

FINAL DRAINAGE REPORT

FOR

**WIDEFIELD WATER & SANITATION
DISTRICT**

BOOSTER 2 PUMP STATION REPLACEMENT

EL PASO COUNTY, COLORADO

100% Submittal

February 2020

Prepared for:

**JDS Hydro Consultants, Inc.
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Colorado Springs, CO 80919**

Prepared by:



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Project #70-077
CID No. 2019.815.2027
PCD Project # PPR-21-069

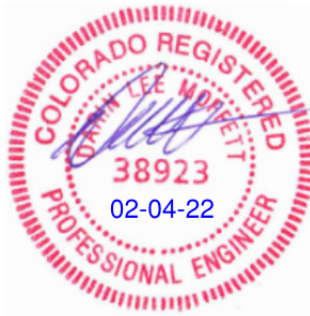
**FINAL DRAINAGE REPORT
FOR
WIDEFIELD WATER & SANITATION DISTRICT
BOOSTER 2 PUMP STATION REPLACEMENT**

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was 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 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.

Darin L. Moffett, P.E. #38923
For and on Behalf of M&S Civil Consultants, Inc



DEVELOPER'S STATEMENT

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

BY: *Robert D. Bangler*

TITLE: *District Engineer*
DATE: *2/1/2022*

ADDRESS: Widefield Water and Sanitation District
8495 Fontaine Blvd.
Colorado Springs, CO80925

EL PASO COUNTY'S STATEMENT

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

BY: _____ DATE: _____
Jennifer Irvine, P.E.
County Engineer/ECM Administrator

CONDITIONS

**FINAL DRAINAGE REPORT
FOR
WIDEFIELD WATER & SANITATION DISTRICT
BOOSTER 2 PUMP STATION REPLACEMENT**

TABLE OF CONTENTS

PURPOSE	4
GENERAL LOCATION AND DESCRIPTION	4
SOILS	4
HYDROLOGIC CALCULATIONS	5
HYDRAULIC CALCULATIONS	5
FLOOD PLAIN STATEMENT	5
DRAINAGE CRITERIA	5
FOUR STEP PROCESS	5
EXISTING DRAINAGE CONDITIONS	5
PROPOSED DRAINAGE CONDITIONS	6
EROSION CONTROL	7
CONSTRUCTION COST OPINION	8
DRAINAGE AND BRIDGE FEES	8
SUMMARY	8
REFERENCES	9

APPENDIX

Vicinity Map
Soils Map
Annotated FIRM Panel
Hydrologic Calculations
Hydraulic Calculations
Grading Erosion Control Plan
Proposed and Existing Drainage Maps

**FINAL DRAINAGE REPORT
FOR
WIDEFIELD WATER & SANITATION DISTRICT
BOOSTER 2 PUMP STATION REPLACEMENT**

PURPOSE

This document is intended to serve as the Final Drainage report for the Widefield Water & Sanitation District Booster 2 Pump Station. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the sitesafely.

GENERAL LOCATION AND DESCRIPTION

The Widefield Water & Sanitation District (WWSD) Booster 2 Pump Station and associated infrastructure and site improvements are to be constructed within both an un-platted parcel and Tract D of Widefield County Club Heights East both of which contiguous and under the ownership of the WWSD.

The parcels of land are located within a portion of the northwest quarter of the southeast quarter and within a portion of the southwest corner of the northeast quarter of Section 19, Township 15 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The site to the north and south by developed residential lots (Lot 7 & Lot 8 of Block 1) within Widefield Country Club Heights East and to east by existing Metropolitan Street Rights-of-Way and to the west by a portion of the Fountain Mutual Irrigation Company Channel (FMIC). Flows from this site are tributary to the East Big Johnson drainage basin and are ultimately tributary to Fountain Creek.

With the exception of the existing tank, pump house, fences and underground utilities the two parcels remain largely undeveloped. Vegetation is sparse, consisting of native grasses. The site has likely experienced overlot grading activities associated within the construction of the existing facilities and adjacent subdivision which occurred in the latter part of the 1970's. The existing site terrain generally slopes from east to west at grade rates that vary between 1% and 10%. The side slopes of the adjacent FMIC channel, directly to the west and southwest of the subject possess steep vegetative slopes that typically range between 1:1-2:1 (H:V).

As previously discussed the proposed site improvement will include a new pump station building and gravel access/parking lot. A small asphalt or concrete access drive with cantilever gate and additional security fencing will added along with below ground utility extensions necessary to connect the pump house to the existing tank site and subsequent waterlines. A small storm water collection system and landscaping will also be provided.

SOILS

Soils for this project are delineated on the Soils map in the appendix as have been determined to be Truckton Sandy Loam (97) and Wiley Silt Loam which have been characterized as Hydrologic Soil Types "A". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". As previously discussed, vegetation on the site is sparse, consisting of native grasses and weeds.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0756 G, effective date December 07, 2018. An annotated FIRM Panel (Floodplain Map) is included in the Appendix to illustrate that NO portion of the site lies within the regulatory 100-year floodplain.

DRAINAGE CRITERIA

Unresolved. Per FEMA website panel number is 08041C0952G. Please revise.

This drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manuals. Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having areas less than 100 acres.

FOUR STEP PROCESS/WATER QUALITY

The proposed project is considered to be development with less than 1 acre of disturbance and is not part of a large common plan of development or sale, as a result no water quality improvements are required per the El Paso County Municipal Separate Storm Sewer System (MS4) Permit.

The proposed and existing conditions have been developed for information purposes and to ensure runoff is safely routed and erosion control is properly implemented. As the proposed earthwork moving activities are anticipated to exceed 500 cubic yards a Stormwater manage Program Plan (SWMP) and Erosion and Stormwater Quality Control Permit (ESQCP) will be provided. A copy of the Proposed Grading and Erosion Control Plans are provided within the appendix of this report.

EXISTING DRAINAGE CONDITIONS

The two parcels that make up the existing site consist of approximately 1.69 acres. With the exception of the existing tank, pump house, fences and underground utilities the parcels remain largely undeveloped. The existing site terrain generally slopes from east to west at grade rates that vary between 1% and 10%. A small ridgeline which runs east to west generally divides the subject site into a north and south basin. With the exception of a small portion of the adjacent residential lot located to the south of the site and a very small portion of the adjacent Rights-of-Way (0.01 ac), the site is not burdened by offsite runoff, having nearly all of the site drainage directed to the adjacent Fountain Mutual Irrigation Company Channel as sheet flow. Onsite inspection shows limited reeling along the channel slopes from subject site

runoff. A small onsite area located at the southeast corner of the site (0.03 acres) discharges to the adjacent Metropolitan street curb and gutter where it is direct to a low point and sump inlet located north of the subject site. Flows intercepted by the inlet appear to be directed to the FMIC via an existing storm sewer (located to the north of lot 7).

Detailed Existing Drainage Discussion

Basin OS1, 0.01 acres, ($Q_5 < 0.1$ cfs, $Q_{100} < 0.1$ cfs), consists of a small area of existing vegetated rights of way located to the west of the subject site. Runoff produced within the Basin OS1 sheet flows to into Basin A.

Basin A, 0.83 acres, ($Q_5 = 0.3$ cfs, $Q_{100} = 1.9$ cfs), consists of a portion of the undeveloped Tract D. Runoff produced within the Basin A combines with flows from Basin OS1 and travels as both sheet and concentrated runoff to the northwest and to the existing FMIC channel. The combined runoff from the 0.84 acres totals 0.3 cfs and 2.0 cfs in the 5 and 100 year storm events respectively at east channel bank (Design Point 1).

Basin OS2, 0.11 acres, ($Q_5 = 0.1$ cfs, $Q_{100} = 0.4$ cfs), consists of a portion of residential Lot 3, Blk 1 of Widefield County Club Heights East. Runoff produced within the Basin OS2 travel west as sheet flow and enters Basin B along the southern property boundary.

Basin B, 0.83 acres, ($Q_5 = 0.4$ cfs, $Q_{100} = 2.3$ cfs), consists of the majority of the south half of the site and includes the existing pump house and water tank. Runoff from Basin B combines with flows from offsite basin OS2 and travels as sheet and concentrated flow to the south west property line and the existing FMIC channel at Design Point 2 ($Q_5 = 0.3$ cfs, $Q_{100} = 2.7$ cfs).

Basin C, 0.03 acres, ($Q_5 < 0.1$ cfs, $Q_{100} = 0.1$ cfs), consists of a segment of existing vegetated roadway rights of way. Runoff produced within the Basin C sheet flows to the west curb and gutter of existing Metropolitan Street. Flows collected with the west curb and gutter section is conveyed north to an existing offsite sump inlet.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

In the proposed condition the site improvements will include installation of a new pump station building and gravel access/parking lot. A small asphalt or concrete access drive with cantilever gate and additional security fencing will added along with the various below ground utility extensions necessary to connect the pump house to the existing tank site and subsequent waterlines. Runoff within the south half of the two parcels generally not be disturbed and will continue to drain as in the existing condition. While drainage from the north half of the site, where improvements are proposed, will now be collected and conveyed by a pair of earthen swales which will direct runoff to a proposed storm drain located at the far west end of the site. A small offsite easement will be required to construct and maintain the proposed storm sewer pipe and outfall. A riprap pad is proposed at the terminus of the pipe to protect the existing channel from any erosion that otherwise might be caused from the existing concentrated. In addition to the riprap armoring around the proposed flared end section, seeded permanent erosion control blanket is proposed to aid in protecting and restoring vegetation to the steep slope of the FMIC channel, where the channel bank will need to be removed and replaced in order to install the pipe. A small amount of riprap is also planned at the entrance of the storm sewer to stabilize the steep slope at the proposed FES. A detailed drainage discussion for each proposed conditions sub-basin is described

below. A worksheet detailing the calculated coefficients for each sub-basin and developed times of concentration can be found in the appendix under Hydrologic Calculations.

Detailed Drainage Discussion

Basin A1, 0.07 acres, ($Q_5 < 0.1$ cfs, $Q_{100} = 0.2$ cfs), consists of a segment of slope grading located along the north and northwest sides of the development. Flows produced within the Basin A1 sheet flow to the existing FMIC channel as in the existing condition. Flows reaching the northwest boundary of the site at Design Point 1 are calculated at less than 0.1 cfs the 5 year event and 0.2 cfs in the 100 year stormevent.

Basin A2, 0.50 acres, ($Q_5 = 1.4$ cfs, $Q_{100} = 2.5$ cfs), consists of a portion of the proposed booster pump house, proposed gravel parking area as well as re-vegetated portions of the existing lot. Runoff from Basin A1 is routed as surface runoff via a min. 1' deep earthen swale to DP1A.

Basin OS1, 0.01 acres, ($Q_5 < 0.1$ cfs, $Q_{100} < 0.1$ cfs), consists of a small area of existing vegetated rights of way located to the west of the subject site. Runoff produced within the Basin OS1 sheet flows to into Basin A3.

UNRESOLVED: areas do not match those shown on drainage map. Revise to remove discrepancies.

Basin A3, 0.10 acres, ($Q_5 = 0.1$ cfs, $Q_{100} = 0.4$ cfs), consists of a portion of the proposed booster pump house, proposed gravel parking area as well as re-vegetated portions of the existing lot. Runoff from Basin A3 is routed as surface runoff via a min. 1' deep earthen swale to DP1A, where it ultimately combines with flows from Basins OS1 and A2 at a proposed 18" private reinforced concrete culvert totaling $Q_5 = 0.8$ cfs, $Q_{100} = 2.6$ cfs. The installation of a culvert to convey runoff from the site directly to the FMIC, will significantly reduce any potential erosion caused by the uncontrolled release of developed runoff across the steep channel embankment slopes.

JDS Hydro has determined in correspondence with the FMIC that approximately 50 cfs is conveyed by the irrigation channel. Given an calculated slope of 0.05%, a bottom width of approximately 9' and 1 to 1 (H:V) side slopes and a n value of 0.03, the calculated normal depth of the channel is approximately 30" at a velocity of 1.7' feet per second. This low tailwater condition will not adversely affect the proposed hydraulics of the proposed storm culvert given the pipe grade and entrance elevation and limited runoff there by allowing for free discharge. Given the design slope of 13.5% the proposed 18" culvert will convey the 2.6 cfs at a normal depth of 3.2" and at a velocity of 12.4 feet per second in the 100 year event. Refer to the Hydraulic Calculations portion of the appendix for additional information.

Basin OS2, 0.11 acres, ($Q_5 = 0.1$ cfs, $Q_{100} = 0.4$ cfs), consists of a portion of residential Lot 3, Blk 1 of Widefield County Club Heights East. Runoff produced within the Basin OS2 travel west as sheet flow and enters Basin B along the southern property boundary.

Basin B, 0.83 acres, ($Q_5 = 0.4$ cfs, $Q_{100} = 2.1$ cfs), consists of the majority of the south half of the site and includes the existing pump house and water tank. Runoff from Basin B combines with flows from offsite basin OS2 and travels as sheet and concentrated flow to the south west property line and the existing FMIC channel at Design Point 2 ($Q_5 = 0.6$ cfs, $Q_{100} = 2.9$ cfs).

Basin C, 0.03 acres, ($Q_5 < 0.1$ cfs, $Q_{100} = 0.1$ cfs), consists of a segment of existing vegetated roadway rights of way. Runoff produced within the Basin C sheet flows to the west curb and gutter of existing Metropolitan Street. Flows collected with the west curb and gutter section is conveyed north to an existing offsite sump inlet.

It should be noted that the estimated combined runoff discharged from the site in the existing condition totals ~ 4.7 cfs (direct addition of DP1, DP1A & DP2) while the total discharge from the proposed

condition is only slightly higher at 5.7 cfs (direct addition of DP1&DP2). These minor increases in flows of approximately 1 cfs are considered negligible. With the installation of the recommended infrastructure, and the presence of an adequate outfall structure, no negative effects are anticipated to water quality or downstream facilities. Furthermore thru the implementation of outfall protection , slope stabilization as well as site stabilization (reseeding) the potential of erosion from construction and function should be mitigated.

EROSION CONTROL

It is the policy of the El Paso County that we submit a grading and erosion control plan with the drainage report. Proposed erosion control blanket, silt fence, vehicle traffic control, concrete washout area are proposed as erosion control measures. Recommendations for Stabilized staging area and stockpile management are also included.

CONSTRUCTION COST OPINION

(Private) Drainage Facilities NON-Reimbursable:

Item	Description	Quantity	Unit Cost	Cost
1.	18" Storm Sewer	50 LF	\$60 /LF	\$3,000.00
2.	18" Flared End Sections	2 EA	\$900 /EA	\$1,800.00
3.	D50=9" Riprap	5 CY	\$50 /CYF	\$250.00
4.	Erosion Control Blanket	42 SY	\$9 /SY	\$575.00
				\$575.00
Total \$				\$5,625.00

DRAINAGE & BRIDGE FEES

The site is currently platted as a Tract. No re-plat is being submitted and the structure is being constructed on the Tract via administrative relief (ADM-19-026) in which it was determined that the proposed project will not require a "1041" permit. Thus no drainage and bridge fees are required for the development of the site.

M &S Civil Consultants, Inc. (M&S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2017.

SUMMARY

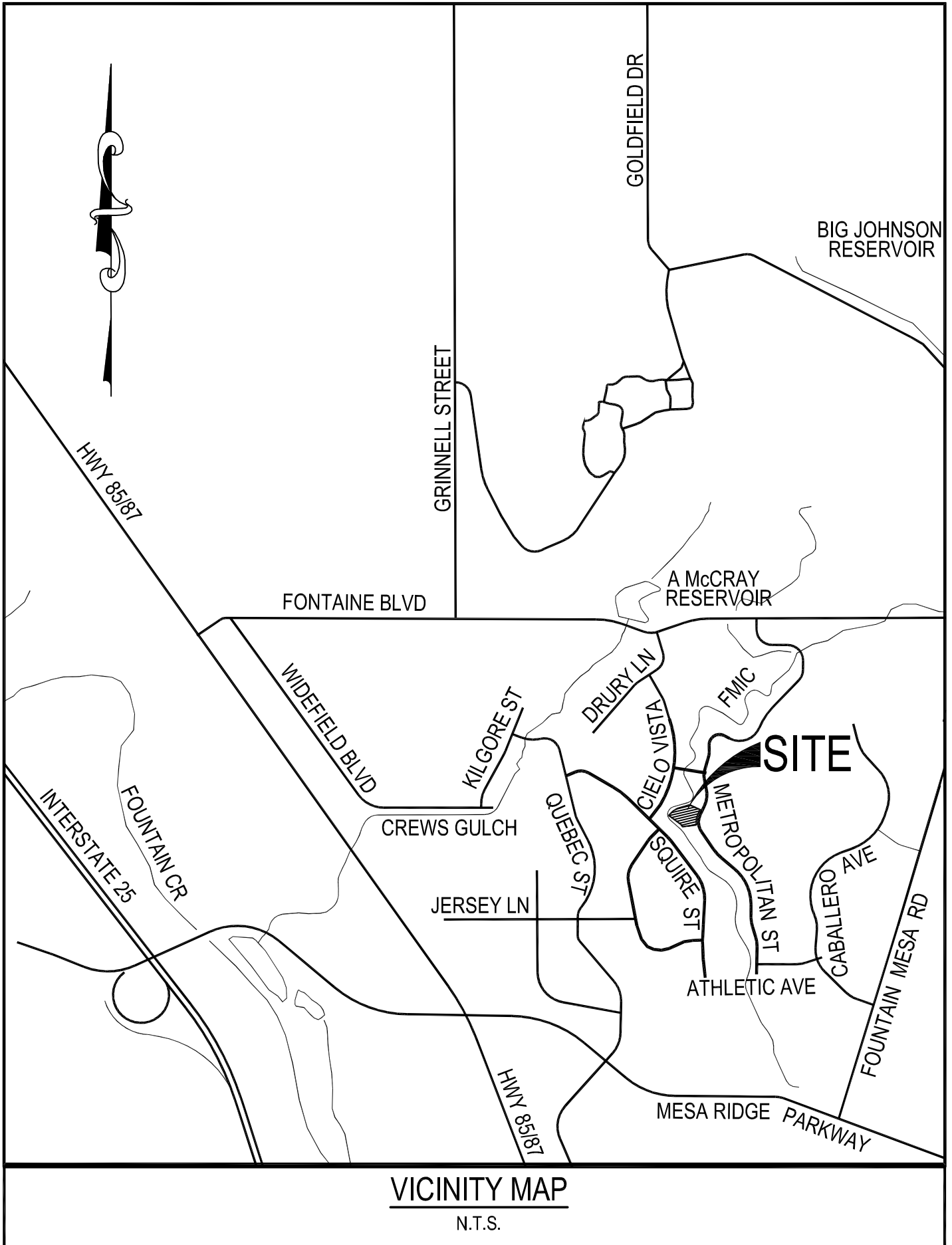
The installation of the proposed facilities associated the construction of Widefield Water and Sanitation District Booster 2 Pump Station site shall not adversely affect adjacent or downstream properties per this final drainage report. The proposed drainage facilities will adequately convey, detain and route runoff from tributary onsite and existing offsite flows to the Sand Creek Drainage channel. Maintenance of the proposed private facilities shall be the responsibility of the WWSD.

REFERENCES

- 1.) "City of Colorado Springs/County of El Paso Drainage Criteria Manual as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs /El Paso County Drainage Criteria Manual as revised in May 2014".
- 2.) "Urban Storm Drainage Criteria Manual Volume 1, 2, & 3 Urban Drainage and Flood Control District, dated 2016."
- 3.) Web Soil Survey, USDA NRCS Soils Map <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>
- 4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date December 7, 2018. <https://msc.fema.gov/portal/home>

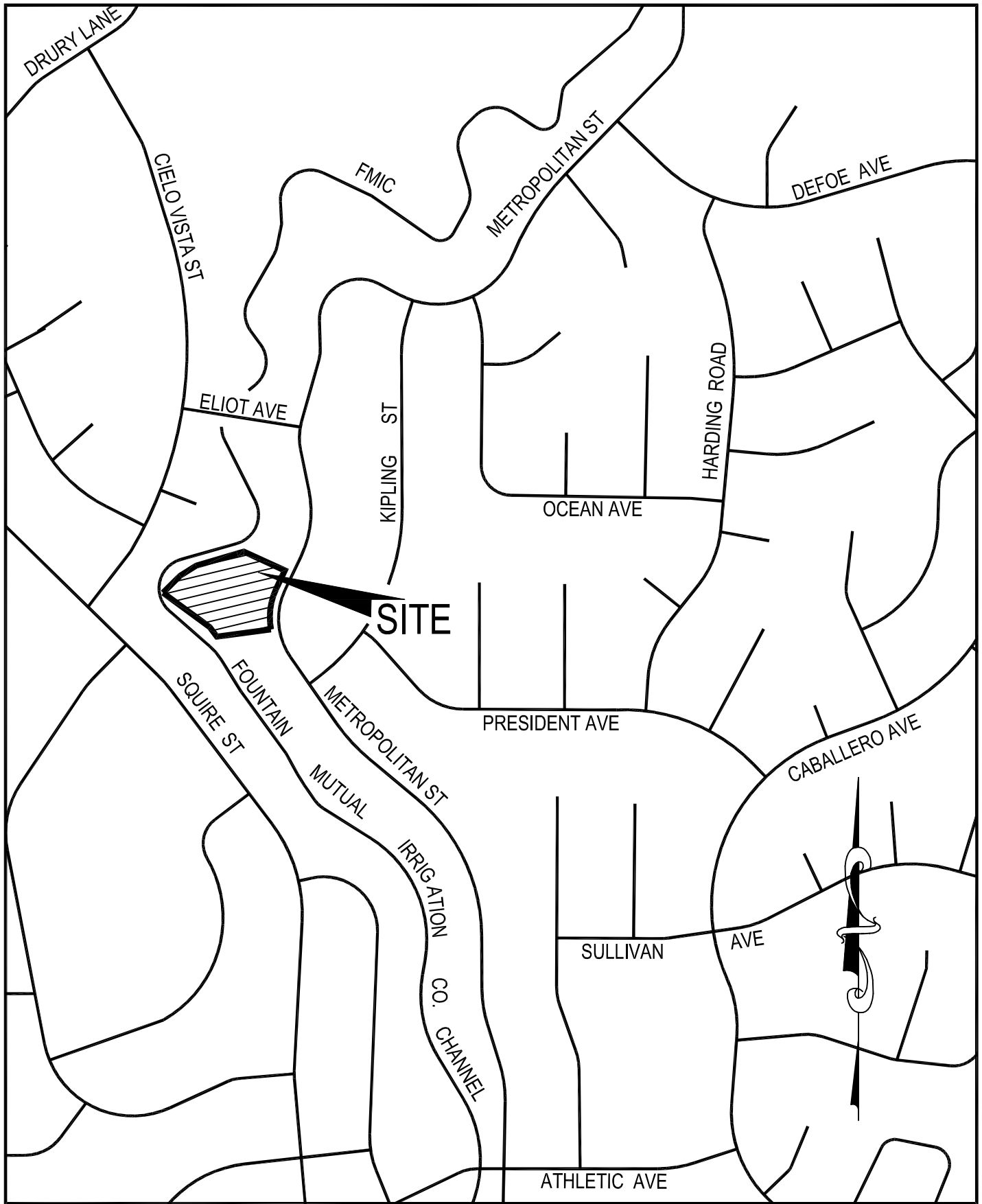
APPENDIX

VICINITY MAP



VICINITY MAP

N.T.S.



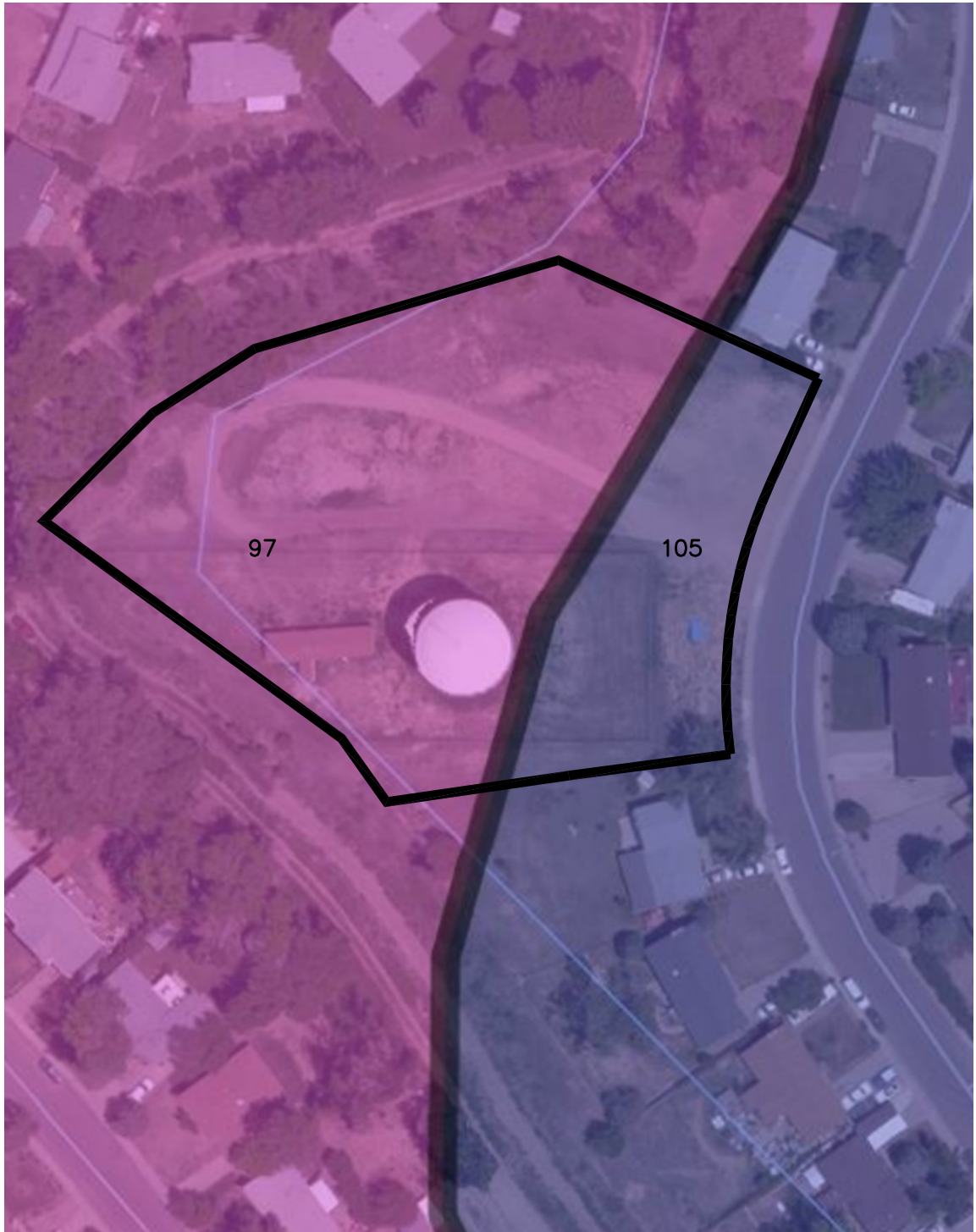
SITE MAP

N.T.S.

SOILS MAP



NOT TO SCALE



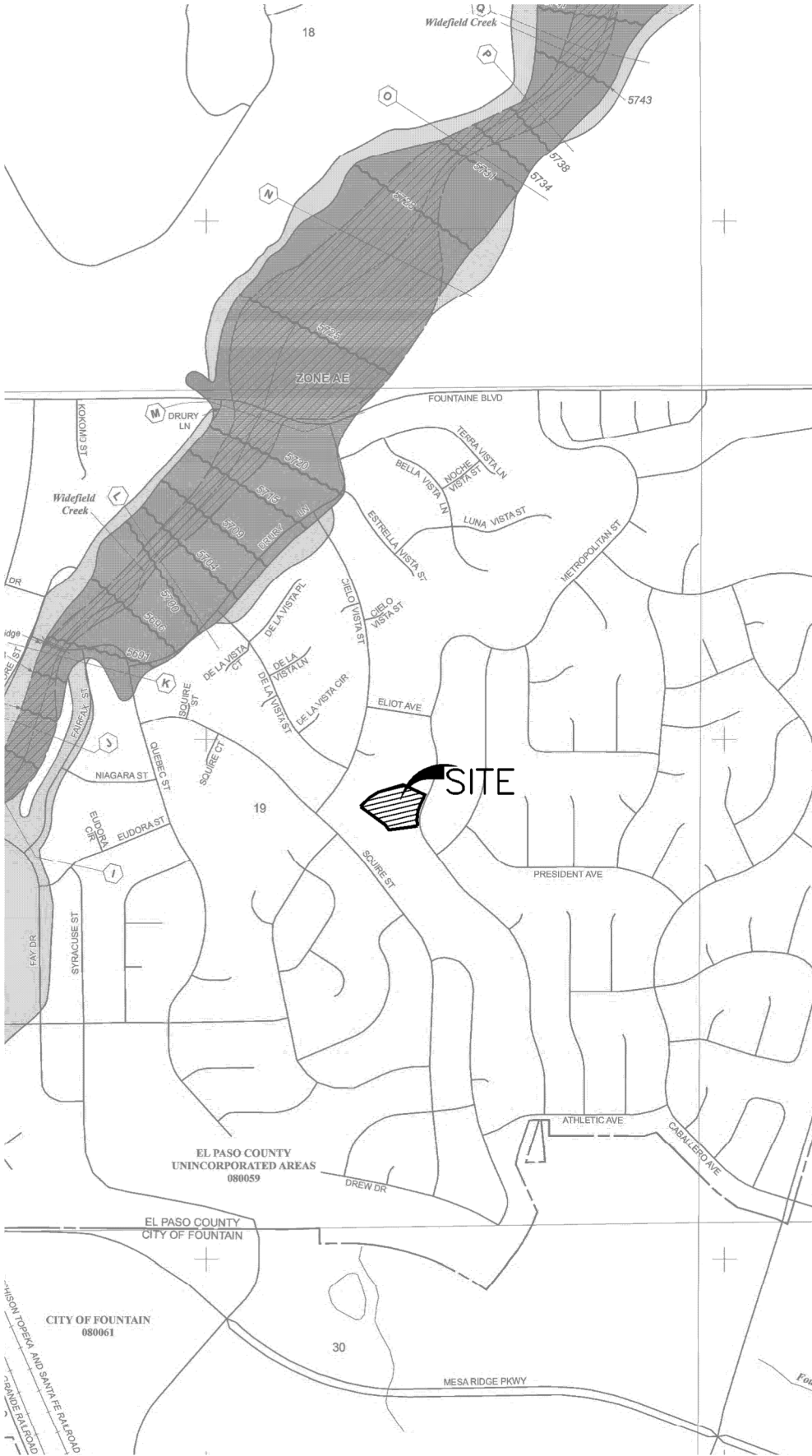
MAP UNIT SYMBOL	MAP UNIT NAME	RATING
97	Truckton sandy loam, 3 to 9 percent slopes	A
108	Wiley silt loam, 3 to 9 percent slopes	B

WIDEFIELD
WATER AND
SANITATION
DISTRICT
BOOSTER 2
PUMP STATION

SOILS MAP



ANNOTATED FIRM PANEL



NFIP

PANEL 0952G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 952 OF 1300
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	08059	0952	G
FOUNTAIN, CITY OF	08061	0552	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
08041C0952G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

WIDEFIELD WATER AND
 SANITATION DISTRICT
 BOOSTER 2 PUMP STATION
 FLOODPLAIN MAP



18
19
30

WIDEFIELD CREEK AND SANTA FE RAILROAD
 PANHANDLE RAILROAD

EL PASO COUNTY
 UNINCORPORATED AREAS
 080059

EL PASO COUNTY
 CITY OF FOUNTAIN

CITY OF FOUNTAIN
 080061

SITE

PRESIDENT AVE

ATHLETIC AVE

MESA RIDGE PKWY

Fou.

HYDROLOGIC CALCULATIONS

WIDEFIELD WATER AND WASTEWATER DISTRICT - BOOSTER 2 PUMP STATION
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

BASIN	TOTAL AREA (SF)	TOTAL AREA (Acres)										RUNOFF COEFFICIENT	
			AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	C ₅	C ₁₀₀
<i>A</i>	<i>36008.1896</i>	<i>0.83</i>	<i>0.00</i>	<i>0.90</i>	<i>0.96</i>	<i>0.00</i>	<i>0.59</i>	<i>0.70</i>	<i>0.83</i>	<i>0.09</i>	<i>0.36</i>	<i>0.09</i>	<i>0.36</i>
<i>B</i>	<i>36198.4781</i>	<i>0.83</i>	<i>0.03</i>	<i>0.90</i>	<i>0.96</i>	<i>0.00</i>	<i>0.59</i>	<i>0.70</i>	<i>0.80</i>	<i>0.09</i>	<i>0.36</i>	<i>0.12</i>	<i>0.38</i>
<i>C</i>	<i>1281.6639</i>	<i>0.03</i>	<i>0.00</i>	<i>0.90</i>	<i>0.96</i>	<i>0.00</i>	<i>0.59</i>	<i>0.70</i>	<i>0.03</i>	<i>0.09</i>	<i>0.36</i>	<i>0.09</i>	<i>0.36</i>
<i>OS1</i>	<i>520.2481</i>	<i>0.01</i>	<i>0.00</i>	<i>0.90</i>	<i>0.96</i>	<i>0.00</i>	<i>0.30</i>	<i>0.50</i>	<i>0.01</i>	<i>0.09</i>	<i>0.36</i>	<i>0.09</i>	<i>0.36</i>
<i>OS2</i>	<i>4830.2806</i>	<i>0.11</i>	<i>0.02</i>	<i>0.90</i>	<i>0.96</i>	<i>0.00</i>	<i>0.30</i>	<i>0.50</i>	<i>0.10</i>	<i>0.09</i>	<i>0.36</i>	<i>0.20</i>	<i>0.44</i>

WIDFIELD WATER AND WASTEWATER DISTRICT - BOOSTER 2 PUMP STATION
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _i (min)	TOTAL (min)	CHECK (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		From DCM Table 5-1															
<i>A</i>	0.83	0.09	0.36	0.09	100	5.5	10.4	90	2.9%	1.2	1.3	11.7	11.1	3.9	6.5	0.3	1.9
<i>B</i>	0.83	0.12	0.38	0.12	60	4	7.3	150	5.3%	1.6	1.5	8.9	11.2	4.3	7.2	0.4	2.3
<i>C</i>	0.03	0.09	0.36	0.09	15	0.3	5.6	0	0.0%	0.0	0.0	5.6	10.1	5.0	8.4	0.0	0.1
<i>OS1</i>	0.01	0.09	0.36	0.09	10	0.2	4.6	0	0.0%	0.0	0.0	4.6	10.1	5.3	8.9	0.0	0.0
<i>OS2</i>	0.11	0.20	0.44	0.20	50	2	7.3	0	0.0%	0.0	0.0	7.3	10.3	4.6	7.7	0.1	0.4

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: DLM
Date: 8/26/2019
Checked by: VAS

WIDEFIELD WATER AND WASTEWATER DISTRICT - BOOSTER 2 PUMP STATION
EXISTING CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

<i>From Area Runoff Coefficient Summary</i>				OVERLAND				PIPE / CHANNEL FLOW				<i>Time of Travel (T_t)</i>	INTENSITY *		TOTAL FLOWS		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
1	OS1, A	0.08	0.30									11.7	3.9	6.5	0.3	2.0	
				Basin B Tc was used													
2	OS2, B, C	0.13	0.38									8.9	4.3	7.2	0.6	2.7	
				Basin A Tc was used													

**WIDEFIELD WATER AND WASTEWATER DISTRICT - BOOSTER 2 PUMP STATION
 PROPOSED CONDITIONS DRAINAGE CALCULATIONS
 (Area Runoff Coefficient Summary)**

BASIN	TOTAL AREA (SF)	TOTAL AREA (Acres)										RUNOFF COEFFICIENT	
			AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	C ₅	C ₁₀₀
A1	2864.3099	0.07	0.00	0.90	0.96	0.00	0.59	0.70	0.07	0.09	0.36	0.09	0.36
A2	21650.5603	0.50	0.06	0.90	0.96	0.09	0.59	0.70	0.35	0.09	0.36	0.27	0.49
A3	15244.5339	0.35	0.02	0.90	0.96	0.07	0.59	0.70	0.27	0.09	0.36	0.22	0.45
B	32440.8858	0.74	0.03	0.90	0.96	0.00	0.59	0.70	0.71	0.09	0.36	0.13	0.39
C	1281.6639	0.03	0.00	0.90	0.96	0.00	0.59	0.70	0.03	0.09	0.36	0.09	0.36
OS1	207.67	0.00	0.00	0.90	0.96	0.00	0.30	0.50	0.00	0.09	0.36	0.09	0.36
OS2	4830.2806	0.11	0.02	0.90	0.96	0.00	0.30	0.50	0.10	0.09	0.36	0.20	0.44

**WIDEFIELD WATER AND WASTEWATER DISTRICT - BOOSTER 2 PUMP STATION
PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Area Drainage Summary)**

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY *		TOTAL FLOWS	
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _i (min)	TOTAL (min)	CHECK (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)
		From DCM Table 5-1															
<i>A1</i>	0.07	0.09	0.36	0.09	10	0.5	3.4	0	0.0%	0.0	0.0	5.0	10.1	5.2	8.7	0.0	0.2
<i>A2</i>	0.50	0.27	0.49	0.27	90	5.5	7.8	285	1.9%	1.4	3.4	11.2	12.1	3.8	6.5	0.5	1.6
<i>A3</i>	0.35	0.22	0.45	0.22	90	5.5	8.3	250	2.2%	1.5	2.8	11.1	11.9	3.9	6.5	0.3	1.0
<i>B</i>	0.74	0.13	0.39	0.13	60	4	7.3	150	5.3%	1.6	1.5	8.8	11.2	4.3	7.2	0.4	2.1
<i>C</i>	0.03	0.09	0.36	0.09	15	0.3	5.6	0	0.0%	0.0	0.0	5.6	10.1	5.0	8.4	0.0	0.1
<i>OS1</i>	0.00	0.09	0.36	0.09	10	0.2	4.6	0	0.0%	0.0	0.0	5.0	10.1	5.2	8.7	0.0	0.0
<i>OS2</i>	0.11	0.20	0.44	0.20	50	2	7.3	0	0.0%	0.0	0.0	7.3	10.3	4.6	7.7	0.1	0.4

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: DLM
Date: 8/26/2019
Checked by: VAS

WIDEFIELD WATER AND WASTEWATER DISTRICT - BOOSTER 2 PUMP STATION
PROPOSED CONDITIONS DRAINAGE CALCULATIONS
(Basin Routing Summary)

<i>From Area Runoff Coefficient Summary</i>				OVERLAND				PIPE / CHANNEL FLOW				<i>Time of Travel (T_t)</i>	INTENSITY *		TOTAL FLOWS		COMMENTS
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)	
1	A1	0.01	0.02									5.0	5.2	8.7	0.0	0.2	Sheet flows to FMIR
				Basin A1 Tc was used													
1A	OS1, A2, A3	0.21	0.40									11.9	3.9	6.5	0.8	2.6	Prop 18" RCP (private)
				Basin A3 Tc was used													
2	OS2, B, C	0.12	0.35									5.6	5.0	8.4	0.6	2.9	Sheet flows to FMIR
				Basin C Tc was used													

HYDRAULIC CALCULATIONS

Worksheet for 18" Pipe @ 13.5% - 2.6 cfs

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.135 ft/ft
Diameter	18.0 in
Discharge	2.60 cfs
Results	
Normal Depth	3.2 in
Flow Area	0.2 ft ²
Wetted Perimeter	1.3 ft
Hydraulic Radius	1.9 in
Top Width	1.14 ft
Critical Depth	7.3 in
Percent Full	17.6 %
Critical Slope	0.005 ft/ft
Velocity	12.44 ft/s
Velocity Head	2.40 ft
Specific Energy	2.67 ft
Froude Number	5.125
Maximum Discharge	41.52 cfs
Discharge Full	38.59 cfs
Slope Full	0.001 ft/ft
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	17.6 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.2 in
Critical Depth	7.3 in
Channel Slope	0.135 ft/ft
Critical Slope	0.005 ft/ft

Worksheet for FMIC Irrigation Channel - 50 cfs

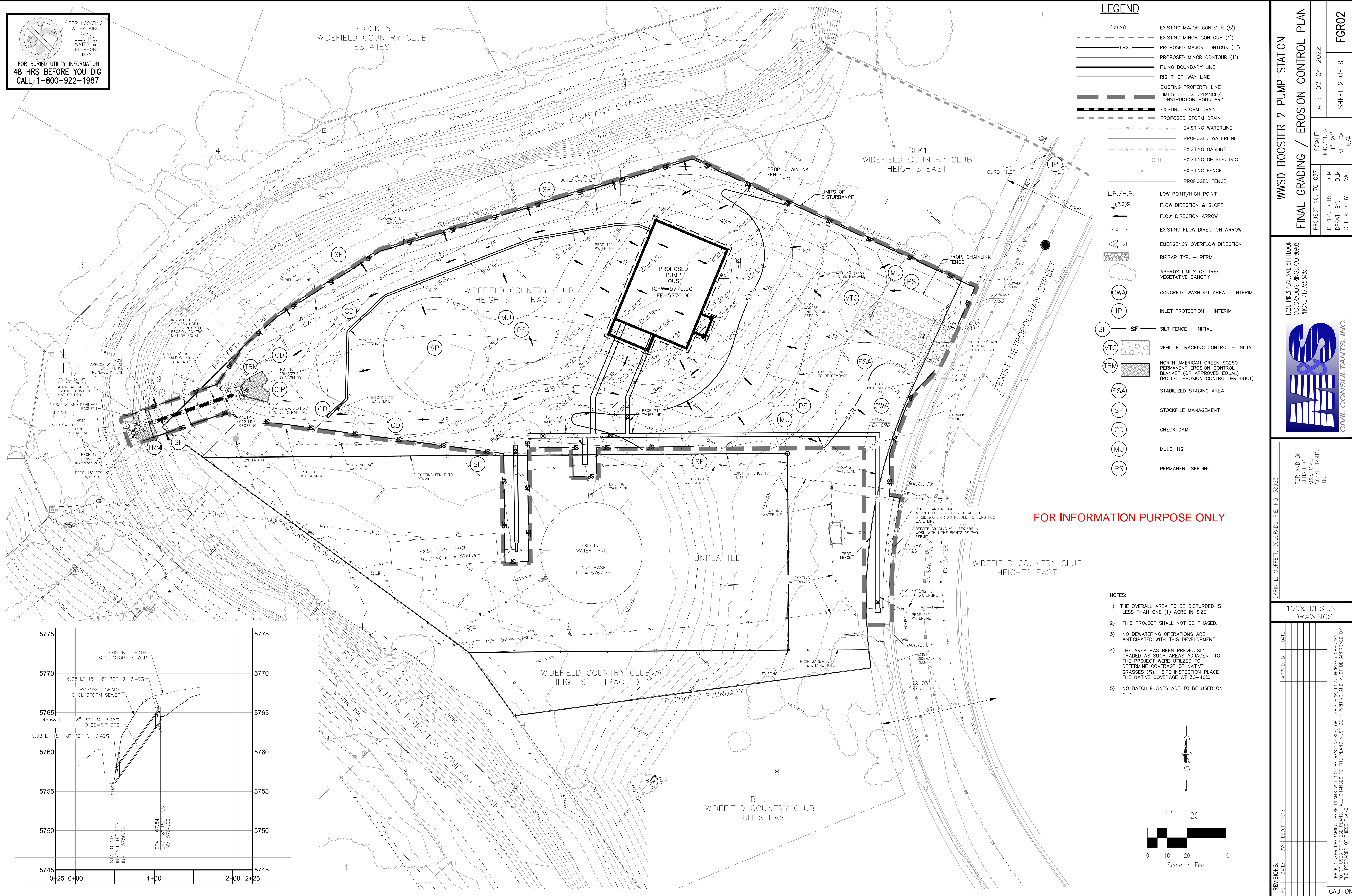
Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.001 ft/ft
Left Side Slope	1.000 H:V
Right Side Slope	1.000 H:V
Bottom Width	9.00 ft
Discharge	50.00 cfs
Results	
Normal Depth	30.3 in
Flow Area	29.1 ft ²
Wetted Perimeter	16.1 ft
Hydraulic Radius	21.6 in
Top Width	14.05 ft
Critical Depth	11.4 in
Critical Slope	0.015 ft/ft
Velocity	1.72 ft/s
Velocity Head	0.05 ft
Specific Energy	2.57 ft
Froude Number	0.211
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	30.3 in
Critical Depth	11.4 in
Channel Slope	0.001 ft/ft
Critical Slope	0.015 ft/ft

GRADING AND EROSION CONTROL PLAN

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
 CALL 1-800-922-1987

BLOCK 5
 WIDEFIELD COUNTRY CLUB
 ESTATES

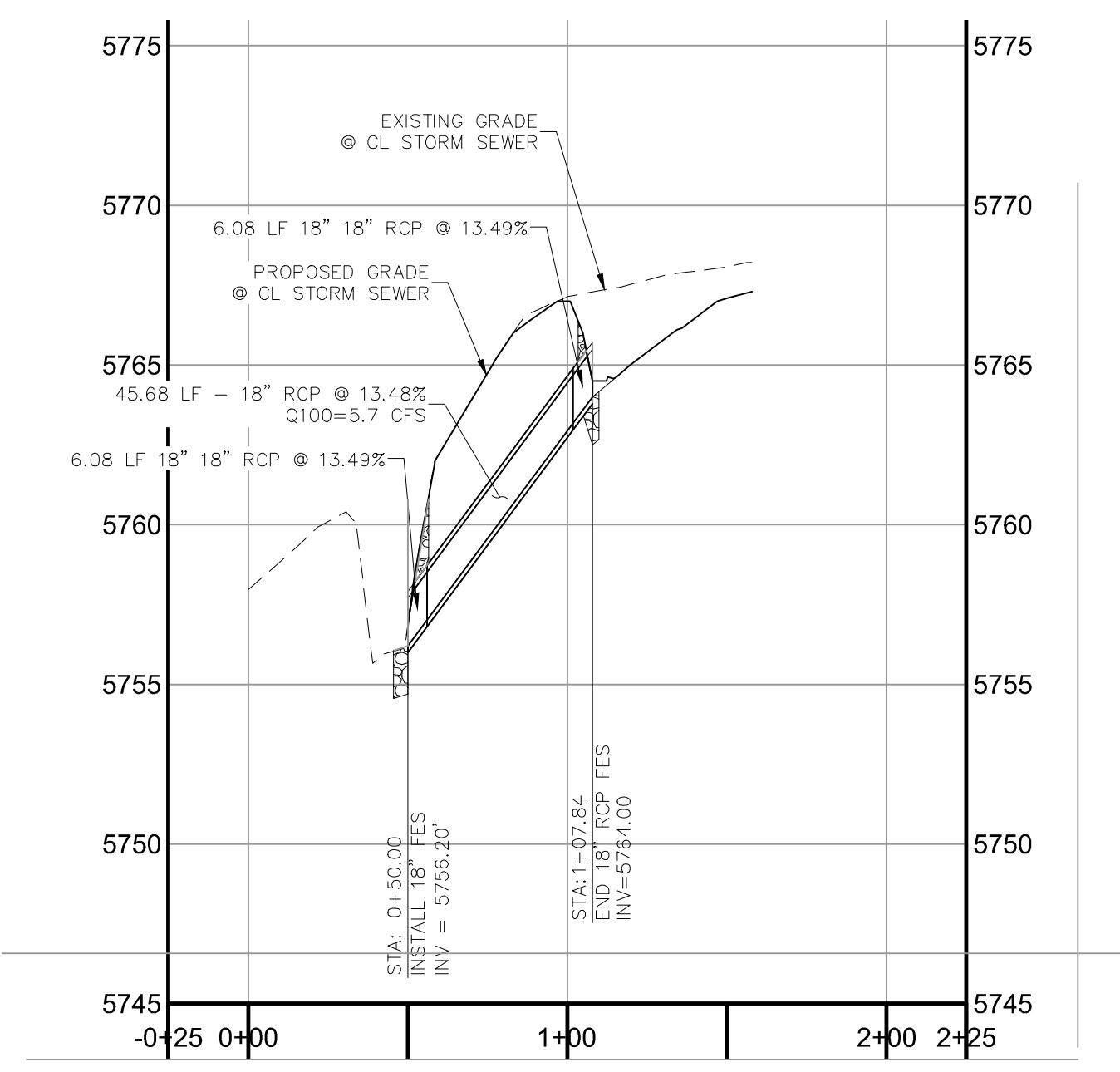
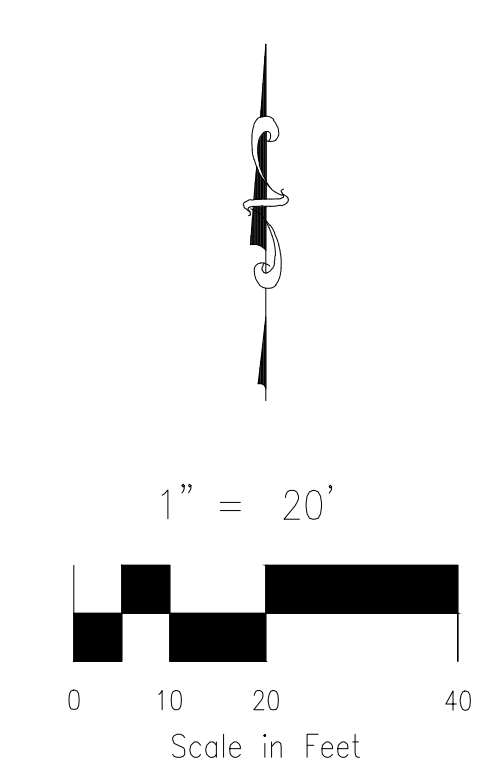


LEGEND

(---) (6920)	EXISTING MAJOR CONTOUR (5')
(---) (6920)	EXISTING MINOR CONTOUR (1')
(---) 6920	PROPOSED MAJOR CONTOUR (5')
(---) 6920	PROPOSED MINOR CONTOUR (1')
(---)	FLING BOUNDARY LINE
(---)	RIGHT-OF-WAY LINE
(---)	EXISTING PROPERTY LINE
(---)	LIMITS OF DISTURBANCE/CONSTRUCTION BOUNDARY
(---)	EXISTING STORM DRAIN
(---)	PROPOSED STORM DRAIN
(---)	EXISTING WATERLINE
(---)	PROPOSED WATERLINE
(---)	EXISTING GASLINE
(---)	EXISTING OH ELECTRIC
(---)	EXISTING FENCE
(---)	PROPOSED FENCE
(---)	L.P./H.P.
(---) (2.0%)	LOW POINT/HIGH POINT
(---)	FLOW DIRECTION & SLOPE
(---)	FLOW DIRECTION ARROW
(---)	EXISTING FLOW DIRECTION ARROW
(---)	EMERGENCY OVERFLOW DIRECTION
(---)	RIPRAP TYP. - PERM
(---)	APPROX LIMITS OF TREE VEGETATIVE CANOPY
(CWA)	CONCRETE WASHOUT AREA - INTERIM
(IP)	INLET PROTECTION - INTERIM
(SF)	SILT FENCE - INITIAL
(VTC)	VEHICLE TRACKING CONTROL - INITIAL
(TRM)	NORTH AMERICAN GREEN SC250 PERMANENT EROSION CONTROL BLANKET (OR APPROVED EQUAL) (ROLLED EROSION CONTROL PRODUCT)
(SSA)	STABILIZED STAGING AREA
(SP)	STOCKPILE MANAGEMENT
(CD)	CHECK DAM
(MU)	MULCHING
(PS)	PERMANENT SEEDING

FOR INFORMATION PURPOSE ONLY

- NOTES:
- 1) THE OVERALL AREA TO BE DISTURBED IS LESS THAN ONE (1) ACRE IN SIZE.
 - 2) THIS PROJECT SHALL NOT BE PHASED.
 - 3) NO DEWATERING OPERATIONS ARE ANTICIPATED WITH THIS DEVELOPMENT.
 - 4) THE AREA HAS BEEN PREVIOUSLY GRADED AS SUCH AREAS ADJACENT TO THE PROJECT WERE UTILIZED TO DETERMINE COVERAGE OF NATIVE GRASSES (%). SITE INSPECTION PLACE THE NATIVE COVERAGE AT 30-40%.
 - 5) NO BATCH PLANTS ARE TO BE USED ON SITE



WMSD BOOSTER 2 PUMP STATION

FINAL GRADING / EROSION CONTROL PLAN

DATE: 02-04-2022

PROJECT NO. 70-077

SCALE: HORIZONTAL: 1"=20' VERTICAL: N/A

DESIGNED BY: DLM

DRAWN BY: DLM

CHECKED BY: VAS

SHEET 2 OF 8

FCR02

102 E. PINE PEAK AVE. 5TH FLOOR
 COLORADO SPRINGS, CO 80903
 PHONE: 719.555.5485

CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF
 M&S CIVIL CONSULTANTS, INC.

100% DESIGN DRAWINGS

REVISIONS:

NO.	DATE	BY	DESCRIPTION	APPROVED BY	DATE

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

File: C:\70077A_Widefield_M&S_Hydro\7010_metroplan\street\plan\FCR02.dwg PlotStamp: 2/4/2022 12:12 PM

EC-2 Temporary and Permanent Seeding (TS/PS)

soil amendments and rototill them into the soil to a depth of 6 inches or more.
 Topsoil should be salvaged during grading operations for use and spread on areas to be revegetated later. Topsoil should be viewed as an important resource to be utilized for vegetation establishment, due to its water-holding capacity, structure, texture, organic matter content, biological activity, and nutrient content. The rooting depth of most native grasses in the semi-arid Denver metropolitan area is 6 to 18 inches. At a minimum, the upper 6 inches of topsoil should be stripped, stockpiled, and ultimately respread across areas that will be revegetated.

Where topsoil is not available, subsoils should be amended to provide an appropriate plant-growth medium. Organic matter, such as well digested compost, can be added to improve soil characteristics conducive to plant growth. Other treatments can be used to adjust soil pH conditions when needed. Soil testing, which is typically inexpensive, should be completed to determine and optimize the types and amounts of amendments that are required.

If the disturbed ground surface is compacted, rip or rototill the surface prior to placing topsoil. If adding compost to the existing soil surface, rototilling is necessary. Surface roughening will assist in placement of a stable topsoil layer on steeper slopes, and allow infiltration and root penetration to greater depth.

Prior to seeding, the soil surface should be rough and the seedbed should be firm, but neither too loose nor compacted. The upper layer of soil should be in a condition suitable for seeding at the proper depth and conducive to plant growth. Seed-to-soil contact is the key to good germination.

Seed Mix for Temporary Vegetation

To provide temporary vegetative cover on disturbed areas which will not be paved, built upon, or fully landscaped or worked for an extended period (typically 30 days or more), plant an annual grass appropriate for the time of planting and mulch the planted areas. Annual grasses suitable for the Denver metropolitan area are listed in Table TS/PS-1. These are to be considered only as general recommendations when specific design guidance for a particular site is not available. Local governments typically specify seed mixes appropriate for their jurisdiction.

Seed Mix for Permanent Revegetation

To provide vegetative cover on disturbed areas that have reached final grade, a perennial grass mix should be established. Permanent seeding should be performed promptly (typically within 14 days) after reaching final grade. Each site will have different characteristics and a landscape professional or the local jurisdiction should be contacted to determine the most suitable seed mix for a specific site. In lieu of a specific recommendation, one of the perennial grass mixes appropriate for site conditions and growth season listed in Table TS/PS-2 can be used. The pure live seed (PLS) rates of application recommended in these tables are considered to be absolute minimum rates for seed applied using proper drill-seeding equipment.

If desired for wildlife habitat or landscape diversity, shrubs such as rubber rabbitbrush (*Chrysothamnus nauseosus*), fourwing saltbush (*Atriplex canescens*) and skunkbrush sumac (*Rhus trilobata*) could be added to the upland seedmixes at 0.25, 0.5 and 1 pound PLS/acre, respectively. In riparian zones, planting root stock of such species as American plum (*Prunus americana*), woods rose (*Rosa woodsii*), plains cottonwood (*Populus sargentii*), and willow (*Populus spp.*) may be considered. On non-topsoiled upland sites, a legume such as Ladak alfalfa at 1 pound PLS/acre can be included as a source of nitrogen for perennial grasses.

TS/PS-2 Urban Drainage and Flood Control District June 2012
 Urban Storm Drainage Criteria Manual Volume 3

Temporary and Permanent Seeding (TS/PS) EC-2

Table TS/PS-2. Minimum Drill Seeding Rates for Perennial Grasses (cont.)

Common Name	Botanical Name	Growth Season ^a	Growth Form	Seeds/ Pound	Pounds of PLS/acre
Sandy Soil Seed Mix					
Blue grama	<i>Bouteloua gracilis</i>	Warm	Sod-forming bunchgrass	825,000	0.5
Camper little bluestem	<i>Schizachyrium scoparium 'Camper'</i>	Warm	Bunch	240,000	1.0
Prairie sandreed	<i>Calamovilfa longifolia</i>	Warm	Open sod	274,000	1.0
Sand dropseed	<i>Sporobolus cryptandrus</i>	Cool	Bunch	5,298,000	0.25
Vaughn sidecoats grama	<i>Bouteloua curtipendula 'Vaughn'</i>	Warm	Sod	191,000	2.0
Arriba western wheatgrass	<i>Agropyron smithii 'Arriba'</i>	Cool	Sod	110,000	5.5
Total					10.25
Heavy Clay, Rocky Foothill Seed Mix					
Ephraim crested wheatgrass ^d	<i>Agropyron cristatum 'Ephraim'</i>	Cool	Sod	175,000	1.5
Oahe Intermediate wheatgrass	<i>Agropyron intermedium 'Oahe'</i>	Cool	Sod	115,000	5.5
Vaughn sidecoats grama ^a	<i>Bouteloua curtipendula 'Vaughn'</i>	Warm	Sod	191,000	2.0
Lincoln smooth brome	<i>Bromus inermis leys 'Lincoln'</i>	Cool	Sod	130,000	3.0
Arriba western wheatgrass	<i>Agropyron smithii 'Arriba'</i>	Cool	Sod	110,000	5.5
Total					17.5

^a All of the above seeding mixes and rates are based on drill seeding followed by crimped straw mulch. These rates should be doubled if seed is broadcast and should be increased by 50 percent if the seeding is done using a Brillion Drill or is applied through hydraulic seeding. Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1. If hydraulic seeding is used, hydraulic mulching should be done as a separate operation.
^b See Table TS/PS-3 for seeding dates.
^c If site is to be irrigated, the transition turf seed rates should be doubled.
^d Crested wheatgrass should not be used on slopes steeper than 6H to 1V.
^e Can substitute 0.5 lbs PLS of blue grama for the 2.0 lbs PLS of Vaughn sidecoats grama.

June 2012 Urban Drainage and Flood Control District June 2012
 Urban Storm Drainage Criteria Manual Volume 3 TS/PS-5

Temporary and Permanent Seeding (TS/PS) EC-2

Seeding dates for the highest success probability of perennial species along the Front Range are generally in the spring from April through early May and in the fall after the first of September until the ground freezes. If the area is irrigated, seeding may occur in summer months, as well. See Table TS/PS-3 for appropriate seeding dates.

Table TS/PS-1. Minimum Drill Seeding Rates for Various Temporary Annual Grasses

Species* (Common name)	Growth Season ^a	Pounds of Pure Live Seed (PLS)/acre ^b	Planting Depth (inches)
1. Oats	Cool	35 - 50	1 - 2
2. Spring wheat	Cool	25 - 35	1 - 2
3. Spring barley	Cool	25 - 35	1 - 2
4. Annual ryegrass	Cool	10 - 15	½
5. Millet	Warm	3 - 15	½ - ¾
6. Sudangrass	Warm	5-10	½ - ¾
7. Sorghum	Warm	5-10	½ - ¾
8. Winter wheat	Cool	20-35	1 - 2
9. Winter barley	Cool	20-35	1 - 2
10. Winter rye	Cool	20-35	1 - 2
11. Triticale	Cool	25-40	1 - 2

^a Successful seeding of annual grass resulting in adequate plant growth will usually produce enough dead-plant residue to provide protection from wind and water erosion for an additional year. This assumes that the cover is not disturbed or moved closer than 8 inches.

Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1 or where access limitations exist. When hydraulic seeding is used, hydraulic mulching should be applied as a separate operation, when practical, to prevent the seeds from being encapsulated in the mulch.

^b See Table TS/PS-3 for seeding dates. Irrigation, if consistently applied, may extend the use of cool season species during the summer months.

^c Seeding rates should be doubled if seed is broadcast, or increased by 50 percent if done using a Brillion Drill or by hydraulic seeding.

June 2012 Urban Drainage and Flood Control District June 2012
 Urban Storm Drainage Criteria Manual Volume 3 TS/PS-3

EC-2 Temporary and Permanent Seeding (TS/PS)

Table TS/PS-3. Seeding Dates for Annual and Perennial Grasses

Seeding Dates	Annual Grasses (Numbers in table reference species in Table TS/PS-1)		Perennial Grasses	
	Warm	Cool	Warm	Cool
January 1–March 15			✓	✓
March 16–April 30	4	1,2,3	✓	✓
May 1–May 15	4		✓	
May 16–June 30	4,5,6,7			
July 1–July 15	5,6,7			
July 16–August 31				
September 1–September 30		8,9,10,11		
October 1–December 31			✓	✓

Mulch

Cover seeded areas with mulch or an appropriate rolled erosion control product to promote establishment of vegetation. Anchor mulch by crimping, netting or use of a non-toxic tackifier. See the Mulching BMP Fact Sheet for additional guidance.

Maintenance and Removal

Monitor and observe seeded areas to identify areas of poor growth or areas that fail to germinate. Reseed and mulch these areas, as needed.

An area that has been permanently seeded should have a good stand of vegetation within one growing season if irrigated and within three growing seasons without irrigation in Colorado. Reseed portions of the site that fail to germinate or remain bare after the first growing season.

Seeded areas may require irrigation, particularly during extended dry periods. Targeted weed control may also be necessary.

Protect seeded areas from construction equipment and vehicle access.

June 2012 Urban Drainage and Flood Control District June 2012
 Urban Storm Drainage Criteria Manual Volume 3 TS/PS-6

EC-2 Temporary and Permanent Seeding (TS/PS)

Table TS/PS-2. Minimum Drill Seeding Rates for Perennial Grasses

Common ^a Name	Botanical Name	Growth Season ^b	Growth Form	Seeds/ Pound	Pounds of PLS/acre
Alkali Soil Seed Mix					
Alkali sacaton	<i>Sporobolus airoides</i>	Cool	Bunch	1,750,000	0.25
Basin wildrye	<i>Elymus cinereus</i>	Cool	Bunch	165,000	2.5
Sodar streambank wheatgrass	<i>Agropyron riparium 'Soda'</i>	Cool	Sod	170,000	2.5
Jose tall wheatgrass	<i>Agropyron elongatum 'Jose'</i>	Cool	Bunch	79,000	7.0
Arriba western wheatgrass	<i>Agropyron smithii 'Arriba'</i>	Cool	Sod	110,000	5.5
Total					17.75
Fertile Loamy Soil Seed Mix					
Ephraim crested wheatgrass	<i>Agropyron cristatum 'Ephraim'</i>	Cool	Sod	175,000	2.0
Dural hard fescue	<i>Festuca ovina 'duriuscula'</i>	Cool	Bunch	565,000	1.0
Lincoln smooth brome	<i>Bromus inermis leys 'Lincoln'</i>	Cool	Sod	130,000	3.0
Sodar streambank wheatgrass	<i>Agropyron riparium 'Soda'</i>	Cool	Sod	170,000	2.5
Arriba western wheatgrass	<i>Agropyron smithii 'Arriba'</i>	Cool	Sod	110,000	7.0
Total					15.5
High Water Table Soil Seed Mix					
Meadow foxtail	<i>Alopecurus pratensis</i>	Cool	Sod	900,000	0.5
Redtop	<i>Agrostis alba</i>	Warm	Open sod	5,000,000	0.25
Reed canarygrass	<i>Phalaris arundinacea</i>	Cool	Sod	68,000	0.5
Lincoln smooth brome	<i>Bromus inermis leys 'Lincoln'</i>	Cool	Sod	130,000	3.0
Pathfinder switchgrass	<i>Panicum virgatum 'Pathfinder'</i>	Warm	Sod	389,000	1.0
Alkar tall wheatgrass	<i>Agropyron elongatum 'Alkar'</i>	Cool	Bunch	79,000	5.5
Total					10.75
Transition Turf Seed Mix^c					
Ruebens Canadian bluegrass	<i>Poa compressa 'Ruebens'</i>	Cool	Sod	2,500,000	0.5
Dural hard fescue	<i>Festuca ovina 'duriuscula'</i>	Cool	Bunch	565,000	1.0
Citation perennial ryegrass	<i>Lolium perenne 'Citation'</i>	Cool	Sod	247,000	3.0
Lincoln smooth brome	<i>Bromus inermis leys 'Lincoln'</i>	Cool	Sod	130,000	3.0
Total					7.5

TS/PS-4 Urban Drainage and Flood Control District June 2012
 Urban Storm Drainage Criteria Manual Volume 3

EC-4 Mulching (MU)

Clean, weed-free and seed-free cereal grain straw should be applied evenly at a rate of 2 tons per acre and must be tacked or fastened by a method suitable for the condition of the site. Straw mulch must be anchored (and not merely placed) on the surface. This can be accomplished mechanically by crimping or with the aid of tackifiers or nets. Anchoring with a crimping implement is preferred, and is the recommended method for areas flatter than 3:1. Mechanical crimpers must be capable of tucking the long mulch fibers into the soil to a depth of 3 inches without cutting them. An agricultural disk, while not an ideal substitute, may work if the disk blades are dull or blunted and set vertically; however, the frame may have to be weighted to afford proper soil penetration.

Grass hay may be used in place of straw; however, because hay is comprised of the entire plant including seed, mulching with hay may seed the site with non-native grass species which might in turn out-compete the native seed. Alternatively, native species of grass hay may be purchased, but can be difficult to find and are more expensive than straw. Purchasing and utilizing a certified weed-free straw is an easier and less costly mulching method. When using grass hay, follow the same guidelines as for straw (provided above).

On small areas sheltered from the wind and heavy runoff, spraying a tackifier on the mulch is satisfactory for holding it in place. For steep slopes and special situations where greater control is needed, erosion control blankets anchored with stakes should be used instead of mulch.

Hydraulic mulching consists of wood cellulose fibers mixed with water and a tackifying agent and should be applied at a rate of no less than 1,500 pounds per acre (1,425 lbs of fibers mixed with at least 75 lbs of tackifier) with a hydraulic mulcher. For steeper slopes, up to 2000 pounds per acre may be required for effective hydroseeding. Hydromulch typically requires up to 24 hours to dry; therefore, it should not be applied immediately prior to inclement weather. Application to roads, waterways and existing vegetation should be avoided.

Erosion control mats, blankets, or nets are recommended to help stabilize steep slopes (generally 3:1 and steeper) and waterways. Depending on the product, these may be used alone or in conjunction with grass or straw mulch. Normally, use of these products will be restricted to relatively small areas. Biodegradable mats made of straw and jute, straw-coconut, coconut fiber, or excelsior can be used instead of mulch. (See the ECM/TRM BMP for more information.)

Some tackifiers or binders may be used to anchor mulch. Check with the local jurisdiction for allowed tackifiers. Manufacturer's recommendations should be followed at all times. (See the Soil Binder BMP for more information on general types of tackifiers.)

Rock can also be used as mulch. It provides protection of exposed soils to wind and water erosion and allows infiltration of precipitation. An aggregate base course can be spread on disturbed areas for temporary or permanent stabilization. The rock mulch layer should be thick enough to provide full coverage of exposed soil on the area it is applied.

Maintenance and Removal

After mulching, the bare ground surface should not be more than 10 percent exposed. Reapply mulch, as needed, to cover bare areas.

MU-2 Urban Drainage and Flood Control District June 2012
 Urban Storm Drainage Criteria Manual Volume 3

FOR INFORMATION PURPOSE ONLY

WWSO BOOSTER 2 PUMP STATION
 GRADING & EROSION CONTROL DETAILS
 PROJECT NO. 70-077 DATE: 02-04-2022
 SCALE: HORIZONTAL: N/A VERTICAL: N/A
 DESIGNED BY: DLM DRAWN BY: DLM CHECKED BY: VAS
 SHEET 3 OF 8
 FGR03

102 E. Pikes Peak Ave., 5th Floor
 Colorado Springs, CO 80903
 PHONE: 719.555.4485

 CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF
 M&S CIVIL CONSULTANTS, INC.
 DAREN L. MOFFETT, COLORADO P.E. NO. 38923

100% DESIGN DRAWINGS
 REVISIONS:
 NO. DATE: BY: DESCRIPTION: APPROV. BY: DATE:
 THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.
 CAUTION

SC-6 Inlet Protection (IP)

- IP-3. Rock Sock Inlet Protection for Sump/Area Inlet
- IP-4. Silt Fence Inlet Protection for Sump/Area Inlet
- IP-5. Over-excavation Inlet Protection
- IP-6. Straw Bale Inlet Protection for Sump/Area Inlet
- CIP-1. Culvert Inlet Protection

Proprietary inlet protection devices should be installed in accordance with manufacturer specifications. More information is provided below on selecting inlet protection for sump and on-grade locations.

Inlets Located in a Sump

When applying inlet protection in sump conditions, it is important that the inlet continue to function during larger runoff events. For curb inlets, the maximum height of the protective barrier should be lower than the top of the curb opening to allow overflow into the inlet during larger storms without excessive localized flooding. If the inlet protection height is greater than the curb elevation, particularly if the filter becomes clogged with sediment, runoff will not enter the inlet and may bypass it, possibly causing localized flooding, public safety issues, and downstream erosion and damage from bypassed flows.

Area inlets located in a sump setting can be protected through the use of silt fence, concrete block and rock socks (on paved surfaces), sediment control logs/straw wattles embedded in the adjacent soil and stacked around the area inlet (on pervious surfaces), over-excavation around the inlet, and proprietary products providing equivalent functions.

Inlets Located on a Slope

For curb and gutter inlets on paved sloping streets, block and rock sock inlet protection is recommended in conjunction with curb socks in the gutter leading to the inlet. For inlets located along unpaved roads, also see the Check Dam Fact Sheet.

Maintenance and Removal

Inspect inlet protection frequently. Inspection and maintenance guidance includes:

- Inspect for tears that can result in sediment directly entering the inlet, as well as result in the contents of the BMP (e.g., gravel) washing into the inlet.
- Check for improper installation resulting in untreated flows bypassing the BMP and directly entering the inlet or bypassing to an unprotected downstream inlet. For example, silt fence that has not been properly trenched around the inlet can result in flows under the silt fence and directly into the inlet.
- Look for displaced BMPs that are no longer protecting the inlet. Displacement may occur following larger storm events that wash away or reposition the inlet protection. Traffic or equipment may also crush or displace the BMP.
- Monitor sediment accumulation upgradient of the inlet protection.

IP-2 Urban Drainage and Flood Control District August 2013
Urban Storm Drainage Criteria Manual Volume 3

SC-6 Inlet Protection (IP)

GENERAL INLET PROTECTION INSTALLATION NOTES

- SEE PLAN VIEW FOR:
 - LOCATION OF INLET PROTECTION.
 - TYPE OF INLET PROTECTION (IP-1, IP-2, IP-3, IP-4, IP-5, IP-6)
- INLET PROTECTION SHALL BE INSTALLED PROMPTLY AFTER INLET CONSTRUCTION OR PAVING IS COMPLETE (TYPICALLY WITHIN 48 HOURS). IF A RAINFALL/RUNOFF EVENT IS FORECAST, INSTALL INLET PROTECTION PRIOR TO ONSET OF EVENT.
- MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

INLET PROTECTION MAINTENANCE NOTES

- INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
- FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
- WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
- SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED AS NECESSARY TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN STORAGE VOLUME REACHES 50% OF CAPACITY, A DEPTH OF 6" WHEN SILT FENCE IS USED, OR 1/4 OF THE HEIGHT FOR STRAW BALES.
- INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED, UNLESS THE LOCAL JURISDICTION APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.
- WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDING AND MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

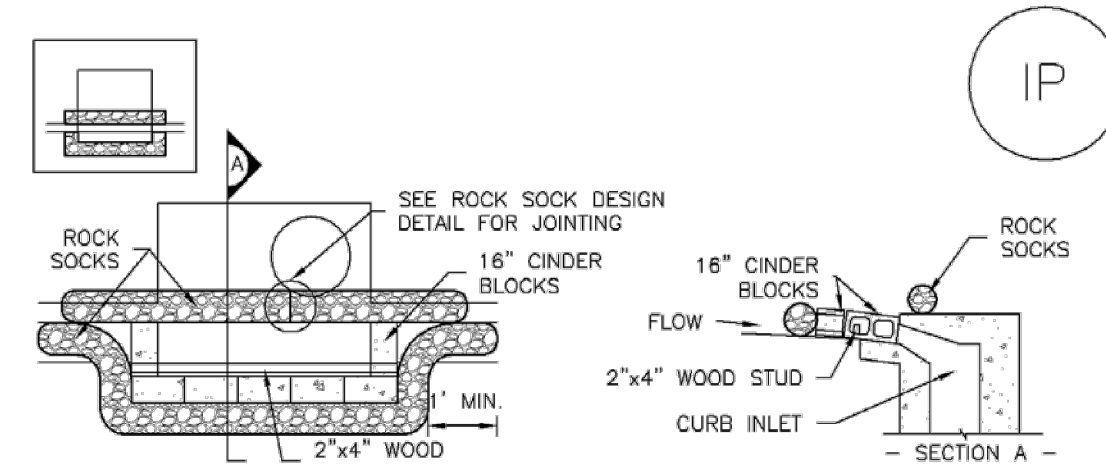
NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF INLET PROTECTION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY PROPRIETARY INLET PROTECTION METHODS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY INLET PROTECTION; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

NOTE: SOME MUNICIPALITIES DISCOURAGE OR PROHIBIT THE USE OF STRAW BALES FOR INLET PROTECTION. CHECK WITH LOCAL JURISDICTION TO DETERMINE IF STRAW BALE INLET PROTECTION IS ACCEPTABLE.

IP-8 Urban Drainage and Flood Control District August 2013
Urban Storm Drainage Criteria Manual Volume 3

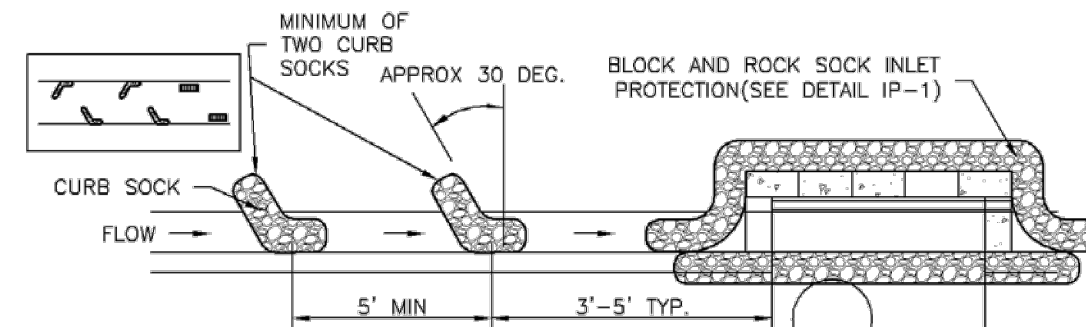
SC-6 Inlet Protection (IP)



IP-1. BLOCK AND ROCK SOCK SUMP OR ON GRADE INLET PROTECTION

BLOCK AND CURB SOCK INLET PROTECTION INSTALLATION NOTES

- SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
- CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW, ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.
- GRAVEL BAGS SHALL BE PLACED AROUND CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER AND JOINED TOGETHER IN ACCORDANCE WITH ROCK SOCK DESIGN DETAIL.



IP-2. CURB ROCK SOCKS UPSTREAM OF INLET PROTECTION

CURB ROCK SOCK INLET PROTECTION INSTALLATION NOTES

- SEE ROCK SOCK DESIGN DETAIL INSTALLATION REQUIREMENTS.
- PLACEMENT OF THE SOCK SHALL BE APPROXIMATELY 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.
- SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED A MINIMUM OF 5 FEET APART.
- AT LEAST TWO CURB SOCKS IN SERIES ARE REQUIRED UPSTREAM OF ON-GRADE INLETS.

IP-4 Urban Drainage and Flood Control District August 2013
Urban Storm Drainage Criteria Manual Volume 3

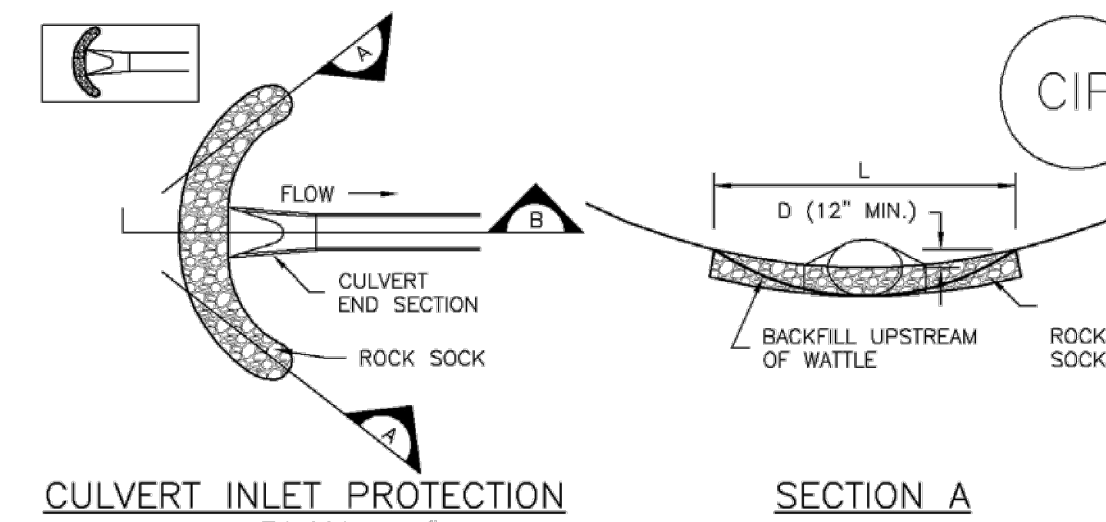
Inlet Protection (IP) SC-6

- Remove sediment accumulation from the area upstream of the inlet protection, as needed to maintain BMP effectiveness, typically when it reaches no more than half the storage capacity of the inlet protection. For silt fence, remove sediment when it accumulates to a depth of no more than 6 inches. Remove sediment accumulation from the area upstream of the inlet protection as needed to maintain the functionality of the BMP.
- Proprietary inlet protection devices should be inspected and maintained in accordance with manufacturer specifications. If proprietary inlet insert devices are used, sediment should be removed in a timely manner to prevent devices from breaking and spilling sediment into the storm drain.

Inlet protection must be removed and properly disposed of when the drainage area for the inlet has reached final stabilization.

August 2013 Urban Drainage and Flood Control District August 2013
Urban Storm Drainage Criteria Manual Volume 3 IP-3

Inlet Protection (IP) SC-6



CIP-1. CULVERT INLET PROTECTION

CULVERT INLET PROTECTION INSTALLATION NOTES

- SEE PLAN VIEW FOR:
 - LOCATION OF CULVERT INLET PROTECTION.
- SEE ROCK SOCK DESIGN DETAIL FOR ROCK GRADATION REQUIREMENTS AND JOINING DETAIL.

CULVERT INLET PROTECTION MAINTENANCE NOTES

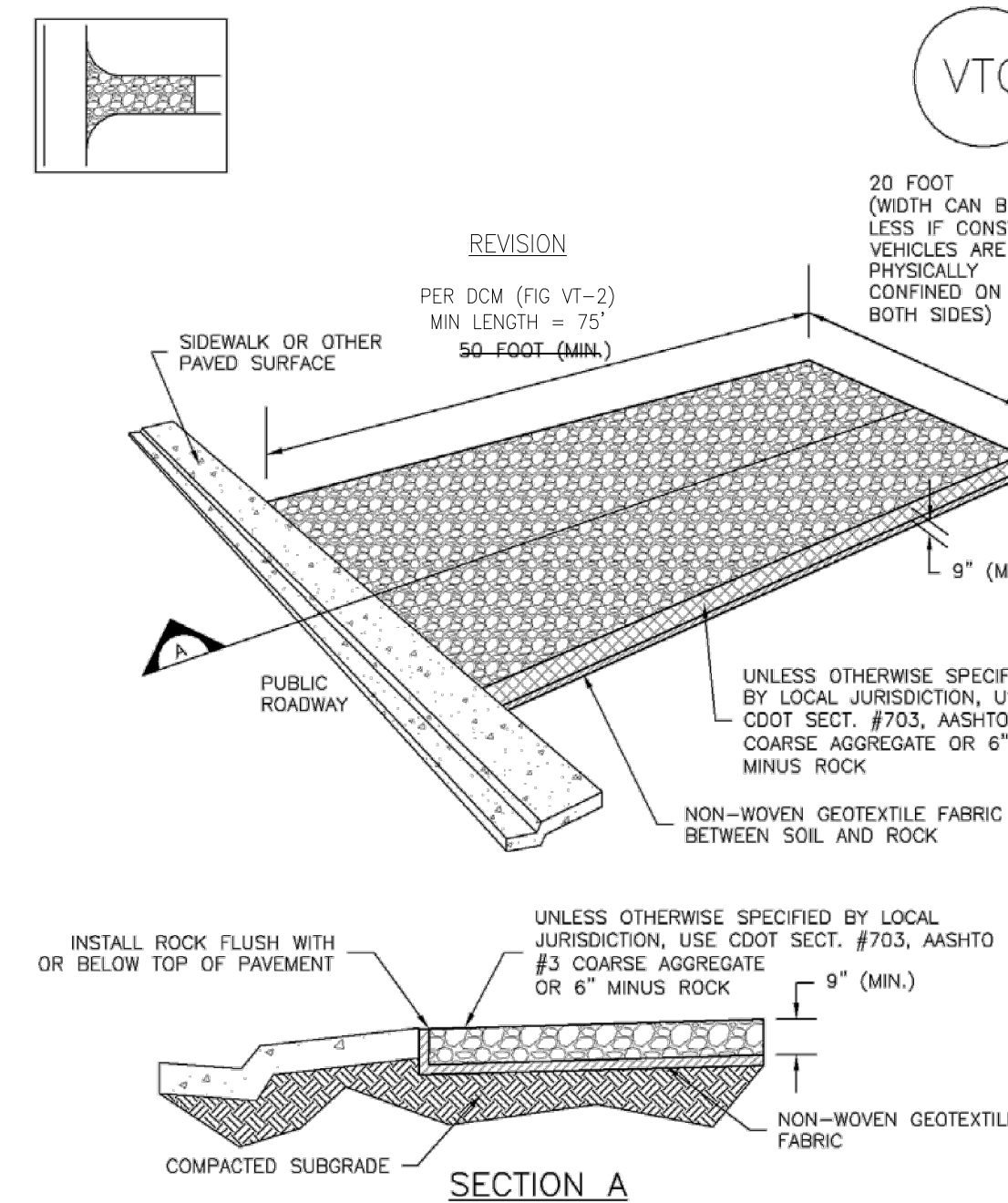
- INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
- FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
- WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
- SEDIMENT ACCUMULATED UPSTREAM OF THE CULVERT SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS 1/2 THE HEIGHT OF THE ROCK SOCK.
- CULVERT INLET PROTECTION SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

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Urban Storm Drainage Criteria Manual Volume 3 IP-7

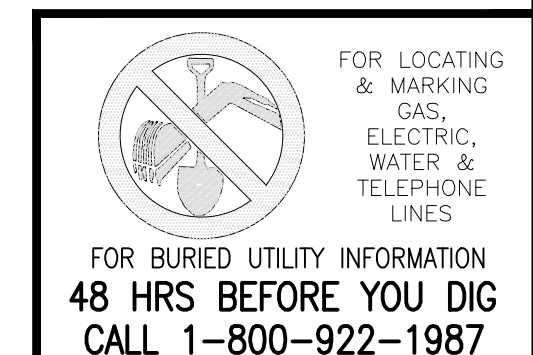
Vehicle Tracking Control (VTC) SM-4



VTC-1. AGGREGATE VEHICLE TRACKING CONTROL

November 2010 Urban Drainage and Flood Control District November 2010
Urban Storm Drainage Criteria Manual Volume 3 VTC-3

FOR INFORMATION PURPOSE ONLY



WWSO BOOSTER 2 PUMP STATION
GRADING & EROSION CONTROL PLAN
DATE: 02-04-2022
SCALE: HORIZONTAL: N/A VERTICAL: N/A
PROJECT NO. 70-077
DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS
SHEET 4 OF 8
FGR04

102 E. Pikes Peak Ave., 5th Floor
Colorado Springs, CO 80903
PHONE: 719.555.5485

CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

DARIN L. MOFFETT, COLORADO P.E. NO. 38923

100% DESIGN DRAWINGS

REVISIONS: NO. DATE: BY: DESCRIPTION: APP'D. BY: DATE:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

EC-6 Rolled Erosion Control Products (RECP)

Turf Reinforcement Mat (TRM): A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh, and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term functionality by permanently reinforcing vegetation during and after maturation. Note: TRMs are typically used in hydraulic applications, such as high flow ditches and channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation or in areas where limited vegetation establishment is anticipated.

Tables RECP-1 and RECP-2 provide guidelines for selecting rolled erosion control products appropriate to site conditions and desired longevity. Table RECP-1 is for conditions where natural vegetation alone will provide permanent erosion control, whereas Table RECP-2 is for conditions where vegetation alone will not be adequately stable to provide long-term erosion protection due to flow or other conditions.

RECP-2 Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

Roller Erosion Control Products (RECP) EC-6

Table RECP-1. ECTC Standard Specification for Temporary Rolled Erosion Control Products
(Adapted from Erosion Control Technology Council 2005)

Product Description	Slope Applications*		Channel Applications*	Minimum Tensile Strength ^{1,4,6}	Expected Longevity
	Maximum Gradient	C Factor ^{2,5}			
Mulch Control Nets	5:1 (H:V)	≤0.10 @ 5:1	Max. Shear Stress ^{3,4,6} 0.25 lbs/ft ² (12 Pa)	5 lbs/ft (0.073 kN/m)	Up to 12 months
Netless Rolled Erosion Control Blankets	4:1 (H:V)	≤0.10 @ 4:1	0.5 lbs/ft ² (24 Pa)	5 lbs/ft (0.073 kN/m)	
Single-net Erosion Control Blankets & Open Weave Textiles	3:1 (H:V)	≤0.15 @ 3:1	1.5 lbs/ft ² (72 Pa)	50 lbs/ft (0.73 kN/m)	
Double-net Erosion Control Blankets	2:1 (H:V)	≤0.20 @ 2:1	1.75 lbs/ft ² (84 Pa)	75 lbs/ft (1.09 kN/m)	
Mulch Control Nets	5:1 (H:V)	≤0.10 @ 5:1	0.25 lbs/ft ² (12 Pa)	25 lbs/ft (0.36 kN/m)	24 months
Erosion Control Blankets & Open Weave Textiles (slowly degrading)	1.5:1 (H:V)	≤0.25 @ 1.5:1	2.00 lbs/ft ² (96 Pa)	100 lbs/ft (1.45 kN/m)	24 months
Erosion Control Blankets & Open Weave Textiles	1:1 (H:V)	≤0.25 @ 1:1	2.25 lbs/ft ² (108 Pa)	125 lbs/ft (1.82 kN/m)	36 months

* C Factor and shear stress for mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material. (See Section 5.3 of Chapter 7 Construction BMPs for more information on the C Factor.)

- ¹ Minimum Average Roll Values, Machine direction using ECTC Mod. ASTM D 5035.
- ² C Factor calculated as ratio of soil loss from RECP protected slope (tested at specified or greater gradient, H:V) to ratio of soil loss from unprotected (control) plot in large-scale testing.
- ³ Required minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in) soil loss) during a 30-minute flow event in large-scale testing.
- ⁴ The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.
- ⁵ Acceptable large-scale test methods may include ASTM D 6459, or other independent testing deemed acceptable by the engineer.
- ⁶ Per the engineer's discretion. Recommended acceptable large-scale testing protocol may include ASTM D 6460, or other independent testing deemed acceptable by the engineer.

RECP-3 Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

EC-6 Rolled Erosion Control Products (RECP)

Table RECP-2. ECTC Standard Specification for Permanent¹ Rolled Erosion Control Products
(Adapted from: Erosion Control Technology Council 2005)

Product Type	Slope Applications	Channel Applications	
		Maximum Shear Stress ^{1,5}	Minimum Tensile Strength ^{2,3}
TRMs with a minimum thickness of 0.25 inches (6.35 mm) per ASTM D 6525 and UV stability of 80% per ASTM D 4355 (500 hours exposure).	0.5:1 (H:V)	6.0 lbs/ft ² (288 Pa)	125 lbs/ft (1.82 kN/m)
	0.5:1 (H:V)	8.0 lbs/ft ² (384 Pa)	150 lbs/ft (2.19 kN/m)
	0.5:1 (H:V)	10.0 lbs/ft ² (480 Pa)	175 lbs/ft (2.55 kN/m)

- ¹ For TRMs containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.
- ² Minimum Average Roll Values, machine direction only for tensile strength determination using **ASTM D 6818** (Supersedes Mod. **ASTM D 5035** for RECPs)
- ³ Field conditions with high loading and/or high survivability requirements may warrant the use of a TRM with a tensile strength of 44 kN/m (3,000 lb/ft) or greater.
- ⁴ Required minimum shear stress TRM (fully vegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in.) soil loss) during a 30-minute flow event in large scale testing.
- ⁵ Acceptable large-scale testing protocols may include **ASTM D 6460**, or other independent testing deemed acceptable by the engineer.

Design and Installation

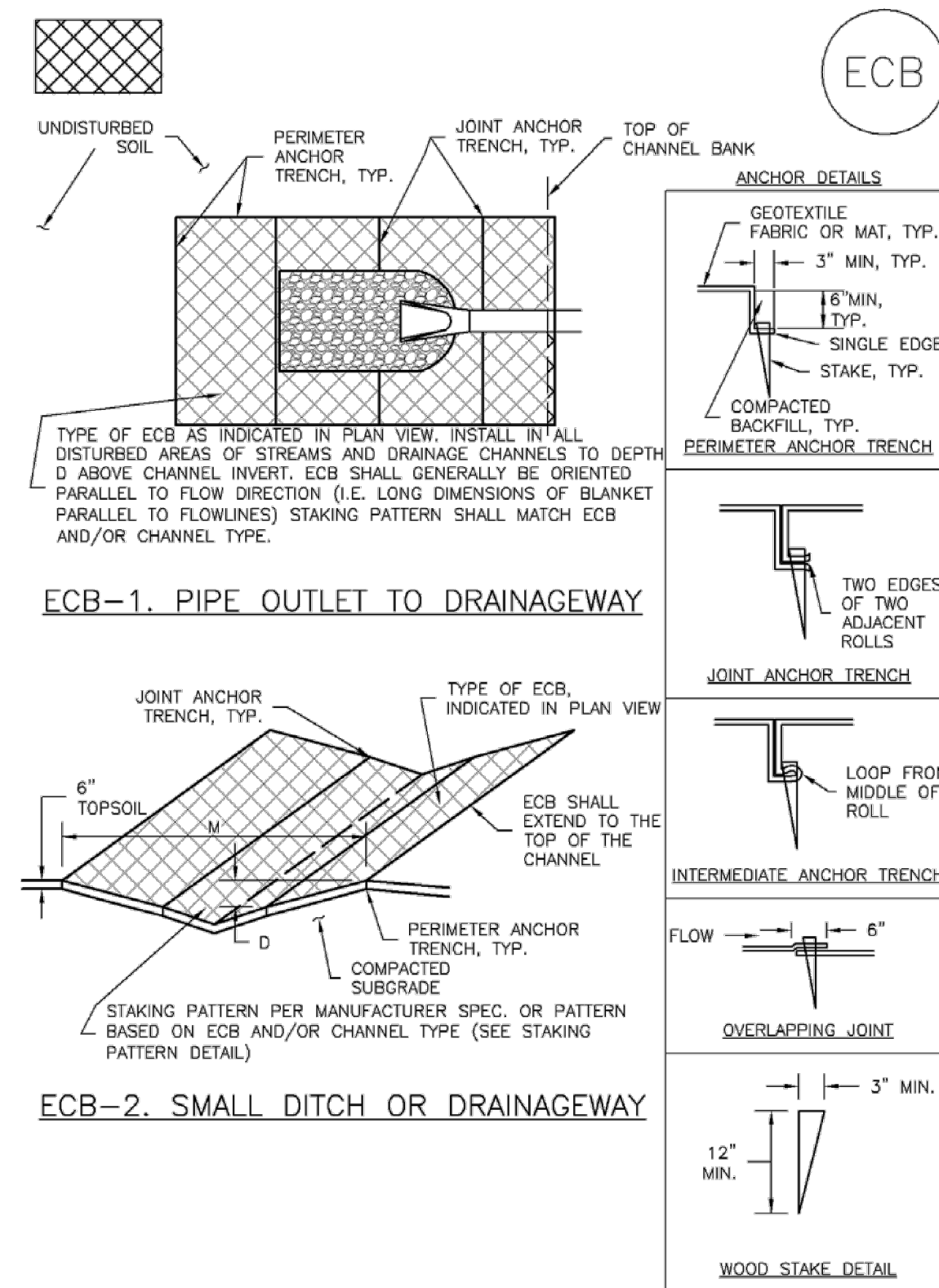
RECPs should be installed according to manufacturer's specifications and guidelines. Regardless of the type of product used, it is important to ensure no gaps or voids exist under the material and that all corners of the material are secured using stakes and trenching. Continuous contact between the product and the soil is necessary to avoid failure. Never use metal stakes to secure temporary erosion control products. Often wooden stakes are used to anchor RECPs; however, wood stakes may present installation and maintenance challenges and generally take a long time to biodegrade. Some local jurisdictions have had favorable experiences using biodegradable stakes.

This BMP Fact Sheet provides design details for several commonly used ECB applications, including:

- ECB-1 Pipe Outlet to Drainageway
- ECB-2 Small Ditch or Drainageway
- ECB-3 Outside of Drainageway

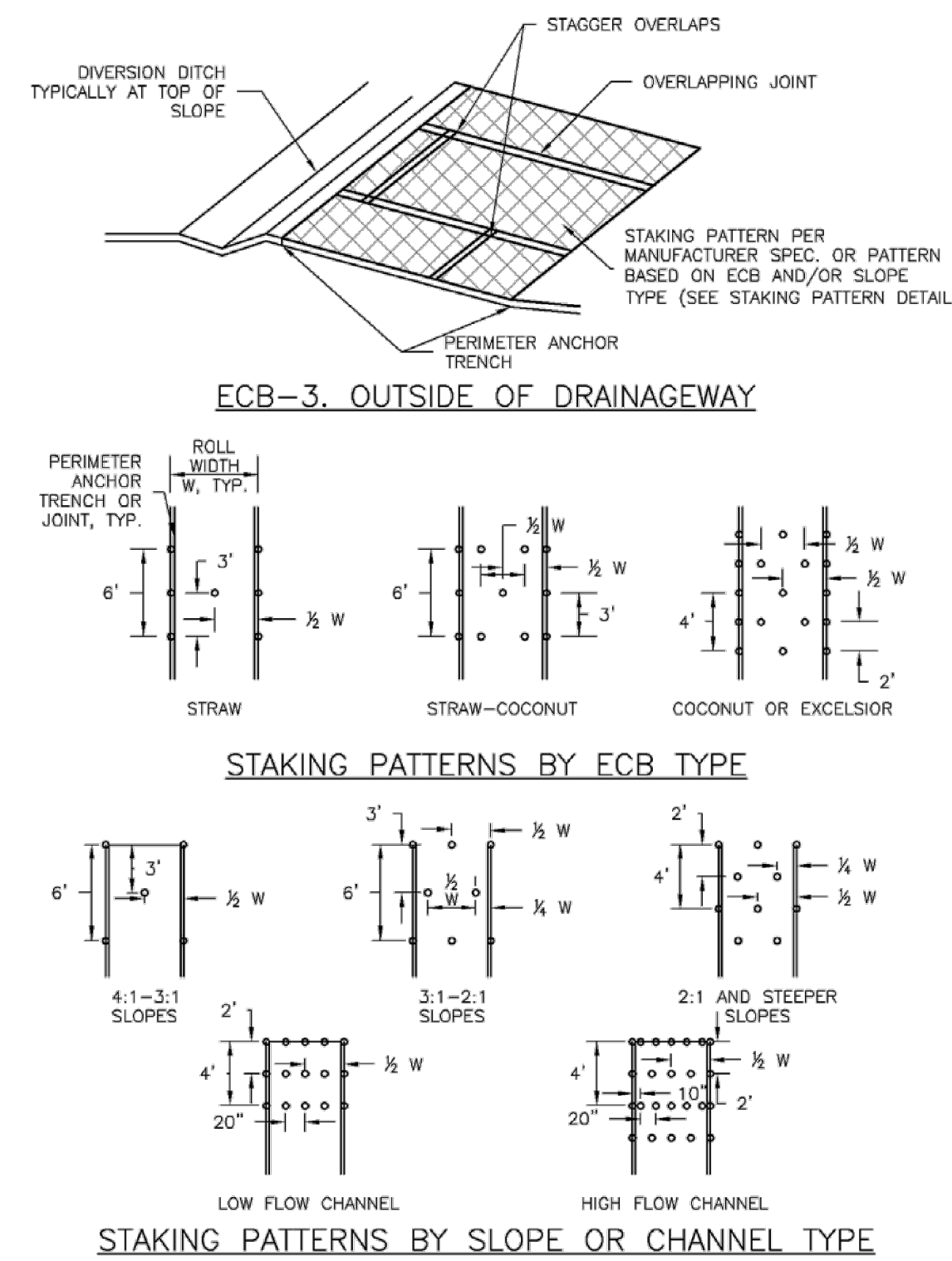
RECP-4 Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

EC-6 Rolled Erosion Control Products (RECP)



RECP-6 Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

Roller Erosion Control Products (RECP) EC-6



RECP-7 Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

EC-6 Rolled Erosion Control Products (RECP)

EROSION CONTROL BLANKET INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
 - LOCATION OF ECB.
 - TYPE OF ECB (STRAW, STRAW-COCONUT, COCONUT, OR EXCELSIOR).
 - AREA, A, IN SQUARE YARDS OF EACH TYPE OF ECB.
2. 100% NATURAL AND BIODEGRADABLE MATERIALS ARE PREFERRED FOR RECPs, ALTHOUGH SOME JURISDICTIONS MAY ALLOW OTHER MATERIALS IN SOME APPLICATIONS.
3. IN AREAS WHERE ECBs ARE SHOWN ON THE PLANS, THE PERMITTEE SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO ECB INSTALLATION AND THE ECB SHALL BE IN FULL CONTACT WITH SUBGRADE. NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.
4. PERIMETER ANCHOR TRENCH SHALL BE USED ALONG THE OUTSIDE PERIMETER OF ALL BLANKET AREAS.
5. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL ECBs EXCEPT STRAW WHICH MAY USE AN OVERLAPPING JOINT.
6. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE-HALF ROLL LENGTH FOR COCONUT AND EXCELSIOR ECBs.
7. OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER FOR ECBs ON SLOPES.
8. MATERIAL SPECIFICATIONS OF ECBs SHALL CONFORM TO TABLE ECB-1.
9. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING ECBs SHALL BE RESEDED AND MULCHED.
10. DETAILS ON DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION WILL GOVERN IF DIFFERENT FROM THOSE SHOWN HERE.

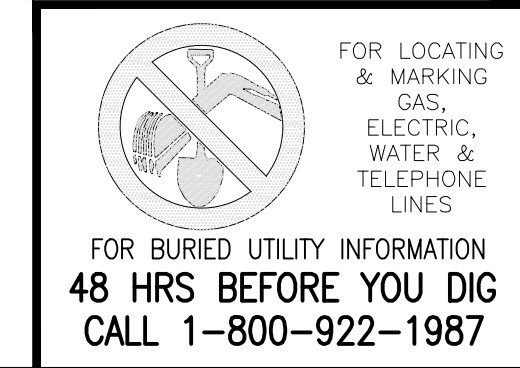
TABLE ECB-1. ECB MATERIAL SPECIFICATIONS

TYPE	COCONUT CONTENT	STRAW CONTENT	EXCELSIOR CONTENT	RECOMMENDED NETTING*
STRAW*	-	100%	-	DOUBLE/NATURAL
STRAW-COCONUT	30% MIN	70% MAX	-	DOUBLE/NATURAL
COCONUT	100%	-	-	DOUBLE/NATURAL
EXCELSIOR	-	-	100%	DOUBLE/NATURAL

*STRAW ECBs MAY ONLY BE USED OUTSIDE OF STRAW AND DRAINAGE CHANNEL. *MULTIPLY NETTING MAY BE ACCEPTABLE IN SOME JURISDICTIONS

RECP-8 Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 3 November 2010

FOR INFORMATION PURPOSE ONLY



WWSO BOOSTER 2 PUMP STATION
GRADING & EROSION CONTROL DETAILS
DATE: 02-04-2022
SHEET 6 OF 8
FCR06

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.
DAREN L. MOFFETT, COLORADO P.E. NO. 38923

100% DESIGN DRAWINGS
REVISIONS: NO. DATE: BY: DESCRIPTION: APPROVED BY: DATE:
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CAUTION

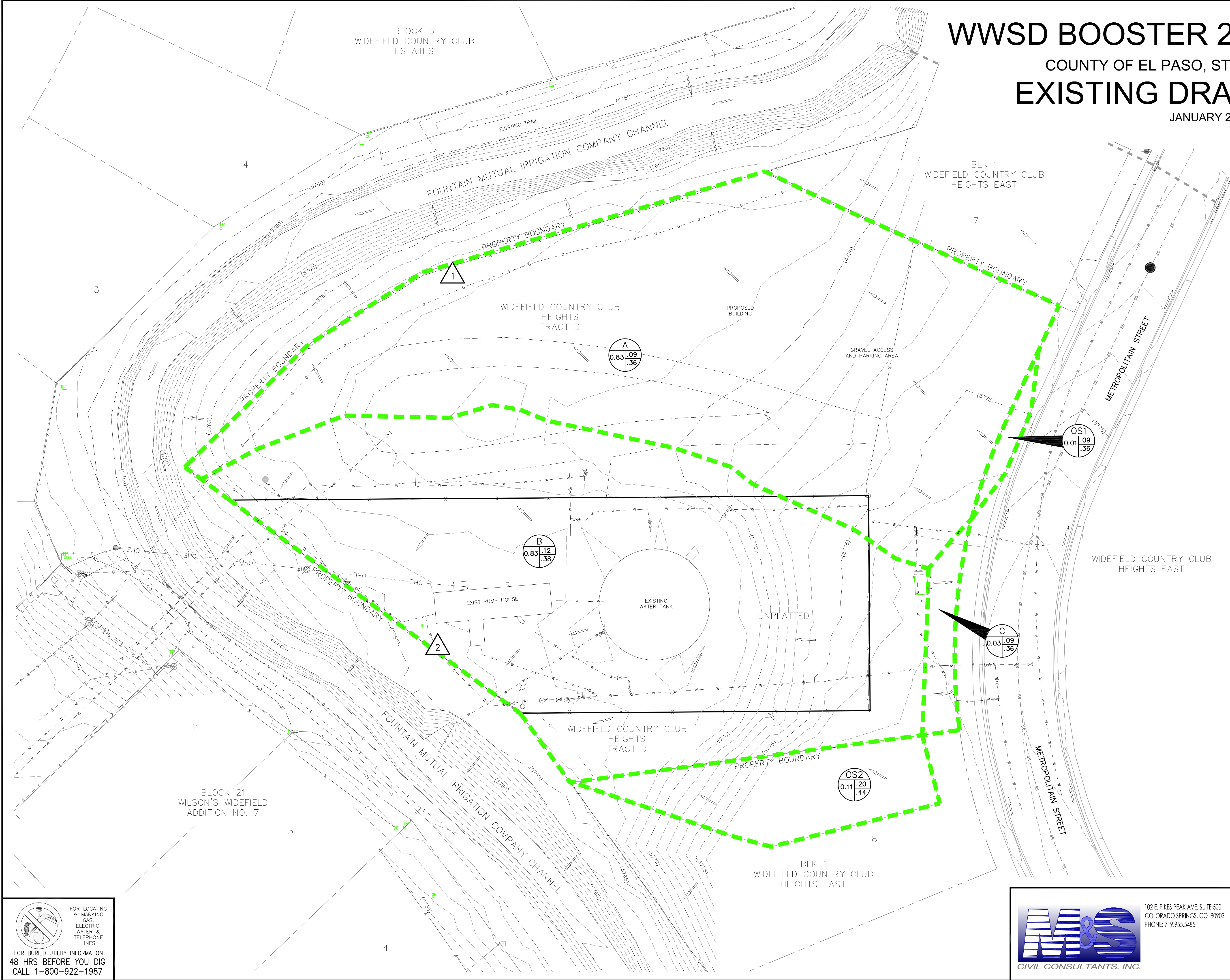
PROPOSED AND EXISTING DRAINAGE MAP

WWSD BOOSTER 2 PUMP STATION

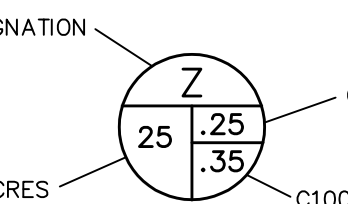


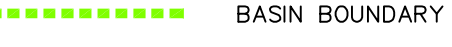
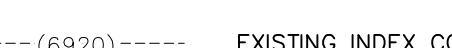

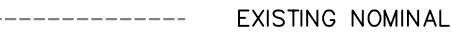

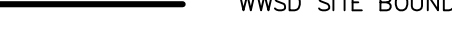

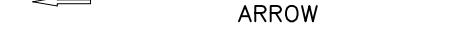
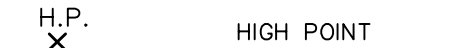


COUNTY OF EL PASO, STATE OF COLORADO

EXISTING DRAINAGE MAP

JANUARY 2020



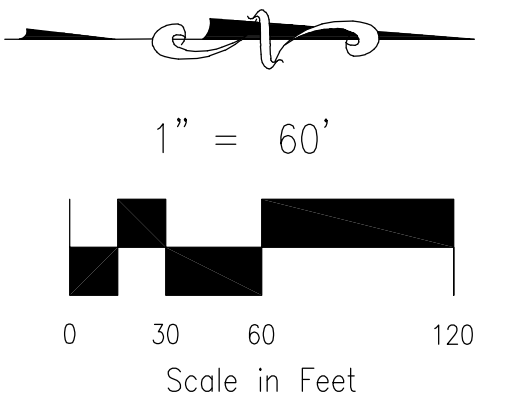
LEGEND

- BASIN DESIGNATION 
- ACRES
-  SURFACE DESIGN POINT (DP)
-  PIPE RUN REFERENCE LABEL
-  BASIN BOUNDARY
-  EXISTING INDEX CONTOUR (5')
-  EXISTING NOMINAL CONTOUR (1')
-  WWSD SITE BOUNDARY
-  EXISTING FLOW DIRECTION ARROW
-  HIGH POINT
-  LOW POINT
-  PROPOSED STORM SEWER PIPE
-  FLARED END SECTION
-  EXISTING FLOW DIRECTION ARROW
-  PROPOSED FLOW DIRECTION

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q _s	Q ₁₀₀
A	0.83	0.3	1.9
B	0.83	0.4	2.3
C	0.03	0.0*	0.1
OS1	0.01	0.0*	0.0*
OS2	0.11	0.1	0.4

* RUNOFF FROM BASIN IS LESS THAN 0.1 CFS

DESIGN POINT SUMMARY			
DESIGN POINT	Q _s	Q ₁₀₀	BASIN & DES. PTS
1	0.3	2.0	OS1, OS2, A
2	0.6	2.7	A1, OS3



FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987



102 E. PIKES PEAK AVE. SUITE 500
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

WWSD BOOSTER 2 PUMP STATION			
EXISTING DRAINAGE MAP			
PROJECT NO. 70-077	SCALE:	DATE: 8/21/2019	
DESIGNED BY: DLM	HORIZONTAL: 1"=20'	SHEET 1 OF 1	EDM
DRAWN BY: DLM	VERTICAL: N/A		
CHECKED BY: VAS			

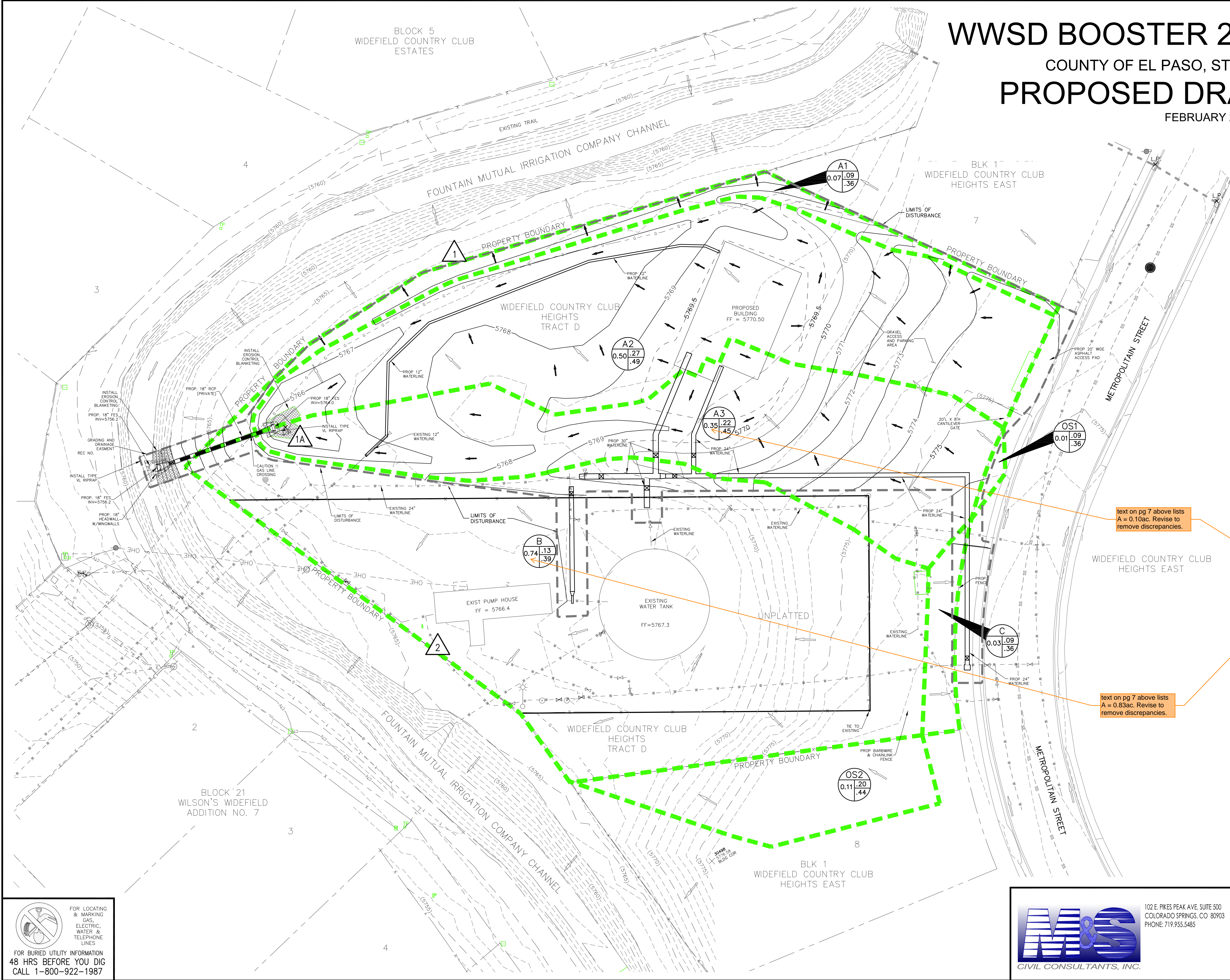
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WWSD BOOSTER 2 PUMP STATION

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

FEBRUARY 2020



- LEGEND**
- Z
25
.25
.35 C5
C100
BASIN DESIGNATION
 - 6 SURFACE DESIGN POINT (DP)
 - 4 PIPE RUN REFERENCE LABEL
 - BASIN BOUNDARY
 - EXISTING INDEX CONTOUR (5')
 - EXISTING NOMINAL CONTOUR (1')
 - WWSD SITE BOUNDARY
 - EXISTING FLOW DIRECTION ARROW
 - H.P. X
L.P. X
HIGH POINT
LOW POINT
 - PROPOSED STORM SEWER PIPE
 - FLARED END SECTION
 - EXISTING FLOW DIRECTION ARROW
 - PROPOSED FLOW DIRECTION

BASIN SUMMARY

BASIN	AREA (ACRES)	Q ₅	Q ₁₀₀
A1	0.07	0.0*	0.2
A2	0.50	0.5	1.6
A3	0.35	0.3	1.0
B	0.74	0.4	2.1
C	0.03	0.0*	0.1
OS1	<0.01	0.0*	0.0*
OS2	0.11	0.1	0.4

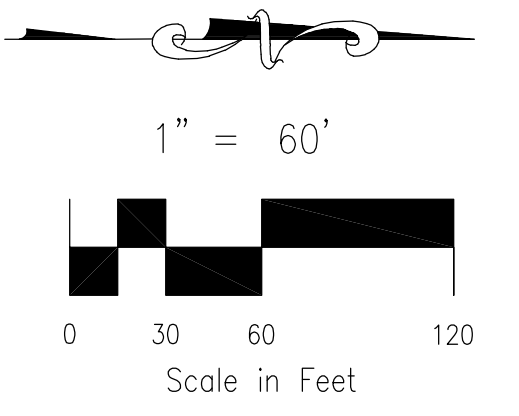
* RUNOFF FROM BASIN IS LESS THAN 0.1 CFS

DESIGN POINT SUMMARY

DESIGN POINT	Q ₅	Q ₁₀₀	BASIN & DES. PTS
1	0.0	0.2	A1
1A	0.8	2.6	OS1, A2, A3
2	0.6	2.9	OS2, B, C

text on pg 7 above lists A = 0.10ac. Revise to remove discrepancies.

text on pg 7 above lists A = 0.83ac. Revise to remove discrepancies.



File: 0:\70077A_Widefield_WAS_05_Hydro\7010 metropolitan street\Map\Eng_Cambis\70077-PDM-2-4-22.dwg Plotstamp: 2/4/2022 10:30 AM

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987

102 E. PIKES PEAK AVE. SUITE 500
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

WWSD BOOSTER 2 PUMP STATION
PROPOSED DRAINAGE MAP

PROJECT NO. 70-077	SCALE:	DATE: 2/4/2022
DESIGNED BY: DLM	HORIZONTAL: 1"=20'	SHEET 1 OF 1
DRAWN BY: DLM	VERTICAL: N/A	
CHECKED BY: VAS		

PDM