JDS-HYDRO CONSULTANTS, INC.

Submit an updated final drainage report.

Per criteria, on-site full spectrum detention (with water quality) is required.

August 18, 2021

Add a section on the updated FDR for the 4-step process. List each step and describe how each step was applied or considered with this project. See ECM Appendix I Section I.7.2.A for the 4 step process.

Dear Mr. Howser:

The purpose of this drainage letter is to satisfy requirements of the El Paso County Site Development Plan (SDP) submittal for the Colorado Centre Metropolitan District (CCMD) administrative building. In 2015, CCMD submitted a drainage report for the water treatment plant and future administrative building on the project site located at the northeast corner of the intersection of Flagstone Street and East Anvil Drive. At the time, the water treatment plant was planned for construction with the administration building to be constructed in the future.

The water treatment plant construction was completed in 2016 and the improvements included construction of the water treatment plant building, access driveway, drainage channel west of the site with area inlet, RCP, and other exterior improvements.

The current SDP submittal is for the administrative building. The drainage report submitted in 2015 for the CCMD Water Treatment Plant SDP submittal included the administration building while noting that a separate Site Development Plan and drainage report would be submitted for the future administration building. However, there are minimal changes proposed in the current submittal which provides a reduction in developed flows. Therefore, a revised drainage report is not proposed for this SDP submittal. Further explanation of the drainage for the administrative building is provided below. A copy of the 2015 drainage report is included as an attachment to this letter.

Proposed drainage improvements with supporting calculations for the development of the administrative building, including driveway, sidewalks, patios, and other impervious area were included in the previously submitted drainage report. The administration building is within Proposed Drainage Basin D1 as shown in Figure DR2 in Appendix F of the drainage report. Curb and gutter directs storm flows to two curb openings with drainage chases and into the channel west of the site. Then the developed flow from drainage basin D1 flows down the western channel, through straw bale check dams, and eventually into a 5-ft by 5-ft area inlet. From there, flows are sent directly to the existing channel along Flagstone via a buried 24-inch Reinforced Concrete Pipe (RCP). The drainage channel, southern most curb opening and drainage chase, area inlet, and RCP were constructed in 2016 as part of the CCMD Water Treatment Plant project. Any necessary channel grading as well as additional rock check dams will be installed in the western channel for this project.

There are no proposed changes to the drainage path or discharge point for this basin. The only difference is a reduction in the impervious area between the values submitted in 2015 and the revised site development plan. Below is a summary of the changes in impervious area.

Update to PCD File No. PPR-21-051

5540 TECH CENTER DRIVE, SUITE 100, COLORADO SPRINGS, CO 80919
(719) 227-0072 FAX (719) 471-3401

PCD File No. _____

This values does not match Site Dev Plan

Table 1 – Impervious Area Comparison

Item	2015 Drainage Report	Revised Site Plan	Difference
Building	5,357 sf	5,399 sf	+42 sf
Streets (Paved)	24,557 sf	25,488 sf	+931 sf
Patios and Walks	10,675 sf	5,489 sf	-5,186 sf
Total	**40,589 sf**	**36,376 sf**	**-4,213 sf**

Since there is less impervious area and therefore less developed flow than that included in the 2015 drainage report, no anticipated negative impact is anticipated downstream and on-site detention is not necessary. The area inlet and RCP were originally sized to convey the 100-year storm event. However, rock check-dams are proposed in the current SDP to help prevent erosion and provide small amounts of detention.

Sincerely,

JDS-Hydro Consultants, Inc.

Ryan Mangino, P.E.

Enclosures

2015 CCMD Water Treatment Facility Drainage Report

DRAINAGE REPORT

COLORADO CENTRE METROPOLITAN DISTRICT WATER TREATMENT FACILITY COLORADO SPRINGS, COLORADO

PERPARED FOR:

Colorado Centre Metropolitan District

August 2015

Prepared By:

JDS-HYDRO CONSULTANTS, INC.

545 EAST PIKES PEAK AVENUE • COLORADO SPRINGS, CO • 80903 • (719) 227-0072 • FAX (719) 471-3401

DRAINAGE REPORT

For

COLORADO CENTRE METROPOLITAN DISTRICT WATER TREATMENT FACILITY

COLORADO SPRINGS, COLORADO

August 2015

JDS-Hydro Project Number 247.01

Prepared For:

Colorado Centre Metropolitan District
4770 Horizonview Dr,
Colorado Springs, CO 80925

Prepared By:

JDS-Hydro Consultants, Inc.
545 East Pikes Peak Avenue, Suite 300
Colorado Springs, Colorado 80903
(719) 227-0072

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VII. Proposed Drainage Patterns ….…….. 4

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X. Erosion Control ……..... 6

XI. Conclusion ……. 6

DESIGN ENGINEER'S STATEMENT

Appendix A Legal Description

Appendix B Horizon View Drive Original Drainage Study

Appendix C NRCS and Earth Engineering Consultants Soils Reports

Appendix D Floodplain Map

Appendix E Existing & Developed Hydraulic Calculations

Appendix F Existing & Developed Drainage Drawings

Appendix G Financial Assurance Estimate

Appendix H Grading & Erosion Control Plan

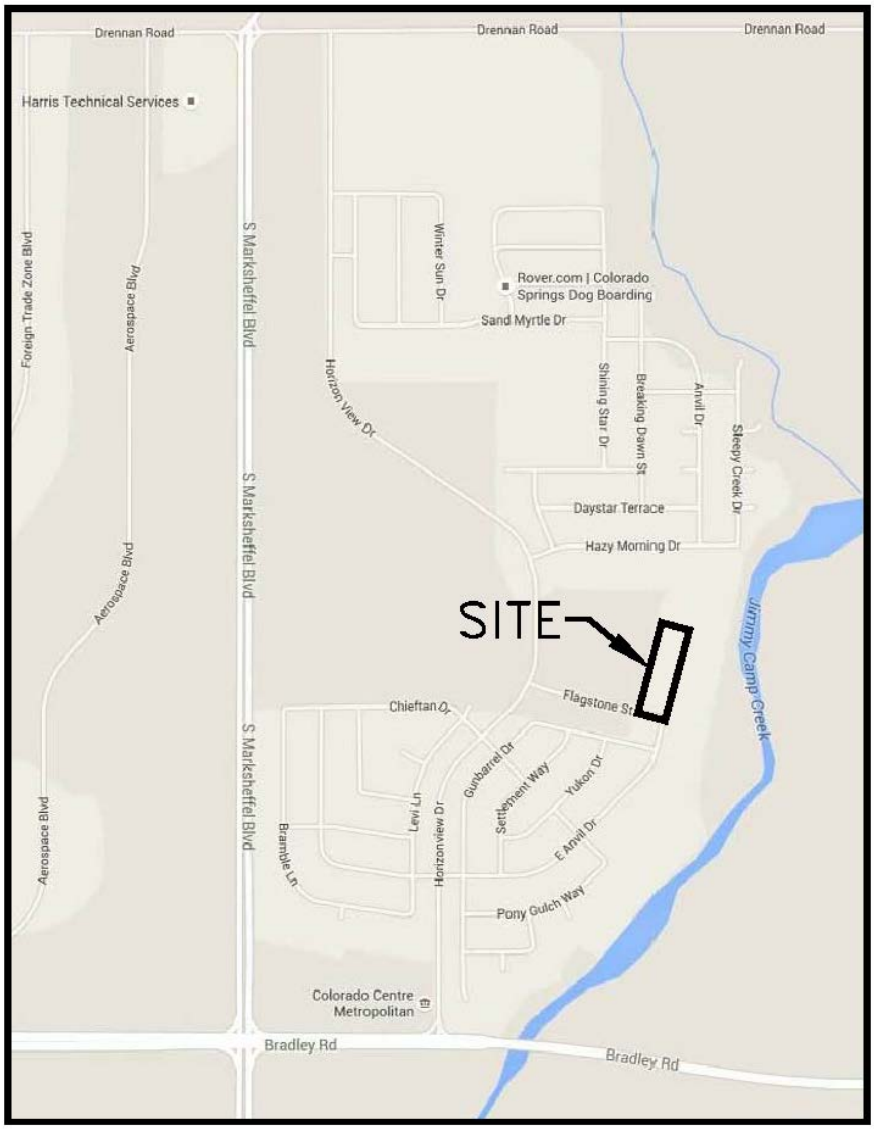
I. Purpose

The purpose of this drainage report is to satisfy requirements of the El Paso County Site Development Plan application. The information in this drainage report is in conformance with the El Paso County Drainage Criteria Manual and includes property information, existing and proposed drainage characteristics, and hydrologic calculations. The applicant is the Colorado Centre Metropolitan District (CCMD, the District).

II. General Location and Description

The subject facility is a proposed water treatment plant located within Colorado Centre Metropolitan District property, approximately 10 miles southeast of downtown Colorado Springs, CO (see vicinity map below). The site is situated at the northeast corner of the intersection of Flagstone Street and East Anvil Drive. A legal description is included in ***Appendix A***.

Vicinity Map



The intent of the applicant is to construct a water treatment facility that will treat groundwater from wells within the District. This plant will be able to serve the demand for water in CCMD. The site is zoned RS-5000 and will remain as such.

This report contains drainage calculations for the proposed water treatment facility as well as a future District administration building. Certain assumptions for impervious areas have been made for the future administration building in this report with the understanding that a separate Site Development Plan and drainage report will be submitted for the future administration building.

Construction of the site improvements and water treatment facility is slated to start in the summer of 2015.

The subject site is bounded by Jimmy Camp Creek to the east; existing "Morning Sun II" Subdivision to the north; undeveloped land to the west; and Flagstone Street/Drainage Channel to the south (per the site plan below).

Site Plan

The drainage channel to the south was built due to a previous drainage study for the area called *Horizonview Drive*, submitted in 1986 by JR Engineering, LTD. That report documented calculations for development improvements in CCMD, specifically developed flows from areas north and upstream of the existing Flagstone channel. Part of the area in that report encompassed the site where the current treatment facility is proposed. The original drainage study is enclosed as ***Appendix B***.

III. Soils Information

Soil on the property, according to the USDA National Resources Conservation Service (NRCS), consists of Ustic Torrifluvents (101) which are classified within Hydrologic Soul Group B. Per the NRCS, this soil is well drained with a low runoff class. Please refer to the enclosed NRCS soil report as well as the soils report for the area performed by Earth Engineering Consultants, LLC in ***Appendix C***.

IV. Floodplain Statement

The Floodplain Insurance Rate Map (FIRM, Panel 08041C0769 F) was reviewed to determine any potential floodplain delineation. A copy of the FIRM panel can be found in ***Appendix D***. As shown, the entirety of the proposed site is located in Zone X, an area determined to be outside of the 100-year floodplain of Jimmy Camp Creek.

V. Hydrology

The hydrology for this site was estimated using the methods outlined in the *El Paso County Drainage Criteria Manual (DCM, Volume 1 – May 2014,) as well as the Engineering Criteria Manual (ECM).*

The topography for the site was compiled using as-built survey information obtained within days prior to generation of this report.

All flow rates for the subject area were estimated using the Rational Method per Section 3.0 of the DCM. Runoff coefficients, times of concentration, and rainfall intensities were derived from calculations, tables and figures included in the DCM. Please refer to ***Appendix E*** for existing and developed drainage calculations.

VI. Existing Drainage Patterns

The major drainage characteristics include the conveyance of water south and east into the existing ditch along Flagstone Street, as well as directly into Jimmy Camp. The subject property was modeled using four existing drainage basins designated A through D.

These basins do not cover the entire property (per the legal description), but are the only basins in which proposed development will occur. Some turf sod for future soccer/baseball fields falls outside of these basins. However, values for existing ground cover is the same as the future turf sod per Table 6-7 of the DCM (short pasture and lawns)

Using the coefficients, formulas, tables, and figures in Section 3.0 of the DCM, existing drainage basin flows were calculated as follows:

Existing Drainage Basin Flows

BASIN	Area (Acres)	C_5	C_{100}	Tc	i_5	i_{100}	Discharge Point	Q_5 (CFS)	Q_{100} (CFS)
A	1.86	0.08	0.35	36.38	1.70	3.60	DE1	**0.25**	**2.34**
B	0.06	0.08	0.35	13.41	2.80	6.00	DE2	**0.01**	**0.13**
C	3.06	0.08	0.35	29.59	1.90	4.00	DE3	**0.47**	**4.29**
D	0.74	0.08	0.35	21.33	2.30	4.80	DE4	**0.14**	**1.25**
Totals	**5.73**							**0.87**	**8.01**

Notes:
1. C values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014
2. Intensity values taken from Figure 6-5 of the DCM May 2014

VII. Proposed Drainage Patterns

The proposed drainage of this site will be similar to the existing drainage with included impacts from the water treatment building, future administration building, and asphalt access road. Water will continue to flow from the site into the existing ditch along Flagstone Street, while other flows will be conveyed directly to Jimmy Camp Creek.

The developed areas of the site were also modeled using four drainage basins designated D1 through D4. The developed basins drain to roughly the same locations as their "existing basin" counterparts, with D1 relative to existing Basin A, D2 relative to existing Basin B, and so on.

Basin D1 is roughly 70% larger than Basin A as it picks up a majority of the access drive and future administration building site. Consequently, Basin D3 is roughly 30% less than Basin C.

Basin D2 remains similar in size to Basin B, but becomes nearly 100% impervious. Basin D4 increases slightly in size compared to Basin D, but contains no impervious area. Flows slightly increase due to a decrease in Time of Concentration since the basin becomes shorter.

Two (2) proposed curb openings with drainage chases are proposed to intercept some flow from the access drive and convey it into the main channel west of the site. The openings are designed to be 4 feet wide and must be in accordance with details SD_3-25 and SD_3-25A of the ECM. The drainage swales that convey flow to the west channel are comprised of riprap from the back of the curb opening to the flowline of the west channel.

As with the existing basins, the developed basins do not cover the entire property, but are the only areas in which proposed development will occur. Again, future turf sod falls outside of the modeled areas, but values for existing ground cover is the same as the future turf sod per Table 6-7 of the DCM (short pasture and lawns)

Using the same coefficients, formulas, tables, and figures in Section 3.0 of the DCM, developed drainage basin flows were calculated as follows:

Developed Drainage Basin Flows

BASIN	Area (Acres)	C_5	C_{100}	Tc	i_5	i_{100}	Discharge Point	Q_5 (CFS)	Q_{100} (CFS)
D1	3.17	0.31	0.52	25.21	2.10	4.40	DP1	**2.09**	**7.30**
D2	0.18	0.89	0.96	5.00	4.10	8.70	DP2	**0.66**	**1.50**
D3	2.12	0.13	0.39	16.45	2.60	5.60	DP3	**0.73**	**4.62**
D4	0.68	0.08	0.35	17.67	2.50	5.40	DP4	**0.14**	**1.29**
Totals	**6.15**						**Totals**	**3.62**	**14.70**

Notes:

1. C values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014 and are weighted per the developed basin tables
2. Intensity values taken from Figure 6-5 of the DCM May 2014

With the proposed development, flows from Basin D1 will flow down the western channel, through straw bale check dams, and eventually into a 5-ft by 5-ft area inlet. From there, flows will be sent directly to the existing channel along Flagstone via a buried 24-inch Reinforced Concrete Pipe (RCP).

The area inlet was sized to convey the 100-year storm, using the grate inlet capacity formula in Section 7.5.2 of the DCM. The RCP was sized using Figure 9-17 of the DCM. ***Appendix E*** contains the calculations and figures used to size the inlet and RCP.

There were no existing calculations in the original drainage study. However, 5-year and 100-year developed flows at the same locations where the subject site discharges were calculated to be a total of **32 CFS** and **65 CFS**, respectively. These numbers are the sum of flows from discharge locations referred to in the report as Off Site 3 (OS.3) and Off Site 4 (OS.4).

The developed calculations for the subject site are less than those calculated in the original report. This is due to a decrease in impervious areas when comparing the currently proposed improvements versus those in the original report. Also, much of the subject area in the original drainage report currently sheet flows directly to Jimmy Camp Creek and not to the design points in the original drainage study. Per this project, much of the subject site will also continue to sheet flow directly to Jimmy Camp Creek and not to the design points considered in the original drainage study.

Since the proposed developed flows from this site are less than the developed flows in the original drainage study, the Applicant is proposing that on-site detention is not necessary. However, straw-bale check-dams are proposed to help prevent erosion and provide small amounts of detention.

The area inlet and RCP were designed to convey flows directly to the existing Flagstone channel instead of via surface flow in the existing cross-pan.

VIII. Proposed Water Quality Improvements

Although the applicant is not proposing a detention pond, the basin with the largest flows (D1) is slated to have straw-bale check dams at intervals within the channel to help with erosion as well as provide small amounts of detention. Please refer to the Existing and Developed Drainage drawings and details in ***Appendix F*** for locations and additional information on the check dams.

IX. Economic Analysis

Included in ***Appendix G*** is the Financial Assurance Estimate form with unit costs per El Paso County's latest template.

X. Erosion Control

Grading of the site will be related to the construction of the proposed treatment facility, access drive, and drainage channel west of the access drive. The proposed methods of erosion control are shown on the Grading & Erosion Control Plan in ***Appendix H***. Erosion control shall include installation of silt fence at the toe of grading operations, curb socks, straw bale check dams, a vehicle tracking control pad, and permanent stabilization of all disturbed areas. Disturbed areas shall be re-seeded with native grasses.

The District will be responsible for maintenance of all permanent BMP's.

XI. Conclusion

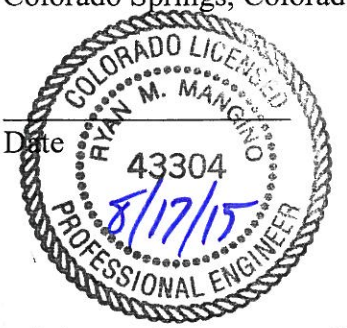
Since the proposed developed flows from this site are less than the developed flows per the original drainage study, and since the drainage channel along Flagstone Street was sized to accommodate the flows anticipated in the original drainage study, it is estimated that the flows from the proposed development will not negatively impact the channel. Therefore, the Applicant is proposing that on-site detention is not necessary. However, straw-bale barrier check-dams are proposed to preserve water quality by helping prevent erosion and provide small amounts of detention. Also, an area inlet and RCP pipe are proposed to convey the larger flows from Basin D1 directly to the Flagstone channel to prevent surface flows into the cross-pan at the intersection of Flagstone St. and East Anvil Dr.

DESIGN ENGINEER'S STATEMENT:

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

JDS-Hydro Consultants, 545 E. Pikes Peak Ave. Suite 300, Colorado Springs, Colorado 80903

Ryan M. Mangino, PE #43304 Date



OWNER/DEVELOPER'S STATEMENT:

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

8/17/15
Date

Colorado Centre Metropolitan District
4770 Horizonview Dr.
Colorado Springs, CO 80925

El PASO COUNTY:

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

8-18-15
Date

Andre P. Brackin, PE
County Engineer / ECM Administrator

Conditions:

Appendix A

JDS-HYDRO CONSULTANTS, INC.

El Paso County Development Services
2880 International Circle
Colorado Springs, CO 80910
Attn: Craig Dossey

June 10, 2015

Re: Colorado Centre Metropolitan District
Water Treatment Facility – Site Development Plan
LEGAL DESCRIPTION

A TRACT OF LAND IN SECION 3, TOWNSHIP 15 SOUTH, RANGE 65 WEST OF THE 6TH P.M., BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEST CORNER OF SAID SECTION; THENCE N 00°10'17" EAST, A DISTANCE OF 1322.35 FEET; THENCE S 89°24'57" WEST, A DISTANCE OF 636.74 FEET TO THE POINT OF BEGINNING OF THIS DESCRIPTION:

- THENCE S 89°24'57" WEST, A DISTANCE OF 416.33 FEET;
- THENCE S 12°40'27" WEST, A DISTANCE OF 635.54 FEET;
- THENCE S 77°19'33" EAST, A DISTANCE OF 520.00 FEET;
- THENCE N 12°40'27" EAST, A DISTANCE OF 243.91 FEET;
- THENCE N 00°35'03" WEST, A DISTANCE OF 500.45 FEET TO THE POINT OF BEGINNING OF THIS DESCRIPTION:

ABOVE DESCRIBED PARCEL CONTAINS APPROXIMATELY 7.73 ACRES, MORE OR LESS.

545 EAST PIKES PEAK AVENUE SUITE 300, COLORADO SPRINGS, CO 80903
(719) 227-0072 FAX (719) 471-3401

Appendix B

JR ENGINEERING, LTD.
2120 Hollowbrook Drive
Colorado Springs, Colorado 80918
303-528-8833

Colorado Springs
Denver
Phoenix

Engineering
Planning
Surveying

74

DRAINAGE STUDY

HORIZONVIEW DRIVE

MARCH 21, 1986

JOB NO. 7017.01

REVISED APRIL 1, 1986

Prepared For:

COLORADO CENTRE METROPOLITAN DISTRICT
1250 Academy Park Loop, Suite #214
Colorado Springs, Colorado 80910

Prepared By:

JR ENGINEERING, LTD.
2120 Hollowbrook Drive, Suite #201
Colorado Springs, Colorado 80918

HORIZONVIEW DRIVE

DRAINAGE REPORT STATEMENT

Engineer's Statement:

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

Michael B. McCarthy 6-4-96

Michael B. McCarthy, P.E. #14617
For and on Behalf of JR Engineering, LLC

COLORADO REGISTERED MICHAEL B. McCARTHY 14617 PROFESSIONAL ENGINEER

Developer's Statement:

The developer has read and will comply with all the requirements specified in this drainage report.

Colorado Centre Metropolitan District
Business Name

By: James Torres James Torres

Title: District Manager

Address: 1250 Academy Park Loop, #214

Colorado Springs, CO 80910

County of El Paso:

Filed in accordance with Section 45-1 of the El Paso County Land Development Code, January, 1980.

El Paso County Department of Transportation Date
Max L. Rothschild, P.E.
Director of Transportation

Conditions:

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General Description	1
Drainage Characteristics	1-3
Hydrologic Calculations	3-4
Summary	4

APPENDIX

USCS	Exhibit A
Master Drainage Study	Exhibit B
SCS Soils Map	Exhibit C
Hydrologic Calculations	Table 1
Culvert Sizing Charts	Figure 7
Inlet Sizing Charts	
Street Capacity Calculations	
Design Charts	
Drainage Plan	Back Cover

DRAINAGE STUDY
HORIZONVIEW DRIVE
MARCH 21, 1986

Scope and Intent

The scope of this drainage study is to estimate the anticipated amount of runoff from developed onsite and adjacent offsite basins and propose adequate methods of routing the runoff to acceptable outfall facilities.

The intent of this study is to satisfy the El Paso County Department of Transportation's concern with regard to proper inlet sizing and street capacities.

General Description

The proposed Horizonview Drive is located in Section 3, Township 15 South, Range 65 West of the Sixth Principal Meridian in El Paso County, State of Colorado. More specifically, it will connect the existing portion of Horizonview Drive (east of Colorado Centre Residential) to existing Drennan Road, see Exhibit A.

Drainage Characteristics

The site presently consists of gentle slopes with poor grass cover. Offsite runoff generally enters from the northeast and flows southwest.

Under a developed condition, runoff will be discharged from Horizonview Drive at two locations. Firstly, runoff from Basins B, C, D, E, F_1, and F_2 will be intercepted by two 15' inlets at the low point in the street profile (Design Point 1). Then it will combine with runoff from Basin G via the 54" CMP (Design Point 2). Basins B and C will remain at historic runoff levels whereas Basin G runoff was calculated using a curve number of 85 to reflect future residential development. A temporary outfall swale is recommended to daylight in a southwesterly direction until the area develops. At that time, a drainage scheme as shown in the "Revised Preliminary Master Drainage Study for Colorado Centre" will be required.

Secondly, runoff from Basins A and H will combine at the culverts beneath the temporary access road to Morning Sun Subdivision. Channel Section 1 will be constructed at a future date. Due to a narrow mat width on the temporary access road, curb openings will be provided to let runoff from Basin OS1 spill into the proposed channel. Once this area develops, Type R inlets will be required. The combined discharge will be channeled southward beneath Horizonview Drive to Design Point 7.

Two 15' inlets will intercept runoff from Basins OS2, I and J. The culverts at Design Point 8 (2 - 60" CMP) will discharge the combined runoff into the proposed outfall channel. Since this channel is discharging into Jimmy Camp Creek, a minimum grade of 0.2 percent is required for optimum outfall elevation. As a result, grass lining is applicable with a concrete trickle channel.

Runoff from Basins K, L, OS3, and OS4 will be intercepted by future improvements (east/west residential street) and discharged into the outfall channel.

Hydrologic Calculations

The method used for calculating the anticipated amounts of runoff is the SCS Method as outlined in "Areawide Urban Runoff Control Manual" and "Procedures for Determining Peak Flows in Colorado".

Design storms with 5-year and 100-year recurrence interval and 24-hour duration were used to estimate basin and design point runoff. The amount of precipitation for these storms is 2.8" and 4.5", respectively. Offsite runoff quantities are from "Drainage Report for Morning Sun Subdivision in Colorado Centre" by United Planning & Engineering, dated February 11, 1986.

Soil type and hydrologic group information was obtained rrom the SCS "Soil Survey of El Paso County Area, Colorado" and summarized in the following table:

Identity Number	Soil Type	Hydrologic Group
2	Ascalon	B
56	Nelson	B
86	Stoneham	B
101	Ustic Torrifluvents	B

The culverts have been sized to prevent the 100-year storm runoff from overtopping the streets. The inlets are sized and spaced to provide an emergency travel lane along Horizonview Drive.

Summary

The runoff quantities associated with the construction of Horizonview Drive will not adversely affect surrounding developments and will be safely channeled to adequate outfall facilities.

Respectfully submitted,

Joseph W. DesJardin
For and on Behalf of JR Engineering, Ltd.

APRIL 4, 1986
Date

Michael B. McCarthy, P.E. #14617
For and on Behalf of JR Engineering, Ltd.

4.4.86
Date

COLORADO REGISTERED MICHAEL B. McCARTHY 14617 PROFESSIONAL ENGINEER

HORIZONVIEW DRAINAGE IMPROVEMENTS
JOB NO 7017.01
GRASS LINED CHANNEL

S T O R M S E W E R

DESCRIPTION	UNIT	QUANT	UNIT COST	EXTENSION
DROP INLET STRUCTURES				
TYPE-R	EA	4.00	4000.00	$ 16,000.00
CULVERTS				
CMP PIPE	LF			
60"		645.00	58.12	37,487.40
OPEN CHANNELS				
STRIPPING	CY	3041.00	0.75	2,280.75
EXCAVATION	CY	38694.00	0.90	34,824.60
FILTER FABRIC	SY	930.00	0.41	381.30
FILTER SAND	CY	63.00	9.00	567.00
GRASS LINED				
SEED @ 45lb/AC	LB	170.00	10.00	1,700.00
JUTE MATTING	SY	18090.00	1.14	20,622.60
RIP-RAP	CY	470.00	30.00	14,100.00
WING & HEADWALLS	CY	17.8	200.00	3,556.00
CONCRETE TRICKLE CHANNEL	LF	2737.00	27.80	76,088.60
SUBTOTAL				191,608.25
10% ENGINEERING CONTINGENCY				19,160.82
TOTAL				$ 210,769.07

Since JR Engineering, Ltd. has no control over the cost of labor, materials, or equipment, or over the contractor's method of determining prices, or over competive bidding or market conditions, our opinions of probable construction cost provided for herein are made on the basis of our experience and qualifications. These opinions represent our best judgment as a design professional familiar with the construction industry. However, JR Developers, Ltd. cannot and does not guarantee that proposal, bids, or the construction cost will not vary from opinions of probable cost prepared by us. If the owner wishes greater assurance as to the construction cost, he shall employ an independent cost estimator.

HORIZONVIEW DRAINAGE IMPROVEMENTS
JOB NO 7017.01
RIP RAP CHANNEL

S T O R M S E W E R

DESCRIPTION	UNIT	QUANT	UNIT COST	EXTENSION
DROP INLET STRUCTURES				
TYPE-R	EA	4.00	4000.00	$ 16,000.00
CULVERTS				
CMP PIPE	LF			
60"		645.00	58.12	37,487.40
OPEN CHANNELS				
STRIPPING	CY	3041.00	0.75	2,280.75
EXCAVATION	CY	38694.00	0.90	34,824.60
FILTER FABRIC	SY	12164.00	0.41	4,987.42
FILTER SAND	CY	1014.00	9.00	9,126.00
RIP-RAP	CY	6083.00	30.00	182,490.00
WING & HEADWALLS	CY	17.8	200.00	3,556.00
SUBTOTAL				290,752.17
10% ENGINEERING CONTINGENCY				29,075.21
TOTAL				$ 319,827.38

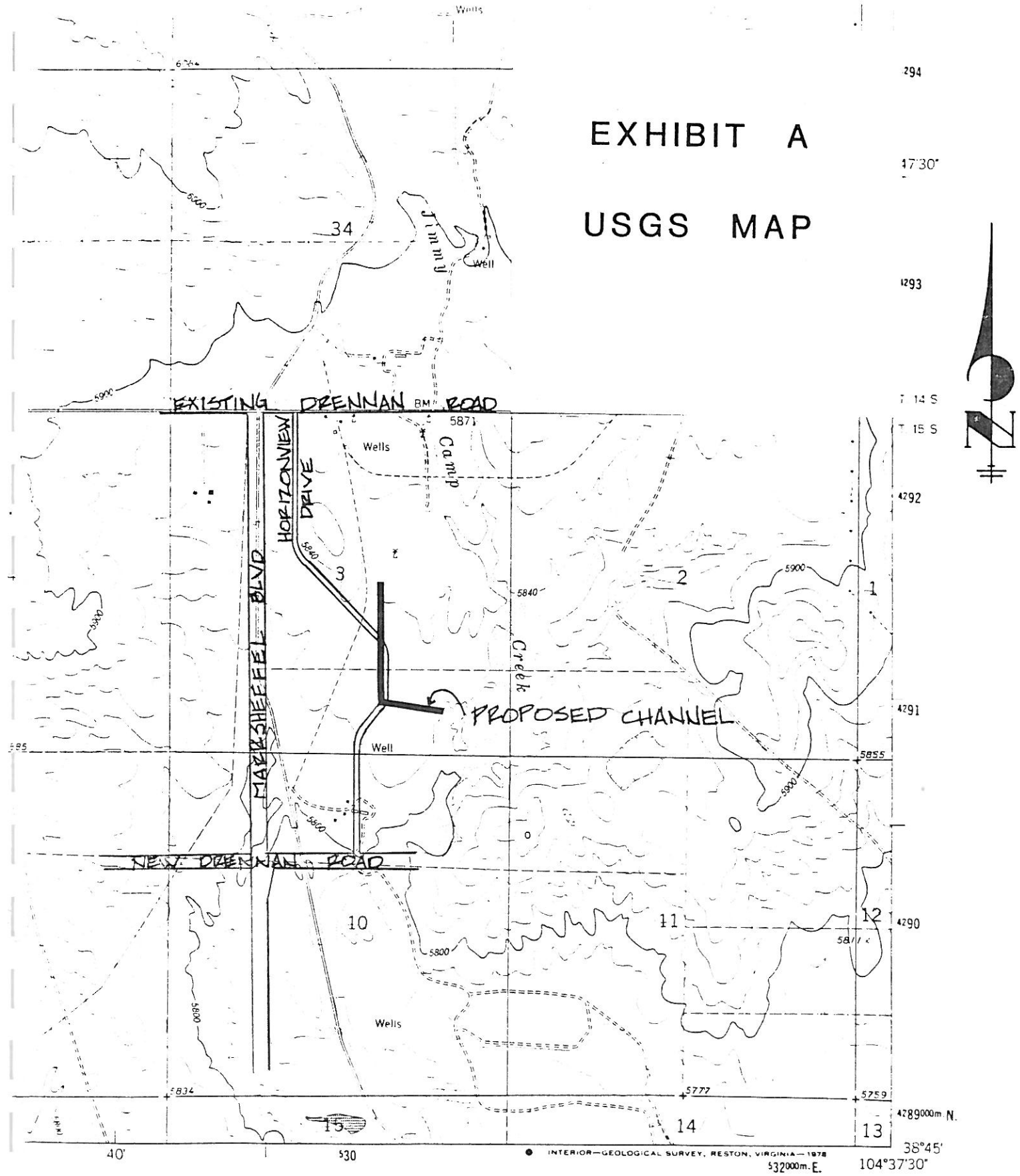
Since JR Engineering, Ltd. has no control over the cost of labor, materials, or equipment, or over the contractor's method of determining prices, or over competive bidding or market conditions, our opinions of probable construction cost provided for herein are made on the basis of our experience and qualifications. These opinions represent our best judgment as a design professional familiar with the construction industry. However, JR Developers, Ltd. cannot and does not guarantee that proposal, bids, or the construction cost will not vary from opinions of probable cost prepared by us. If the owner wishes greater assurance as to the construction cost, he shall employ an independent cost estimator.

APPENDIX

EXHIBIT A - USGS

EXHIBIT A

USGS MAP



INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1978

1 MILE

FEET

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty ———

Medium-duty ——— Unimproved dirt ========

U.S. Route State Route

COLORADO

QUADRANGLE LOCATION

ELSMERE, COLO.

(FOUNTAIN NE)
5061 II NE

EXHIBIT B - MASTER DRAINAGE STUDY

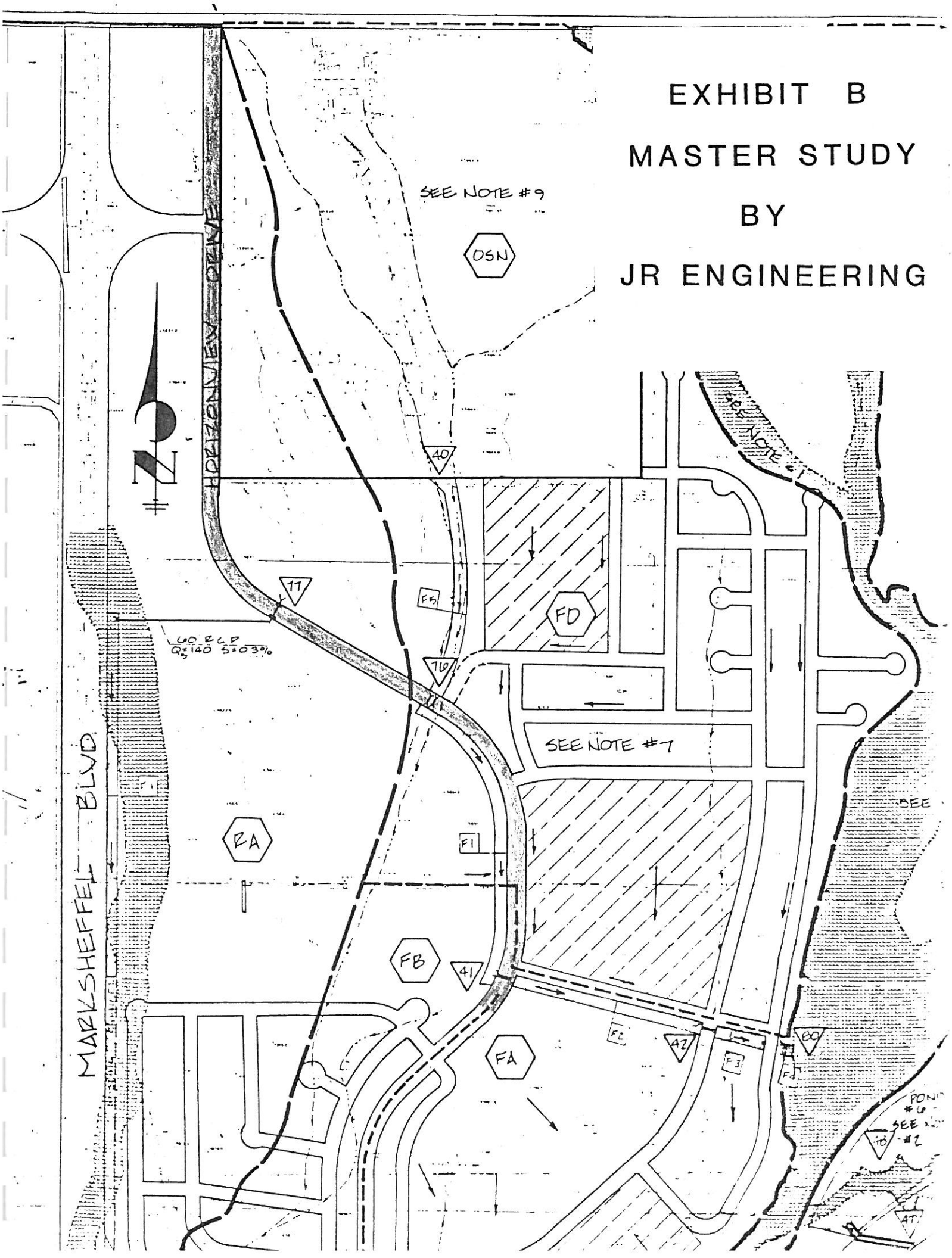


EXHIBIT B
MASTER STUDY
BY
JR ENGINEERING
SEE NOTE #9
OSN
40
77
FS
FD
76
SEE NOTE #7
RA
F1
FB
41
FA
F2
42
F3
80
MARKSHEFFEL BLVD

EXHIBIT C - SCS SOILS MAP

EXHIBIT C

SOILS MAP

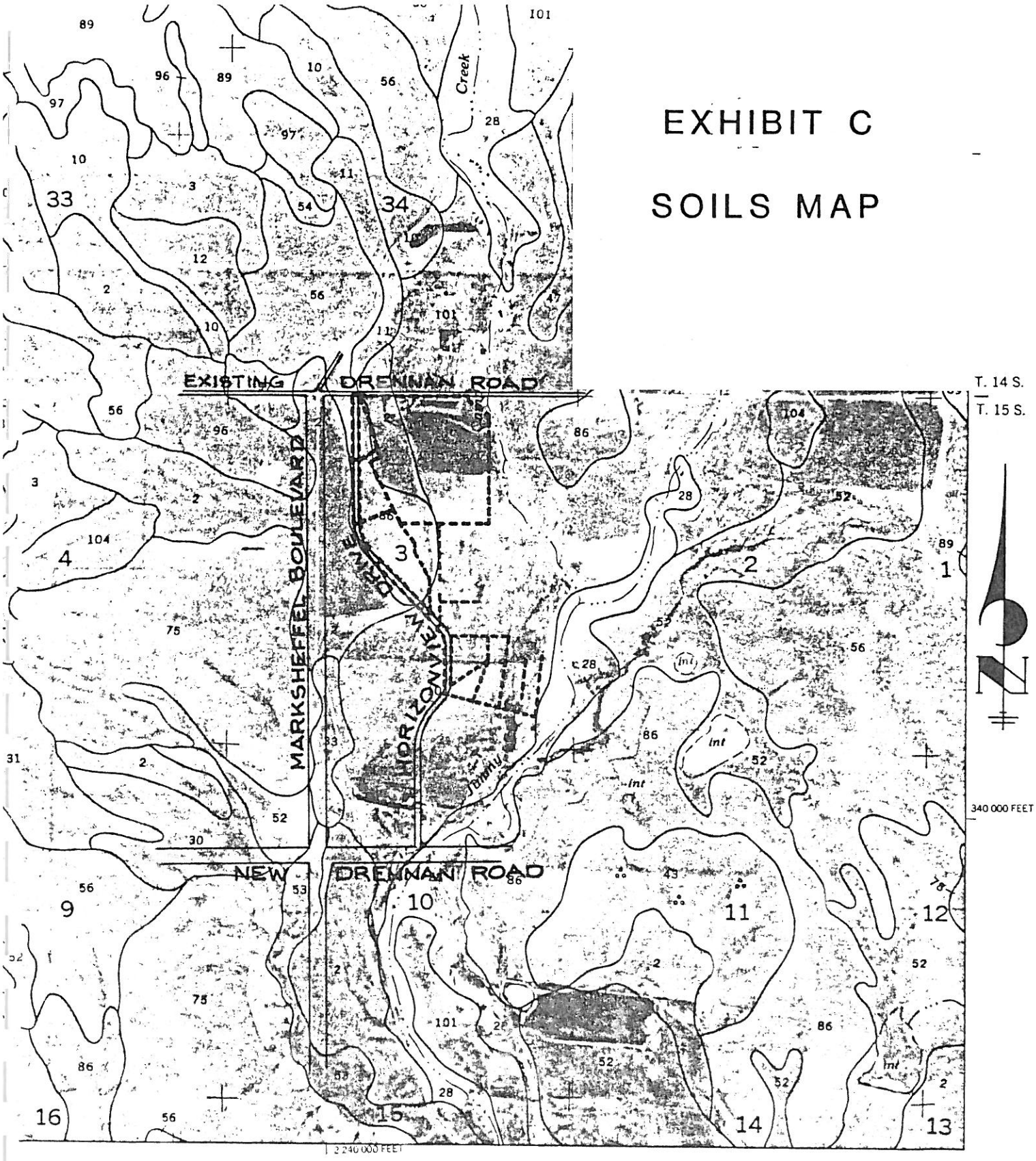


TABLE 1 - HYDROLOGIC CALCULATIONS

MAJOR BASIN	SUB BASIN	AREA Planim. Head.	AREA SQ. MILE	BASIN LENGTH	BASIN HEIGHT	Tc (HR)	q_p (CSM/IN.)	SOIL GROUP	DEV. TYPE	CURVE NO.	5 YR. / 100 YR. FLOW Q(IN)	Q_5 (CFS)	Q_{100} (CFS)
	B		0.0045	270	4	L=0.1 0.17	870	B	POOR RANGE	79	1.04 / 2.38	4	9
	C		0.0024	995	19	V=5 FPS 0.06	1000	B	55% PAVE 45% GRASS	86	1.49 / 3.00	4	9
	D		0.0138	560	34	0.14	920	B	POOR RANGE	79	1.04 / 2.38	13	30
	E		0.0034	1195	18	V=5 FPS 0.07	1000	B	55% P. 45% G.	86	1.49 / 3.00	6	11
	F_1		0.0020	700		V=5 FPS 0.04	1000	B	55% P. 45% G.	86	1.49 / 3.00	3	6
CHECK ROAD CAPACITY			0.0266			0.34	675			81	1.16 / 2.55	21	46
	F_2		0.0028	1000		V=5 FPS 0.06	1000	B	55% P. 45% G.	86	1.49 / 3.00	4	8
DESIGN POINT (1)			0.0294			0.34	675			81	1.16 / 2.55	23	51
	G		0.0254	900	9	V=2 FPS 0.13	960	B	1/3 ACRE RES.	85	1.42 / 2.91	35	71
DESIGN POINT (2)			0.0543			0.34	675			83	1.29 / 2.72	48	101
DESIGN POINT (3)	A		0.1272	2150	1.26%	V=1.5 FPS 0.40	630	B	POOR RANGE	79	1.04 / 2.38	83	191
	H		0.0118	1200		V=8 FPS 0.04	1000	B	1/8 AC. RES.	85	1.42 / 2.91	17	34
DESIGN POINT (4)	OS 1	FROM MORNING SUN	0.0190			0.22	800	B	SCHOOL	80	1.2 / 2.4	18	36
DESIGN POINT (5) =	DESIGN POINT (6)		0.1580			0.40	630			80	1.10 / 2.46	109	245

HYDROLOGIC COMPUTATION – BASIC DATA

PROJ HORIZON VIEW DRIVE

By: JWD
Date: 3-21-86

DEVELOPED RUNOFF

MAJOR BASIN	SUB BASIN	AREA Planim. Read.	AREA SQ. MILE	BASIN LENGTH	BASIN HEIGHT	Tc (HR)	q_p (CSM/IN.)	SOIL GROUP	DEV. TYPE	CURVE NO.	5 YR. / 100 YR. FLOW Q(IN)	(CFS) q_5	(CFS) q_{100}
	I	200x90	0.0006	200	1% V=5FPS	0.01	1000	B	55% P 45% G	86	1.49 / 3.00	1	2
	OS-2	FROM MORNING SUN	0.0170	1700	15	0.25	760	B	RES.	85	1.5 / 2.95	19	38
	J		0.0116	700	1.5% 10	V=1 FPS 0.19	840	B	SCHOOL	80	1.10 / 2.46	11	24
DESIGN POINT 7			0.0292			0.25	760			93	1.29 / 2.72	29	60
	DESIGN POINT 5		0.1580			0.40	630			80	1.10 / 2.46	109	245
DESIGN POINT 8			0.1872			0.44	600			80	1.10 / 2.46	124	276
	K		0.0056	650	1% 6	V=1 FPS 0.18	860	B	SCHOOL	80	1.10 / 2.46	5	12
	L		0.0122	1050	8	V=1 FPS 0.29	720	B	SCHOOL	80	1.10 / 2.46	10	22
	OS-3	FROM MORNING SUN	0.0156			0.24	770			84	1.4 / 2.8	17	34
	OS-4	FROM MORNING SUN	0.0140			0.23	780			84	1.4 / 2.8	15	31
	DESIGN POINT (8)		0.1872			0.44	600			80	1.10 / 2.46	124	276
DESIGN POINT (9)			0.2346			0.49	575			81	1.16 / 2.55	156	344

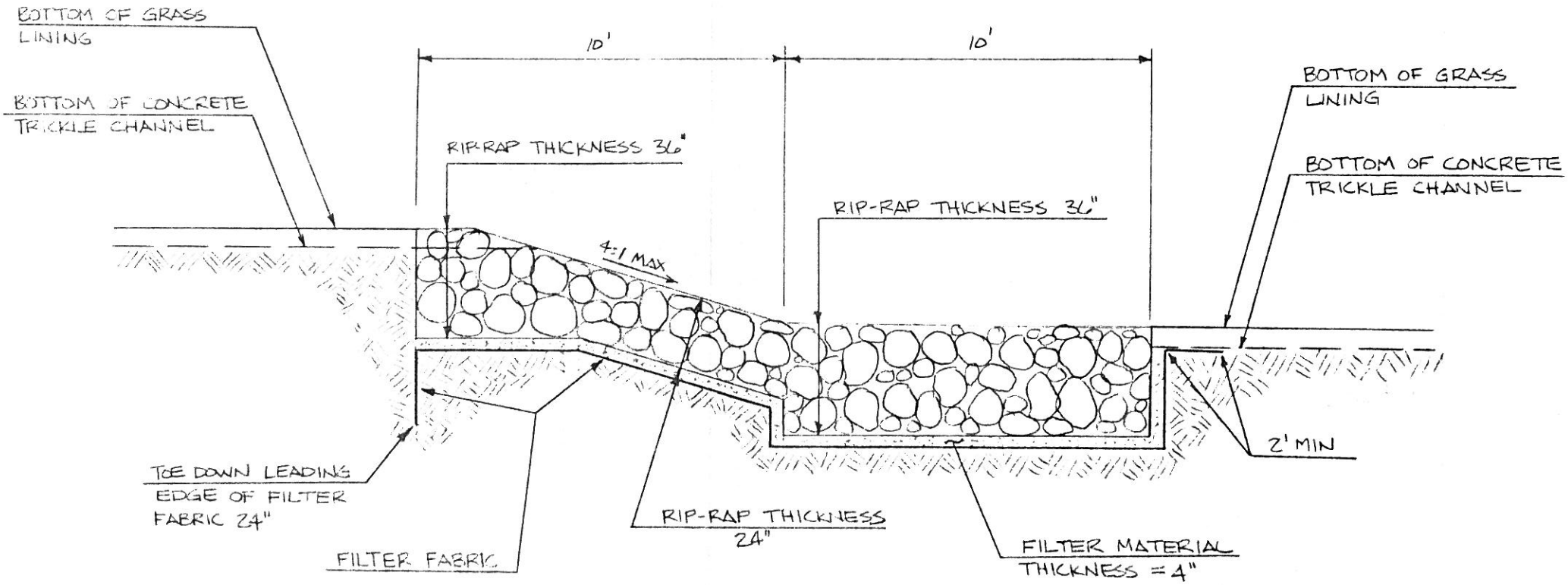
HYDROLOGIC COMPUTATION – BASIC DATA

PROJ HORIZONVIEW DRIVE

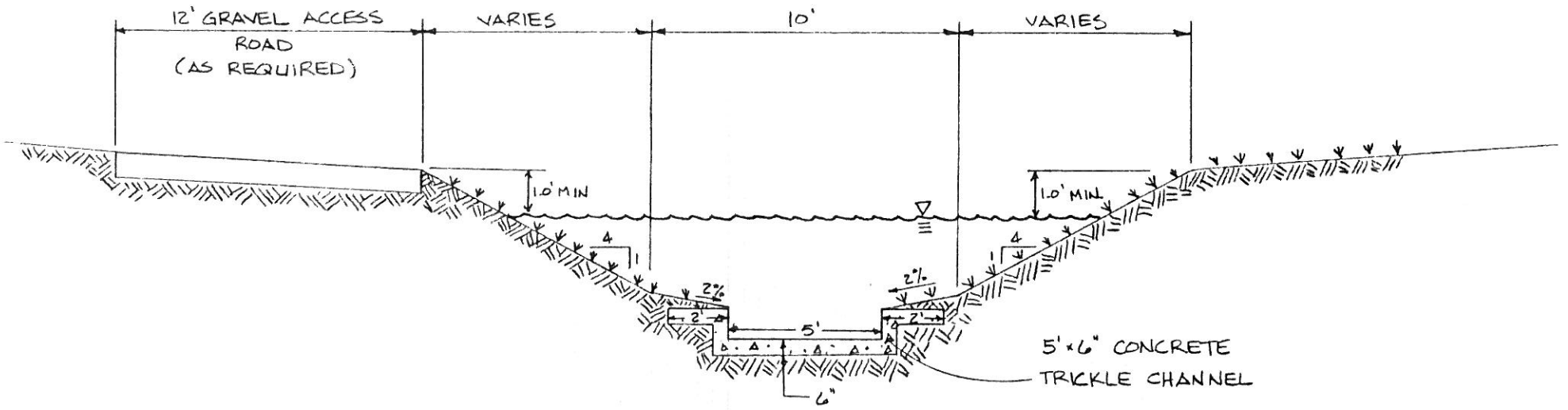
By: JWD
Date: 3-21-86

DEVELOPED RUNOFF

FIGURE 7 - CULVERT SIZING CHARTS



DROP STRUCTURE DETAIL



HORIZONVIEW CHANNEL

Q_{100} = 245 CFS
B = 10'
N = 0.025 (COMPOSITE)
Z = 4
S = 0.3%
Y_{100} = 2.7'
V_{100} = 4.71 FPS

TYPICAL GRASS LINED CHANNEL SECTION

(N.T.S.)

OUTFALL CHANNEL

Q_{100} = 344 CFS
B = 10'
N = 0.025 (COMPOSITE)
Z = 4
S = 0.2%
Y_{100} = 3.4'
V_{100} = 4.37 FPS

PROJECT: HORIZONVIEW

DESIGNER: JWW

DATE: 3.21.96

HYDROLOGIC AND CHANNEL INFORMATION

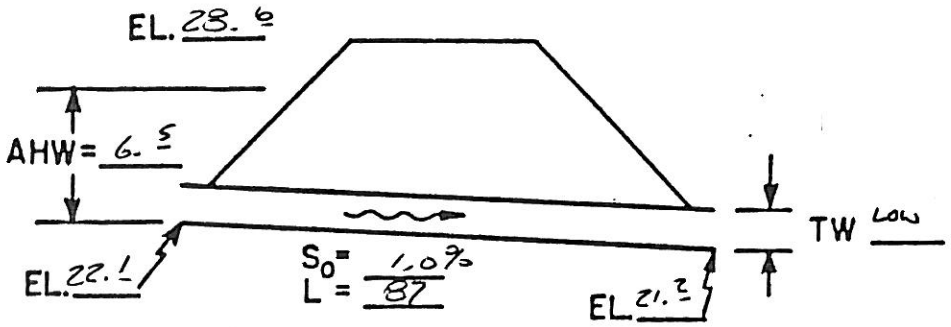
Q_1 = 48 TW_1 = ____

Q_2 = 101 TW_2 = SMALL

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: DESIGN POINT 2



MEAN STREAM VELOCITY = ____

MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
5YR																
TRY 1-54"CMP	48	4.5'	0.65	2.9												✓O.K.
100YR																
TRY 1-54"CMP	101	4.5'	1.05'	4.7	0.5	1.8	2.9	3.70	—	3.7	0.87	4.6	4.7			✓O.K.

SUMMARY & RECOMMENDATIONS: USE 1-54"CMP

Figure 7

PROJECT: HORIZONVIEW

DESIGNER: JWD

DATE: 3-21-86

HYDROLOGIC AND CHANNEL INFORMATION

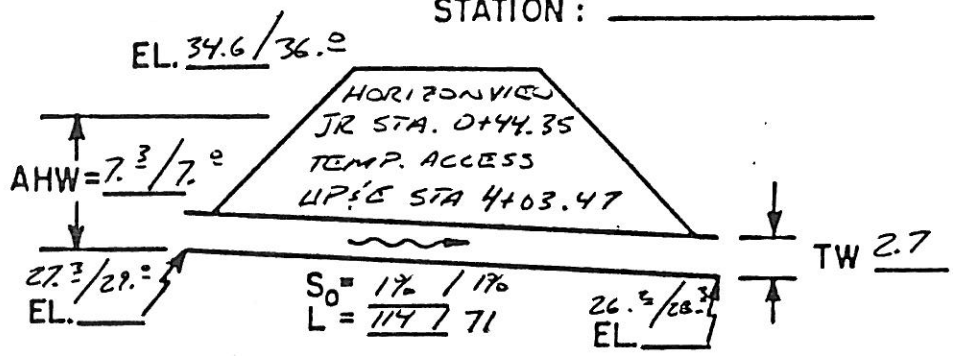
Q_1 = 109 TW_1 = ____

Q_2 = 245 TW_2 = 2.7

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}; Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION: DESIGN POINTS 5 & 6



MEAN STREAM VELOCITY = ____

MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING H.W.	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW = H + h_o − LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
5YR																
TRY 2-60" CMP	54.5	5.0	0.6	3.0												✓O.K.
100 YR																
TRY 2-60" CMP	122.5	5.0	0.98	4.9	0.25	1.5	3.2	4.1	2.7	4.1	1.14 / 0.71	4.6	4.9			✓O.K.

SUMMARY & RECOMMENDATIONS: USE 2-60" CMP

Figure 7

PROJECT: HORIZONVIEW

DESIGNER: JWV

DATE: 3-21-86

HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = 124 TW_1 = ____

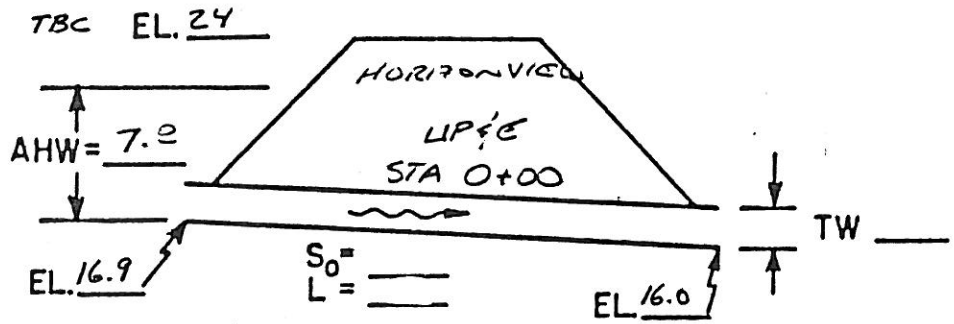
Q_2 = 276 TW_2 = 3.4

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

DESIGN POINT

STATION: B



MEAN STREAM VELOCITY = ____

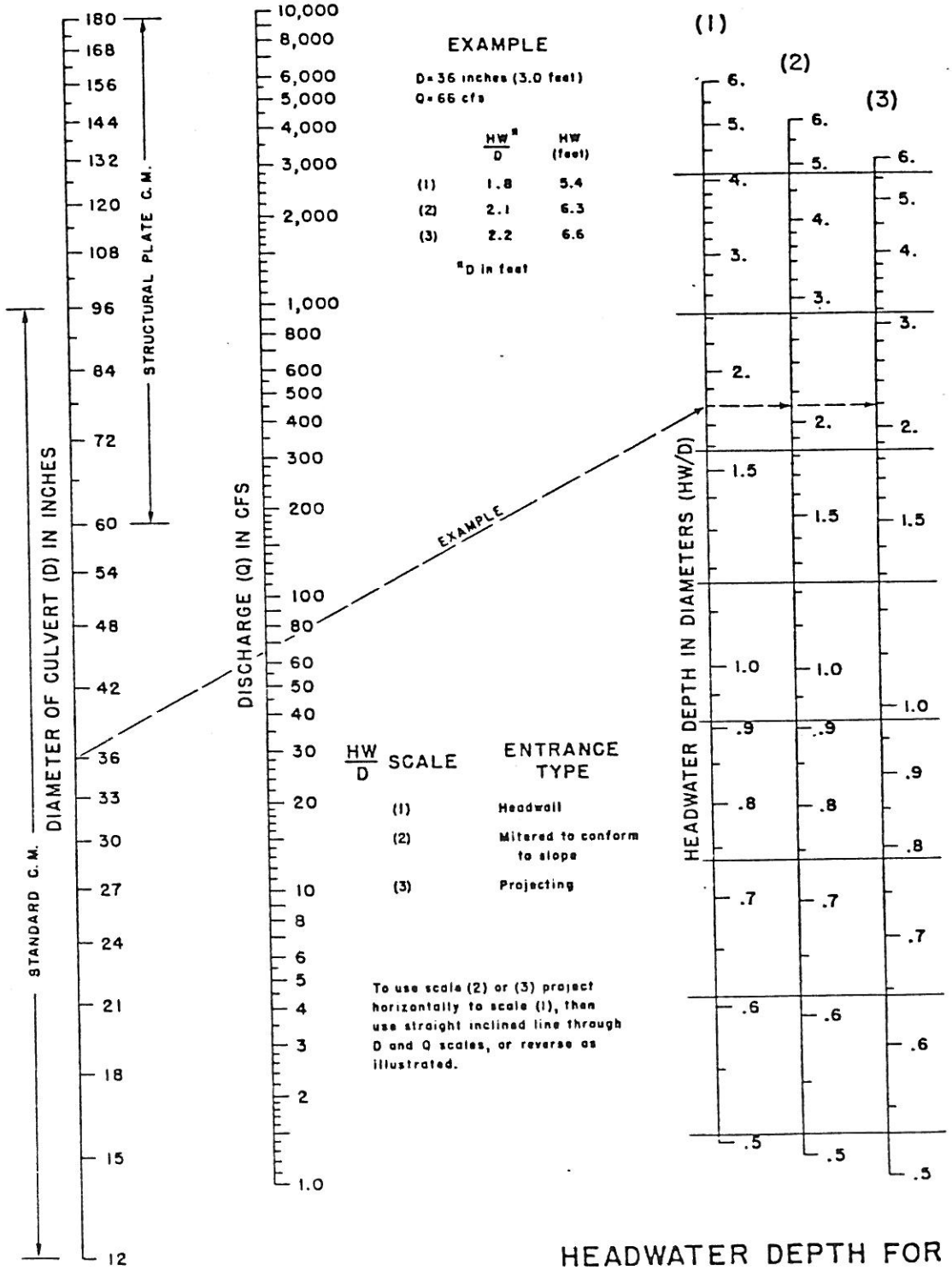
MAX. STREAM VELOCITY = ____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION										CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL HW=H + h_o - LS_o											
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW				
5 YR																
TRY 2-60" CMP	62	5.0	0.6	3.0												√O.K.
100 YR																
TRY 2-60" CMP	138	5.0	1.05	5.25	0.25	1.8	3.3	4.15	3.4	4.15	0.9	5.05	5.25			√O.K.

SUMMARY & RECOMMENDATIONS: USE 2-60" CMP

Figure 7

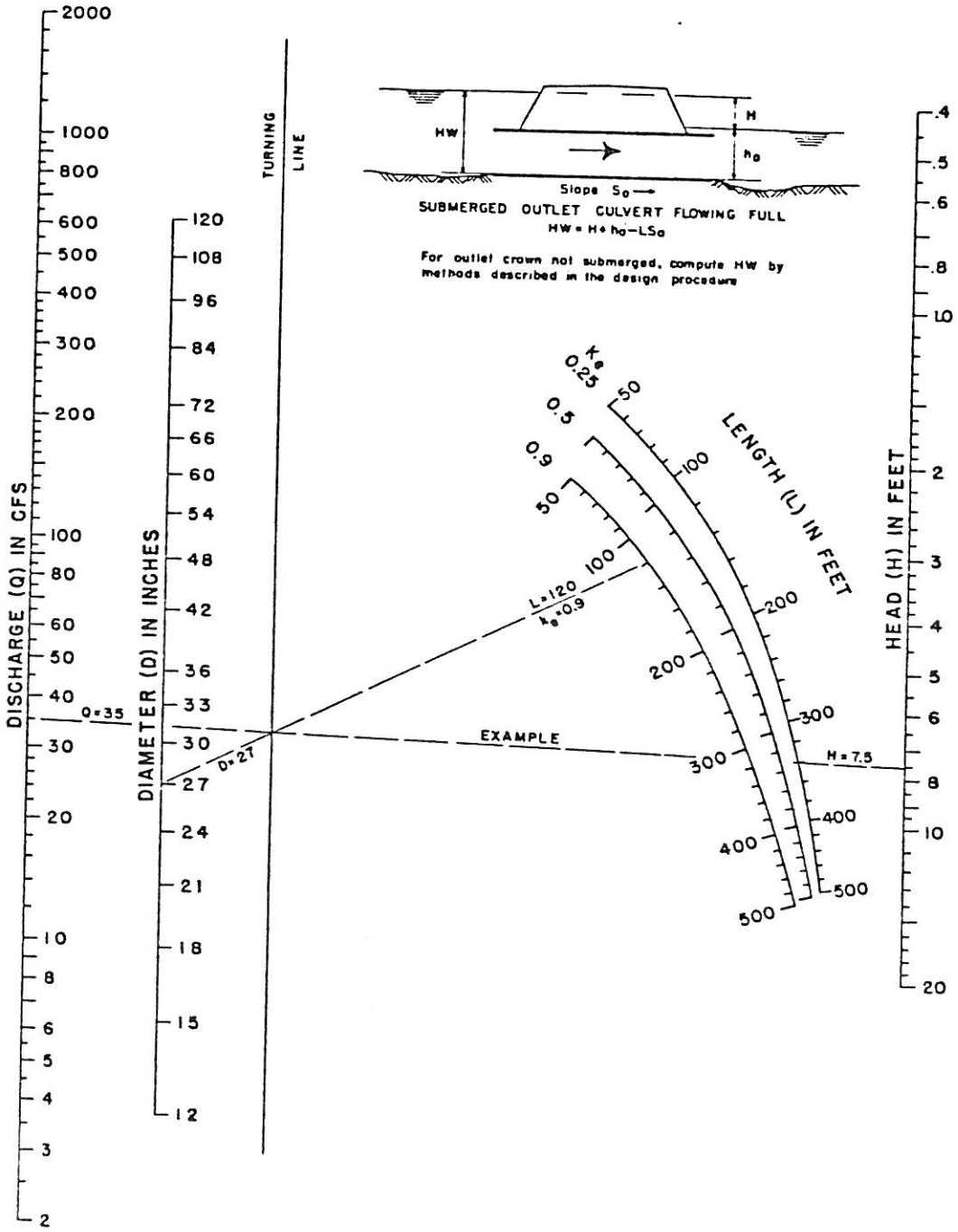
CHART 5



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

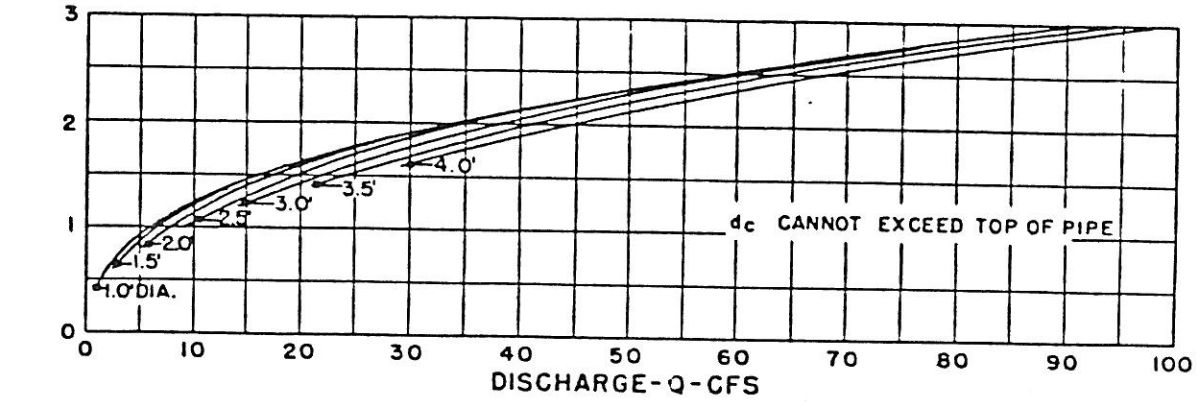
CHART 11

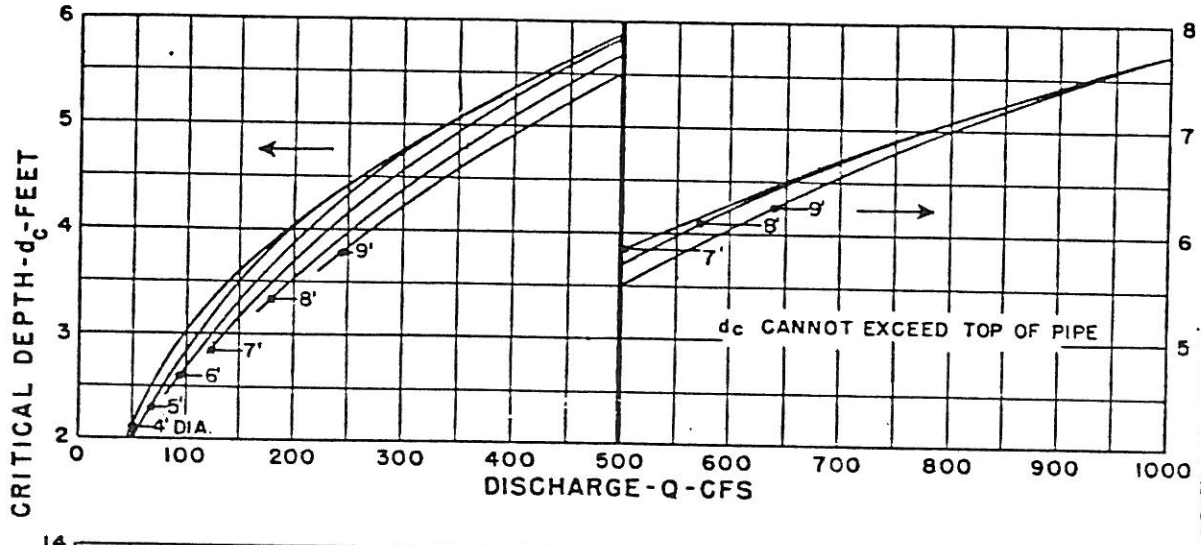


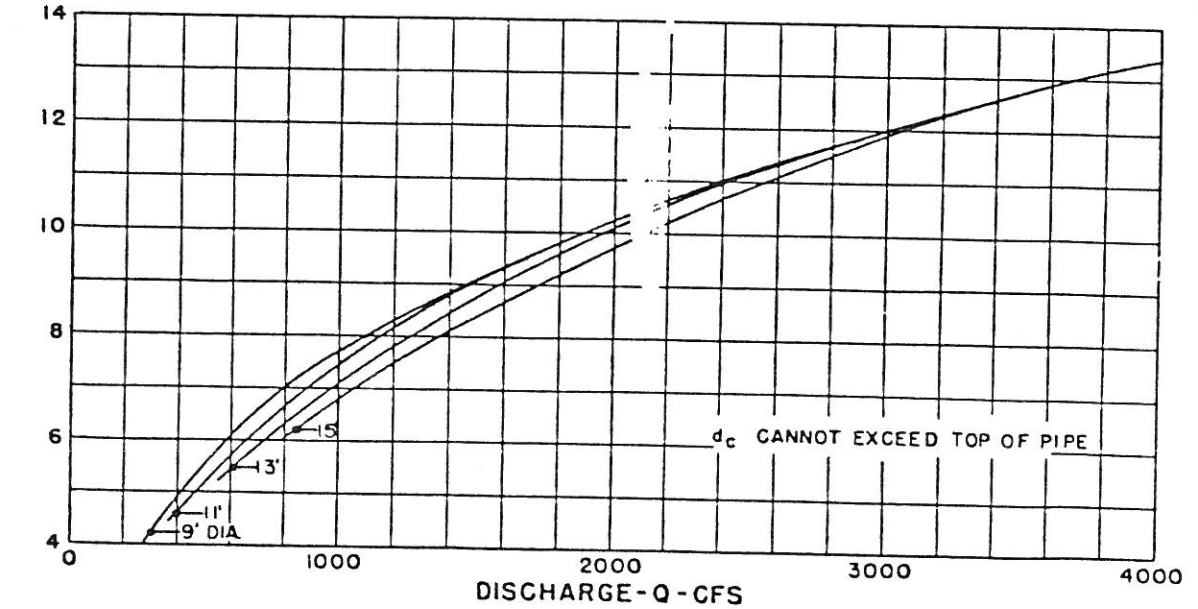
HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
n = 0.024

BUREAU OF PUBLIC ROADS JAN 1963

CHART 16







BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH
CIRCULAR PIPE

INLET SIZING CHARTS

2120 HOLLOWBROOK DR.
COLORADO SPRINGS, COLORADO 80918
303-528-8833

LAND DEVELOPMENT CONSULTANTS

HORIZONVIEW DRIVE

JWD 3-21-86

INLET CAPACITIES

AT DESIGN POINT 1

$Q_5 = 23$ CFS
$Q_{100} = 51$ CFS (2-15' INLETS)

$Q_{CAPACITY} = 3.09\ L\ Y_o^{3/2}$

$= 3.09\ (15)(0.67)^{1.5}$

$= 25.4$ CFS EACH

✓ O.K.

AT DESIGN POINT 7

$Q_5 = 29$ CFS
$Q_{100} = 60$ CFS (2-15' INLETS)

5 YR

$Y = 0.67$ $a = 0.25'$

$\frac{Q_A}{L_A} = 0.7$ CHART II A

$L_A = \frac{29\ CFS}{0.7} = 41.4'$

$\frac{L}{L_A} = \frac{30}{41.4} = 0.72$

$\frac{Q_{INTERCEPTED}}{Q_A} = 0.38$ CHART II B

$Q_i = 25$ CFS

$Q_{FLOW\ BY} = 4$ CFS ✓O.K.

100 YR

$Y = 1.0$ $a = 0.25'$

$\frac{Q_A}{L_A} = 0.9$

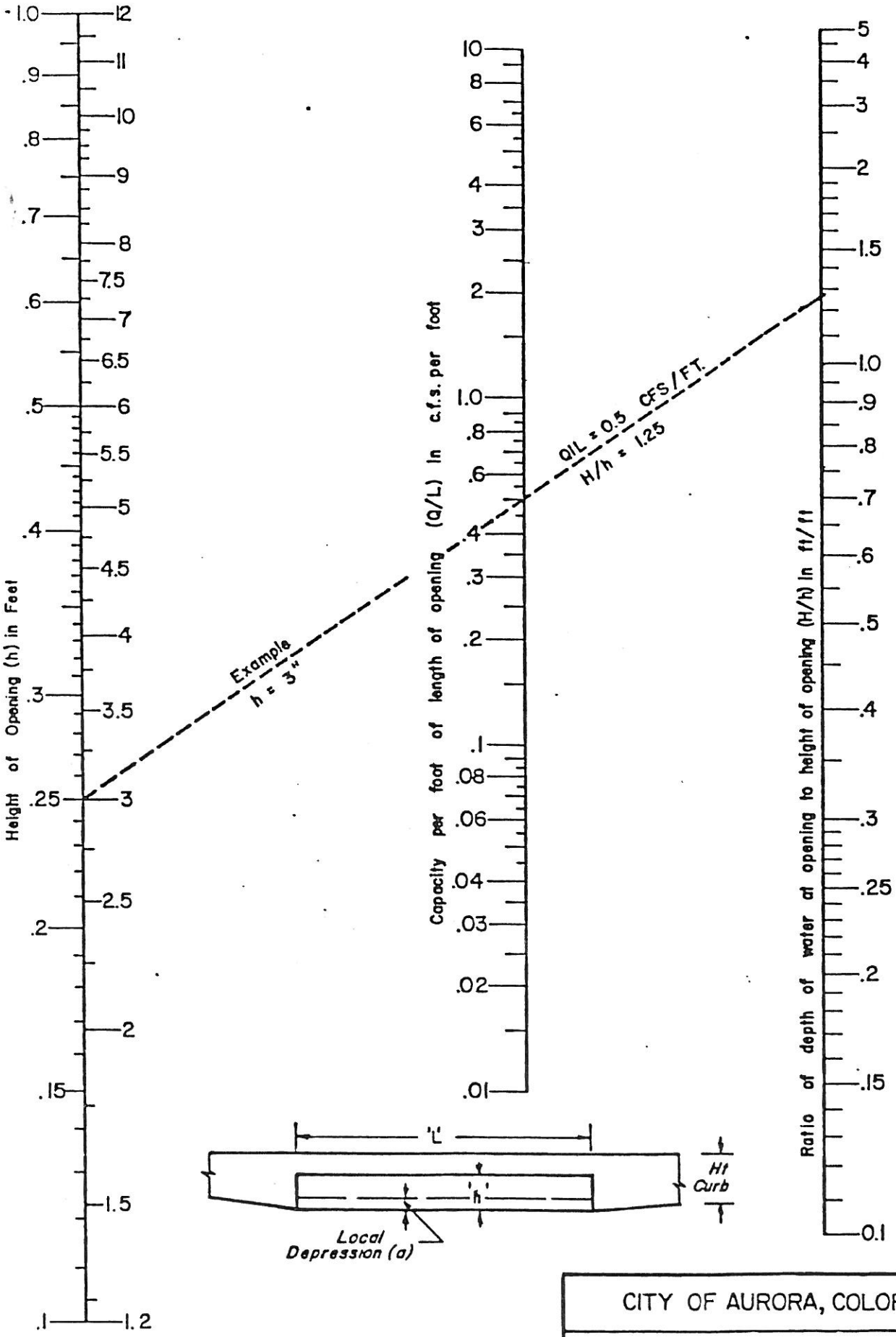
$L_A = \frac{60}{0.9} = 66.7'$

$\frac{L}{L_A} = \frac{30}{66.7} = 0.45$

$\frac{Q_i}{Q_A} = 0.7$

$Q_i = 42$ CFS

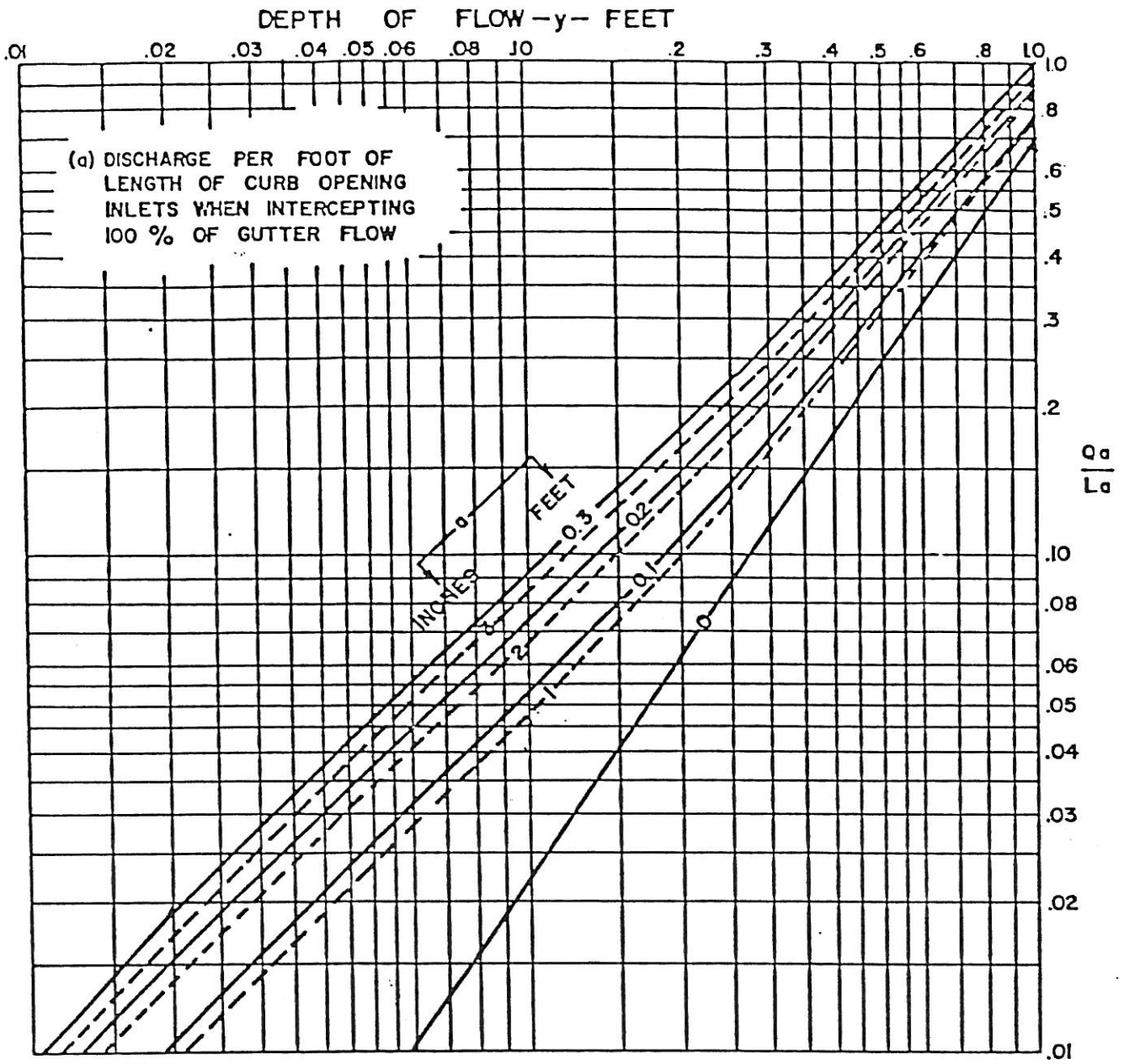
$Q_{FLOW\ BY} = 13$ CFS ✓O.K.

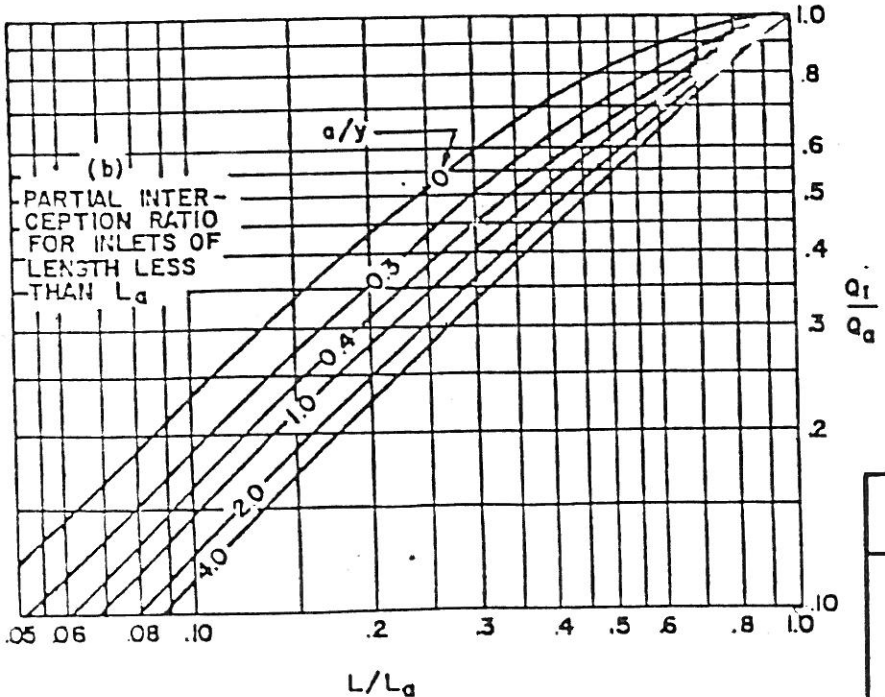


CITY OF AURORA, COLORADO

NOMOGRAPH FOR CAPACITY OF CURB OPENING INLETS AT SUMP

F.U.	6-19-72





CITY OF AURORA, COLORADO

CAPACITY OF CURB OPENING INLETS ON CONTINUOUS GRADE

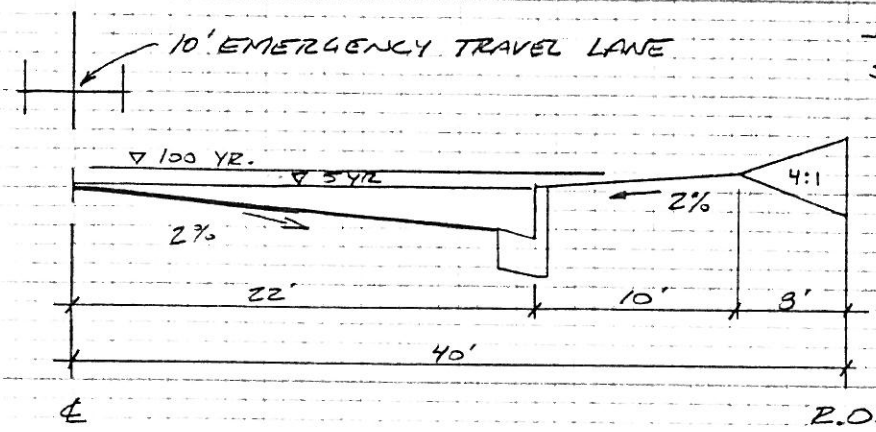
J.J	6-19-72

STREET CAPACITY CALCULATIONS

JR DEVELOPERS, LTD
2120 HOLLOWBROOK DR.
COLORADO SPRINGS, COLORADO 80918
303-528-8833

LAND DEVELOPMENT CONSULTANTS

COLORADO CENTRE
JWD 3-21-86
STREET CAPACITIES



HORIZONVIEW DRIVE

n = 0.016
A = 7.17 FT²
P = 22.68 FT.
S = 1.95%
V_5 = 4.9 FPS

5 YR $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$= \frac{1.486}{0.016} (7.17)\left(\frac{7.17}{22.68}\right)^{0.66} (0.0195)^{0.5}$

= 43.5 (.80 REDUCTION)

= 35 CFS EACH SIDE

n = 0.016
A = 9.37 FT²
P = 32.79 FT.
S = 1.95%
V_{100} = 4.7 FPS

100 YR $Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$= \frac{1.486}{0.016} (9.37)\left(\frac{9.37}{32.79}\right)^{0.66} (0.0195)^{0.5}$

= 57.9 (0.80 REDUCTION)

= 46 CFS EACH SIDE

NOTE: MOST OF THE STREET IS IN FULL CUT SECTION, WHICH HAS GREATEL CAPACITY.

DESIGN CHARTS

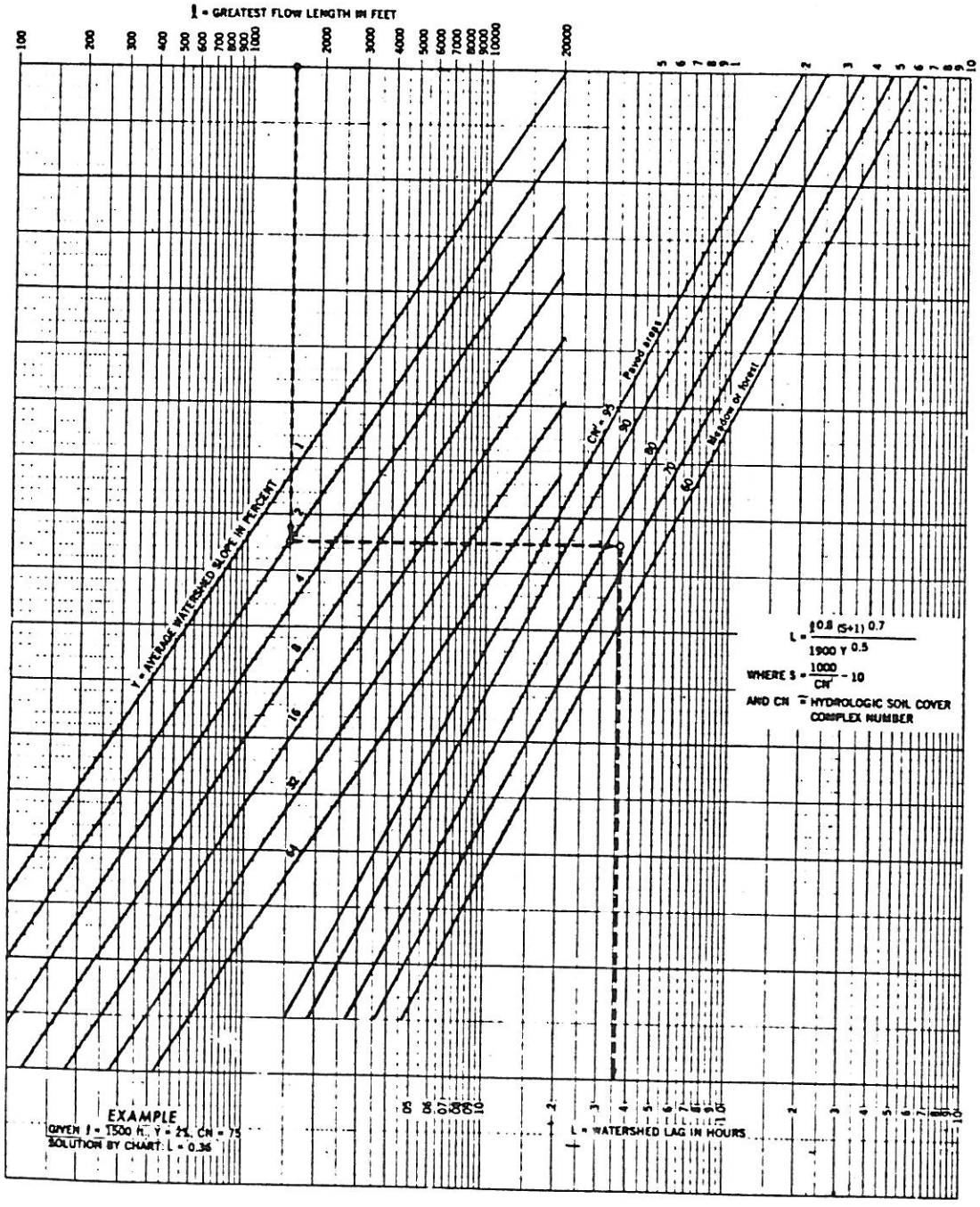


Figure 3-3.--Curve number method for estimating lag (L) for homogeneous watersheds under natural conditions up to 2,000 acres.

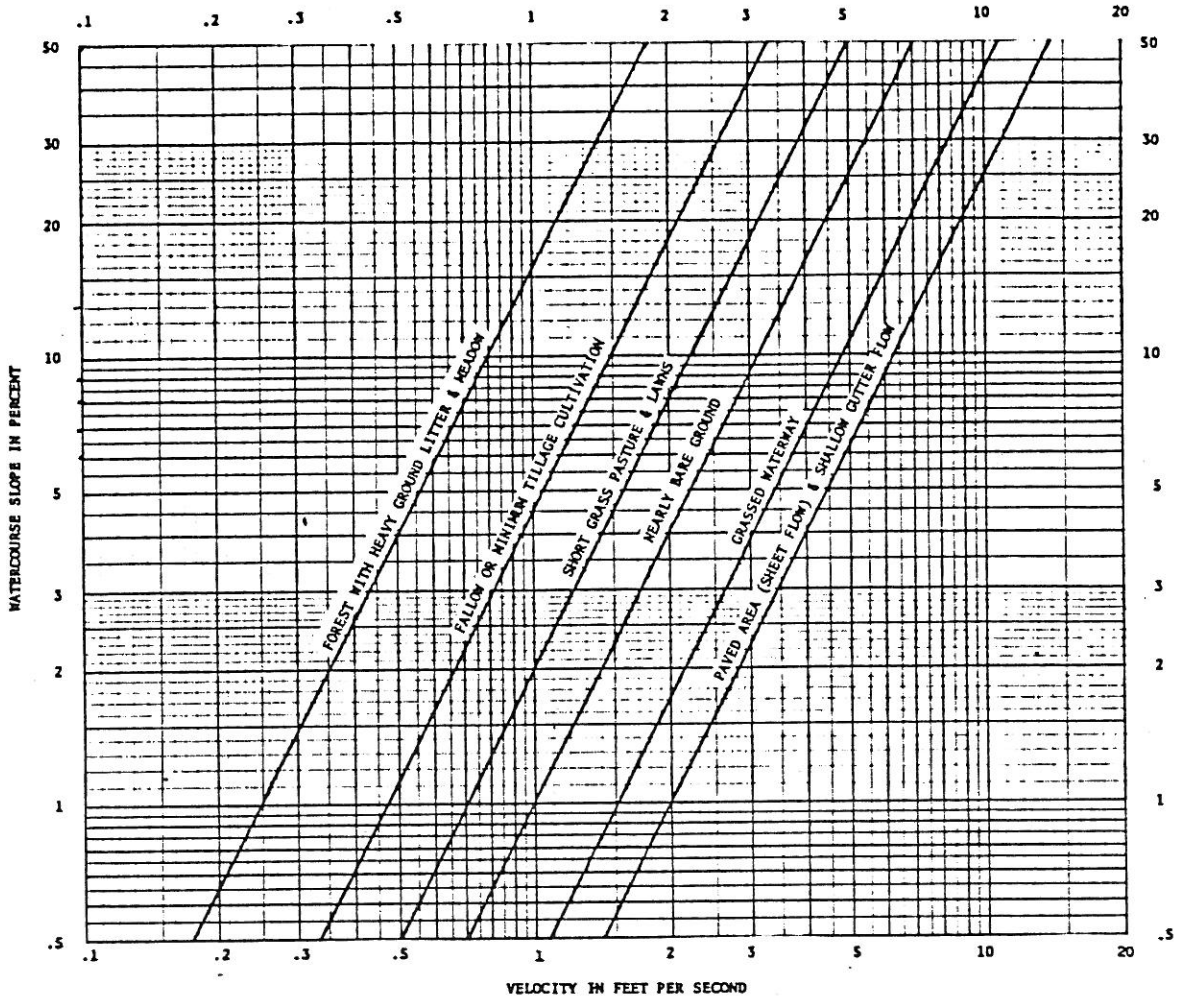


Figure 3-1.--Average velocities for estimating travel time for overland flow.

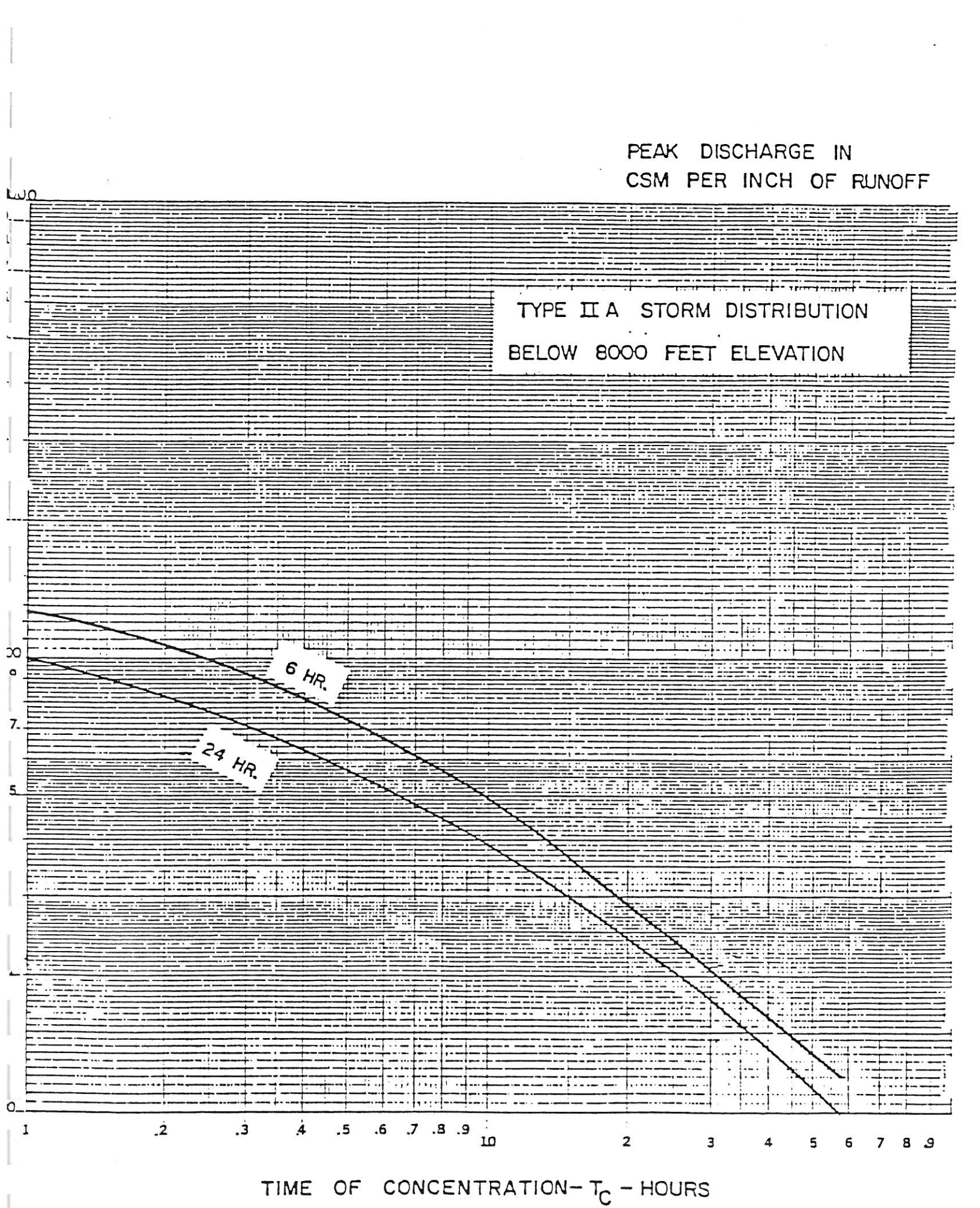

PEAK DISCHARGE IN
CSM PER INCH OF RUNOFF
TYPE II A STORM DISTRIBUTION
BELOW 8000 FEET ELEVATION
6 HR.
24 HR.
0
1
.2
.3
.4
.5
.6
.7
.8
.9
10
2
3
4
5
6
7
8
9
TIME OF CONCENTRATION- T_C - HOURS

FIGURE III-4

Appendix C

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for El Paso County Area, Colorado

Colorado Centre

July 28, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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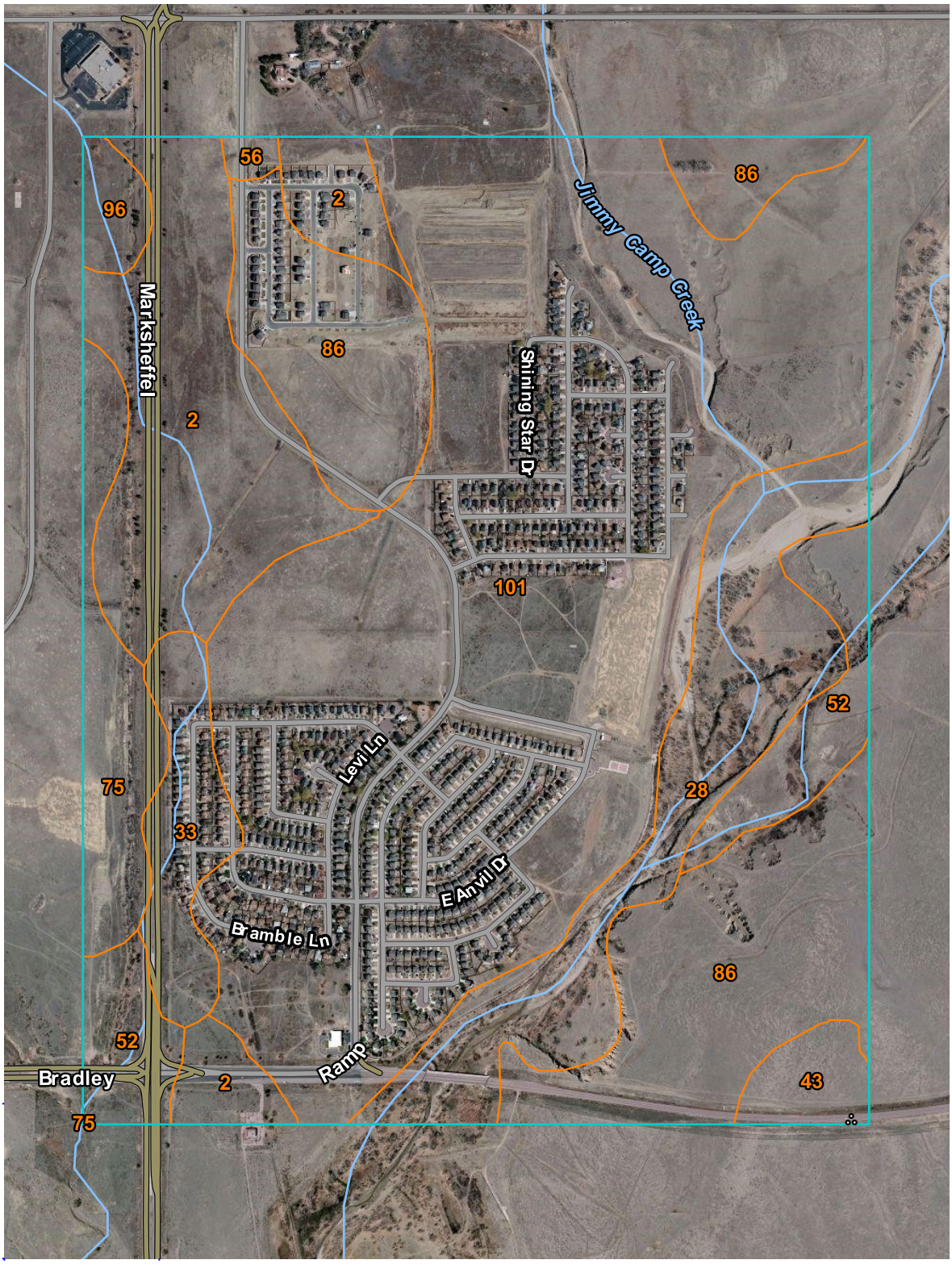
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

104° 39' 47" W
104° 38' 29" W
38° 46' 52" N
38° 45' 31" N



Map Scale: 1:12,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84

MAP LEGEND

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

Soils
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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: http://websoilsurvey.nrcs.usda.gov
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 12, Sep 29, 2014

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
2	Ascalon sandy loam, 1 to 3 percent slopes	92.6	12.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	71.1	9.4%
33	Heldt clay loam, 0 to 3 percent slopes	23.6	3.1%
43	Kim loam, 1 to 8 percent slopes	10.4	1.4%
52	Manzanola clay loam, 1 to 3 percent slopes	35.1	4.6%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	2.2	0.3%
75	Razor-Midway complex	27.9	3.7%
86	Stoneham sandy loam, 3 to 8 percent slopes	120.1	15.9%
96	Truckton sandy loam, 0 to 3 percent slopes	7.4	1.0%
101	Ustic Torrifluvents, loamy	365.3	48.3%
Totals for Area of Interest		**755.8**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally

are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

2—Ascalon sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367q
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Ascalon

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian deposits

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 21 inches: sandy clay loam
BC - 21 to 27 inches: sandy loam
Ck1 - 27 to 48 inches: sandy loam
Ck2 - 48 to 60 inches: loamy sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R069XY026CO)
Other vegetative classification: SANDY PLAINS (069BY026CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w

Hydrologic Soil Group: A
Ecological site: Sandy Bottomland (R069XY031CO)
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)

Minor Components

Fluvaquentic haplaquoll
Percent of map unit:
Landform: Swales

Other soils
Percent of map unit:

Pleasant
Percent of map unit:
Landform: Depressions

33—Heldt clay loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 3686
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Heldt and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Heldt

Setting
Landform: Alluvial fans, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium derived from shale

Typical profile
Ap - 0 to 8 inches: clay loam
Bw - 8 to 41 inches: silty clay
Bk - 41 to 60 inches: silty clay loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Gypsum, maximum in profile: 4 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 10.4 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: Alkaline Plains (R069XY047CO)
Other vegetative classification: ALKALINE PLAINS (069BY047CO)

Minor Components

Other soils
Percent of map unit:

Pleasant
Percent of map unit:
Landform: Depressions

43—Kim loam, 1 to 8 percent slopes

Map Unit Setting
National map unit symbol: 368k
Elevation: 5,300 to 5,600 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition
Kim and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kim

Setting
Landform: Fans, hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile
A - 0 to 6 inches: loam
C - 6 to 60 inches: loam

Properties and qualities

Slope: 1 to 8 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
Calcium carbonate, maximum in profile: 20 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R069XY006CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

52—Manzanola clay loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 368w
Elevation: 5,200 to 6,000 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Manzanola

Setting

Landform: Fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous clayey alluvium

Typical profile

Ap - 0 to 6 inches: clay loam
Bt - 6 to 32 inches: clay loam
Bk - 32 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Gypsum, maximum in profile: 4 percent
Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: Saline Overflow (R069XY037CO)
Other vegetative classification: SALINE OVERFLOW (069AY037CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 45 percent

Tassel and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Shaly Plains (R069XY046CO)
Other vegetative classification: SHALY PLAINS (069AY046CO)

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shaly Plains (R069XY046CO)
Other vegetative classification: SHALY PLAINS (069AY046CO)

Minor Components

Pleasant
Percent of map unit:
Landform: Depressions

Other soils
Percent of map unit:

75—Razor-Midway complex

Map Unit Setting
National map unit symbol: 369p
Elevation: 5,300 to 6,100 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition
Razor and similar soils: 50 percent
Midway and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Razor

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: stony clay loam
Bw - 4 to 22 inches: cobbly clay loam
Bk - 22 to 29 inches: cobbly clay
Cr - 29 to 33 inches: weathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Alkaline Plains (R069XY047CO)
Other vegetative classification: ALKALINE PLAINS (069AY047CO)

Description of Midway

Setting

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

Typical profile

A - 0 to 4 inches: clay loam
C - 4 to 13 inches: clay
Cr - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 3 to 25 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 15 percent

Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shaly Plains (R069XY046CO)
Other vegetative classification: SHALY PLAINS (069AY045CO)

Minor Components

Pleasant
Percent of map unit:
Landform: Depressions

Other soils
Percent of map unit:

86—Stoneham sandy loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 36b2
Elevation: 5,100 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition
Stoneham and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stoneham

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile
A - 0 to 4 inches: sandy loam
Bt - 4 to 8 inches: sandy clay loam
Btk - 8 to 11 inches: sandy clay loam
Ck - 11 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 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
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R069XY026CO)
Other vegetative classification: SANDY PLAINS (069AY026CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

96—Truckton sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 36bf
Elevation: 6,000 to 7,000 feet
Mean annual precipitation: 14 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

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

Description of Truckton

Setting

Landform: Flats
Landform position (three-dimensional): Talf

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 24 inches: sandy loam
C - 24 to 60 inches: coarse sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 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 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

101—Ustic Torrifluvents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Ustic Torrifluvents

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Saline Overflow (R069XY037CO)
Other vegetative classification: OVERFLOW (069BY036CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

SUBSURFACE EXPLORATION REPORT
COLRADO CENTRE WATER TREATMENT PLANT
NORTHEAST CORNER OF FLAGSTONE STREET & EAST ANVIL DRIVE
COLORADO SPRINGS, COLORADO
EEC PROJECT NO. 2142014

Prepared for:

T-Bone Construction
1330 Valley Street
Colorado Springs, Colorado 80915

Attn: Mr. Charlie Long

Prepared by:

Earth Engineering Consultants, LLC.
1036A Elkton Drive
Colorado Springs, Colorado 80907

September 8, 2014

EARTH ENGINEERING
CONSULTANTS, LLC

T-Bone Construction
1330 Valley Street
Colorado Springs, Colorado 80915

Attn: Mr. Charlie Long (clong@tboneconstruction.com)

RE: Subsurface Exploration Report
Colorado Centre Water Treatment Plant
Northeast Corner Flagstone Street & East Anvil Drive
Colorado Springs, Colorado
EEC Project No. 2142014

Mr. Long;

Enclosed, herewith, are the results of the geotechnical subsurface exploration completed by Earth Engineering Consultants, LLC (EEC) personnel for the referenced project. In summary, the subsurface soils encountered in the test borings consisted of native sandy silt/sandy lean clay materials underlain by silty sand extending to the depths explored, and/or lean clay/silty sand fill materials extending to the underlying fine granular sand strata and/or to the depths explored. The removal and re-conditioning of the in-place sandy lean clay/silty sand fill materials as described herein will be required to develop site foundation, floor slab, and pavement grades within the planned development.

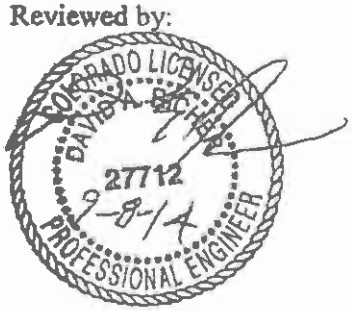
It is our opinion the anticipated lightly loaded buildings could be supported on conventional footing foundations bearing on newly placed engineered/controlled fills which are placed and compacted as outlined in this report. Geotechnical recommendations concerning design and construction of the foundations and support of floor slabs and pavements are presented in the text of the attached report.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we can be of further service to you in any other way, please do not hesitate to contact us.

Respectfully submitted,
Earth Engineering Consultants, LLC

Richard D. Reiter, NICET Level III
Project Manager

Reviewed by:



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APPENDIX

TEST BORING LOCATION MAP

TEST BORING LOGS

DRILLING AND EXPLORATION NOTES

LABORATORY TEST RESULTS

UNIFIED SOIL CLASSIFICATION SYSTEM

SUBSURFACE EXPLORATION REPORT
COLORADO CENTRE TREATMENT PLANT
NORTHEAST CORNER FLAGSTONE STREET & EAST ANVIL DRIVE
COLORADO SPRINGS, COLORADO
EEC PROJECT NO. 2142014

September 8, 2014

INTRODUCTION

The subsurface exploration for the proposed Colorado Centre Treatment Plant site at the northeast corner of Flagstone Street & East Anvil Drive in Colorado Springs, Colorado has been completed. The plant site includes a new administration building, new water treatment building, baseball field, and driveway/parking areas. For this study a total of eight (8) soil borings were completed at the site. Two (2) soil borings were advanced within each proposed building footprint to obtain information on existing subsurface conditions. The borings were extended to approximate depths of 20-feet below existing site grades. Two (2) soil boring were advanced in the baseball field area that extended to approximate depths of 10-feet below existing site grade and two (2) soil borings in the proposed driveway/parking areas the extended to depths of approximately 5-feet below existing site grades. Individual boring logs and site diagrams indicating the approximate boring locations are provided with this report.

Based on the information provided to us, we understand for this project, the administration building and water treatment structures will be single store, pre-engineered metal framed buildings having approximately 5,000 square feet and 2,560 square feet in plan dimensions (respectively). The water treatment building will be constructed over below grade fiberglass storage tanks. We expect foundation loads for the proposed structure will be light to moderate with continuous wall loads less than 4 kips per lineal foot and column loads less than 100 kips. Floor loads will be less than 100 psf. If actual loads exceed those as presented herein, we should be consulted to verify the design parameters as provided in this report are appropriate for the increased loading conditions. Grading plans indicate cuts and fills on the order of 2 to 3 feet are anticipated to develop subgrade elevations.

The purpose of this report is to describe the subsurface conditions encountered in the borings, analyze and evaluate the test data and provide geotechnical recommendations concerning design and construction of foundations and support of floor slabs and pavements.

EXPLORATION AND TESTING PROCEDURES

The boring locations were established in the field by the client prior to drilling. The approximate boring locations are indicated on the attached boring location diagram provided to EEC by the client. The locations of the borings should be considered accurate only to the degree implied by the methods used to make the field measurements.

The test borings were completed using a truck mounted, D-90 drill rig equipped with a hydraulic head employed in drilling and sampling operations. The boreholes were advanced using 4-inch nominal diameter continuous flight augers. Samples of the subsurface materials encountered were obtained using split barrel and California barrel sampling procedures.

In split barrel and California barrel sampling procedures, standard sampling spoons are advanced into the ground by means of a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the split barrel and California barrel samplers is recorded and is used to estimate the in-situ relative density of cohesionless soils and, to a lesser degree of accuracy, the consistency of cohesive soils and hardness of weathered bedrock. In the California barrel sampling procedure, relatively undisturbed samples are obtained in removable brass liners. All samples obtained in the field were sealed and returned to the laboratory for further examination, classification, and testing.

Laboratory moisture content tests were completed on each of the recovered samples. In addition, dry density, Atterberg limits and washed sieve analysis tests were completed to evaluate the quantity and plasticity of fines in the subgrade samples. Swell/consolidation tests were completed on select samples to evaluate the potential for the subgrade and foundation bearing materials to change volume with variation in moisture and load. Results of the outlined tests are indicated on the attached boring logs and summary sheets.

As part of the testing program, all samples were examined in the laboratory and classified in accordance with the attached General Notes and the Unified Soil Classification System, based on the soil's texture and plasticity. The estimated group symbol for the Unified Soil

Classification System is indicated on the boring logs and a brief description of that classification system is included with this report.

SITE AND SUBSURFACE CONDITIONS

The new treatment plant facility will be located within the open lot at the northeast corner of Flagstone Street & East Anvil Drive in Colorado Springs, Colorado. The site is bordered by Flagstone Street to the south, open field to the west, Hazy Morning Drive to the north and Jimmy Camp Creek to the east. The development area is an open lot with grass/weed and some trees ground cover. Site drainage is to the south with maximum difference in ground surface elevations across the proposed individual building sites on the order of 2 to 4 feet. Other than the existing building, no other evidence of prior building construction was observed at the site by EEC field personnel.

An EEC representative was on site during drilling to evaluate the subsurface conditions encountered and direct the drilling activities. Field logs prepared by EEC site personnel were based on visual and tactual observation of disturbed samples and auger cuttings. The final boring logs included with this report may contain modifications to the field logs based on the results of laboratory testing and evaluation. Based on the results of the field borings and laboratory evaluation, subsurface conditions can be generalized as follows.

At test borings TB-1 and TB-2 (treatment building), approximately 8 to 12 inches of topsoil/vegetation was encountered at the surface of the test borings. The topsoil/vegetation was underlain by moderately stiff sandy lean clay that extended to depths of approximately 4 feet. The sandy lean clays were underlain by clayey sands that were medium dense and extended to depths of approximately 9 feet. Moderately stiff sandy lean clay was encountered beneath the clayey sands and extended to depths of approximately 14 feet. Silty sand was encountered beneath the sandy lean clays and extended to the maximum depths explored, approximately 20 feet below existing site grades. The clayey sand exhibited low potential to swell with increases in moisture content at current density and moisture content.

At test borings TB-3 and TB-4 (administration building), approximately 8 to 12 inches of topsoil/vegetation was encountered at the surface of the test borings. The topsoil/vegetation was underlain fill consisting of lean clay that extended to depth s of approximately 9 to 12 feet below existing ground surface. The lean clay fills were soft to moderately stiff and were underlain by sand with varying amounts of silt. The loose to medium dense silty sand extended to the maximum depth explored, approximately 20 feet below existing site grades. The lean clay soils showed potential to both consolidate and swell with increases in moisture content at current moisture and in-place density.

At test borings TB-5 and TB-6 (baseball field), approximately 8 to 12 inches of topsoil/vegetation was encountered at the surface of the test borings. The topsoil/vegetation was underlain by fill consisting of layers of clayey sand underlain by silty sand underlain by sandy lean that extended to the maximum depths explored, approximately 10 feet below existing site grades.

At test borings P-1 and P-2 (driveway/parking areas), approximately 8 to 12 inches of topsoil/vegetation was encountered at the surface of the test borings. The topsoil/vegetation was underlain by fill consisting of layers of sandy lean clay underlain by silty sand that extended to the maximum depths explored, approximately 5 feet below existing site grades.

The stratification boundaries indicated on the boring logs represent the approximate locations of changes in soil types. In-situ, the transition of materials may be gradual and indistinct.

GROUNDWATER CONDITIONS

Observations were made while drilling and after completion of the borings to detect the presence and depth to hydrostatic groundwater. Free water was encountered in test borings TB-1 and TB-2 at depths of approximately 18 feet below existing ground surface when checked after completion of drilling. Free water was not encountered in any of the other test boring when checked after completion of drilling. Longer-term observations in cased holes sealed from the influence of surface water would be required to more accurately evaluate ground water levels.

Zones of perched and/or trapped water may be encountered at different times throughout the year in more permeable zones in the subgrades. The location and amount of perched and/or trapped water and the depth to the hydrostatic groundwater table can vary over time depending on hydrologic conditions and other conditions not apparent at the time of this report.

ANALYSIS AND RECOMMENDATIONS

Fill extending approximately 9 to 12 feet below existing ground surface in test boring TB-3, TB-4 TB-5, TB-6, P-1 and P-2. It is our understanding information on whether the existing fill was placed in a controlled manner and density testing performed during placed is not available.

Swell – Consolidation Test Results

The swell-consolidation test is commonly performed to evaluate the swell or collapse potential of soils or bedrock for determining foundation, floor slab and pavement design criteria. In this test, relatively undisturbed samples obtained directly from the California sampler or thin-walled tubes are placed in a laboratory apparatus and inundated with water under a predetermined load. The swell-index is the resulting amount of swell or collapse as a percent of the sample's thickness after the inundation period. The sample obtained at a depth of approximate 4 to 5-feet intervals is pre-loaded at 500 psf to simulate the overburden soil pressure. All samples are inundated with water and monitored for swell and consolidation. After the inundation period additional incremental loads are applied to evaluate the swell pressure and consolidation.

For this assessment, we conducted three (3) swell-consolidation tests at the 4 to 5 intervals/depths at the site. The swell index values for the sample analyzed revealed low swell/consolidation characteristics on the order of (+) 1.0%. The (+) test results indicate the clayey sand and lean clay soils exhibited swell potential characteristics. The swell/consolidation-index for the lean clay and clayey sand subsoil samples, encountered at proposed foundation bearing elevation, inundated and pre-loaded at the 500 psf loading criteria was approximately (+) 1.0%.

Colorado Association of Geotechnical Engineers (CAGE) uses the following information to provide uniformity in terminology between geotechnical engineers to provide a relative correlation of slab performance risk to measured swell. "The representative percent swell values are not necessarily measured values; rather, they are a judgment of the swell of the soil and/or bedrock profile likely to influence slab performance." Geotechnical engineers use this information to also evaluate the swell potential risks for foundation performance based on the risk categories.

Recommended Representative Swell Potential Descriptions and Corresponding Slab Performance Risk Categories		
Slab Performance Risk Category	**Representative Percent Swell (500 psf Surcharge)**	**Representative Percent Swell (1000 psf Surcharge)**
Low	0 to < 3	0 < 2
Moderate	3 to < 5	2 to < 4
High	5 to < 8	4 to < 6
Very High	> 8	> 6

Foundation Systems – Water Treatment Building

The proposed treatment building will be a partial slab-on-grade building constructed over three (3) fiberglass storage tanks. The tanks are anticipated to bear on the subsoils at depths of approximately 10 to 12 feet below floor slab elevations with foundations also bearing at depths of approximately 10 to 12 feet below floor slab elevations.

Based on the results of the field borings and laboratory testing, it is our opinion the proposed pre-engineered metal framed building foundations could be supported on conventional spread footing foundations bearing in the in-place clayey sand site soils. For design of foundations bearing on the sandy lean clays, we recommend using a net allowable total soils bearing pressure not to exceed 1,500 psf. The net bearing pressure refers the pressure at foundation bearing level in excess of the minimum surrounding overburden pressure. Total load should include both dead and live loads. A minimum dead load pressure would not be required in the low swell potential site soils.

Upon completion of each of the excavations and prior to placement foundation concrete, an "open-hole/foundation excavation" evaluation should be performed by EEC personnel to evaluate that materials encountered during excavation are acceptable for support of the structure.

Care should be taken during construction to avoid disturbing the bearing materials. Materials which are loosened or disturbed by the construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced prior to placement of foundation concrete.

We estimate the long-term settlement of foundations designed and constructed as outlined above would be less than 1 inch.

Below Grade Walls - Lateral Earth Pressures

For any portion of the proposed buildings being constructed below grade, those portions will be subject to lateral earth pressures. Passive lateral earth pressures may help resist the driving forces for retaining wall or other similar site structures. Active lateral earth pressures could be used for design of structures where some movement of the structure is anticipated, such as retaining walls. The total deflection of structures for design with active earth pressure is estimated to be on the order of one half of one percent of the height of the down slope side of the structure. We recommend at-rest pressures be used for design of structures where rotation of the walls is restrained. Passive pressures and friction between the footing and bearing soils could be used for design of resistance to movement of foundation walls.

Coefficient values for backfill with anticipated types of soils for calculation of active, at rest and passive earth pressures are provided in the table below. Equivalent fluid pressure is equal to the coefficient times the appropriate soil unit weight. Those coefficient values are based on horizontal backfill with backfill soils consisting of essentially on-site non-cohesive subsoils or approved imported granular materials with friction angles of 25 and 35 degrees, respectively. For the at-rest and active earth pressures, slopes down and away from the structure would result in reduced driving forces with slopes up and away from the structures resulting in

greater forces on the walls. The passive resistance would be reduced with slopes away from the wall. The top 30-inches of soil on the passive resistance side of walls could be used as a surcharge load; however, should not be used as a part of the passive resistance value. Frictional resistance is equal to the tangent of the friction angle times the normal force. Surcharge loads or point loads placed in the backfill can also create additional loads on below grade walls. Those situations should be designed on an individual basis.

Soil Type	On-Site Medium Dense	Imported Medium Dense Granular
Wet Unit Weight	118	135
Saturated Unit Weight	135	140
Friction Angle ϕ – (assumed)	25°	35°
Active Pressure Coefficient	0.49	0.27
At-rest Pressure Coefficient	0.66	0.43
Passive Pressure Coefficient	2.04	3.70

The outlined values do not include factors of safety nor allowances for hydrostatic loads and are based on assumed friction angles, and should be verified prior to construction. Care should be taken to develop appropriate drainage systems behind below grade walls to eliminate potential for hydrostatic loads developing on the walls. Those systems would likely include perimeter drain systems extending to sump areas or free outfall where reverse flow cannot occur into the system. Where necessary, appropriate hydrostatic load values should be used for design.

Underground Water Storage Tanks

It is our understanding the underground fiberglass water storage tank foundations are anticipated to bear on the subsoils encountered at depths of approximately 12 to 14 feet below existing ground surface. The sandy lean clays soils encountered at that elevation could be used to support the tank foundations. For design of the tank foundation bearing on the sandy lean clay soils, we recommend using a net allowable total soils bearing pressure not to exceed

1,500 psf. The net bearing pressure refers the pressure at foundation bearing level in excess of the minimum surrounding overburden pressure. Total load should include both dead and live loads. A minimum dead load pressure would not be required in the low swell potential site soils.

The tanks should be backfilled in accordance with the tank manufactures recommendations. Pea gravel is typically recommended for tank backfill and would be suitable to support the building floor slab.

Floor Slab Subgrades – Water Treatment Building

To reduce the potential for differential settlement between the site sandy lean clays and typically granular tank backfill materials we recommend the building floor slab be supported on at least two (2) feet of similar materials used to backfill the underground tanks. Prior to placement of fill or at-grade slabs, the exposed subgrades should be scarified to a minimum depth of 9 inches, adjusted in moisture content and compacted to at least 95% of the material's maximum dry density as determined in accordance with ASTM Specification D-698, the standard Proctor procedure. The moisture content of the scarified soils should be adjusted to be within the range of ±2% of standard Proctor optimum moisture at the time of compaction.

Fill materials required to develop the floor slab subgrades should consist of approved, low-volume change soils which are free from organic matter and debris. Normally, low volume change soils will have a liquid limit of 30 or less and plasticity index of 15 or less. Fill in this area should be placed in loose lifts not to exceed 9 inches thick, adjusted in moisture content as recommended for the scarified materials and compacted to at least 95% of the material's maximum dry density as determined in accordance with the standard Proctor procedure.

After preparation of the subgrades, care should be taken to avoid disturbing the in-place materials. Subgrade materials which are loosened or disturbed by the construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced or, if possible, densified in place prior to construction of the overlying floor slabs.

The floor slab could be designed using a modulus of subgrade support (k-value) of 200 pci for the silty sands prepared as previously outlined.

Care should be taken after preparation of the subgrades to avoid disturbing the subgrade materials. Materials which are loosened or disturbed by the construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced prior to placement of the overlying floor slabs. Care should be taken to maintain proper moisture content in the subgrade soils prior to placement of any overlying improvements.

Positive drainage should be developed away from the new building to prevent wetting of subgrade or bearing materials. Subgrade or bearing soils allowed to become wetted subsequent to construction can result in movement and failure of the overlying improvements.

Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Interior trench backfill placed beneath slabs should be compacted in a similar manner as previously described for fill material to develop the subgrades.
- Floor slabs should not be constructed on frozen subgrade.
- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Site Development – Administration Building

Uncontrolled fill extending to depths of approximately 9 to 12 feet below existing ground surface was encountered in the test borings (TB-3 & TB-4) advanced within the building footprint. The variable lean clay fills are unsuitable for support of the building foundation and floor slab.

To reduce the potential for post-construction movement in the varying fills, it is our opinion the existing fills that extend to depths of approximately 9 to 12 feet below existing ground surface should be over-excavated to the native silty sand site soils. The removed fill lean clay materials could stockpiled and mixed into one homogenous soil type then moisture reconditioned, placed and compacted as controlled fill. At a minimum, the foundations for the proposed administration building should be supported on a zone of at least 9-feet of reconditioned site soils or an approved imported structural fill material. The over-excavations should extend laterally in all direction at least 7 feet from the edges of the foundations.

The subgrades exposed after removal of the fill materials should be scarified to a minimum depth of 9 inches, adjusted in moisture content and compacted to at least 95% of the material's maximum dry density as determined in accordance with ASTM Specification D698, the standard Proctor procedure. The moisture content of the scarified silty sand subsoils should be adjusted to be within the range of $\pm$2% of standard Proctor optimum moisture prior to compaction.

The lean clay fill materials observed at the site appear useable for development of building pad subgrade, pavement subgrades or as backfill material, provided proper moisture conditioning and compaction efforts are monitored.

Imported structural fill could also be used to develop foundation bearing subgrades and should be approved by the geotechnical engineer prior to placement. Imported structural fill should consist of approved granular materials which contain sufficient fines (at least 20% to 25% passing the number 200 sieve) to prevent ponding of water in the backfill and should have low expansive characteristics.

All fill material should be placed in loose lifts not to exceed 9 inches thick, adjusted in moisture content and compacted to at least 95% of the material's maximum dry density as determined in accordance with the standard Proctor procedure. The moisture content of the mixed reconditioned lean clay fills and site soils should be adjusted to be within the range of -1% to +3% of standard Proctor optimum moisture prior to compaction and approved imported

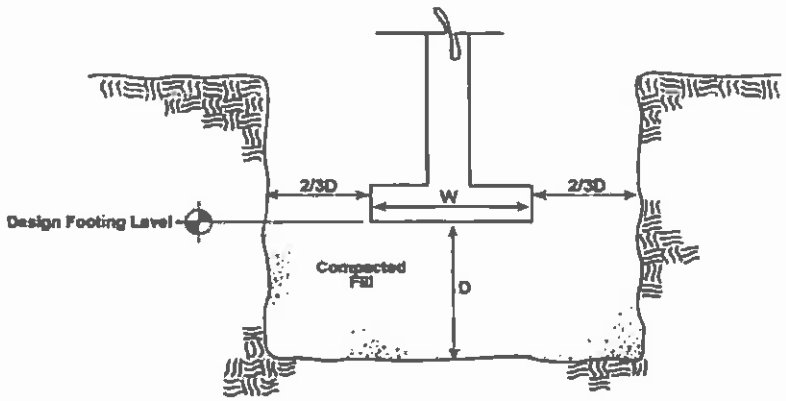
fills adjusted to be within the range of ±2% of standard Proctor optimum moisture prior to compaction.

A representative of EEC should evaluate the base of the over-excavation prior to placement of any fill materials. Frequent density tests should be performed by EEC during the placement of the structural fill. After preparation of the subgrades, care should be taken to avoid disturbing the in-place materials. Subgrade materials which are loosened or disturbed by construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced or densified in place prior to placement of foundation concrete.

Foundation Systems- Administration Building

Based on results of field borings and laboratory testing as outlined in this report, it is our opinion the proposed building could be supported on conventional spread footing foundations; however an over-excavation and replacement procedure will be necessary to develop suitable bearing subgrades. Due to the variability of the existing lean clay fill, we recommend the lean clay fills be removed to the natural silty sand soils (approximately 9 to 12 feet below existing site grades) and the foundation bear on the recondition lean clay fills or approved imported structural fill material. All foundations should bear on uniform type subsoils to minimize the potential for differential movement of dissimilar soils types.

Over-excavation should extend laterally beyond all edges of the footings at least 8 inches per foot of over-excavation depth below footing base elevation. The over-excavation should then be backfilled up to the footing base elevation with the recondition site soils or approved imported structural fill material. The engineered fill material should be adjusted to be within the range of -1% to +3% of standard Proctor optimum moisture prior to compaction, placed in uniform lifts of 9 inches or less in loose thickness and compacted to at least 95% of the material's standard Proctor maximum dry density (ASTM Specification D698). The over-excavation and backfill procedure is illustrated in the following figure.



Prior to placement and compaction of the engineered fill material an open-hole/foundation excavation observation should be performed to observe the existing subsoils below the fill zone to determine if additional over-excavation is necessary.

Footings bearing on a zone of approved engineered/structural fill material as described above could be designed for a maximum net allowable total load soil bearing pressure of 2,000 psf. A minimum dead load pressure would not be required in the low swell potential bearing soils. The net bearing pressure refers to the pressure at foundation bearing level in excess of the minimum surrounding overburden pressure. Total load includes full dead load and live load conditions. A minimum dead load pressure would not be required in the reconditioned site soils.

Exterior foundations and foundations in unheated areas should be located a minimum of 30 inches below final adjacent exterior grades to provide frost protection. We recommend formed continuous footings have a minimum width of 16 inches and isolated column foundations have a minimum width of 24 inches.

We estimate the long-term settlement of footing foundations designed and constructed as outlined above would be less than 1 inch.

No unusual problems are anticipated in completing the excavation required for construction of the footing foundations. Care should be taken during construction to avoid disturbing the foundation bearing materials. Materials which are loosened or disturbed by the construction

activities or materials which become dry and desiccated or wet and softened should be removed and replaced prior to placement of foundation concrete.

Floor Slab Subgrades- Administration Building

The floor slabs could also be supported on at least 9-feet of compacted recondition lean clay fill soils or approved imported structural fill placed and compacted as recommended in the *Site Development* section of this report. Prior to placement of fill or at-grade slabs, the exposed subgrades should be scarified to a minimum depth of 9 inches, adjusted in moisture content and compacted to at least 95% of the material's maximum dry density as determined in accordance with ASTM Specification D698, the standard Proctor procedure. The moisture content of the scarified soils should be adjusted to be within the range of ±2% of standard Proctor optimum moisture at the time of compaction.

After preparation of the subgrades, care should be taken after preparation of the subgrades to avoid disturbing the subgrade materials. Materials which are loosened or disturbed by the construction activities or materials which become dry and desiccated or wet and softened should be removed and replaced prior to placement of the overlying floor slabs. Care should be taken to maintain proper moisture content in the subgrade soils prior to placement of any overlying improvements.

Positive drainage should be developed away from the new building to prevent wetting of subgrade or bearing materials. Subgrade or bearing soils allowed to become wetted subsequent to construction can result in movement and failure of the overlying improvements.

Additional floor slab design and construction recommendations are as follows:

* Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.
* Control joints should be provided in slabs to control the location and extent of cracking.

* Interior trench backfill placed beneath slabs should be compacted in a similar manner as previously described for fill material to develop the subgrades.
* Floor slabs should not be constructed on frozen subgrade.
* Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Seismic Considerations

The site soil conditions consist of approximately 20-feet and greater depths of varying layers of overburden cohesive and essentially granular soils. For those site conditions as well as the in-situ characteristics of the subsurface profile, the 2009 International Building Code indicates a Seismic Site Classification D.

Pavements – Design and Construction Recommendations

All existing topsoil/vegetation and tree root systems should be completely removed prior to any site improvements.

We expect the site pavements will include areas designated for automobile traffic and areas of light duty traffic and heavy truck traffic. For design purposes heavy duty /or light truck traffic areas, (trash trucks, loading areas etc.), we are using an assumed equivalent daily load axle (EDLA) rating of 25 and in automobile areas we are using an EDLA of 10. Based on the subsurface conditions encountered at the site and the classification of the subsoils within the pavement sections, the on-site private drives and parking areas are being designed using an R-value of 10.

Due to the existing characteristics of the near surface fill materials, we suggest over-excavating a minimum of 2 feet of the near surface fill soils and replacement of these soils as moisture conditioned/engineered fill material beneath pavement areas and/or replacing these on-site subgrade soils with an imported CDOT Class 7 ABC/structural fill material or equivalent. Additional recommendations can be provided upon request. Placement and

compaction of either the on-site subsoils and/or imported fill material should conform to the requirements presented in the "Site Preparation" section of this report.

Due to the potential pumping conditions, which could develop in a moisture treatment process of on-site cohesive soils, we also suggest in conjunction with the over-excavation process, for subgrade stabilization purposes, incorporating at least 13% by weight of Class C fly ash into the upper 12 inches of subgrade.

Proof rolling and recompacting the subgrade is recommended immediately prior to placement of the aggregate road base section. Soft or weak areas delineated by the proof rolling operations should be undercut or stabilized in-place to achieve the appropriate subgrade support.

Subgrade stabilization should be considered to mitigate for swelling, consolidation prone, and/or pumping subgrade soils. The stabilization could include incorporation of Class "C" fly ash to enhance the subgrade integrity. An alternate would be to over-excavate and/or "cut to grade" to accommodate a minimum of 2-foot layer of non-expansive granular soils (i.e., a CDOT Class 7 ABC and/or equivalent) to be placed and compacted beneath the pavement section. Hot Mix Asphalt (HMA) pavement materials underlain by crushed aggregate base course (ABC) materials with or without a fly ash treated subgrade, and non-reinforced concrete pavement are feasible alternatives for the proposed on-site paved sections.

Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade or consolidation of a wetted subgrade. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is therefore important to minimize moisture changes in the subgrade to reduce shrink/swell movements.

Recommended pavement sections are provided in the table below. The HMA pavement materials should be grading S (75) with PG 58-28 oil. The ABC materials should be CDOT

Class 5 or Class 6 materials. Portland cement concrete should be a design mix with a minimum 28-day compressive strength of 4,000 psi and should be air entrained.

Composite HMA underlain by ABC pavements may show rutting and distress in truck, bus loading and turning areas such as the drive thru lane. Concrete pavements should be used in those areas.

RECOMMENDED MINIMUM PAVEMENT SECTIONS		
	Automobile Parking	**Heavy Duty Areas**
EDLA	10	25
Reliability	75%	85%
Resilient Modulus	4195	4195
PSI Loss	2.5	2.0
Design Structure Number	2.46	3.06
Composite: Alternative A		
Hot Mix Asphalt - (0.44 strength coefficient)	4"	5"
Aggregate Base Course - (0.11 strength coefficient)	7"	8"
Design Structure Number	(2.53)	(3.08)
Composite: Alternative B		
Hot Mix Asphalt - (0.44 strength coefficient)	3-1/2"	4-1/2"
Aggregate Base Course - (0.11 strength coefficient)	4"	6"
[1] Fly Ash Treated Subgrade (0.05 strength coefficient)	12"	12"
Design Structure Number	(2.58)	(3.24)
Composite: Alternative C		
Hot Mix Asphalt - (0.44 strength coefficient)	3"	4"
Aggregate Base Course - (0.11 strength coefficient)	4"	6"
[2] Select Subbase – 12 to 18-inches structural fill	12"	12"
Design Structure Number	(2.60)	(3.26)
PCC (Non-reinforced)	5"	7"

(1) If fly ash is utilized for the on-site pavement areas for stabilization purposes, it is recommended that at least the upper 12-inches of the prepared subgrade be treated with approximately 13% fly ash (by weight) of Class C fly ash.

(2) If the select subbase alternative is chosen, we recommend a minimum of 12-inches of imported structural fill be moisture conditioned and compacted to at least 95% of the materials standard Proctor dry density. For the structural number coefficient benefit we are using a design value of 0.07.

The recommended pavement sections are minimums and periodic maintenance should be expected. Longitudinal and transverse joints should be provided as needed in concrete pavements for expansion/contraction and isolation. The location and extent of joints should be based upon the final pavement geometry. Sawed joints should be cut in general accordance with ACI recommendations. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Since the cohesive soils on the site have some shrink/swell potential, pavements could crack in the future primarily because of the volume change of the soils when subjected to an increase in moisture content to the subgrade. The cracking, while not desirable, does not necessarily constitute structural failure of the pavement. Stabilization of the subgrades will reduce the potential for cracking of the pavements.

The collection and diversion of surface drainage away from paved areas is critical to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas in order to reduce the potential for wetting of the subgrade soils.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventive maintenance. The following recommendations should be considered the minimum:

- The subgrade and the pavement surface should be adequately sloped to promote proper surface drainage.
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g. garden centers, wash racks)
- Install joint sealant and seal cracks immediately,

- Seal all landscaped areas in, or adjacent to pavements to minimize or prevent moisture migration to subgrade soils;
- Placing compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Placing curb, gutter, and/or sidewalk directly on approved proof rolled subgrade soils with the use of base course materials.

Preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance.

Site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, or rainfall. As a result, the pavement subgrade may not be suitable for pavement construction and corrective action will be required. The subgrade should be carefully evaluated at the time of pavement construction for signs of disturbance, rutting, or excessive drying. If disturbance has occurred, pavement subgrade areas should be reworked, moisture conditioned, and properly compacted to the recommendations in this report immediately prior to paving.

Please note that if during or after placement of the stabilization or initial lift of pavement, the area is observed to be yielding under vehicle traffic or construction equipment, it is recommended that EEC be contacted for additional alternative methods of stabilization, or a change in the pavement section.

Other Considerations

Positive drainage should be developed away from the structure and pavement areas with a minimum slope of 1-inch per foot for the first 10-feet away from the improvements in landscape areas. Care should be taken in planning of landscaping adjacent to the building and parking and drive areas to avoid features which would pond water adjacent to the pavement, foundations or stemwalls. Placement of plants which require irrigation systems or could result in fluctuations of the moisture content of the subgrade material should be avoided adjacent to site improvements. Lawn watering systems should not be placed within 5 feet of the perimeter of the building and parking areas. Spray heads should be designed not to spray water on or immediately adjacent to the structure or site pavements. Roof drains should be designed to discharge at least 5 feet away from the structure and away from the pavement areas.

GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between boring or across the site. The nature and extent of such variations may not become evident until construction. If variations appear evident, it will be necessary to re-evaluate the recommendations of this report.

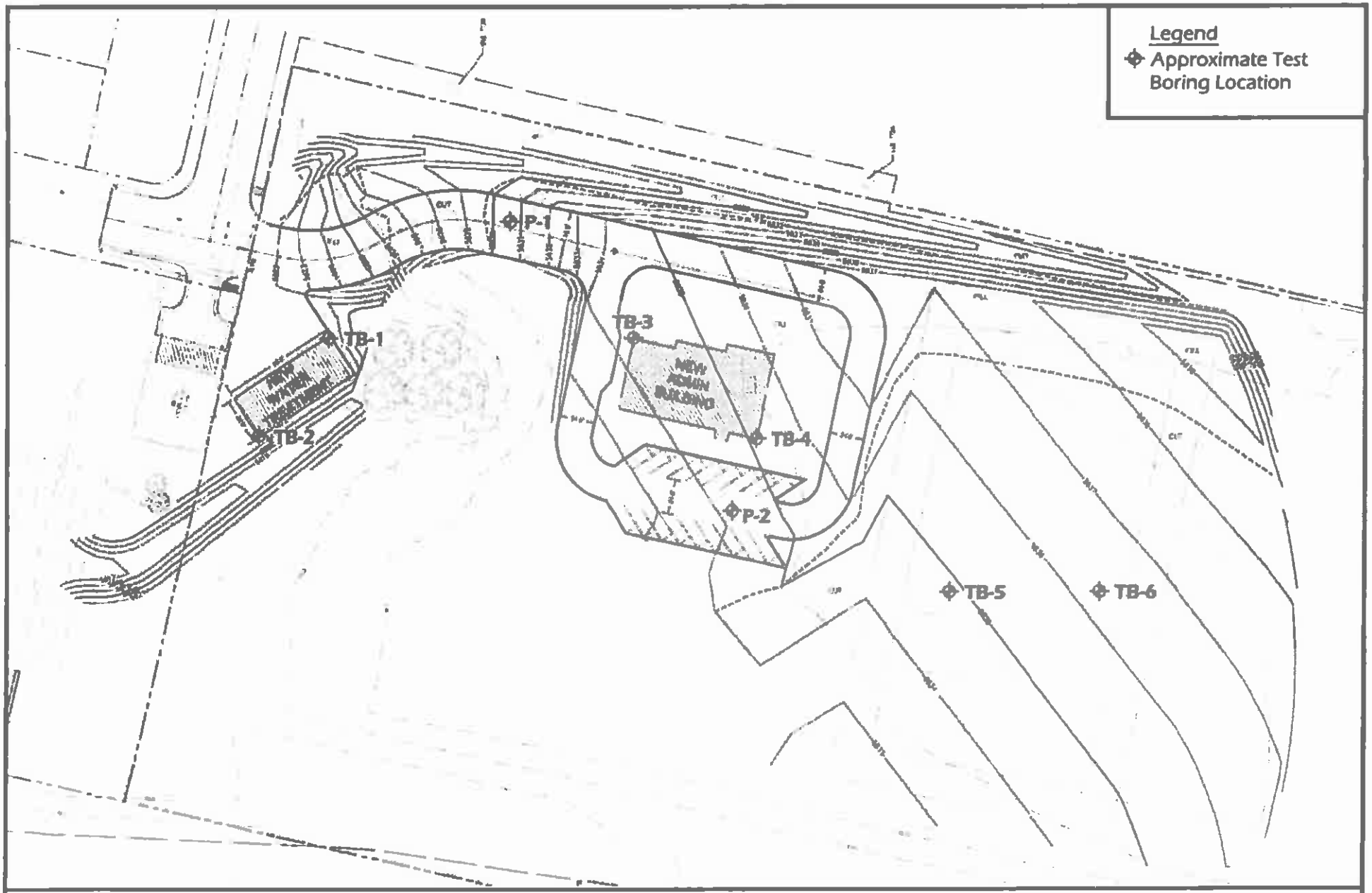
It is recommended that the geotechnical engineer be retained to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained for testing and observations during earthwork and foundation construction phases to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of T-Bone Construction, Colorado Centre Metropolitan District and/or assignees, for specific application to the project discussed and have been prepared in accordance with generally accepted geotechnical engineering practices.

No warranty, express or implied, is made. In the event that any changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing by the geotechnical engineer.

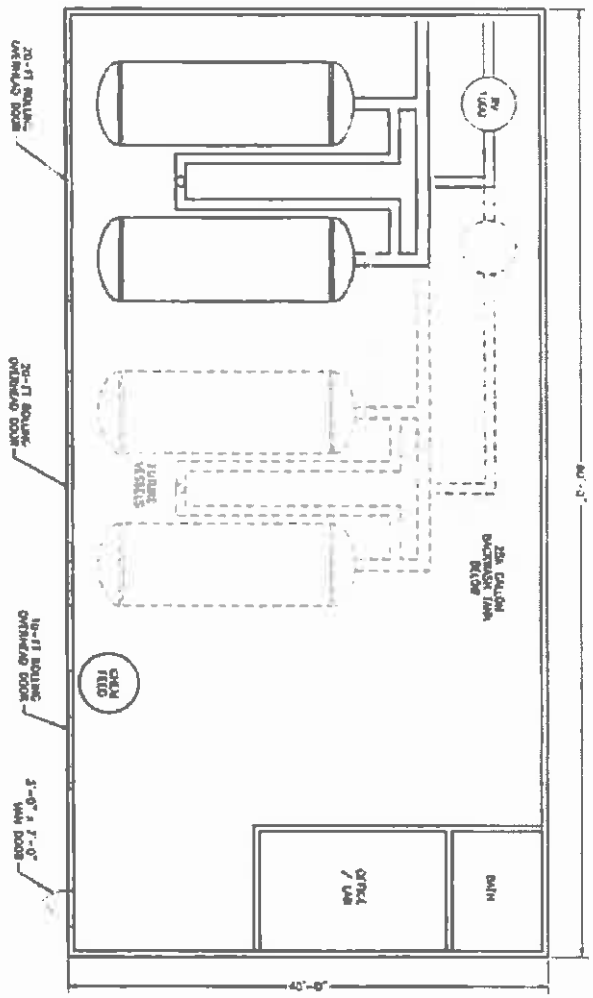
APPENDIX

DRAWINGS/LOGS/LAB DATA



North
Not to Scale

Boring Location Diagram
Colorado Center Treatment Plant
NE Corner of Flagstone Street & East Anvil Drive - Colorado Springs, Colorado
EEC Project #: 2142014 Date: September 2014



1

COLORADO CENTRE METRO DISTRICT
WATER TREATMENT PLANT

BUILDING LAYOUT

JDS-HYDRO CONSULTANTS, INC.
545 EAST PIKE'S PEAK AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-0072

LOG OF BORING: TB-1

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5821 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 to 12 inches — 5820.0									
	SANDY LEAN CLAY, brown, moist		CL	1	SS	9	15.1			
	4.0 — 5817.0									
	CLAYEY SAND, brown, moist	5	SC	2	CA	16	16.9	104.9		LL=39 PI=25 -200=48.3
	9.0 — 5812.0									
	SANDY LEAN CLAY, brown,moist	10	CL	3	SS	11	18.6			
	14.0 — 5807.0									
	SILTY SAND, brown, moist to saturated ▽	15	SM	4	SS	9	9.2			LL=NV PI=NP -200=18.0
	20.0 — 5801.0	20	SP-SM	5	SS	10	17.1			
	END OF BORING									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES. IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS

WL	▽ 18	0 hrs	
WL			
WL			

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO 2142014.GPJ EEC.GDT 8/29/14

LOG OF BORING: TB-2

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5821 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 to 12 inches — 5820.0									
	SANDY LEAN CLAY, brown, moist		CL	1	SS	23	9.3			LL=31 PI=13 -200=50.5
	4.0 — 5817.0									
	CLAYEY SAND, brown, moist		SC	2	CA	19	9.7	108.2		LL=30 PI=10 -200=37.6
	9.0 — 5812.0	5								
	SANDY LEAN CLAY, brown, moist		SM	3	SS	10	21.8			
	14.0 — 5807.0	10								
	SILTY SAND, brown, moist to saturated ▽		SM	4	SS	4	24.9			
	20.0 — 5801.0	15								
	END OF BORING		SP-SM	5	SS	5	20.1			
		20								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS			
WL	▽ 18	0 hrs	
WL			
WL			

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GTO 2142014.GPJ EEC.GDT 8/20/14

LOG OF BORING: TB-3

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5832 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 to 12 inches — 5831.0									
	FILL, consisting of lean clay, brown, moist		CL	1	SS	8	8.6			
			CL	2	CA	4	9.4	87.7		LL=41 PI=26 -200=87.8
		5								
	9.0 — 5823.0									
	SAND, with varyng amounts of silt, brown, moist		SM	3	SS	4	8.5			
		10								
			SM	4	SS	9	12.5			
		15								
			SP-SM	5	SS	11	4.6			LL=NV PI=NP -200=6.0
	20.0 — 5812.0	20								
	END OF BORING									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS		
WL		
WL		
WL	None observed 8/8/14	

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO 2142014.GPJ EEC.GDT 8/29/14

LOG OF BORING: TB-4

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5835 ft.									
	TOPSOIL/VEGETATION, approximately 8 to 12 inches — 5834.0	1.0								
	FILL, consisting of lean clay, brown, moist		CL	1	SS	13	10.5			
			CL	2	SS	14	9.4			
		5								
			CL	3	CA	13	10.4			LL=45 PI=33 -200=94.8
		10								
	12.0 — 5823.0									
	SAND, with varying amounts of silt, brown, moist		SM	4	SS	11	6.5			LL=NV PI=NP -200=34.1
		15								
	20.0 — 5815.0		SP-SM	5	SS	6	7.4			
	END OF BORING	20								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS		
WL		
WL		
WL	None observed 8/8/14	

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO 2142014.GPJ EEC.GDT 8/29/14

LOG OF BORING: TB-5

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5836 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 to 12 inches — 5835.0									
	FILL, consisitng of clayey sand, brown, moist									
	4.0 — 5832.0									
	FILL, consisiting of silty sand, brown, moist		SM	1	SS	5	4.8			LL=NV PI=NP -200=21.7
	9.0 — 5827.0	5								
	10.0 FILL, consisting of sandy lean clay, brown, moist — 5826.0		CL	2	SS	9	16.3			
	END OF BORING	10								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS		
WL		
WL		
WL	None observed 8/8/14	

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO 2142014.GPJ EEC.GDT 8/29/14

LOG OF BORING: TB-6

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5837 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 to 12 inches — 5836.0									
	FILL, consisitng of clayey sand, brown, moist									
	4.0 — 5833.0									
	FILL, consisiting of silty sand, brown, moist	5	SM	1	SS	15	14.2			
	9.0 — 5828.0									
	10.0 FILL, consisting of sandy lean clay, brown, moist — 5827.0	10	CL	2	SS	8	12.7			LL=35 PI=16 -200=68.3
	END OF BORING									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS		
WL		
WL		
WL	None observed 8/8/14	

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO 2142014.GPJ EEC.GDT 8/29/14

LOG OF BORING: P-1

OWNER	ARCHITECT/ENGINEER
Colorado Centre Metropolitan District	
SITE Flagstone Street & East Anvil Drive, Colorado Springs, Colorado	**PROJECT** New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5827 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 to 12 inches 5826.0									
	FILL, consisting of lean clay with sand, brown, moist		CL	1	SS	5	29.8			LL=41 PI=26 -200=72.3
	3.0 5824.0									
	FILL, consisting of silty sand, brown, moist		CL	2	SS	3	35.5			
	5.0 5822.0	5								
	END OF BORING									

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS		
WL		
WL		
WL	None observed 8/8/14	

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO_2142014.GPJ_EEC.GDT 8/29/14

LOG OF BORING: P-2

OWNER: Colorado Centre Metropolitan District

ARCHITECT/ENGINEER:

SITE: Flagstone Street & East Anvil Drive, Colorado Springs, Colorado

PROJECT: New Treatment Plant Site

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS or AASHTO Classification	SAMPLES NUMBER	SAMPLES TYPE	SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH PSF	
	Approx. Surface Elev.: 5834 ft.									
	1.0 TOPSOIL/VEGETATION, approximately 8 th 12 inches 5833.0									
	FILL, consisting of lean clay with sand, brown, moist		CL	1	SS	12	12.8			
	3.0 5831.0									
	FILL, consisitng of silty sand, brown, moist									
	5.0 5829.0		SM	2	SS	9	5.6			LL=NV PI=NP -200=40.8
	END OF BORING	5								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

Calibrated Hand Penetrometer*

WATER LEVEL OBSERVATIONS		
WL		
WL		
WL	None observed 8/8/14	

EARTH ENGINEERING CONSULTANTS

BORING STARTED	8-8-14		
BORING COMPLETED	8-8-14		
RIG	D-90	FOREMAN	RR
APPROVED	RR	JOB #	2142014

GEO 2142014 GPJ EEC.GDT 8/29/14

DRILLING AND EXPLORATION

DRILLING & SAMPLING SYMBOLS:

SS: Split Spoon - 13/8" I.D., 2" O.D., unless otherwise noted
ST: Thin-Walled Tube - 2" O.D., unless otherwise noted
R: Ring Barrel Sampler - 2.42" I.D., 3" O.D. unless otherwise noted
PA: Power Auger
HA: Hand Auger
DB: Diamond Bit = 4", N, B
AS: Auger Sample
HS: Hollow Stem Auger
PS: Piston Sample
WS: Wash Sample
FT: Fish Tail Bit
RB: Rock Bit
BS: Bulk Sample
PM: Pressure Meter
WB: Wash Bore

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL : Water Level
WCI: Wet Cave in
DCI: Dry Cave in
AB : After Boring
WS : While Sampling
WD : While Drilling
BCR: Before Casing Removal
ACR: After Casting Removal

Water levels indicated on the boring logs are the levels measured in the borings at the time indicated. In pervious soils, the indicated levels may reflect the location of ground water. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION

Soil Classification is based on the Unified Soil Classification system and the ASTM Designations D-2488. Coarse Grained Soils have move than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as : clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 - 16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80 +	Extremely Dense

PHYSICAL PROPERTIES OF BEDROCK

DEGREE OF WEATHERING:

Slight	Slight decomposition of parent material on joints. May be color change.
Moderate	Some decomposition and color change throughout.
High	Rock highly decomposed, may be extremely broken.

HARDNESS AND DEGREE OF CEMENTATION:

Limestone and Dolomite:

Hard	Difficult to scratch with knife.
Moderately Hard	Can be scratched easily with knife.
Hard	Cannot be scratched with fingernail.
Soft	Can be scratched with fingernail.

Shale, Siltstone and Claystone:

Hard	Can be scratched easily with knife, cannot be scratched with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be easily dented but not molded with fingers.

Sandstone and Conglomerate:

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

EEC

EEC

SUMMARY OF TEST RESULTS

EEC Project No. 2142014

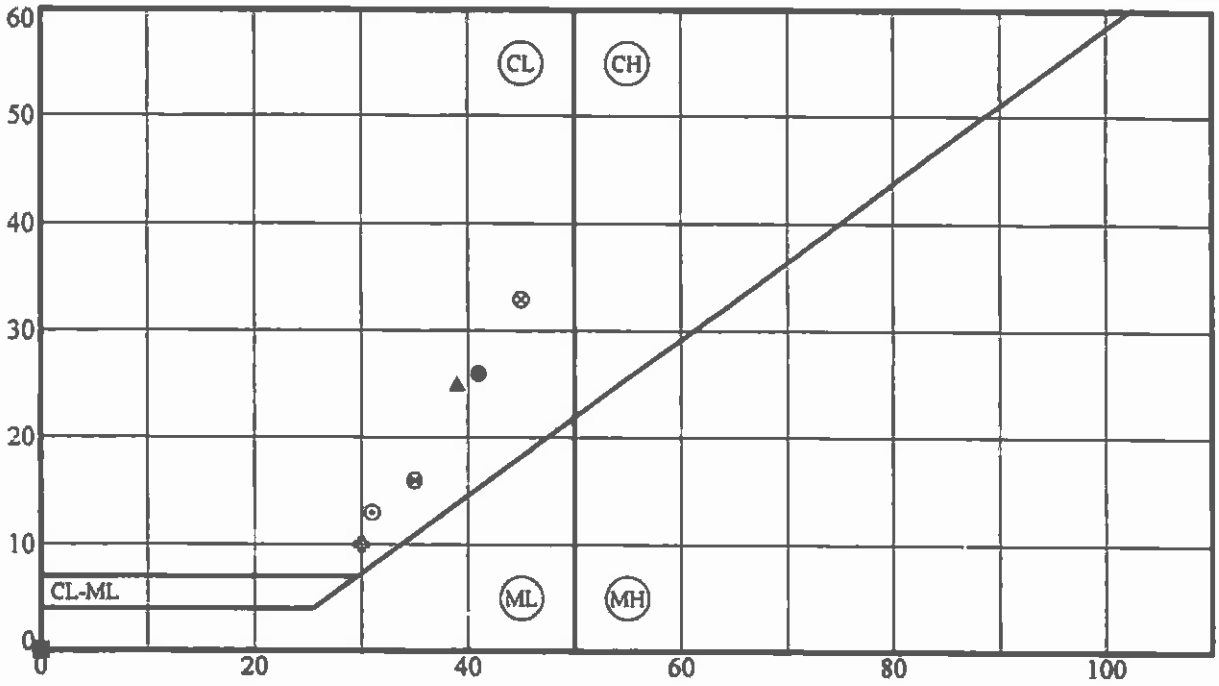
Boring No.	Depth (Ft.)	Moisture (%)	Dry Density (PCF)	Compressive Strength (PSF)	Swell Pressure (PSF)	-200	Liquid Limit (%)	Plasticity Index (%)	Group Index	Classification USCS	Penetration Blows/In
TB-1	2.0-3.0	15.1									9/12
	4.0-5.0	16.9	104.9			48.3	39	25		SC	16/12
	9.0-10.0	18.6									11/12
	14.0-15.0	9.2				18.0	NV	NP		SM	9/12
	19.0-20.0	17.1									10/12
TB-2	2.0-3.0	9.3				50.5	31	13		CL	23/12
	4.0-5.0	9.7	108.2			37.6	30	10		SC	19/12
	9.0-10.0	21.8									10/12
	14.0-15.0	24.9									4/12
	19.0-20.0	20.1									5/12
TB-3	2.0-3.0	8.6									8/12
	4.0-5.0	9.4	87.7			87.8	41	26		CL	4/12
	9.0-10.0	8.5									4/12
	14.0-15.0	12.5									9/12
	19.0-20.0	4.6				6.0	NV	NP		SP-SM	11/12

EEC

SUMMARY OF TEST RESULTS

EEC Project No. 2142014

Boring No.	Depth (Ft.)	Moisture (%)	Dry Density (PCF)	Compressive Strength (PSF)	Swell Pressure (PSF)	-200	Liquid Limit (%)	Plasticity Index (%)	Group Index	Classification USCS	Penetration Blows/In
TB-4	2.0-3.0	10.5									13/12
	4.0-5.0	9.4									14/12
	9.0-10.0	10.4				94.8	45	22		CL	13/12
	14.0-15.0	6.5				34.1	NV	NP		SM	11/12
	19.0-20.0	7.4									6/12
TB-5	4.0-5.0	4.8				21.7	NV	NP		SM	5/12
	9.0-10.0	16.3									9/12
TB-6	4.0-5.0	14.2									15/12
	9.0-10.0	12.7				68.3	35	16		CL	8/12
P-1	1.0-2.0	29.8				72.3	41	26		CL	5/12
	4.0-5.0	35.5									3/12
P-2	1.0-2.0	12.8									12/12
	4.0-5.0	5.6				40.8	NV	NP		SM	9/12



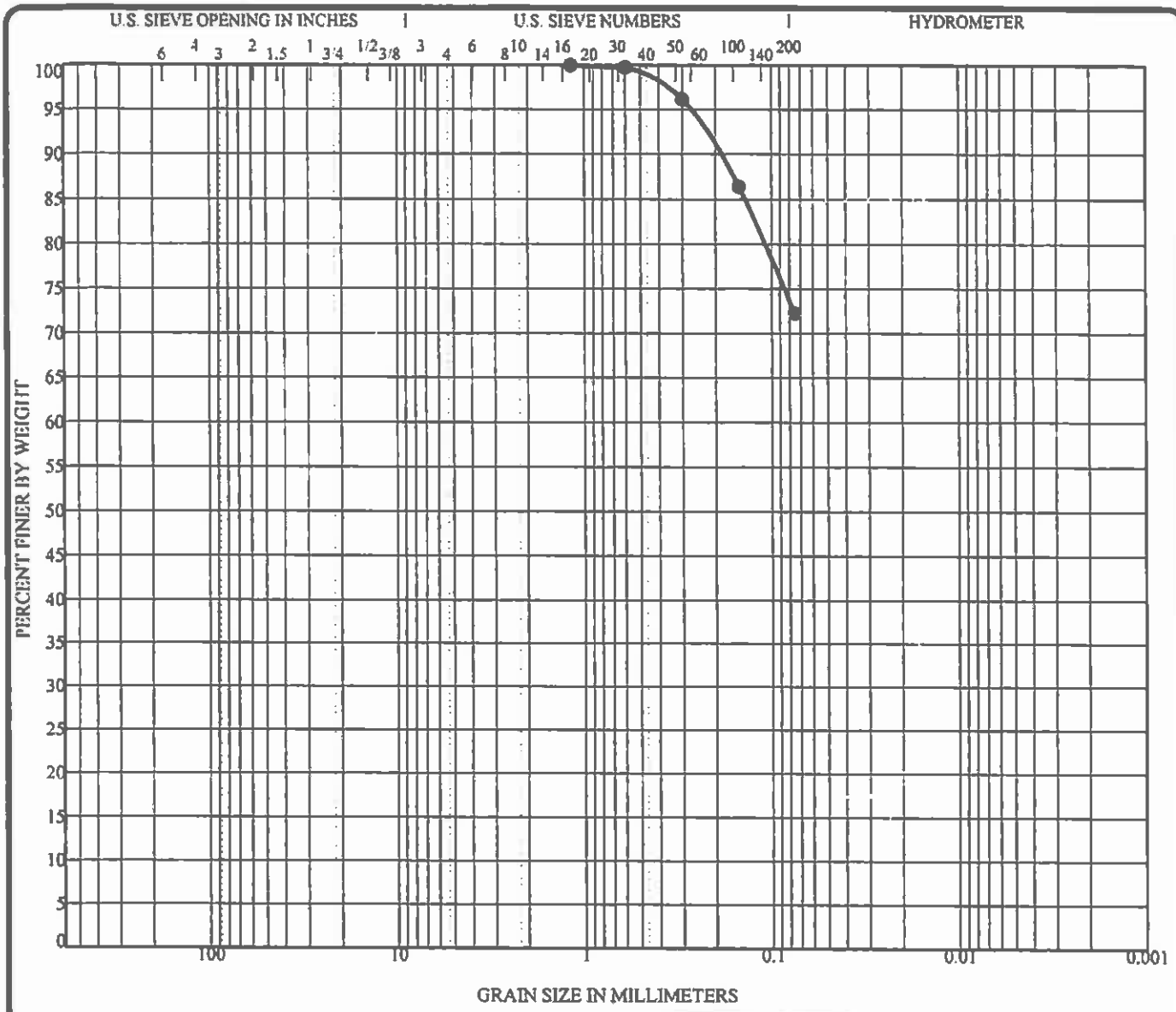
	Sample Identification - Sample Depth		LL	PL	PI	Fines	Classification
●	P-1	1.0	41	15	26	72.3	LEAN CLAY with SAND(CL)
⊠	P-2	4.0	NV	NV	NP	40.8	SILTY SAND(SM)
▲	TB-1	4.0	39	14	25	48.3	CLAYEY SAND(SC)
★	TB-1	14.0	NV	NV	NP	18.0	SILTY SAND(SM)
⊙	TB-2	2.0	31	18	13	50.5	SANDY LEAN CLAY(CL)
✿	TB-2	4.0	30	20	10	37.6	CLAYEY SAND(SC)
○	TB-3	4.0	41	15	26	87.8	LEAN CLAY(CL)
△	TB-3	19.0	NV	NV	NP	6.0	POORLY GRADED SAND with SILT(SP-SM)
⊗	TB-4	9.0	45	12	33	94.8	LEAN CLAY(CL)
⊕	TB-4	14.0	NV	NV	NP	34.1	SILTY SAND(SM)
□	TB-5	4.0	NV	NV	NP	21.7	SILTY SAND(SM)
⊖	TB-6	9.0	35	19	16	68.3	SANDY LEAN CLAY(CL)

EARTH ENGINEERING CONSULTANTS

ATTERBERG LIMITS' RESULTS

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US ATTERBERG LIMITS 2142014.GPJ EEC.GDT 8/8/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	P-1	1.0	LEAN CLAY with SAND(CL)	41	15	26		

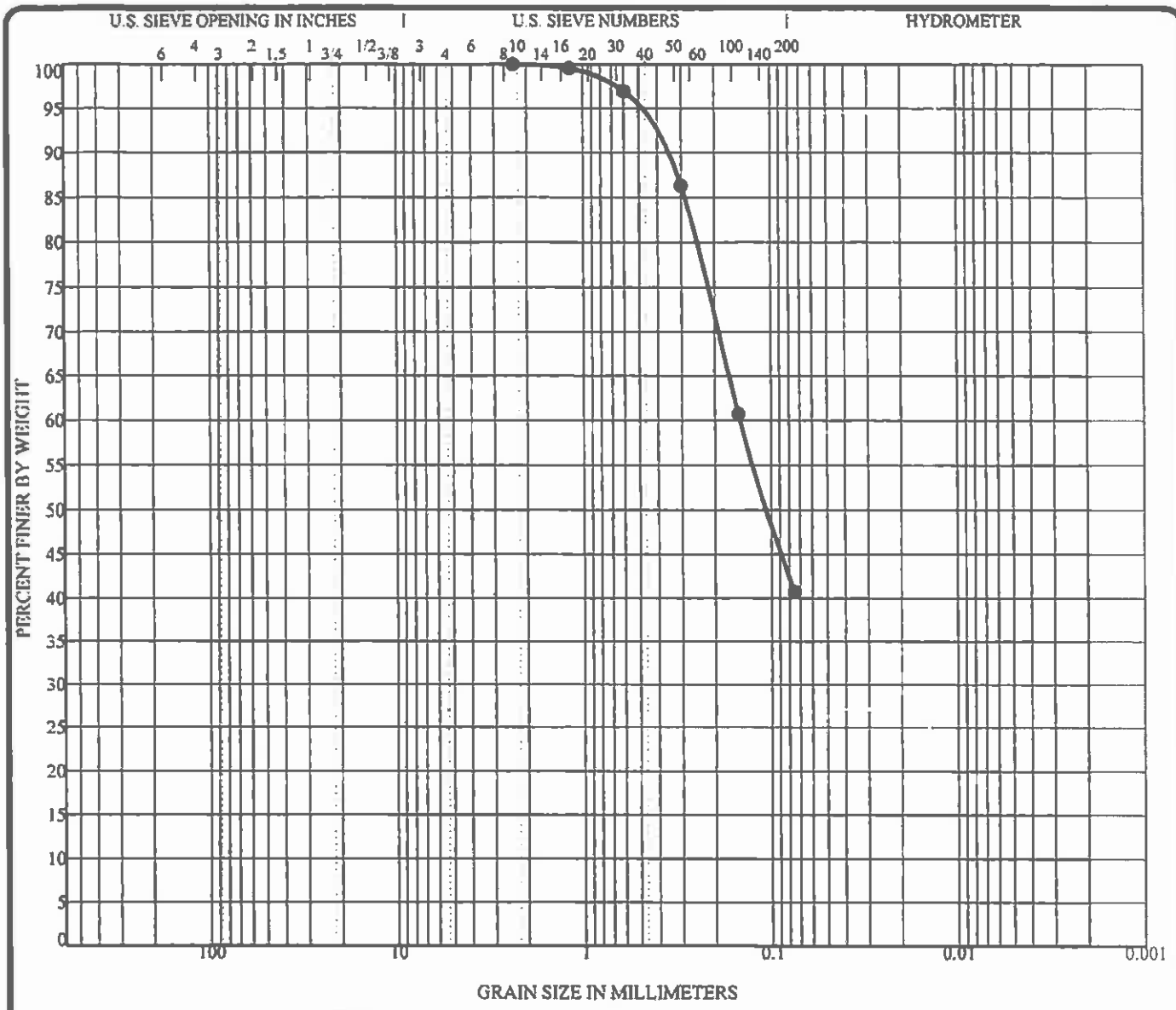
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	P-1	1.0	1.18				0.0	27.7	72.3	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	P-2	4.0	SILTY SAND(SM)	NV	NV	NP		

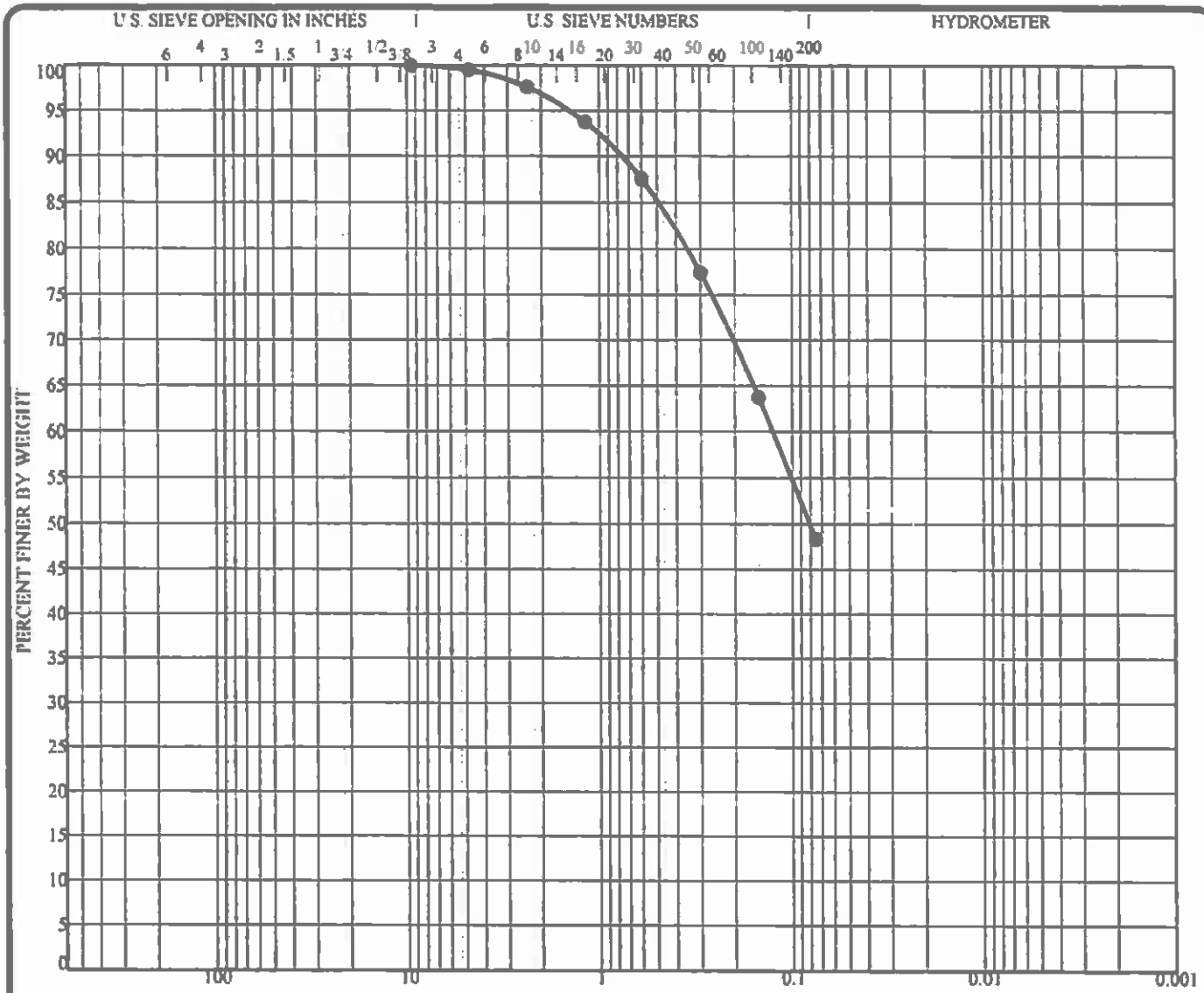
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	P-2	4.0	2.36	0.146			0.0	59.2	40.8	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-1	4.0	CLAYEY SAND(SC)	39	14	25		

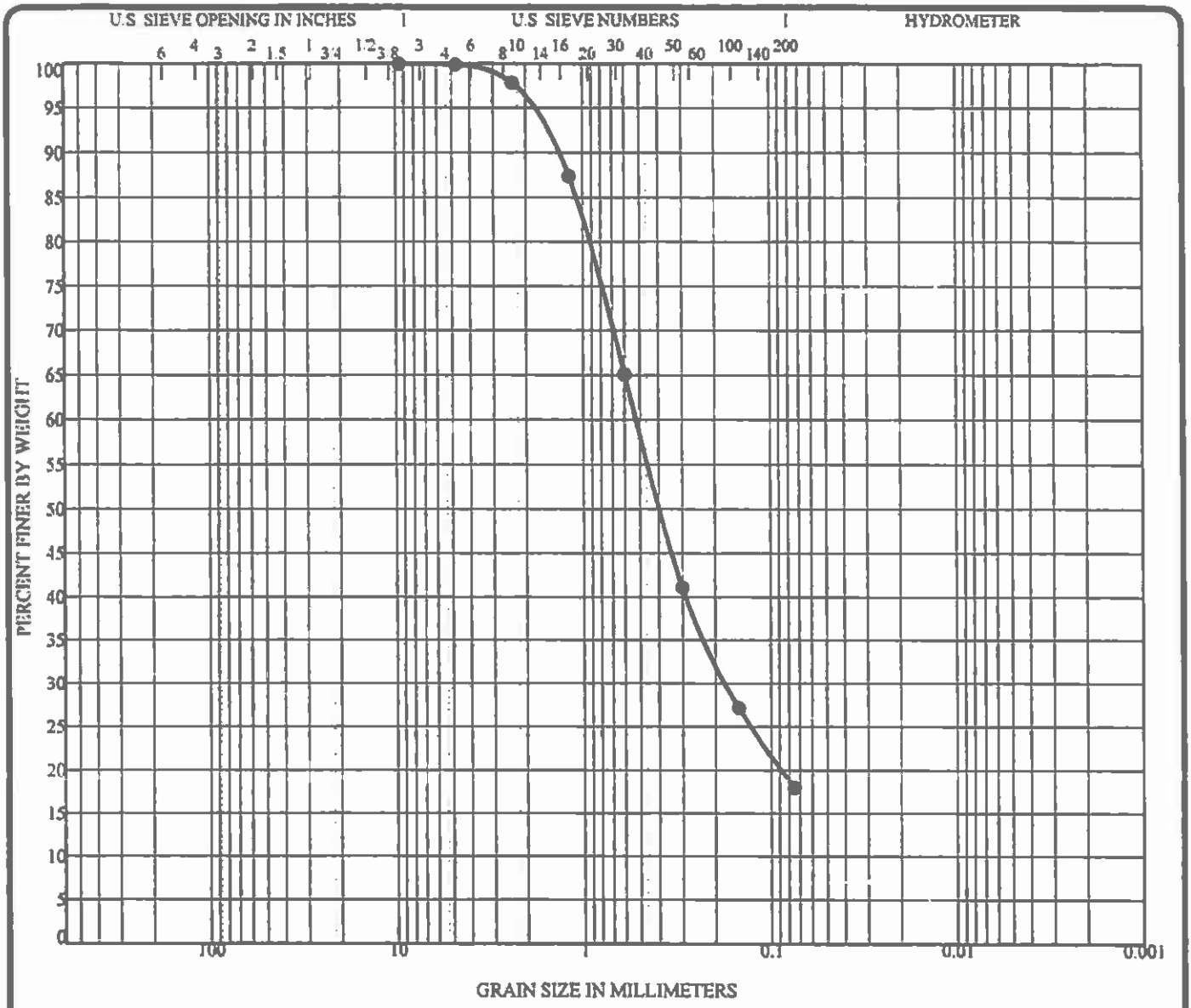
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-1	4.0	9.5	0.127			0.5	51.2	48.3	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-1	14.0	SILTY SAND(SM)	NV	NV	NP		

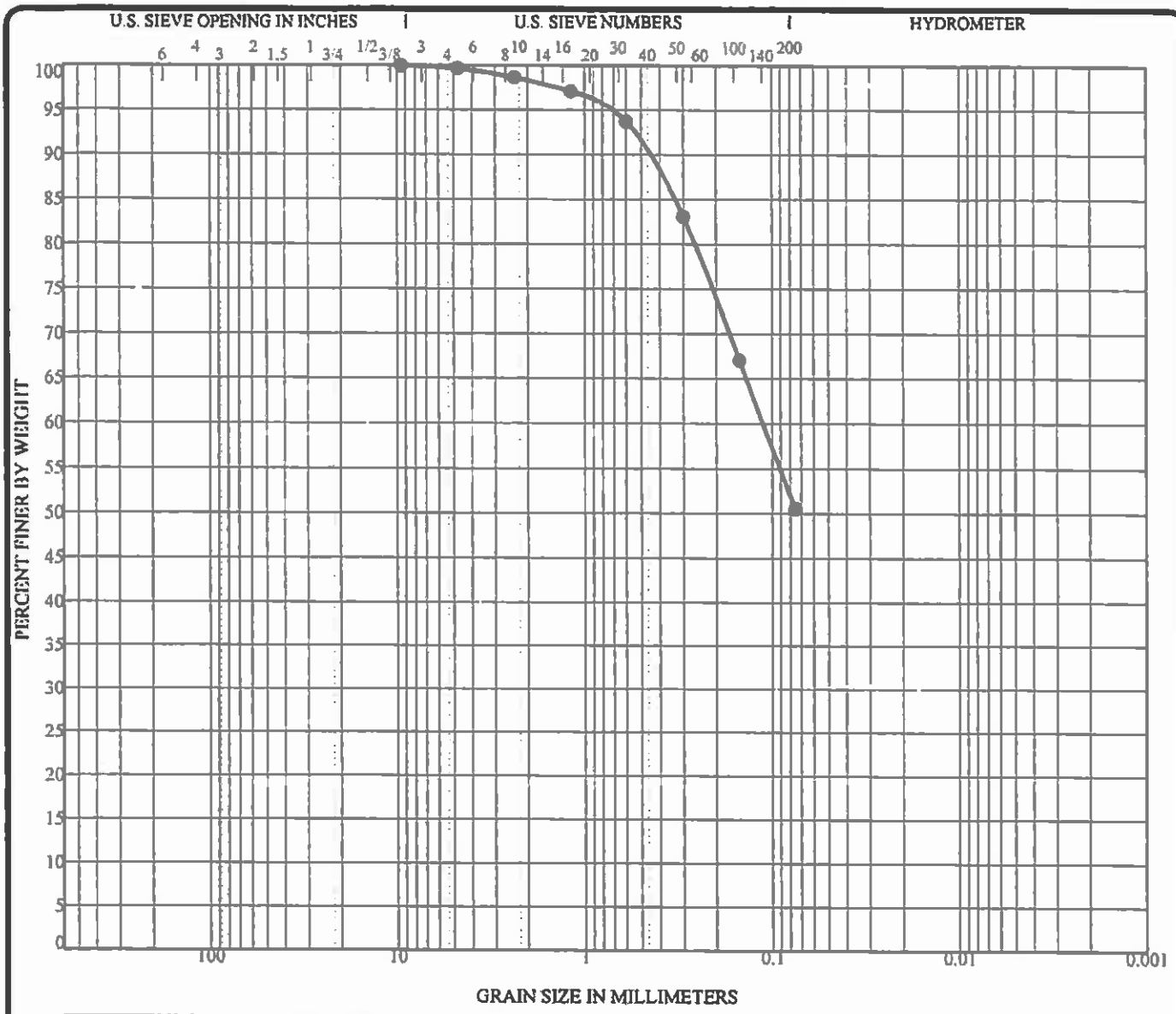
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-1	14.0	9.5	0.518	0.173		0.1	81.9	18.0	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/7/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-2	2.0	SANDY LEAN CLAY(CL)	31	18	13		

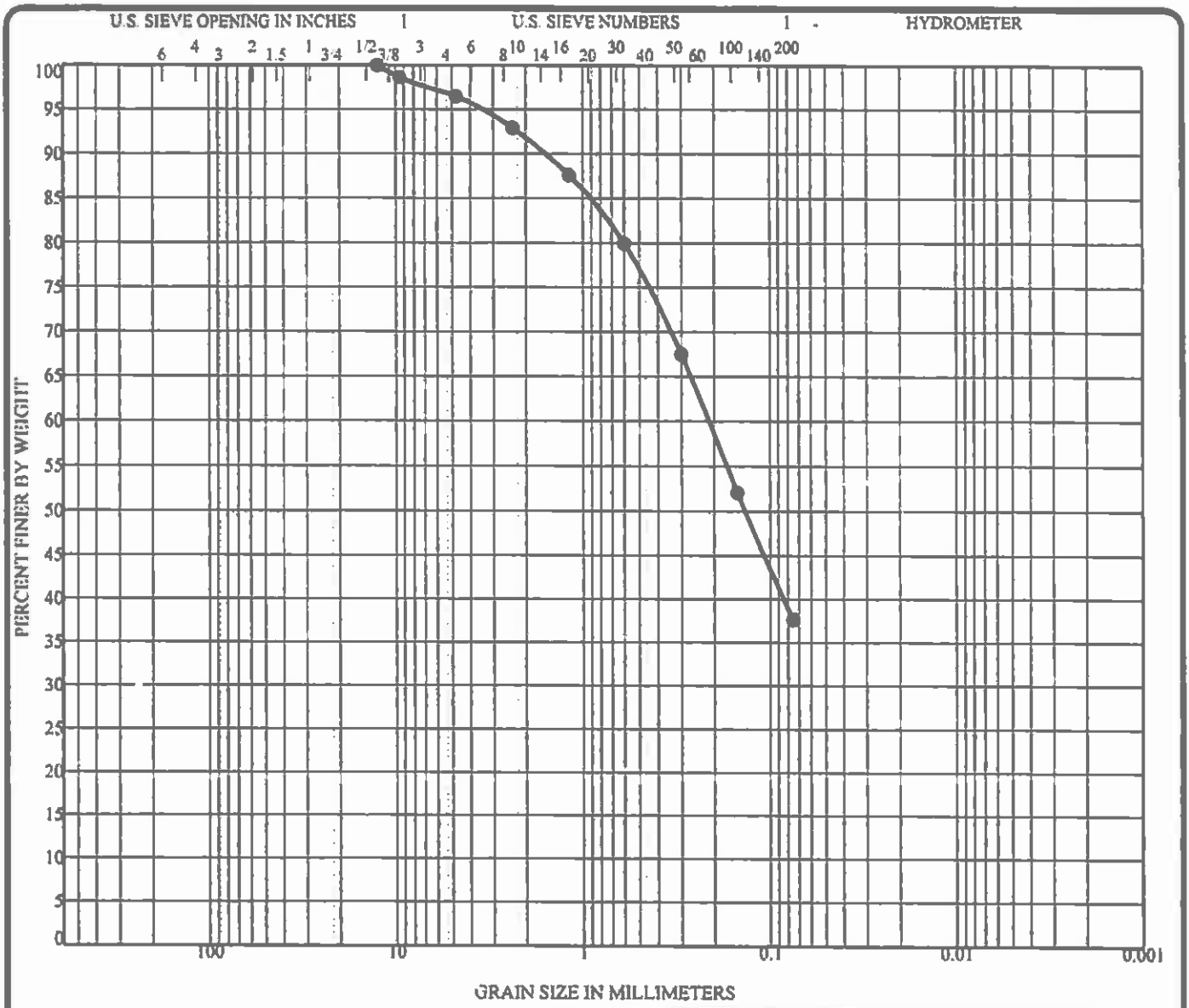
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-2	2.0	9.5	0.112			0.3	49.1	50.5	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-2	4.0	CLAYEY SAND(SC)	30	20	10		

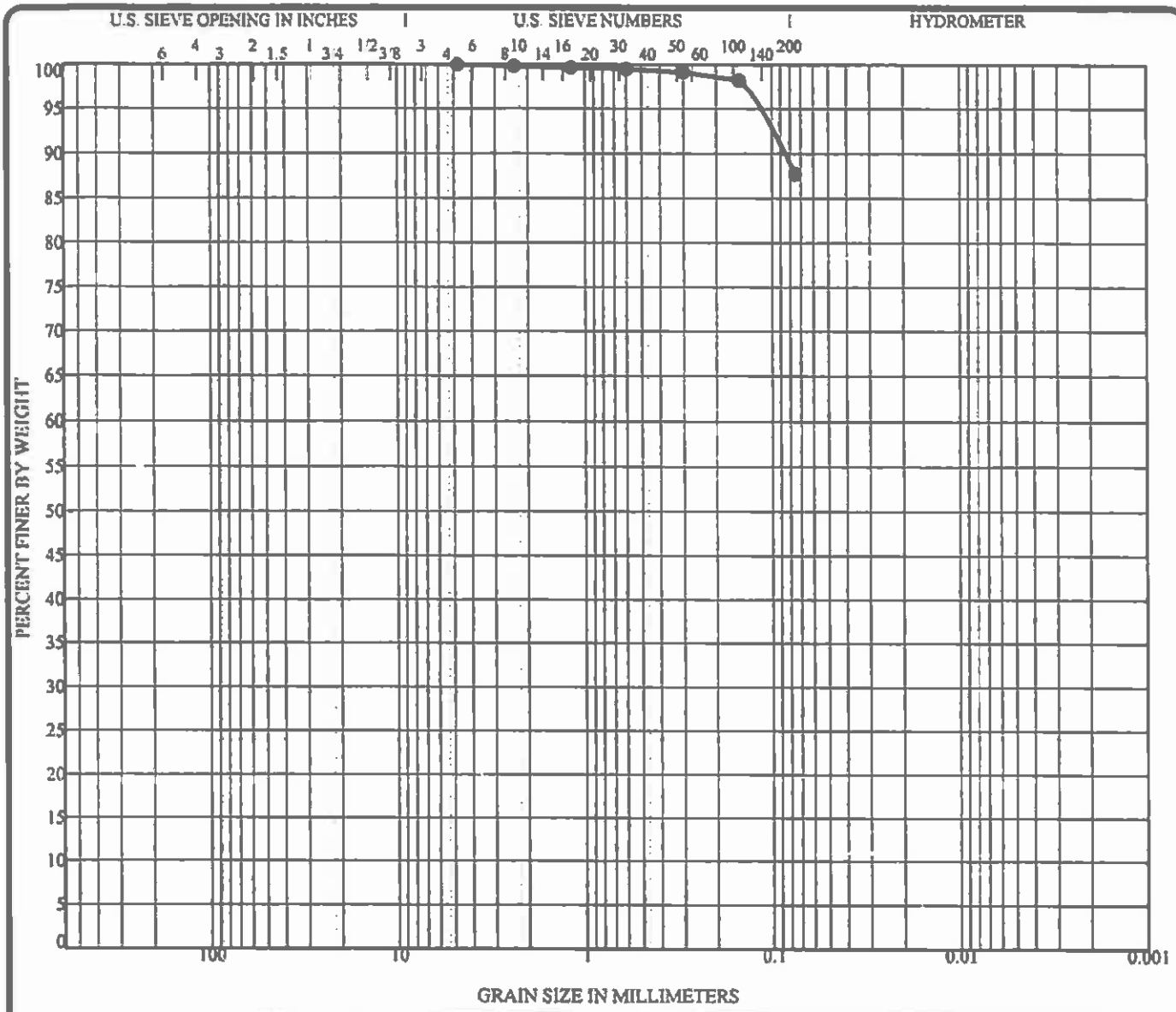
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-2	4.0	12.5	0.214			3.5	58.8	37.6	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-3	4.0	LEAN CLAY(CL)	41	15	26		

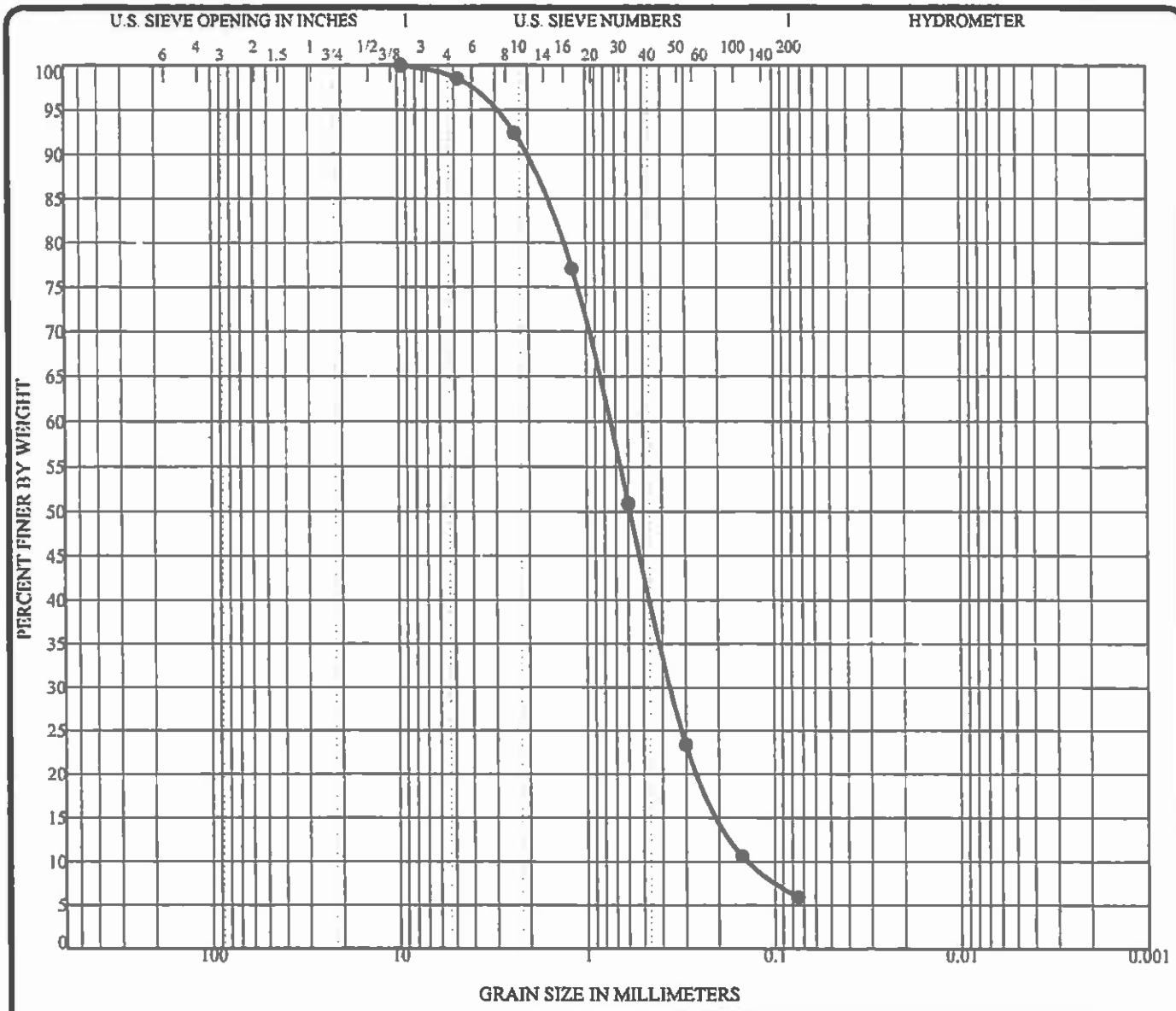
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-3	4.0	4.75				0.0	12.2	87.8	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 6/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-3	19.0	POORLY GRADED SAND with SILT(SP-SM)	NV	NV	NP	1.22	5.58

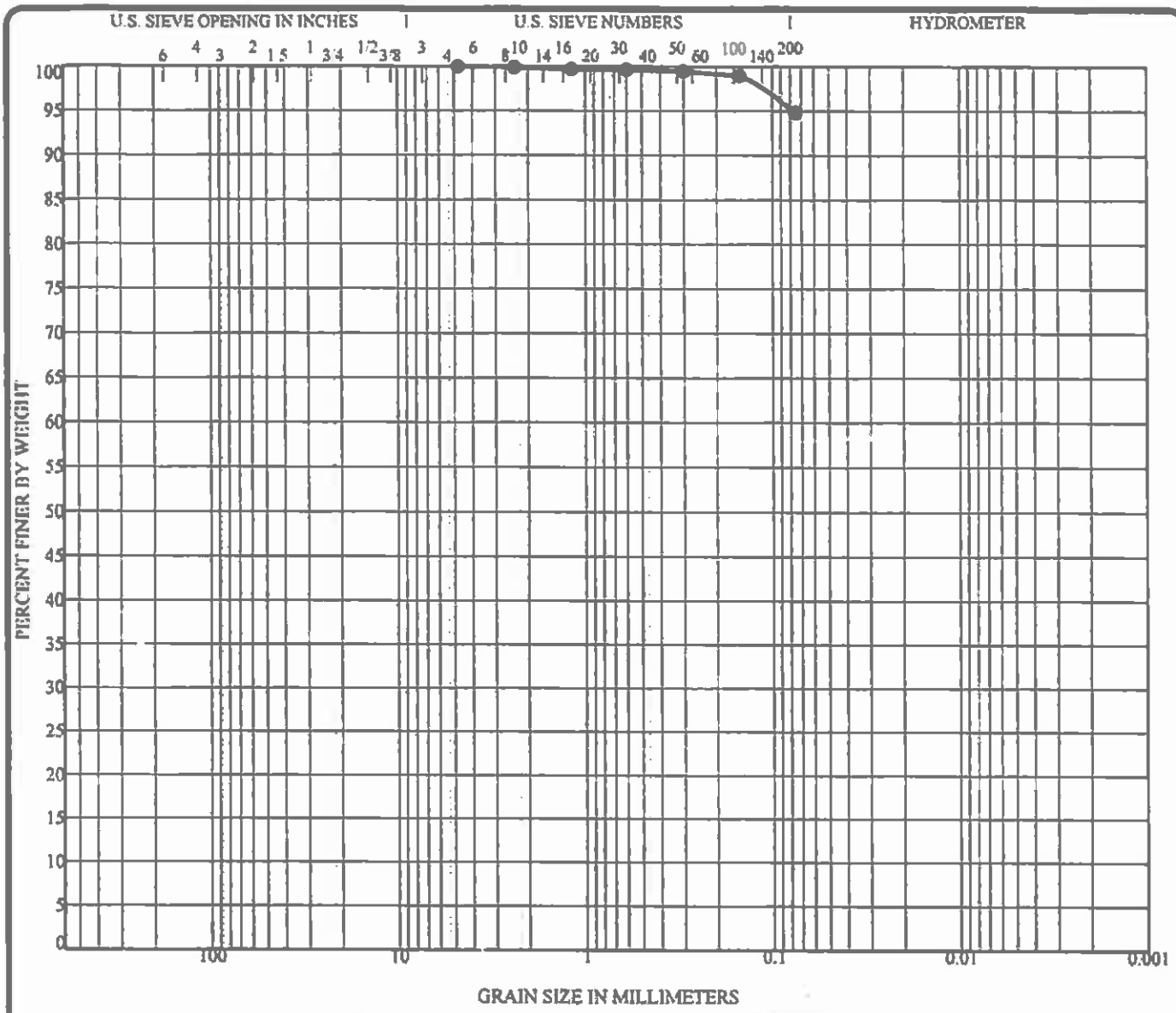
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-3	19.0	9.5	0.759	0.354	0.136	1.5	92.6	6.0	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-4	9.0	LEAN CLAY(CL)	45	12	33		

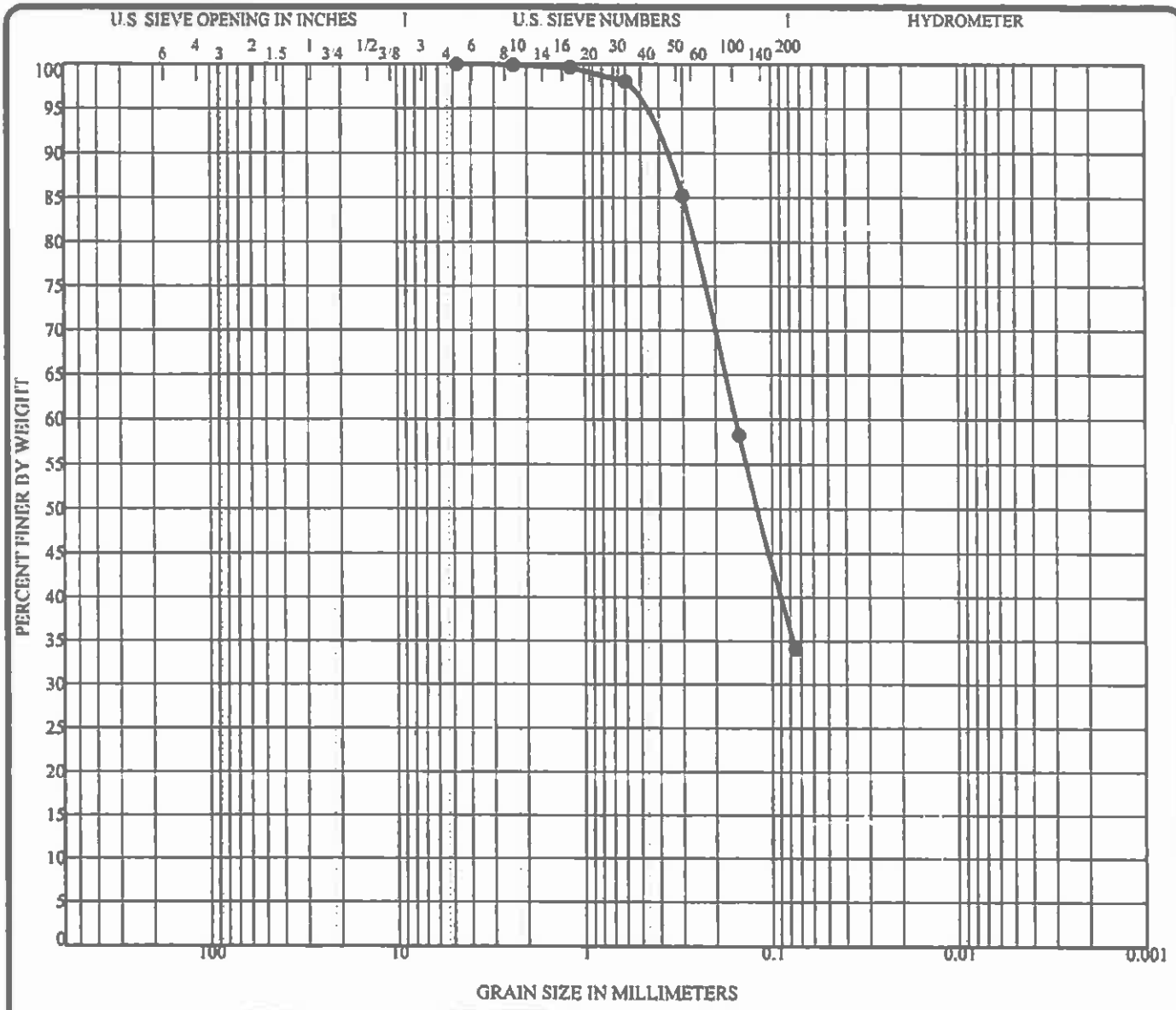
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-4	9.0	4.75				0.0	5.2	94.8	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-4	14.0	SILTY SAND(SM)	NV	NV	NP		

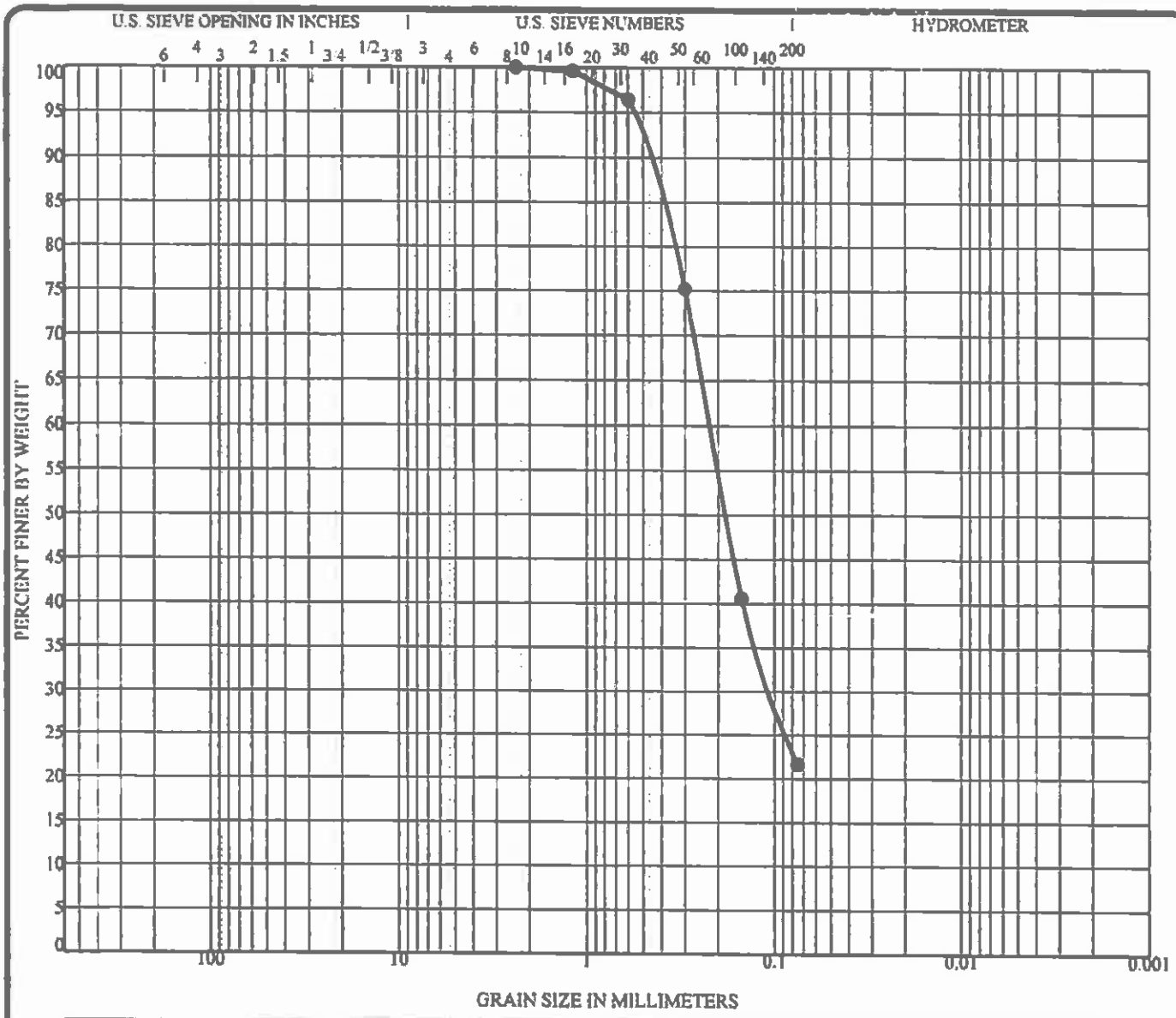
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-4	14.0	4.75	0.157			0.0	65.9	34.1	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/8/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-5	4.0	SILTY SAND(SM)	NV	NV	NP		

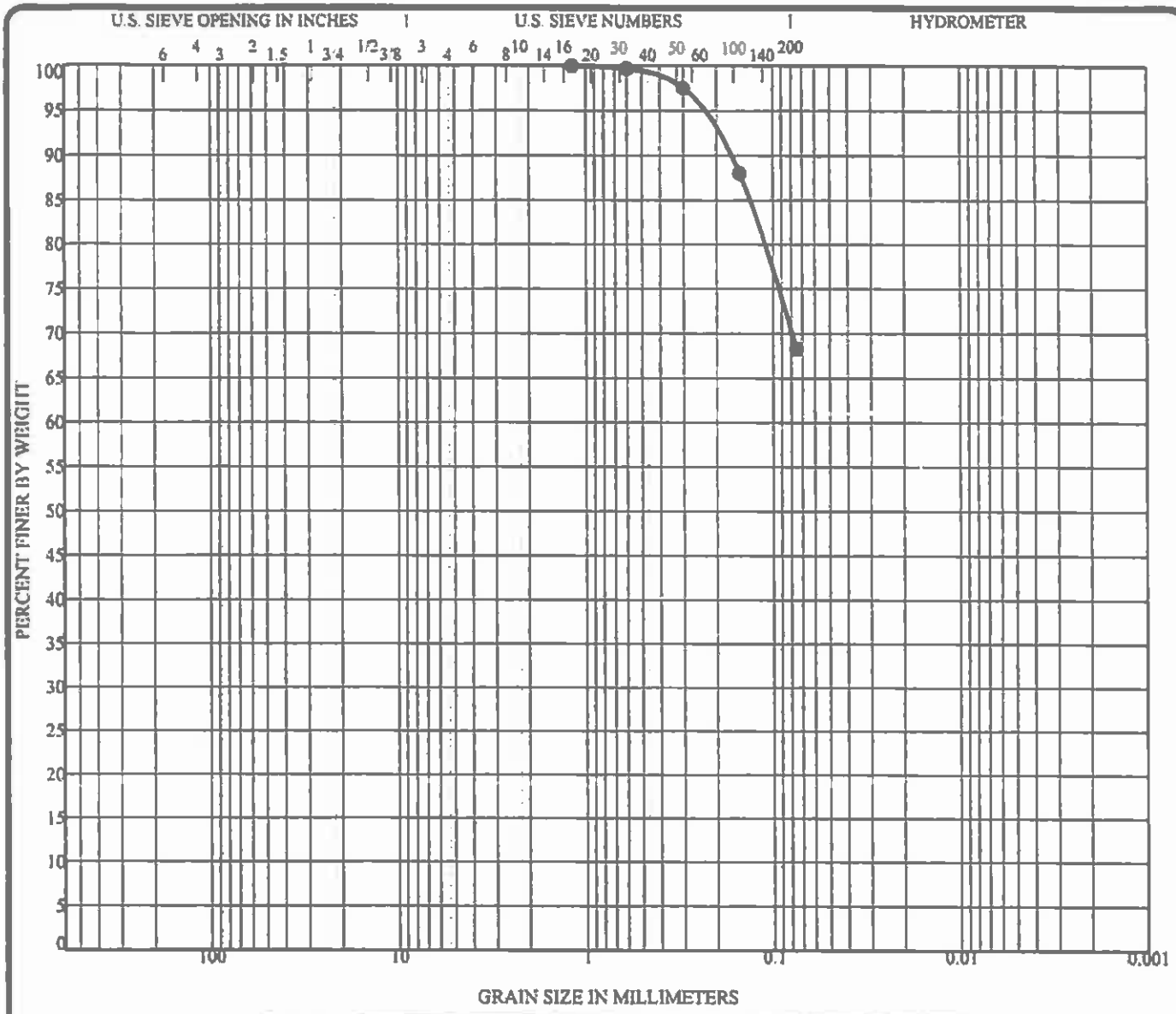
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-5	4.0	2.36	0.221	0.102		0.0	78.3	21.7	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TB-6	9.0	SANDY LEAN CLAY(CL)	35	19	16		

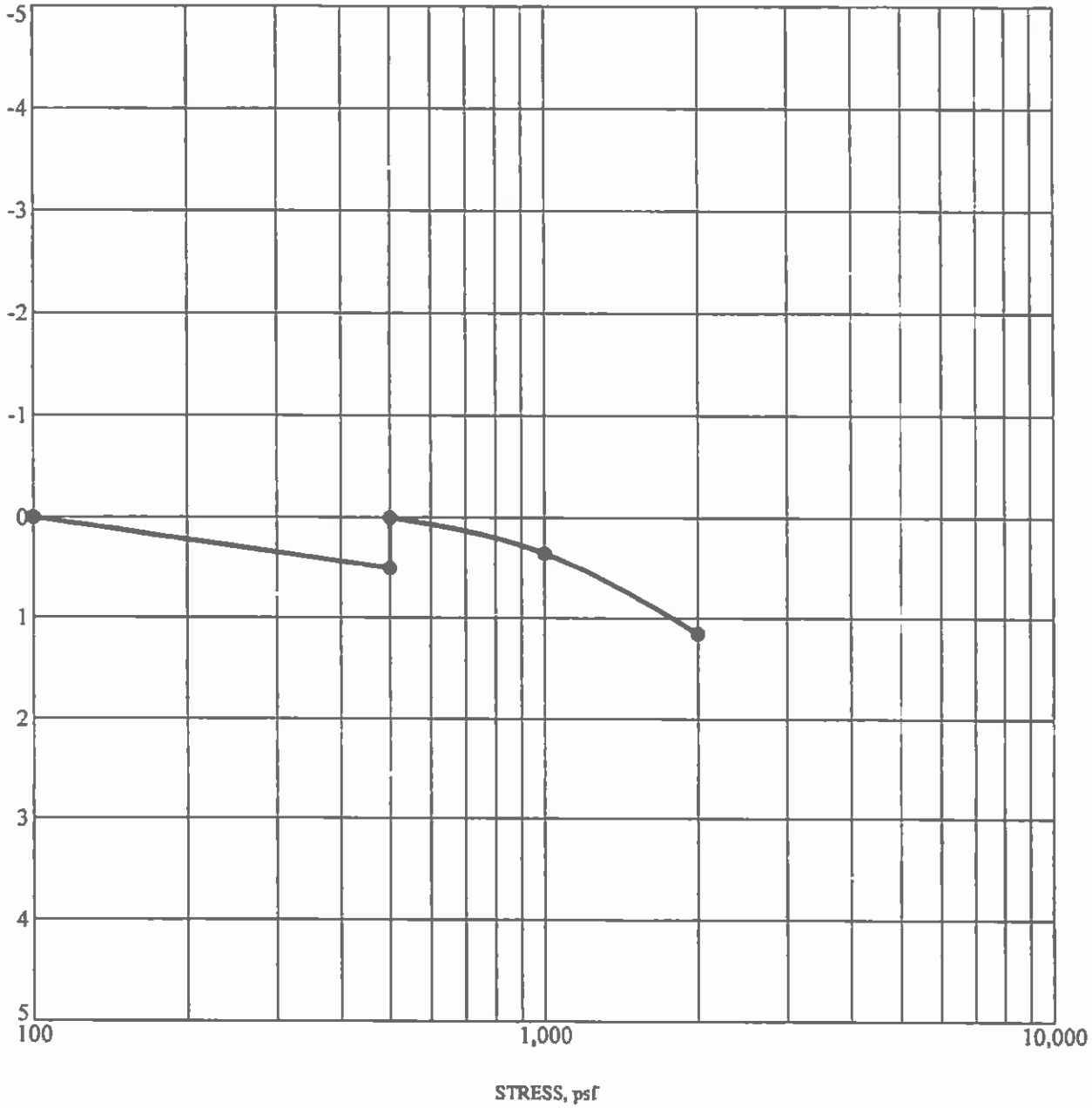
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TB-6	9.0	1.18				0.0	31.7	68.3	

EARTH ENGINEERING CONSULTANTS

GRAIN SIZE DISTRIBUTION

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US GRAIN SIZE 2142014.GPJ EEC.GDT 8/18/14



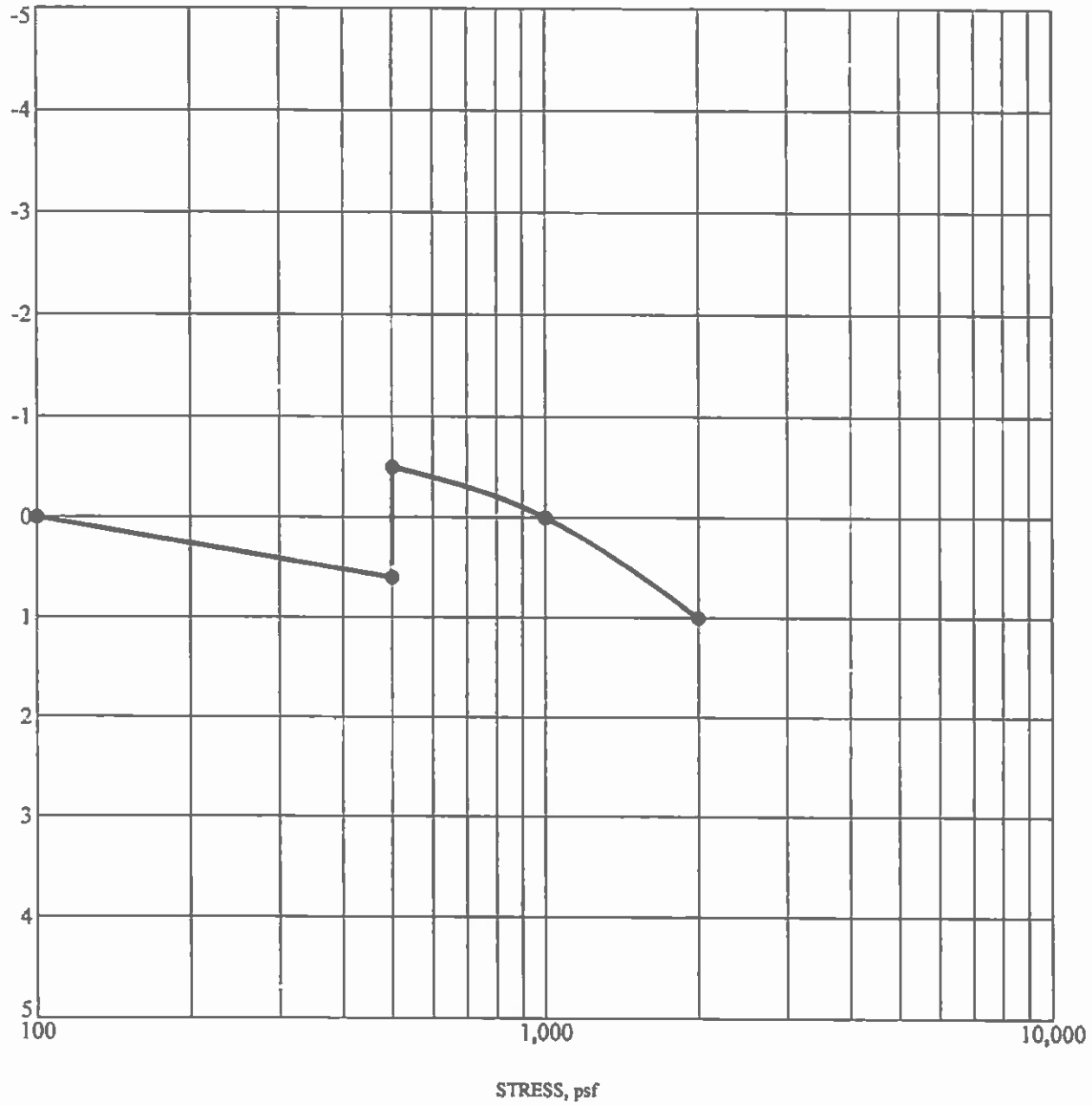
Specimen Identification		Classification	DD	MC%
● TB-1	4.0	CLAYEY SAND(SC)	104.9	16.9

EARTH ENGINEERING CONSULTANTS

SWELL / CONSOLIDATION TEST

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US CONSOL. STRAIN 2142014.GPJ EEC.GDT 8/18/14



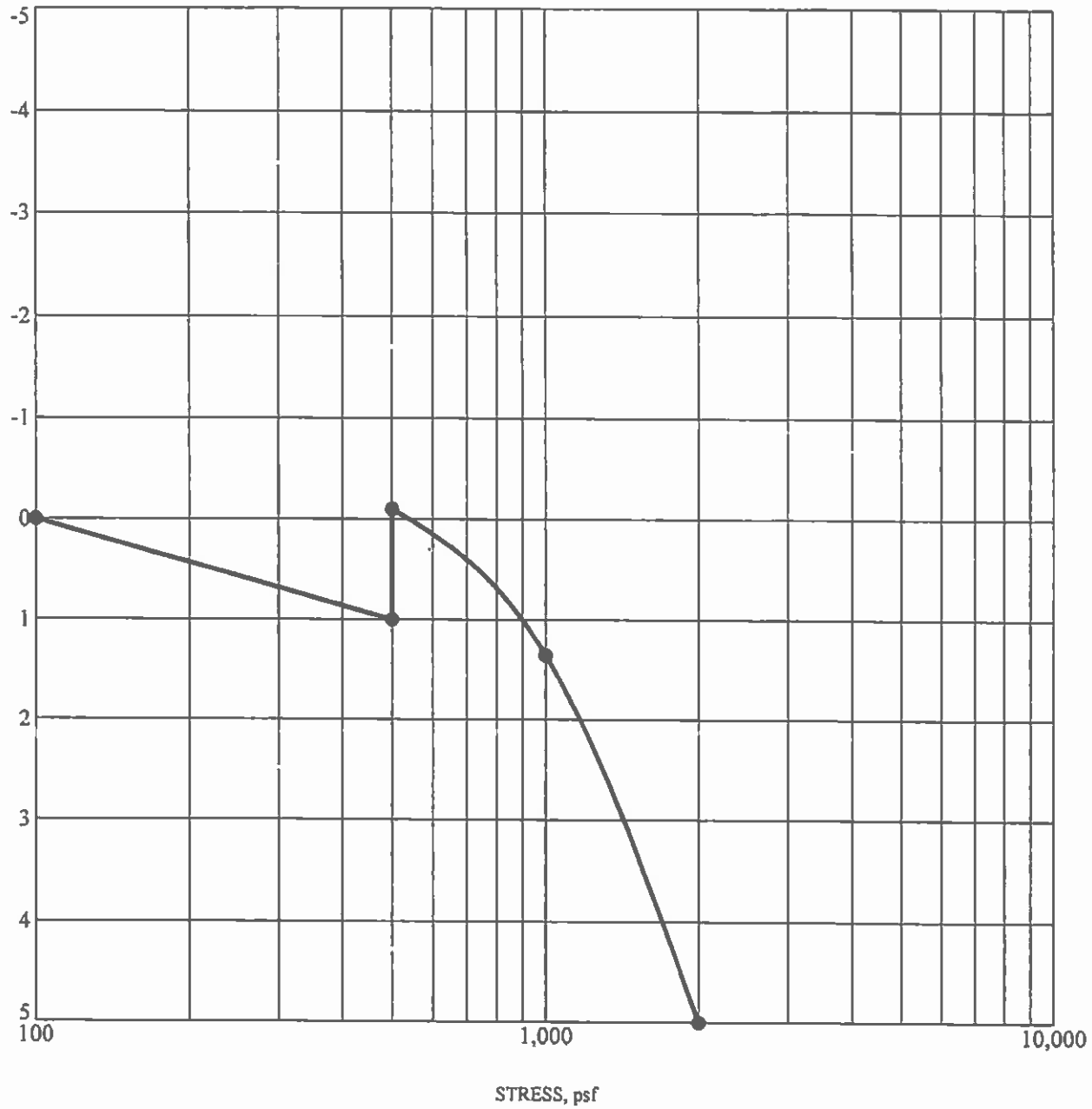
Specimen Identification		Classification	DD	MC%
● TB-2	4.0	CLAYEY SAND(SC)	108.2	9.7

EARTH ENGINEERING CONSULTANTS

SWELL / CONSOLIDATION TEST

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US CONSOL STRAIN 2142014.GPJ EEC.GDT 8/18/14



Specimen Identification		Classification	DD	MC%
● TB-3	4.0	LEAN CLAY(CL)	87.7	9.4

EARTH ENGINEERING CONSULTANTS

SWELL / CONSOLIDATION TEST

Owner: Colorado Centre Metropolitan District
Project: New Treatment Plant Site
Location: Flagstone Street & East Anvil Drive
Job #: 2142014

US CONSOL STRAIN 2142014.GPJ EEC.GDT 8/18/14

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse-Grained Soils more than 50% retained on No. 200 sieve	Gravels more than 50% of coarse fraction retained on No. 4 sieve	Cleans Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$		GW	Well-graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3^E$		GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH		GM	Silty gravel, G, H
			Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[I]	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$		SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3^E$		SP	Poorly graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH		SM	Silty sand[G,H,I]
			Fines classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried	< 0.75	OL	Organic clay[K,L,M,N]
			Liquid limit - not dried			Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
			PI lots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried	< 0.75	OH	Organic clay[K,L,M,P]
			Liquid limit - not dried			Organic silt[K,L,M,O]
Highly organic soils		Primarily organic matter, dark in color, and organic odor			PT	Peat

[A]Based on the material passing the 3-in. (75-mm) sieve

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-CM, or SC-SM.

[H]If fines are organic, add "with organic fines" to roup name.

[I]If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K]If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

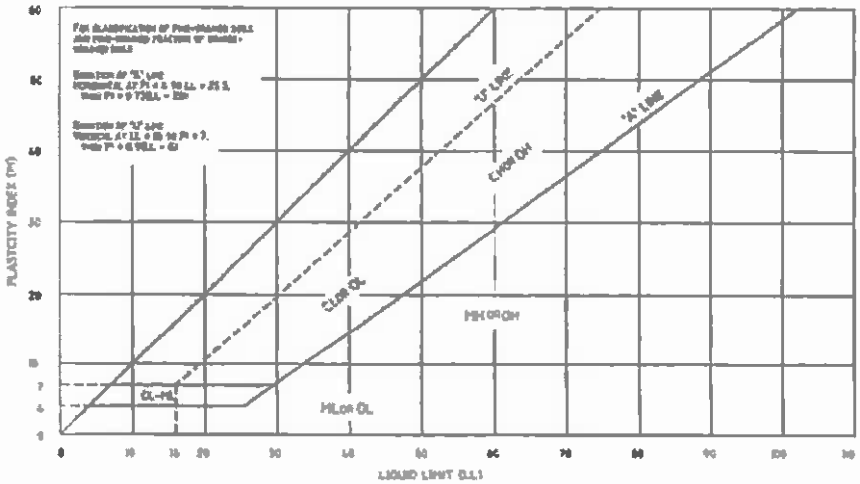
[M]If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI ≥ 4 and plots on or above "A" line.

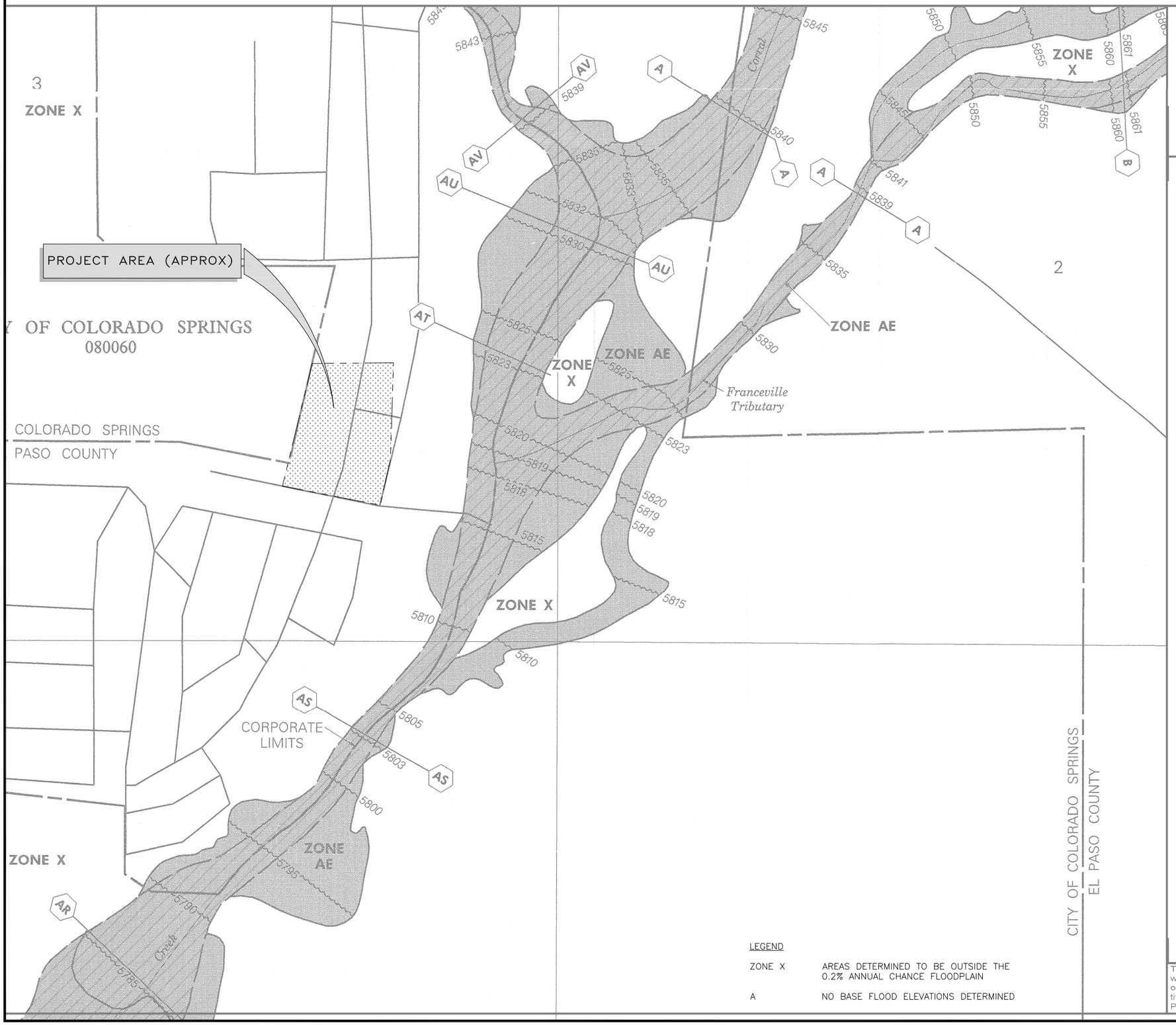
[O]PI < 4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.



Appendix D



APPROXIMATE SCALE IN FEET

500 0 500

LEGEND

ZONE X	AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN
A	NO BASE FLOOD ELEVATIONS DETERMINED

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 769 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0769	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0769	F

MAP NUMBER 08041C0769 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

JDS-HYDRO CONSULTANTS, INC.
545 EAST PIKES PEAK AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-0072

COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
FEMA FLOODPLAIN MAP
DSD File No. PPR-15-029

Project No.:	247.01
Scale:	AS NOTED
Date:	08/05/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	

Appendix E

WEIGHTED CURVE NUMBERS / RUNOFF COEFFICIENTS

EXISTING DRAINAGE BASINS

COLORADO CENTRE METROPOLITAN DISTRICT

WATER TREATMENT FACILITY

BASIN INFORMATION AND VALUES

BASIN	AREA (AC) OF EACH SOIL TYPE 101[1] (Group B)		LAND USE[2]	AREA PERCENTAGE[2]	PERCENT IMPERVIOUS[2]	5-yr RUNOFF COEFFICIENT[2]	100-yr RUNOFF COEFFICIENT[2]
	SF	AC					
A	80,943	1.86	Pasture/ Meadow	100.0%	0.0%	0.08	0.35
B	2,605	0.06	Pasture/ Meadow	100.0%	0.0%	0.08	0.35
C	133,444	3.06	Pasture/ Meadow	100.0%	0.0%	0.08	0.35
D	32,423	0.74	Pasture/ Meadow	100.0%	0.0%	0.08	0.35
Totals	***249,415***	***5.73***		**Composite C Values**		**0.08**	**0.35**

Notes:

1. 101=Ustic Torrifluevents, Loamy (NRCS)

2. Values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014

TIMES OF CONCENTRATION

EXISTING DRAINAGE BASINS
COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT FACILITY

Per Section 3.2 of the Drainage Criteria Manual - May 2014

BASIN A

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	300.0	feet	
Elev. Difference=	4.90	feet	
S=	Elev. Difference/L		
S=	0.016	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	27.18	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	7	unitless	Table 6-7 - Shor Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	13.11	feet	
L=	580.5	feet	
Sw=	0.0226	feet/foot	
V=	1.1	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	551.83	seconds	
Tt=	9.20	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**36.38**	**minutes**	

BASIN B

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	138.0	feet	
Elev. Difference=	5.91	feet	
S=	Elev. Difference/L		
S=	0.043	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	13.41	minutes	
Velocity of Concentrated Flow			***No Concentrated Flow***
V=	(Cv)*(Sw^0.5)		
Cv=	0	unitless	Table 6-7 - Shor Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	0	feet	
L=	0	feet	
Sw=	0.0000	feet/foot	
V=	0.0	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	0.00	seconds	
Tt=	0.00	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**13.41**	**minutes**	

BASIN C

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	284.6	feet	
Elev. Difference=	12.00	feet	
S=	Elev. Difference/L		
S=	0.042	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	19.36	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	7	unitless	Table 6-7 - Shor Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	8	feet	
L=	528.6	feet	
Sw=	0.0151	feet/foot	
V=	0.9	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	613.83	seconds	
Tt=	10.23	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**29.59**	**minutes**	

BASIN D

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	300.0	feet	
Elev. Difference=	14.31	feet	
S=	Elev. Difference/L		
S=	0.048	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	19.09	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	7	unitless	Table 6-7 - Shor Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	4.86	feet	
L=	162.8	feet	
Sw=	0.0299	feet/foot	
V=	1.2	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	134.61	seconds	
Tt=	2.24	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**21.33**	**minutes**	

WEIGHTED CURVE NUMBERS / RUNOFF COEFFICIENTS

DEVELOPED DRAINAGE BASINS
COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT FACILITY

		SURFACE TYPE	AREA (SF)	AREA (AC)	C_5	C_{100}	AREA*(C_{100})	% of TOTAL AREA	% IMPERVIOUS	IMP. AREA (AC)
DEVELOPED										
BASIN		Roofs	5,357	0.123	0.730	0.81	0.100	3.88%	90	
D1		Streets (Paved)	24,557	0.564	0.900	0.96	0.541	17.79%	100	
138,020	SF	Drive and Walks	10,675	0.245	0.900	0.96	0.235	7.73%	100	
3.169	AC	Pasture/Meadow (Native)	97,431	2.237	0.080	0.35	0.783	70.59%	0	
		Totals/Weighted	***138,020***	***3.169***	***0.31***	***0.52***		***100.00%***	***29.02%***	***0.932***

		SURFACE TYPE	AREA (SF)	AREA (AC)	C_5	C_{100}	AREA*(C_{100})	% of TOTAL AREA	% IMPERVIOUS	IMP. AREA (AC)
DEVELOPED										
BASIN		Roofs	0	0.000	0.730	0.81	0.000	0.00%	90	
D2		Streets (Paved)	5,366	0.123	0.900	0.96	0.118	68.51%	100	
7,832	SF	Drive and Walks	2,412	0.055	0.900	0.96	0.053	30.80%	100	
0.180	AC	Pasture/Meadow (Native)	54	0.001	0.080	0.35	0.000	0.69%	0	
		Totals/Weighted	***7,832***	***0.180***	***0.89***	***0.96***		***100.00%***	***99.31%***	***0.179***

		SURFACE TYPE	AREA (SF)	AREA (AC)	C_5	C_{100}	AREA*(C_{100})	% of TOTAL AREA	% IMPERVIOUS	IMP. AREA (AC)
DEVELOPED										
BASIN		Roofs	3,680	0.084	0.730	0.81	0.068	3.98%	90	
D3		Streets (Paved)	0	0.000	0.900	0.96	0.000	0.00%	100	
92,451	SF	Drive and Walks	3,074	0.071	0.900	0.96	0.068	3.33%	100	
2.122	AC	Pasture/Meadow (Native)	85,697	1.967	0.080	0.35	0.689	92.69%	0	
		Totals/Weighted	***92,451***	***2.122***	***0.13***	***0.39***		***100.00%***	***6.91%***	***0.155***

		SURFACE TYPE	AREA (SF)	AREA (AC)	C_5	C_{100}	AREA*(C_{100})	% of TOTAL AREA	% IMPERVIOUS	IMP. AREA (AC)
DEVELOPED										
BASIN		Roofs	0	0.000	0.730	0.81	0.000	0.00%	90	
D4		Streets (Paved)	0	0.000	0.900	0.96	0.000	0.00%	100	
29,769	SF	Drive and Walks	0	0.000	0.900	0.96	0.000	0.00%	100	
0.683	AC	Pasture/Meadow (Native)	29,769	0.683	0.080	0.35	0.239	100.00%	0	
		Totals/Weighted	***29,769***	***0.683***	***0.08***	***0.35***		***100.00%***	***0.00%***	***0.000***

Total Impervious Area ***1.265*** ***AC***

TIMES OF CONCENTRATION

DEVELOPED DRAINAGE BASINS
COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT FACILITY

Per Section 3.2 of the Drainage Criteria Manual - May 2014

BASIN A

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	100.0	feet	
Elev. Difference=	5.30	feet	
S=	Elev. Difference/L		
S=	0.053	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	10.64	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	7	unitless	Table 6-7 - Short Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	12	feet	
L=	766	feet	
Sw=	0.0157	feet/foot	
V=	0.9	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	874.29	seconds	
Tt=	14.57	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**25.21**	**minutes**	

BASIN B

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.90	unitless	Per Table 6-6 (Streets - Paved)
L=	89.6	feet	
Elev. Difference=	3.90	feet	
S=	Elev. Difference/L		
S=	0.044	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	2.11	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	20	unitless	Table 6-7 - Paved Areas
Sw=	Elev. Difference/L		
Elev. Difference=	3.9	feet	
L=	89.6	feet	
Sw=	0.0435	feet/foot	
V=	4.2	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	21.47	seconds	
Tt=	0.36	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**2.47**	**minutes**	
Tc Min.=	**5**	**minutes**	

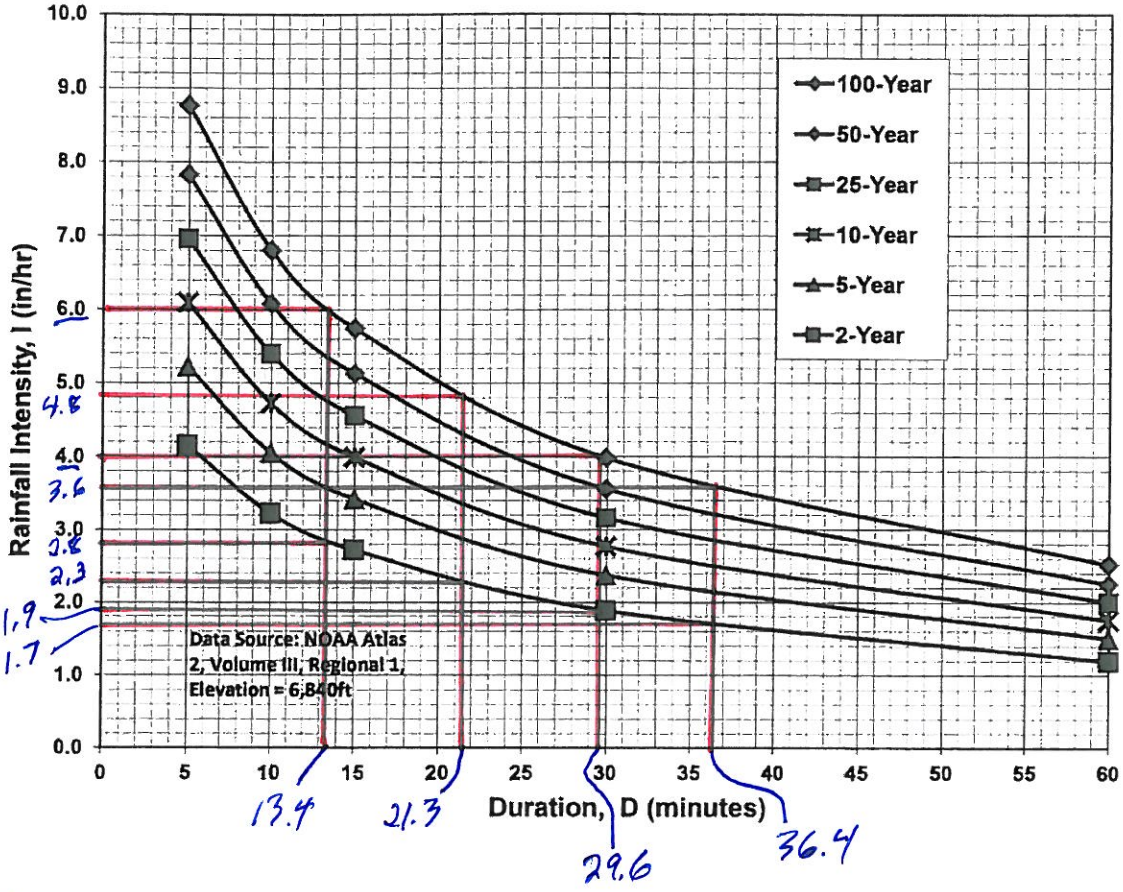
BASIN C

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	61.8	feet	
Elev. Difference=	7.00	feet	
S=	Elev. Difference/L		
S=	0.113	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	6.51	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	7	unitless	Table 6-7 - Short Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	8	feet	
L=	518.6	feet	
Sw=	0.0154	feet/foot	
V=	0.9	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	596.49	seconds	
Tt=	9.94	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**16.45**	**minutes**	

BASIN D

Formulas and Values		Units	Notes
Overland Initial Flow Values			
C_5=	0.08	unitless	Per Table 6-6 (Pasture/Meadow)
L=	230.0	feet	
Elev. Difference=	14.90	feet	
S=	Elev. Difference/L		
S=	0.065	feet/foot	
Overland Initial Flow Time			
Ti=	$(0.395(1.1-C_5)(L^{0.5}))/(S^{0.33})$		
Ti=	15.11	minutes	
Velocity of Concentrated Flow			
V=	(Cv)*(Sw^0.5)		
Cv=	7	unitless	Table 6-7 - Short Pasture & Lawns
Sw=	Elev. Difference/L		
Elev. Difference=	2.75	feet	
L=	147	feet	
Sw=	0.0187	feet/foot	
V=	1.0	feet/second	
Travel Time of Concentrated Flow			
Tt=	L/V		
Tt=	153.54	seconds	
Tt=	2.56	minutes	
Total Time of Concentration			
Tc=	Ti+Tt		
Tc=	**17.67**	**minutes**	

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



CCMD

Existing Conditions

IDF Equations

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

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

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

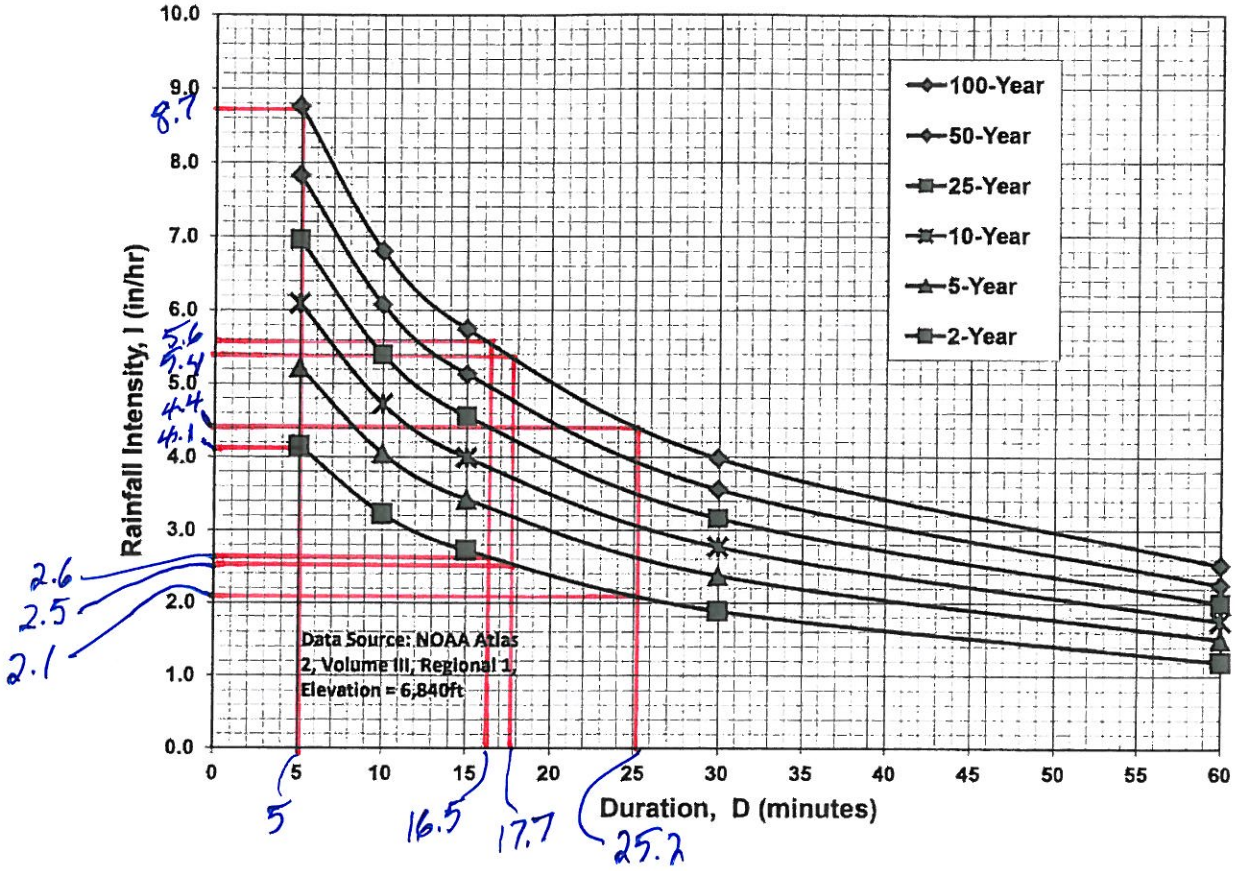
$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

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

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



CCMD

Developed Conditions

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.

EXISTING DRAINAGE BASIN FLOWS

COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT FACILITY

BASIN	Area (Acres)	C_5	C_{100}	Tc	i_5	i_{100}	Discharge Point	Q_5 (CFS)	Q_{100} (CFS)
A	1.86	0.08	0.35	36.38	1.70	3.60	DE1	**0.25**	**2.34**
B	0.06	0.08	0.35	13.41	2.80	6.00	DE2	**0.01**	**0.13**
C	3.06	0.08	0.35	29.59	1.90	4.00	DE3	**0.47**	**4.29**
D	0.74	0.08	0.35	21.33	2.30	4.80	DE4	**0.14**	**1.25**
Totals	**5.73**							**0.87**	**8.01**

Notes:
1. C values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014
2. Intensity values taken from Figure 6-5 of the DCM May 2014

DEVELOPED DRAINAGE BASIN FLOWS

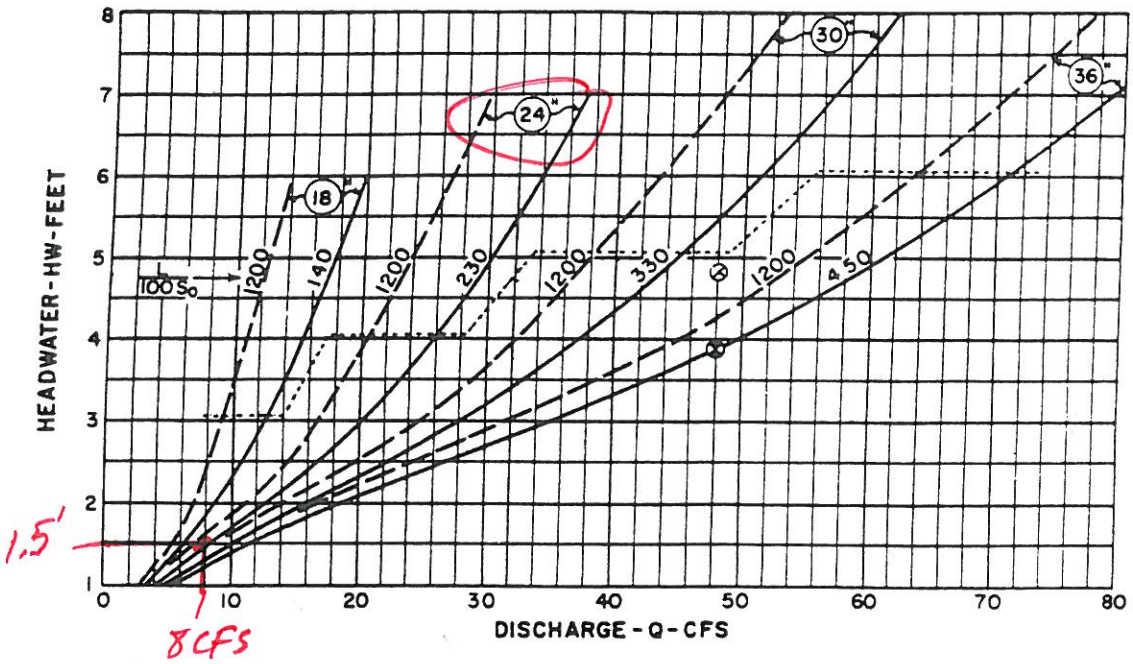
COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT FACILITY

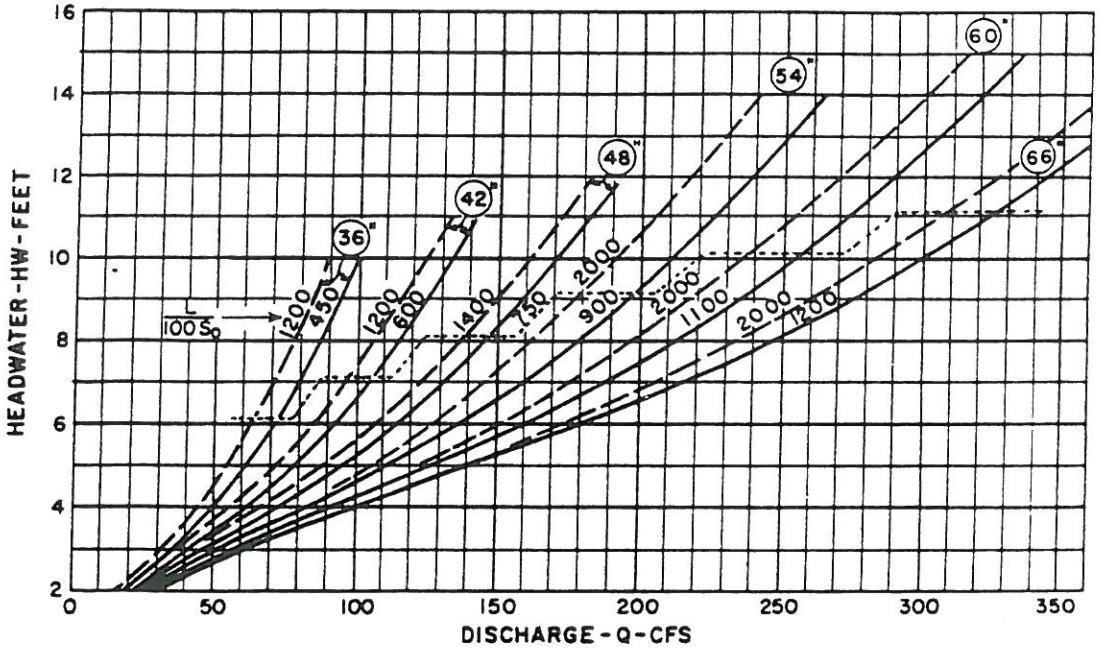
BASIN	Area (Acres)	C_5	C_{100}	Tc	i_5	i_{100}	Discharge Point	Q_5 (CFS)	Q_{100} (CFS)
D1	3.17	0.31	0.52	25.21	2.10	4.40	DP1	**2.09**	**7.30**
D2	0.18	0.89	0.96	5.00	4.10	8.70	DP2	**0.66**	**1.50**
D3	2.12	0.13	0.39	16.45	2.60	5.60	DP3	**0.73**	**4.62**
D4	0.68	0.08	0.35	17.67	2.50	5.40	DP4	**0.14**	**1.29**
Totals	**6.15**						**Totals**	**3.62**	**14.70**

Notes:
1. C values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014 and are weighted per the developed basin tables
2. Intensity values taken from Figure 6-5 of the DCM May 2014

Area Inlet Capacity
Formula: $Qi=(3.0*P*d^{1.5})/F$
Values: P= 20 ft (Perimeter)* F= 2 Clogging Factor d= 0.4 ft (depth of water)
Solution: ***Qi= 7.5895 cfs***
*P= 5 ft x 5 ft square opening

Per 7.5.2 of the Drainage Criteria Manual





EXAMPLE

⊗ GIVEN:
48 CFS; AHW = 4.8 FT.
L = 60 FT.; S_o = 0.003

⊗ SELECT 36"
HW = 3.9 FT.

BUREAU OF PUBLIC ROADS JAN. 1963

CULVERT CAPACITY
CIRCULAR CONCRETE PIPE
SQUARE-EDGED ENTRANCE
18" TO 66"

Appendix F

LEGEND

- BOUNDARY / RIGHT-OF-WAY
- EXISTING WATER LINE (W)
- EXISTING RAW WATER LINE (RAW)
- EXISTING SANITARY SEWER LINE (SS)
- EXISTING STORM SEWER
- EXISTING UNDERGROUND ELECTRIC (UGE)
- EXISTING OVERHEAD ELECTRIC (OHE)
- EXISTING TELEPHONE LINE (TEL)
- EXISTING GAS LINE (GAS)
- EXISTING FENCE
- EXISTING VALVE
- EXISTING CONTOURS (7270)
- DRAINAGE BASIN (C)
- DISCHARGE POINT (DE3)
- BASIN BOUNDARY LINE
- Tc FLOWLINE

0' 30' 60'
11x17 SCALE: 1"=60'
24x36 SCALE: 1"=30'

DE4
DE3
ULTRA RESOURCES INC.
SCHEDULE #: 5500000224

D
C
B
A

EXISTING TREATMENT FACILITY
DE2
DE1
E. ANVIL DR.
FLAGSTONE ST.

ULTRA RESOURCES INC.
SCHEDULE #: 5503400001

BASIN	Area (Acres)	C_5	C_{100}	Tc	i_5	i_{100}	Discharge Point	Q_5 (CFS)	Q_{100} (CFS)
A	1.86	0.08	0.35	36.38	1.70	3.60	DE1	**0.25**	**2.34**
B	0.06	0.08	0.35	13.41	2.80	6.00	DE2	**0.01**	**0.13**
C	3.06	0.08	0.35	29.59	1.90	4.00	DE3	**0.47**	**4.29**
D	0.74	0.08	0.35	21.33	2.30	4.80	DE4	**0.14**	**1.25**
Totals	**5.73**							**0.87**	**8.01**

Notes:
1. C values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014
2. Intensity values taken from Figure 6-5 of the DCM May 2014

JDS-HYDRO CONSULTANTS, INC.
545 EAST PIKES PEAK AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-0072

COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
EXISTING DRAINAGE

OVERALL SITEPLAN

Project No.:	247.01
Scale:	AS NOTED
Date:	08/05/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	

DR1
of 5

LEGEND

BOUNDARY / RIGHT-OF-WAY	DRAINAGE BASIN (D1)
EXISTING WATER LINE (W)	
EXISTING RAW WATER LINE (RAW)	DISCHARGE POINT (DP1)
EXISTING SANITARY SEWER LINE (SS)	
EXISTING STORM SEWER	BASIN BOUNDARY LINE
EXISTING UNDERGROUND ELECTRIC (UGE)	Tc FLOWLINE
EXISTING OVERHEAD ELECTRIC (OHE)	
EXISTING TELEPHONE LINE (TEL)	
EXISTING GAS LINE (GAS)	
EXISTING FENCE	
EXISTING VALVE	
EXISTING CONTOURS (7270)	

0' 30' 60'

11x17 SCALE: 1"=60'
24x36 SCALE: 1"=30'

JIMMY CAMP CREEK

DP4

DP3

D4

D3

D1

D2

FUTURE ADMINISTRATION BUILDING

PROPOSED WATER TREATMENT FACILITY

EXISTING DRAINAGE DITCH

DP2

DP1

E. ANVIL DR.

FLAGSTONE ST.

FLAGSTONE CHANNEL

INSTALL STRAW BALE BARRIER CHECK DAMS AS SHOWN (SEE DETAILS SHEET DR4 & GRADING & EROSION CONTROL PLAN)

INSTALL 4-FOOT WIDE CURB OPENING & DRAINAGE CHASE PER ECM DETAILS SD_3-25 & SD_3-25A. INSTALL RIPRAP CHANNEL W/ D50=12" FROM CURB OPENING TO MAIN CHANNEL FLOWLINE.

INSTALL 4-FOOT WIDE CURB OPENING & DRAINAGE CHASE PER ECM DETAILS SD_3-25 & SD_3-25A. INSTALL RIPRAP CHANNEL W/ D50=12" FROM CURB OPENING TO MAIN CHANNEL FLOWLINE.

AREA INLET W/ 24" RCP TO EXISTING FLAGSTONE CHANNEL. (SEE SHEET DR3 FOR DETAILS)

STA: 0+64.6
11.25° BEND

STA: 0+43.4
11.25° BEND

STA: 0+24.5
11.25° BEND

BASIN	Area (Acres)	C_5	C_{100}	Tc	i_5	i_{100}	Discharge Point	Q_5 (CFS)	Q_{100} (CFS)
D1	3.17	0.31	0.52	25.21	2.10	4.40	DP1	**2.09**	**7.30**
D2	0.18	0.89	0.96	5.00	4.10	8.70	DP2	**0.66**	**1.50**
D3	2.12	0.13	0.39	16.45	2.60	5.60	DP3	**0.73**	**4.62**
D4	0.68	0.08	0.35	17.67	2.50	5.40	DP4	**0.14**	**1.29**
Totals	**6.15**						**Totals**	**3.62**	**14.70**

Notes:
1. C values taken from Table 6-6 of the Drainage Criteria Manual (DCM) May 2014 and are weighted per the developed basin tables
2. Intensity values taken from Figure 6-5 of the DCM May 2014

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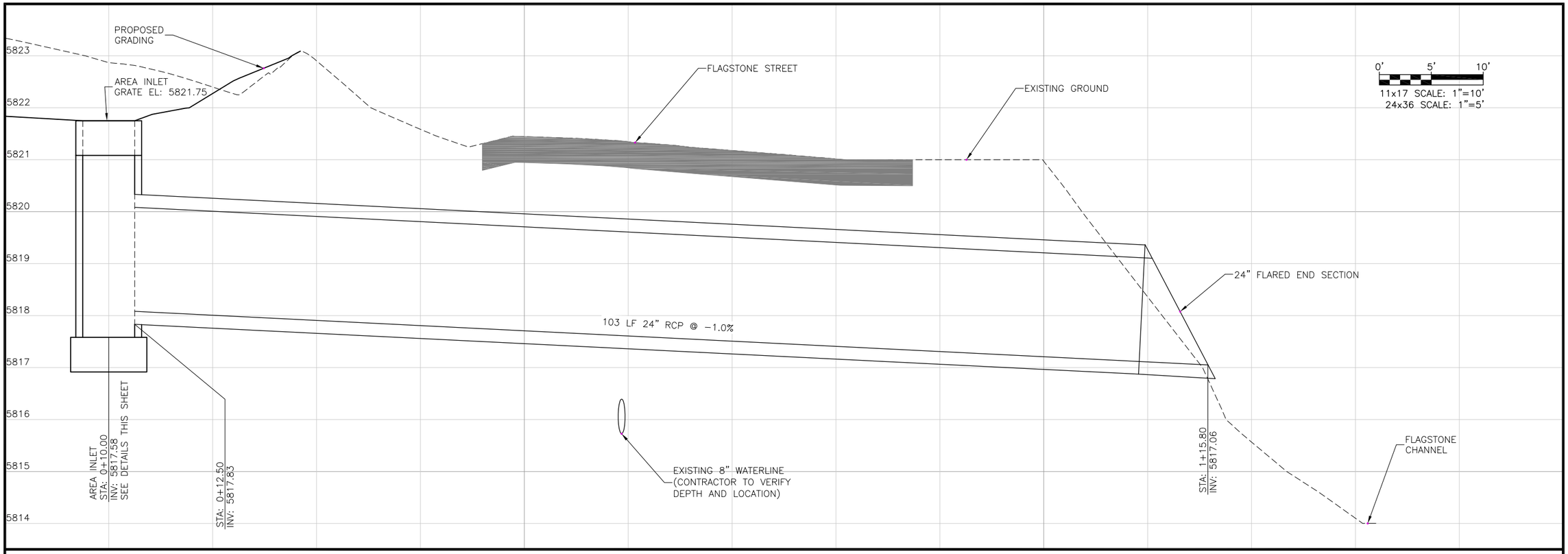
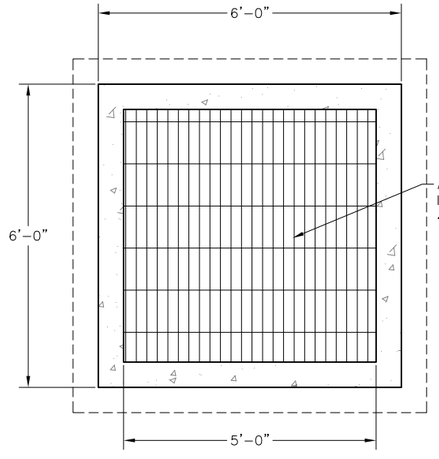
COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
PROPOSED DRAINAGE

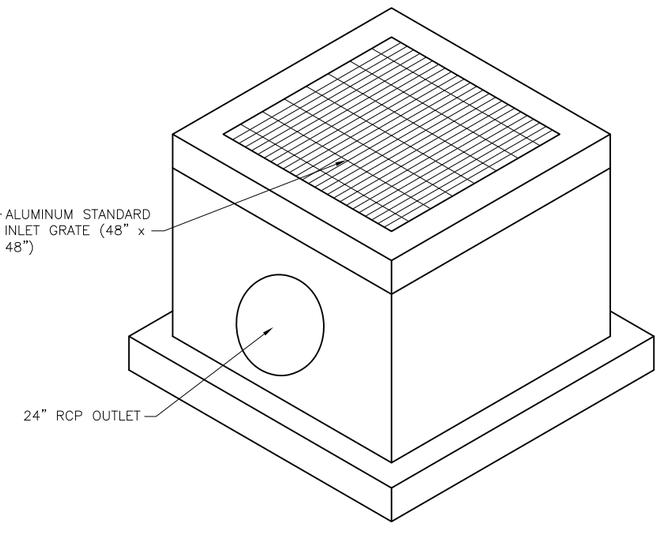
SITEPLAN

Project No.:	247.01
Scale:	AS NOTED
Date:	08/05/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	

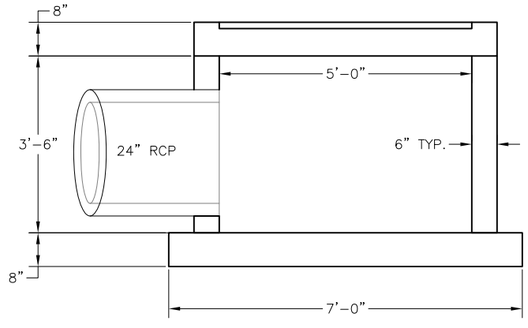




AREA INLET – TOP VIEW
N.T.S.



AREA INLET – ISOMETRIC VIEW
N.T.S.



AREA INLET – SIDE VIEW
N.T.S.

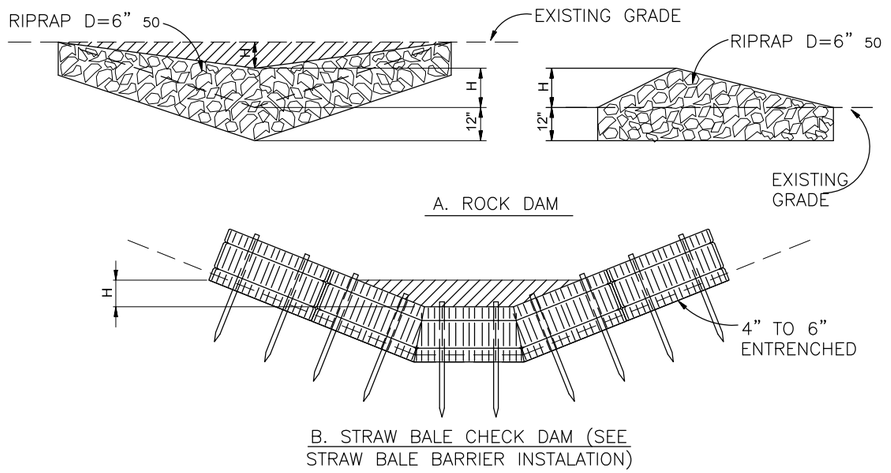
SEE SHEET DR5 FOR AREA INLET AND RCP CALCULATIONS.

JDS-HYDRO CONSULTANTS, INC.
545 EAST PIKES PEAK AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-0072

COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
PROPOSED DRAINAGE
RCP PROFILE & AREA INLET DETAILS

Project No.:	247.01
Scale:	AS NOTED
Date:	08/17/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	

DR3
of 5



L= THE DISTANCE SUCH THAT POINTS A AND B ARE AT THE SAME ELEVATION.

C. SPACING CHECK DAMS

CHECK DAM
NTS

SB

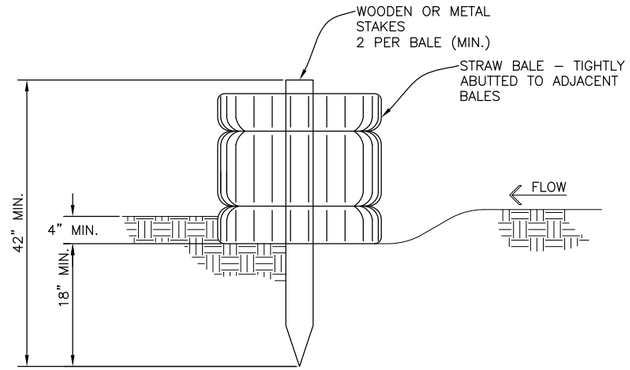
CHECK DAM NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALES USED AS CHECK DAMS ARE TO MEET THE REQUIREMENTS STATED IN FIGURE STRAW BALE BARRIER DETAIL.
2. THE "H" DIMENSION SHALL BE SELECTED TO PROVIDE WEIR FLOW CONVEYANCE FOR 2–YEAR FLOW OR GREATER.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL CHECK DAMS, ESPECIALLY AFTER STORM EVENTS.
2. REPLACE STONE AS NECESSARY TO MAINTAIN THE CORRECT HEIGHT OF THE DAM.
3. ACCUMULATED SEDIMENT AND DEBRIS IS TO BE REMOVED FROM BEHIND THE DAMS AFTER EACH STORM OR WHEN 1/2 OF THE ORIGINAL HEIGHT OF THE DAM IS REACHED.
4. CHECK DAMS ARE TO REMAIN IN PLACE AND OPERATIONAL UNTIL THE DRAINAGE AREA AND CHANNEL ARE PERMANENTLY STABILIZED.
5. WHEN CHECK DAMS ARE REMOVED THE CHANNEL LINING OR VEGETATION IS TO BE RESTORED.



STRAW BALE BARRIER
N.T.S.

SB

STRAW BALE BARRIER NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALE BARRIERS SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
2. BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF CERTIFIED WEED FREE HAY OR STRAW AND WEIGH NOT LESS THAN 35 POUNDS.
3. BALES ARE TO BE PLACED IN A SINGLE ROW WITH THE END OF THE BALES TIGHTLY ABUTTING ONE ANOTHER.
4. EACH BALE IS TO BE SECURELY ANCHORED WITH AT LEAST TWO STAKES AND THE FIRST STAKE IS TO BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER.
5. STAKES ARE TO BE A MINIMUM OF 42 INCHES LONG. METAL STAKES SHALL BE STANDARD "T" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD STAKES SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.
6. BALES ARE TO BE BOUND WITH EITHER WIRE OR STRING AND ORIENTED SUCH THAT THE BINDINGS ARE AROUND THE SIDES AND NOT ALONG THE TOPS AND BOTTOMS OF THE BALE.
7. GAPS BETWEEN BALES ARE TO BE CHINKED (FILLED BY WEDGING) WITH STRAW OR THE SAME MATERIAL OF THE BALE.
8. END BALES ARE TO EXTEND UPSLOPE SO THE TRAPPED RUNOFF CANNOT FLOW AROUND THE ENDS OF THE BARRIER.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT STRAW BALE BARRIERS IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.
2. DAMAGED OR INEFFECTIVE BARRIERS SHALL PROMPTLY BE REPAIRED, REPLACING BALES IF NECESSARY, AND UNENTRENCHED BALES NEED TO BE REPAIRED WITH COMPACTED BACKFILL MATERIAL.
3. SEDIMENT SHALL BE REMOVED FROM BEHIND STRAW BALE BARRIERS WHEN IT ACCUMULATES TO APPROXIMATELY 1/2 THE HEIGHT OF THE BARRIER.
4. STRAW BALE BARRIERS SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED

HAY BALE SPACING REQUIREMENTS

SLOPE	SPACING
0.5%	300'
1.0%	150'
2.0%	75'
3.0%	50'

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COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
PROPOSED DRAINAGE
DRAINAGE DETAILS

Project No.:	247.01
Scale:	AS NOTED
Date:	08/05/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	

Area Inlet Capacity

Formula: $Qi=(3.0*P*d^{1.5})/F$

Values:

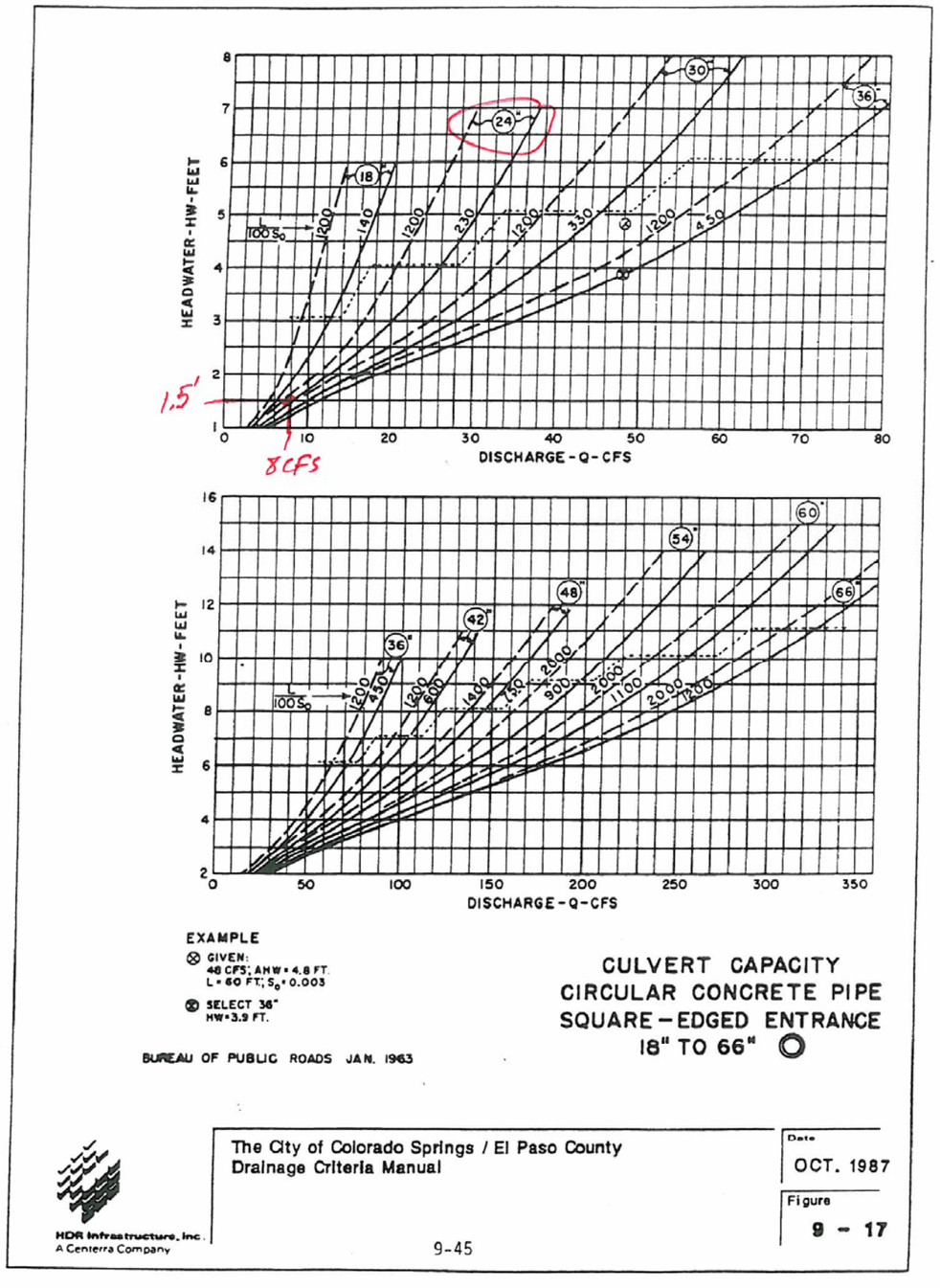
P=	20	ft (Perimeter)*
F=	2	Clogging Factor
d=	0.4	ft (depth of water)

Solution:

Qi= 7.589 cfs

*P= 5 ft x 5 ft square opening

Per 7.5.2 of the Drainage Criteria Manual



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COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
PROPOSED DRAINAGE
AREA INLET & RCP CALCULATIONS

Project No.:	247.01
Scale:	AS NOTED
Date:	08/17/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	

Appendix G

2015 Financial Assurance Estimate Form

(Basic form) 3/17/2015

Project Information	
Colorado Centre - Water Treatment Facility	**8/17/2015**
Project Name	Date

Section 1 - Grading and Erosion Control BMPs	**Quantity**	**Units**		**Price**			
Earthwork*	12,472.00	CY	@	$ $5	=	$ 62,360.00	*
Permanent Seeding*	4.50	AC	@	$ $582	=	$ 2,619.00	*
Mulching*	4.90	AC	@	$ $507	=	$ 2,484.30	*
Permanent Erosion Control Blanket*		SY	@	$ $6	=	$	*
Temporary Erosion Control Blanket		SY	@	$ $3		$	
Vehicle Tracking Control	1.00	EA	@	$ $1,625	=	$ 1,625.00	
Safety Fence		LF	@	$3	=	$	
Silt Fence	1,813.00	LF		$ [illegible]4	=	$ 7,252.00	
Temporary Seeding	5.35	AC	@	$ $[illegible]	=	$ 2,594.75	
Temporary Mulch	5.35	AC		$ $50	=	$ 2,712.45	
Erosion Bales	27.00		@	$	=	$ 567.00	
Erosion Logs		LF	@	$ $6	=	$	
Rock Ditch Checks		EA	@	$	=	$	
Inlet Protection	2.00		@	$ $153	=	$ 306.00	
Sediment Basin		EA	@	$ $1,625	=	$	
Concrete Washout Basin	1.00	EA	@	$ $776	=	$ 776.00	
			@	$	=	$	
* specified items subject to defect warranty financial assurance				**Section 1 Subtotal**	=	$ 83,296.50	

Section 2 - Public Improvements**	**Quantity**	**Units**		**Price**		
- Roadway Improvements						
Construction Traffic Control		LS	@	$	=	$
Aggregate Base Course		Tons	@	$ $18	=	$
Asphalt Pavement		Tons	@	$ $65	=	$
Raised Median, Paved		SF	@	$ $7	=	$
Electrical Conduit, Size =		LF	@	$ $14	=	$
Traffic Signal, complete intersection		EA	@	$ $250,000	=	$
Regulatory Sign	1.00	EA	@	$ $100	=	$ 100.00
Advisory Sign		EA	@	$ $100	=	$
Guide/Street Name Sign		EA	@	$		$
Epoxy Pavement Marking		SF	@	$ $12	=	$
Thermoplastic Pavement Marking		SF	@	$ $22	=	$
Barricade - Type 3		EA	@	$ $115	=	$
Delineator (Type I)		EA	@	$ $21	=	$
Curb and Gutter, Type C (Ramp)		LF	@	$ $21	=	$
Curb and Gutter, Type A (6" Vertical)		LF	@	$ $16	=	$
Curb and Gutter, Type B (Median)		LF	@	$ $13	=	$
Pedestrian Ramp		SY	@	$ $108	=	$

Cross Pan			SY	@	$ $53	=	$
Curb Chase			EA	@	$ $1,300	=	$
Guardrail Type 3 (W-Beam)			LF	@	$ $18	=	$
Guardrail Type 7 (Concrete)			LF	@	$ $67	=	$
Guardrail End Anchorage			EA	@	$ $1,978	=	$
Guardrail Impact Attenuator			EA	@	$ $3,564	=	$
Sound Barrier Fence			LF	@	$ $100	=	$
- Storm Drain Improvements							
Concrete Box Culvert (M Standard), Size (W x H)			LF	@	$	=	$
Reinforced Concrete Pipe (RCP)	Size		LF	@	$	=	$
18" Reinforced Concrete Pipe			LF	@	$ $69	=	$
24" Reinforced Concrete Pipe			LF	@	$ $84	=	$
30" Reinforced Concrete Pipe			LF	@	$ $94	=	$
36" Reinforced Concrete Pipe			LF	@	$ $124	=	$
42" Reinforced Concrete Pipe			LF	@	$ $134	=	$
48" Reinforced Concrete Pipe			LF	@	$ $178	=	$
54" Reinforced Concrete Pipe			LF	@	$ $182	=	$
60" Reinforced Concrete Pipe			LF	@	$ 216	=	$
66" Reinforced Concrete Pipe			LF	@	$	=	$
72" Reinforced Concrete Pipe			LF	@	$ $2	=	$
High Density Polyethylene (HDPE) Pipe	Size		LF	@	$	=	$
Corrugated Steel Pipe (CSP)	Size		LF	@	$	=	$
18" Corrugated Steel Pipe			LF	@	$ $66	=	$
24" Corrugated Steel Pipe			LF	@	$ $96	=	$
30" Corrugated Steel Pipe			LF	@	$101	=	$
36" Corrugated Steel Pipe			LF	@	$ $136	=	$
42" Corrugated Steel Pipe			LF	@	$ $147	=	$
48" Corrugated Steel Pipe			LF	@	$ $169	=	$
54" Corrugated Steel Pipe				@	$ $193	=	$
60" Corrugated Steel Pipe			LF	@	$ $227	=	$
66" Corrugated Steel Pipe			LF	@	$ $278	=	$
72" Corrugated Steel Pipe			LF	@	$ $330	=	$
78" Corrugated Steel Pipe			LF	@	$ $381	=	$
84" Corrugated Steel Pipe			LF	@	$ $432	=	$
Flared End Section (FES) RCP			EA	@	$	=	$
Flared End Section (FES) HDPE			EA	@	$	=	$
Flared End Section (FES) CSP			EA	@	$	=	$
End Treatment- Headwall			EA	@	$	=	$
End Treatment- Wingwall			EA	@	$	=	$
End Treatment - Cutoff Wall			EA	@	$	=	$
Curb Inlet (Type R) L=5', Depth < 5 feet			EA	@	$ $3,791	=	$
Curb Inlet (Type R) L=5', 5'-10' Depth			EA	@	$ $5,044		$
Curb Inlet (Type R) L =5' , 10'-15' Depth			EA	@	$ $6,027	=	$
Curb Inlet (Type R) L =10', Depth < 5 feet			EA	@	$ $5,528	=	$
Curb Inlet (Type R) L =10' , 5'-10' Depth			EA	@	$ $6,694	=	$
Curb Inlet (Type R) L =10' , 10'-15' Depth			EA	@	$ $7,500	=	$
Curb Inlet (Type R) L =15' , Depth < 5 feet			EA	@	$ $7,923	=	$
Curb Inlet (Type R) L =15' , 5'-10' Depth			EA	@	$ $8,000	=	$
Curb Inlet (Type R) L =15' , 10'-15' Depth			EA	@	$ $8,800	=	$
Curb Inlet (Type R) L =20' , Depth < 5 feet			EA	@	$ $8,000	=	$
Curb Inlet (Type R) L =20' , 5'-10' Depth			EA	@	$ $8,830	=	$

Curb Inlet (Type R) L =_____', __' - __' Depth		EA	@	$		=	$
Curb Inlet (Type R) L =_____', __' - __' Depth		EA	@	$		=	$
Grated Inlet (Type C), < 5' deep		EA	@	$	$3,270	=	$
Grated Inlet (Type D), < 5' deep		EA	@	$	$3,908	=	$
Storm Sewer Manhole, Box Base, Depth < 15 feet		EA	@	$	$8,592	=	$
Storm Sewer Manhole, Slab Base, Depth < 15 feet		EA	@	$	$4,575	=	$
Geotextile (Erosion Control)		SY	@	$	$5	=	$
Rip Rap, d50 Size from 6" to 24"		CY	@	$	$98	=	$
Rip Rap, Grouted		CY	@	$	$215	=	$
Drainage Channel Construction, Size (W x H)		LF	@	$		=	$
Channel Lining, Concrete		CY	@	$	$450	=	$
Channel Lining, Rip Rap		CY	@	$	$98	=	$
Channel Lining, Grass		AC	@	$	$1,287	=	$
Channel Lining, Other Stabilization		SY	@	$	$3	=	$
Detention Outlet Structure		EA	@	$		=	$
Detention Emergency Spillway		EA	@	$		=	$
Permanent Water Quality Facility (Describe)		EA	@	$		=	$
**all items this section subject to defect warranty financial assurance. + For flared end sections, multiply pipe LF cost by 6				**Section 2 Subtotal**		=	$ 100.00 **

Section 3 - Common Development Improvements (Private or District)***	Quantity	Units		Price		
- Roadway Improvements						
(Include any applicable items from above Public Improvements list, that are to be private and NOT maintained by El Paso County)			@	$	=	$
			@	$	=	$
			@	$	=	$
Concrete Sidewalk	596.00	SY	@	$ $38	=	$ 22,648.00
Asphalt Pavement	767.00	TON	@	$ 65	=	$ 49,855.00
Aggregate Base	1,465.00	TON	@	$ 18	=	$ 26,370.00
Curb and Gutter, Type A (6" Vertical)	1,974.00	LF		$ 16		31,584.00
Curb Chase	1.00	EA		$ 1,300		1,300.00
- Storm Drain Improvements						
(Include any applicable items from above Public Improvements list, that are to be private and NOT maintained by El Paso County)			@	$	=	$
			@	$	=	$
			@	$	=	$
			@	$	=	$
			@	$	=	$
			@	$	=	$
- Water System Improvements						
Water Main Pipe (PVC), Size 8"	815.00		@		=	$ 76,610.00
Water Main Pipe (Ductile Iron), Size 8"		LF	@	$ $137	=	$
Gate Valves, 8"		EA		$ $1,852	=	$ 18,520.00
Fire Hydrant Assembly w/ all valves	4.00		@	$6,430	=	$ 25,720.00
Water Service Line Installation, inc. tap & valves	2.00	EA	@	$1,253	=	$ 2,506.00
Fire Cistern Installation, complete		EA	@	$	=	$
- Sanitary Sewer Improvements						
Sewer Main Pipe (PVC), Size 8"		LF	@	$ $94	=	$ 42,864.00
Sanitary Sewer Manhole, Depth < 15 fe	3.00	EA	@	$ $4,575	=	$ 13,725.00
Sanitary Service Line Installation, complete	2.00	EA	@	$ 1,516	=	$ 3,032.00
Sanitary Sewer Lift Station, complete		EA	@	$	=	$
- Landscaping (If Applicable)						
(List landscaping line items and cost - usually only in case of subdivision specific condition of approval, or PUD)	1.00	LS	@	$ 2,000	=	$ 2,000.00
		EA	@	$	=	$
		EA	@	$	=	$
		EA	@	$	=	$
		EA	@	$	=	$
***items in this section are not subject to defect warranty financial assurance				**Section 3 Subtotal**	=	$ 283,850.00

Financial Assurance Totals			
As-built drawings - **(FILL IN IF THERE ARE ANY PUBLICLY-MAINTAINED IMPROVEMENTS)**			$
(Inc. survey to verify detention pond volumes.)	**Construction Financial Assurance Total**	=	$ 367,246.50
	(Sum of all Section Totals)		
	Public Improvements Total* **		$ 67,563.30
	Defect Warranty Financial Assurance Total	=	$ 13,512.66
	(20%of Section 2 Subtotal and 20% of identified Grading and Erosion BMP items)		

Approvals

I hereby certify that this is an accurate and complete estimate of costs for the work as shown on the approved Construction Drawings associated with the Project.

Engineer — Date

(P.E. Seal)

Approved by Owner / Applicant — Date

Approved by El Paso Couny Engineer / ECM Administra — Date

Appendix H

PROPOSED SILT FENCE

PROPOSED VEHICLE TRACKING PAD

PROPOSED CURB SOCK

PROPOSED LANDSCAPING

STRAW BALE BARRIER CHECK–DAM

243.910
N12°40'27"E

500.450
N00°35'03"W

14°0'0"

0' 30' 60'

11x17 SCALE: 1"=60'
24x36 SCALE: 1"=30'

5820
5825
5830
5833
5835
5834
5832
5836
5837

416.330
S89°24'57"W

S77°19'33"E
520.000

PROPOSED WATER TREATMENT PLANT
FF EL: 5822.5

5822

FUTURE ADMINISTRATION BUILDING

S12°40'27"W
635.540

INSTALL 4–FOOT WIDE CURB OPENING W/ DRAINAGE CHASE PER ECM DETAILS SD_3–25 & SD_3–25A. INSTALL RIPRAP CHANNEL d50=12" FROM CURB OPENING TO MAIN CHANNEL FLOWLINE.

INSTALL STRAW BALE BARRIER CHECK–DAMS AS SHOWN (SEE DETAILS SHEET C8)

INSTALL 4–FOOT WIDE CURB OPENING W/ DRAINAGE CHASE PER ECM DETAILS SD_3–25 & SD_3–25A. INSTALL RIPRAP CHANNEL d50=12" FROM CURB OPENING TO MAIN CHANNEL FLOWLINE.

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COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
GRADING & EROSION CONTROL PLAN

DSD File No. PPR–15–029

Project No.:	247.01
Scale:	AS NOTED
Date:	08/05/15
Design:	RMM
Drawn:	RMM
Check:	JPM
Revised:	
	08/17/15

GEC1
of 5

EROSION CONTROL NOTES:

1. CONSTRUCTION MAY NOT COMMENCE UNTIL A CONSTRUCTION PERMIT IS OBTAINED FROM DEVELOPMENT SERVICES AND A PRECONSTRUCTION CONFERENCE IS HELD WITH DEVELOPMENT SERVICES INSPECTIONS.
2. STORMWATER DISCHARGES FROM CONSTRUCTION SITES SHALL NOT CAUSE OR THREATEN TO CAUSE POLLUTION, CONTAMINATION, OR DEGRADATION OF STATE WATERS. ALL WORK AND EARTH DISTURBANCE SHALL BE DONE IN A MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF SITE WATERS, INCLUDING WETLANDS.
3. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS TO REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING.
4. A SEPARATE STORMWATER MANAGEMENT PLAN (SWMP) FOR THIS PROJECT SHALL BE COMPLETED AND AN EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP) ISSUED PRIOR TO COMMENCING CONSTRUCTION. DURING CONSTRUCTION THE SWMP IS THE RESPONSIBILITY OF THE DESIGNATED STORMWATER MANAGER, SHALL BE LOCATED ON SITE AT ALL TIMES AND SHALL BE KEPT UP TO DATE WITH WORK PROGRESS AND CHANGES IN THE FIELD.
5. ONCE THE ESQCP HAS BEEN ISSUED, THE CONTRACTOR MAY INSTALL THE INITIAL STAGE EROSION AND SEDIMENT CONTROL BMPS AS INDICATED ON THE GEC. A PRECONSTRUCTION MEETING BETWEEN THE CONTRACTOR, ENGINEER, AND EL PASO COUNTY WILL BE HELD PRIOR TO ANY CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE APPLICANT TO COORDINATE THE MEETING TIME AND PLACE WITH COUNTY DSD INSPECTIONS STAFF.
6. SOIL EROSION CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN 21 CALENDAR DAYS AFTER FINAL GRADING, OR FINAL EARTH DISTURBANCE, HAS BEEN COMPLETED. DISTURBED AREAS AND STOCKPILES WHICH ARE NOT AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN 30 DAYS SHALL ALSO BE MULCHED WITHIN 21 DAYS AFTER INTERIM GRADING. AN AREA THAT IS GOING TO REMAIN IN AN INTERIM STATE FOR MORE THAN 60 DAYS SHALL ALSO BE SEEDED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES AND BMPS SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED AND ESTABLISHED.
7. TEMPORARY SOIL EROSION CONTROL FACILITIES SHALL BE REMOVED AND EARTH DISTURBANCE AREAS GRADED AND STABILIZED WITH PERMANENT SOIL EROSION CONTROL MEASURES PURSUANT TO STANDARDS AND SPECIFICATION PRESCRIBED IN THE DCM VOLUME II AND THE ENGINEERING CRITERIA MANUAL (ECM) APPENDIX I.
8. ALL PERSONS ENGAGED IN EARTH DISTURBANCE SHALL IMPLEMENT AND MAINTAIN ACCEPTABLE SOIL EROSION AND SEDIMENT CONTROL MEASURES INCLUDING BMPS IN CONFORMANCE WITH THE EROSION CONTROL TECHNICAL STANDARDS OF THE DRAINAGE CRITERIA MANUAL (DCM) VOLUME II AND IN ACCORDANCE WITH THE STORMWATER MANAGEMENT PLAN (SWMP).
9. ALL TEMPORARY EROSION CONTROL FACILITIES INCLUDING BMPS AND ALL PERMANENT FACILITIES INTENDED TO CONTROL EROSION OF ANY EARTH DISTURBANCE OPERATIONS, SHALL BE INSTALLED AS DEFINED IN THE APPROVED PLANS, THESWMP AND THE DCM VOLUME II AND MAINTAINED THROUGHOUT THE DURATION OF THE EARTH DISTURBANCE OPERATION.
10. ANY EARTH DISTURBANCE SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY REDUCE ACCELERATED SOIL EROSION AND RESULTING SEDIMENTATION. ALL DISTURBANCES SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME.
11. ANY TEMPORARY OR PERMANENT FACILITY DESIGNED AND CONSTRUCTED FOR THE CONVEYANCE OF STORMWATER AROUND, THROUGH, OR FROM THE EARTH DISTURBANCE AREA SHALL BE DESIGNED TO LIMIT THE DISCHARGE TO A NON-EROSIVE VELOCITY.
12. CONCRETE WASH WATER SHALL BE CONTAINED AND DISPOSED OF IN ACCORDANCE WITH THE SWMP. NO WASH WATER SHALL BE DISCHARGED TO OR ALLOWED TO RUNOFF TO STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES.
13. EROSION CONTROL BLANKETING IS TO BE USED ON SLOPES STEEPER THAN 3:1.
14. BUILDING, CONSTRUCTION, EXCAVATION, OR OTHER WASTE MATERIALS SHALL NOT BE TEMPORARILY PLACED OR STORED IN THE STREET, ALLEY, OR OTHER PUBLIC WAY, UNLESS IN ACCORDANCE WITH AN APPROVED TRAFFIC CONTROL PLAN. BMP'S MAY BE REQUIRED BY EL PASO COUNTY ENGINEERING IF DEEMED NECESSARY, BASED ON SPECIFIC CONDITIONS AND CIRCUMSTANCES.
15. VEHICLE TRACKING OF SOILS AND CONSTRUCTION DEBRIS OFF-SITE SHALL BE MINIMIZED. MATERIALS TRACKED OFFSITE SHALL BE CLEANED UP AND PROPERLY DISPOSED OF IMMEDIATELY.
16. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL WASTES FROM THE CONSTRUCTION SITE FOR DISPOSAL IN ACCORDANCE WITH LOCAL AND STATE REGULATORY REQUIREMENTS. NO CONSTRUCTION DEBRIS, TREE SLASH, BUILDING MATERIAL WASTES OR UNUSED BUILDING MATERIALS SHALL BE BURIED, DUMPED, OR DISCHARGED AT THE SITE.
17. THE OWNER, SITE DEVELOPER, CONTRACTOR, AND/OR THEIR AUTHORIZED AGENTS SHALL BE RESPONSIBLE FOR THE REMOVAL OF ALL CONSTRUCTION DEBRIS, DIRT, TRASH, ROCK, SEDIMENT, AND SAND THAT MAY ACCUMULATE IN THE STORM SEWER OR OTHER DRAINAGE CONVEYANCE SYSTEM AND STORMWATER APPURTENANCES AS A RESULT OF SITE DEVELOPMENT.
18. THE QUANTITY OF MATERIALS STORED ON THE PROJECT SITE SHALL BE LIMITED, AS MUCH AS PRACTICAL, TO THAT QUANTITY REQUIRED TO PERFORM THE WORK IN AN ORDERLY SEQUENCE. ALL MATERIALS STORED ON-SITE SHALL BE STORED IN A NEAT, ORDERLY MANNER, IN THEIR ORIGINAL CONTAINERS, WITH ORIGINAL MANUFACTURER'S LABELS.
19. NO CHEMICALS ARE TO BE USED BY THE CONTRACTOR, WHICH HAVE THE POTENTIAL TO BE RELEASED IN STORMWATER UNLESS PERMISSION FOR THE USE OF A SPECIFIC CHEMICAL IS GRANTED IN WRITING BY THE ECM ADMINISTRATOR. IN GRANTING THE USE OF SUCH CHEMICALS, SPECIAL CONDITIONS AND MONITORING MAY BE REQUIRED.
20. BULK STORAGE STRUCTURES FOR PETROLEUM PRODUCTS AND OTHER CHEMICALS SHALL HAVE ADEQUATE PROTECTION SO AS TO CONTAIN ALL SPILLS AND PREVENT ANY SPILLED MATERIAL FROM ENTERING STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES.
21. NO PERSON SHALL CAUSE THE IMPEDIMENT OF STORMWATER FLOW IN THE FLOW LINE OF THE CURB AND GUTTER OR IN THE DITCHLINE.
22. INDIVIDUALS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33 USC 1344), IN ADDITION TO THE REQUIREMENTS INCLUDED IN THE DCM VOLUME II AND THE ECM APPENDIX I, ALL APPROPRIATE PERMITS MUST BE OBTAINED BY THE CONTRACTOR PRIOR TO CONSTRUCTION (NPDES, FLOODPLAIN, 404, FUGITIVE DUST, ETC.). IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS AND LAWS, RULES, OR REGULATIONS OF OTHER FEDERAL, STATE, OR COUNTY AGENCIES, THE MORE RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.
23. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE AT APPROVED CONSTRUCTION ACCESS POINTS.
24. PRIOR TO ACTUAL CONSTRUCTION THE PERMITEE SHALL VERIFY THE LOCATION OF EXISTING UTILITIES.
25. A WATER SOURCE SHALL BE AVAILABLE ON SITE DURING EARTHWORK OPERATIONS AND UTILIZED AS REQUIRED TO MINIMIZE DUST FROM EARTHWORK EQUIPMENT AND WIND.
26. THE SOILS REPORT FOR THIS SITE HAS BEEN PREPARED BY EARTH ENGINEERING CONSULTANTS, LLC, DATED SEPTEMBER 8, 2014, AND SHALL BE CONSIDERED A PART OF THESE PLANS.
27. AT LEAST TEN DAYS PRIOR TO THE ANTICIPATED START OF CONSTRUCTION, FOR PROJECTS THAT WILL DISTURB 1 ACRE OR MORE, THE OWNER OR OPERATOR OF CONSTRUCTION ACTIVITY SHALL SUBMIT A PERMIT APPLICATION FOR STORMWATER DISCHARGE TO THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, WATER QUALITY DIVISION. THE APPLICATION CONTAINS CERTIFICATION OF COMPLETION OF A STORMWATER MANAGEMENT PLAN (SWMP), OF WHICH THIS GRADING AND EROSION CONTROL PLAN MAY BE A PART. FOR INFORMATION OR APPLICATION MATERIALS CONTACT:

    COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
    WATER QUALITY CONTROL DIVISION
    WQCD - PERMITS
    4300 CHERRY CREEK DRIVE SOUTH
    DENVER, CO 80246-1530
    ATTN: PERMITS UNIT

28. ALL AREAS NOTED TO BE RESEEDED SHALL BE SEEDED WITH A NATIVE AND INTRODUCED GRASS MIXTURE. THE SEED WILL BE APPLIED USING MECHANICAL TYPE DRILLS AT 0.25"-0.5" INTO TOPSOIL. AREA NOT ACCESSIBLE TO A DRILL SEEDER AND SLOPES STEEPER THAN 2:1 SHALL BE HAND BROADCAST AT DOUBLE THE ABOVE SEED RATE AND RAKED AT 1/4 TO 1/2 INTO THE TOPSOIL. ALL SEEDED AREAS WILL BE MULCHED: 1-1/2 TONS CERTIFIED WEED FREE NATIVE HAY PER ACRE MECHANICALLY CRIMPED IN TOPSOIL IN COMBINATION WITH AN ORGANIC MULCH TACKIFIER. MAINTENANCE OF ANY SWALES WILL INCLUDE EROSION CONTROL AND PREVENTION, DEBRIS REMOVAL AND OCCASIONAL MOWING. CARE SHALL BE USED DURING THE REMOVAL OF SEDIMENT FROM ANY DRAINAGE WAYS. ANY SEEDING OR EROSION CONTROL MEASURE THAT IS DISTURBED DURING MAINTENANCE SHALL BE IMMEDIATELY REPAIRED. THE SEED MIX SHALL BE MADE UP OF THE FOLLOWING AS PER THE EL PASO COUNTY CONSERVATION DISTRICT (RECOMMENDATION OBTAINED APRIL 2015):

COMMON NAME (N=NATIVE, I=INTRODUCED)		SCIENTIFIC NAME	LBS PLS/ACRE
WHEATGRASS, SIBERIAN	I	AGROPYRON FRAGILE	2.04
WHEATGRASS, SLENDER	N	ELYMUS TRACHYCAULUS	10.90
WHEATGRASS, INTERMEDIATE	I	THINOPYRUM INTERMEDIUM	3.00
WILDRYE, RUSSIAN	I	PSATHYROSTACHYS JUNCEA	2.04
WHEATGRASS, WESTERN	N	PASCOPYRUM SMITHII	3.20
CLOVER, RED	I	TRIFOLIUM PRATENSE	0.40
FLAX, BLUE-APPAR	I	LINUM PERENNE	0.41
SULPHUR-FLOWER BUCKWHEAT	N	ERIOGONUM UMBELLATUM	0.55
TOTAL/POUNDS/ACRE			22.54

TIMING, CONSTRUCTION STAGING AND SEQUENCING:

EXPECTED START DATE:
INSTALL TEMPORARY EROSION CONTROL - 2 DAYS
- PERIMETER SILT FENCING
- VEHICLE TRACKING CONTROL PAD
- CURB SOCKS

ROUGH GRADING - 3 DAYS
INSTALL FINAL SITE IMPROVEMENTS - 4 MONTHS
REMOVE TEMPORARY EROSION CONTROL - 2 DAYS

MINIMUM BEST MANAGEMENT PRACTICES ELEMENTS:

STEP 1- EROSION AND SEDIMENT CONTROL
INSTALL SEDIMENT TRAPPING DEVICES (PERIMETER CONTROLS) PRIOR TO THE START OF CONSTRUCTION.
STEP 2- SPILL PREVENTION AND RESPONSE
STEP 3- MATERIAL MANAGEMENT
MATERIAL AND EQUIPMENT STORAGE AREAS SHALL BE SECURE AND CONTAINED TO PREVENT DISCHARGE OF ANY MATERIAL IN RUNOFF. WASTE SHALL BE CONTAINED AND DISPOSED OF PROPERLY. MAINTAIN BMP'S DURING BUILDING AND UTILITY CONSTRUCTION.
STEP 4- INSPECTION AND MAINTENANCE
(SEE EROSION CONTROL NOTES)
STEP 5- INSTALL FINAL STABILIZATION - BASE COURSE, LANDSCAPING, EROSION CONTROL BLANKETS, AND SEEDING.
STEP 6- REMOVE TEMPORARY CONTROLS - SILT FENCING AFTER PERMANENT FEATURES ARE INSTALLED.

FINAL STABILIZATION AND LONG-TERM STORMWATER MANAGEMENT:

FINAL STABILIZATION MEASURES INCLUDE BASE COURSE, PARTIAL LANDSCAPE, AND REVEGETATION

EARTHWORK SUMMARY:

PROPOSED WATER TREATMENT SITE:
CUT - 12,993 CY
FILL - 453 (*1.15) = 521 CY
NET - 12,472 CY CUT

DISTURBED AREA - 6.15 AC

EROSION CONTROL FACILITIES:

SILT FENCE (SF) - 1,813 LF
VEHICLE TRACKING PAD (VT) - 1
CURB SOCK LOCATIONS (CS) - 2
STRAW BALE CHECK DAMS - 9

ENGINEER'S STATEMENT:

THIS GRADING AND EROSION CONTROL PLAN WAS PREPARED UNDER MY DIRECTION AND SUPERVISION AND IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. SAID PLAN HAS BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR GRADING AND EROSION CONTROL PLANS. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARING THIS PLAN.

RYAN M. MANGINO, PE #43304 _____ DATE

OWNER'S STATEMENT:

THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN.

NAME _____ DATE

EL PASO COUNTY:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/ OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/ OR ACCURACY OF THIS DOCUMENT.

FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

ANDRE BRACKIN, P.E. _____ DATE
COUNTY ENGINEER/ECM ADMINISTRATOR

JDS-HYDRO CONSULTANTS, INC.
545 EAST PIKES PEAK AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-0072

COLORADO CENTRE METROPOLITAN DISTRICT
WATER TREATMENT PLANT IMPROVEMENTS
EROSION CONTROL NOTES

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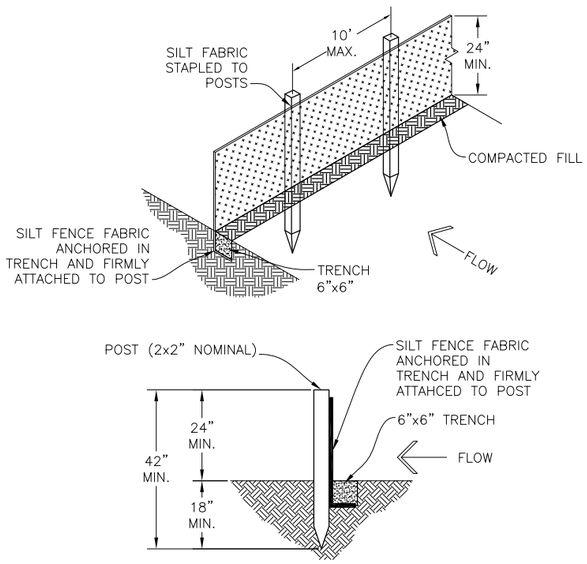


SILT FENCE DETAIL
N.T.S.

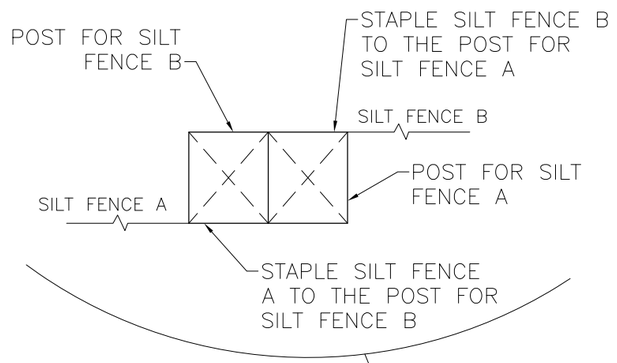
INSTALLATION REQUIREMENTS:

1. SILT FENCES SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
2. WHEN JOINTS ARE NECESSARY, SILT FENCE GEOTEXTILE SHALL BE SPLICED TOGETHER ONLY AT SUPPORT POST AND SECURELY SEALED.
3. METAL POSTS SHALL BE "STUDDED TEE" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD POSTS SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.
4. THE FILTER MATERIAL SHALL BE FASTENED SECURELY TO METAL POSTS USING WIRE TIES, OR TO WOOD POSTS WITH 3/4" LONG #9 HEAVY-DUTY STAPLES. THE SILT FENCE GEOTEXTILE SHALL NOT BE STAPLED TO EXISTING TREES.
5. WHILE NOT REQUIRED, WIRE MESH FENCE MAY BE USED TO SUPPORT THE GEOTEXTILE. WIRE FENCE SHALL BE FASTENED SECURELY TO THE UPSLOPE SIDE OF THE POSTS USING HEAVY-DUTY WIRE STAPLES AT LEAST 3/4" LONG, TIE WIRES OR HOG RINGS. THE WIRE SHALL EXTEND INTO THE TRENCH A MINIMUM OF 6 INCHES AND SHALL NOT EXTEND MORE THAN 3 FEET ABOVE THE ORIGINAL GROUND SURFACE.
6. ALONG THE TOE OF FILLS, INSTALL THE SILT FENCE ALONG A LEVEL CONTOUR AND PROVIDE AN AREA BEHIND THE FENCE FOR RUNOFF TO POND AND SEDIMENT TO SETTLE. A MINIMUM DISTANCE OF 5 FEET FROM THE TOE OF THE FILL IS RECOMMENDED.
7. THE HEIGHT OF THE SILT FENCE FROM THE GROUND SURFACE SHALL BE MINIMUM OF 24 INCHES AND SHALL NOT EXCEED 36 INCHES. HIGHER FENCES MAY IMPOUND VOLUMES OF WATER SUFFICIENT TO CAUSE FAILURE OF THE STRUCTURE.

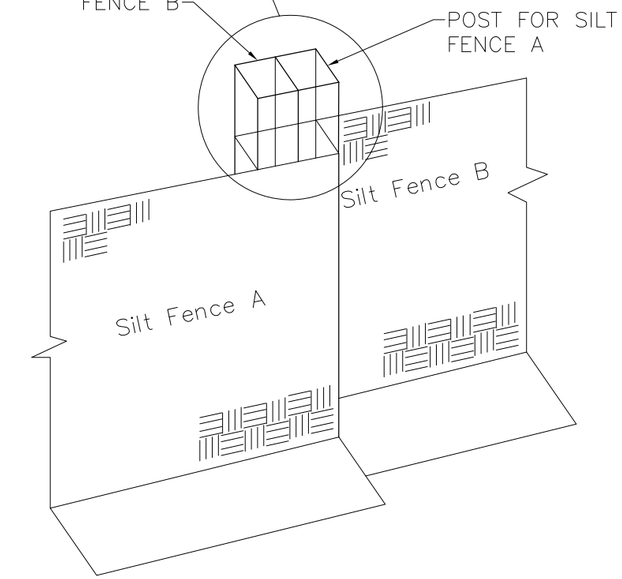
MAINTENANCE REQUIREMENTS:

1. CONTRACTOR SHALL INSPECT SILT FENCES IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS OF NO RAINFALL. DAMAGED, COLLAPSED, UNENTRENCHED OR INEFFECTIVE SILT FENCES SHALL BE PROMPTLY REPAIRED OR REPLACED.
2. SEDIMENT SHALL BE REMOVED FROM BEHIND SILT FENCE WHEN IT ACCUMULATES TO HALF THE EXPOSED GEOTEXTILE HEIGHT.
3. SILT FENCES SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED.

TOP VIEW OF SILT FENCE POSTS DETAIL



REFER TO "TOP VIEW OF SILT FENCE POSTS DETAIL"



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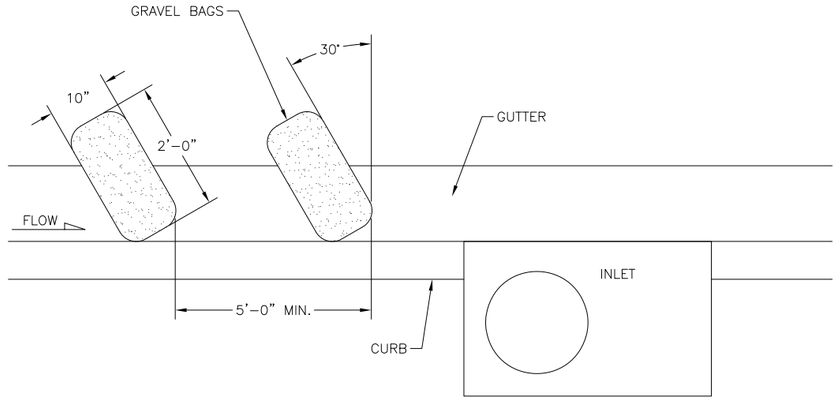


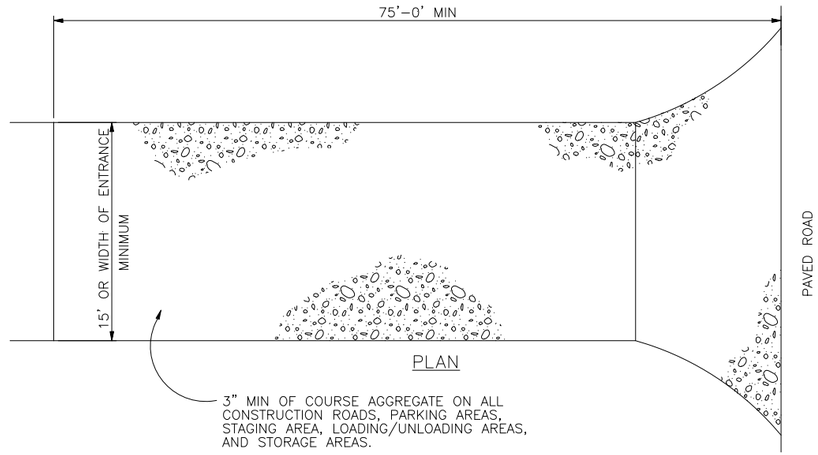
CURB SOCK DETAIL
N.T.S.

INSTALLATION REQUIREMENTS:

1. CURB SOCKS SHALL BE INSTALLED PRIOR TO CONSTRUCTION AT EXISTING CURB AND GUTTER LOCATIONS UPSTREAM OF EXISTING INLETS.
2. SOCK IS TO BE MADE OF 1/4-INCH WIRE MESH (USED WITH GRAVEL ONLY) OR GEOTEXTILE.
3. WASHED SAND OR GRAVEL 3/4-INCH TO 4 INCHES IN DIAMETER IS PLACED INSIDE THE SOCK.
4. PLACEMENT OF THE SOCK IS TO BE 30-DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.
5. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED AT A MINIMUM 5 FEET APART.
6. AT LEAST 2 CURB SOCKS IN SERIES ARE REQUIRED.

MAINTENANCE REQUIREMENTS:

1. CONTRACTOR SHALL INSPECT INLET PROTECTION IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL AND WEEKLY DURING PERIODS OF NO RAINFALL.
2. DAMAGED OR INEFFECTIVE INLET PROTECTION SHALL PROMPTLY BE REPAIRED OR REPLACED.
3. SEDIMENT SHALL BE REMOVED FROM BEHIND THE SOCK WHEN GUTTER WIDTH IS FILLED.
4. INLET PROTECTION SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED WITHIN THE UPSTREAM DRAINAGE AREA.



VEHICLE TRACKING PAD DETAIL
N.T.S.

INSTALLATION REQUIREMENTS:

1. ALL ENTRANCES TO THE CONSTRUCTION SITE ARE TO BE STABILIZED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
2. CONSTRUCTION ENTRANCES ARE TO BE BUILT WITH AN APRON TO ALLOW FOR TURNING TRAFFIC, BUT SHOULD NOT BE BUILT OVER EXISTING PAVEMENT EXCEPT FOR A SLIGHT OVERLAP.
3. AREAS TO BE STABILIZED ARE TO BE PROPERLY GRADED AND COMPACTED.
4. CONSTRUCTION ROADS, PARKING AREAS, LOADING/UNLOADING ZONES, STORAGE AREAS, AND STAGING AREAS ARE TO BE STABILIZED.
5. CONSTRUCTION ROADS ARE TO BE BUILT TO CONFORM TO SITE GRADES, BUT SHOULD NOT HAVE SIDE SLOPES OR ROAD GRADES THAT ARE EXCESSIVELY STEEP.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL STABILIZED AREAS, ESPECIALLY AFTER STORM EVENTS.
2. STONES ARE TO BE REAPPLIED PERIODICALLY AND WHEN REPAIR IS NECESSARY.
3. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED DAILY BY SHOVELING OR SWEEPING. SEDIMENT IS NOT TO BE WASHED DOWN STORM SEWER DRAINS.
4. OTHER ASSOCIATED SEDIMENT CONTROL MEASURES ARE TO BE INSPECTED TO ENSURE GOOD WORKING CONDITION.
5. TO BE REMOVED JUST PRIOR TO FINAL SURFACING AND STABILIZATION.

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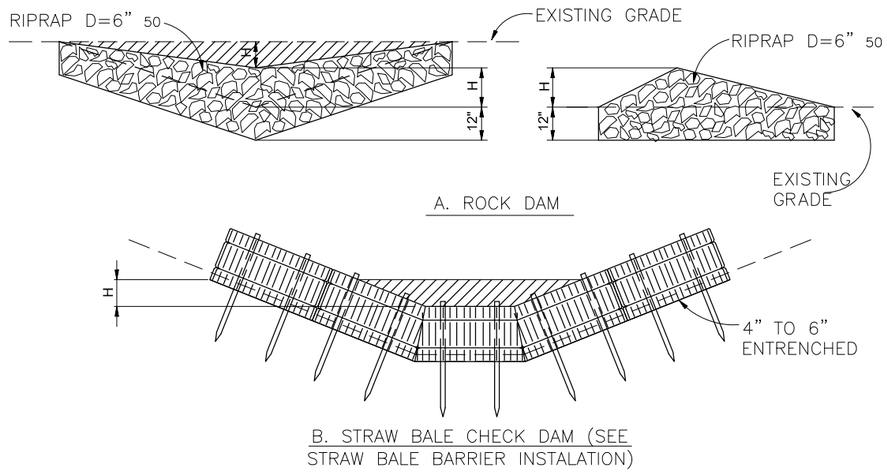


CHECK DAM
NTS

SB

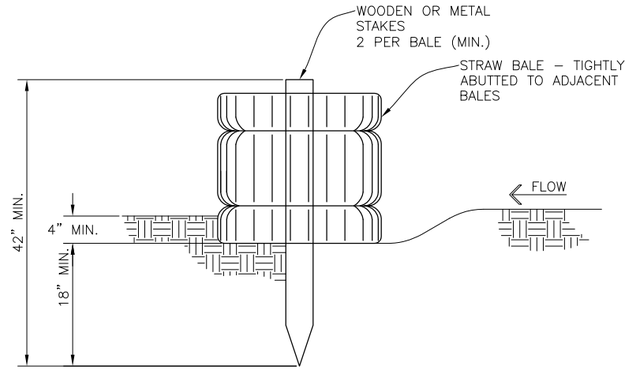
CHECK DAM NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALES USED AS CHECK DAMS ARE TO MEET THE REQUIREMENTS STATED IN FIGURE STRAW BALE BARRIER DETAIL.
2. THE "H" DIMENSION SHALL BE SELECTED TO PROVIDE WEIR FLOW CONVEYANCE FOR 2–YEAR FLOW OR GREATER.

MAINTENANCE REQUIREMENTS

1. REGULAR INSPECTIONS ARE TO BE MADE OF ALL CHECK DAMS, ESPECIALLY AFTER STORM EVENTS.
2. REPLACE STONE AS NECESSARY TO MAINTAIN THE CORRECT HEIGHT OF THE DAM.
3. ACCUMULATED SEDIMENT AND DEBRIS IS TO BE REMOVED FROM BEHIND THE DAMS AFTER EACH STORM OR WHEN 1/2 OF THE ORIGINAL HEIGHT OF THE DAM IS REACHED.
4. CHECK DAMS ARE TO REMAIN IN PLACE AND OPERATIONAL UNTIL THE DRAINAGE AREA AND CHANNEL ARE PERMANENTLY STABILIZED.
5. WHEN CHECK DAMS ARE REMOVED THE CHANNEL LINING OR VEGETATION IS TO BE RESTORED.



STRAW BALE BARRIER
N.T.S.

SB

STRAW BALE BARRIER NOTES

INSTALLATION REQUIREMENTS

1. STRAW BALE BARRIERS SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.
2. BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF CERTIFIED WEED FREE HAY OR STRAW AND WEIGH NOT LESS THAN 35 POUNDS.
3. BALES ARE TO BE PLACED IN A SINGLE ROW WITH THE END OF THE BALES TIGHTLY ABUTTING ONE ANOTHER.
4. EACH BALE IS TO BE SECURELY ANCHORED WITH AT LEAST TWO STAKES AND THE FIRST STAKE IS TO BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER.
5. STAKES ARE TO BE A MINIMUM OF 42 INCHES LONG. METAL STAKES SHALL BE STANDARD "T" OR "U" TYPE WITH MINIMUM WEIGHT OF 1.33 POUNDS PER LINEAR FOOT. WOOD STAKES SHALL HAVE A MINIMUM DIAMETER OR CROSS SECTION DIMENSION OF 2 INCHES.
6. BALES ARE TO BE BOUND WITH EITHER WIRE OR STRING AND ORIENTED SUCH THAT THE BINDINGS ARE AROUND THE SIDES AND NOT ALONG THE TOPS AND BOTTOMS OF THE BALE.
7. GAPS BETWEEN BALES ARE TO BE CHINKED (FILLED BY WEDGING) WITH STRAW OR THE SAME MATERIAL OF THE BALE.
8. END BALES ARE TO EXTEND UPSLOPE SO THE TRAPPED RUNOFF CANNOT FLOW AROUND THE ENDS OF THE BARRIER.

MAINTENANCE REQUIREMENTS

1. CONTRACTOR SHALL INSPECT STRAW BALE BARRIERS IMMEDIATELY AFTER EACH RAINFALL, AT LEAST DAILY DURING PROLONGED RAINFALL, AND WEEKLY DURING PERIODS NO RAINFALL.
2. DAMAGED OR INEFFECTIVE BARRIERS SHALL PROMPTLY BE REPAIRED, REPLACING BALES IF NECESSARY, AND UNENTRENCHED BALES NEED TO BE REPAIRED WITH COMPACTED BACKFILL MATERIAL.
3. SEDIMENT SHALL BE REMOVED FROM BEHIND STRAW BALE BARRIERS WHEN IT ACCUMULATES TO APPROXIMATELY 1/2 THE HEIGHT OF THE BARRIER.
4. STRAW BALE BARRIERS SHALL BE REMOVED WHEN ADEQUATE VEGETATIVE COVER IS ATTAINED

HAY BALE SPACING REQUIREMENTS

SLOPE	SPACING
0.5%	300'
1.0%	150'
2.0%	75'
3.0%	50'

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