Final Drainage Report

for

"Town of Monument Water Tank Site"

744 Forest View Way
Town of Monument, Colorado, 80132

PCD File Number - PPR-21-030

Prepared for:
El Paso County
Planning and Community Development Department
2880 International Circle
Colorado Springs, CO 80910
(719) 520-6695

Prepared by:
Forsgren Associates
56 Inverness Drive East, Suite 112
Englewood, CO 80112
(720) 214-5884

January 10, 2022

Engineer's Statement:

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

_____

James L. Adams
Registered Professional Engineer
State of Colorado
No. 38375

SEAL

Owner/Developer's Statement:

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

_____ _____

Town of Monument Date

645 Beacon Lite Rd

Monument, CO 80132

El Paso County:

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

_____ _____

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

Conditions:

Table of Contents

1 GENERAL LOCATION AND DESCRIPTION

1.1 SITE LOCATION

The proposed tank site is located at 744 Forest View Way, Monument, Colorado 80132. The El Paso County parcel number is 7116204006. The lot is bordered by Forrest View Way on the northeast side, and residential lots to the east and west.

1.2 DESCRIPTION OF PROPERTY

The legal description of the 2.0 MG water tank site is "Lot 6 Forest View Estates Filing 4." The lot is 2.55 acres. The site generally slopes from the southwest to the northeast. The site contains steep slopes with the average slope ranging from 20% to 25%. The site is covered in native grasses and vegetation, with evergreen trees scattered sporadically around the site. The soil type across the site consists approximately of 88% kettle gravelly loamy sand at 8% to 40% slopes; 11% perrypark gravelly sandy loam at 3% to 9% slopes; and 0.7% Boyett-frenchcreek complex at 2% to 15% slopes.

2 Previous Reports

The following reports and plans reviewed in the process of preparing this drainage letter:

1) Final Drainage Report Forest View Estates Filing No. 4, prepared by Kiowa Engineering December 22, 2004.
2) Geotechnical Evaluation - Monument Water Tank, prepared by Ninyo & Moore, November 18, 2016.

3 DRAINAGE BASINS AND SUB-BASINS

3.1 MAJOR DRAINAGE BASINS

The site is located within the Raspberry Mountain watershed. Runoff from the basin generally flows to the east via natural drainageways that are well vegetated, ultimately discharging to Monument Creek.

3.2 ONSITE SUB-BASIN DESCRIPTION

3.2.1 Existing Basin A

Existing Basin A is the lower northeast portion of the lot. It is approximately 2.18 acres and is covered in native grasses and vegetation. The soil profile is generally a gravelly sandy loam with slopes ranging from 15% to 25%. The site slopes from the southwest to the northeast. Soil properties generally resemble Hydrologic Soil Group (HSG) B category. Runoff from the basin drains toward Forest View Way where it is captured in a roadside ditch and drains north along the road to two 48-inch RCP culverts that discharge runoff to the other side of Forest View Way. The existing roadside ditch is approximately 22-feet wide and 3-feet deep and well vegetated with native grasses. The culverts discharge to an existing riprap lined channel. The culverts and

channel were designed and sized as part of the Forest View Estates Filing No. 4 Final Drainage Report.

3.2.2 Existing Basin B

Existing Basin B is the upper southwest portion of the lot, which will remain undeveloped and undisturbed. It is approximately 0.89 acres and is covered in native grasses and vegetation. The soil profile is generally a gravelly sandy loam with 25% slopes. The site slopes from the southwest to the northeast. Soil properties generally resemble Hydrologic Soil Group (HSG) B category. Runoff from the basin drains toward Forest View Way where it is captured in a roadside ditch and drains north along the road to two 48-inch RCP culverts that discharge runoff to the other side of Forest View Way. The existing roadside ditch is approximately 22-feet wide and 3-feet deep and well vegetated with native grasses. The culverts discharge to an existing riprap lined channel. The culverts and channel were designed and sized as part of the Forest View Estates Filing No. 4 Final Drainage Report.

4 DRAINAGE DESIGN CRITERIA

4.1 REGULATIONS

Design standards and criteria presented in the ***El Paso County Drainage Criteria Manual,*** by El Paso County, October 2018 was used in the development of this report and analysis presented herein. The Rational Method was used to determine maximum storm water runoff for a 5-year and 100-year storm event. In accordance with the El Paso County Engineering Criteria Manual (ECM), this project is excluded from permanent water quality (PWQ) management requirements. Per section I.7.1.B.4, underground utilities are excluded from PWQ management requirements. This exclusion applies to the 5.6 miles of 12-inch PVC pipeline. The remaining disturbance at the water storage tank site is 0.94 acres. This is less than 1 acre; therefore, this portion of the project is also excluded from PWQ management requirements.

Revise section if needed per comments on GEC Plan about LOC.

4.2 PREVIOUS DRAINAGE STUDIES

- Final Drainage Report Forest View Estates Filing No. 4, prepared by Kiowa Engineering December 22, 2004.

4.3 HYDROLOGIC CRITERIA

The rational method was used to determine post development peak runoff rates from the site. Rainfall intensity for the 5-year and 100-year return interval events are 5.17 in/hr and 8.68 in/hr respectively.

5 DRAINAGE FACILITY DESIGN

5.1 HYDROLOGIC CALCULATIONS

Information related to rational method calculations is presented below.

5-Year & 100-Year Storm Runoff (Existing)									
Basin		**Area**	**Tc**	**5 Intensity**	**100 Intensity**	**5 Comp. C**	**100 Comp. C**	**5 Q**	**100 Q**
		(Acres)	(Min.)	(In./hr.)	(In./hr.)			**(cfs)**	**(cfs)**
A	Basin A	2.18	5.00	5.17	8.68	0.08	0.35	**0.9**	**6.6**
B	Basin B	0.89	5.00	5.17	8.68	0.08	0.35	**0.4**	**2.7**
OS 1	Off-Site 1	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**
Routed	**Design Points**								
Basin A	1	2.18	5.00	5.17	8.68	0.08	0.35	**0.9**	**6.6**
A + B	2	3.07	5.00	5.17	8.68	0.08	0.35	**1.3**	**9.3**
OS 1	3	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**
5-Year & 100-Year Storm Runoff (Proposed)									
Basin		**Area**	**Tc**	**5 Intensity**	**100 Intensity**	**5 Comp. C**	**100 Comp. C**	**5 Q**	**100 Q**
		(Acres)	(Min.)	(In./hr.)	(In./hr.)			**(cfs)**	**(cfs)**
A	Basin A	2.18	5.00	5.17	8.68	0.19	0.43	**2.1**	**8.1**
B	Basin B	0.89	5.00	5.17	8.68	0.08	0.35	**0.4**	**2.7**
OS-1	Off-Site 1	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**
Routed	**Design Points**								
Basin A	1	2.18	5.00	5.17	8.68	0.19	0.43	**2.1**	**8.1**
A + B	2	3.07	5.00	5.17	8.68	0.16	0.41	**2.5**	**10.8**
OS-1	3	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**

5.1.1 Four Step Process to Minimize Adverse Impacts of Urbanization

El Paso County requires the UDFCD Four Step Process be utilized for receiving waters protection. The goal of the Four Step Process is to reduce runoff volumes, treat the water quality capture volume of runoff, stabilize drainageways, and implement long-term source controls.

1) ***Employ Runoff Reduction Practices*** – To reduce peaks and volumes from urbanizing areas, employ a practice generally termed "minimizing directly connected impervious areas" (MDCIA).
2) ***Stabilize Drainageways*** – Drainageway, natural and manmade, erosion can be a major source of sediment and associated constituents, such as phosphorus. Natural drainageways are often subject to bed and bank erosion when urbanizing areas increase the frequency, reate and volume of runoff. Therefore, drainageways are required to be stabilized.
3) ***Provide Water Quality Capture Volume (WQCV)*** – All applicable development sites must have operational permanent stormwater quality control measures at the completion of construction. Designing structures that provide the WQCV is a common preferred approach in El Paso County.

Per Table 5-1 in ECM Chap 5, the % impervious for gravel is 80%. So please account for that (road plus drainage swale) in your calcs and this discussion. 0.28ac only represents the impervious area of the tank itself. The new effective area will be closer to 0.43ac at a 16.8% impervious ratio (still within the 10-20% range discussed in the next paragraph).

4) ***Consider Need for Industrial and Commercial BMPs*** – If a new development or significant redevelopment activity is planned for an industrial or commercial site, the need for specialized BMPs must be considered.

In accordance with the El Paso County Engineering Criteria Manual (ECM), this project is excluded from permanent water quality (PWQ) management requirements. Per section I.7.1.B.4, underground utilities are excluded from PWQ management requirements. This exclusion applies to the 5.6 miles of 12-inch PVC pipeline. The remaining disturbance at the water storage tank site is 0.94 acres. This is less than 1 acre; therefore, this portion of the project is also excluded from PWQ management requirements.

Revise section if needed per comments on GEC Plan about LOC.

5.2 DRAINAGE PLAN

The proposed site improvements include a 2 MG water storage tank, a 12-foot gravel access road to the tank, and site grading to accommodate the new tank. The proposed grading and drainage plan does not significantly alter the existing drainage patterns of the site. The total lot area is 2.55 acres and the total disturbance for the tank site lot is estimated at 0.94 acres. The completed improvements will have a total impervious area of 0.28 acres resulting in a 13% impervious ratio for the site. The proposed improvements are within Basin A and the proposed 5-year and 100-year runoff rates are 2.1 cfs and 8.1 cfs respectively.

The tanks site lot is contained within the R5 basin of the Forest View Estates Final Drainage Report. The hydrologic calculations used to size the existing 48-inch culverts (and all drainage structures within Forest View Estates Filing 4) assume large lot residential land use, with lots between 1 and 3 acres in size. This assumption generally equates to between 10 and 20 percent imperviousness for each lot, and a 66 SCS curve number used for runoff calculations. The proposed tank site improvements are consistent with these assumptions; therefore, the improvements will not have any adverse impacts to downstream drainage infrastructure which are sized for the proposed land use.

add "OS-1" in parenthesis to match tables on previous page and so OS-1 is searchable in this pdf.

The proposed 18-inch culvert under the access road captures runoff from offsite basin 1 which has an area of 1.31 acres. The Forest View Estates final drainage report basin plan was used to estimate the tributary area. The offsite basin is undeveloped and has 5-year and 100-year runoff rates of 0.5 cfs and 4.0 cfs respectively. The culvert capacity calculation is provided in the attachments. The culvert has a full flow capacity of 16.55 cfs, and 24% full flow capacity at the design discharge of 4 cfs.

Runoff from the tank and adjacent gravel access road will be directed to a proposed riprap lined channel with 4-foot bottom width and 3 to 1 side slopes. This proposed drainage channel, and the undeveloped upper portion of the lot discharge to an existing swale adjacent to Forest View Way. Approximately 80-feet north of the site, the existing roadside swale discharges to two 48-inch culverts that route flow to the east under Forest View Way to an existing riprap lined drainageway. This drainage channel extends approximately 575-feet along Deer Valley Court before discharging to the natural drainageway. This drainageway routes flow to the east ultimately discharging to Monument Creek. Additionally, the tank contains a 12-inch drain and overflow line that will also discharge to this drainageway. Any flow from this line will be of

Is this affected by the house on Lot 18, that according to the FDR for SF03046 is within the drainageway? This is more of just an FYI, that you only need to consider mentioning. It is likely out of the scope of this project to analyze the drainage around a house that was built in the drainageway.

limited duration and infrequent. The line runs parallel to Forest View Way before crossing the road just before the existing 48-inch culverts and discharging to the existing drainage.

All tables, figures, charts, drawings, etc., can be found within the Appendices.

5.3 FLOODPLAIN STATEMENT

There are no floodplain modifications proposed for this project. The proposed aboveground utility improvements are not within a 100-year floodplain. Flood Insurance Rate Maps (FIRM) #08041C0257G and #08041C0276G; dated December 7, 2018 are provided in Appendix B.

5.4 ADDITIONAL PERMITTING REQUIREMENTS

There is no proposed discharge of dredged or fill material within site. There have been no endangered species identified on site. Approximately 0% of stormwater from the 5-yr storm event will be held on site for no longer than 72 hours.

6 CONCLUSIONS

Stormwater runoff from the proposed development will not have negative impacts on the existing site conditions or the storm drainage system's ability to convey flows from the site; and will not adversely affect the downstream and surrounding developments.

6.1 COMPLIANCE WITH STANDARDS

The drainage plan is compliant with applicable standards including the El Paso County DCM and ECM.

6.2 VARIANCES

There are no variances being requested.

7 REFERENCES

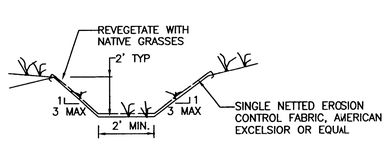
El Paso County Drainage Criteria Manual, by El Paso County, dated October 2018.

Urban Drainage Criteria Manual, Volumes 1-3, by Urban Drainage and Flood Control District, Inc, April, 2008.

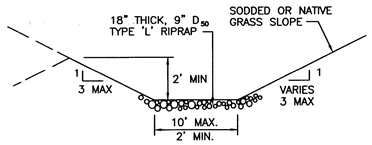
8 APPENDICES

A. Forest View Estates Filing No. 4 Drainage Map
B. Site Drainage Plan and Runoff Calculations
C. FEMA FIRM Maps
D. Culvert & Channel Capacity Calculations
E. NRCS Custom Soil Resource Report

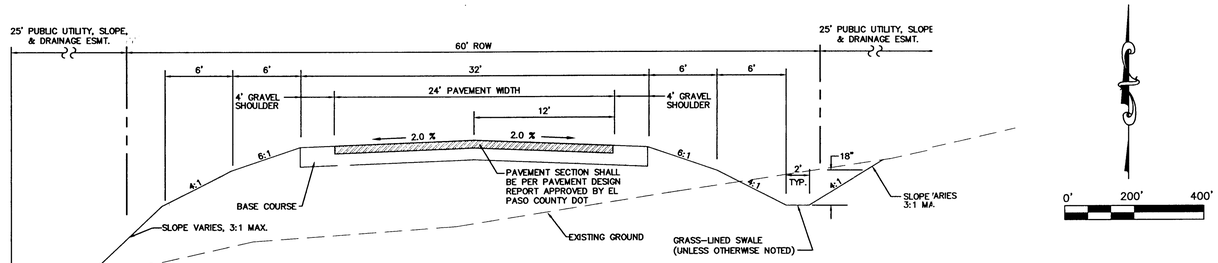
Appendix A - Forest View Estates Filing No. 4 Drainage Map



TYPICAL GRASSLINED SWALE SECTION
NTS



GRASSLINED AND RIPRAP SWALE
NTS



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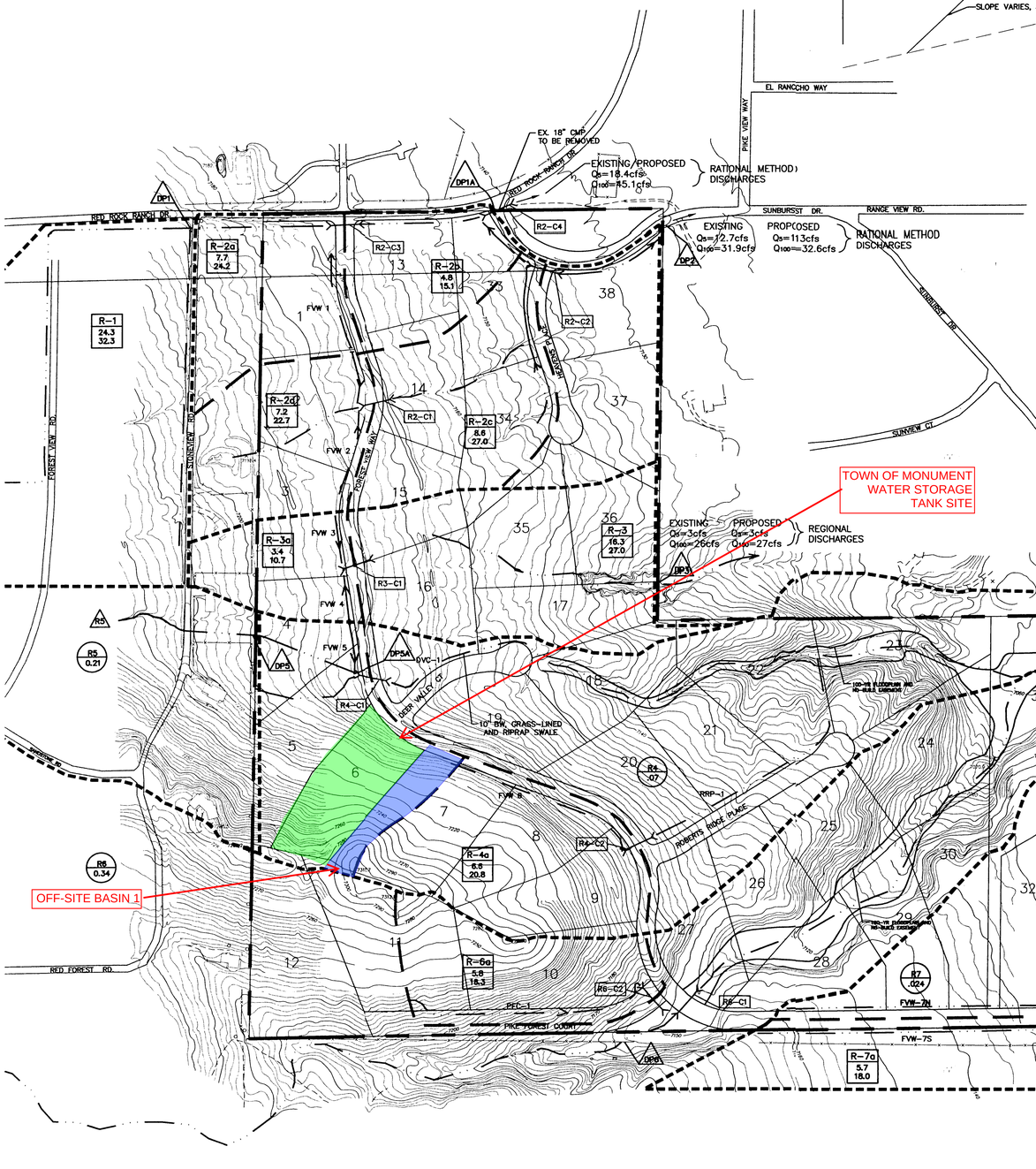
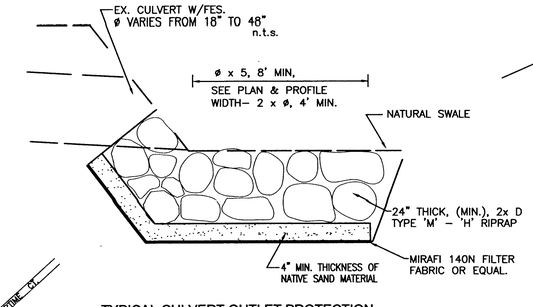
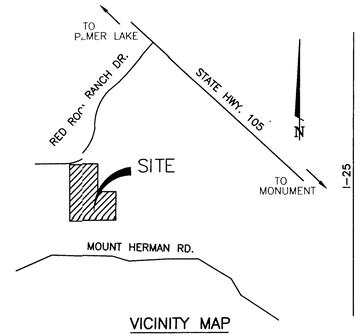
N.T.S.





TYPICAL CULVERT OUTLET PROTECTION
NTS



VICINITY MAP
NO SCALE

SUMMARY OF PROPOSED CONDITION RATIONAL METHOD DISCHARGES

SUB-BASIN/DP	Q5 (cfs)	Q100 (cfs)
R1	13.4	32.3
DP1	13.4	32.3
DP1A	18.4	45.1
DP2	13.3	32.6

SUB-BASIN DISCHARGES SUMMARY (1)

SUB-BASIN	Q5 (cfs)	Q100 (cfs)
R3	3	27
R4	15	83
R5	20	176
R6	21	230
R7	4	28

DESIGN POINT DISCHARGES SUMMARY (1)

DESIGN PT.	Q5 (cfs)	Q100 (cfs)
DP3	3	27
DP4	42	459
DP5	20	176
DP5A	21	186
DP6	21	230

(1) PEAK DISCHARGES LISTED DERIVED FROM REGIONAL SCS/HEC-1 ANALYSIS

SUMMARY OF DRAINAGE CONVEYANCES

CULVERT NUMBER	SIZE / TYPE
R2-C1	24" RCP
R2-C2	30" RCP
R2-C3	36" RCP
R2-C4	36" RCP
R3-C1	18" RCP
R4-C1	2-48" RCP
R4-C2	24" RCP
R6-C1	2-48" RCP
R6-C2	24" RCP
R7-C1	24" RCP

LEGEND

R4 .07	REGIONAL BASIN NUMBER AREA (SM)
R-2a 7.7 12.8	RATIONAL BASIN NUMBER AREA (Ac) 100-YR RUNOFF
2.2 cfs 4.3 cfs	5-YEAR RUNOFF 100-YEAR RUNOFF
1	DESIGN POINT
	REGIONAL DRAINAGE BASIN BOUNDARY
	RATIONAL DRAINAGE BASIN BOUNDARY
C-13	CONVEYANCE ELEMENT/ HYDRAULIC STRUCTURE
	TIME OF CONCENTRATION FLOW PATH
FVW-1	ROADSIDE SWALE #

SUMMARY OF ROADSIDE SWALES

SWAL #	100-YR FLOW DEPTH (FT)	BW (FT)	TYPE
FVW	0.68	2'	GL
FVW	0.76	2'	GL
FVW	0.46	2'	GL
FVW	0.45	2'	GL
FVW	0.47	2'	GL
FVW	0.69	2'	GL
FVW N	0.28	2'	GL
FVW S	0.64	2'	GL
DVC	1.20	10'	GL & RR
RRR	0.75	2'	GL
PFC	0.80	2'	GL & RR
HP-	1.36	2'	GL

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904 - 4208
(719) 630-7342

FOREST VIEW ESTATES FILING NO. 4
FINAL DRAINAGE REPORT
PROPOSED HYDROLOGIC SUB-BASIN MAP
EL PASO COUNTY, COLORADO

Project No.: 03084
Date: 07/23/04
Design: RNW
Drawn: MHH
Check: RNW
Revisions:

Fig. 4

03084 FIG4.dwg/Aug 18, 2004

Appendix B – Site Drainage Plan and Runoff Calculations

1 – Existing Drainage Plan

2 – Proposed Drainage Plan

TOWN OF MONUMENT - WATERLINE AND STORAGE TANK
SITE DEVELOPMENT PLANS
LOT 6, FOREST VIEW ESTATES FILING NO. 4

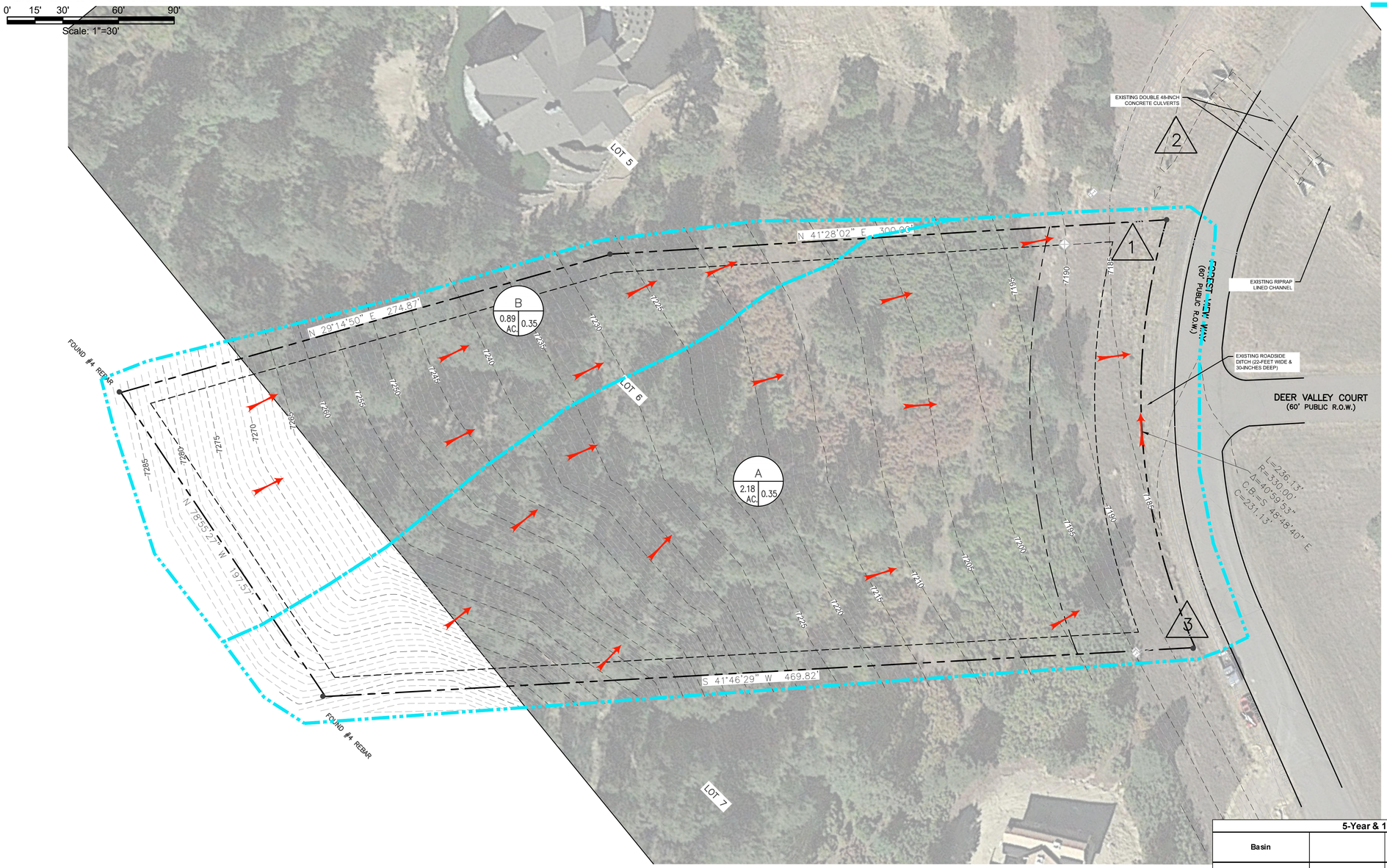
GRAPHIC SCALE

0' 15' 30' 60' 90'

Scale: 1"=30'

LEGEND:

- PROPERTY BOUNDARY
- BASIN DESIGNATION (A; 4.80 AC.; .80)
  - "C" COEFFICIENT (100 YR)
  - BASIN AREA (ACRES)
- DESIGN POINT (4)
- BASIN LINE
- FLOW DIRECTION



TANK SITE DRAINAGE PLAN

SCALE: 1"= 30'

5-Year & 100-Year Storm Runoff (Existing)

Basin		Area	Tc	5 Intensity	100 Intensity	5 Comp. C	100 Comp. C	5 Q	100 Q
		(Acres)	(Min.)	(In./hr.)	(In./hr.)			(cfs)	(cfs)
A	Basin A	2.18	5.00	5.17	8.68	0.08	0.35	**0.9**	**6.6**
B	Basin B	0.89	5.00	5.17	8.68	0.08	0.35	**0.4**	**2.7**
OS 1	Off-Site 1	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**

Routed	Design Points								
Basin A	1	2.18	5.00	5.17	8.68	0.08	0.35	**0.9**	**6.6**
A + B	2	3.07	5.00	5.17	8.68	0.08	0.35	**1.3**	**9.3**
OS 1	3	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**

NO.	REVISIONS	BY	DATE

FORSGREN Associates Inc.
56 INVERNESS DRIVE EAST #112, ENGLEWOOD, CO 80112
PH: 720.232.6644

PROJECT NO.
DRAWN
DESIGNED
APPROVED
QA/QC

EXISTING DRAINAGE PLAN

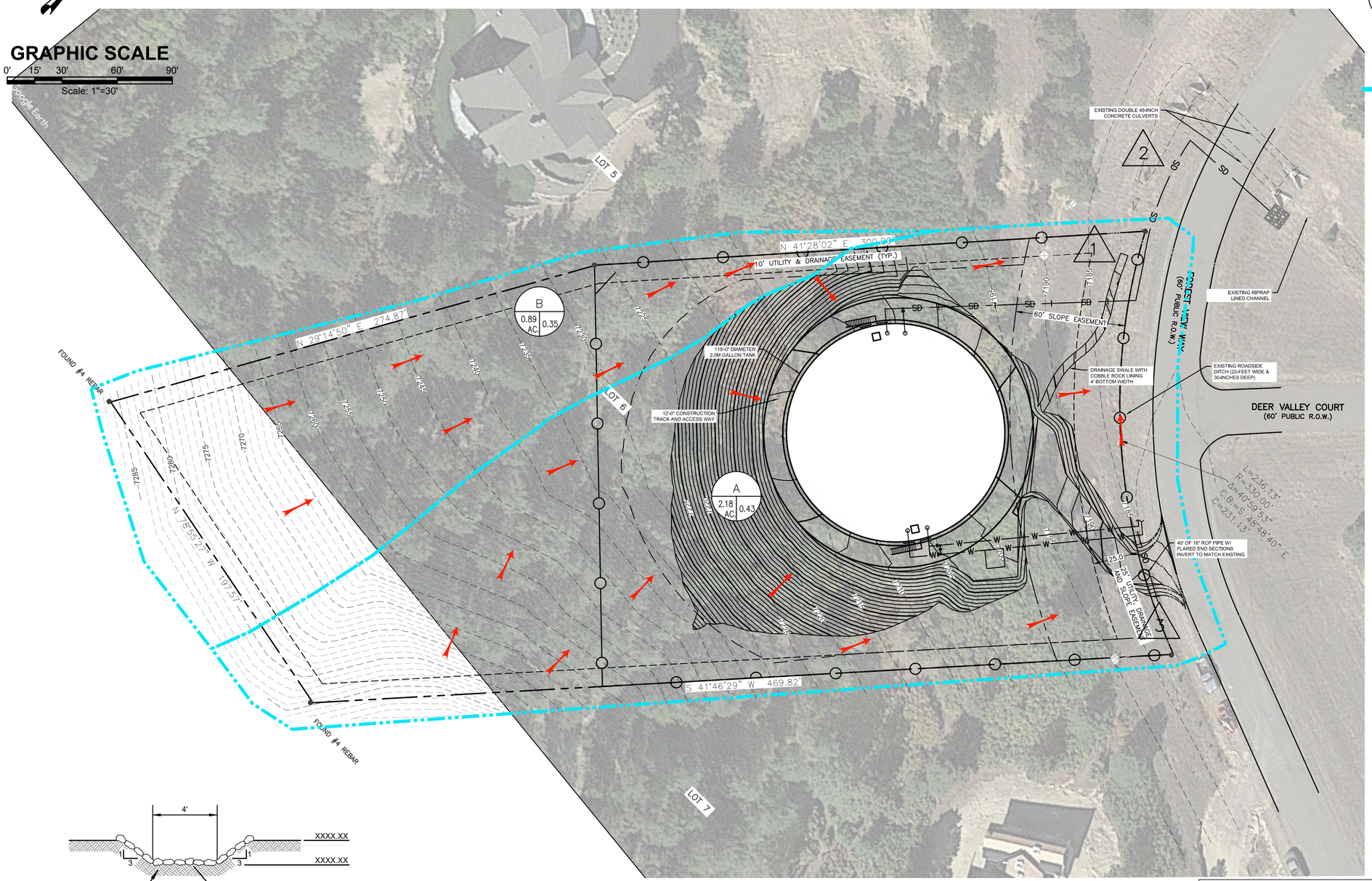
SHEET NO:
FIGURE 1

DATE:
SEP 2021

PAGE NO:

P:\Clients\Monument\04-20-0153 Waterline & Storage Tank\Submittals\Site Development Plan_2nd Submittal\Drainage Report\Figures\EXISTING - DRAINAGE PLAN.dwg ---- - 1/10/2022 3:24 PM

TOWN OF MONUMENT - WATERLINE AND STORAGE TANK
SITE DEVELOPMENT PLANS
LOT 6, FOREST VIEW ESTATES FILING NO. 4



LEGEND:

- PROPERTY BOUNDARY
- BASIN DESIGNATION (A)
- "C" COEFFICIENT (100 YR) (.80)
- BASIN AREA (ACRES) (4.80 AC.)
- DESIGN POINT (4)
- BASIN LINE
- FLOW DIRECTION

Please shade areas excluded from WQ treatment on this map or a new map, per comments on PBMP Form.

DRAINAGE CHANNEL TYPE 2
SCALE: N.T.S. SPEC # 31 22 40 002

TANK SITE DRAINAGE PLAN
SCALE: 1"= 30'

5-Year & 100-Year Storm Runoff (Proposed)

Basin		Area	Tc	5 Intensity	100 Intensity	5 Comp. C	100 Comp. C	5 Q	100 Q
		(Acres)	(Min.)	(In./hr.)	(In./hr.)			(cfs)	(cfs)
A	Basin A	2.18	5.00	5.17	8.68	0.19	0.43	**2.1**	**8.1**
B	Basin B	0.89	5.00	5.17	8.68	0.08	0.35	**0.4**	**2.7**
OS-1	Off-Site 1	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**

Routed	Design Points								
Basin A	1	2.18	5.00	5.17	8.68	0.19	0.43	**2.1**	**8.1**
A + B	2	3.07	5.00	5.17	8.68	0.16	0.41	**2.5**	**10.8**
OS-1	3	1.31	5.00	5.17	8.68	0.08	0.35	**0.5**	**4.0**

NO.	REVISIONS	BY	DATE

FORSGREN Associates Inc.
56 INVERNESS DRIVE EAST #112, ENGLEWOOD, CO 80112
PH: 720.232.6644

PROJECT NO.
DRAWN
DESIGNED
APPROVED
QA/QC

PROPOSED DRAINAGE PLAN

SHEET NO:
FIGURE 2
DATE:
JAN 2022
PAGE NO:

Appendix C – FEMA FIRM Maps

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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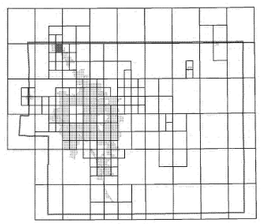
El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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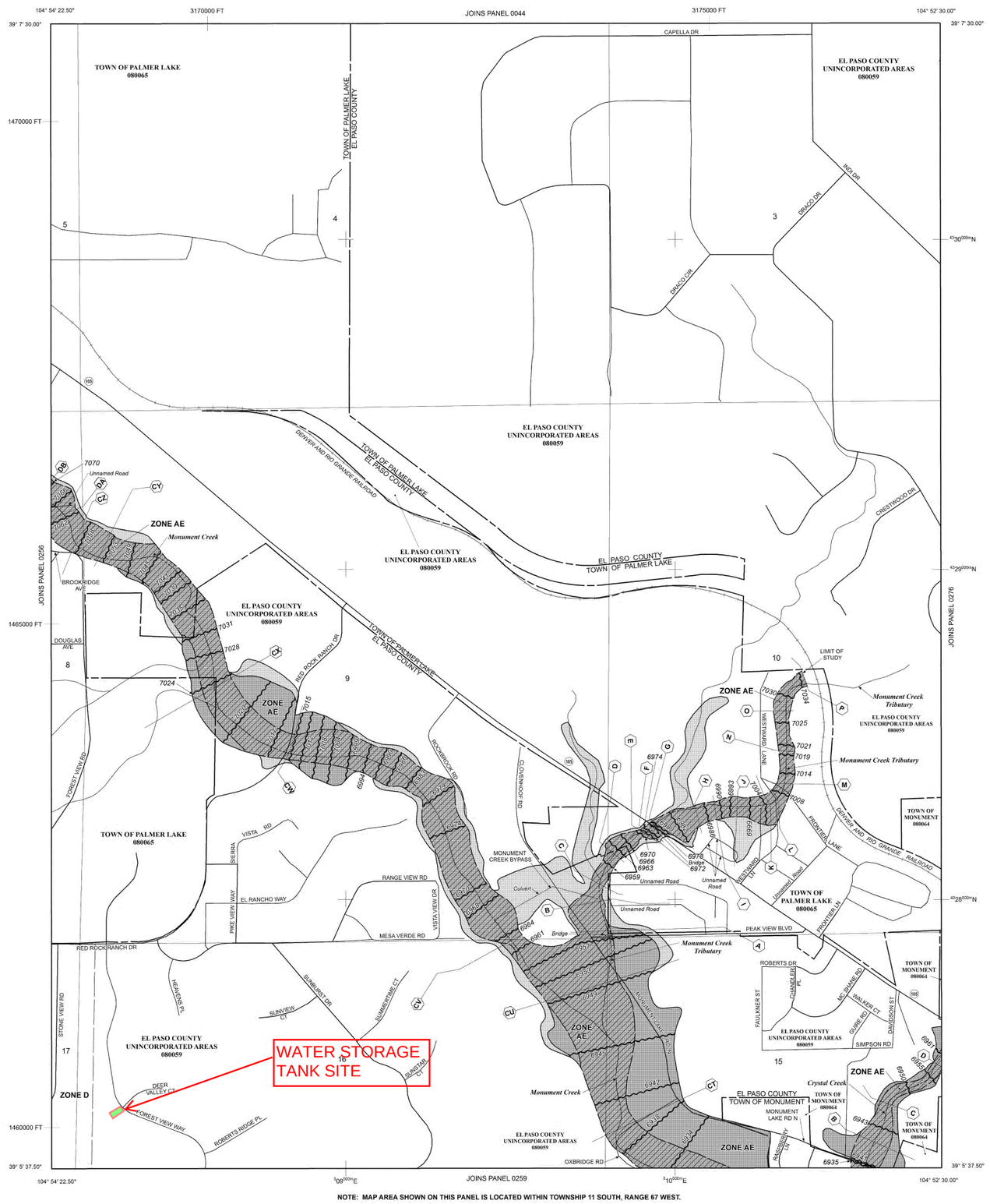

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 SOUTH, RANGE 67 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

- A — A — Cross section line
- 23 — 23 — Transect line
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- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0257G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 257 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0257	G
MONUMENT, TOWN OF	080064	0257	G
PALMER LAKE, TOWN OF	080065	0257	G

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

MAP NUMBER 08041C0257G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

NOTES TO USERS

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

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

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

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

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

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

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

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

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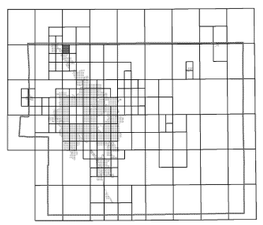

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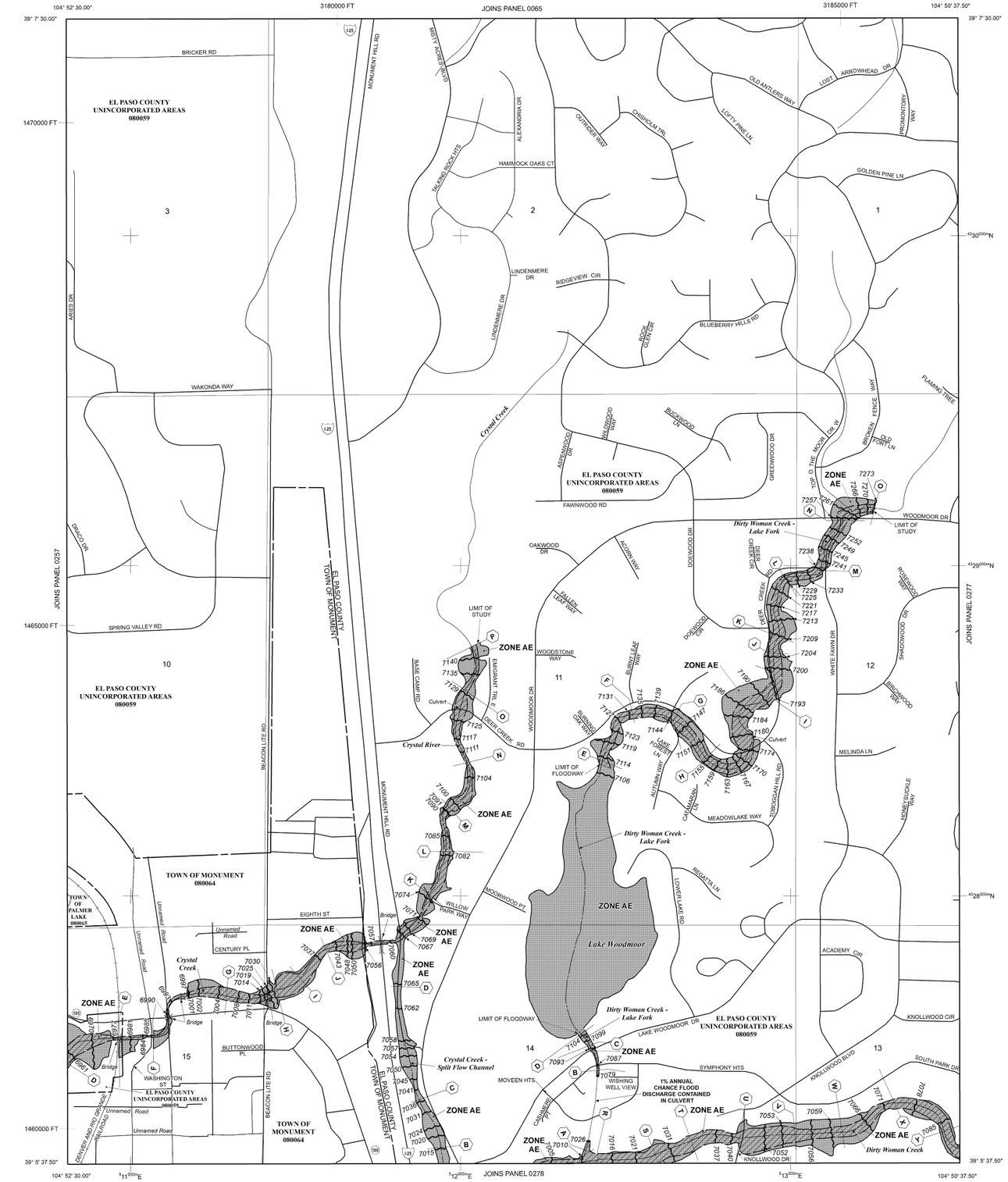

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FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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Floodway boundary
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NFIP

PANEL 0276G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 276 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0276	G
MONUMENT, TOWN OF	080064	0276	G
PALMER LAKE, TOWN OF	080065	0276	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

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MAP NUMBER 08041C0276G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

104°54'34"W 39°5'56"N

104°53'57"W 39°5'28"N

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

1:6,000

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

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/2/2021 at 11:48 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

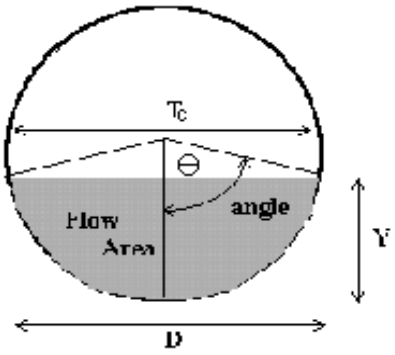
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix D – Culvert & Channel Capacity Calculations

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

Project: Town of Mounument Waterline & Storage Tank

Pipe ID: Culvert 1



Design Information (Input)			
Pipe Invert Slope	So =	0.0250	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	**Q =**	**4.00**	**cfs**

Full-flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	16.65	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.23	radians
Flow area	An =	0.52	sq ft
Top width	Tn =	1.41	ft
Wetted perimeter	Pn =	1.85	ft
Flow depth	Yn =	0.50	ft
Flow velocity	Vn =	7.75	fps
Discharge	Qn =	4.00	cfs
Percent Full Flow	Flow =	24.0%	of full flow
Normal Depth Froude Number	Fr_n =	2.26	supercritical

Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.59	radians
Critical flow area	Ac =	0.91	sq ft
Critical top width	Tc =	1.50	ft
Critical flow depth	Yc =	0.77	ft
Critical flow velocity	Vc =	4.41	fps
Critical Depth Froude Number	Fr_c =	1.00	

Hydraulic Analysis Report

Project Data

Project Title: Monument Water Storage Tank

Designer:

Project Date: Monday, January 10, 2022

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 3.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Channel Width: 4.0000 ft

Longitudinal Slope: 0.1250 ft/ft

Manning's n: 0.0350

Depth: 0.5000 ft

Result Parameters

Flow: 21.8068 cfs

Area of Flow: 2.7500 ft^2

Wetted Perimeter: 7.1623 ft

Hydraulic Radius: 0.3840 ft

Average Velocity: 7.9298 ft/s

Top Width: 7.0000 ft

Froude Number: 2.2295

Critical Depth: 0.7928 ft

Critical Velocity: 4.3120 ft/s

Critical Slope: 0.0223 ft/ft

Critical Top Width: 8.76 ft

Calculated Max Shear Stress: 3.9000 lb/ft^2

Calculated Avg Shear Stress: 2.9949 lb/ft^2

Appendix E - NRCS Custom Soil Resource Report

United States Department of Agriculture

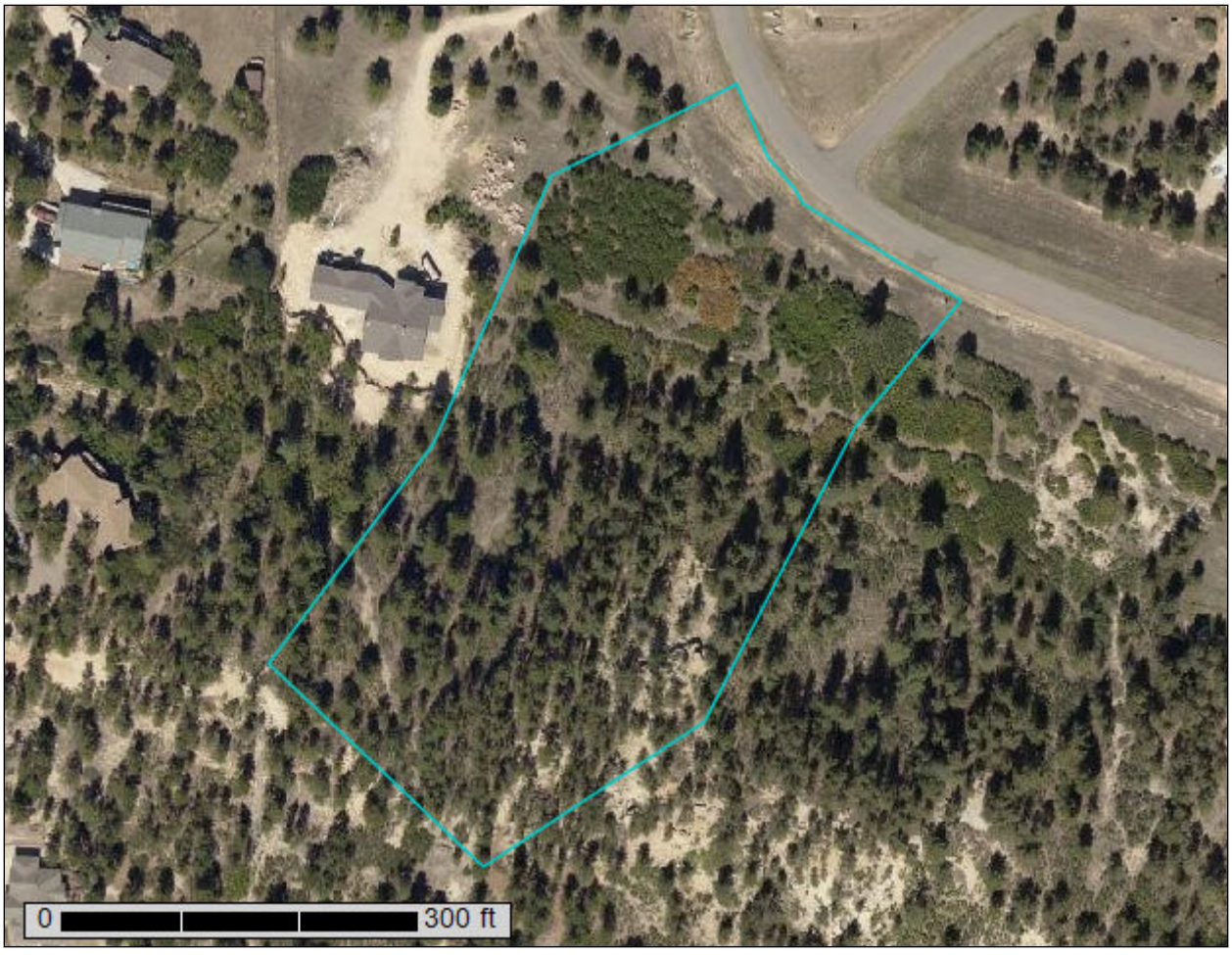
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado; and Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties

Town of Monument Tank Site



May 13, 2021

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.

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

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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 Scale: 1:1,380 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

Soil Survey Area: Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties
Survey Area Data: Version 7, Jun 5, 2020

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	3.8	88.2%
65	Perrypark gravelly sandy loam, 3 to 9 percent slopes	0.5	11.0%
Subtotals for Soil Survey Area		**4.3**	**99.3%**
Totals for Area of Interest		**4.3**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Boyett-Frenchcreek complex, 2 to 15 percent slopes	0.0	0.7%
Subtotals for Soil Survey Area		**0.0**	**0.7%**
Totals for Area of Interest		**4.3**	**100.0%**

Map Unit Descriptions

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

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

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

mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

41—Kettle gravelly loamy sand, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 368h
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Kettle

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

65—Perrypark gravelly sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369b
Elevation: 7,000 to 7,500 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Perrypark

Setting

Landform: Hills, alluvial fans
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic alluvium derived from granite

Typical profile

A - 0 to 4 inches: gravelly sandy loam
Bt - 4 to 48 inches: sandy clay loam
C - 48 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R048AY222CO
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties

3—Boyett-Frenchcreek complex, 2 to 15 percent slopes

Map Unit Setting

National map unit symbol: jpjc
Elevation: 6,800 to 8,000 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 70 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Boyett and similar soils: 50 percent
Frenchcreek and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boyett

Setting

Landform: Ridges on stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Old alluvium over material weathered from arkosic sandstone and/or granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 6 inches: sandy loam
E - 6 to 10 inches: gravelly coarse sandy loam
Bt1 - 10 to 17 inches: gravelly sandy loam
Bt2 - 17 to 35 inches: gravelly sandy loam
Btk - 35 to 43 inches: gravelly sandy loam
Ck - 43 to 54 inches: sandy loam
R - 54 to 58 inches: bedrock

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Low
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 content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water capacity: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Other vegetative classification: Ponderosa pine/true mountain mahogany (PIPO/CEMO2) (C1107)
Hydric soil rating: No

Description of Frenchcreek

Setting

Landform: Swales on stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Parent material: Alluvium derived from granite and/or arkosic sandstone

Typical profile

A - 0 to 4 inches: gravelly sandy loam
Bw - 4 to 14 inches: gravelly sandy loam
C1 - 14 to 30 inches: very gravelly coarse sandy loam
C2 - 30 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.01 to 6.02 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Other vegetative classification: Ponderosa pine/true mountain mahogany (PIPO/CEMO2) (C1107)
Hydric soil rating: No

Minor Components

Perrypark

Percent of map unit: 15 percent
Landform: Valley sides, alluvial fans
Down-slope shape: Linear, concave, convex
Across-slope shape: Linear, concave, convex
Other vegetative classification: Little bluestem - blue grama (SCSC-BOGR2) (G0502)
Hydric soil rating: No

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