

An architectural rendering of the True North Commons development. The scene features a large, modern building with a prominent, white, angular roof structure. In the foreground, there is a landscaped area with a paved walkway where a person is walking a dog. To the left, a multi-level parking structure is visible. The background consists of rolling, brownish mountains under a cloudy sky. The overall atmosphere is one of a modern, integrated urban environment.

True North Commons

MASTER DEVELOPMENT DRAINAGE PLAN

SUBMITTED TO WATER RESOURCES ENGINEERING – CITY OF
COLORADO SPRINGS - ENGINEERING DIVISION

BY

MATRIX DESIGN GROUP

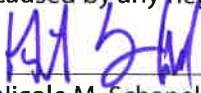
JANUARY 2, 2019

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Engineer's Statement:

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



Nicole M. Schanel
Registered Professional Engineer
State of Colorado
No. 52434

02 JAN 2019

Date




Developer's Statement:

Blue & Silver Development Partners, LLC hereby certifies that the drainage facilities for True North Commons shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of True North Commons, guarantee that final drainage design review will absolve Blue & Silver Development Partners, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Blue & Silver Development Partners, LLC

Business Name

By: 
Daniel J. Schnepf, PE
Title: President & CEO
Address: 2435 Research Parkway
Colorado Springs, CO 80920

City of Colorado Springs:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.


For the City Engineer

01/11/2019
Date

Conditions:

I. Introduction

True North Commons is comprised of 57.8 acres of undeveloped land located on the west side of Interstate 25 at the North Gate exit. The site is owned by the United States Air Force Academy (USAFA) and is currently being annexed into the City of Colorado Springs. The site has not been platted and will remain unplatted through the development process.

The 57-acre piece of land will be portioned off into two separate parcels. Parcel 1 (approximately 36 acres) will contain about 20 acres of land to be developed at a later time, as well as approximately 16 acres comprised of a combination of retail and commercial development, including a new Visitor's Center for USAFA. Parcel 2 (approximately 21 acres) is to encompass a mix of retail, office space as well as hotel and conference uses. Blue & Silver Development Partners, LLC will be entering into a long-term lease agreement with USAFA in order to develop the land. The Project location is shown in Figure 1.

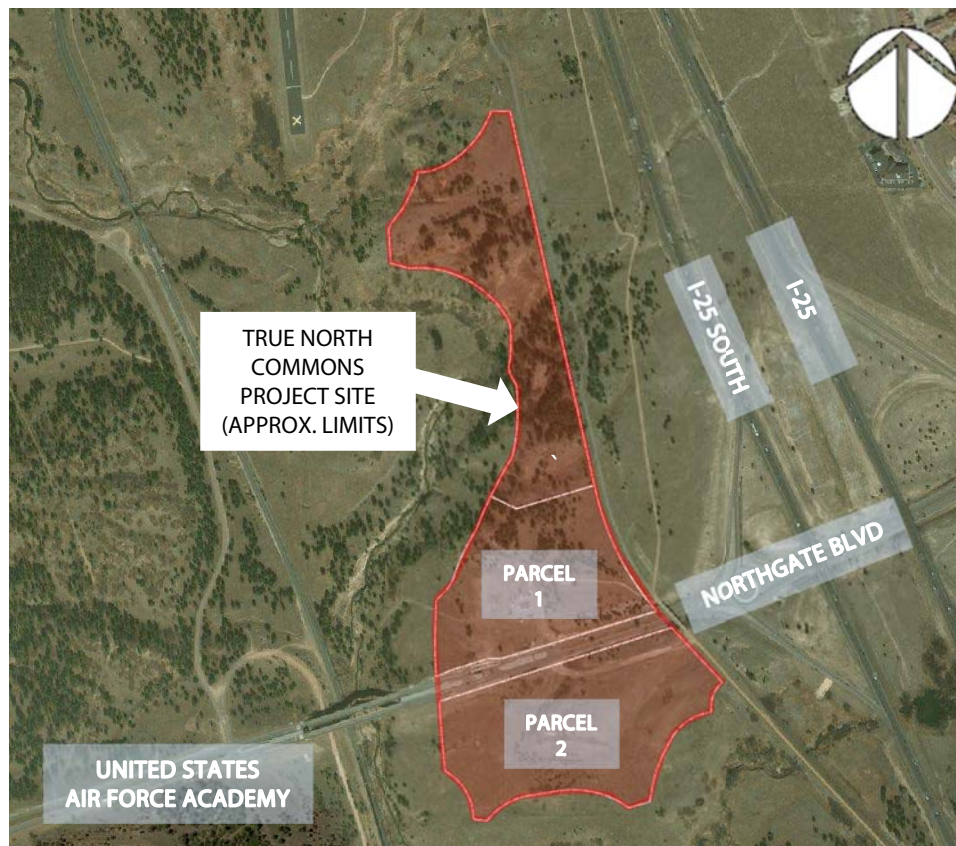


Figure 1. Project Location

True North Commons is located in both Sections 1 and 12, Township 12 South, Range 67 West of the 6th P.M. in the City of Colorado Springs, County of El Paso, State of Colorado. The site is bound on the east by the Interstate 25 corridor and on the west side by Monument Creek. Undeveloped USAFA property lies to the north and south of the overall site. The proposed property is divided into two parcels by

Northgate Boulevard. The northern extends approximately 3,000 feet north of Northgate Boulevard. The second parcel extends about 1,000 feet to the south, with the existing roadway providing the northerly boundary.

Topographical information for the site was found using *United States Geological Survey* (USGS) mapping. The *Web Soil Survey*, created by the *Natural Resources Conservation Service* was utilized to investigate the existing general soil types within the site. As previously mentioned, this report has been prepared in accordance to the standards set forth in the DCM. In addition, the *Urban Storm Drainage Criteria Manuals, Volumes 1 through 3*, dated 2016 have been used to supplement the City Criteria Manual.

The purpose of this Master Development Drainage Plan is to identify and evaluate the offsite and onsite drainage patterns associated with the undeveloped land and to provide hydrologic and hydraulic analyses of the area to ensure compliance with the City of Colorado Springs Drainage Criteria Manual Volumes 1 & 2 (DCM) as well as provide safe, effective routing to the downstream outfalls. In addition to the reviews by the City of Colorado Springs, USAFA will also serve as a jurisdiction for the project and will evaluate this MDDP.

This parcel currently discharges into Monument Creek and Smith Creek (a tributary of Monument Creek) and, eventually, Fountain Creek. A Restoration Study was completed by Matrix Design Group titled "Monument Creek Watershed Restoration Master Plan", dated October 31, 2016 that analyzed the creek and its tributaries and outlined the framework needed for rehabilitation of the creek from recent fire and flood damages but a detailed drainage planning study of this area has not yet been completed (refer to Figure 2 below). As such, this MDDP will analyze the existing drainage patterns and use these calculations to ensure the developed condition has no adverse impacts to any downstream infrastructure.

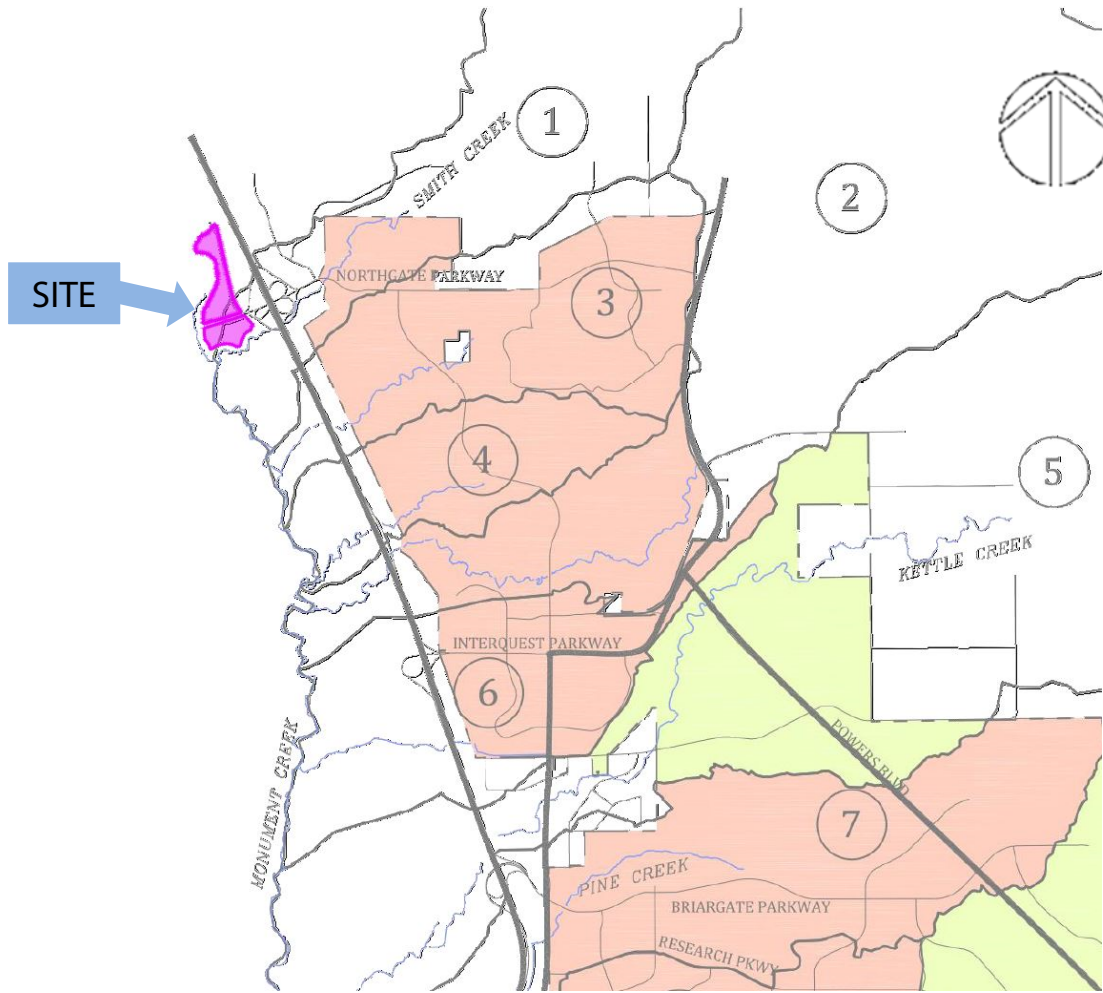


Figure 2. Drainage Basin Planning Study Map

II. Project Characteristics

The Monument Creek watershed reaches north to approximately County Line Road and is the receiving waters for the True North Commons development, though this region has not previously been included in any DBPS. The site is presently undeveloped and covered with natural vegetation with the exception of Northgate Boulevard and a gravel parking lot associated with the Santa Fe Trail.

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict the stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. Refer to the Soil Map provided in Appendix C for a detailed description of the soils for the site. The following soil types are present in the development area:

Table 1. NRCS Soil Survey for El Paso County

Soil ID Number	Soil	Hydrologic Classification	Runoff Class	Percent on Site
42	Kettle-Rock outcrop complex	B	Medium	36.9%
71	Pring coarse sandy loam (3%-8% slopes)	B	Low	31.0%
93	Tomah-Crowfoot complex (8%-15% slopes)	B	Medium	32.1%

The ultimate receiving waters for the entirety of the site is Monument Creek. The proposed development drains in a general northeast to southwest pattern until being collected by existing, natural swales which convey the flows offsite and into Monument Creek. With the exception of a southeastern portion of the site, these swales discharge the collected flows directly into Monument Creek, including the flows captured in Northgate Boulevard. The remaining piece of land also runs in a general northeast to southwest drainage pattern and is collected in an existing swale. However, this swale discharges into Smith Creek. Smith Creek is a tributary of Monument Creek and the two creeks converge approximately 600 feet southwest of the site’s southern boundary.

The 57-acre parcel will be annexed into the City of Colorado Springs and zoned as a Planned Unit Development (PUD). Specifically, the site is planned for uses consisting of office, retail, commercial, hotel, and governmental. The proposed condition of the site will include modifications to the existing Northgate Boulevard, 8 acres for the new USAFA Visitor’s Center, 8 acres of retail and commercial space, 10.5 acres of office space, and 10.5 acres of hotel and conferences uses.

III. Hydrologic Analysis

The hydrology for this project uses the Rational Method as recommended by the DCM (Volume 1, Chapter 6, Section 3) for the minor and major storms. The Rational Method is used for drainage basins less than 100 acres in size.

Rational Method coefficients from Table 6-6 of the DCM were utilized in the calculations. Refer to Appendix B for the aforementioned table. The time of concentration consists of the initial time of overland flow combined with the travel time of concentrated flow until reaching a point of discharge. A minimum time of concentration of 5 minutes is utilized for urban area. The hypothetical rainfall depths for the 24-hour storm duration utilized were taken from the DCM with the minor and major storm event depths listed in the table below.

Table 2. DCM 1-Hour Rainfall Depths

Storm Recurrence Interval	Rainfall Depth (inches)
5-year	1.50
100-year	2.52

The rainfall intensity equation for the Rational Method was taken from the DCM Figure 6-5 (Appendix B).

Existing Drainage Conditions

The undeveloped site runs in a general northeast to southwest pattern before draining offsite and eventually into Monument Creek. The existing calculations have been summarized:

Table 3. Existing Conditions Basin & Design Point Summary

Basin ID	Acreage	Q ₅	Q ₁₀₀
OS1	28.4	7.6	51.4
OS2	10.7	2.5	17.1
OS3	10.4	35.7	65.8
A	20.2	6.5	43.9
B	16.4	4.4	29.6
C	3.4	7.1	13.2
D	11.3	3.5	23.4
E	10.0	2.3	15.4
DP1	48.6	12.2	81.9
DP2	27.1	5.7	38.0
DP3	13.9	35.4	65.3
DP4	11.3	3.5	23.4
DP5	10.0	2.3	15.4

More specifically, the *existing conditions* for the site have been analyzed and are presented by design point as follows:

Existing Design Point 1 ($Q_5 = 12.2$ cfs, $Q_{100} = 89.1$ cfs) is located at the western boundary of the site where the runoff discharges into Monument Creek. The contributing sub-basins for this design point include offsite Sub-basin OS1 (28.4 acres; $Q_5 = 7.6$ cfs, $Q_{100} = 51.4$ cfs) which includes the runoff that flows onto the site from the northeast and continues to travel in a general northeast to southwest direction until combining with the runoff from onsite Sub-basin A (20.2 acres; $Q_5 = 6.5$ cfs, $Q_{100} = 43.9$ cfs). The combined flows are collected through natural drainage swales until they leave the site. The graphic below depicts the area encompassed by this design point and has been added for a visual reference only. Please refer to the Existing Conditions Drainage Map for more detailed information (Appendix C).

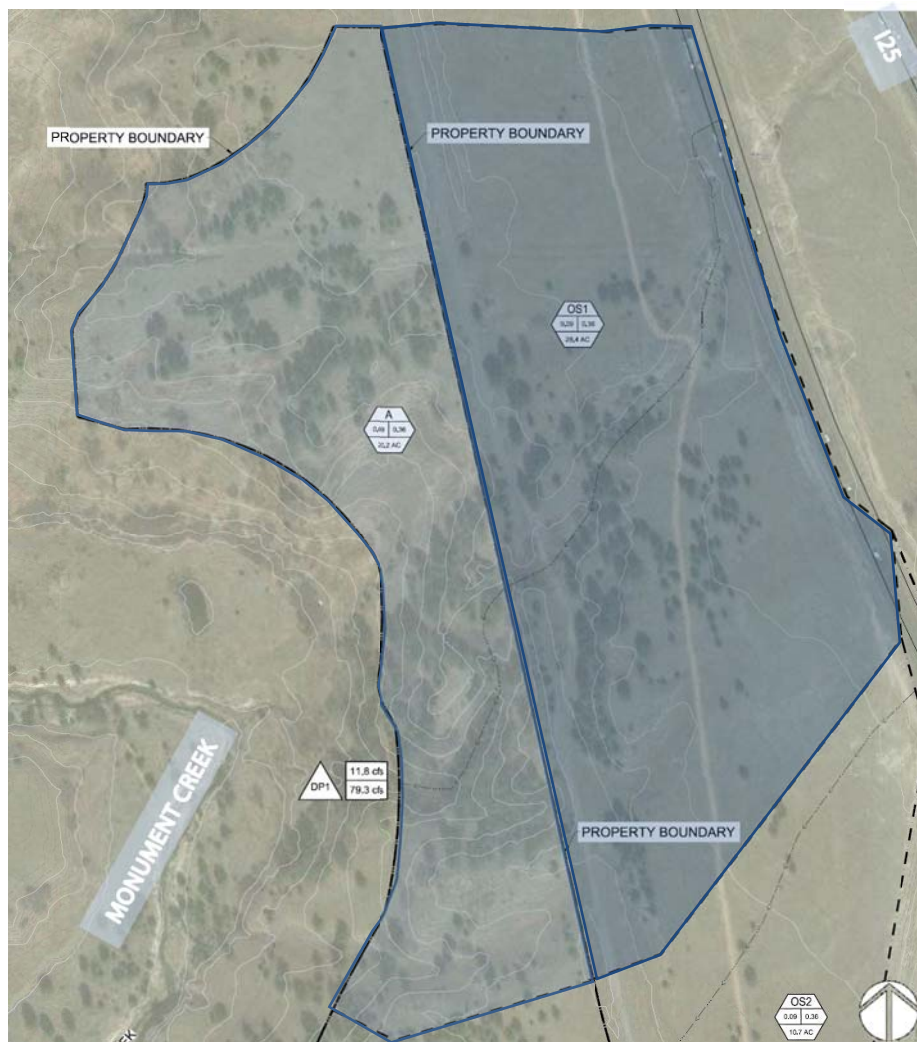


Figure 3. Existing Design Point 1

Existing Design Point 2 ($Q_5 = 5.7$ cfs, $Q_{100} = 38.0$ cfs) is composed of the offsite Sub-basin OS2 (10.7 acres; $Q_5 = 35.7$ cfs, $Q_{100} = 17.1$ cfs) which sheet flows from the northeast to the southwest until converging into shallow concentrated flows and which continue in their current pattern onto onsite Sub-basin B (16.4 acres; $Q_5 = 4.4$ cfs, $Q_{100} = 29.6$ cfs). This combined runoff exits the proposed site and releases into Monument Creek.



Figure 4. Existing Design Point 2

Existing Design Point 3 ($Q_5 = 35.4$ cfs, $Q_{100} = 65.3$ cfs) accounts for runoff created by offsite Sub-basin OS3 (10.4 acres; $Q_5 = 2.5$ cfs, $Q_{100} = 65.8$ cfs) and onsite Sub-basin C (3.43 acres; $Q_5 = 7.1$ cfs, $Q_{100} = 13.2$ cfs). The majority of these basins consist of the exist paved Northgate Boulevard ramps and roadway corridor. Runoff from offsite Sub-basin OS3 drains to roadside swales that continue onto onsite Sub-basin C until releasing into Monument Creek at the bridge crossing.

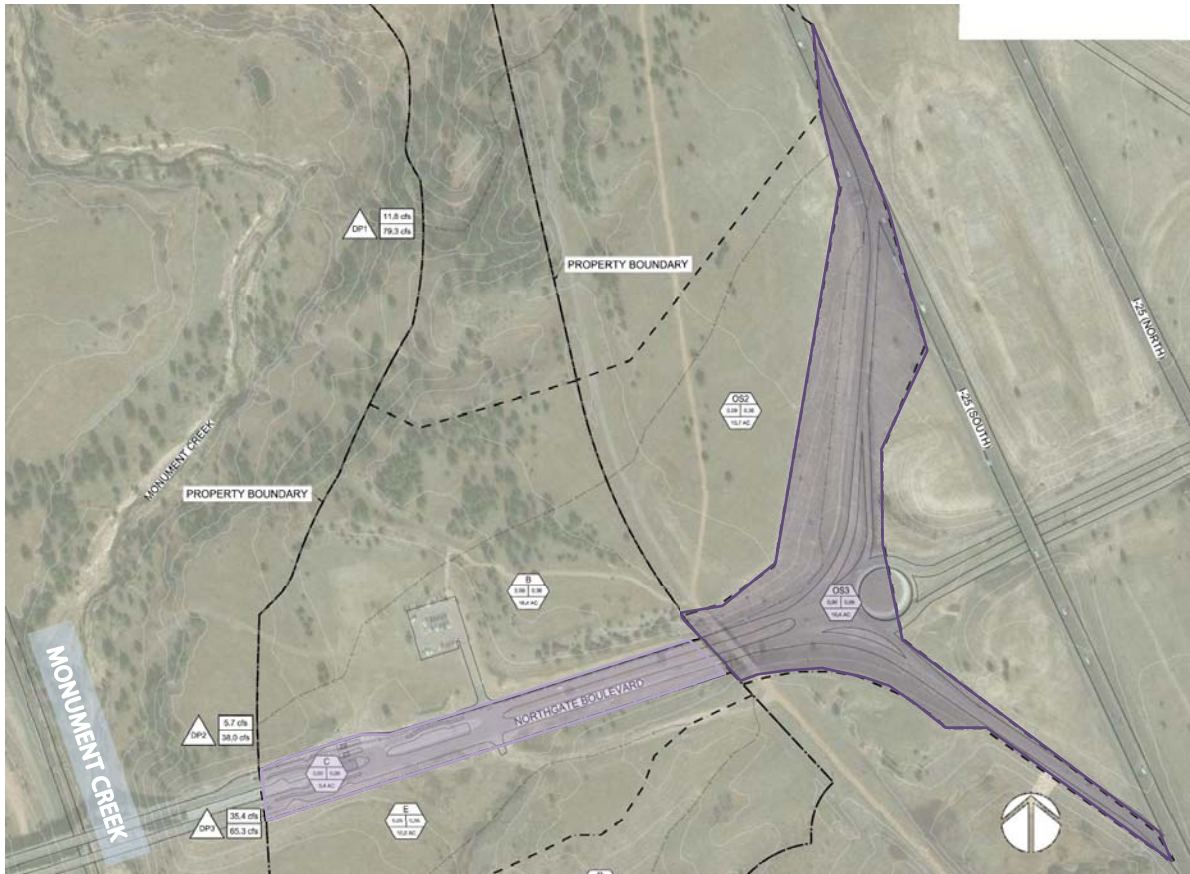


Figure 5. Existing Design Point 3

Existing Design Point 4 consists of a singular onsite sub-basin, Sub-basin D (11.3 acres; $Q_5 = 3.5$ cfs, $Q_{100} = 23.4$ cfs). Drainage generated in this existing area sheet flows to an existing natural drainage swale in the middle of the sub-basin. Once collected in the swale, the runoff is conveyed to the southwest, continuing offsite and eventually discharging into Smith Creek, a tributary of Monument Creek. Similarly, **Existing Design Point 5** includes only onsite Sub-basin E (10.0 acres; $Q_5 = 2.3$ cfs, $Q_{100} = 15.4$ cfs). Runoff from this area flows from the northeast to southwest until leaving the site and draining into Monument Creek.

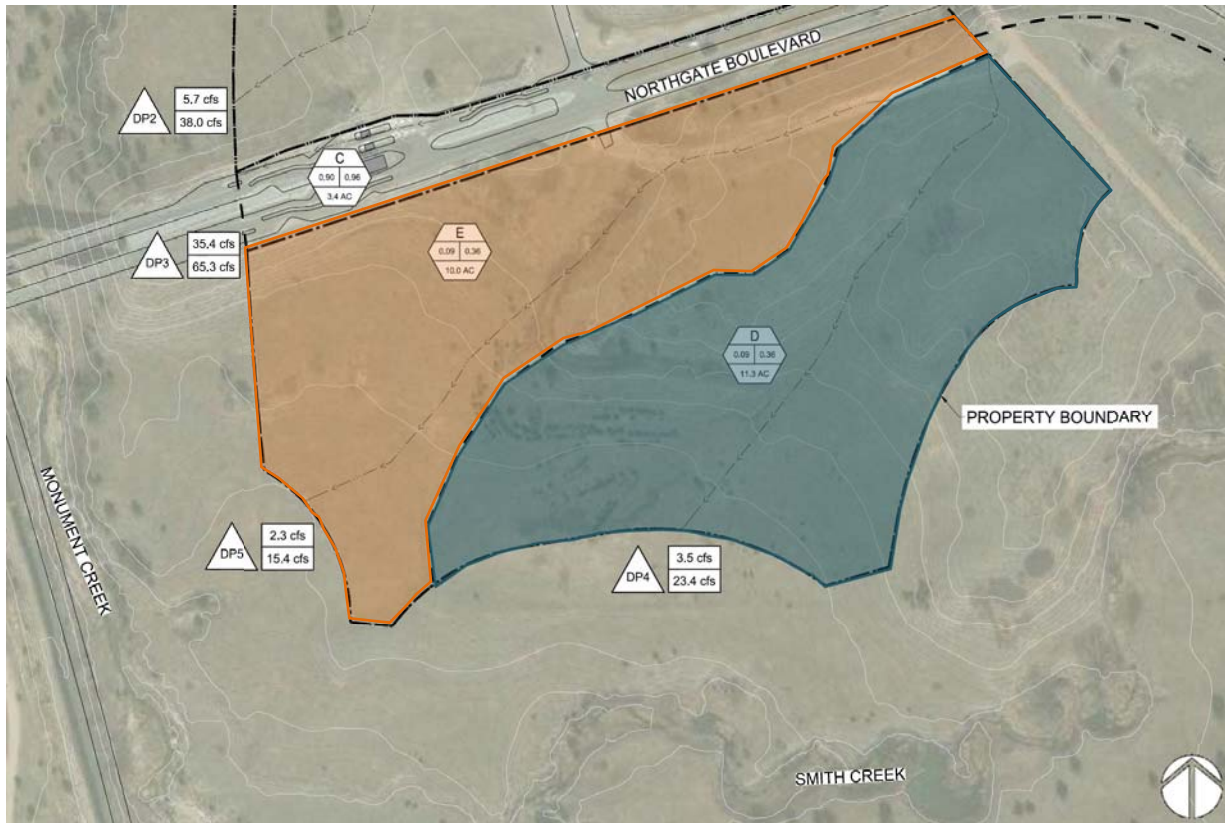


Figure 6. Existing Design Points 4 & 5

Developed Drainage Conditions

The drainage pattern for the developed conditions will continue to travel to the southwest as in the undeveloped conditions. The drainage from the parcels will be split by Northgate Boulevard and treated by two separate Full Spectrum Detention Ponds prior to releasing the flows outside of the property lines. From there, the treated discharge will flow overland into Monument Creek. The developed calculations have been summarized:

Table 4. Developed Conditions Basin & Design Point Summary

Basin ID	Acreage	Q ₅	Q ₁₀₀
OS1	28.4	7.6	51.4
OS2	10.7	2.5	17.1
OS3	10.4	35.7	65.8
A	20.2	6.5	43.9
B1	8.3	33.2	60.6
B2	8.2	31.5	57.4
C	3.4	7.1	13.2
D	10.5	40.7	74.2
E	10.0	37.2	67.9
DP1	48.6	12.2	81.9
DP2	19.0	23.1	50.5
DP3	13.9	35.4	65.3
DP4	22.0	56.9	104.8
DP5	20.5	55.3	100.8

More specifically, the developed conditions for the site have been analyzed and are presented by design point as follows:

Design Point 1 in the developed condition is to remain unchanged from **Existing Design Point 1**. At this time, onsite Sub-basin A is to remain undeveloped and the flows from this basin as well as offsite Sub-basin OS1 will continue to drain as they have historically, as previously discussed. When future development occurs, a final drainage report and Full Spectrum Detention Pond will be required.

Design Point 2 ($Q_5 = 23.1$ cfs, $Q_{100} = 50.5$ cfs) is the convergence of offsite Sub-basin OS2 as well as onsite Sub-basin B1 (8.3 acres; $Q_5 = 33.2$ cfs, $Q_{100} = 60.6$ cfs). Sub-basin B1 is planning to contain the proposed USAFA Visitor's Center and associated parking and has been modeled using coefficients utilized for commercial development. At this time, offsite Sub-basin OS2 is anticipated to remain undeveloped. The combined flows will be conveyed by curb and gutter and directed to proposed storm infrastructure located at **Design Point 2**. From here, the runoff will be conveyed to the west until releasing into the northern Full Spectrum Detention Pond at **Design Point 4**.

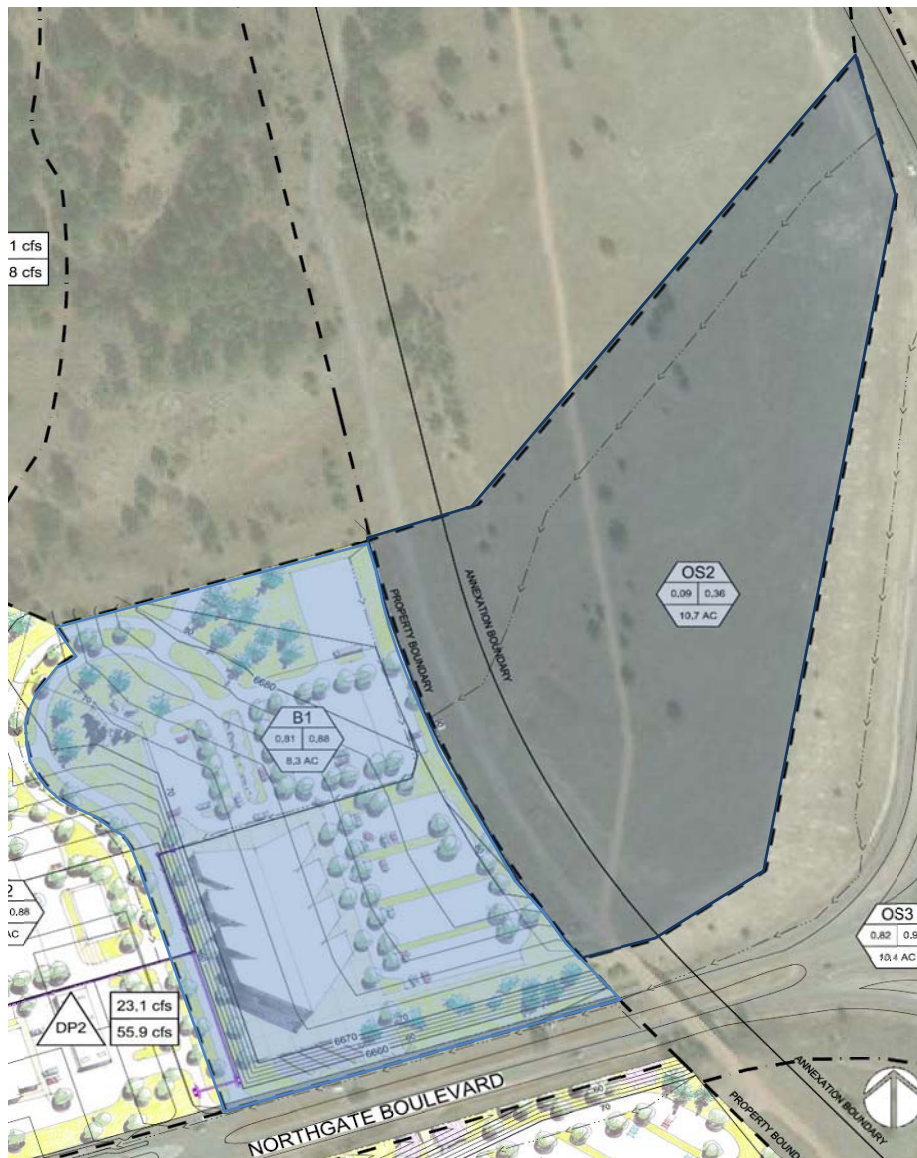


Figure 7. Proposed Design Point 2

Design Point 3, similarly to **Design Point 1**, will also remain unchanged from its existing condition and will continue to contribute the flows analyzed presented earlier in this report.

Design Point 4 ($Q_5 = 56.9$ cfs, $Q_{100} = 104.8$ cfs) is located at the Full Spectrum Detention Pond (North Pond) that will be required to treat the runoff generated for the developed site north of Northgate Boulevard. This will include the abovementioned **Design Points 2 and 3**, as well as flows from onsite Sub-basin B2 (8.2 acres; $Q_5 = 31.5$ cfs, $Q_{100} = 57.4$ cfs). Sub-basin B2 has an anticipated use of commercial and has been evaluated based on the corresponding coefficients for this use provided in the DCM.



Figure 8. Proposed Design Point 4

Design Point 5 ($Q_5 = 55.3$ cfs, $Q_{100} = 100.8$ cfs) is located at the southern detention facility (South Pond) that will be required, located at the southwest corner of the site. This design point will encompass onsite flows from Sub-basin D (10.5 acres; $Q_5 = 40.7$ cfs, $Q_{100} = 74.2$ cfs) which will be directed by proposed curb, gutter, and storm infrastructure to the southwest, combining with flows from Sub-basin E (10.0 acres; $Q_5 = 37.2$ cfs, $Q_{100} = 67.9$ cfs). This Full Spectrum Detention Basin has been designed to accommodate 20.5 acres of developed runoff, which will require a pond volume of approximately 3.2 acre-feet of storage. In previous conditions, portions of these two sub-basins would have released into Smith Creek prior to its convergence with Monument Creek. In the proposed conditions, all flows from these sub-basins will be directed into the detention basin before releasing directly to Monument Creek.

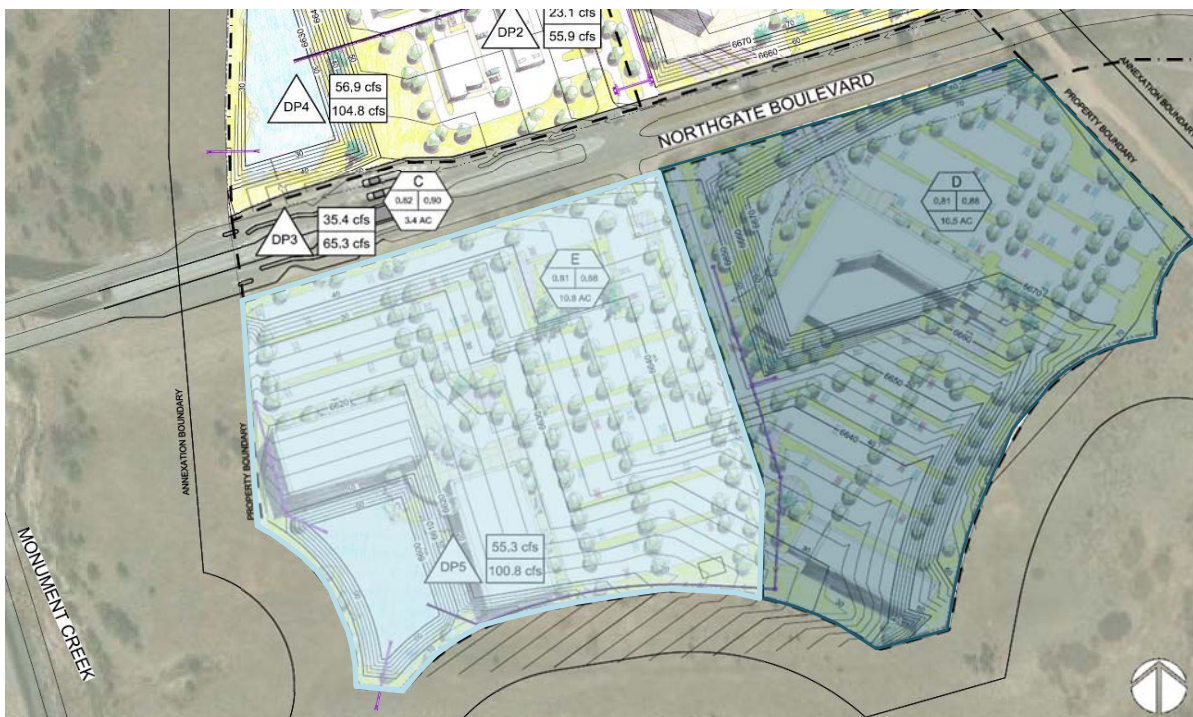


Figure 9. Proposed Design Point 5

Detention and Water Quality

In accordance with the City of Colorado Springs drainage criteria, the proposed True North Commons will provide onsite Full Spectrum Detention Facilities to mitigate the developed drainage impacts. Both proposed facilities for the development will be Extended Detention Basins (EDB) that will discharge just to the west of the property boundary, allowing the treated runoff to flow overland into Monument Creek at the approved unit release rate stated in Table 13-2 of the DCM, included in Appendix B. The calculated release rates for each pond are stated in the Table 6, below.

Table 5. Pond Releases

Design Return Period (Years)	NRCS Hydrologic Soil Group	Contributing Area (Acres)		Total Allowable Release (cfs)	
		North Pond	South Pond	North Pond	South Pond
5	0.04	40.0	20.5	$Q_5 = 1.6$	$Q_5 = 0.8$
100	0.30			$Q_{100} = 12$	$Q_{100} = 6.2$

The North Pond EDB has a total watershed area of 40.0 acres with an imperviousness of 50% to include the developed onsite sub-basins as well as the offsite, undeveloped acreage of Sub-basin OS2. This results in the following volumes:

Water Quality Capture Volume (WQCV): 0.705 acre-feet
 Excess Urban Runoff Volume (EURV): 2.192 acre-feet
 5-YR Detention Volume: 2.267 acre-feet
 100-YR Detention Volume: 3.835 acre-feet

The South Pond EDB has been designed to accommodate 20.5 acres of developed runoff with an approximate imperviousness of 95%. The required volumes calculated:

Water Quality Capture Volume (WQCV): 0.764 acre-feet
 Excess Urban Runoff Volume (EURV): 2.192 acre-feet
 5-YR Detention Volume: 2.296 acre-feet
 100-YR Detention Volume: 3.208 acre-feet

The Final Drainage Reports that will be required for the development will provide detailed pond routing calculations using UD-Detention from the Urban Drainage Flood Control District for final design.

IV. Hydraulic Analysis

In accordance with the DCM, major drainage will be conveyed through a combination of open channels, underground storm sewer capacity, and allowable street capacity. Calculations have been completed per the DCM Volume 1, Chapter 9, Section 7.

As previously stated, the entire site is located within the Monument Creek Drainage Basin, and all drainage that exits the site will ultimately release into Monument Creek. In the developed conditions, Design Points 4 and 5 represent the two site exit points for the drainage of True North Commons.

The storm systems as well as both proposed full spectrum detention ponds will be privately owned and maintained by the business improvement district that is currently being established for the property.

A hydraulic analysis using the Manning's equation has been completed to determine the pipe capacity of the trunk mains for the site, refer to Appendix A for calculations. **Pipe Run 1** includes the trunk main located in the proposed road that extends to the north from Northgate Boulevard. Because the site is at a preliminary design stage, this pipe has been designed to accommodate the entirety of the flow reaching DP1, resulting in a 36" storm drain. This pipe will connect to an inlet and extend west to **Pipe Run 2** (48"), which has been designed to capture the DP4 design flows and will discharge into the northern detention pond. **Pipe Run 3** (42") will convey the runoff generated in Sub-Basin D to the south and then west where it will connect to **Pipe Run 4**, a 48" storm drain that will carry the DP5 flows to the west and discharge into the south pond. A more detailed analysis of the roadways, storm sewers, swales, and inlets will be required to be completed at the time of development of the parcels. At this time, no improvements to any existing infrastructure are anticipated.



Figure 10. Pipe Run Summary

Per the *Flood Insurance Rate Maps (FIRM) 08041CO290 F and 08041CO290 F*, effective dates March 17, 1997, published by the Federal Emergency Management Agency (FEMA), the entirety of the site is located within Zone D, which is specified as an area in which flood hazards are undetermined. However, the site does not lie within the 100-year floodplain as delineated from the GIS provided by USAFA.

V. Environmental Evaluations

Concurrent with this MDDP, an Environmental Assessment is being completed for the property. There are wetlands located on the site which are currently being delineated as either jurisdictional or non-jurisdictional in coordination with the United States Army Corp of Engineers (USCOE). Prebles Meadow Jumping Mouse has been located within the annexation boundary, but not within the developable

area. The project will coordinate with US Fish and Wildlife Service, USAFA, and the US COE for any impact mitigation that may be required.

All onsite detention facilities shall be designed to accommodate water quality requirements. As the development of each parcel progresses, the detention guidelines in this report are to be upheld.

Per the DCM Chapter 1, Section 4, the City of Colorado Springs requires the UDFCD Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

Step 1: Reduce runoff by disconnecting impervious area, eliminating “unnecessary” impervious area and encouraging infiltration into soils that are suitable.

Site specific landscaping will be done on each lot to decrease the connectivity of impervious areas. Grass-lined swales will be used where possible to allow ground infiltration.

Step 2: Treat and slowly release the WQCV.

Each pond will meet the DCM standards for the release rates of Full Spectrum Detention Ponds for Water Quality Capture Volumes.

Step 3: Stabilize stream channels.

The two Full Spectrum Detention Ponds that will treat the developed site for water quality and detention will release at the City of Colorado Springs maximum release rate of 0.30 cfs/acre, resulting in a much lower release rate than the present conditions. At the location of each outfall, outside of the property boundary, a permanent low tailwater basin will be installed to mitigate any erosion created by the point discharge. These factors will eliminate any adverse impacts that could occur from the development, therefore no creek improvements are required.

Step 4: Implement source controls.

During construction, the contractor will have designated concrete washout areas and will implement sediment control logs and inlet protection in order to control pollutants at their source.

VI. Fee Development

Monument Creek continues to run south after leaving the True North Commons property. At the intersection of I-25 and Cimarron, Monument Creek converges with (and continues on as) Fountain Creek. Per the **2018 Drainage, Bridge and Pond Fees** released by Colorado Springs, fees vary based on the associated basin study within the Fountain Creek watershed. This fee schedule (found in Appendix B) states that “Pursuant to the recommendation of the Subdivisions Storm Drainage Board adopted at its meeting of September 15, 1977, there are exempted and excluded from the provisions of this part construction of the main Fountain Creek Channel from the confluence of Fountain Creek with Monument Creek northwest to the City limits. Land development taking place adjacent to Fountain Creek shall remain responsible for dedicating rights of way necessary for the channelization

of Fountain Creek, and the developers shall continue to pay to the City as a condition of subdivision plat approval the applicable drainage fees. Drainage fees are required in accordance with the appropriate basin study.”

As previously stated in this report, True North Commons is not located within any existing basin study and fees have not been established. If the site were to be platted in the future, fees will be required.

VII. References

- City of Colorado Springs, Colorado. 2014. Drainage Criteria Manual, Volumes 1 & 2.
- Matrix Design Group, Inc. 2016. Monument Creek Watershed Restoration Master Plan.
- NRCS. 1981. Soil Survey of El Paso County, Colorado. U.S. Department of Agriculture Soil Conservation Service, now the Natural Resource Conservation Service.
- Urban Drainage and Flood Control District. 2001 (Rev. 2016). Urban Storm Drainage Criteria Manual. Volumes 1-3

Appendix A – Hydrologic and Hydraulic Calculations

Project Name: True North Commons
Project Location: Colorado Springs
Designer: NMS
Notes: Existing Conditions

Average Channel Velocity 5 ft/s (If specific channel vel is used, this will be ignored)
 Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Basin	Contributing Basins	Area		Rational 'C' Values										Flow Lengths		Initial Flow		Channel Flow		Tc (min)	Minor Storm Flow Rate Q5 cfs	Major Storm Flow Rate Q100 cfs	
		sf	acres	Surface Type 1			Surface Type 2			Surface Type 3			Composite		Initial ft	Channel ft	Average Slope	Initial Tc (min)	Average Slope				Velocity (ft/s)
OS1		1,238,609	28.44	0.09	0.36	1,238,609	0.90	0.96	0	0.81	0.88	0	0.09	0.36	179	1013	0.067	13.0	0.036	2.2	20.7	7.6	51.4
OS2		466,760	10.72	0.09	0.36	466,760	0.90	0.96	0	0.81	0.88	0	0.09	0.36	120	948	0.017	16.9	0.019	1.7	26.2	2.5	17.1
OS3		454,202	10.43	0.09	0.36	45,420	0.90	0.96	408,782	0.81	0.88	0	0.82	0.90	136	1290	0.029	4.1	0.037	3.8	9.8	35.7	65.8
A		878,699	20.18	0.09	0.36	878,699	0.90	0.96	0	0.81	0.88	0	0.09	0.36	150	428	0.067	11.9	0.068	3.4	14.0	6.5	43.9
B		714,832	16.42	0.09	0.36	714,832	0.90	0.96	0	0.81	0.88	0	0.09	0.36	138	1024	0.036	14.0	0.046	2.5	20.8	4.4	29.6
C		149,267	3.43	0.09	0.36	14,927	0.90	0.96	134,340	0.81	0.88	0	0.82	0.90	48	1214	0.021	2.7	0.003	0.8	28.0	7.1	13.2
D		490,256	11.26	0.09	0.36	490,256	0.90	0.96	0	0.81	0.88	0	0.09	0.36	124	881	0.073	10.6	0.061	3.0	15.5	3.5	23.4
E		435,392	10.00	0.09	0.36	435,392	0.90	0.96	0	0.81	0.88	0	0.09	0.36	157	1110	0.013	21.1	0.056	2.8	27.7	2.3	15.4
DP1	DP1 & A	2,117,308	48.61	0.09	0.36	2,117,308	0.90	0.96	0	0.81	0.88	0	0.09	0.36	179	1591	0.067	13.0	0.047	2.5	23.6	12.2	81.9
DP2	OS2 & B	1,181,592	27.13	0.09	0.36	1,181,592	0.90	0.96	0	0.81	0.88	0	0.09	0.36	120	2110	0.017	16.9	0.036	2.2	32.9	5.7	38.0
DP3	OS3 & C	603,469	13.86	0.09	0.36	60,347	0.90	0.96	543,122	0.81	0.88	0	0.82	0.90	136	2504	0.029	4.1	0.021	2.8	19.0	35.4	65.3
DP4	D	490,256	11.26	0.09	0.36	490,256	0.90	0.96	0	0.81	0.88	0	0.09	0.36	124	881	0.073	10.6	0.061	3.0	15.5	3.5	23.4
DP5	E	435,392	10.00	0.09	0.36	435,392	0.90	0.96	0	0.81	0.88	0	0.09	0.36	157	1110	0.013	21.1	0.056	2.8	27.7	2.3	15.4

Project Name: True North Commons
Project Location: Colorado Springs
Designer: NMS
Notes: Proposed Condition

Average Channel Velocity 5 ft/s (If specific channel vel is used, this will be ignored)
 Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Basin	Contributing Basins	Area		Rational 'C' Values										Flow Lengths		Initial Flow			Channel Flow			Tc	Minor Storm Flow Rate		Major Storm Flow Rate		
		sf	acres	Surface Type 1			Surface Type 2			Surface Type 3			Surface Type 4			Composite		Initial	Channel	Initial	Low Point	Average	Velocity	Channel	Total	Q5	Q100
				C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C5	C100	Area	C5	C100	ft	ft	Tc (min)	Elevation	Slope	(ft/s)	Tc (min)	(min)	cfs	cfs
OS1		1,238,609	28.44	0.09	0.36	1,238,609	0.90	0.96	0	0.81	0.88	0	0.12	0.39	0	0.09	0.36	179	1013	13.0	6678	0.036	2.2	7.7	20.7	7.6	51.4
OS2		466,760	10.72	0.09	0.36	466,760	0.90	0.96	0	0.81	0.88	0	0.12	0.39	0	0.09	0.36	120	948	16.9	6692	0.019	1.7	9.3	26.2	2.5	17.1
OS3		454,202	10.43	0.09	0.36	45,420	0.90	0.96	408,782	0.81	0.88	0	0.12	0.39	0	0.82	0.90	136	1290	4.1	6658	0.037	3.8	5.7	9.8	35.7	65.8
A		878,699	20.18	0.09	0.36	878,699	0.90	0.96	0	0.81	0.88	0	0.12	0.39	0	0.09	0.36	150	426	11.9	6639	0.068	3.4	2.1	14.0	6.5	43.9
B1		360,108	8.27	0.09	0.36	0	0.90	0.96	0	0.81	0.88	360,108	0.12	0.39	0	0.81	0.88	40	871	1.9	6658	0.037	3.8	3.8	5.8	33.2	60.6
B2		354,728	8.15	0.09	0.36	0	0.90	0.96	0	0.81	0.88	354,728	0.12	0.39	0	0.81	0.88	28	1033	2.3	6630	0.040	4.0	4.3	6.6	31.5	57.4
C		149,267	3.43	0.09	0.36	14,927	0.90	0.96	134,340	0.81	0.88	0	0.12	0.39	0	0.82	0.90	48	1214	2.7	6653	0.003	0.8	25.3	28.0	7.1	13.2
D		456,750	10.49	0.09	0.36	0	0.90	0.96	0	0.81	0.88	456,750	0.12	0.39	0	0.81	0.88	17	1228	1.5	6600	0.041	4.1	5.0	6.5	40.7	74.2
E		434,099	9.97	0.09	0.36	0	0.90	0.96	0	0.81	0.88	434,099	0.12	0.39	0	0.81	0.88	83	1086	2.8	6626	0.040	4.0	4.5	7.4	37.2	67.9
DP1	OS1 & A	2,117,308	48.61	0.09	0.36	2,117,308	0.90	0.96	0	0.81	0.88	0	0.12	0.39	0	0.09	0.36	179	1591	13.0	6639	0.047	2.5	10.6	23.6	12.2	81.9
DP2	OS2 & B1	826,868	18.99	0.09	0.36	466,760	0.90	0.96	0	0.81	0.88	360,108	0.12	0.39	0	0.41	0.59	179	2167	8.9	6639	0.035	2.2	16.4	25.3	20.9	50.5
DP3	OS3 & C	603,469	13.86	0.09	0.36	60,347	0.90	0.96	543,122	0.81	0.88	0	0.12	0.39	0	0.82	0.90	136	2504	4.1	6653	0.021	2.8	14.9	19.0	35.4	65.3
DP4	DP3 & B2	958,197	22.00	0.09	0.36	60,347	0.90	0.96	543,122	0.81	0.88	354,728	0.12	0.39	0	0.82	0.90	136	3125	4.1	6658	0.015	3.6	14.5	18.6	56.9	104.8
DP5	D & E	890,849	20.46	0.09	0.36	0	0.90	0.96	0	0.81	0.88	890,849	0.12	0.39	0	0.81	0.88	136	2504	4.3	6653	0.021	3.4	12.3	16.6	55.3	100.8

Channel Report

PIPE RUN 1

Circular

Diameter (ft) = 3.00

Invert Elev (ft) = 1.00

Slope (%) = 1.00

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 55.90

Highlighted

Depth (ft) = 2.10

Q (cfs) = 55.90

Area (sqft) = 5.30

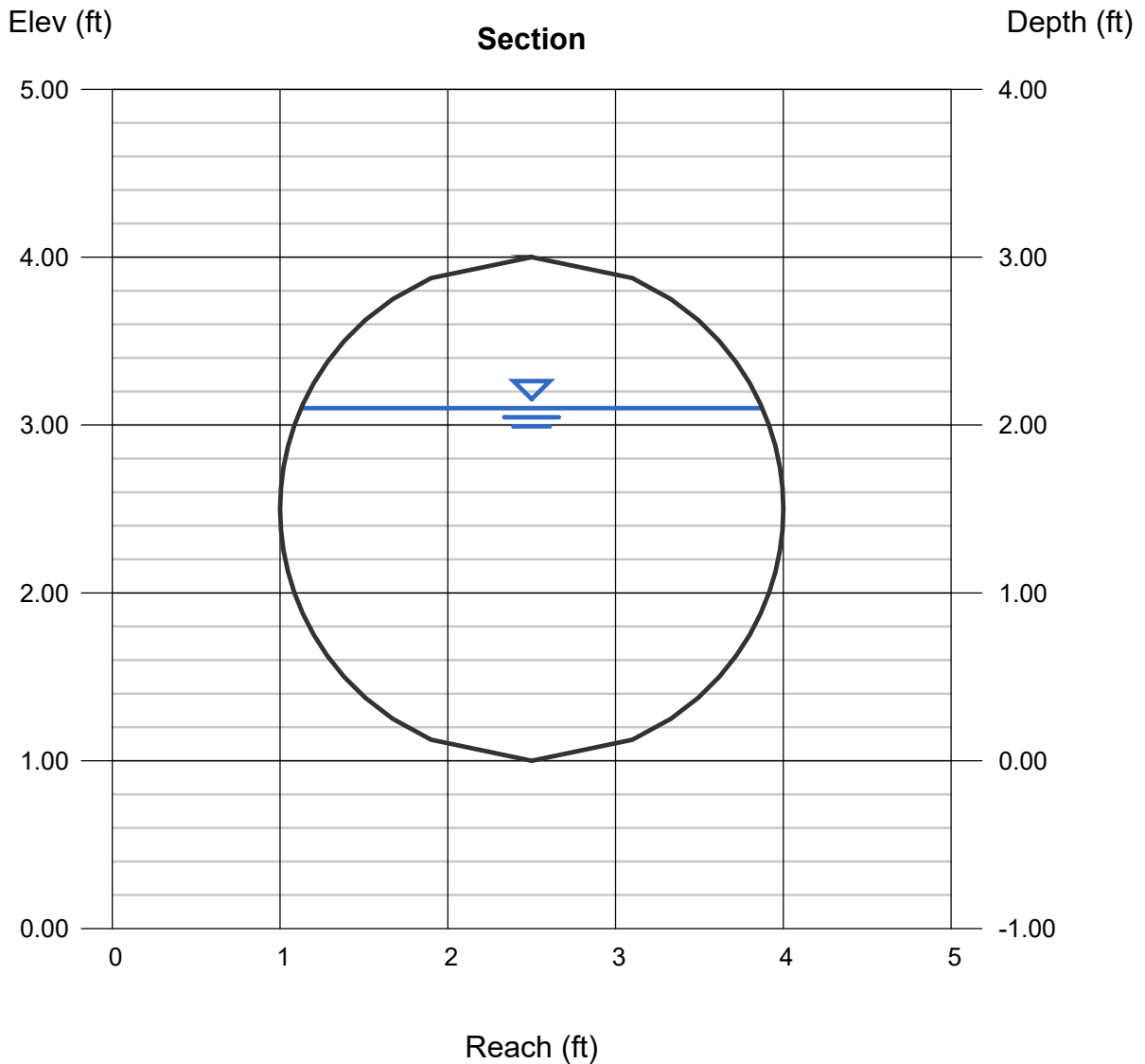
Velocity (ft/s) = 10.56

Wetted Perim (ft) = 5.95

Crit Depth, Yc (ft) = 2.43

Top Width (ft) = 2.75

EGL (ft) = 3.83



Channel Report

PIPE RUN 2

Circular

Diameter (ft) = 4.00

Invert Elev (ft) = 1.00

Slope (%) = 1.00

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 104.80

Highlighted

Depth (ft) = 2.54

Q (cfs) = 104.80

Area (sqft) = 8.42

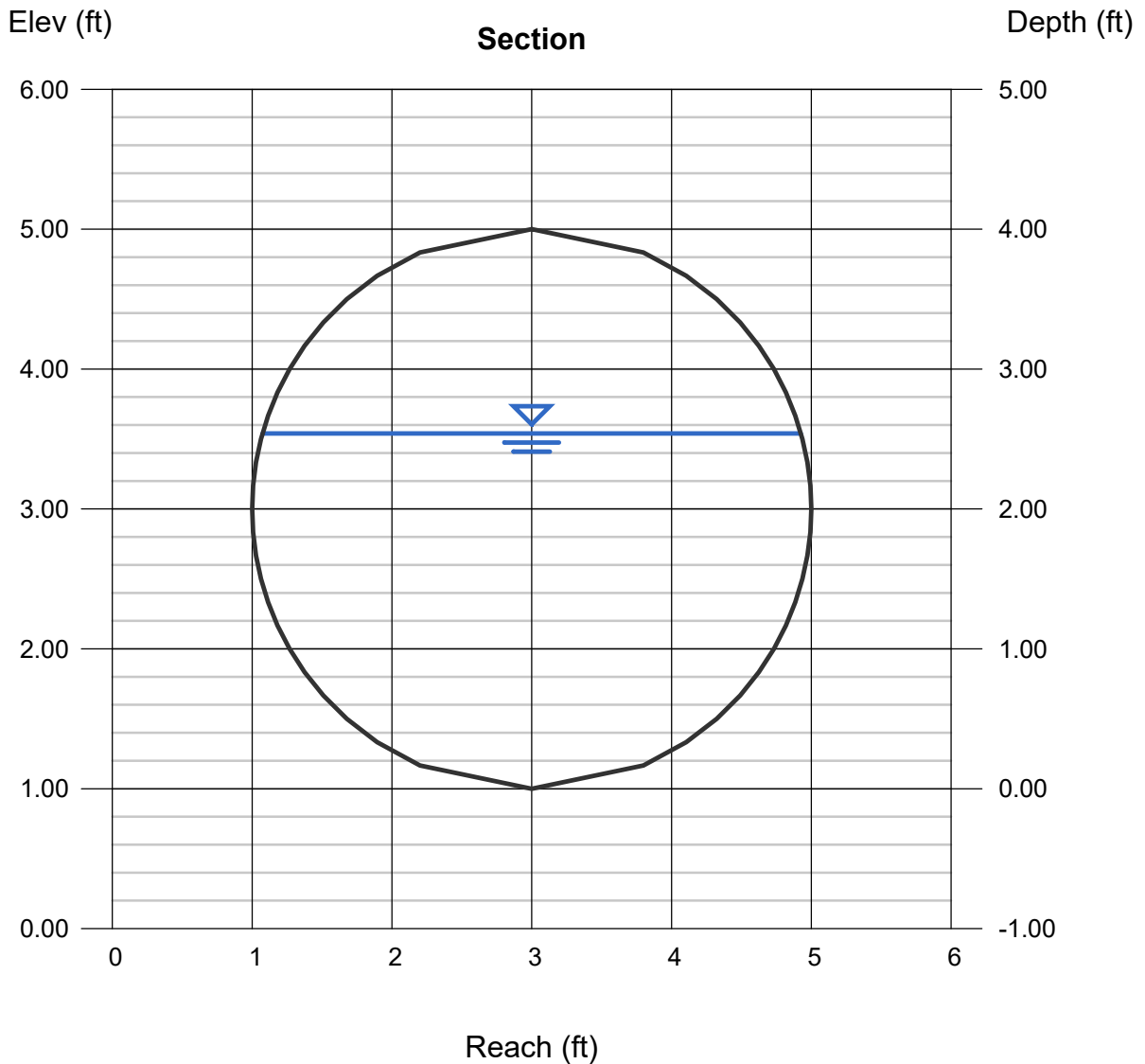
Velocity (ft/s) = 12.44

Wetted Perim (ft) = 7.38

Crit Depth, Yc (ft) = 3.10

Top Width (ft) = 3.85

EGL (ft) = 4.95



Channel Report

PIPE RUN 3

Circular

Diameter (ft) = 3.50

Invert Elev (ft) = 1.00

Slope (%) = 1.00

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 74.20

Highlighted

Depth (ft) = 2.24

Q (cfs) = 74.20

Area (sqft) = 6.51

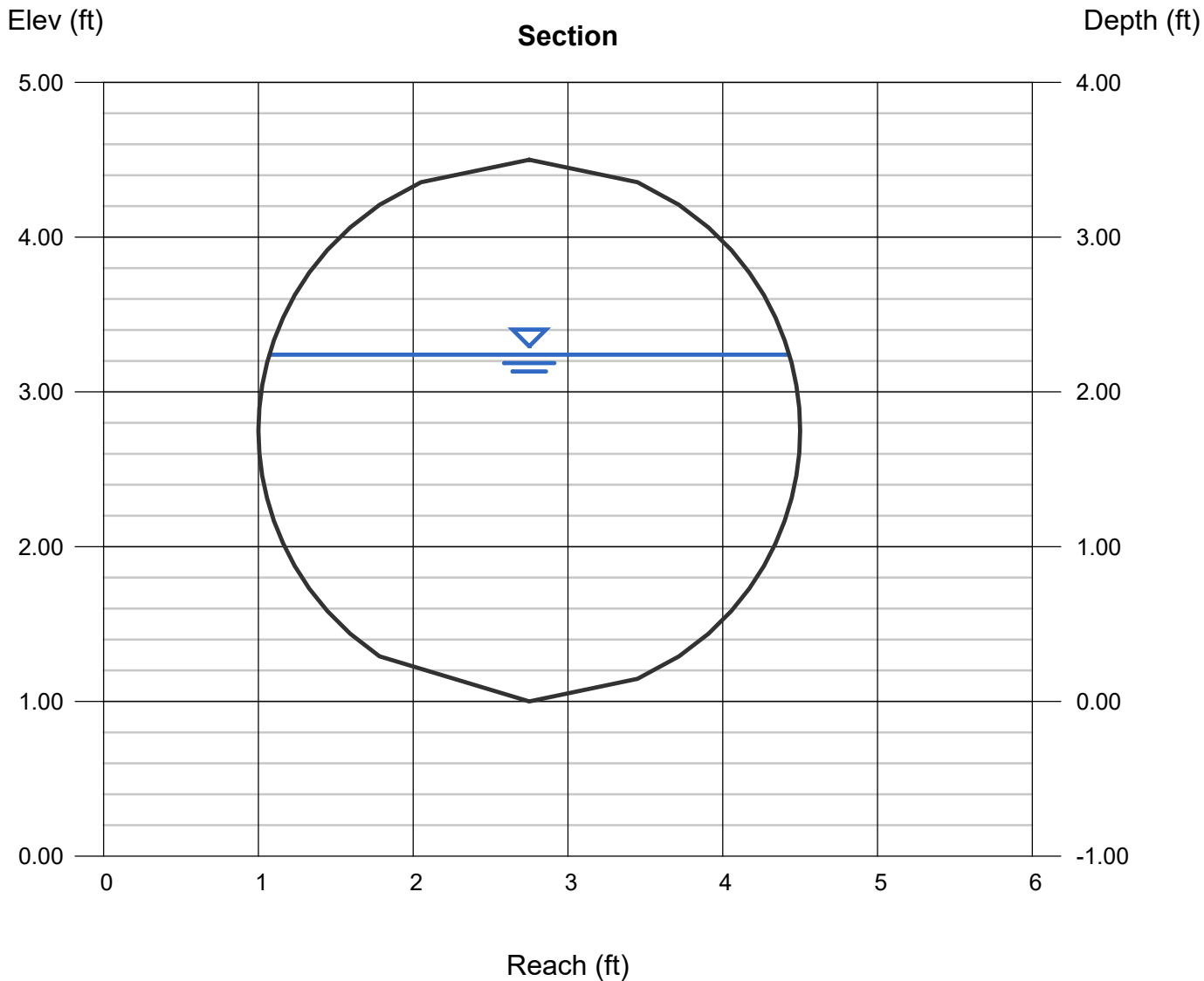
Velocity (ft/s) = 11.41

Wetted Perim (ft) = 6.49

Crit Depth, Yc (ft) = 2.70

Top Width (ft) = 3.36

EGL (ft) = 4.26



Channel Report

PIPE RUN 4

Circular

Diameter (ft) = 4.00

Invert Elev (ft) = 1.00

Slope (%) = 1.00

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 100.80

Highlighted

Depth (ft) = 2.47

Q (cfs) = 100.80

Area (sqft) = 8.16

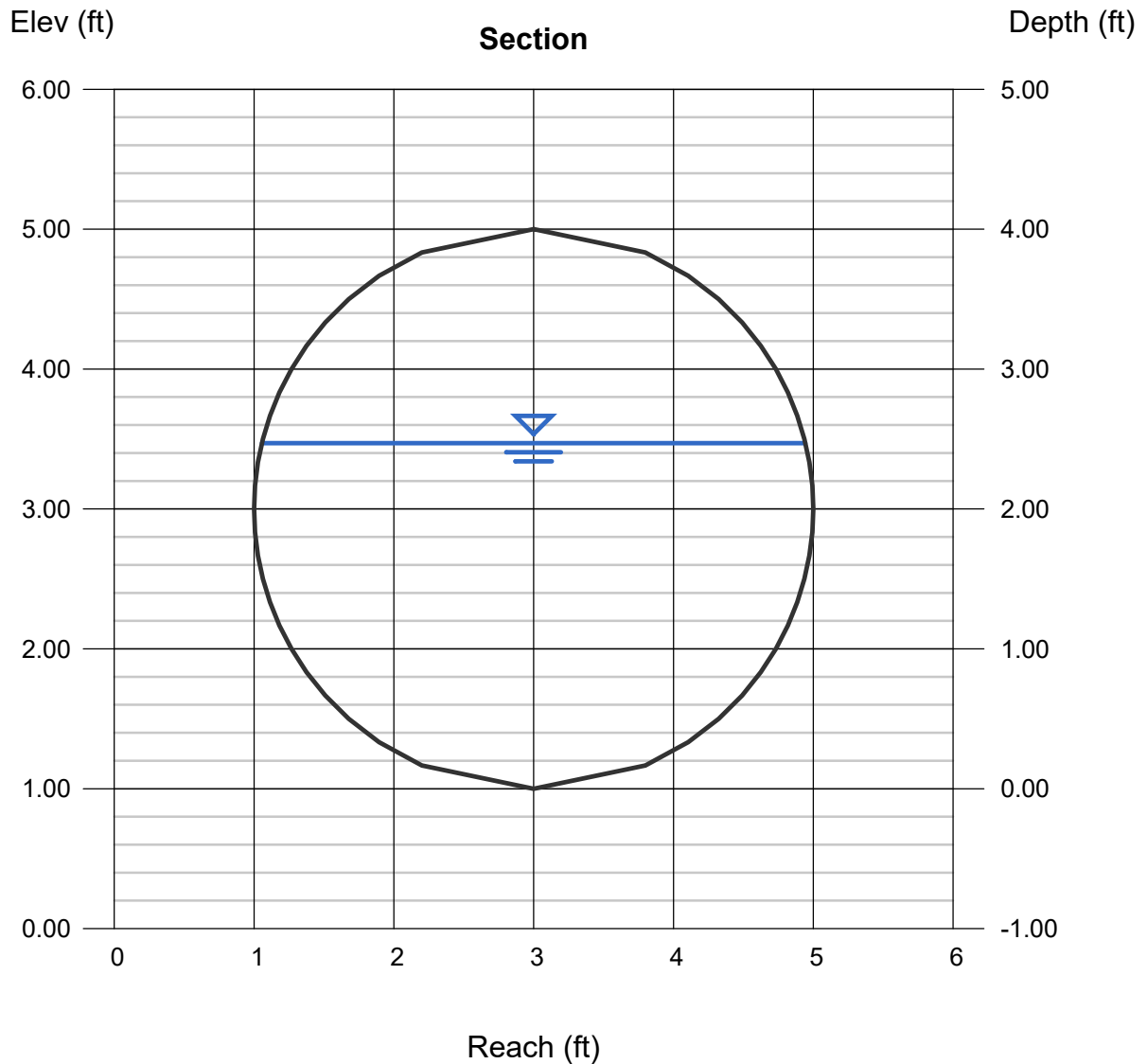
Velocity (ft/s) = 12.35

Wetted Perim (ft) = 7.24

Crit Depth, Y_c (ft) = 3.04

Top Width (ft) = 3.89

EGL (ft) = 4.84



Appendix B – Standard Design Charts and Tables

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

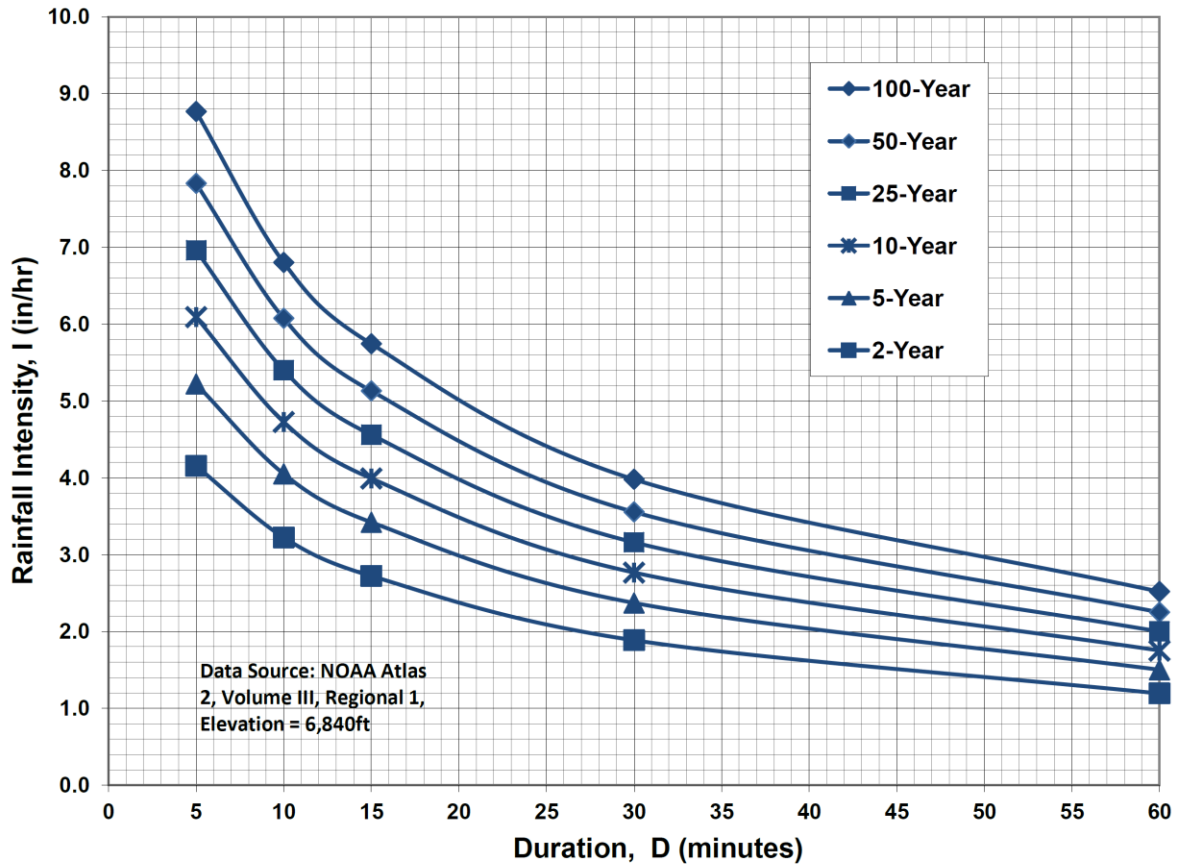
Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_5 = -1.50 \ln(D) + 7.583$$

$$I_2 = -1.19 \ln(D) + 6.035$$

Note: Values calculated by equations may not precisely duplicate values read from figure.

Figure 6-25. Estimate of Average Concentrated Shallow Flow

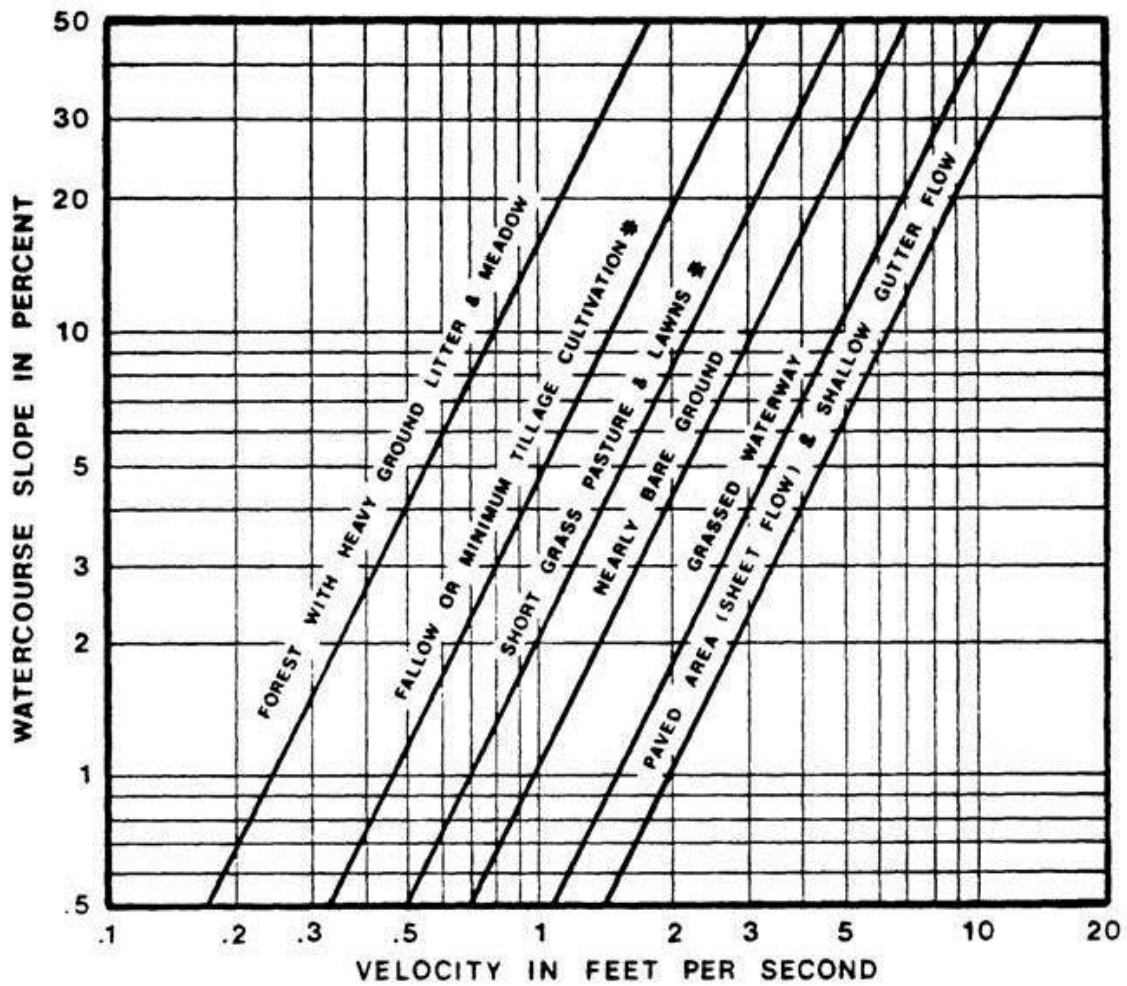


Table 13-2. Allowable Unit Release Rates (cfs/ac)
(For 2-hour Design Storm w/ARC I CNs)

Design Return Period (years)	NRCS Hydrologic Soil Group		
	A	B	C&D
2	0.00	0.01	0.04
5	0.00	0.04	0.30
100	0.10	0.30	0.50

**2018 DRAINAGE, BRIDGE AND POND FEES
CITY OF COLORADO SPRINGS
Effective January 1, 2018**

Basin Name	DBPS Year	Drainage Fee/Acre	Bridge Fee/Acre	Pond Land Fee/Acre	Pond Facility Fee/Acre	Surcharge/Acre
19th Street	1964	\$3,777				
21st Street	1977	\$5,765				
Bear Creek	1980	\$3,710	\$350			
Big Johnson, Crews	1991	\$14,354	\$1,180	\$241		
Black Squirrel Creek	1989	\$13,151	\$1,502	\$789		
Camp Creek	1964	\$2,127				
Cottonwood Creek ¹	2000	\$13,241	\$1,059			\$678
Douglas Creek	1981	\$11,929	\$267			
Dry Creek ²	1966	\$0.00				
Elkhorn Basin ³	n/a	\$0.00				
Fishers Canyon ⁴	1991	\$0.00				
Fountain Creek ⁵	n/a	VAR				
Jimmy Camp Creek	2015	\$7,474			\$2,436	
Kettle Creek ⁶ Old Ranch Trib.	2001	\$0.00				
Little Johnson	1988	\$12,528		\$1,227		
Mesa	1986	\$10,027				
Middle Tributary	1987	\$6,556		\$1,121		
Miscellaneous ⁷	n/a	\$11,157				
Monument Branch ¹²	1987	\$0.00				
North Rockrimmon	1973	\$5,766				
Park Vista (MDDP)	2004	\$16,059				
Peterson Field	1984	\$12,113	\$558			
Pine Creek ⁸	1988	\$0.00				
Pope's Bluff	1976	\$3,839	\$657			
Pulpit Rock	1968	\$6,358				
Sand Creek ⁹	1996	\$11,851	\$713	\$1,070	\$3,445	\$1,249
Shooks Run ¹⁰	1994	\$0.00				
Smith Creek ¹¹	2002	\$0.00				
South Rockrimmon	1976	\$4,508				
Southwest Area	1984	\$12,621				
Spring Creek	1968	\$9,943				
Templeton Gap	1977	\$6,558	\$72			
Windmill Gulch	1992	\$13,678	\$268	\$3,055		

All Drainage, Bridge and Detention Pond Facilities Fees adjusted by 5.7% over 2017 by City Council Resolution No. 157-17 on December 12, 2017 to be effective on January 1, 2018. \$58/acre increase to Sand Creek Drainage Fee approved by Board July 13, 2017. Land Fees are based on the Park Land Dedication Fee which is currently \$76,602/acre (0% change for inflation in 2017).

¹ The 2018 Cottonwood Creek drainage fee consists of a capital improvement fee of \$10,172 per acre and land fee of \$3,069 per acre for a total of \$13,241 per acre. These fees are adjusted annually using different procedures but are combined for collection purposes. **The surcharge fee of \$678/ac is due in cash; credits for prior facility construction cannot be used to offset this fee,** which is deposited into a separate City fund known as the "Cottonwood Creek Surcharge" fund.

² Dry Creek is a closed basin per City Council Resolution No. 118-08 on June 24, 2008

³ Elkhorn Basin is a closed basin per the Annexation Agreements for the area.

⁴ Fishers Canyon is a closed basin per City Council Resolution No. 74-08 on April 22, 2008.

⁵ Pursuant to the recommendation of the Subdivision Storm Drainage Board adopted at its meeting of September 15, 1977, there are exempted and excluded from the provisions of this part construction of the main Fountain Creek Channel from the confluence of Fountain Creek with Monument Creek northwest to the City limits. Land developments taking place adjacent to Fountain Creek shall remain responsible for dedicating rights of way necessary for the channelization of Fountain Creek, and the developers shall continue to pay to the City as a condition of subdivision plat approval the applicable drainage fees. Drainage fees are required in accordance with the appropriate basin study.

⁶ Kettle Creek Old Ranch Tributary is a closed basin per City Council Resolution 139-02 on August 27, 2002.

⁷ Miscellaneous fee is assessed on unstudied areas and the Roswell and Westside Basins.

⁸ Pine Creek is a closed basin per City Council Resolution No. 236-88 on December 13, 1988.

⁹ Sand Creek Detention Pond #2 Surcharge (Ridgeview and Indigo Ranch) = \$1,249/ac. for 2018. Sand Creek Pond fees include two components, one for facility construction costs (\$4,515) and one for land dedication costs (\$1,070), the total Pond fee within Sand Creek is \$4,329/ac.

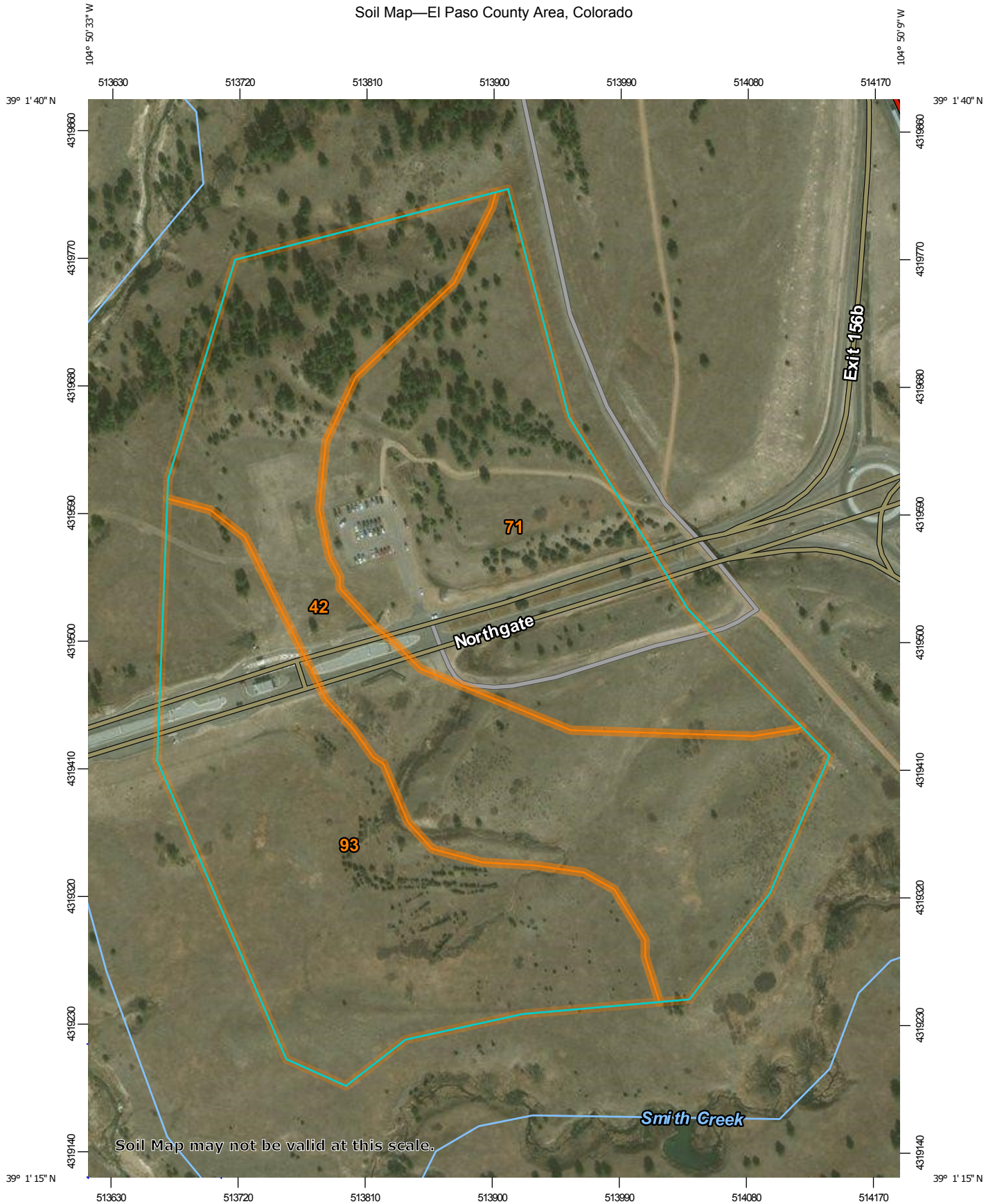
¹⁰ Shooks Run is a closed basin pursuant to the recommendation of the Drainage Board, adopted at its meeting on October 15, 1963.

¹¹ Smith Creek is a closed basin per City Council Resolution 140-02 on August 27, 2002

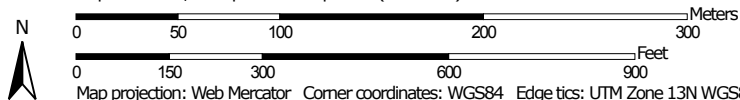
¹² Monument Branch Basin is a closed basin per City Council Res. 177-10 on October 12, 2010

Appendix C – Maps

Soil Map—El Paso County Area, Colorado



Map Scale: 1:3,710 if printed on A portrait (8.5" x 11") sheet.



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




Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

9/13/2018
Page 1 of 3

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 15, Oct 10, 2017

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

Date(s) aerial images were photographed: Feb 22, 2014—Mar 9, 2017

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
42	Kettle-Rock outcrop complex	17.8	36.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	15.0	31.0%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	15.5	32.1%
Totals for Area of Interest		48.2	100.0%

El Paso County Area, Colorado

42—Kettle-Rock outcrop complex

Map Unit Setting

National map unit symbol: 368j
Elevation: 6,800 to 7,700 feet
Frost-free period: 110 to 130 days
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 60 percent
Rock outcrop: 20 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
Natural 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 storage in profile: 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

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 60 percent

Depth to restrictive feature: 0 inches to lithic bedrock

Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Hydrologic Soil Group: D

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

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

Map Unit Setting

National map unit symbol: 369k

Elevation: 6,800 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent

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

Description of Pring

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam

C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High
(2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: Loamy Park (R048AY222CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

93—Tomah-Crowfoot complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 36bb

Elevation: 7,300 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent

Crowfoot and similar soils: 30 percent

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

Description of Tomah

Setting

Landform: Alluvial fans, hills

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile

A - 0 to 10 inches: loamy sand

E - 10 to 22 inches: coarse sand

C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: Sandy Divide (R049BY216CO)

Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Hills, alluvial fans

Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand
E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Minor Components

Other soils

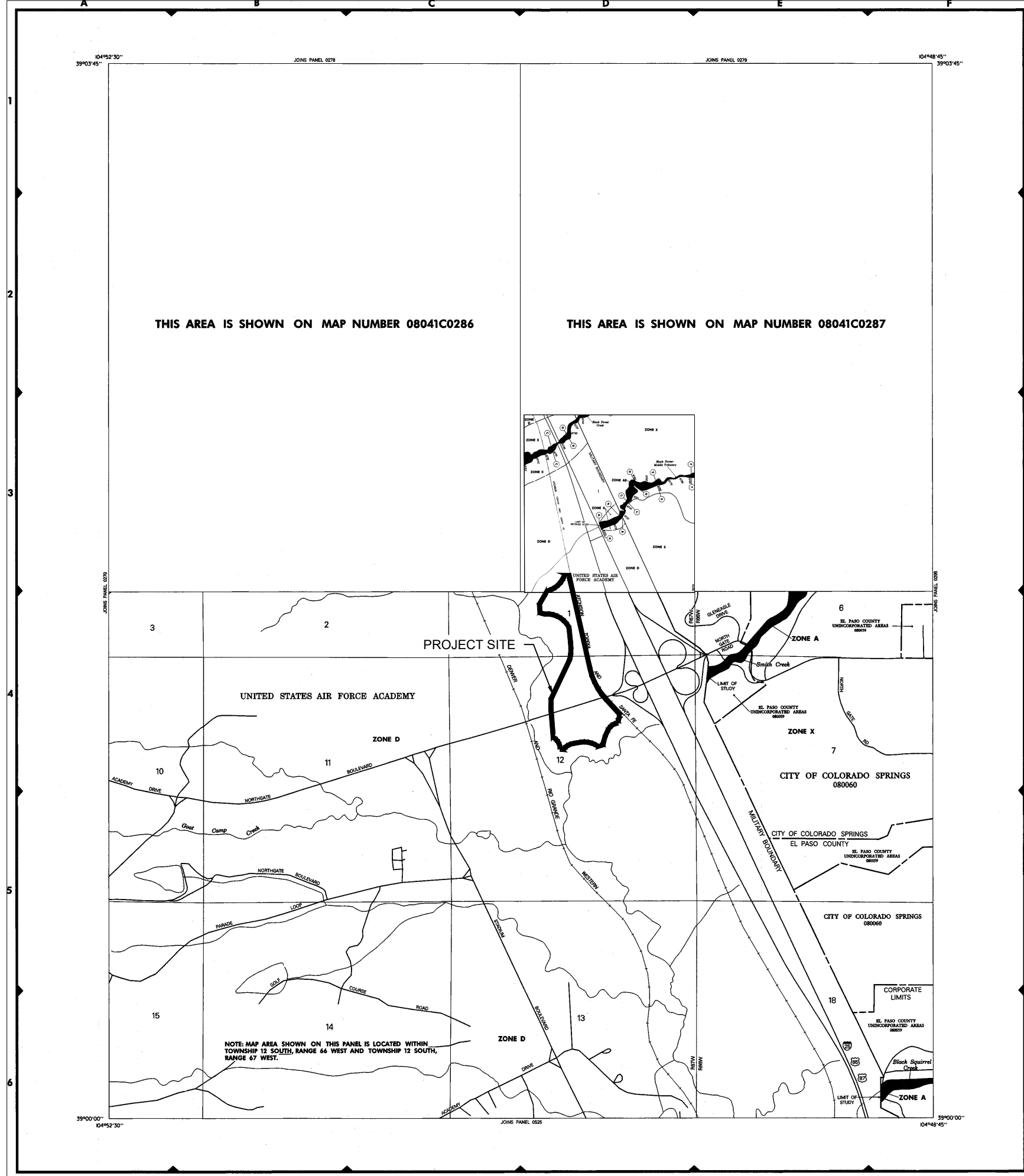
Percent of map unit:
Hydric soil rating: No

Pleasant

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

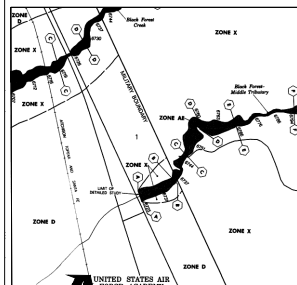
Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017



THIS AREA IS SHOWN ON MAP NUMBER 08041C0286

THIS AREA IS SHOWN ON MAP NUMBER 08041C0287



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 66 WEST AND TOWNSHIP 12 SOUTH, RANGE 67 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR 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 AD** Flood depths of 1 to 3 feet (usually sheet flow or sloping terrain); average depths determined; for areas of abutment flooding, velocities also determined.
- ZONE APP** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- ZONE V** Coastal flood with velocity hazard (wave action); base flood elevations determined.
- ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X** Areas of 500-year flood areas of 100-year flood with average depth of less than 1 foot or with drainage areas less than 1 square mile and areas protected by levees from 100-year flood.

OTHER AREAS

- ZONE D** Areas determined to be outside 500-year floodway.
- ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

- Identified 1982 Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.
- Identified 1992 Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

BOUNDARIES

- Flood Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones
- Base Flood Elevation Line; Elevation in Feet; See Map Index for Elevation Datum.
- Cross Section Line
- Base Flood Elevation in Feet Where Uniform Within Zone; See Map Index for Elevation Datum.
- Elevation Reference Mark
- RM7
- RM2
- River Mile

COORDINATES

Horizontal Coordinates Based on North American Datum of 1983 (NAD 83) Projection.

79°07'30", 32°22'30"

NOTES

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, or all planimetric features outside Special Flood Hazard Areas.

Coastal base flood elevations apply only to lowlands of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AD, APP, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with respect to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

This map may incorporate approximate boundaries of Coastal Barrier Resources System Units and/or Other Protected Areas established under the Coastal Barrier Improvement Act of 1980 (PL 96-380).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see Section 8.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed map index.

MAP REPOSITORY

Refer to Repository Listing on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when additional rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 658-4820.

APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 290 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

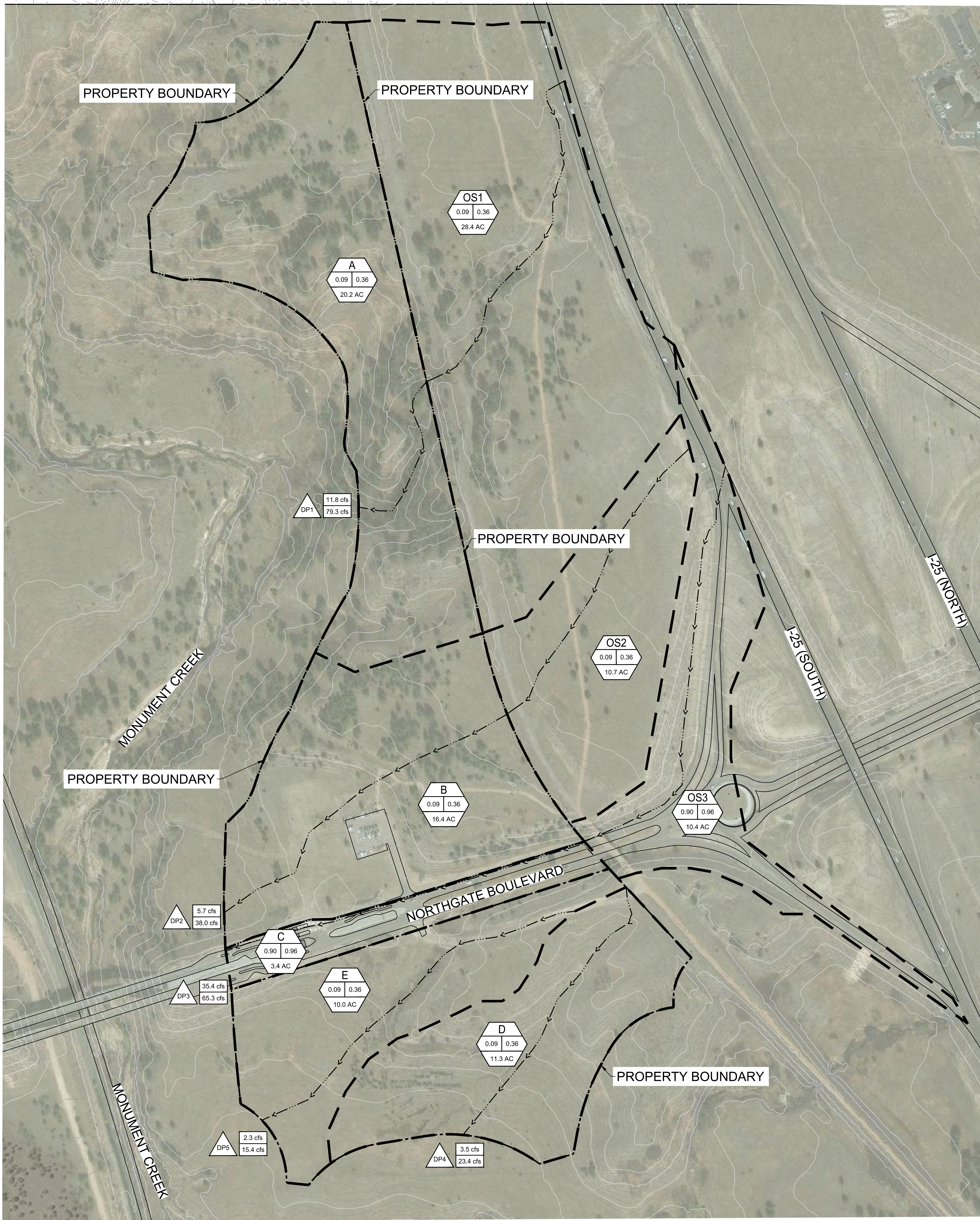
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS CITY OF EL PASO COUNTY UNINCORPORATED AREAS	08000	0290	F
COLORADO SPRINGS CITY OF EL PASO COUNTY UNINCORPORATED AREAS	08005	0290	F

MAP NUMBER 08041C0290 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

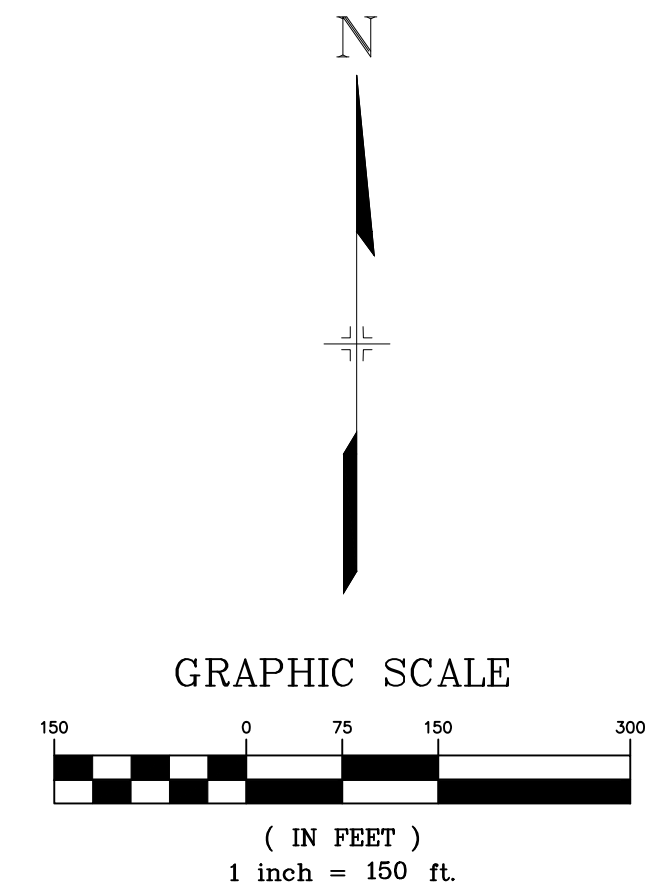


LEGEND

- SUB-BASIN BOUNDARY
- EXISTING CONTOUR
- FLOW DIRECTION
- DESIGN POINT
- SUB-BASIN DESIGNATION
- SUB-BASIN RUNOFF COEFFICIENT (5YR & 100YR)
- SUB-BASIN AREA (AC.)
- 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- PROPERTY LINE

Design Point Summary	
ID	Q100 (cfs)
OS1	51.4
OS2	17.1
OS3	65.8
A	43.9
B	29.6
C	13.2
D	23.4
E	15.4
DP1	81.9
DP2	38.0
DP3	65.3
DP4	23.4
DP5	15.4

NOTE:
ALL STORM SEWER INFRASTRUCTURE TO
BE PRIVATELY OWNED AND MAINTAINED



REFERENCE DRAWINGS	NO.	DATE	DESCRIPTION	BY

COMPUTER FILE MANAGEMENT

FILE NAME: S:\18.1000.001 True North Commons\200 Drainage\201 Drainage Reports\MDDP\DWG\DR01.dwg
 PLOT DATE: December 3, 2018 3:08:56 PM
 THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE

NO.	DATE	DESCRIPTION	BY

PREPARED BY:

MATRIX DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

SEAL

PRELIMINARY
THIS DRAWING HAS NOT
BEEN APPROVED BY
GOVERNING AGENCIES AND
IS SUBJECT TO CHANGE

TRUE NORTH COMMONS

BLUE & SILVER DEVELOPMENT PARTNERS, LLC
COLORADO SPRINGS, COLORADO

EXISTING CONDITIONS DRAINAGE MAP

FOR AND ON BEHALF OF
MATRIX DESIGN GROUP, INC.
PROJECT No. 18.1000.001

DESIGNED BY: NMS
DRAWN BY: NMS
CHECKED BY: GGS

SCALE: HORIZ. 1"=150'
VERT. N/A

DATE ISSUED: 12/2018
SHEET 1 OF 2

DRAWING No. **DR01**

