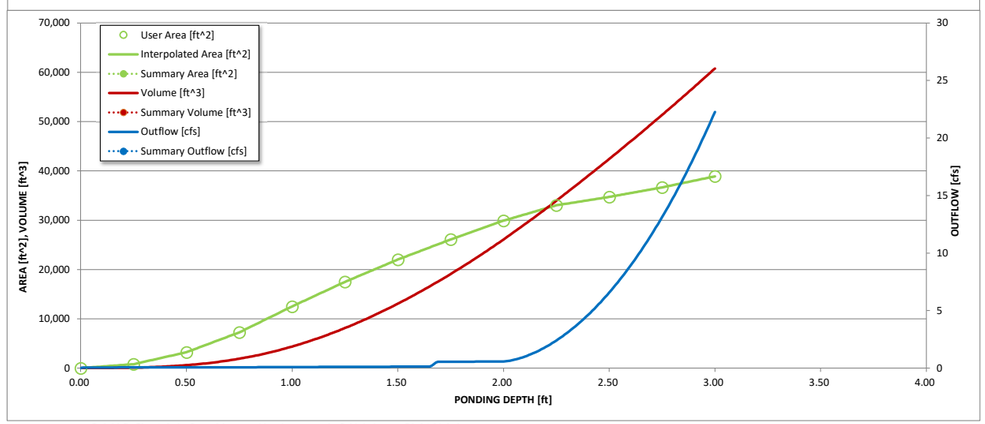
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.93	1.50	1.73	2.23	2.24	2.67	3.59
CUHP Runoff Volume (acre-ft) =	0.088	0.387	0.201	0.339	0.395	0.520	0.522	0.631	0.863
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.201	0.339	0.395	0.520	0.522	0.631	0.863
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.001	0.034	0.046	0.845	0.863	1.709	3.552
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A			0.383			1.475	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.13	0.29	0.29	0.50	1.20
Peak Inflow Q (cfs) =	N/A	N/A	3.2	5.3	6.0	8.2	8.2	10.2	13.9
Peak Outflow Q (cfs) =	0.086	0.2	0.113	0.130	0.135	0.557	0.558	0.573	1.539
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.8	0.4	0.7	0.6	0.4	0.4
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.02	N/A	N/A	N/A	0.0	0.0	0.0	0.0
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) =	13	42	26	39	44	46	46	47	49
Time to Drain 99% of Inflow Volume (hours) =	**13**	44	27	40	45	48	48	50	51
Maximum Ponding Depth (ft) =	0.96	1.67	1.24	1.53	1.63	1.78	1.79	1.94	2.17
Area at Maximum Ponding Depth (acres) =	0.27	0.57	0.39	0.52	0.55	0.61	0.61	0.67	0.73
Maximum Volume Stored (acre-ft) =	0.090	0.391	0.179	0.315	0.369	0.456	0.456	0.558	0.712

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.05	0.35
	0:15:00	0.00	0.00	0.27	0.93	1.12	0.94	0.94	1.02	1.59
	0:20:00	0.00	0.00	1.40	2.54	2.93	2.14	2.15	2.49	3.50
	0:25:00	0.00	0.00	2.91	4.98	5.76	4.32	4.34	4.92	6.80
	0:30:00	0.00	0.00	3.24	5.35	6.04	7.92	7.95	9.33	12.77
	0:35:00	0.00	0.00	2.91	4.72	5.32	8.19	8.23	10.18	13.87
	0:40:00	0.00	0.00	2.55	4.04	4.56	7.60	7.63	9.39	12.79
	0:45:00	0.00	0.00	2.10	3.41	3.89	6.58	6.61	8.38	11.42
	0:50:00	0.00	0.00	1.75	2.92	3.27	5.77	5.80	7.30	9.94
	0:55:00	0.00	0.00	1.53	2.54	2.89	4.78	4.81	6.20	8.43
	1:00:00	0.00	0.00	1.37	2.25	2.60	4.14	4.16	5.48	7.45
	1:05:00	0.00	0.00	1.21	1.99	2.31	3.63	3.64	4.92	6.69
	1:10:00	0.00	0.00	1.00	1.74	2.05	3.04	3.05	3.99	5.42
	1:15:00	0.00	0.00	0.82	1.48	1.84	2.54	2.55	3.22	4.37
	1:20:00	0.00	0.00	0.70	1.28	1.62	2.04	2.05	2.44	3.31
	1:25:00	0.00	0.00	0.64	1.17	1.42	1.70	1.71	1.89	2.56
	1:30:00	0.00	0.00	0.61	1.11	1.29	1.44	1.45	1.55	2.10
	1:35:00	0.00	0.00	0.59	1.07	1.20	1.27	1.28	1.35	1.82
	1:40:00	0.00	0.00	0.58	0.95	1.13	1.15	1.16	1.20	1.62
	1:45:00	0.00	0.00	0.57	0.87	1.08	1.08	1.08	1.11	1.49
	1:50:00	0.00	0.00	0.56	0.81	1.05	1.02	1.03	1.04	1.40
	1:55:00	0.00	0.00	0.48	0.76	0.99	0.99	0.99	0.99	1.34
	2:00:00	0.00	0.00	0.42	0.71	0.90	0.96	0.97	0.97	1.30
	2:05:00	0.00	0.00	0.31	0.51	0.65	0.70	0.70	0.70	0.95
	2:10:00	0.00	0.00	0.22	0.37	0.46	0.50	0.50	0.51	0.68
	2:15:00	0.00	0.00	0.15	0.26	0.33	0.35	0.35	0.36	0.49
	2:20:00	0.00	0.00	0.11	0.18	0.23	0.24	0.25	0.25	0.34
	2:25:00	0.00	0.00	0.07	0.12	0.15	0.17	0.17	0.17	0.23
	2:30:00	0.00	0.00	0.05	0.08	0.10	0.11	0.11	0.12	0.16
	2:35:00	0.00	0.00	0.03	0.05	0.06	0.07	0.07	0.07	0.10
	2:40:00	0.00	0.00	0.01	0.03	0.03	0.04	0.04	0.04	0.06
	2:45:00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

STANDARD FORM SF-4
TIME OF CONCENTRATION (DEVELOPED)

SUB-BASIN DATA			OVERLAND SHEET FLOW TIME / INITIAL TIME (T_i)					Travel Time (T_t)						T_c CHECK (URBANIZED BASINS)		FINAL	TIME TO PEAK FLOW	REMARKS
Design		Area	Elevations		Length	Slope	T_i	Elevations		Length	Slope	Vel.	T_t	Length	T_c	T_c		
Basin No.	C_5	(acres)	Upstream	Downstream	(ft)	(%)	(minutes)	Upstream	Downstream	(ft)	(%)	(fps)	(min)	(ft)	(minutes)	(minutes)	(minutes)	
A	0.87	0.84	4720.0	4719.7	109.0	0.3	6.6	4719.7	4718.9	62.0	1.3	2.2	0.5	171	11.0	7.1	**10.0**	**Minimum Tc of 10 minutes**
B	0.87	1.98	4719.8	4718.8	244.8	0.4	8.8	4718.8	4717.0	380.0	0.5	1.5	4.2	625	13.5	13.0	**14.0**	
P1	0.15	0.33	4719.2	4715.5	87.0	4.3	9.8	4715.5	4714.9	108.0	0.5	1.5	1.2	195	11.1	11.0	**12.0**	
P2	0.15	0.97	4717.0	4716.8	44.8	0.6	13.6	4716.8	4715.0	234.1	0.7	1.7	2.3	279	11.5	15.9	**12.0**	
W	0.15	2.06	4723.0	4717.0	75.2	8.0	7.4	4717.0	4706.0	164.8	6.7	5.2	0.5	240	11.3	8.0	**10.0**	**Minimum Tc of 10 minutes**
X	0.15	0.14	4720.0	4719.5	86.0	0.5	19.4	4719.5	4719.0	58.0	0.9	1.9	0.5	144	10.8	19.9	**11.0**	
Y	0.15	0.15	4719.2	4718.0	90.0	1.3	14.9	4718.0	4710.0	76.0	10.5	2.2	0.6	166	10.9	15.5	**11.0**	
Z	0.15	0.62	4718.8	4718.7	48.0	0.2	20.7	4718.7	4717.9	16.2	5.0	4.4	0.1	64	10.4	20.8	**11.0**	

STANDARD FORM SF-4
TIME OF CONCENTRATION (HISTORIC)

SUB-BASIN DATA			OVERLAND SHEET FLOW TIME / INITIAL TIME (T_i)					Travel Time (T_t)						T_c CHECK (URBANIZED BASINS)		FINAL	TIME TO PEAK FLOW	REMARKS
Design		Area	Elevations		Length	Slope	T_i	Elevations		Length	Slope	Vel.	T_t	Length	T_c	T_c		
Basin No.	C	(acres)	Upstream	Downstream	(ft)	(%)	(minutes)	Upstream	Downstream	(ft)	(%)	(fps)	(min)	(ft)	(minutes)	(minutes)	(minutes)	
Hist. A - 10	0.25	7.10	4720.8	4719.0	271.0	0.7	28.9	4719.0	4693.0	167.0	15.6	2.5	1.1	438	12.4	30.0	**13.0**	
Hist. A - 100	0.50	7.10	4720.8	4719.0	271.0	0.7	20.4	4719.0	4693.0	167.0	15.6	2.5	1.1	438	12.4	21.5	**13.0**	

STANDARD FORM SF-5 (10-YEAR)
STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			COMMENTS
	AREA DESIGN	AREA (acres)	RUNOFF COEFFICIENT	C · A	T_c (min.)	I (in/hr)	Q (cfs)	T_c (min.)	I (in/hr)	∑ C · A	Q (cfs)	SLOPE (%)	FLOW (cfs)	FLOW (cfs)	SLOPE (%)	SIZE (inches)	LENGTH (ft)	VELOC. (fps)	T_t (min.)	
1	Basin A	0.84	0.88	0.74	10	4.68	3.46													Basin A Outlfow to P1
2	Basin B	1.98	0.88	1.74	14	4.05	7.06													Basin B Outlfow to P2
6	Basin W	2.06	0.25	0.52	10	4.68	2.41													Runoff into Roselawn
3	Basin X	0.14	0.25	0.04	11	4.50	0.16													Runoff into US 50
4	Basin Y	0.62	0.25	0.16	11	4.50	0.70													Runoff into S&V Sub
5	Basin Z	0.15	0.25	0.04	11	4.50	0.17													Runoff into US 50
7	Basin A + P1	1.17						115			0.06									Pond P1 Outflow
8	Basin B + P2	2.95						125			0.14									Pond P2 Outflow

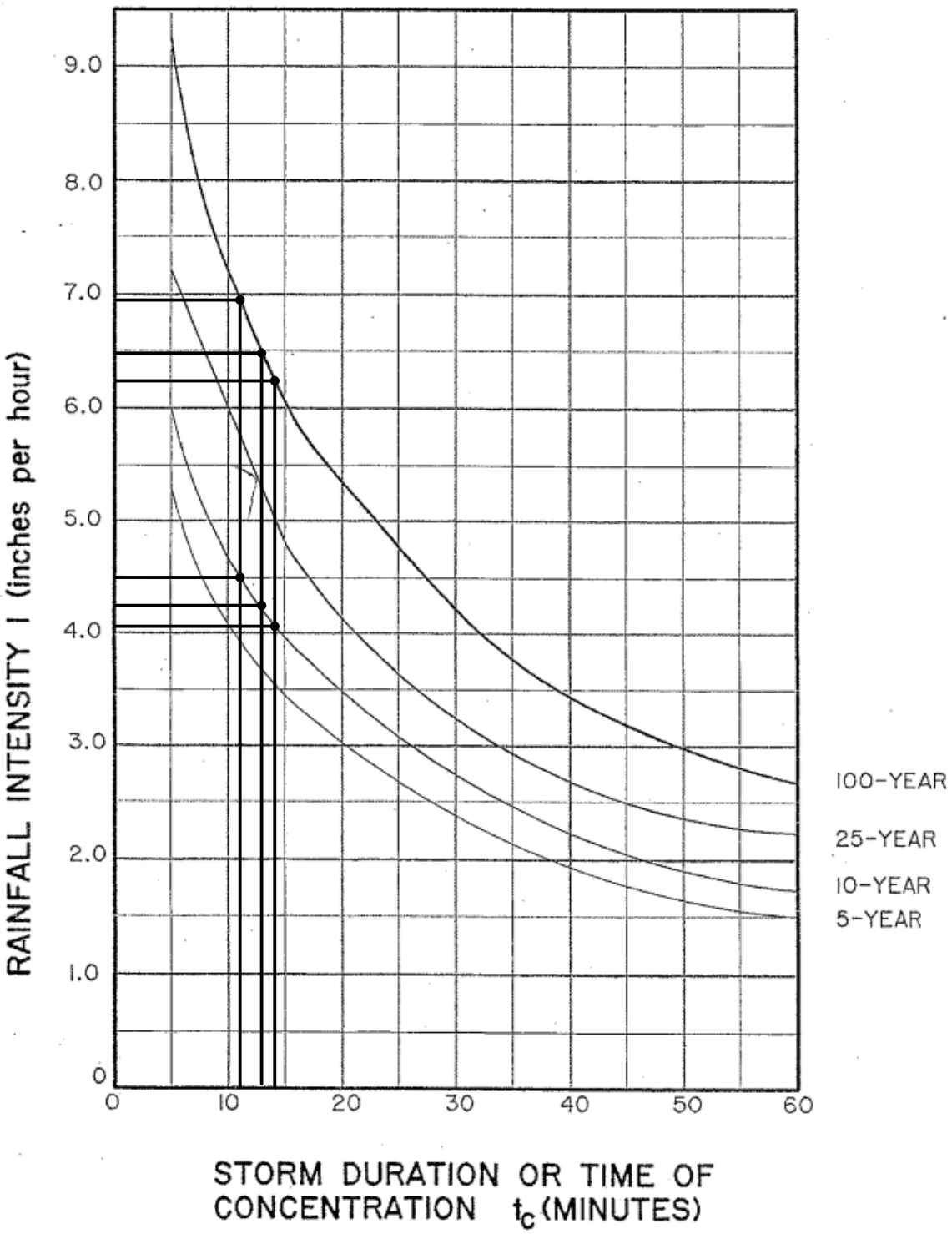
STANDARD FORM SF-5 (100-YR)
STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			COMMENTS
	AREA DESIGN	AREA (acres)	RUNOFF COEFFICIENT	C · A	T_c (min.)	I (in/hr)	Q (cfs)	T_c (min.)	I (in/hr)	∑ C · A	Q (cfs)	SLOPE (%)	FLOW (cfs)	FLOW (cfs)	SLOPE (%)	SIZE (inches)	LENGTH (ft)	VELOC. (fps)	T_t (min.)	
1	Basin A	0.84	0.89	0.75	10	7.20	5.38													Basin A Outlfow to P1
2	Basin B	1.98	0.89	1.76	14	6.20	10.93													Basin B Outlfow to P2
6	Basin W	2.06	0.50	1.03	10	7.20	7.42													Runoff into Roselawn
3	Basin X	0.14	0.50	0.07	11	6.90	0.48													Runoff into US 50
4	Basin Y	0.62	0.50	0.31	11	6.90	2.14													Runoff into S&V Sub
5	Basin Z	0.15	0.50	0.08	11	6.90	0.52													Runoff into US 50
7	Basin A + P1	1.17						95			0.38									Pond P1 Outflow
8	Basin B + P2	2.95						75			0.57									Pond P2 Outflow

STANDARD FORM SF-5 (HISTORIC)
STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			COMMENTS
	AREA DESIGN	AREA (acres)	RUNOFF COEFFICIENT	C · A	T_c (min.)	I (in/hr)	Q (cfs)	T_c (min.)	I (in/hr)	∑ C · A	Q (cfs)	SLOPE (%)	FLOW (cfs)	FLOW (cfs)	SLOPE (%)	SIZE (inches)	LENGTH (ft)	VELOC. (fps)	T_t (min.)	
1	Basin A - 10yr	7.10	0.25	1.78	13	4.25	7.54													10-yr Historic
1	Basin A - 100yr	7.10	0.50	3.55	13	6.45	22.90													100-yr Historic

TIME-INTENSITY-FREQUENCY CURVES



CITY OF PUEBLO, COLORADO STORM DRAINAGE DESIGN CRITERIA	DATE: 6/97 SHT. NO.: A-1

Spillway Sizing Calculations Pond P1

$$Q = \left(\frac{1.49}{n}\right) A \left(\frac{A}{P}\right)^{2/3} S^{1/2} \quad *$$

Channel Design			Channel Flow		
S =	0.11	Slope of Channel (ft/ft)	P =	14.46	Wetted Perimeter (ft)
n =	0.0395	Manning's Roughness Coefficient	A =	1.93	Cross Sectional Area (ft^2)
Z_1 =	25.0	Side Slope (ft) (H:V)	R_H =	0.13	Hydraulic Radius (ft)
Z_2 =	25.0	Side Slope (ft) (H:V)	T =	14.45	Top Width of Flow (ft)
B =	4.0	Bottom Width of Channel (ft)	V =	3.27	Flow Velocity (fps)
Q=	6.30	Flow Rate (cfs)	D =	0.209	Depth of Flow (ft)

The emergency spillway for pond P1 is designed to have a minimum crest width of 4.0 feet with side slopes of 25:1. In the case of 100-yr peak inflow rate being forced through the spillway, the depth of the overflow in the spillway will be 0.209 feet. The freeboard above the spillway is designed at 1.0 feet above the 100-yr water surface elevation. The flow through the spillway will prevent overtopping from the pond.

Spillway Sizing Calculations Pond P2

$$Q = \left(\frac{1.49}{n}\right) A \left(\frac{A}{P}\right)^{2/3} S^{1/2} \quad *$$

Channel Design			Channel Flow		
S =	0.005	Slope of Channel (ft/ft)	P =	11.68	Wetted Perimeter (ft)
n =	0.0395	Manning's Roughness Coefficient	A =	7.20	Cross Sectional Area (ft^2)
Z_1 =	4.0	Side Slope (ft) (H:V)	R_H =	0.62	Hydraulic Radius (ft)
Z_2 =	4.0	Side Slope (ft) (H:V)	T =	11.45	Top Width of Flow (ft)
B =	4.0	Bottom Width of Channel (ft)	V =	1.93	Flow Velocity (fps)
Q=	13.90	Flow Rate (cfs)	D =	0.932	Depth of Flow (ft)

The emergency spillway for pond P2 is designed to have a minimum crest width of 4.0 feet with side slopes of 4:1. In the case of 100-yr peak inflow rate being forced through the spillway, the depth of the overflow in the spillway will be 0.932 feet. The freeboard above the spillway is designed at 1.0 feet above the 100-yr water surface elevation. The flow through the spillway will prevent overtopping from the pond.

* The above spillways were designed using calculations from the Manning's Equation for Open Flow Channels.

Riprap Sizing Calculations Pond P1

$$v = \frac{Q_{100}}{W_B}$$

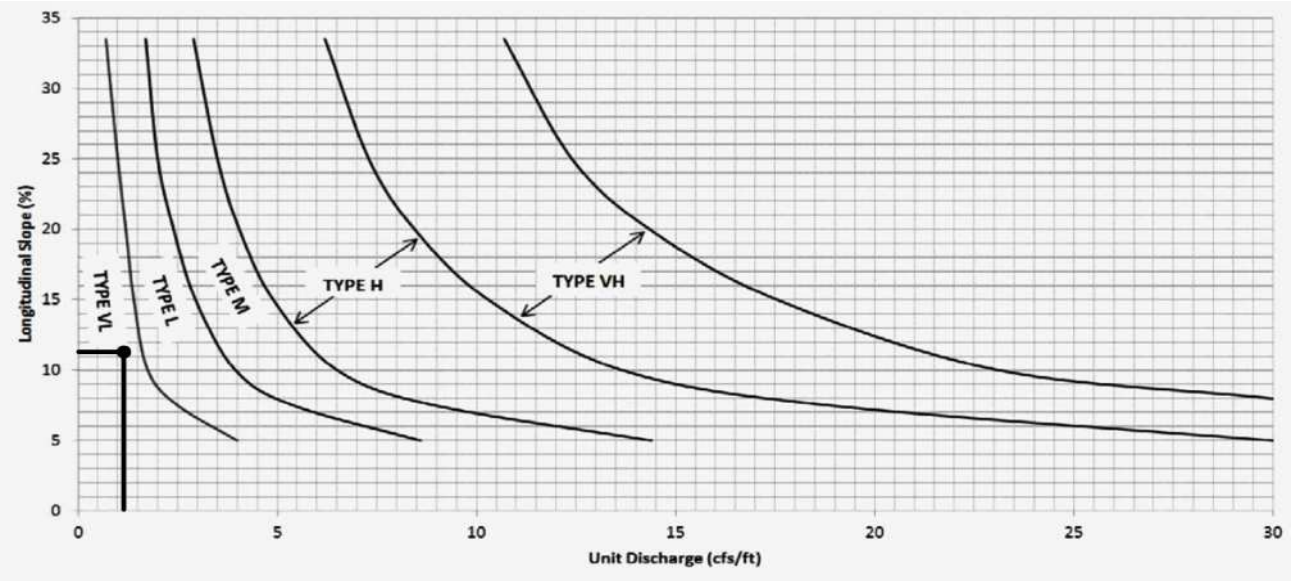
Q_{100} =	6.3	100-yr Developed Peak Inflow (cfs)
W_B =	4.0	Bottom Width of Spillway (ft)
v =	1.6	Unit Discharge (cfs/ft)

Unit discharge rate determined by dividing the 100-yr devloped peak pond inflow rate by the bottom crest width of the spillway, excluding the side slopes. Per *Development of Riprap Testing in Flumes: Phase II Follow-up Investigations (Apt et al. 1988)* .

$$D^{50} = 5.23 \times S^{0.43} \times \left(1.35 C_f v\right)^{0.56}$$

S =	0.11	Longitudinal Slope (ft/ft)
C_f =	2.00	Concentration Factor
v =	1.58	Unit Discharge (cfs/ft)
D^{50} =	4.62	Min. Median Rock Size (in)

Median riprap rock size determined using Equation 4.6 of *Development of Riprap Testing in Flumes: Phase II Follow-up Investigations (Apt et al. 1988)* .



With a minimum Safety Factor of 2.5, Type M riprap with a median stone size of 12" is required for Pond-P1.

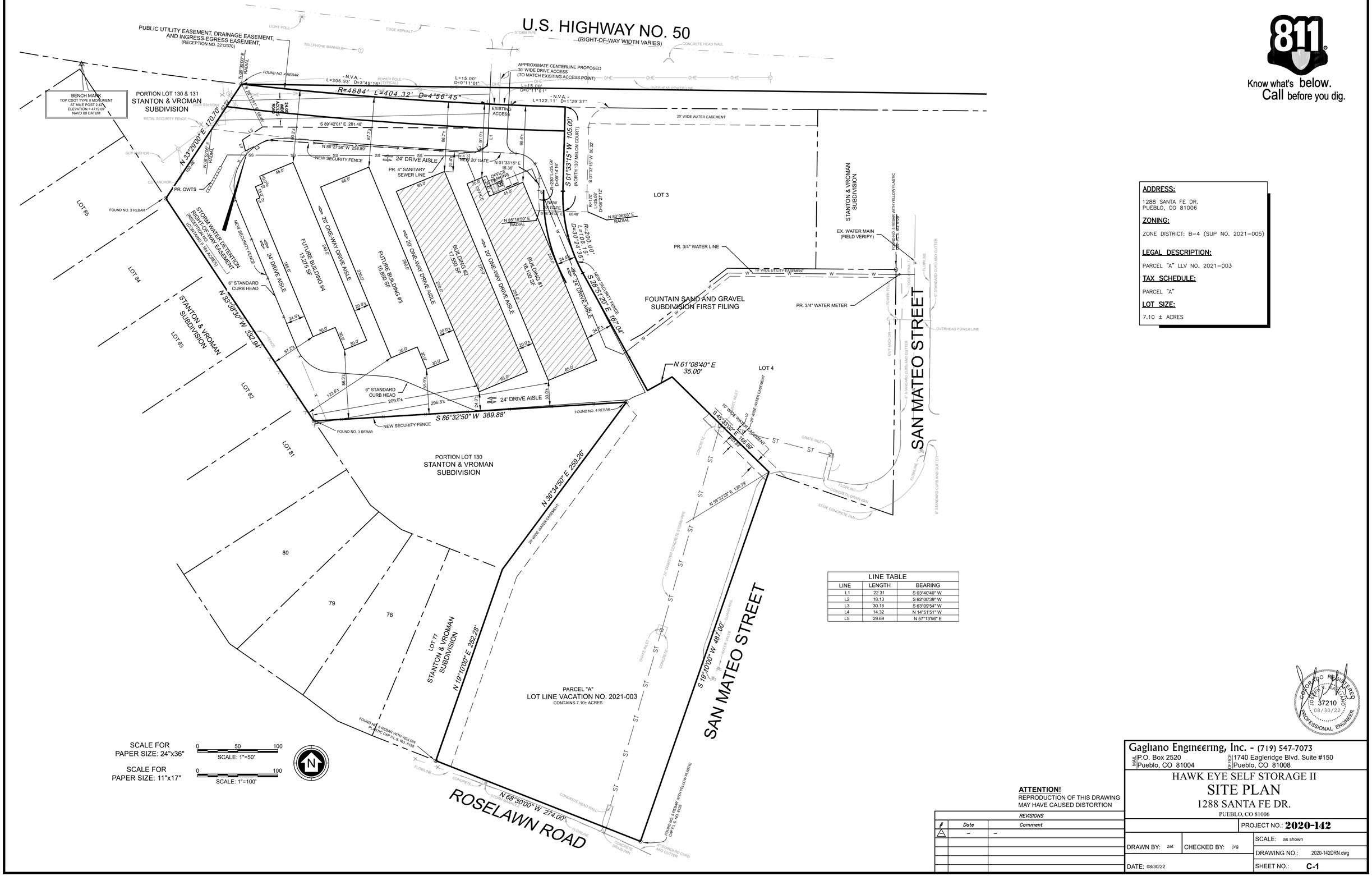
Riprap Sizing Calculations Pond P2

$$D^{50} = [\frac{V \times S^{0.17}}{4.5(G_s - 1)^{0.66}}]\text{^}2$$

S =	0.005	Longitudinal Slope (ft/ft)
G_s =	2.60	Specific Gravity of Stone
V =	1.93	Velocity (ft/sec)
D^{50} =	0.02	Min. Median Rock Size (ft)

Median riprap rock size determined using mild-slope equation *(Hughes, et al. 1983)* .

With a minimum Safety Factor of 2.5, Type M riprap with a median stone size of 12" is required for Pond-P2.



LINE TABLE		
LINE	LENGTH	BEARING
L1	22.31	S 03°40'40" W
L2	18.13	S 62°00'39" W
L3	30.16	S 63°09'54" W
L4	14.32	N 14°51'51" W
L5	29.69	N 57°13'56" E

Know what's below. Call before you dig.

ADDRESS:

1288 SANTA FE DR.
PUEBLO, CO 81006

ZONING:

ZONE DISTRICT: B-4 (SUP NO. 2021-005)

LEGAL DESCRIPTION:

PARCEL "A" LLV NO. 2021-003

TAX SCHEDULE:

PARCEL "A"

LOT SIZE:

7.10 ± ACRES

COLORADO REGISTERED 37210 08/30/22 PROFESSIONAL ENGINEER

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#	Date	Comment
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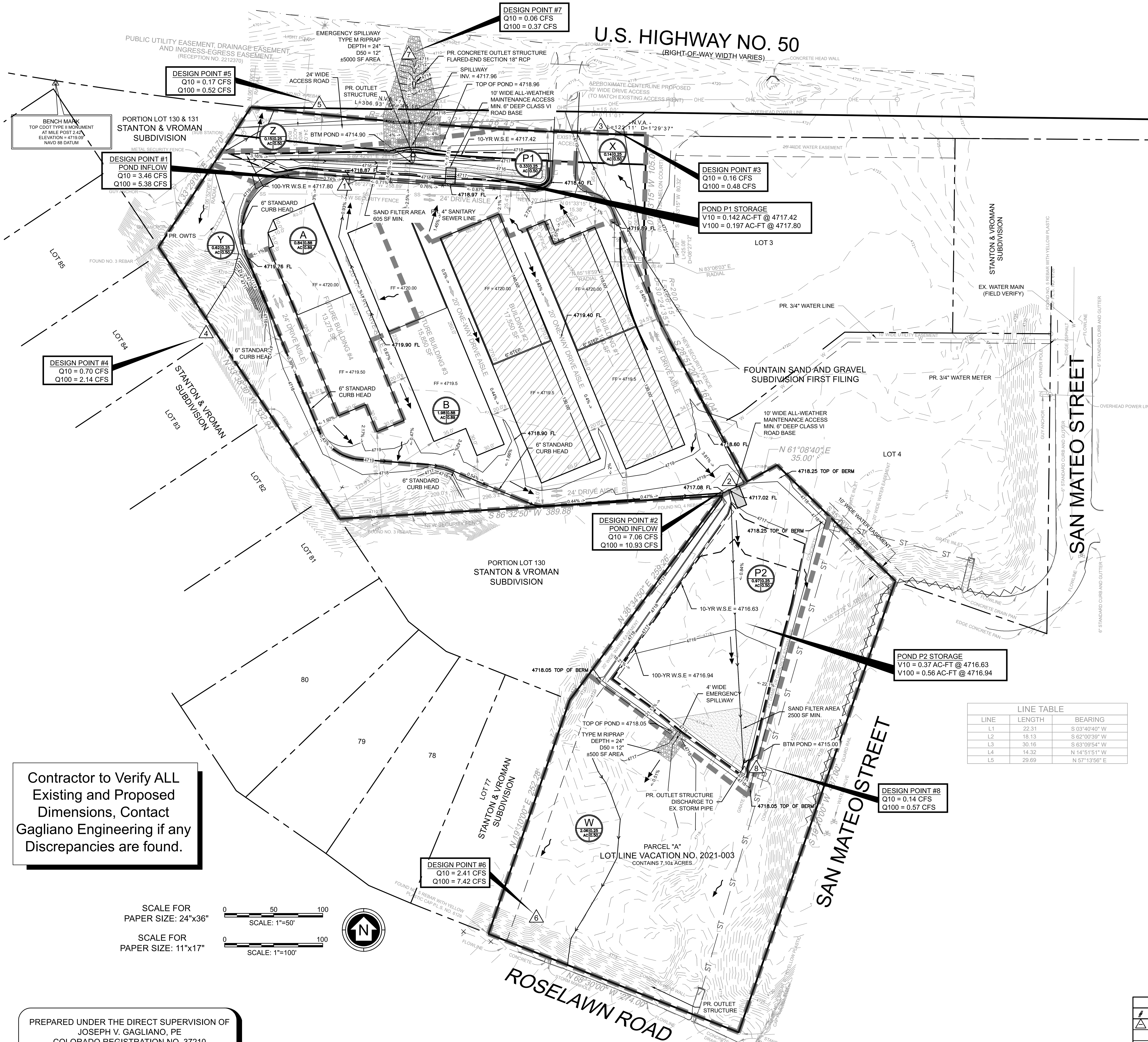
MAIL: P.O. Box 2520, Pueblo, CO 81004
OFFICE: 1740 Eagleridge Blvd. Suite #150, Pueblo, CO 81008

HAWK EYE SELF STORAGE II
SITE PLAN
1288 SANTA FE DR.
PUEBLO, CO 81006

PROJECT NO.: **2020-142**
DRAWN BY: zet | CHECKED BY: jvg
SCALE: as shown
DRAWING NO.: 2020-142DRN.dwg
DATE: 08/30/22
SHEET NO.: **C-1**



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L3	30.16	S 63°09'54" W
L4	14.32	N 14°51'51" W
L5	29.69	N 57°13'56" E

Contractor to Verify ALL Existing and Proposed Dimensions, Contact Gagliano Engineering if any Discrepancies are found.

SCALE FOR PAPER SIZE: 24"x36" — 0 50 100 — SCALE: 1"=50'

SCALE FOR PAPER SIZE: 11"x17" — 0 100 — SCALE: 1"=100'

PREPARED UNDER THE DIRECT SUPERVISION OF
JOSEPH V. GAGLIANO, PE
COLORADO REGISTRATION NO. 37210

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ADDRESS:
1288 SANTA FE DR.
PUEBLO, CO 81006

ZONING:
ZONE DISTRICT: B-4 (SUP NO. 2021-005)

LEGAL DESCRIPTION:
PARCEL "A" LLV NO. 2021-003

TAX SCHEDULE:
PARCEL "A"

LOT SIZE:
7.10 ± ACRES

STANDARD NOTES:

a. PRIOR TO ANY CONSTRUCTION, INCLUDING SITE GRADING AND EXCAVATION, AN APPROVED 'EROSION AND SEDIMENT CONTROL PLAN' SHALL BE POSTED ON-SITE AND ALL REQUIRED BMPS INSTALLED.

b. GENERAL CONTRACTOR SHALL MAINTAIN AND UPDATE THE 'EROSION AND SEDIMENT CONTROL PLAN' AS CONSTRUCTION DICTATES. CURRENT AND CORRECT PLAN SHALL REMAIN ON-SITE AND BE READILY ACCESSIBLE TO THE CITY STORMWATER INSPECTOR AT ALL TIMES.

c. GENERAL CONTRACTOR OR HIS REPRESENTATIVE SHALL INSPECT, AT A MINIMUM, THE SITE EVERY 2 WEEKS AND WITHIN 24 HOURS OF ANY PRECIPITATION OR SNOWMELT EVENT THAT CAUSES SURFACE EROSION. (I.E., THAT RESULTS IN STORMWATER RUNNING ACROSS THE GROUND).

d. GENERAL CONTRACTOR/OWNER IS FULLY RESPONSIBLE TO MAINTAIN ALL REQUIRED BMPS TO PREVENT EROSION AND SEDIMENT FROM LEAVING THE CONSTRUCTION SITE.

e. FAILURE TO COMPLY WITH MINIMUM REQUIREMENTS IS A VIOLATION WITH THE CITY ORDINANCES.

GENERAL NOTE:

ALL STORMWATER FACILITIES AND BMPS LOCATED IN CITY ROWS OR TYING INTO CITY STORMWATER SYSTEM NEED TO BE INSPECTED BY CITY STORMWATER PERSONNEL. PLEASE CONTACT INSPECTOR DURING CONSTRUCTION. 553-2291 OR 821-1276.

DRAINAGE LEGEND

- BASIN DESIGNATION
- 10 YEAR RUNOFF COEFFICIENT
- 100 YEAR RUNOFF COEFFICIENT
- ACREAGE
- DESIGN POINT
- EXISTING DRAINAGE DIRECTION
- PROPOSED DRAINAGE DIRECTION
- PROPOSED SPOT ELEVATION FL = FLOWLINE TOW = TOP OF WALKWAY OR WALL
- PROPERTY BOUNDARY
- BASIN BOUNDARY
- EXISTING 5' CONTOUR
- EXISTING 1' CONTOUR
- PROPOSED 5' CONTOUR
- PROPOSED 1' CONTOUR

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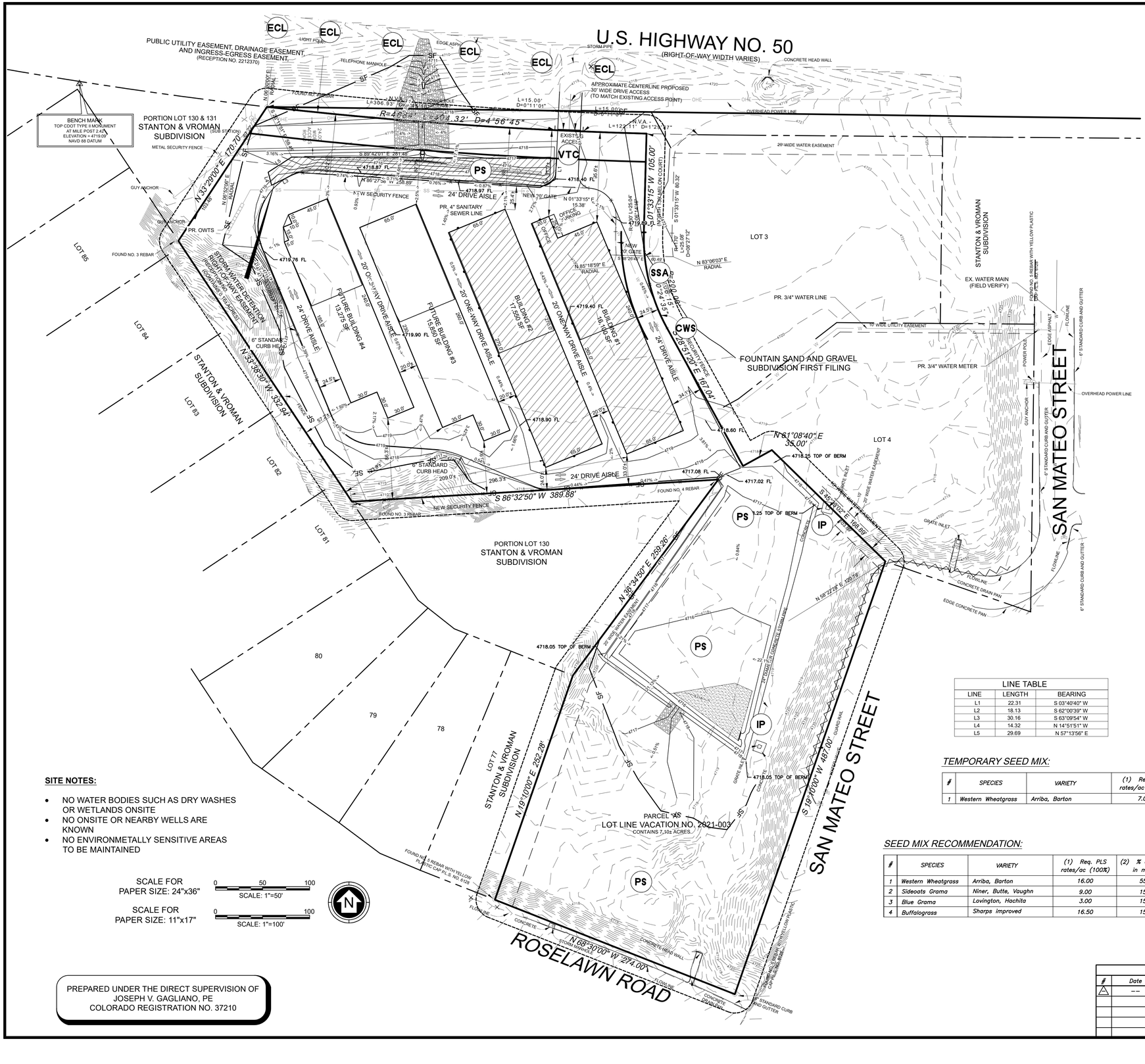
OFFICE: 1740 Eagleridge Blvd. Suite #150, Pueblo, CO 81008

HAWK EYE SELF STORAGE II
GRADING & DRAINAGE PLAN
1288 SANTA FE DR.
PUEBLO, CO 81006

PROJECT NO.: **2020-142**

DRAWN BY: zet	CHECKED BY: jvg	SCALE: as shown	
		DRAWING NO.: 2020-142DRN.dwg	
DATE: 08/30/22		SHEET NO.: C-2	



ADDRESS:

1288 SANTA FE DR.
PUEBLO, CO 81006

ZONING:

ZONE DISTRICT: B-4 (SUP NO. 2021-005)

LEGAL DESCRIPTION:

PARCEL "A" LLV NO. 2021-003

TAX SCHEDULE:

PARCEL "A"

LOT SIZE:

7.10 ± ACRES

STANDARD NOTES:

a. PRIOR TO ANY CONSTRUCTION, INCLUDING SITE GRADING AND EXCAVATION, AN APPROVED 'EROSION AND SEDIMENT CONTROL PLAN' SHALL BE POSTED ON-SITE AND ALL REQUIRED BMPS INSTALLED.

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c. GENERAL CONTRACTOR OR HIS REPRESENTATIVE SHALL INSPECT, AT A MINIMUM, THE SITE EVERY 2 WEEKS AND WITHIN 24 HOURS OF ANY PRECIPITATION OR SNOWMELT EVENT THAT CAUSES SURFACE EROSION. (I.E., THAT RESULTS IN STORMWATER RUNNING ACROSS THE GROUND).

d. GENERAL CONTRACTOR/OWNER IS FULLY RESPONSIBLE TO MAINTAIN ALL REQUIRED BMPS TO PREVENT EROSION AND SEDIMENT FROM LEAVING THE CONSTRUCTION SITE.

e. FAILURE TO COMPLY WITH MINIMUM REQUIREMENTS IS A VIOLATION WITH THE COUNTY ORDINANCES.

LEGEND

- EXISTING DRAINAGE DIRECTION
- PROPOSED DRAINAGE DIRECTION
- PROPERTY BOUNDARY
- 5395 EXISTING 5' CONTOUR
- 5397 EXISTING 1' CONTOUR
- 5395 PROPOSED 5' CONTOUR
- 5397 PROPOSED 1' CONTOUR
- SF SILT FENCE
- PS PERMANENT SEEDING
- IP INLET PROTECTION
- CWS CONCRETE WASHOUT STRUCTURE
- VTC VEHICLE TRACKING CONTROL
- SSA STABILIZED STAGING AREA
- ECL EROSION CONTROL LOG

LINE TABLE		
LINE	LENGTH	BEARING
L1	22.31	S 03°40'40" W
L2	18.13	S 62°00'39" W
L3	30.16	S 63°09'54" W
L4	14.32	N 14°51'51" W
L5	29.69	N 57°13'56" E

SITE NOTES:

- NO WATER BODIES SUCH AS DRY WASHES OR WETLANDS ONSITE
- NO ONSITE OR NEARBY WELLS ARE KNOWN
- NO ENVIRONMETALLY SENSITIVE AREAS TO BE MAINTAINED

PARCEL "A"
LOT LINE VACATION NO. 2021-003
CONTAINS 7.10± ACRES

SCALE FOR PAPER SIZE: 24"x36" — 0 50 100 — SCALE: 1"=50'

SCALE FOR PAPER SIZE: 11"x17" — 0 100 — SCALE: 1"=100'

TEMPORARY SEED SPECIFICATIONS

Where it is not possible to permanently stabilize a disturbed area immediately after the final earthmoving has been completed or where the earthmoving activity ceases for more than 20 days, temporary seeding shall be done using the following seeding specifications:

TEMPORARY SEED MIX:

#	SPECIES	VARIETY	(1) Req. PLS rates/ac (100%)	(2) % of species in mixture	(3) PLS seeding rate per species/ac ((1) x (2))
1	Western Wheatgrass	Arriba, Barton	7.00	100.00	7.00

SEED MIX RECOMMENDATION:

#	SPECIES	VARIETY	(1) Req. PLS rates/ac (100%)	(2) % of species in mixture	(3) PLS seeding rate per species/ac ((1) x (2))
1	Western Wheatgrass	Arriba, Barton	16.00	55.00	8.80
2	Sideoats Grama	Niner, Butte, Vaughn	9.00	15.00	1.35
3	Blue Grama	Lovington, Hachita	3.00	15.00	0.45
4	Buffalograss	Sharps Improved	16.50	15.00	2.48

PREPARED UNDER THE DIRECT SUPERVISION OF
JOSEPH V. GAGLIANO, PE
COLORADO REGISTRATION NO. 37210

COLORADO REGISTERED PROFESSIONAL ENGINEER
JOSEPH V. GAGLIANO
37210
08/30/22
PROFESSIONAL ENGINEER

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HAWK EYE SELF STORAGE II
EROSION CONTROL PLAN
1288 SANTA FE DR.
PUEBLO, CO 81006

PROJECT NO.: **2020-142**
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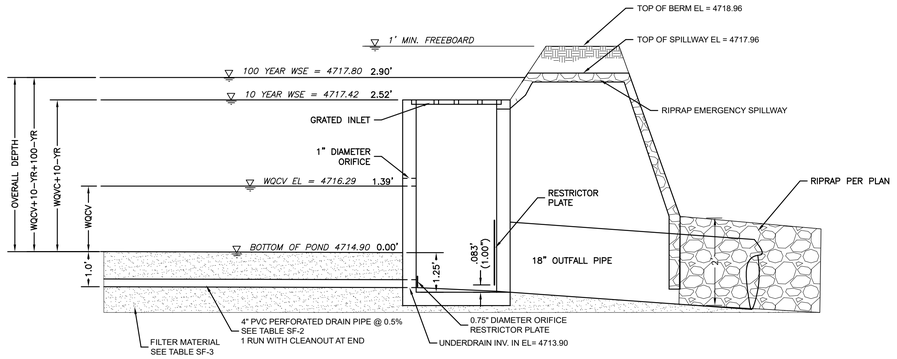
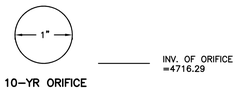
DATE: 08/30/22
SHEET NO.: **C-3**

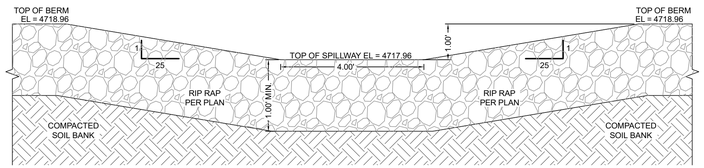
POND 1



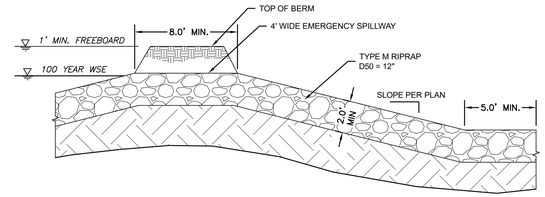
POND P1 OUTLET STRUCTURE
N.T.S.



POND P1 VERTICAL ORIFICE DETAIL
N.T.S.

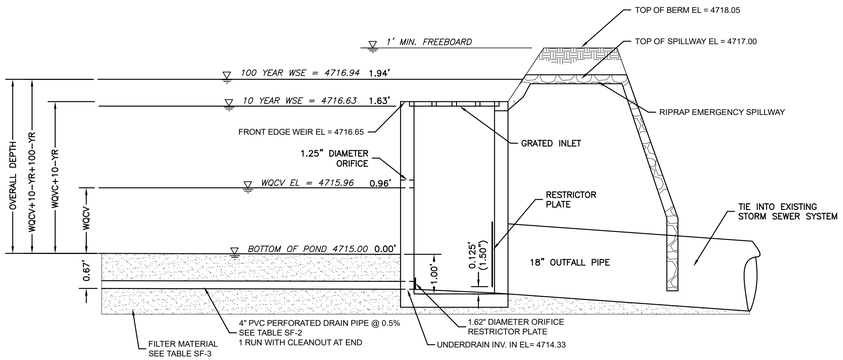


POND P1 SPILLWAY CROSS SECTION
N.T.S.

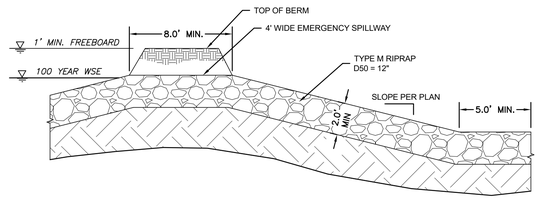


POND P1 SPILLWAY PROFILE
N.T.S.

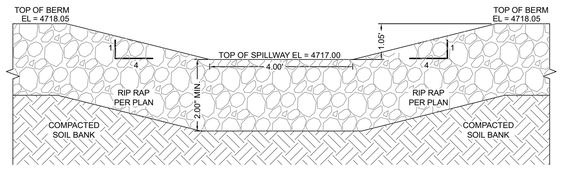
POND 2



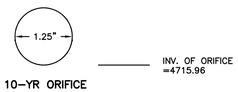
POND P2 OUTLET STRUCTURE
N.T.S.



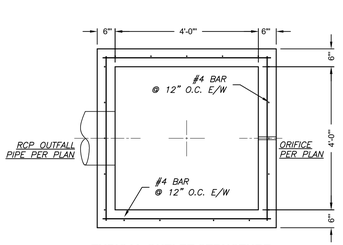
POND P2 SPILLWAY PROFILE
N.T.S.



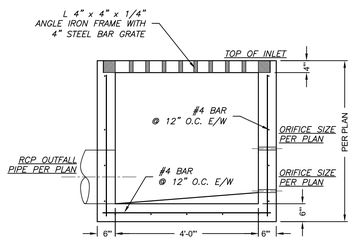
POND P2 SPILLWAY CROSS SECTION
N.T.S.



POND P2 VERTICAL ORIFICE DETAIL
N.T.S.



TYPICAL OUTLET STRUCTURE PLAN VIEW
SCALE: 1/2" = 1'-0"



TYPICAL OUTLET STRUCTURE SECTION VIEW
SCALE: 1/2" = 1'-0"

Table SF-2. Dimensions for Slotted Pipe[1]

Pipe Size	Slot Length	Maximum Slot Width	Slot Centers	Open Area (per foot)
4"	1-1/16"	0.032"	0.413"	1.90 in^2
6"	1-3/8"	0.032"	0.516"	1.98 in^2

[1] Pipe must conform to requirements of ASTM designation F949. There shall be no evidence of splitting, cracking, or breaking when the pipe is tested per ASTM test method D2412 in accordance with F949 section 7.5 and ASTM F794 section 8.5. Contech A-2000 slotted pipe (or equal).

Table SF-3. Physical Requirements for Separator Fabric[1]

Property	Class B		Test Method
	Elongation < 50%[2]	Elongation > 50%[2]	
Grab Strength, N (lbs)	800 (180)	510 (115)	ASTM D 4632
Puncture Resistance, N (lbs)	310 (70)	180 (40)	ASTM D 4833
Trapezoidal Tear Strength, N (lbs)	310 (70)	180 (40)	ASTM D 4533
Apparent Opening Size, mm (US Sieve Size)	AOS < 0.3mm (US Sieve Size No. 50)		ASTM D 4751
Permittivity, sec^{-1}	0.02 default value, must also be greater than that of soil		ASTM D 4491
Permeability, cm/sec	k fabric > k soil for all classes		ASTM D 4491
Ultraviolet Degradation at 500 hours	50% strength retained for all classes		ASTM D 4355

[1] Strength values are in the weaker principle direction
[2] As measured in accordance with ASTM D 4632

Table SF-1. Gradation specifications for CDOT Class B or C filter material
(Source: CDOT Table 703-7)

	CDOT Class B filter material	CDOT Class C filter material
Sieve Size	Mass Percent Passing Square Mesh Sieves	
37.5 mm (1.5")	100	
19.0 mm (0.75")		100
4.75 mm (No.4)	20-60	60-100
1.18 um (No. 16)	10-30	
300 um (No. 50)	0-10	10-30
150 um (No. 100)		0-10
75 um (No. 200)	0-3	0-3

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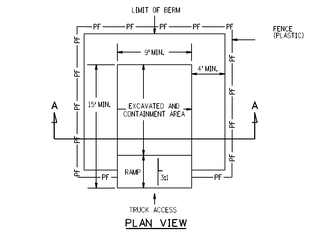
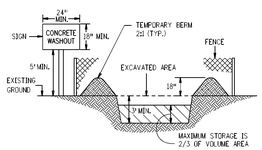
MAIL: P.O. Box 2520 Pueblo, CO 81004
OFFICE: 1740 Eagleridge Blvd. Suite #150 Pueblo, CO 81008

HAWK EYE SELF STORAGE II
DRAINAGE DETAILS
1288 SANTA FE DR.
PUEBLO, CO 81006

PROJECT NO.: **2020-142**
DRAWN BY: zet
CHECKED BY: jvg
SCALE: as shown
DRAWING NO.: 2020-142DRN.dwg
DATE: 08/30/22
SHEET NO.: **C-4**



PLAN VIEW



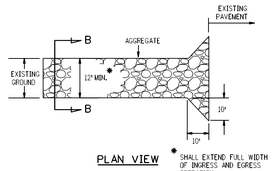
SECTION A-A

NOTES:

1. EROSION BALES MAY BE USED AS AN ALTERNATIVE FOR THE BERM.
2. A FENCE (PLASTIC) CONFORMING TO SUBSECTION 607.02 SHALL BE INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT AT THE OPENING.
3. THE CONCRETE WASHOUT SIGN SHALL HAVE LETTERS AT LEAST 3 INCHES HIGH AND CONFORM TO SUBSECTION 630.02.

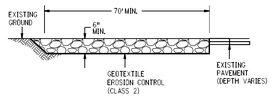
CONCRETE WASHOUT STRUCTURE

CWS

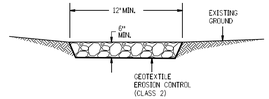


PLAN VIEW

* SHALL EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION.



ELEVATION SECTION



SECTION B-B

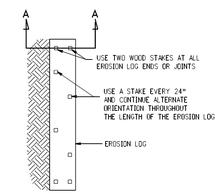
NOTES:

1. AGGREGATE FOR THE CONSTRUCTION ENTRANCE SHALL CONFORM TO SUBSECTION 208.02 (K).
2. THE CONTRACTOR SHALL PROTECT CURB AND GUTTER THAT CROSSES THE ENTRANCE FROM DAMAGE. PROTECTION OF THE CURB AND GUTTER WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

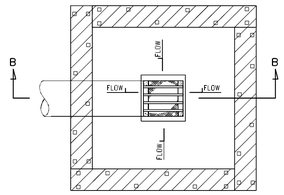
VEHICLE TRACKING PAD

VTC

Computer File Information		Sheet Revisions		Colorado Department of Transportation	TEMPORARY EROSION CONTROL	STANDARD PLAN NO.
Creation Date: 06/08/10 Initials: DD		Date	Comments	4201 East Arkansas Avenue, Denver, Colorado 80222		M-208-1
Last Modification Date: 07/29/11 Initials: LTA	(R-X)	08/26/10	Revised to meet new water quality standards.	Phone: (303) 757-9083, Fax: (303) 757-9820		Sheet No. 1 of 12
FullPath: www.dot.state.co.us/DesignSupport/	(R-X)		Revised sheets 1-7 and added sheets 8-12.	Project Development Branch DD/LTA	Issued By: Project Development Branch on July 04, 2006	
Drawing File Name: 2080101012.dgn	(R-X)	07/29/11	Revised sheet 5 of 12.			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)					



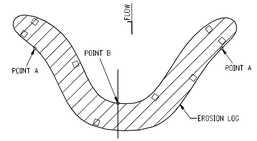
PLAN VIEW



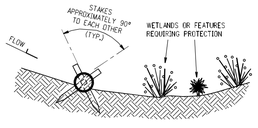
PLAN VIEW

NOTES

1. EROSION LOGS SHALL BE EMBEDDED 2 INCHES INTO THE SOIL.
2. STAKES SHALL BE EMBEDDED TO A MINIMUM DEPTH OF 12 INCHES.
3. EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.

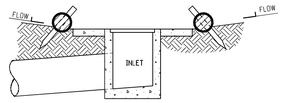


PLAN VIEW



SECTION A-A

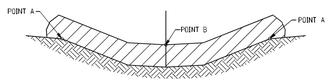
TYPICAL STAKE INSTALLATION



SECTION B-B

NOTE: LOCATE EROSION LOGS AT THE OUTSIDE EDGE OF THE CONCRETE APRON.

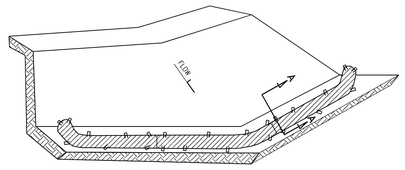
EROSION LOG FILTER AT DROP INLET



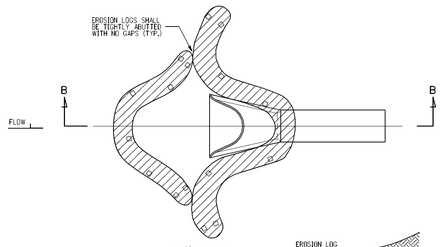
POINTS A SHALL BE HIGHER THAN POINT B.

ELEVATION

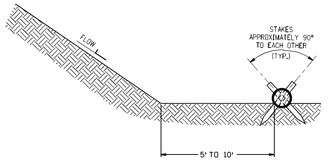
EROSION LOG DITCH INSTALLATION



ISOMETRIC VIEW



PLAN VIEW

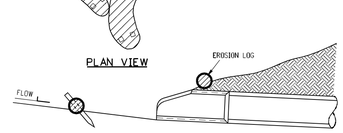


SECTION A-A

NOTES:

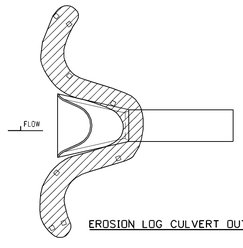
1. EROSION LOGS USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
2. EROSION LOGS SHALL BE PLACED ON THE CONTOUR, WITH ENDS FLARED UP SLOPE.

EROSION LOG TOE OF SLOPE PROTECTION



SECTION B-B

EROSION LOG CULVERT INLET PROTECTION



EROSION LOG CULVERT OUTLET PROTECTION

ECL

EROSION LOG APPLICATIONS

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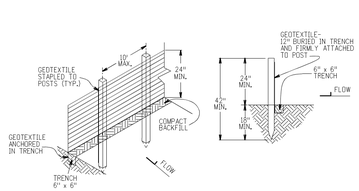
Creation Date: 06/08/10 Initials: DD		Date	Comments	4201 East Arkansas Avenue, Denver, Colorado 80222		M-208-1
Last Modification Date: 07/29/11 Initials: LTA	(R-X)	08/26/10	Revised to meet new water quality standards.	Phone: (303) 757-9083, Fax: (303) 757-9820		Sheet No. 2 &3 of 12
FullPath: www.dot.state.co.us/DesignSupport/	(R-X)		Revised sheets 1-7.	Project Development Branch DD/LTA	Issued By: Project Development Branch on July 04, 2006	
Drawing File Name: 2080102012.dgn	(R-X)		Added sheets 8-12.			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)					

NOTES

1. SILT FENCE SHALL HAVE A MAXIMUM DRAINAGE AREA OF ONE-QUARTER ACRE PER 100 FEET OF SILT FENCE LENGTH; MAXIMUM SLOPE LENGTH BEHIND BARRIER IS 100 FEET; MAXIMUM GRADIENT BEHIND THE BARRIER IS 2zl.
2. SILT FENCE USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
3. SILT FENCE SHALL BE PLACED ON THE CONTOUR, WITH ENDS FLARED UP SLOPE.

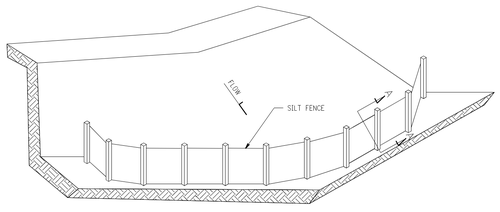


SILT FENCE

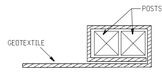
GEOTEXTILE SHALL BE ATTACHED TO WOOD POSTS WITH THREE OR MORE STAPLES PER POST.

STAPLES SHALL BE ½"

WOOD POST SHALL BE 1½" X 1½" NOMINAL.

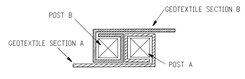


ISOMETRIC VIEW



END SECTION DETAIL (PLAN VIEW)

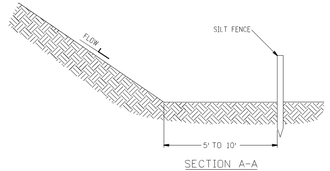
GEOTEXTILE SHALL BE FOLDED AROUND TWO POSTS ONE FULL TURN. SECURE GEOTEXTILE TO POST WITH THREE STAPLES MINIMUM.



JOINING SECTION DETAIL (PLAN VIEW)

FOLD GEOTEXTILE AROUND EACH POST ONE FULL TURN. SECURE GEOTEXTILE TO POST WITH THREE STAPLES MINIMUM.

POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.



SECTION A-A

TOE OF SLOPE PROTECTION

SILT FENCE APPLICATION

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FullPath: www.dot.state.co.us/DesignSupport/	(R-X)		Revised sheets 1-7.	Project Development Branch DD/LTA	Issued By: Project Development Branch on July 04, 2006	
Drawing File Name: 2080101012.dgn	(R-X)		Added sheets 8-12.			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)					

ATTENTION!
REPRODUCTION OF THIS DRAWING MAY HAVE CAUSED DISTORTION

REVISIONS		
#	Date	Comment
1	--	--

COLORADO REGISTERED PROFESSIONAL ENGINEER 37210 08/30/22 PROFESSIONAL ENGINEER

Gagliano Engineering, Inc. - (719) 547-7073
MAIL: P.O. Box 2520, Pueblo, CO 81004
OFFICE: 1740 Eagleridge Blvd. Suite #150, Pueblo, CO 81008

HAWK EYE SELF STORAGE II

EROSION CONTROL DETAILS

1288 SANTA FE DR.
PUEBLO, CO 81006

PROJECT NO.: **2020-142**

DRAWN BY: zet | CHECKED BY: jvg | SCALE: as shown

DRAWING NO.: 2020-142DRN.dwg

DATE: 08/30/22 | SHEET NO.: **C-5**