

I:\2023\23009 - The Rock Commerce Center\GEC\Sheet Series\GEC\The Rock\23009_Cover_Sheet.dwg tab: 1 OF 24 COVER SHEET Oct 20, 2023 - 1:02pm csalz

THE ROCK COMMERCE CENTER GRADING AND EROSION CONTROL PLANS

LOCATED IN THE SOUTHWEST QUARTER OF THE
NORTHWEST QUARTER OF SECTION 11, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
EL PASO COUNTY, STATE OF COLORADO.

PROJECT TEAM

OWNER / DEVELOPER

CENTRAL DEVELOPMENT, LLC
1600 S. ALBION ST., #200
DENVER, CO 80222
303.628.0200 voice
CONTACT: JEREMY RECORDS

CIVIL ENGINEER

REDLAND
1500 W. CANAL CT.
LITTLETON, CO 80120
720.283.6783 voice
CONTACT: MARK CEVAAL, P.E.
EMAIL: mcevaal@redland.com

ARCHITECT

INTERGROUP ARCHITECTS
2000 W. LITTLETON BLVD.
LITTLETON, CO 80120
303.407.1157 voice
CONTACT: BILL SMITH, AIA

LANDSCAPE ARCHITECT

STACKLOT
5366 S. CURTICE ST.
LITTLETON, CO 80120
303.808.4523 voice
CONTACT: STEVE WIENS
EMAIL: steve@stacklot.com

LEGAL DESCRIPTION:

PARCEL B:

THAT PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE 6TH P.M. LYING EAST OF THE EAST LINE OF THAT TRACT CONVEYED TO THE STATE HIGHWAY DEPARTMENT BY QUITCLAIM DEED RECORDED SEPTEMBER 8, 1948 IN BOOK 1185, PAGE 458, ALSO DESCRIBED AS: THAT PART OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE P.M., COUNTY OF EL PASO, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:
COMMENCING AT THE SOUTHWEST CORNER OF SAID NORTHWEST QUARTER; THENCE EASTERLY ALONG THE SOUTHERLY LINE OF SAID NORTHWEST QUARTER A DISTANCE OF 996.04 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY OF INTERSTATE HIGHWAY 25 DESCRIBED IN THAT DEED TO THE STATE HIGHWAY DEPARTMENT RECORDED SEPTEMBER 8, 1948 IN BOOK 1185 AT PAGE 458, WHICH POINT IS THE TRUE POINT OF THE BEGINNING OF THE PARCEL TO BE DESCRIBED; THENCE ON A DEFLECTION ANGLE TO THE LEFT 95°08'20" AND ALONG SAID EASTERLY RIGHT OF WAY LINE A DISTANCE OF 1334.24 FEET TO A POINT ON THE NORTHERLY LINE OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER; THENCE ON A DEFLECTION ANGLE TO THE RIGHT 95°00'36" AND ALONG SAID NORTHERLY LINE 441.95 FEET TO THE NORTHEAST CORNER OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER; THENCE ON A DEFLECTION ANGLE TO THE RIGHT 90°16'15" AND ALONG THE EASTERLY LINE OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER A DISTANCE OF 1329.88 FEET TO THE SOUTHEAST CORNER OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER; THENCE ON A DEFLECTION ANGLE TO THE RIGHT 89°51'29" AND ALONG THE SOUTHERLY LINE OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER A DISTANCE OF 319.15 FEET TO THE POINT OF BEGINNING.

DESIGN 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 PREPARATION OF THESE DETAILED PLANS AND SPECIFICATIONS

MARK D. CEVAAL, P.E. #33123

DATE

OWNER/DEVELOPER'S STATEMENT

I, THE OWNER/DEVELOPER HAVE READ AND WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN.

JEREMY RECORDS
CENTRAL DEVELOPMENT, LLC
1600 S. ALBION ST #200,
DENVER, CO 80222

DATE

EL PASO COUNTY

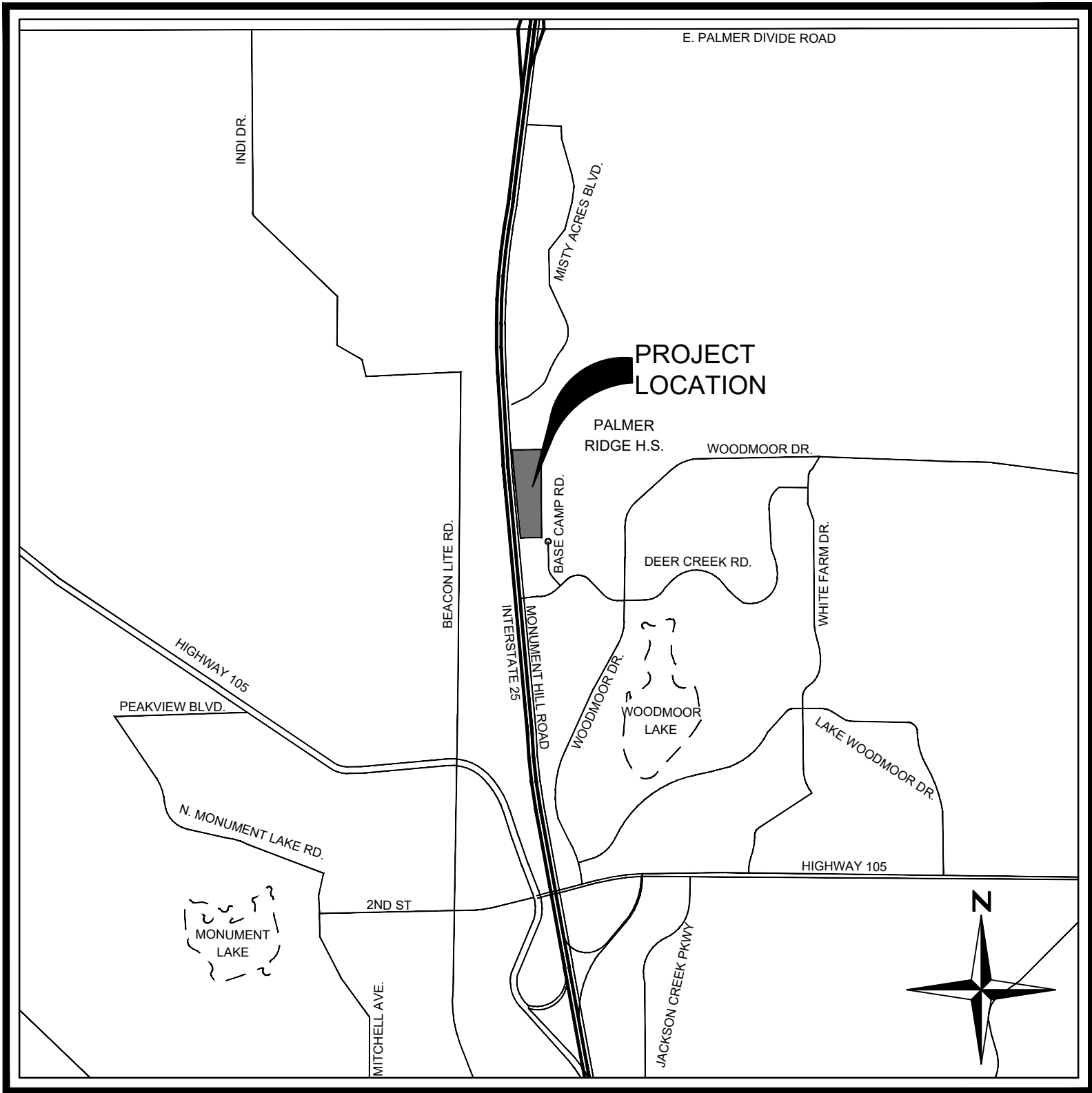
COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WITH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
FIELD IN ACCORDANCE WITH REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2, AND ENGINEERING CRITERIA MANUAL AS AMENDED.
IN ACCORDANCE WITH ECM SECTION 1.12, THESE CONSTRUCTION DOCUMENTS WILL BE VALID FOR CONSTRUCTION FOR A PERIOD OF 2 YEARS FROM THE DATE SIGNED BY THE EL PASO COUNTY ENGINEER. IF CONSTRUCTION HAS NOT STARTED WITHIN THOSE 2 YEARS, THE PLANS WILL NEED TO BE RESUBMITTED FOR APPROVAL, INCLUDING PAYMENT OF REVIEW FEES AT THE PLANNING AND COMMUNITY DEVELOPMENT DIRECTORS DISCRETION.

JENNIFER IRVINE, P.E.
COUNTY ENGINEER/ECM ADMINISTRATOR

DATE

Change to Josh Palmer, PE

The County signature block was updated as requested.

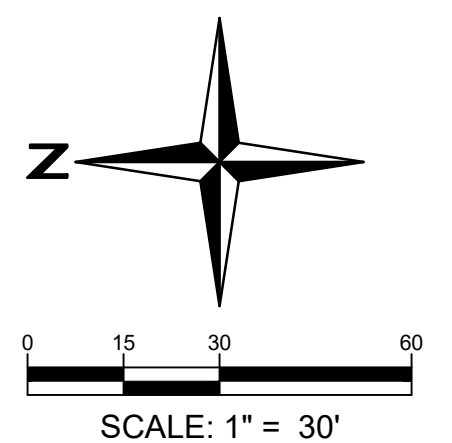


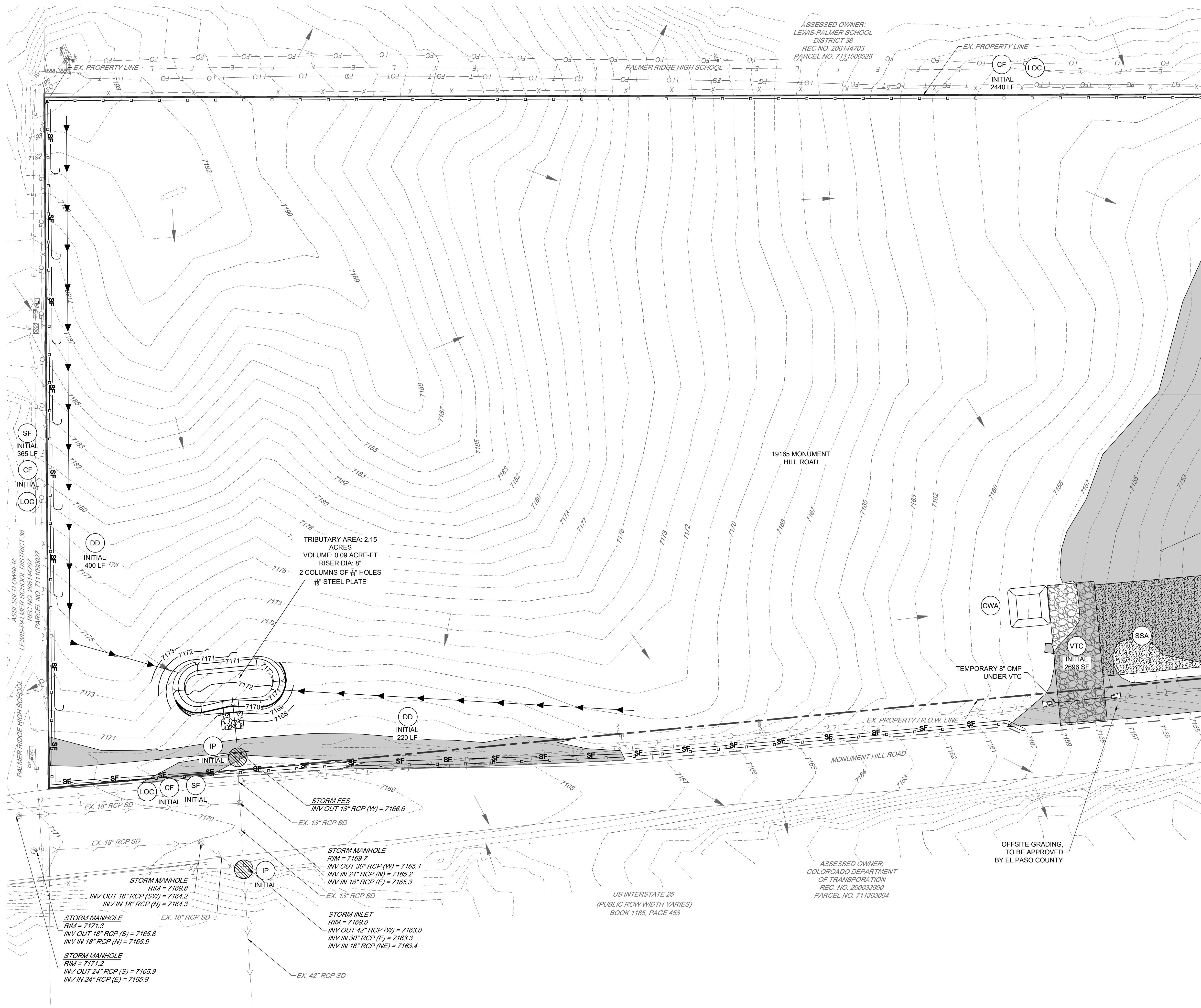
13. THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO FOR THE LOCATION OF UNDERGROUND GAS, ELECTRIC AND COMMUNICATION UTILITIES AT LEAST 48 HOURS PRIOR TO CONSTRUCTION (CALL 811 OR 1-800-922-1987). THE CONTRACTOR SHALL ALSO NOTIFY OTHER APPLICABLE UTILITY COMPANIES TO OBTAIN FIELD LOCATES OF ALL EXISTING UTILITIES PRIOR TO

	PROPERTY LINE
	R.O.W.
	LOT LINE
	SETBACK
	EASEMENT
	ROAD CENTERLINE
	CURB AND GUTTER (CATCH)
	CURB AND GUTTER (SPILL)
	SIDEWALK
	STORM SEWER
	SANITARY SEWER
	TRENCH DRAIN
	WATER LINE
	IRRIGATION LINE
	NONPOTABLE WATER LINE
	RAW WATER LINE
	MANHOLE w/ DIA. (FT.)
	INLET
	FLARED END SECTION
	WATER BEND
	WATER CROSS
	WATER TEE
	WATER REDUCER
	WATER VALVE
	FIRE HYDRANT
	PLUG/CAP
	SANITARY SEWER SERVICE (* INDICATES NON-TYPICAL LOCATION)
	WATER SERVICE (* INDICATES NON-TYPICAL LOCATION)
	UTILITY CROSSING
	UNDERDRAIN w/ SIZE (IN.)
	RETAINING WALL
	CONTOUR MAJOR
	CONTOUR MINOR
	SPOT ELEVATION
	SLOPE ARROW (4:1 MAX UNLESS NOTED OTHERWISE)
	LIMITS OF CONSTRUCTION / SAWCUT
	PEDESTRIAN ACCESSIBLE ROUTE
	LOT TYPE
	LINE OF SIGHT
	OVER FLOW ARROW
	DEMOLITION

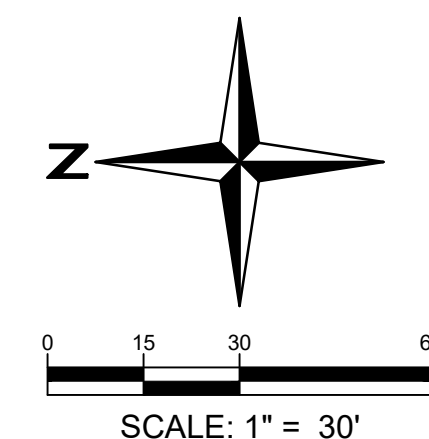
ABC	AGGREGATE BASE COARSE
ARV	AIR RELEASE VALVE
BB MH	BOX BASE MANHOLE
BC	BUILDING CORNER
BFE	BASEMENT FLOOR ELEVATION
B.O.P.	BOTTOM OF PIPE (ELEVATION)
BW	BOTTOM OF WALL
CATV	CABLE TELEVISION
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
D.E.	DRAINAGE EASEMENT
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	DOMESTIC WATER
E	EAST
EC	END CURVE RETURN
EG	EXISTING GRADE/GROUND
ELEC	ELECTRIC OR ELECTRICAL
ELEV	ELEVATION
EOP	EDGE OF PAVEMENT
ESMT	EASEMENT
EX.	EXISTING
FFE	FINISH FLOOR ELEVATION
FG	FINISH GRADE
FL	FLOWLINE
FM	FORCE MAIN
FO	FIBER OPTIC
G.E.	GAS EASEMENT
GB	GRADE BREAK
GFE	GARAGE FINISH FLOOR
GM	GAS METER
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HP	HIGH POINT
IBV	INLINE BUTTERFLY VALVE
INV	INVERT (ELEVATION)
IRR	IRRIGATION
L	LEFT
LF	LINEAR FEET/FOOT
LP	LOW POINT
MAX	MAXIMUM
ME	MATCH EXISTING
MH	MANHOLE
MIN	MINIMUM
N	NORTH
PC	POINT ON CURVE
PCC	POINT OF COMPOUND CURVE
PCR	POINT OF CURVE RETURN
PL	PROPERTY LINE
PRC	POINT OF REVERSE CURVE
PROP.	PROPOSED
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS OR RIGHT
R.O.W.	RIGHT OF WAY
RCP	REINFORCED CONCRETE PIPE
S	SOUTH
S.D.M.E.	SIDEWALK, DRAINAGE, AND MAINTENANCE EASEMENT
S.M.E.	SIDEWALK AND MAINTENANCE EASEMENT
S.W.E.	SIDEWALK EASEMENT
SD	STORM DRAIN
SS	SANITARY SEWER
SSMH	SANITARY SEWER MANHOLE
STA	STATION
STM	STORMWATER
STM MH	STORMWATER MANHOLE
TBC	TOP BACK OF CURB
TBW	TOP BACK OF WALK
TC	TOP OF CURB
TOF	TOP OF FOUNDATION
T.O.P.	TOP OF PIPE (ELEVATION)
TW	TOP OF WALL
TYP	TYPICAL
U.E.	UTILITY EASEMENT
VC	VERTICAL CURVE
W	WEST
WL	WATERLINE
WM	WATER METER
WV	WATER VALVE

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
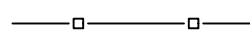



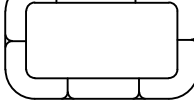
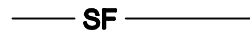

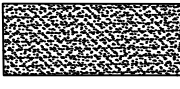
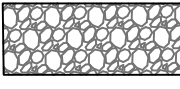


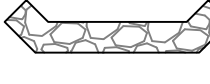
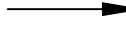







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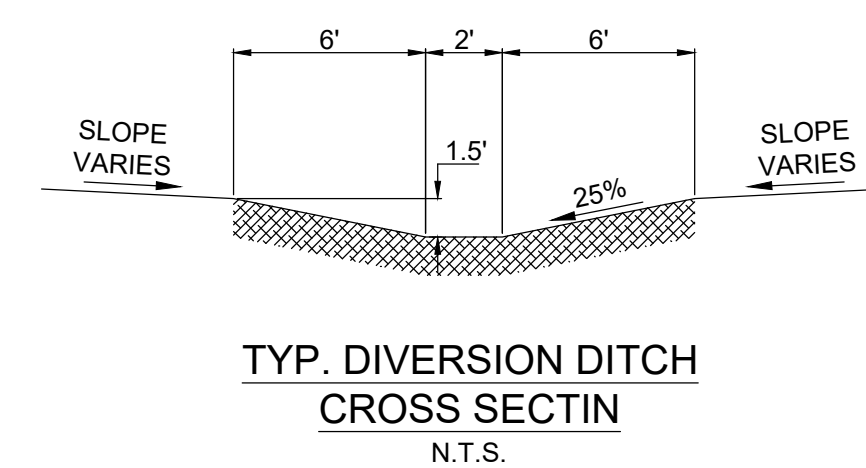
LEGEND

- | | | |
|---|-------|--------------------------|
|  | (CWA) | CONCRETE WASHOUT AREA |
|  | (CF) | CONSTRUCTION FENCE |
|  | (DD) | DIVERSION DITCH |
|  | (IP) | INLET PROTECTION |
|  | (OP) | OUTLET PROTECTION |
|  | (SB) | SEDIMENT BASIN |
|  | (SF) | SILT FENCE |
|  | (SCL) | SEDIMENT CONTROL LOG |
|  | (SSA) | STABILIZED STAGING AREA |
|  | (VTC) | VEHICLE TRACKING CONTROL |
|  | (ECB) | EROSION CONTROL BLANKET |
|  | (LOC) | LIMITS OF CONSTRUCTION |
|  | (ST) | SEDIMENT TRAP |
|  | | FLOW ARROW |
|  | (CS) | CURB SOCKET |
|  | | REMOVE INDICATED BMP |
|  | | AREA OF FILL |

MATCHLINE - SEE
SHEET NO. 6 OF 10

12.3 ACRES DISTURBED

This was added to the legend as requested.



THE ROCK COMMERCE CENTER

GRADING AND EROSION CONTROL PLANS

INITIAL EROSION CONTROL PLAN

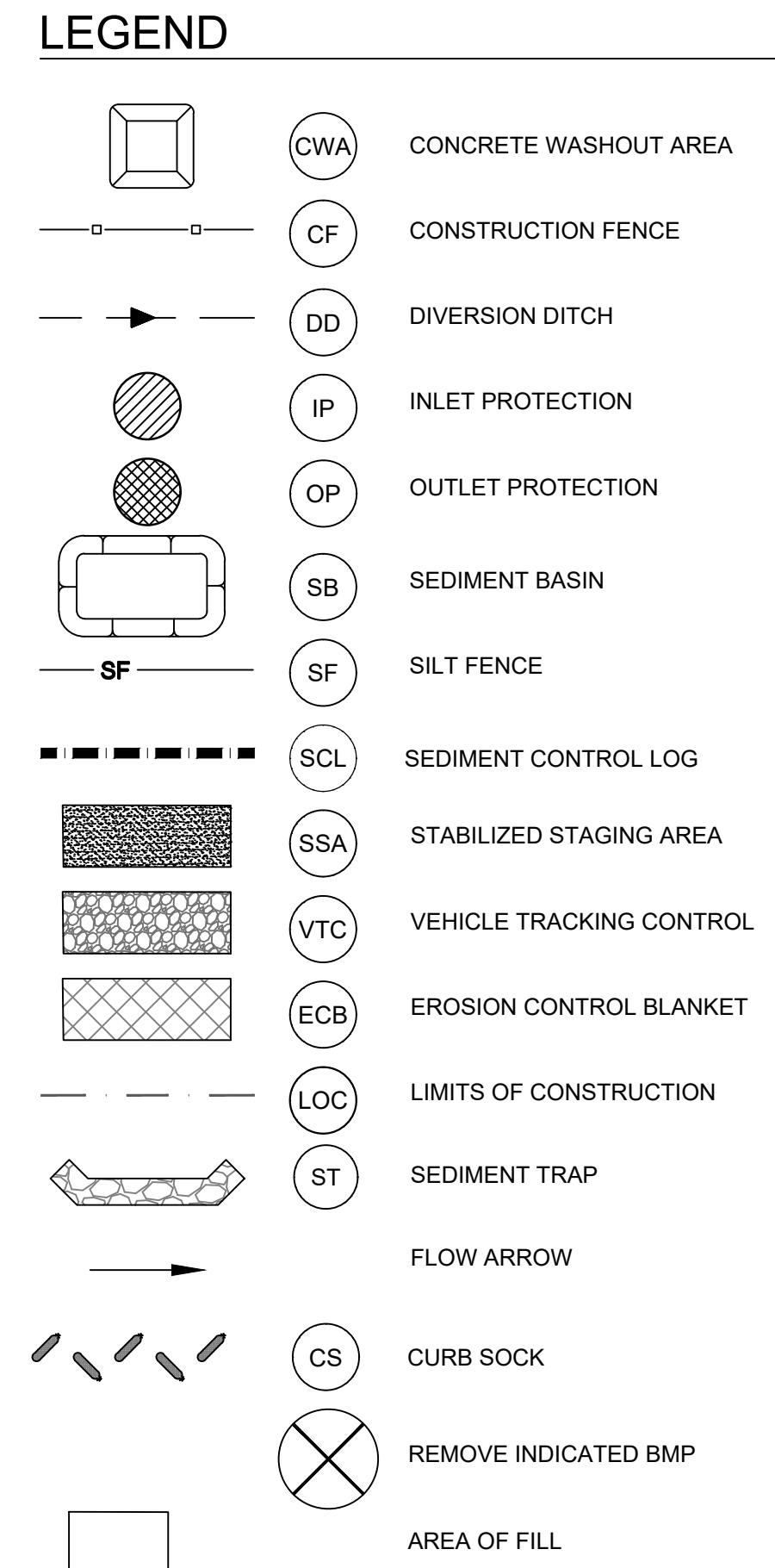
SHEET

5 OF 10

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**NOT FOR
CONSTRUCTION**

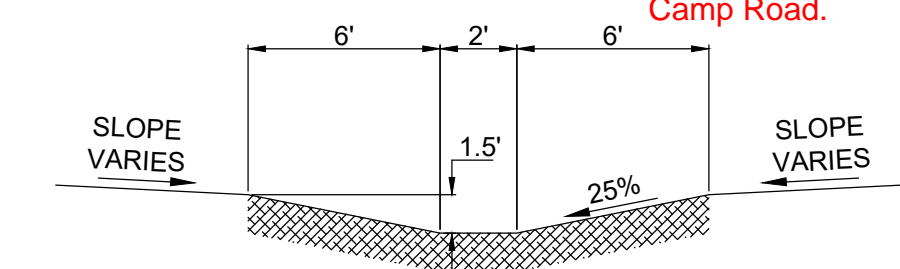
15 Years
Redland
WHERE GREAT PLACES BEGIN
■ Land Planning ■ Landscape Architecture
■ Civil Engineering ■ Construction Management
720.283.6783
REDLAND.COM



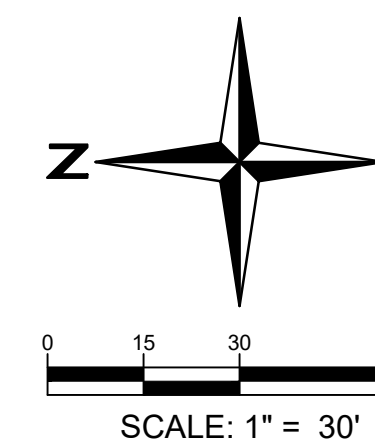
12.3 ACRES DISTURBED

extend CF outside LOD.

Construction fence was extended to outside of the limit disturbance. The



TYP. DIVERSION DITCH
CROSS SECTIN
N.T.S.



PCD FILE NO. PPR2329

**NOT FOR
CONSTRUCTION**

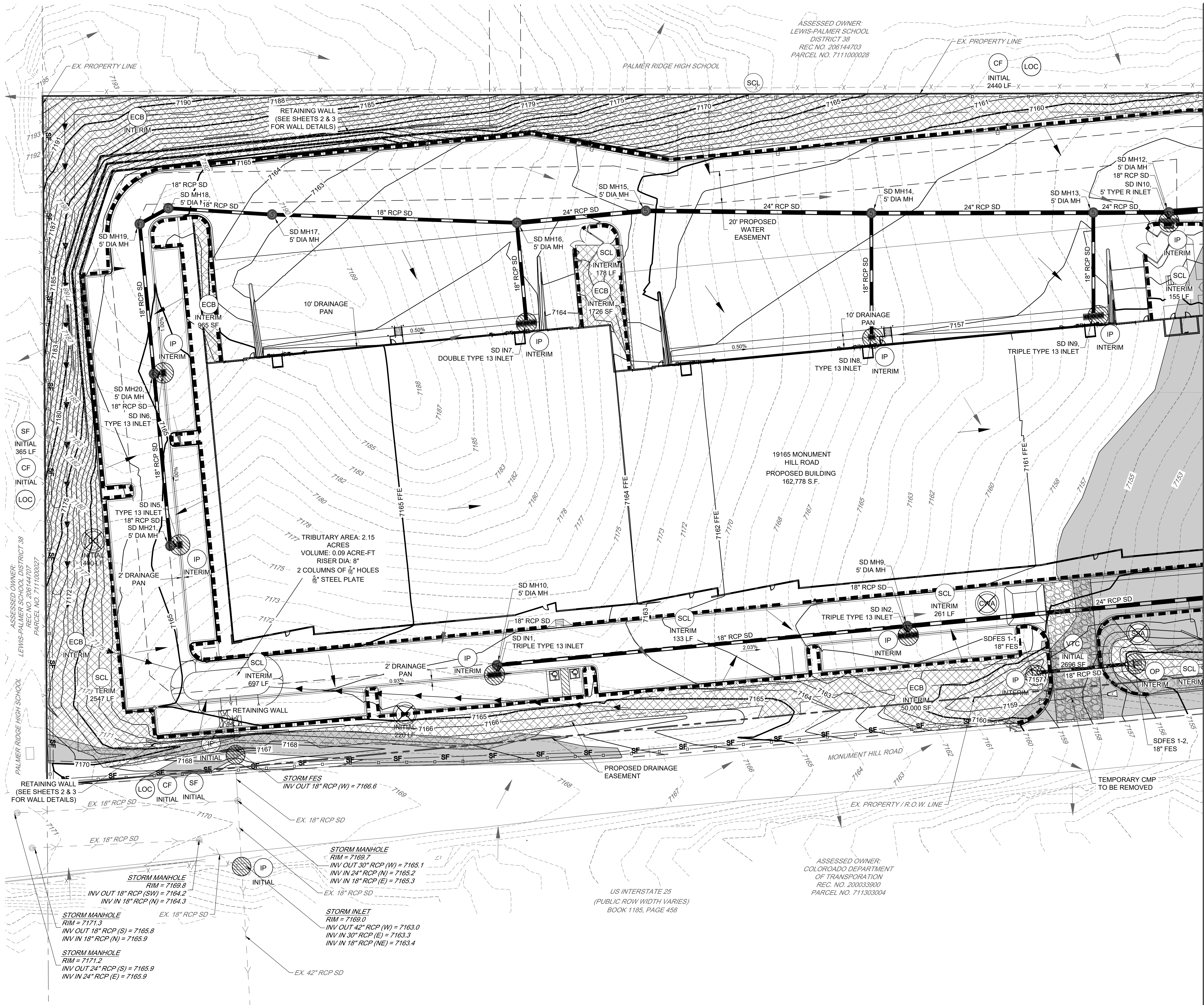
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THE ROCK COMMERCE CENTER
GRADING AND EROSION CONTROL PLANS
INITIAL EROSION CONTROL PLAN

SHEET

6 OF 10

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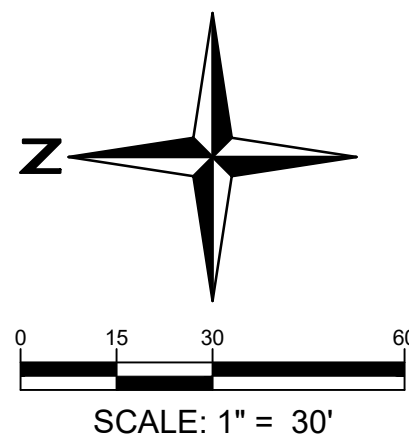
LEGEND

- CWA CONCRETE WASHOUT AREA
- CF CONSTRUCTION FENCE
- DD DIVERSION DITCH
- IP INLET PROTECTION
- OP OUTLET PROTECTION
- SB SEDIMENT BASIN
- SF SILT FENCE
- SCL SEDIMENT CONTROL LOG
- SSA STABILIZED STAGING AREA
- VTC VEHICLE TRACKING CONTROL
- ECB EROSION CONTROL BLANKET
- LOC LIMITS OF CONSTRUCTION
- ST SEDIMENT TRAP
- FLOW ARROW
- CS CURB SOCK
- REMOVE INDICATED BMP
- AREA OF FILL

MATCHLINE - SEE SHEET NO. 8 OF 10

I didn't see the concrete drainage pan detail. Comment Response stated that it was on Sheet 5. I believe that is just the diversion ditch detail. Include 2' and 10' concrete drainage pan detail on this sheet.

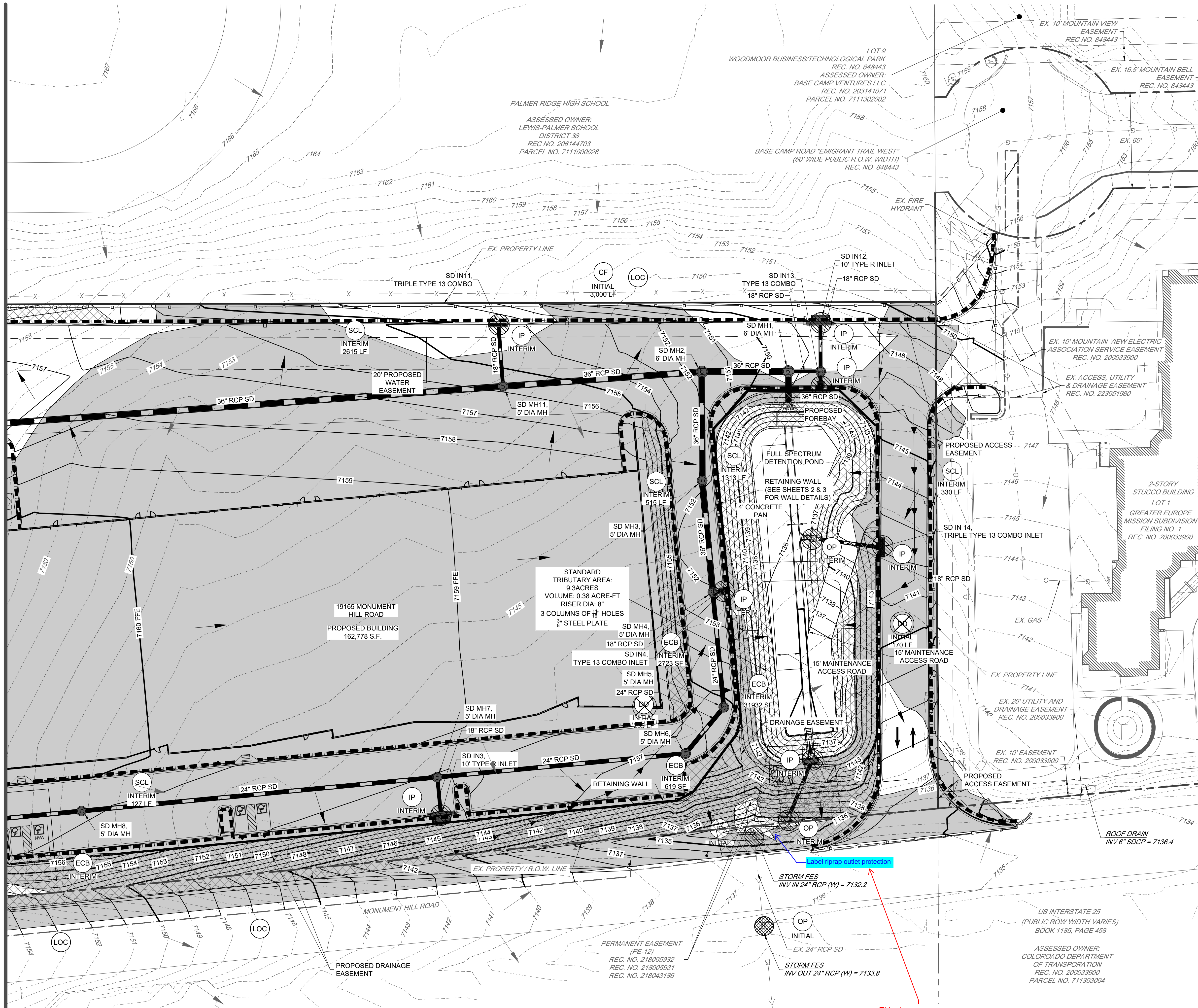
The concrete drainage pan details were added to these sheets from the SDP Grading Plan Sheets.



PROJECT NO.	DATE	NO.	NOTES
23009	07/28/2023	1	1ST SUBMITTAL
	10/20/2023	2	2ND SUBMITTAL

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MATCHLINE - SEE
SHEET NO. 7 OF 10



LEGEND

- | | | |
|--|-----|--------------------------|
| | CWA | CONCRETE WASHOUT AREA |
| | CF | CONSTRUCTION FENCE |
| | DD | DIVERSION DITCH |
| | IP | INLET PROTECTION |
| | OP | OUTLET PROTECTION |
| | SB | SEDIMENT BASIN |
| | SF | SILT FENCE |
| | SCL | SEDIMENT CONTROL LOG |
| | SSA | STABILIZED STAGING AREA |
| | VTC | VEHICLE TRACKING CONTROL |
| | ECB | EROSION CONTROL BLANKET |
| | LOC | LIMITS OF CONSTRUCTION |
| | ST | SEDIMENT TRAP |
| | | FLOW ARROW |
| | CS | CURB SOCK |
| | | REMOVE INDICATED BMP |
| | | AREA OF FILL |

FULL SPECTRUM POND SUMMARY		
ZONE	VOLUME (AC-FT)	WATER ELEV.
WQCV	0.294	7137.55
EURV	0.675	7140.11
100-YEAR	0.518	7141.64

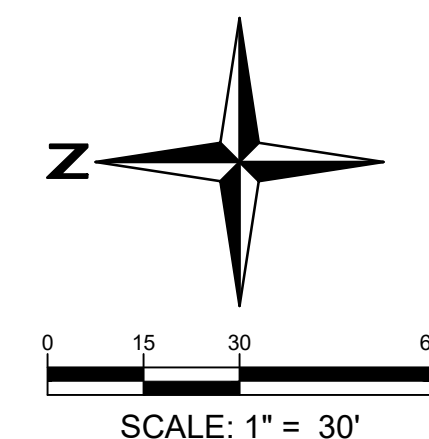
The Pond detail sheets will be added to the Construction Documents for approval.

Provide pond details, including (but not limited to):
- forebay
- outlet structure
- trash rack and orifice plate details
- spillway
- trickle channel
- pond bottom
- maintenance access road
- riprap outlet protection

A final erosion control plan to show seeding, mulching, permanent ECB, and Pavement was added.

show final erosion control figures (seeding mulching, pavement, ECB etc.). For clarification, do not show cut/fill shading or other temporary BMPs. Unresolved.

This riprap was labeled with type, width, depth, and thickness.



PCD FILE NO. PPR2329

15 Redland
YEARS
WHERE GREAT PLACES BEGIN

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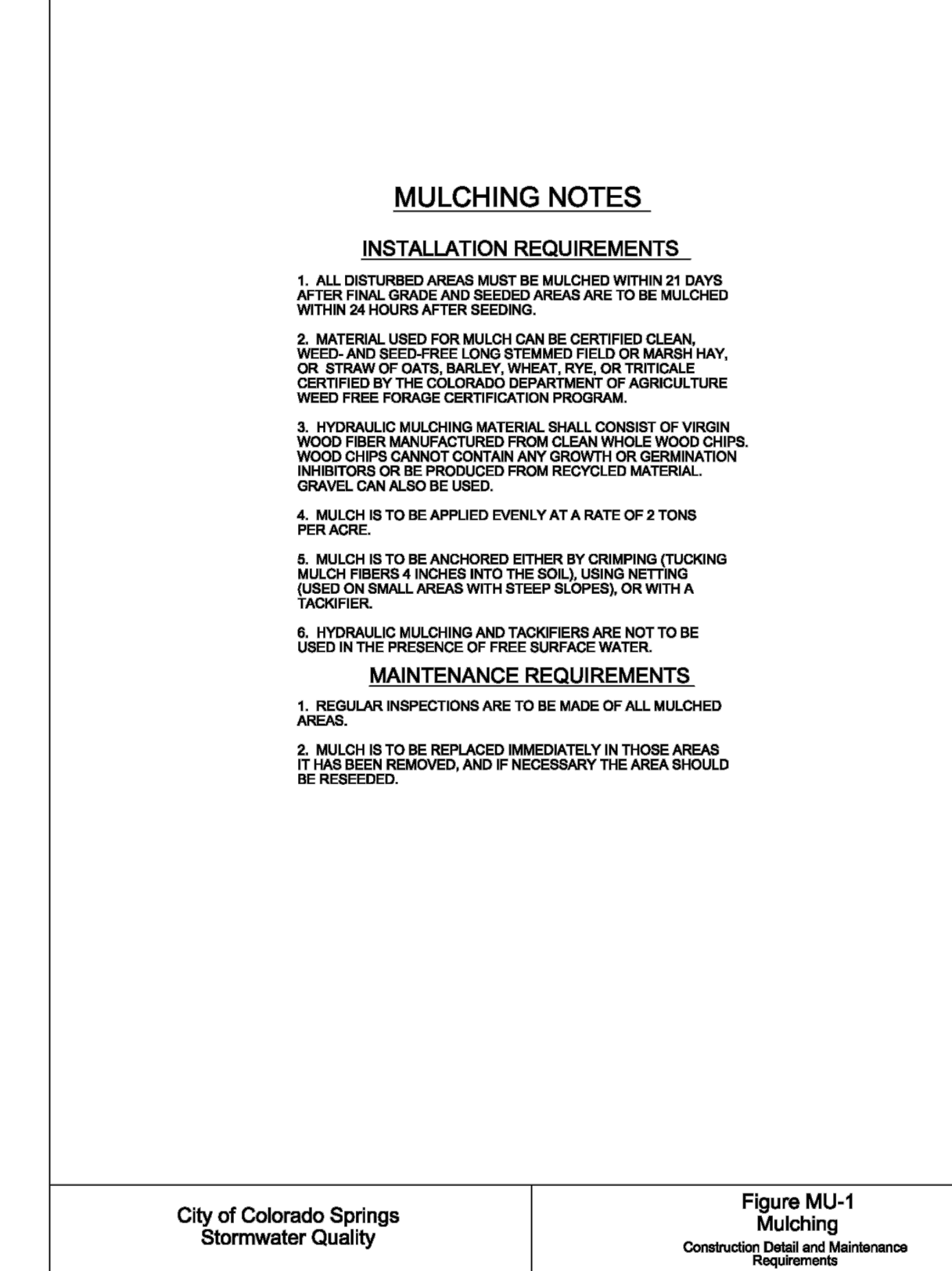
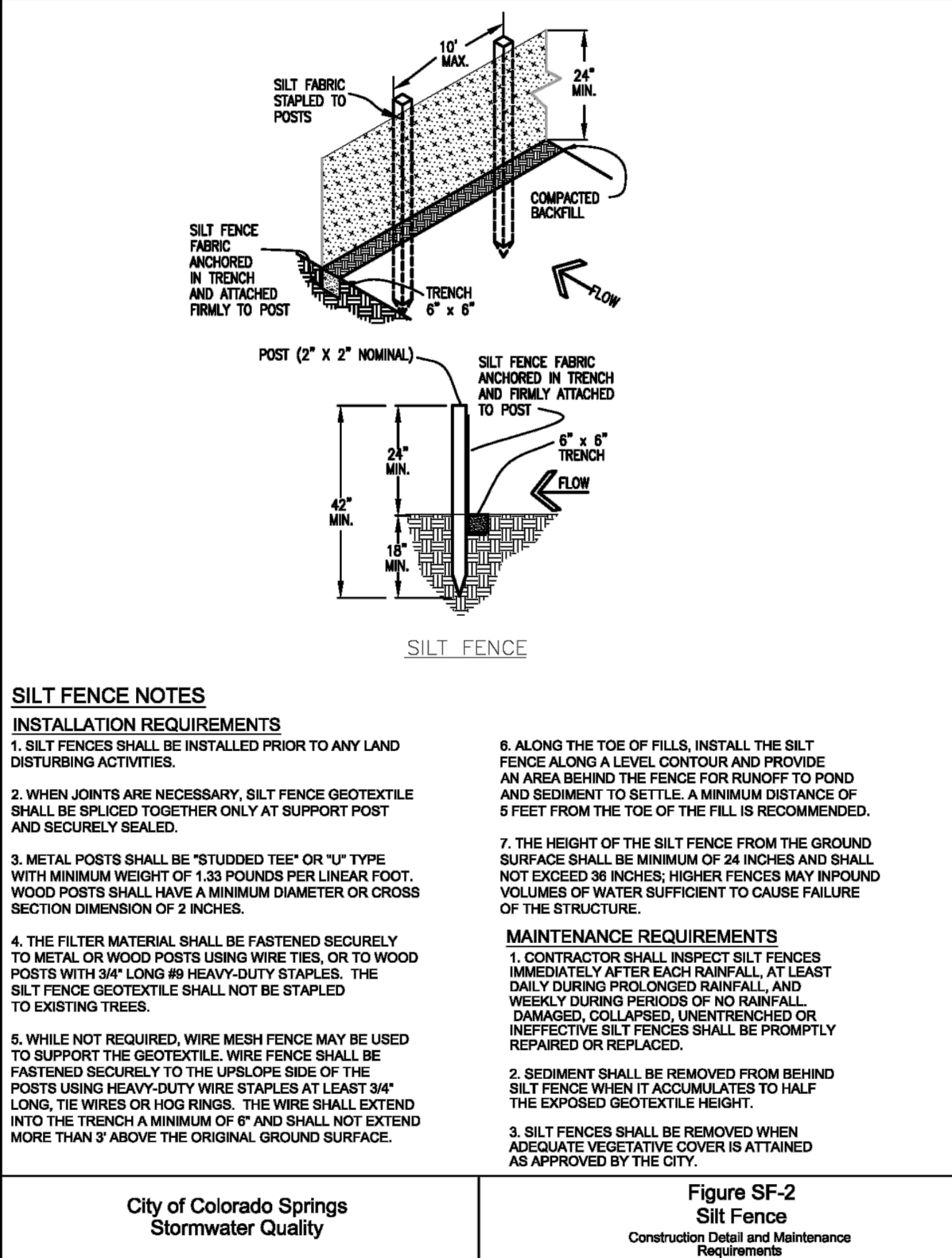
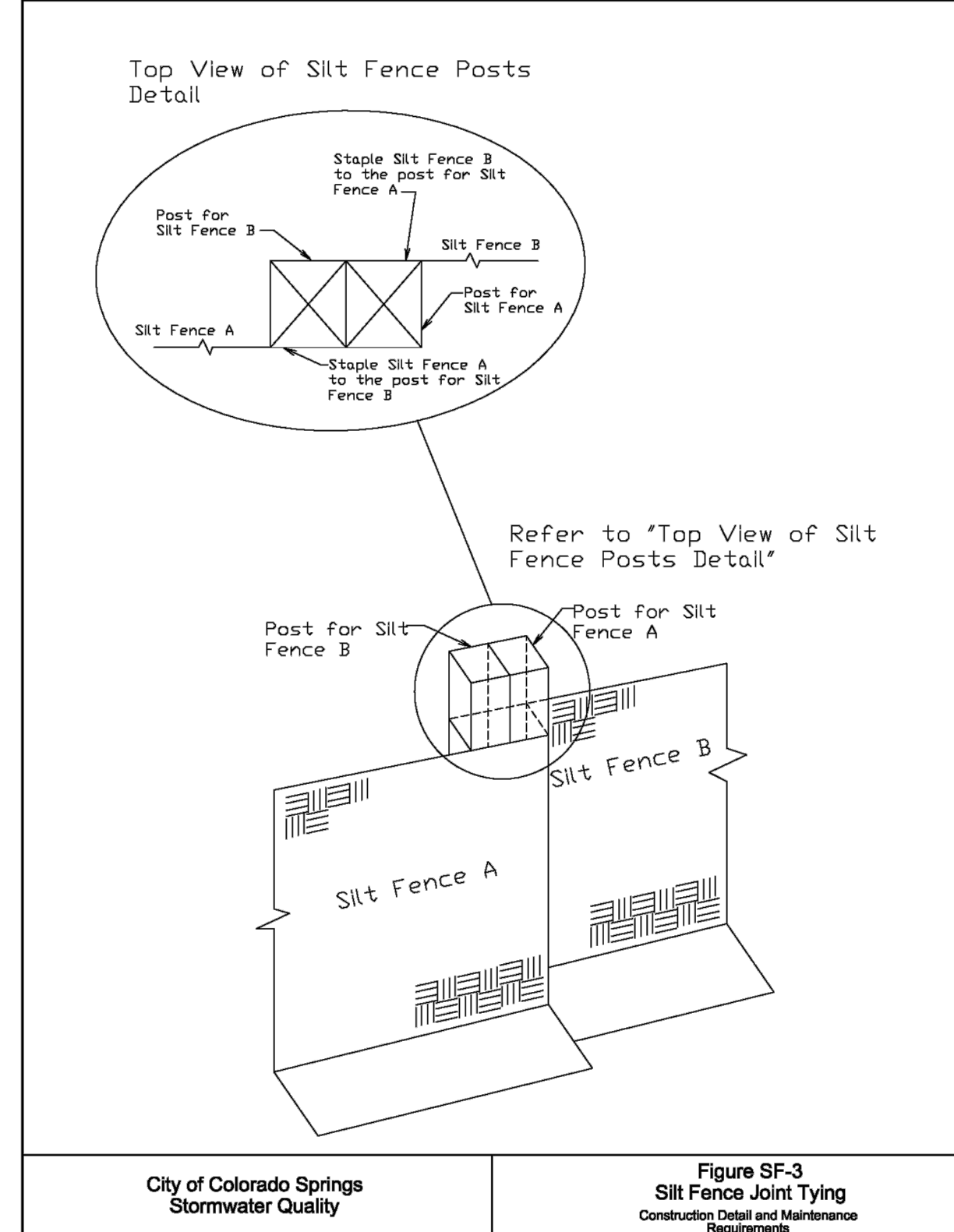
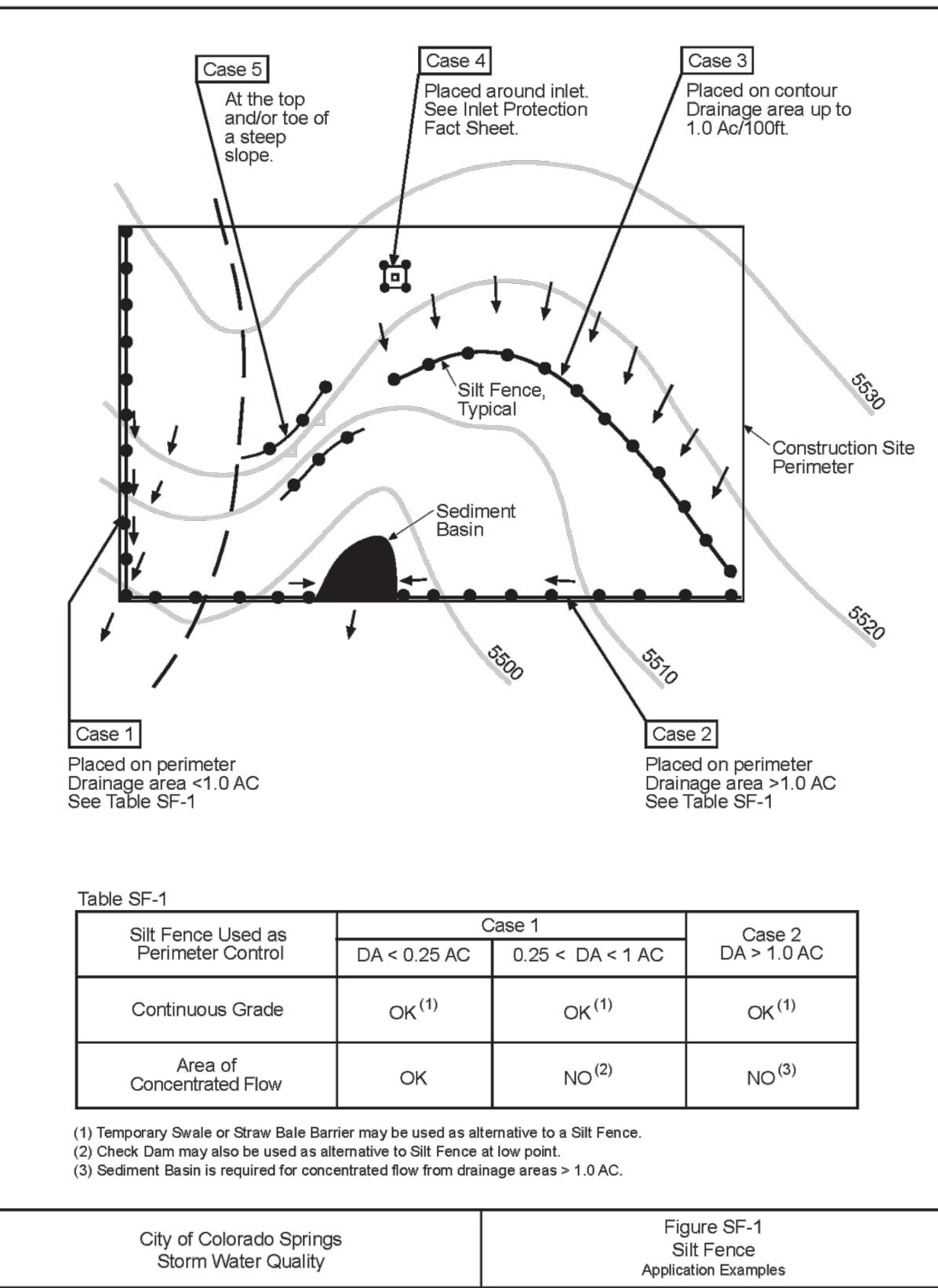
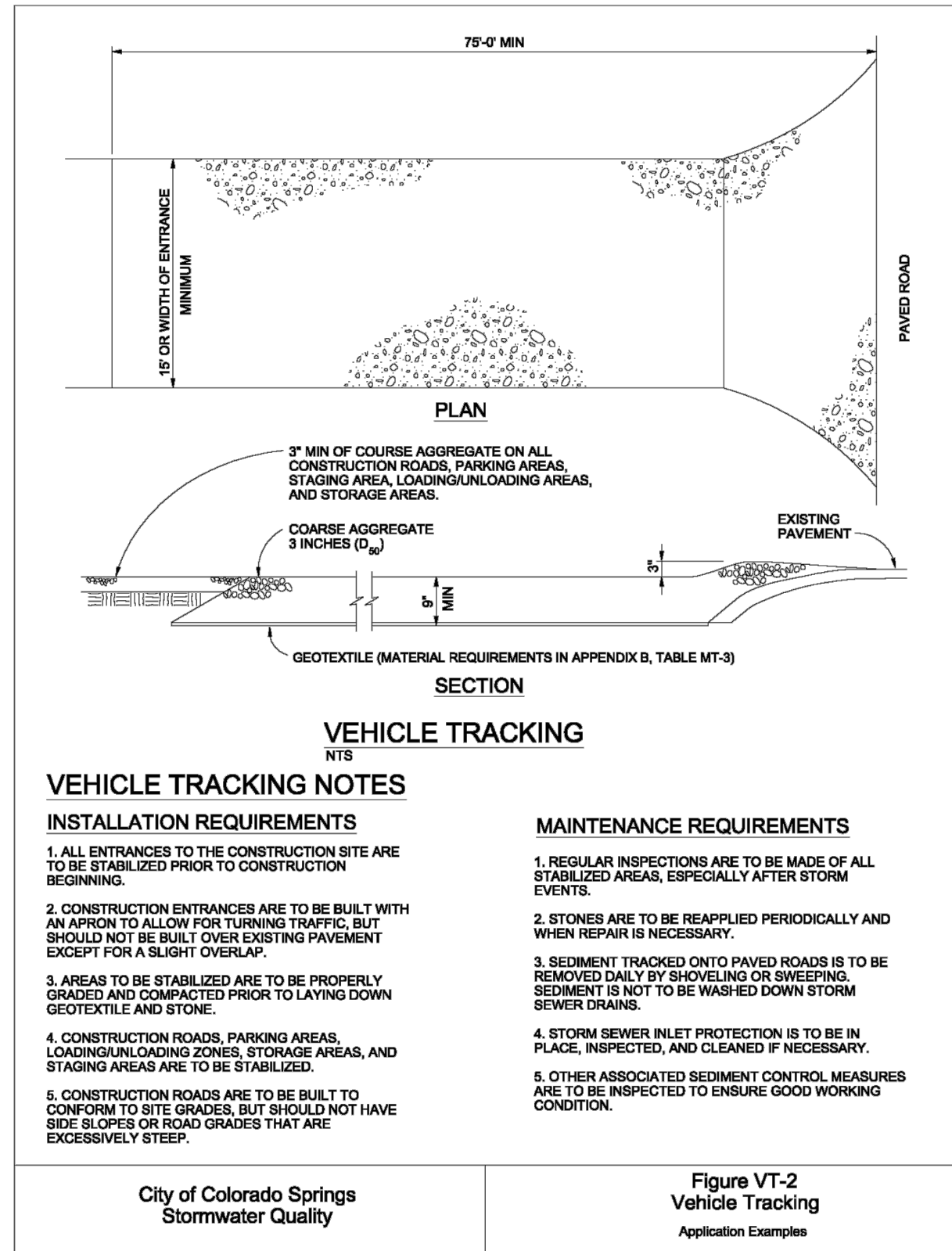
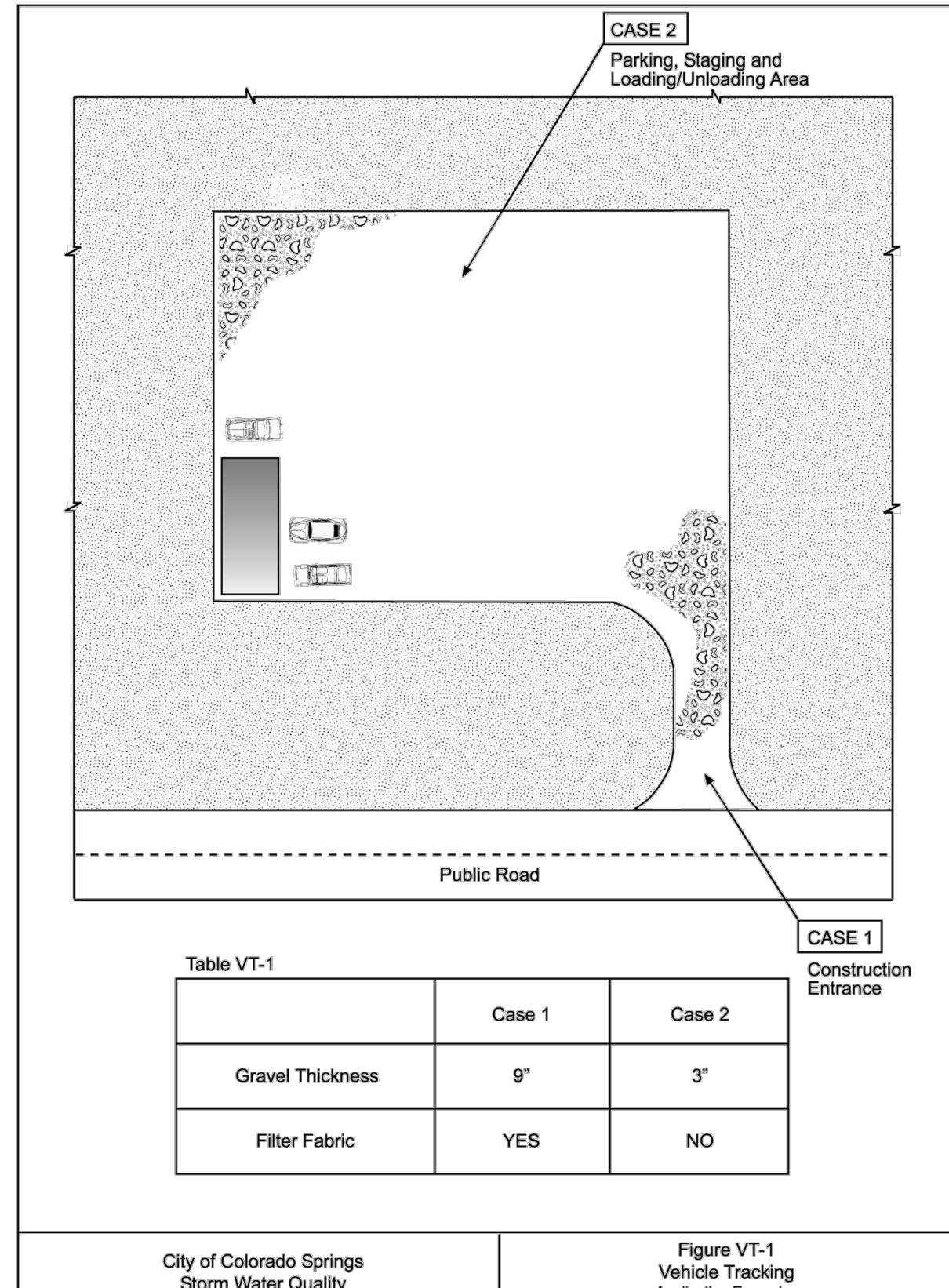
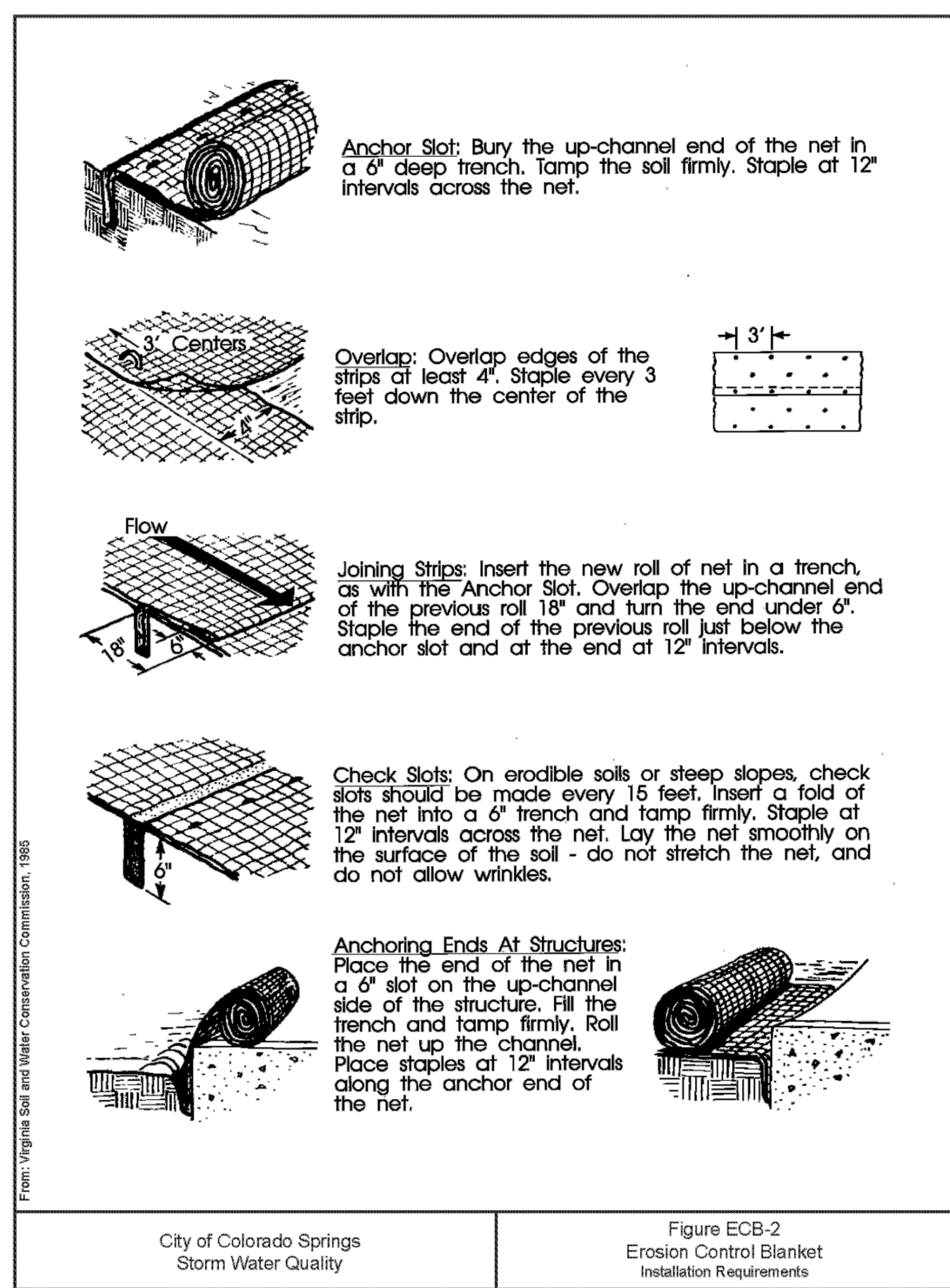
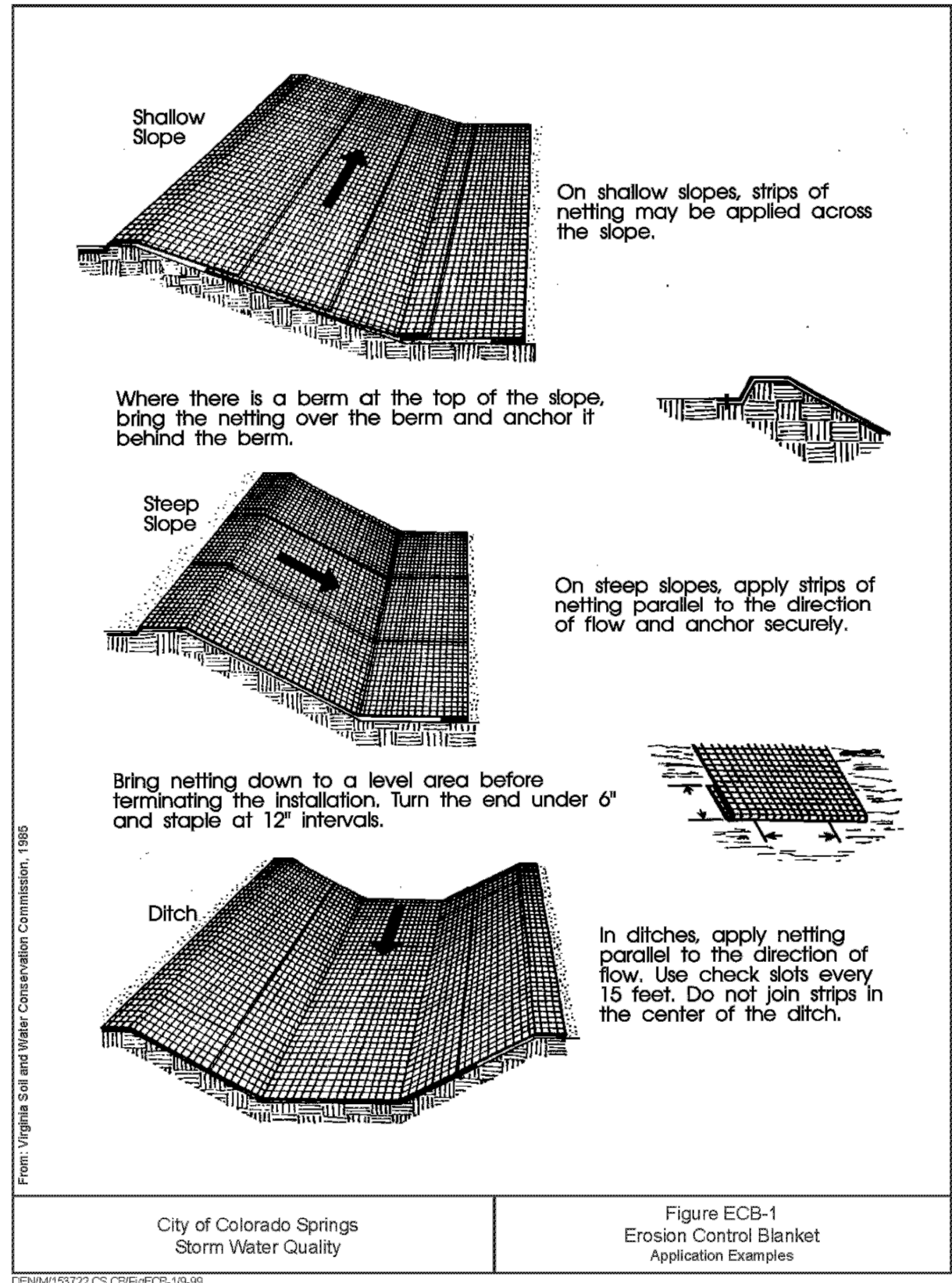
Land Planning
Landscape Architecture
Civil Engineering
Construction Management

**NOT FOR
CONSTRUCTION**

PROJECT NO. 23009		NOTES	
DATE	NO.	DATE	NO.
07/28/2023	1	1ST SUBMITTAL	
10/20/2023	2	2ND SUBMITTAL	

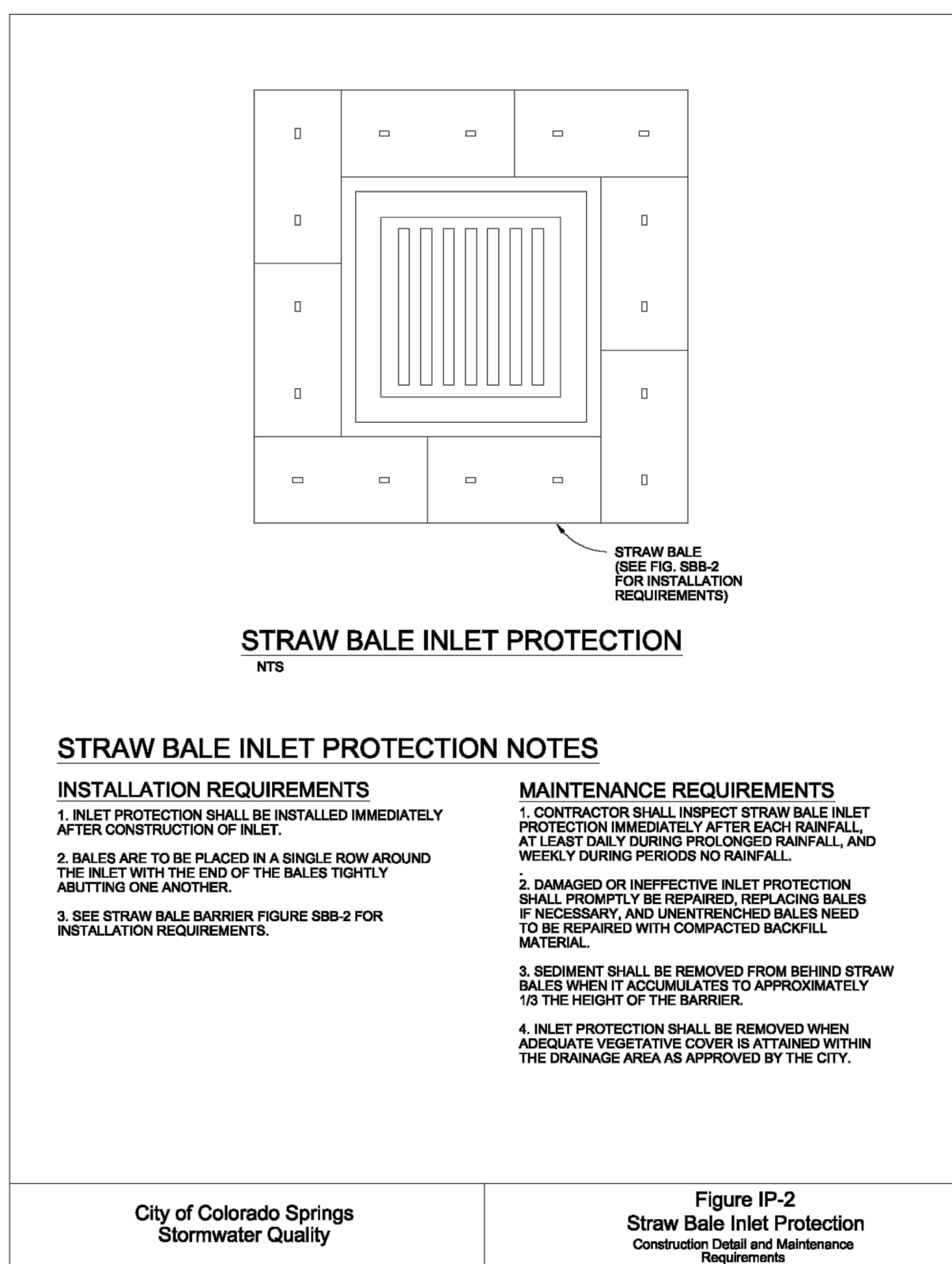
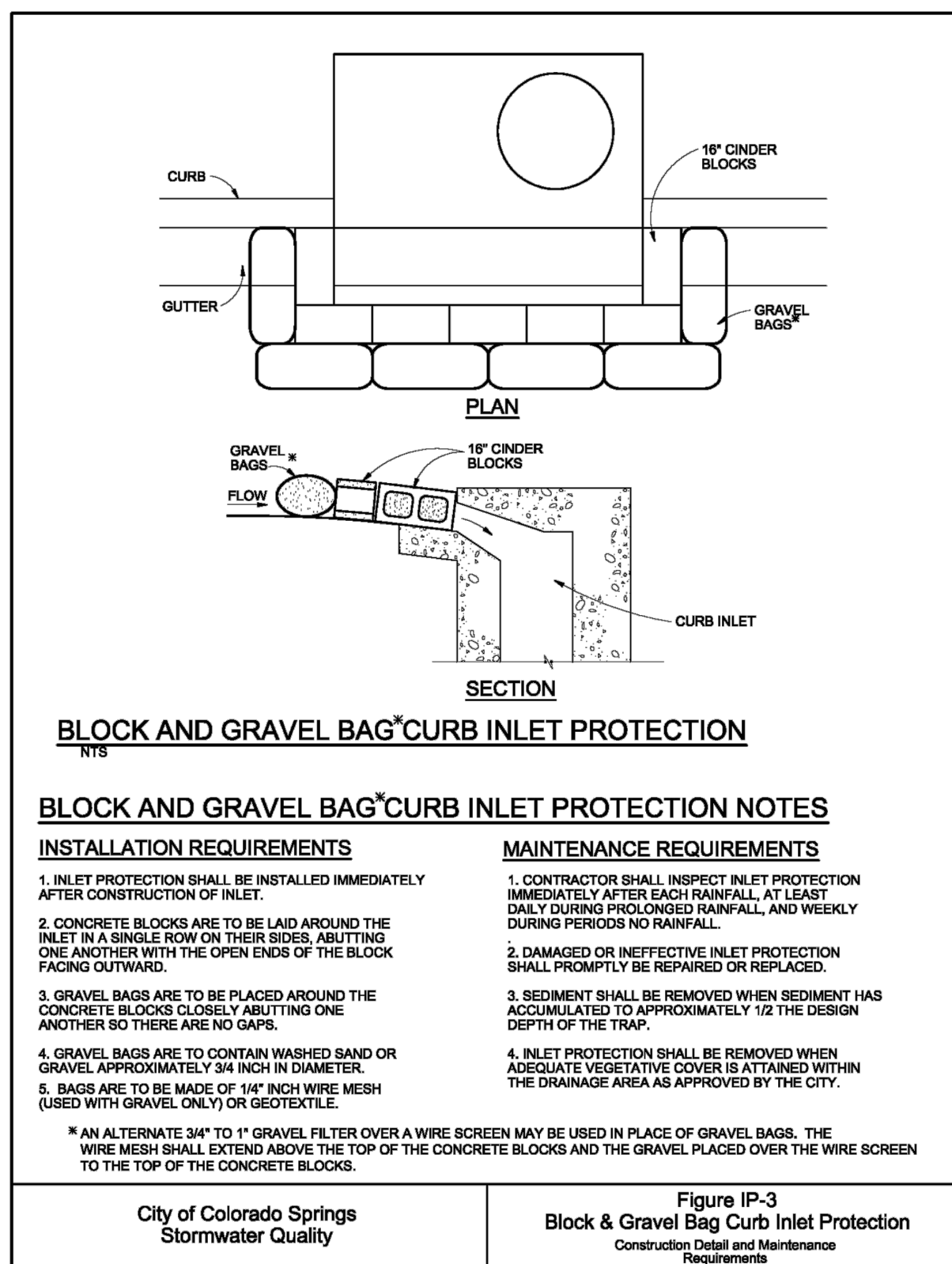
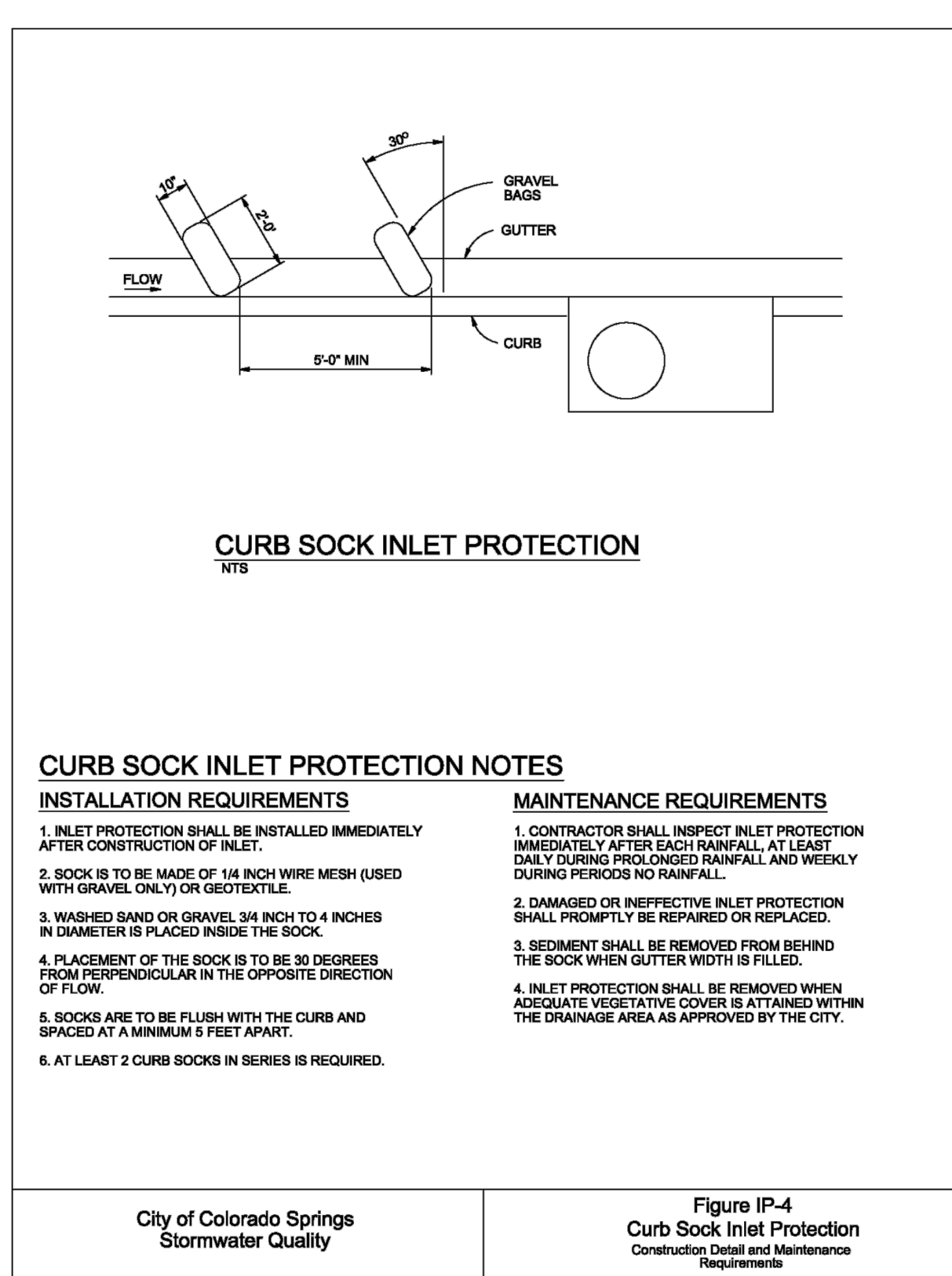
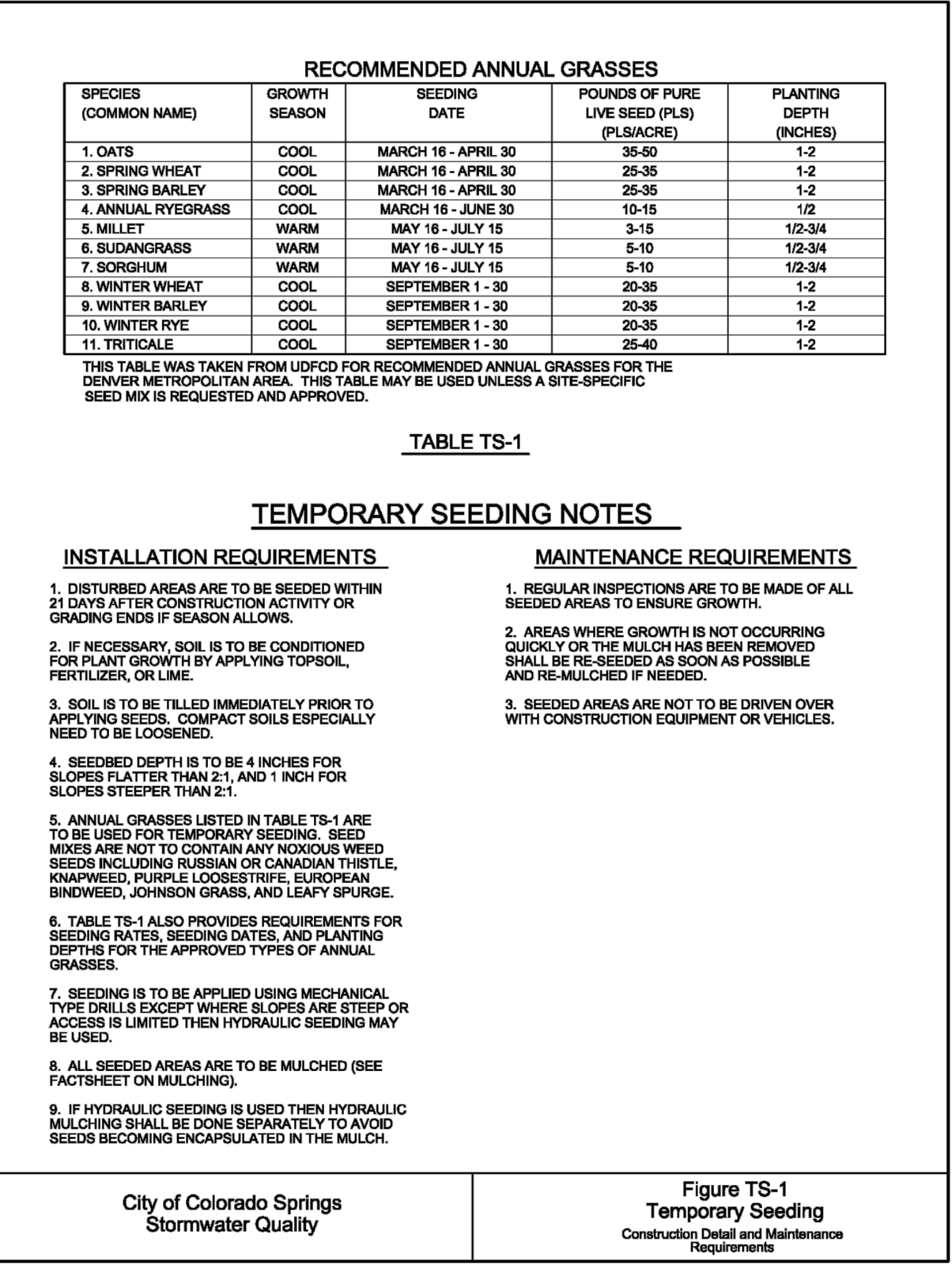
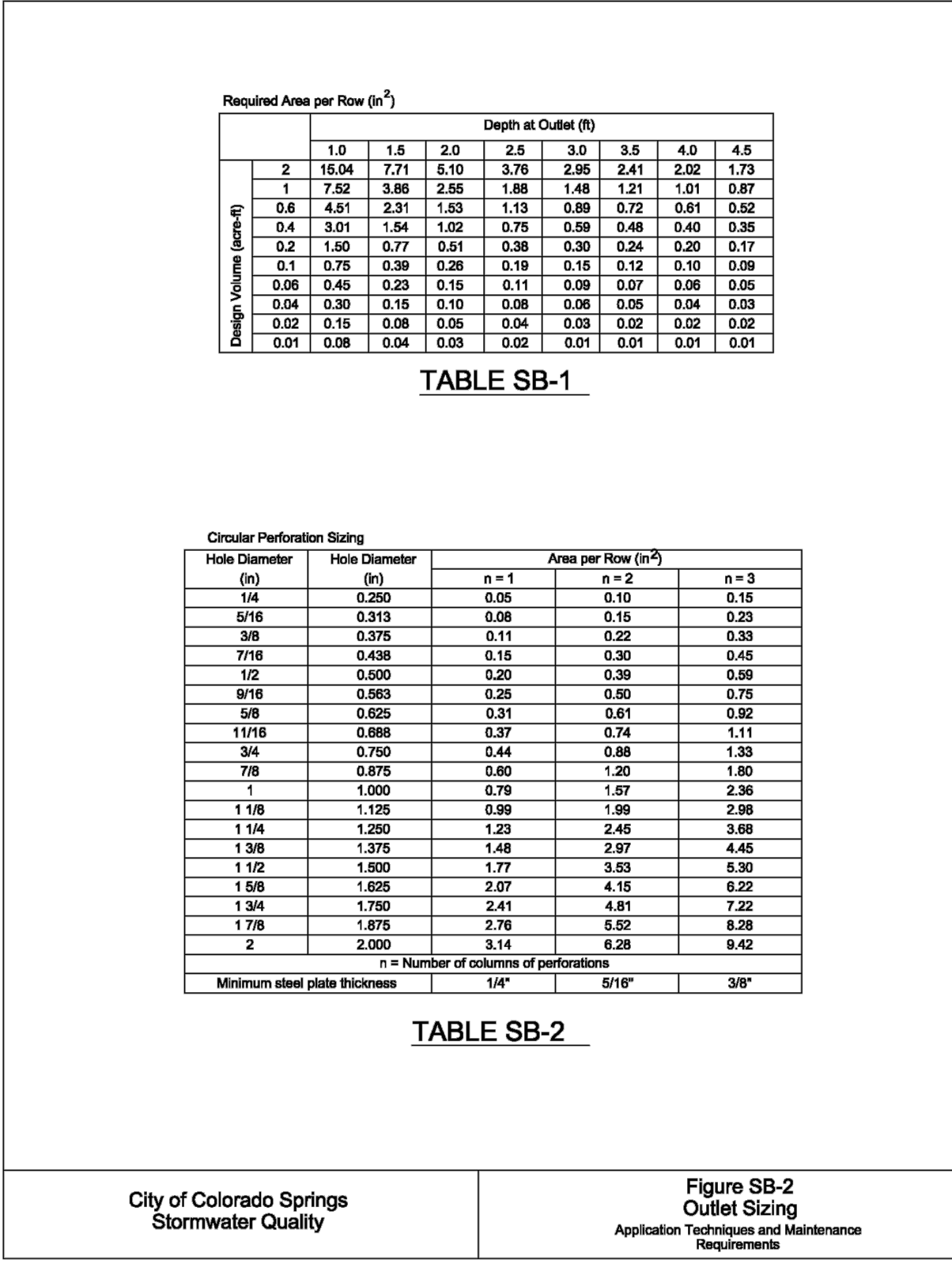
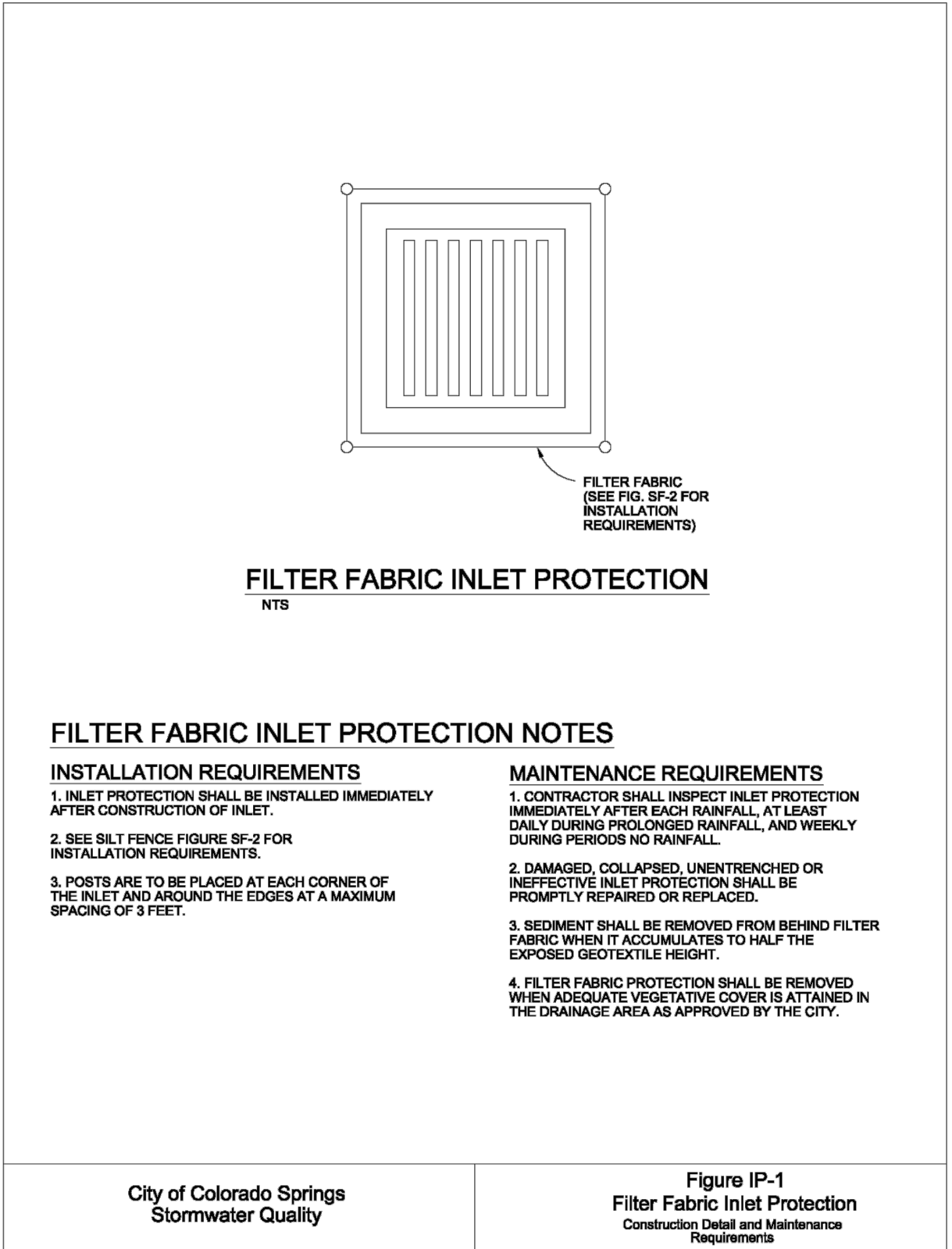
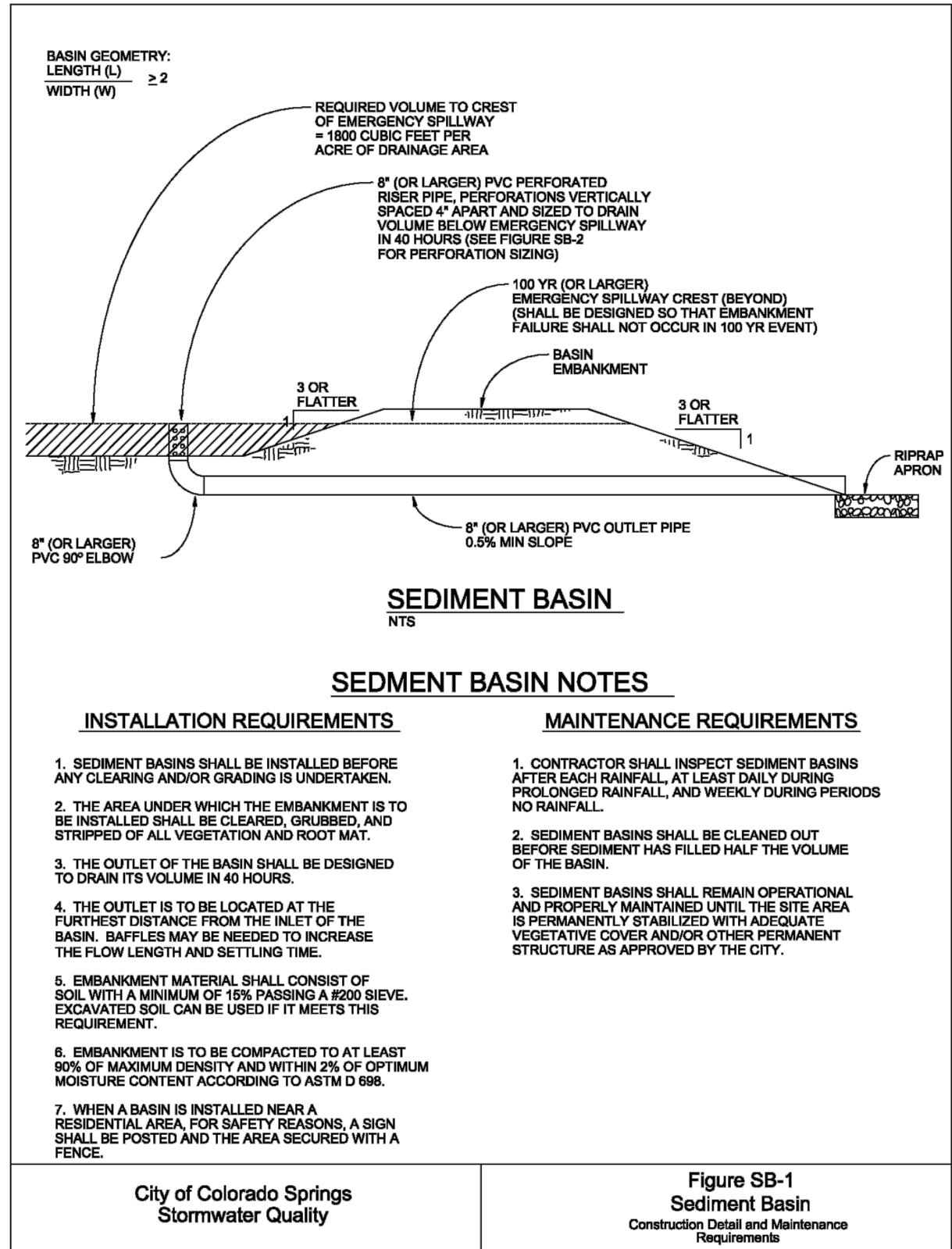
THE ROCK COMMERCE CENTER
GRADING AND EROSION CONTROL PLANS
INTERIM EROSION CONTROL PLAN

SHEET
8 OF 10



PROJECT NO.	DATE	NO.	NOTES
23009	07/28/2023	1	1ST SUBMITTAL
	10/20/2023	2	2ND SUBMITTAL

I:\2023\23009 - The Rock Commerce Center\23009_GEC Details.dwg tab: GEC DETAILS Oct 20, 2023 - 1:04pm csal



SHEET

PCD FILE NO. PPR2329

10 OF 10

THE ROCK COMMERCE CENTER

GRADING AND EROSION CONTROL PLANS

GEC DETAILS

NOTES

NO.

DATE

PROJECT NO. 23009

DATE

NO.

NOTES

1

1ST SUBMITTAL

2

2ND SUBMITTAL

10/20/2023

1

2

10/20/2023

1

2

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1

2

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2

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1

2

10/20/2023

NOT FOR CONSTRUCTION

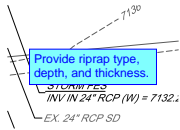
15 Redland YEARS WHERE GREAT PLACES BEGIN

720.283.4793 LANDSCAPE ARCHITECTURE REDLAND.CO

Land Planning • Land Engineering • Construction Management

V2_Grading and Erosion Control Plan Comments.pdf Markup Summary

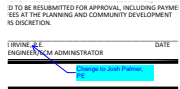
Carlos (1)



Subject: Callout
Page Label: [4] 4 OF 10 GRADING PLAN
Author: Carlos
Date: 11/8/2023 3:30:30 PM
Color: ■

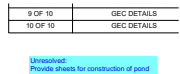
Provide riprap type, depth, and thickness.

CDurham (4)



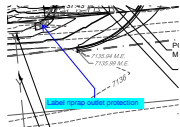
Subject: Callout
Page Label: [1] 1 OF 10 COVER SHEET
Author: CDurham
Date: 11/6/2023 4:47:56 PM
Color: ■

Change to Josh Palmer, PE



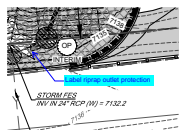
Subject: Text Box
Page Label: [1] 1 OF 10 COVER SHEET
Author: CDurham
Date: 11/6/2023 5:00:51 PM
Color: ■

Unresolved:
Provide sheets for construction of pond



Subject: Callout
Page Label: [4] 4 OF 10 GRADING PLAN
Author: CDurham
Date: 11/6/2023 4:52:02 PM
Color: ■

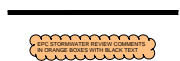
Label riprap outlet protection



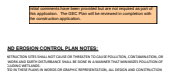
Subject: Callout
Page Label: [8] 8 OF 10 INTERIM EROSION CONTROL PLAN
Author: CDurham
Date: 11/6/2023 4:54:03 PM
Color: ■

Label riprap outlet protection

Christina Prete (9)



Subject: Stormwater Comments Color
Page Label: [1] 1 OF 10 COVER SHEET
Author: Christina Prete
Date: 11/7/2023 12:12:46 PM
Color: ■

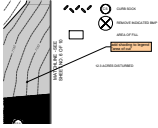


Subject: Contractor
Page Label: [1] 1 OF 10 COVER SHEET
Author: Christina Prete
Date: 11/7/2023 12:13:50 PM
Color: ■

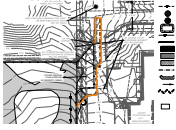
Initial comments have been provided but are not required as part of this application. The GEC Plan will be reviewed in completion with the construction application.



Subject: Resolved
Page Label: [3] 3 OF 10 GRADING PLAN
Author: Christina Prete
Date: 11/7/2023 7:17:43 AM
Color: ■



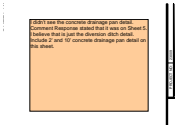
Subject: Contractor
Page Label: [5] 5 OF 10 INITIAL EROSION CONTROL PLAN
Author: Christina Prete
Date: 11/7/2023 11:57:46 AM
Color: ■ add shading to legend
"area of cut"



Subject: PolyLine
Page Label: [6] 6 OF 10 INITIAL EROSION CONTROL PLAN
Author: Christina Prete
Date: 11/7/2023 11:46:32 AM
Color: ■

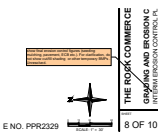


Subject: Contractor
Page Label: [6] 6 OF 10 INITIAL EROSION CONTROL PLAN
Author: Christina Prete
Date: 11/7/2023 11:46:51 AM
Color: ■ extend CF outside LOD.



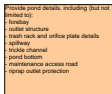
Subject: Contractor
Page Label: [7] 7 OF 10 INTERIM EROSION CONTROL PLAN
Author: Christina Prete
Date: 11/7/2023 11:51:54 AM
Color: ■

I didn't see the concrete drainage pan detail. Comment Response stated that it was on Sheet 5. I believe that is just the diversion ditch detail. Include 2' and 10' concrete drainage pan detail on this sheet.



Subject: Text Box
Page Label: [8] 8 OF 10 INTERIM EROSION CONTROL PLAN
Author: Christina Prete
Date: 11/7/2023 12:03:36 PM
Color: ■

show final erosion control figures (seeding mulching, pavement, ECB etc.). For clarification, do not show cut/fill shading or other temporary BMPs . Unresolved.



Subject: Contractor
Page Label: [8] 8 OF 10 INTERIM EROSION CONTROL PLAN
Author: Christina Prete
Date: 11/7/2023 12:06:55 PM
Color: ■

Provide pond details. including (but not limited to):
- forebay
- outlet structure
- trash rack and orifice plate details
- spillway
- trickle channel
- pond bottom
- maintenance access road
- riprap outlet protection

Final Drainage Report The Rock Commerce Center

Prepared for:

Central Development LLC
1660 S Albion St, Suite 200
Denver, CO 80222
(303) 628-0200 voice

Prepared by:

Redland
1500 W Canal Court
Littleton, Colorado 80120
(720) 283-6783 voice
Mark D. Cevaall, P.E.

PCD File No. PPR2329

July 28, 2023
October 20, 2023
Project No. 23009.001

Signature Page

The Rock Commerce Center

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.

SIGNATURE (Affix Seal) : _____
Colorado P.E. No. 33123

10/20/23
Date

Developer's Statement

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

[Jeremy Records, Principal]
[Central Development LLC]
[1660 S Albion St, Suite 200
Denver, CO 80222]

Date

El Paso County

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

Joshua Palmer, P.E.
County Engineer / ECM Administrator

Date

Conditions:

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Appendix A – Vicinity Map, Soils Map, FIRM Map

Appendix B – Hydrologic Calculations

Appendix C – Hydraulic Calculations

Appendix D – Reference Documents

Appendix E – Drainage Maps

General Location and Description

Introduction

The purpose of this Final Drainage Report is to identify on-site and off-site drainage patterns, storm sewer, inlet locations, areas tributary to the site, and to safely route the developed flows to the proposed full spectrum pond. Analyses for the proposed drainage patterns and requirements for the proposed The Rock Commerce Center development, hereafter referred to as the Site, are presented in the appendices of this Report.

Site Location

The Site is located on unplatted land in the Northwest Quarter of Section 11, Township 11 South, Range 67 West of the 6th Principal Meridian, El Paso County, Colorado. The site is bordered on the west side by Monument Hill Road and I-25, Palmer Ridge High School to the north and west, and 18950 Base Camp Road to the south, see Appendix A. The site will have two connections onto Monument Hill Road and one connection to the southeast to Base Camp Road.

Description of Property

The Site encompasses approximately 11.61 acres and is currently undeveloped. Native grasses and weeds currently cover the site with a few small trees. The site generally falls north to south but has a ridge running diagonally from the northwest corner toward Monument Hill Road splitting the site north and south. The northern section of site slopes at about 12% from west to east. The middle of the site slopes at about 4% from the northeast to the southwest. The southern section of site slopes at about 4% from the west to east.

The property is proposed to include a 162,778 SF commercial warehouse/showroom with associated parking, sidewalks, drive aisles, and landscaping. The building will be located in the middle of the site running north to south parallel to Monument Hill Road. The total disturbed area is 12.30 acres. The disturbed area is greater than the project area due to offsite improvements and grading required for Monument Hill Road. There will also be some offsite improvements required to create an access to Base Camp Road.

The Site is located within the Crystal Creek Drainage Basin which outfalls to Monument Lake per the *El Paso County Drainage Basin Map (DBMP) prepared by the Board of Commissioners, El Paso County, dated 2005*.

There are no existing irrigation facilities on the Site.

There is an existing 18" RCP storm sewer located near the northwest corner of the Site located in a roadside swale next to Monument Hill Road. This storm sewer crosses Monument Hill Road and ties into a 42" storm sewer which flows under I-25 to outfall west of I-25. An existing 24" storm sewer is also located near the southwest corner of the site in a roadside swale next to Monument Hill Road. The southwest storm sewer conveys flows under Monument Hill Road

Unresolved:
The assessor's site shows the lot as being 10 acres. Please revise or discuss how total was determined.

Unresolved:
LOI and TIS state 163,800 sf please revise for consistency.

and outfalls into the I-25 right of way where it then enters another storm sewer that outfalls to the west of I-25.

The property lies within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panel 08041C0276G dated December 18, 2018. Based on a review of the FIRM panel, the Site is located within Flood Zone X which is designated as an area determined to be outside the 0.2% (500-year) annual chance floodplain (see Appendix A).

The NRCS soil survey indicates that the soil on site is primarily Tomah-Crowfoot loamy sands and Tomah-Crowfoot complex, whose hydrologic soil group is Type B. A soil map has been included in the appendix for reference.

Drainage Basins and Subbasins

Existing Major Basin Description

The Site is located within the Crystal Creek Drainage Basin. The Crystal Creek Basin outfalls to Monument Lake. The Site is included in the *Dirty Woman Creek and Crystal Creek Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, dated September 1993. The Final Drainage Report for Palmer Ridge High School, prepared by Tetra Tech, dated July 3, 2007 (PRHS Report)* also includes a small portion of the site. Both of these previous drainage reports focus primarily on the flows entering and flowing through Crystal Creek. The flows from the site flow west crossing under I-25 before flowing southwest in an undefined channel towards Crystal Creek and eventually Monument Lake.

Existing Subbasin Description

The Site currently is made up of three existing basins that are all part of the Crystal Creek Drainage Basin. Basin A is the north basin that is 2.35 acres and drains east to west to an existing 18" storm sewer at Design Point A that eventually outfalls west of I-25. Basin A has a total surface runoff of 1.4 cfs in the 10-year event and 4.3 cfs in the 100-year event at Design Point A. Basin B is the largest existing basin with 7.40 acres flowing northeast to southwest into an existing 24" storm sewer at Design Point B. This existing storm sewer outfalls on the west side of Monument Hill Road where the flow enters another storm sewer to eventually outfall west of I-25. Basin B has a total surface runoff of 3.7 cfs in the 10-year event and 11.4 cfs in the 100-year event at Design Point B. Both Basin A and B flow in an undefined channel on the west side of I-25 to the southwest until eventually making it to Monument Lake. Basin C is the south basin on the site with 1.86 acres flowing east to southwest. Basin C has a total surface runoff of 1.0 cfs in the 10-year event and 3.2 cfs in the 100-year event at Design Point C. The runoff from this basin currently enters a roadside ditch on the east side of Monument Hill Road where it flows south away from the site to eventually enter Crystal Creek. An Existing Conditions Map is included in Appendix E.

There are four existing off-site basins that currently flow onto the site or into the Monument Hill Road swale adjacent to the Site. Basin OSA1 is a west portion of the Palmer Ridge High School that includes the school's west entrance and a detention pond. Basin OSA1 is 0.70

The design point flow summary states 3.07 & 7.27 cfs for the 10 & 100 year storms at Design Point A. Please revise statement if you are referring to basin flow only. Similar comment for other basins described in this section.

These just the flows r flows a points. distincto to this report.

acres and flows northeast to southwest where it enters the existing 24" storm sewer at Design Point A. The flow from Basin OSA1 at Design Point A is 1.9 cfs in the 10-year event and 3.2 cfs in the 100-year event. Basin EP1 represents Detention Pond B from the PRHS Report. According to the PRHS Report the 100-year release rate from the existing pond is 35.33 cfs at Design Point A. Basin OSB1 is a southwest portion of the Palmer Ridge High School that includes field, lawn, and parts of the school's track. Basin OSB1 is 0.74 acres and flows east to west on to the Site. The runoff then flows through Basin B until it reaches the existing 24" storm sewer at Design Point B. The flow generated from Basin OSB1 at Design Point B is 0.4 cfs in the 10-year event and 1.1 cfs in the 100-year event. The largest existing offsite basin is Basin OSC1 at 1.91 acres. Basin OSC1 is the southwest corner of the Palmer Ridge High School and includes field, lawn, and parts of the school's track. Basin OSC1 flows northeast to southwest flowing through Basin C until it reaches the roadside ditch next to Monument Hill Road at Design Point C. The flow generated from Basin OSC1 is 1.0 cfs in the 10-year event and 2.9 cfs in the 100-year event.

After routing flows from off-site and on-site basins through the Standard SF form for the 10-year and 100-year storm events the existing drainage values were found:

Design Point A has a combined 3.07 cfs for the 10-year event from Basins A1 and Basin OSA1. Design Point A has a combined 7.27 cfs for the 100-year event from Basins A1 and Basin OSA1. The Existing Pond B from the Lewis Palmer Ridge High School Drainage Report has an emergency overflow that is tributary to Design Point A. Assuming the outlet structure is completely clogged Design Point A would receive an extra 35.33 cfs.

Design Point B has a combined 5.53 cfs for the 10-year event from Basins B1 and Basin OSB1. Design Point B has a combined 15.26 cfs for the 100-year event from Basins B1 and Basin OSB1.

Design Point C has a combined 1.97 cfs for the 10-year event from Basins C1 and Basin OSC1. Design Point C has a combined 6.02 cfs for the 100-year event from Basins C1 and Basin OSC1.

Drainage Design Criteria

This Report has been prepared in accordance with the *El Paso County Drainage Criteria Manual Volume 1 & 2 October 2018*. Supplemental information is taken from the *Mile High Flood District Urban Storm Drainage Criteria Manual Volumes 1, 2 and 3*.

Water Quality is required to be provided on the site and the developed 100-year release rate is 90% of the predeveloped flow from the Site. Existing storm sewers are located in the northwest and southwest corners of the site within drainage easements. The pond sizing and outlet design was done through the Mile High Flood District Detention v4-06 spreadsheet. A tributary area table is provided in Appendix B. The table shows that the area on-site the is tributary to the pond is 10.98 acres at 77% imperviousness. The Full Spectrum Pond will also accept water from 5 off-site basins for a total of 3.2 acres. The Full Spectrum Pond was sized for the full site of 11.38 acres. The Full Spectrum Pond is over detaining runoff to offset the

runoff not detained on-site. The pond is not sized to detain the additional runoff from the off-site basins but the emergency overflow is sized to be able to pass the developed 100-year runoff plus the additional off-site runoff. The outlet of the proposed full spectrum pond is planned to discharge into the existing roadside ditch and enter the existing 24" storm sewer near the southwest of the Site. The full spectrum pond will be designed so the release of the 100-year runoff will be restricted to a release rate equal to or less than 90% of the predeveloped runoff. It was estimated that the predeveloped 10-year runoff to be 4.0 cfs and the 100-year runoff to be 11.7 cfs. For the purpose of this Report, the 100-year storm event will be released from the pond at a rate of 10.4 cfs. The release rate of 10.4 cfs was chosen since it is 88.9% of the predeveloped runoff.

The hydrologic design was computed using the Rational Method as defined by El Paso County Drainage Criteria Manual. The 10-year storm was used as the minor storm event, while the 100-year storm was used as the major event. The one-hour point rainfall depth used for the 10-year storm was 1.75 inches and 2.52 inches for the 100-year event. The Rational Method was used to analyze fully developed conditions. Hydraulic grade lines were calculated using Haestad's StormCadd and are attached in the appendices. On-site detention includes a full spectrum detention pond with water quality control volume, excess urban runoff volume, and the 100-year flood volume. The 100-year release is required to be less than 10.6 CFS. Inlets were sized using the UD-Inlet_V4.06 spreadsheet. The full spectrum pond was sized using the MHFD-Detention_v4.06 spreadsheet.

Runoff/Proposed Basin Description

Major Basins

The Site in its development condition includes 3 primary Basins described as Basins A, B, and C. The Proposed Drainage Map is included in Appendix E. Basin B is the largest basin with 10.58 acres on-site plus an additional 3.88 acres of an off-site basin tributary to it. Basin B consists of 30 on-site basins and 8 off-site basins. The on-site basins are numbered B1 through B30 and the off-site basins are numbered OSB1 through OSB8. Basin A has 0.12 acres on-site plus an additional 0.71 acres of an off-site tributary to it. Basin C has 0.11 acres on-site and no off-site basins.

According to paragraph
above release rate is 10.4 cfs.

This
mat
para

Sub-Basins

Basin A1 (0.09 Acres):

Basin A1 represents the northwest edge of the Site and includes the portion of the roadside ditch along Monument Hill Road that is located on the site. Basin A1 is tributary to the existing 18" storm sewer located in the northwest of the Site and discharges under Monument Hill Road and to the west side of I-25. This Basin has an overall imperviousness of 0%. This Basin is not tributary to the proposed full spectrum pond. Water quality is not required for this basin because under exclusion I.7.1.B.7 the land is undeveloped and will remain undeveloped.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 0.1 \text{ CFS} \quad Q_{100} = 0.2 \text{ CFS}$$

Basin OSA1 (0.71 Acres)

Basin OSA1 consists of a portion of the Palmer Ridge High School site and the east half section of Monument Hill Road. This basin all flows to the road side ditch and is tributary to the northwest existing storm sewer. This Basin has an overall imperviousness of 63%.

$$C_{10} = 0.64 \quad C_{100} = 0.74$$

$$Q_{10} = 2.4 \text{ CFS} \quad Q_{100} = 4.0 \text{ CFS}$$

The combined Basin A 100-year overland routed runoff of 3.51 CFS discharges to the existing 18" storm sewer at Design Point A and will not be routed through the proposed full spectrum pond.

Basin B1 (0.53 Acres)

Basin B1 consists of parking lot, sidewalk, and landscape islands located to the west of proposed Building. It will also receive the water from a portion of the roof in basin B16. The grades of this Basin generally slope at 3% and 4%. Runoff will sheet flow to a 2-foot concrete drainage pan where the concentrated flow will be collected in a Triple Type 13 Inlet at Design Point 1 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 64%. Emergency overflow from this Basin will route to the next downstream Sub-basin, B2.

$$C_{10} = 0.64 \quad C_{100} = 0.74$$

$$Q_{10} = 2.0 \text{ CFS} \quad Q_{100} = 3.4 \text{ CFS}$$

Basin B2 (0.48 Acres)

Basin B2 consists of parking lot, sidewalk, and landscape islands located to the west of proposed Building B. It will also receive the water from a portion of the roof in basins B17 and B18. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a 2-foot concrete drainage pan where the concentrated flow will be collected in a Triple Type 13 Inlet at Design Point 2 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 73%.

$$C_{10} = 0.71 \quad C_{100} = 0.80$$

$$Q_{10} = 2.0 \text{ CFS} \quad Q_{100} = 3.2 \text{ CFS}$$

Basin B3 (0.30 Acres)

Basin B3 consists of parking lot, sidewalk, and landscape islands located to the west of the proposed building. This basin also includes the north entrance into the site. It will also receive the water from a portion of the roof in basin B19 and the off-site basin OSB7. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow away from the proposed building to the curb and gutter on the west side. The concentrated flow will be then be conveyed through a curb chase at Design Point 3 and conveyed to the next downstream basin, B4. This Basin has an overall imperviousness of 95%.

$$C_{10} = 0.88 \quad C_{100} = 0.93$$

$$Q_{10} = 1.6 \text{ CFS} \quad Q_{100} = 2.4 \text{ CFS}$$

Basin B4 (0.19 Acres)

Basin B4 consists of parking lot, sidewalk, and landscape islands located to the west of the proposed building. It will also receive the water from a portion of the roof in basin B20. The grades of this Basin generally slope at 3%. Runoff will sheet flow away from the proposed building to the curb and gutter on the west side. The concentrated flow will be then be conveyed to a 10' Type R Inlet at Design Point 4 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 100%.

$$C_{10} = 0.92 \quad C_{100} = 0.96$$

$$Q_{10} = 1.0 \text{ CFS} \quad Q_{100} = 1.5 \text{ CFS}$$

Basin B5 (0.40 Acres)

Basin B5 consists of parking lot, sidewalk, and landscape islands located to the west and south of the proposed building. It will also receive the water from a portion of the roof in basin B21. The grades of this Basin generally slope at 3% and 7%. Runoff will sheet flow away from the proposed building to the curb and gutter on the west side. The concentrated flow will be then be conveyed to a Single Type 13 Combo Inlet at Design Point 5 and conveyed to the proposed Full spectrum pond via storm sewer. This Basin has an overall imperviousness of 82%. Emergency overflow from this Basin will overtop of curb and enter the proposed full spectrum pond.

$$C_{10} = 0.78 \quad C_{100} = 0.85$$

$$Q_{10} = 1.8 \text{ CFS} \quad Q_{100} = 2.9 \text{ CFS}$$

Basin B6 (0.31 Acres)

Basin B6 consists of parking lot, sidewalk, landscape islands, and landscape buffer located to the north of proposed Building. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a 2-foot concrete drainage pan where the concentrated flow will be collected in a Single Type 13 Inlet at Design Point 6 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 68%.

$$C_{10} = 0.68 \quad C_{100} = 0.77$$

$$Q_{10} = 1.2 \text{ CFS} \quad Q_{100} = 2.0 \text{ CFS}$$

Basin B7 (0.40 Acres)

Basin B7 consists of parking lot, sidewalk, landscape islands, and landscape buffer located to the north of proposed Building. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a 2-foot concrete drainage pan where the concentrated flow will be collected in a Single Type 13 Inlet at Design Point 7 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 58%. Emergency overflow from this Basin will route to the next downstream Basin, B6.

$$C_{10} = 0.60 \quad C_{100} = 0.70$$

$$Q_{10} = 1.4 \text{ CFS} \quad Q_{100} = 2.4 \text{ CFS}$$

Basin B8 (0.98 Acres)

Basin B8 consists of loading dock and landscape islands located to the east of proposed Building. It will also receive the water from a portion of the roof in basin B22. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a 10-foot concrete drainage pan where the concentrated flow will be collected in a Double Type 13 Inlet at Design Point 8 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 68%.

$$C_{10} = 0.68 \quad C_{100} = 0.77$$

$$Q_{10} = 3.9 \text{ CFS} \quad Q_{100} = 6.4 \text{ CFS}$$

Basin B9 (0.59 Acres)

Basin B9 consists of loading dock and landscape islands located to the east of proposed Building. It will also receive the water from a portion of the roof in basin B23. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a 10-foot concrete drainage pan where the concentrated flow will be collected in a on grade Single Type 13 Inlet at Design Point 9 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 71%. Emergency overflow from this Basin will route to the next downstream Basin, B10.

$$C_{10} = 0.70 \quad C_{100} = 0.78$$

$$Q_{10} = 2.4 \text{ CFS} \quad Q_{100} = 3.9 \text{ CFS}$$

Basin B10 (0.67 Acres)

Basin B10 consists of loading dock located to the east of proposed Building. It will also receive the water from the offsite basin OSB1 and a portion of the roof in basin B24. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a 10-foot concrete drainage pan where the concentrated flow will be collected in a Triple Type 13 Inlet at Design Point 10 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 83%.

$$C_{10} = 0.79 \quad C_{100} = 0.85$$

$$Q_{10} = 3.1 \text{ CFS} \quad Q_{100} = 4.9 \text{ CFS}$$

Basin B11 (0.37 Acres)

Basin B11 consists of loading dock and landscape islands located to the east of proposed Building. It will also receive the water from the off-site basin OSB2 and a portion of the roof in basin B25. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a curb and gutter on the west side of the drive aisle where the concentrated flow will be collected in a 5' Type R Inlet at Design Point 11 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 74%.

$$C_{10} = 0.72 \quad C_{100} = 0.80$$

$$Q_{10} = 1.6 \text{ CFS} \quad Q_{100} = 2.5 \text{ CFS}$$

Basin B12 (0.75 Acres)

Basin B12 consists of loading dock located to the east of proposed Building. It will also receive the water from the off-site basin OSB3 and a portion of the roof in basin B26. The grades of this Basin generally slope between 3% to 5%. Runoff will sheet flow to a curb and gutter on the east side of the drive aisle where the concentrated flow will be collected in an on-grade Triple Type 13 Combo Inlet at Design Point 12 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 89%. Emergency overflow from this Basin will route to the next downstream Basin, B13.

$$C_{10} = 0.83 \quad C_{100} = 0.89$$

$$Q_{10} = 3.6 \text{ CFS} \quad Q_{100} = 5.6 \text{ CFS}$$

Basin B13 (0.43 Acres)

Basin B13 consists of loading dock and landscaping located to the east and south of proposed Building. It will also receive the water from the off-site basin OSB4 and a portion of the roof in basin B27. The grades of this Basin generally slope between 3% to 7%. Runoff will sheet flow to a curb and gutter on the west side of the drive aisle where the concentrated flow will be collected in a 10' Type R Inlet at Design Point 13 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 81%. Emergency overflow from this Basin will route to the next downstream Basin, B14.

$$C_{10} = 0.77 \quad C_{100} = 0.84$$

$$Q_{10} = 2.0 \text{ CFS} \quad Q_{100} = 3.1 \text{ CFS}$$

Basin B14 (0.08 Acres)

Basin B14 consists of drive aisle and landscape islands located to the south of proposed Building. The grades of this Basin generally slope between 3% to 7%. Runoff will sheet flow to a curb and gutter where the concentrated flow will be collected in a Single Type 13 Combo Inlet at Design Point 14 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 87%.

$$C_{10} = 0.82 \quad C_{100} = 0.88$$

$$Q_{10} = 0.4 \text{ CFS} \quad Q_{100} = 0.6 \text{ CFS}$$

Basin B15 (0.11 Acres)

Basin B15 consists of a loading dock area and landscape islands located to the east of proposed Building. It will also receive the water from the off-site basin OSB5. The grades of this Basin generally slope between 4% to 8%. Runoff will sheet flow to a curb and gutter on the north side of the entrance drive where the concentrated flow will be collected in a on grade Triple Type 13 Combo Inlet at Design Point 15 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 97%.

$$C_{10} = 0.90 \quad C_{100} = 0.94$$

$$Q_{10} = 0.6 \text{ CFS} \quad Q_{100} = 0.9 \text{ CFS}$$

Basin B16 (0.30 Acres)

Basin B16 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to grade through a drainage chase located on the west side of proposed Building into Basin B1. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B17 (0.30 Acres)

Basin B17 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to grade through a drainage chase located on the west side of proposed Building into Basin B2. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B18 (0.30 Acres)

Basin B18 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to grade through a drainage chase located on the west side of proposed Building into Basin B2. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B19 (0.30 Acres)

Basin B19 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to grade through a drainage chase located on the west side of proposed Building into Basin B3. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B20 (0.30 Acres)

Basin B20 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to grade through a drainage chase located on the west side of proposed Building into Basin B4. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B21 (0.30 Acres)

Basin B21 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to grade through a drainage chase located on the west side of proposed Building into Basin B5. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B22 (0.42 Acres)

Basin B22 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to the east side of proposed Building into Basin B8. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.8 \text{ CFS} \quad Q_{100} = 2.9 \text{ CFS}$$

Basin B23 (0.36 Acres)

Basin B23 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to the east side of proposed Building into Basin B9. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.6 \text{ CFS} \quad Q_{100} = 2.5 \text{ CFS}$$

Basin B24 (0.30 Acres)

Basin B24 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to the east side of proposed Building into Basin B10. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.0 \text{ CFS}$$

Basin B25 (0.30 Acres)

Basin B25 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to the east side of proposed Building into Basin B11. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.84$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B26 (0.30 Acres)

Basin B26 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to the east side of proposed Building into Basin B12. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B27 (0.30 Acres)

Basin B27 consists of a portion of the proposed roof. The slope of the rooftop is 2.5% and runoff will sheet flow to a roof drain. Runoff will then discharge to the east side of proposed Building into Basin B13. This Basin has an overall imperviousness of 90%.

$$C_{10} = 0.75 \quad C_{100} = 0.81$$

$$Q_{10} = 1.3 \text{ CFS} \quad Q_{100} = 2.1 \text{ CFS}$$

Basin B28 (0.06 Acres)

Basin B28 consists of a portion of the roadside ditch next to Monument Hill Road that is on site. The grades of this Basin generally slope between 4% to 15%. Runoff will sheet flow to roadside ditch where the concentrated flow will be conveyed under the north entrance to the south half of the roadside ditch via an 18" culvert at design point RC1. This Basin has an overall imperviousness of 0%. This Basin it not tributary to the proposed full spectrum pond. Water quality is not required for this basin because under exclusion I.7.1.B.7 the land is undeveloped and will remain undeveloped.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 0.0 \text{ CFS} \quad Q_{100} = 0.1 \text{ CFS}$$

Basin B29 (0.38 Acres)

Basin B29 consists of a portion of the roadside ditch next to Monument Hill Road and landscaping. The grades of this Basin generally slope between 4% to 33%. Runoff will sheet flow to the Monument Hill Road roadside ditch where the concentrated flow will be collected by the existing southwest 24" storm sewer at design point B. It will then be conveyed to the west side of I-25 via the existing storm sewer. This Basin has an overall imperviousness of 0%. This Basin is not tributary to the proposed full spectrum pond. Water quality is not required for this basin because under exclusion I.7.1.B.7 the land is undeveloped and will remain undeveloped.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 0.2 \text{ CFS} \quad Q_{100} = 0.8 \text{ CFS}$$

Basin B30 (0.61 Acres)

Basin B30 consists of the proposed full spectrum pond that include lawn and the gravel access road. The sides of the full spectrum pond will be 33% except for the access road that is a max of 10%. The runoff will sheet flow down to the trickle channel where the concentrated flow will then flow west to the outlet structure. This basin has an overall imperviousness of 3%.

$$C_{10} = 0.08 \quad C_{100} = 0.44$$

$$Q_{10} = 0.3 \text{ CFS} \quad Q_{100} = 1.9 \text{ CFS}$$

Basin B31 (0.02 Acres)

Basin B31 consists of road at the central entrance of the site along Monument Hill Road. The basin will drain northeast to southwest into the curb at the south side of the entrance. The concentrated gutter flow will then discharge into the road side ditch and flow to Design Point B. This basin has an overall imperviousness of 100%. This Basin is not tributary to the proposed full spectrum pond. Water quality is not required for this basin because under exclusion I.7.1.C.1 that allows for 20%, not to exceed 1 acre, of the development to not be captured for water quality.

$$C_{10} = 0.87 \quad C_{100} = 0.90$$

$$Q_{10} = 0.1 \text{ CFS} \quad Q_{100} = 0.1 \text{ CFS}$$

Basin OSB1 (0.08 Acres)

Basin OSB1 consists of lawn and field on the west edge of the Palmer Ridge School Site. The grades of this Basin generally slope between 6% to 8%. Runoff will sheet flow to the southwest onto the site and enter the curb and gutter in basin B10. Where the concentrated flow will be collected in a Triple Type 13 Inlet at Design Point 10 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 0%.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 0.1 \text{ CFS} \quad Q_{100} = 0.2 \text{ CFS}$$

Basin OSB2 (0.34 Acres)

Basin OSB2 consists of lawn, field, and a portion of the school's track on the west edge of the Palmer Ridge School Site. The grades of this Basin generally slope between 1% to 12%. Runoff will sheet flow to the west onto the site and enter the curb and gutter in basin B11. Where the concentrated flow will be collected in a 5' Type R Inlet at Design Point 11 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 0%.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 0.2 \text{ CFS} \quad Q_{100} = 0.8 \text{ CFS}$$

Basin OSB3 (0.78 Acres)

Basin OSB3 consists of lawn, field, and a portion of the school's track on the west edge of the Palmer Ridge School Site. The grades of this Basin generally slope between 1% to 25%. Runoff will sheet flow to the west onto the site and enter the curb and gutter in basin B12. Where the concentrated flow will be collected in a Triple Type 13 Combo Inlet at Design Point 12 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 0%.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 0.6 \text{ CFS} \quad Q_{100} = 1.9 \text{ CFS}$$

Basin OSB4 (1.88 Acres)

Basin OSB4 consists of lawn, field, and a portion of the school's track on the west edge of the Palmer Ridge School Site. The grades of this Basin generally slope between 1% to 25%. Runoff will sheet flow to the west onto the site and enter the curb and gutter in basin B13. Where the concentrated flow will be collected in a 10' Type R Inlet at Design Point 13 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 0%.

$$C_{10} = 0.15 \quad C_{100} = 0.35$$

$$Q_{10} = 1.1 \text{ CFS} \quad Q_{100} = 3.7 \text{ CFS}$$

Basin OSB5 (0.06 Acres)

Basin OSB5 consists of landscaping, parking lot, and drive aisle between the site and Case Camp Road to the southeast. The grades of this Basin generally slope between 3% to 7%. Runoff will sheet flow to the northwest onto the site and enter the curb and gutter in basin B15. Where the concentrated flow will be collected in a 5' Type R Inlet at Design Point 15 and conveyed to the proposed full spectrum pond via storm sewer. This Basin has an overall imperviousness of 71%.

$$C_{10} = 0.70 \quad C_{100} = 0.78$$

$$Q_{10} = 0.2 \text{ CFS} \quad Q_{100} = 0.4 \text{ CFS}$$

Basin OSB6 (0.21 Acres)

Basin OSB6 consists of a half section of Monument Hill Road and a portion of the roadside ditch to the west of the site. The grades of this Basin generally slope between 2% to 20%. Runoff will sheet flow to the southeast and enter the roadside ditch. Where the concentrated flow will be conveyed under the north entrance of the site to the south half of the roadside ditch, via an 18" culvert at Design Point RC1. This Basin has an overall imperviousness of 49%. This basin is not tributary to the proposed full spectrum pond.

$$C_{10} = 0.53 \quad C_{100} = 0.65$$

$$Q_{10} = 0.6 \text{ CFS} \quad Q_{100} = 1.0 \text{ CFS}$$

Basin OSB7 (0.05 Acres)

Basin OSB7 consists of a half section of Monument Hill Road and the north connection to the site. The grades of this Basin generally slope between 2% to 4%. Runoff will sheet flow to the southeast enter the site through the north entrance. The sheet flow will be collected in the curb and gutter in Basin B3. This Basin has an overall imperviousness of 100%.

$$C_{10} = 0.92 \quad C_{100} = 0.96$$

$$Q_{10} = 0.3 \text{ CFS} \quad Q_{100} = 0.4 \text{ CFS}$$

Basin OSB8 (0.47 Acres)

Basin OSB8 consists of a half section of Monument Hill Road and a portion of the roadside ditch to the west of the site. The grades of this Basin generally slope between 2% to 33%. Runoff will sheet flow to the southeast and enter the roadside ditch. Where the concentrated flow will be collected by the existing southwest 24" storm sewer at design point B. It will then be conveyed to the west side of I-25 via the existing storm sewer. This Basin has an overall imperviousness of 65%. This Basin it not tributary to the proposed full spectrum pond.

$$C_{10} = 0.65 \quad C_{100} = 0.75$$

$$Q_{10} = 1.6 \text{ CFS} \quad Q_{100} = 2.7 \text{ CFS}$$

The combined Basin B 100-year runoff of 54.14 cfs that discharges to the proposed full spectrum pond at Design Point O-1 and 1.31 cfs at Design Point O-2. Basins B28 and B29 combine with Basins OSB6 and OSB8 in the roadside ditch adjacent to Monument Hill Road to discharge into the existing 24" storm sewer at Design Point B. The previously mentioned basins have a combined 100-year runoff of 4.29 cfs that enters the roadside ditch without being routed through the full spectrum pond. This flow of 4.29 cfs then combines with the 100-year release from the full spectrum pond of 10.4 cfs and enters the 24" existing storm sewer at Design Point B. Since, the full spectrum pond delays the release on the 100-year event, the peak flow at Design Point B is 10.4 cfs.

Basin C1 (0.22 Acres):

Basin C1 represents the southwest edge of the site and includes the south entrance road. Basin C1 will sheet flow south to enter the Monument Hill Road roadside ditch that runs south from the site. This Basin has an overall imperviousness of 80%. Water quality is not required for this basin because under exclusion I.7.1.C.1 that allows for 20%, not to exceed 1 acres, of the development to not be captured for water quality.

$$C_{10} = 0.76 \quad C_{100} = 0.84$$

$$Q_{10} = 1.0 \text{ CFS} \quad Q_{100} = 1.6 \text{ CFS}$$

Basin C has a total 100-year runoff of 1.6 cfs that discharges to the existing roadside ditch next to Monument Hill Road without being routed through the proposed full spectrum pond.

Under exclusion I.7.1.B.7 the project is allowed to have 20%, not to exceed 1 acre of development to not be captured and treated for water quality. There are 5 on-site basin that are not captured and treated that sum to 0.77 acres. These basins are Basins A1, B28, B29, B31, and C1.

The proposed drainage design will decrease 100-year flows going to the existing storm sewer at Design Point A from 7.27 cfs to 3.51 cfs. With the restriction of the outflows from the proposed full spectrum pond, the 100-year flows at Design Point B will decrease from 15.26 cfs to 10.4 cfs. It will decrease the 100-year flows entering the roadside ditch next to Monument Hill Road at Design Point C from 6.02 cfs to 1.6 cfs. These values and calculations can be found in Appendix B in the Existing and Developed SF Form Tables. The proposed Site will not have an adverse impact on existing downstream conveyance systems.

Stormwater Detention and Water Quality Design

Runoff from the Site will surface flow and be piped to a full spectrum pond located near the southwest corner of the Site. The full spectrum pond has been sized using the MHFD-Detention_v4.06 spreadsheet to meet the El Paso County Drainage Criteria Manual Standards. The full spectrum pond has been sized to provide Water Quality Control Volume (WQCV), Excess Urban Runoff Volume (EURV) and 100-year flood protection for the developed Site. The full spectrum pond has been sized for 11.4 acres with a watershed imperviousness of 77%. The area that is tributary to the pond is 10.98 acres however, 11.4 acres was used to size the pond to over detain stormwater on the site. This was done offset the stormwater that is not being detained on-site. The full spectrum pond is approximately 80 feet by 230 feet in size. Runoff enters the full spectrum pond via a forebay at the east end of the pond, Forebay O-1, and an 18" FES at about the midpoint of the south side of the pond, Design Point O-2. Forebay O-1 notch was calculated at 5.7 inches wide to release at 1.08 cfs. The calculation for Forebay O-1 were made using the UD-BMP v3.07 from Mile High Flood District. The required WQCV is 0.294 ac-ft. The micropool water surface elevation and outlet pipe are at a water surface elevation of 7134.23. The WQCV provided is 0.294 ac-ft at an elevation of 7137.55. The WQCV is drained through an orifice plate that has four 1-1/4" diameter with

23" between the bottom two holes and 15" spacing for the top two holes. The 99% drain time for the WQCV is 40 hours. The EURV storage provided by the full spectrum pond is 0.675 ac-ft at an elevation of 7140.11. The EURV will be drained from the full spectrum pond through the same orifice plate as the WQCV. In the 100-year storm event, runoff overtops the overflow weir and is released through an 18" storm sewer with a restrictor plate. The restrictor plate will be 8.5 inches above the invert of the 18" pipe. An additional 0.518 ac-ft volume is provided in the full spectrum pond for the release of the 100-year runoff. The 100-year runoff will pond to an elevation of 7141.64 and will discharge at a maximum of 10.4 cfs into the roadside ditch next to Monument Hill Road. The 99% drain time of the 100-year volume is 76 hours. A concrete emergency spillway is provided on the west side of the full spectrum pond. The spillway crest length is 20 feet with an invert elevation of 7142.00. The spillway end slopes are 5H:1V. The emergency spillway discharges into the roadside ditch next to Monument Hill Road. The spillway was over sized to allow the flows from offsite to be bypassed over the spillway in the 100-year event. The full spectrum pond calculations are included in Appendix C.

A 15' wide maintenance access road is provided to the outlet structure of the proposed full spectrum pond.

The County of El Paso requires the UDFCD Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the WQCV, stabilizing drainageways, and implementing long-term source controls. The four steps and how they are implemented into the proposed design is below:

- 1) Step one is Employ Runoff Reduction Practices.
 - The existing roadside ditch on the west side of the site are being conserved and landscaping islands are being used. With the grades on site, there are no more opportunities to implement Runoff Reduction Practices.
- 2) Step two is Stabilize Drainage Ways.
 - No stream is located within the vicinity of this project so step three does not apply. Stormwater runoff from the Site is being provided water quality treatment and discharged into a storm sewer system rather than flowing directly into the Monument Hill Road roadside ditch. The Monument Hill Road roadside ditch is located on the west property line. This project will benefit the Monument Hill Road roadside ditch by reducing the amount of sediment tributary to the ditch from the Site and by improving the embankment and running slope of the ditch.
- 3) Step three is Provide a Water Quality Capture Volume.
 - Water Quality Capture Volume is provided in the full spectrum pond and is released over a period of 40 hours. Which lowers the peak flow at the existing storm sewer in the Monument Hill Road roadside ditch.
- 4) Step four is Identify Best Management Practices to be used to control industrial and commercial pollutants.

- All parking, driving aisle, and loading docks drain to the proposed storm sewer system and are discharged into the full spectrum pond. This will remove pollutants from the commercial runoff.

Drainage Fees

The Site will require \$23,078 per Impervious Acre for the 2023 Drainage Fee and an additional \$1,262 per Impervious Acre for the 2023 Bridge Fee. With 10.16 acres of impervious area, the Site will require a Drainage Fee of \$247,294.40.

\$23,078 per Impervious Acre = \$23,078*10.16 = \$234,472.48

\$1,262 per Impervious Acre = \$1,262*10.16 = \$12,821.92

\$12,821.92+\$234,472.48 = \$247,294.40

Include calculation/description of how 10.16 acres of impervious area was determined.

Erosion Control Plan

A Grading and Erosion Control Plan will be submitted to the County for review and approval prior to construction.

This line can be deleted as bridge and drainage fees are always kept separate.

Construction Cost Estimate

Storm sewer and water quality are required for the Site. All drainage and detention facilities are private and non-reimbursable. The storm infrastructure includes RCP storm sewer, inlets and manholes. The full spectrum pond includes an outlet structure and spillway. Below is a cost estimate for the private storm facilities and the full spectrum pond.

	QUANTITY	UNIT	UNIT PRICE	TOTAL COST
Strom Sewer				
18" RCP (0-8' depth)	1,150	LF	\$50.00	\$57,500
24" RCP (0-8' depth)	1,150	LF	\$65.00	\$74,750
36" RCP (0-8' depth)	654	LF	\$100.00	\$65,400
5' Dia. Manhole	20	EA	\$4,500.00	\$90,000
5' Type 'R' Inlet	2	EA	\$4,750.00	\$9,500
6' Dia. Manhole	2	EA	\$6,000.00	\$12,000
10' Type 'R' Inlet	1	EA	\$6,500.00	\$6,500
18" Flared End Section	4	EA	\$1,350.00	\$5,400
Type '13' Inlet	22	EA	\$3,500.00	\$77,000
Type 'VL' Rip Rap	1,270	CY	\$110.00	\$139,700
Type 'VH' Rip Rap - Spillway	2,400	CY	\$100.00	\$240,000
Concrete Drainage Pan	1,255	LF	\$5.00	\$6,275
Cutoff Wall - Spillway	10	CY	\$1,250.00	\$12,500
Pond Gravel Access Road	4,385	SY	\$10.00	\$43,850
Forebay (36"-42" Inlet)	1	EA	\$15,000.00	\$15,000
Pond Outlet Structure	1	EA	\$15,000.00	\$15,000
Trickle Channel	200	LF	\$90.00	\$18,000
			Subtotal	\$888,375
			15% Contingency	\$133,256
			TOTAL COST	\$1,021,631

Other Government Agency Requirements

The proposed drainage improvements on The Rock Commerce Center will not require any other agency approval. It is not with the FEMA floodplain so will not require further review or floodplain map revisions. The full spectrum pond's spillway will not need review by the State Engineer's office since it is less than 10' in height at the centerline of the spillway

Conclusion

The proposed drainage improvements on The Rock Commerce Center will have no adverse effects to the surrounding properties, downstream storm conveyance system, or regional drainage facilities. The Site was designed in compliance with the El Paso County Stormwater Criteria. The Site development proposed is in conformance with the approved land use and zoning. This Report and its findings are in conformance with all pertinent studies related to this site. The existing roadside ditches along Monument Hill Road are in stable condition currently. The existing ditch will require new erosion control measures during and post construction. This project will require the regrading of the road side ditches so their current state will be improved. The two culverts under I-25 currently have permanent inlet protection and new permanent inlet protection is being installed with the public improvement plans submitted with this project. The existing culverts will also be receiving less flow than in the current conditions and the flow capacity calculations are included in Appendix B of this Report.

References

REFERENCES

1. *Drainage Criteria Manual Volumes 1 & 2, El Paso County. October 2018.*
2. *Mile High and Flood District, Denver, Colorado, Urban Storm Drainage Criteria Manual, Volume 1-3, latest online addition.*
3. *The El Paso County Drainage Basin Map (DBMP), El Paso County Board of Commissioners, 2005*
4. *Final Drainage Report for Palmer Ridge High School, Monument, Colorado, Tetra Tech, July 3, 2007*

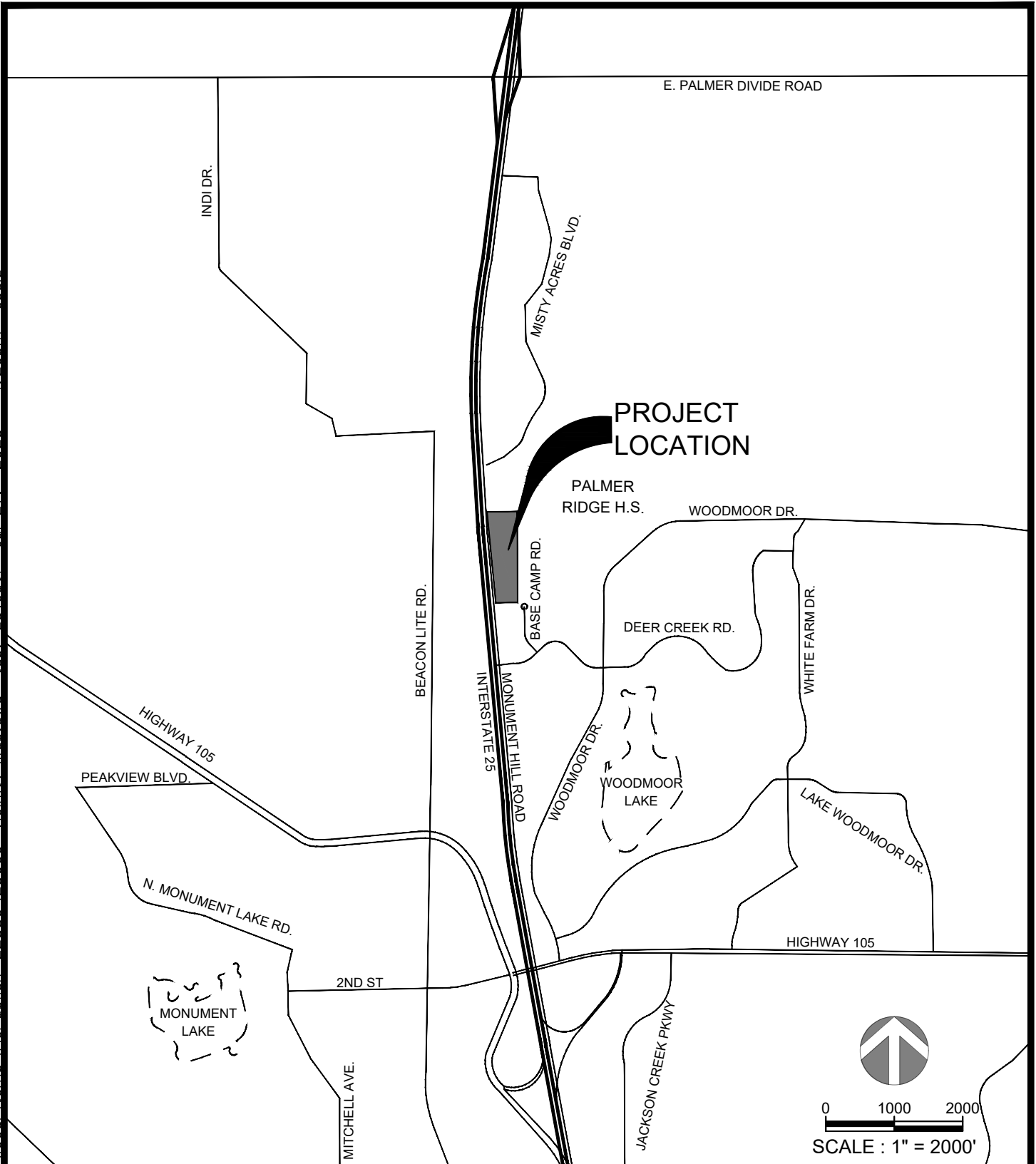


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Appendix A - Vicinity Map, FIRM Map, Soils Map

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THE ROCK LOT 1 FILING NO. 1

VICINTY MAP EXHIBIT

15 YEARS **Redland**
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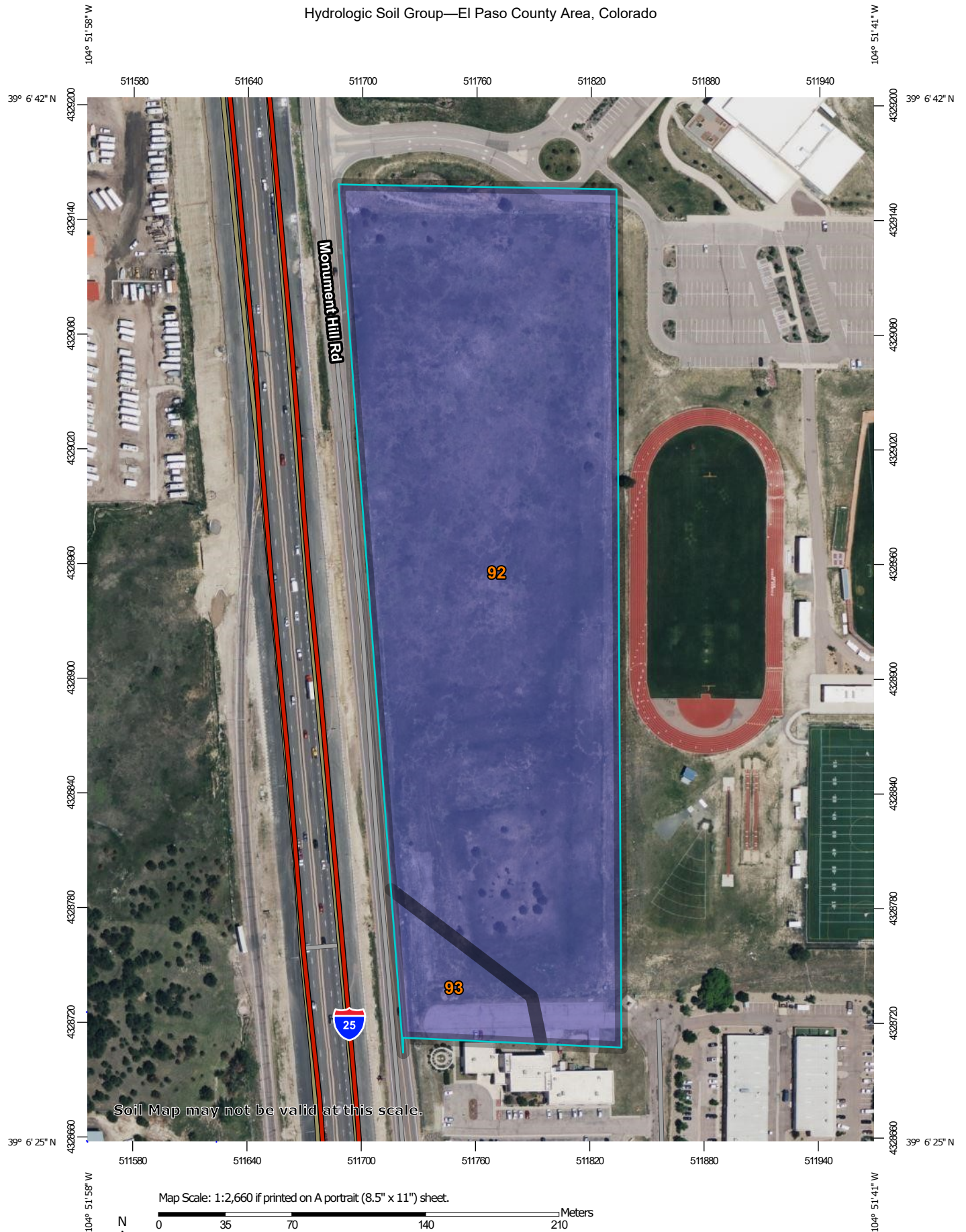
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DATE: 07/28/2023

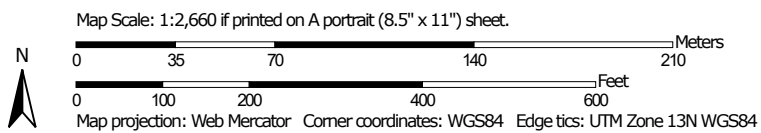
DRAWING NO:

1 OF 1

Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

6/12/2023
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	13.6	93.8%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	0.9	6.2%
Totals for Area of Interest			14.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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

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

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

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

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix B - Hydrologic Calculation



STANDARD FORM SF-1 - UNDEVELOPED RUNOFF COEFFICIENTS

PROJECT NAME: The Rock Commerce Center
PROJECT NUMBER: 23009
CALCULATED BY: CJS
CHECKED BY: MC

DATE: 10/19/2023
JURISDICTION: El Paso

LAND USE:	Drive/Walk	Roof	Lawn	Undeveloped Land	Gravel Road
IMPERVIOUSNESS	100%	90%	0%	2%	40%
C10 VALUES	0.92	0.75	0.15	0.17	0.63
C100 VALUES	0.96	0.81	0.35	0.36	0.7

NRCS SOIL TYPE: TYPE B

OVERALL SITE STUDY AREA

DESIGN BASIN	DESIGN POINT	Drive/Walk (AC)	Roof (AC)	Lawn (AC)	Undeveloped Land (AC)	Gravel Road (AC)	TOTAL AREA (AC)	C _d (10)	C _d (100)	Imp (%)
A1	A	0.00	0.00	0.00	2.35	0.00	2.35	0.17	0.36	2%
OSA1	A	0.40	0.00	0.00	0.35	0.00	0.75	0.57	0.68	54%
BASIN A		0.40			2.71		3.10			14%
		12.7%			87.3%		100.0%			
B1	B	0.00	0.00	0.00	7.40	0.00	7.40	0.17	0.36	2%
OSB1	B	0.00	0.00	0.00	1.14	0.00	1.14	0.17	0.36	2%
OSB2	B	0.38	0.00	0.00	0.38	0.00	0.76	0.55	0.66	51%
BASIN B		0.38			8.92		9.29			6%
		4.1%			95.9%		100.0%			
C1	C	0.00	0.00	0.00	1.86	0.00	1.86	0.17	0.36	2%
OSC1	C	0.00	0.00	0.00	1.91	0.00	1.91	0.17	0.36	2%
BASIN C					3.77		3.77			2%
					100.0%		100.0%			



STANDARD FORM SF-2 - UNDEVELOPED
TIME OF CONCENTRATION

PROJECT NAME: The Rock Commerce Center
PROJECT NUMBER: 23009
CALCULATED BY: CJS
CHECKED BY: MC

DATE: 10/16/2023
JURISDICTION: El Paso

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)						t _c CHECK (URBANIZED BASINS)			FINAL T _c	RUNOFF COEFFICIENT	
DESIGN BASIN (1)	AREA (AC) (2)	C ₁₀ (3)	LENGTH* (FT) (4)	SLOPE (%) (5)	T _i (MINUTES) (6)	LENGTH (FT) (7)	SLOPE (%) (8)	C _v (9)	Land Surface (10)	VEL (FPS) (11)	T _t (MINUTES) (12)	COMP. t _c (13)	TOTAL LENGTH (14)	REGIONAL t _c (15)	Min. t _c	C ₁₀	C ₁₀₀
A1	2.35	0.17	110	5.0%	10	445	5.0%	5.0	Tillage/Field	1.1	6.6	17.1	555	25.9	17.1	0.17	0.36
OSA1	0.75	0.57	128	3.5%	7.3	192	4.3%	5.0	Tillage/Field	1.0	3.1	10.4	320	17.0	10.4	0.57	0.68
B1	7.40	0.17	197	4.0%	15.1	962	4.4%	5.0	Tillage/Field	1.0	15.3	30.4	1159	26.3	26.3	0.17	0.36
OSB1	1.14	0.17	85	2.0%	12.5	104	16.0%	5.0	Tillage/Field	2.0	0.9	13.3	189	25.7	13.3	0.17	0.36
OSB2	0.76	0.55	100	2.0%	8.1	750	4.1%	5.0	Tillage/Field	1.0	12.3	20.4	850	17.8	17.8	0.55	0.66
C1	1.86	0.17	155	5.0%	12.4	385	3.3%	5.0	Tillage/Field	0.9	7.1	19.5	540	25.9	19.5	0.17	0.36
OSC1	1.91	0.17	165	1.0%	21.9	210	7.0%	5.0	Tillage/Field	1.3	2.6	24.5	375	25.8	24.5	0.17	0.36



STANDARD FORM SF-3 - UNDEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 10 YEAR EVENT

PROJECT NAME: The Rock Commerce Center
 PROJECT NUMBER: 23009
 CALCULATED BY: CJS
 CHECKED BY: MC

P_1 (1-Hour Rainfall) = 1.75

DATE: 10/16/2023
 JURISDICTION: El Paso

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{10}	t_c (minutes)	$C*A$ (ac)	I (in/hr)	Q (cfs)	t_c (minutes)	$S(C*A)$ (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t_t (minutes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
	A	A1	2.4	0.17	17.1	0.4	3.73	1.5	17.09	0.82	3.73	3.07								
	A	OSA1	0.7	0.57	10.4	0.4	4.66	2.0	17.09	0.82	3.73	3.07								
	B	B1	7.4	0.17	26.3	1.3	2.97	3.7	26.27	1.86	2.97	5.53								
	B	OSB1	1.1	0.17	13.3	0.2	4.19	0.8	26.27	1.86	2.97	5.53								
	B	OSB2	0.8	0.55	17.8	0.4	3.66	1.5	26.27	1.86	2.97	5.53								
	C	C1	1.9	0.17	19.5	0.3	3.49	1.1	24.55	0.64	3.08	1.97								
	C	OSC1	1.9	0.17	24.5	0.3	3.08	1.0	24.55	0.64	3.08	1.97								



STANDARD FORM SF-3 - UNDEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: The Rock Commerce Center
PROJECT NUMBER: 23009
CALCULATED BY: CJS
CHECKED BY: MC

P_1 (1-Hour Rainfall) = 2.52

DATE: 10/16/2023
JURISDICTION: El Paso

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t _t (minutes)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	A	A1	2.4	0.36	17.1	0.8	5.37	4.6	17.09	1.35	5.37	7.27									
	A	OSA1	0.7	0.68	10.4	0.5	6.71	3.4	17.09	1.35	5.37	7.27									
	B	B1	7.4	0.36	26.3	2.7	4.27	11.4	26.27	3.57	4.27	15.26									
	B	OSB1	1.1	0.36	13.3	0.4	6.04	2.5	26.27	3.57	4.27	15.26									
	B	OSB2	0.8	0.66	17.8	0.5	5.27	2.6	26.27	3.57	4.27	15.26									
	C	C1	1.9	0.36	19.5	0.7	5.03	3.4	24.55	1.36	4.44	6.02									
	C	OSC1	1.9	0.36	24.5	0.7	4.44	3.0	24.55	1.36	4.44	6.02									

BASIN SUMMARY - UNDEVELOPED



PROJECT NAME: The Rock Commerce Center DATE: 10/16/2023
 PROJECT NUMBER: 23009.000 JURISDICTION: El Paso
 CALCULATED BY: CJS
 CHECKED BY: MC

Basin Summary Table

Basin	Area (AC)	Runoff Coefficients		I (%)	Peak Flows (cfs)	
		C ₁₀	C ₁₀₀		Q ₁₀	Q ₁₀₀
A1	2.35	0.17	0.36	2%	1.5	4.6
OSA1	0.75	0.57	0.68	54%	2.0	3.4
B1	7.40	0.17	0.36	2%	3.7	11.4
OSB1	1.14	0.17	0.36	2%	0.8	2.5
OSB2	0.76	0.41	0.66	51%	1.5	2.6
C1	1.86	0.17	0.36	2%	1.1	3.4
OSC1	1.91	0.17	0.36	2%	1.0	3.0



STANDARD FORM SF-1 - DEVELOPED RUNOFF COEFFICIENTS

PROJECT NAME: The Rock Commerce Center
PROJECT NUMBER: 23009
CALCULATED BY: CJS
CHECKED BY: MC

DATE: 10/19/2023
JURISDICTION: El Paso

LAND USE:	Drive/Walk	Roof	Lawn	Undeveloped Land	Gravel Road
IMPERVIOUSNESS	100%	90%	0%	2%	40%
C10 VALUES	0.92	0.75	0.15	0.17	0.63
C100 VALUES	0.96	0.81	0.35	0.36	0.7

NRCS SOIL TYPE: TYPE B

OVERALL SITE STUDY AREA

DESIGN BASIN	DESIGN POINT	Drive/Walk (AC)	Roof (AC)	Lawn (AC)	Undeveloped Land (AC)	Gravel Road (AC)	TOTAL AREA (AC)	C _d (10)	C _d (100)	Imp (%)
B16	1	0.00	0.30	0.00			0.30	0.75	0.81	90%
B1	1	0.34	0.00	0.19			0.53	0.64	0.74	64%
B17	2	0.00	0.30	0.00			0.30	0.75	0.81	90%
B18	2	0.00	0.30	0.00			0.30	0.75	0.81	90%
B2	2	0.35	0.00	0.13			0.48	0.71	0.80	73%
B19	3	0.00	0.30	0.00			0.30	0.75	0.81	90%
B3	3	0.29	0.00	0.02			0.30	0.88	0.93	95%
B20	4	0.00	0.30	0.00			0.30	0.75	0.81	90%
B4	4	0.19	0.00	0.00			0.19	0.92	0.96	100%
B21	5	0.00	0.30	0.00			0.30	0.75	0.81	90%
B5	5	0.33	0.00	0.07			0.40	0.78	0.85	82%
B27	13	0.00	0.30	0.00			0.30	0.75	0.81	90%
B7	7	0.23	0.00	0.17			0.40	0.60	0.70	58%
B6	6	0.21	0.00	0.10			0.31	0.68	0.77	68%
B8	8	0.67	0.00	0.31			0.98	0.68	0.77	68%
B22	8	0.00	0.42	0.00			0.42	0.75	0.81	90%
B9	9	0.42	0.00	0.17			0.59	0.70	0.78	71%
B23	9	0.00	0.36	0.00			0.36	0.75	0.81	90%
B24	10	0.00	0.30	0.00			0.30	0.75	0.81	90%
B10	10	0.56	0.00	0.12			0.67	0.79	0.85	83%
B25	11	0.00	0.30	0.00			0.30	0.75	0.81	90%
B26	12	0.00	0.30	0.00			0.30	0.75	0.81	90%
B11	11	0.27	0.00	0.09			0.37	0.72	0.80	74%
B12	12	0.66	0.00	0.08			0.75	0.83	0.89	89%
B13	13	0.35	0.00	0.08			0.43	0.77	0.84	81%
B14	14	0.07	0.00	0.01			0.08	0.82	0.88	87%
B15	15	0.11	0.00	0.00			0.11	0.90	0.94	97%
C1	C	0.18	0.00	0.05			0.22	0.76	0.84	80%
A1	A	0.00	0.00	0.09			0.09	0.15	0.35	0%



STANDARD FORM SF-1 - DEVELOPED RUNOFF COEFFICIENTS

PROJECT NAME: The Rock Commerce Center

DATE: 10/19/2023

PROJECT NUMBER: 23009

JURISDICTION: El Paso

CALCULATED BY: CJS

CHECKED BY: MC

B28	RC1	0.00	0.00	0.06			0.06	0.15	0.35	0%
B29	B	0.00	0.00	0.36			0.36	0.15	0.35	0%
OSB1	10	0.00	0.00	0.08			0.08	0.15	0.35	0%
OSB2	11	0.00	0.00	0.34			0.34	0.15	0.35	0%
OSB3	12	0.00	0.00	0.78			0.78	0.15	0.35	0%
OSB4	13	0.00	0.00	1.88			1.88	0.15	0.35	0%
OSA1	A	0.45	0.00	0.26			0.71	0.64	0.74	63%
OSB6	RC1	0.10	0.00	0.11			0.21	0.53	0.65	49%
OSB7	4	0.05	0.00	0.00			0.05	0.92	0.96	100%
OSB8	B	0.31	0.00	0.16			0.47	0.65	0.75	65%
OSB5	15	0.04	0.00	0.02			0.06	0.70	0.78	71%
B30	16	0.00	0.00	0.56		0.05	0.61	0.08	0.44	3%
B31	B	0.02					0.02	0.87	0.90	100%



STANDARD FORM SF-2 - DEVELOPED TIME OF CONCENTRATION

PROJECT NAME: The Rock Commerce Center
PROJECT NUMBER: 23009
CALCULATED BY: CJS
CHECKED BY: MC

DATE: 10/16/2023
JURISDICTION: El Paso

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)						t _c CHECK (URBANIZED BASINS)			FINAL T _c	RUNOFF COEFFICIENT	
DESIGN BASIN (1)	AREA (AC) (2)	C ₁₀ (3)	LENGTH* (FT) (4)	SLOPE (%) (5)	T _i (MINUTES) (6)	LENGTH (FT) (7)	SLOPE (%) (8)	C _v (9)	Land Surface (10)	VEL (FPS) (11)	T _t (MINUTES) (12)	COMP. t _c (13)	TOTAL LENGTH (14)	REGIONAL t _c (15)	Min. t _c	C ₁₀	C ₁₀₀
B16	0.30	0.75	50	2.5%	3	210	2.5%	20.0	Paved Areas	3.2	1.1	4.5	260	10.9	5.0	0.75	0.81
B1	0.53	0.64	77	30.0%	2.4	228	0.8%	20.0	Paved Areas	1.7	2.2	4.6	305	15.4	5.0	0.64	0.74
B17	0.30	0.75	100	2.5%	4.7	200	2.0%	20.0	Paved Areas	2.8	1.2	5.9	300	10.9	5.9	0.75	0.81
B18	0.30	0.75	50	2.5%	3.3	210	2.5%	20.0	Paved Areas	3.2	1.1	4.5	260	10.9	5.0	0.75	0.81
B2	0.48	0.71	70	5.0%	3.5	189	75.0%	20.0	Paved Areas	17.3	0.2	3.6	259	13.6	5.0	0.71	0.80
B19	0.30	0.75	50	2.5%	3.3	375	1.5%	20.0	Paved Areas	2.4	2.6	5.9	425	11.1	5.9	0.75	0.81
B3	0.30	0.88	40	2.5%	1.9	230	1.0%	20.0	Paved Areas	2.0	1.9	3.8	270	10.2	5.0	0.88	0.93
B20	0.30	0.75	50	2.5%	3.3	210	2.5%	20.0	Paved Areas	3.2	1.1	4.5	260	10.9	5.0	0.75	0.81
B4	0.19	0.92	65	3.0%	1.8	115	1.0%	20.0	Paved Areas	2.0	1.0	2.8	180	9.1	5.0	0.92	0.96
B21	0.30	0.75	50	2.5%	3.3	265	2.5%	20.0	Paved Areas	3.2	1.4	4.7	315	10.9	5.0	0.75	0.81
B5	0.40	0.78	60	3.0%	3.1	275	3.5%	20.0	Paved Areas	3.7	1.2	4.4	335	12.2	5.0	0.78	0.85
B27	0.30	0.75	50	2.5%	3.3	300	2.5%	20.0	Paved Areas	3.2	1.6	4.9	350	10.9	5.0	0.75	0.81
B7	0.40	0.60	90	30.0%	2.8	45	1.0%	20.0	Paved Areas	2.0	0.4	3.2	135	16.2	5.0	0.60	0.70
B6	0.31	0.68	90	25.0%	2.5	66	1.0%	20.0	Paved Areas	2.0	0.6	3.1	156	14.5	5.0	0.68	0.77
B8	0.98	0.68	65	33.0%	2.0	324	2.5%	20.0	Paved Areas	3.2	1.7	3.7	389	14.6	5.0	0.68	0.77
B22	0.42	0.75	75	2.0%	4.4	120	2.0%	20.0	Paved Areas	2.8	0.7	5.1	195	10.8	5.1	0.75	0.81
B9	0.59	0.70	100	18.0%	2.8	175	1.2%	20.0	Paved Areas	2.2	1.3	4.2	275	14.1	5.0	0.70	0.78
B23	0.36	0.75	50	2.5%	3.3	250	2.0%	20.0	Paved Areas	2.8	1.5	4.8	300	10.9	5.0	0.75	0.81
B24	0.30	0.75	50	2.5%	3.3	200	0.5%	20.0	Paved Areas	1.4	2.4	5.7	250	11.0	5.7	0.75	0.81
B10	0.67	0.79	100	18.0%	2.2	250	0.5%	20.0	Paved Areas	1.4	2.9	5.1	350	12.4	5.1	0.79	0.85



STANDARD FORM SF-2 - DEVELOPED TIME OF CONCENTRATION

PROJECT NAME: The Rock Commerce Center
PROJECT NUMBER: 23009
CALCULATED BY: CJS
CHECKED BY: MC

DATE: 10/16/2023
JURISDICTION: El Paso

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)						t _c CHECK (URBANIZED BASINS)			FINAL T _c	RUNOFF COEFFICIENT	
DESIGN BASIN (1)	AREA (AC) (2)	C ₁₀ (3)	LENGTH* (FT) (4)	SLOPE (%) (5)	T _i (MINUTES) (6)	LENGTH (FT) (7)	SLOPE (%) (8)	C _v (9)	Land Surface (10)	VEL (FPS) (11)	T _t (MINUTES) (12)	COMP. t _c (13)	TOTAL LENGTH (14)	REGIONAL t _c (15)	Min. t _c	C ₁₀	C ₁₀₀
B25	0.30	0.75	50	2.5%	3.3	120	2.5%	20.0	Paved Areas	3.2	0.6	4.0	170	10.8	5.0	0.75	0.81
B26	0.30	0.75	50	2.5%	3.3	280	2.5%	20.0	Paved Areas	3.2	1.5	4.8	330	10.9	5.0	0.75	0.81
B11	0.37	0.72	100	6.5%	3.7	10	1.0%	20.0	Paved Areas	2.0	0.1	3.8	110	13.4	5.0	0.72	0.80
B12	0.75	0.83	100	3.0%	3.4	290	1.7%	20.0	Paved Areas	2.6	1.9	5.2	390	11.2	5.2	0.83	0.89
B13	0.43	0.77	100	3.0%	4.2	175	4.0%	20.0	Paved Areas	4.0	0.7	4.9	275	12.4	5.0	0.77	0.84
B14	0.08	0.82	85	7.0%	2.5	47	4.2%	20.0	Paved Areas	4.1	0.2	2.6	132	11.2	5.0	0.82	0.88
B15	0.11	0.90	70	3.0%	2.2	70	4.0%	20.0	Paved Areas	4.0	0.3	2.5	140	9.6	5.0	0.90	0.94
C1	0.22	0.76	50	2.5%	3.2	125	2.0%	20.0	Paved Areas	2.8	0.7	4.0	175	12.6	5.0	0.76	0.84
A1	0.09	0.15	60	3.3%	9.0	215	3.0%	7.0	Short Pasture/Lawn	1.2	3.0	12.0	275	26.2	12.0	0.15	0.35
B28	0.06	0.15	40	5.0%	6.4	200	7.5%	7.0	Short Pasture/Lawn	1.9	1.7	8.2	240	26.1	8.2	0.15	0.35
B29	0.36	0.15	40	5.0%	6.4	470	4.0%	7.0	Short Pasture/Lawn	1.4	5.6	12.0	510	26.3	12.0	0.15	0.35
OSB1	0.08	0.15	75	7.4%	7.7	180	4.0%	20.0	Paved Areas	4.0	0.8	8.5	255	26.1	8.5	0.15	0.35
OSB2	0.34	0.15	100	3.9%	11.1	165	3.5%	20.0	Paved Areas	3.7	0.7	11.8	265	26.1	11.8	0.15	0.35
OSB3	0.78	0.15	100	7.2%	9.0	230	10.9%	20.0	Paved Areas	6.6	0.6	9.6	330	26.1	9.6	0.15	0.35
OSB4	1.88	0.15	100	2.3%	13.2	350	14.3%	7.0	Short Pasture/Lawn	2.6	2.2	15.4	450	26.1	15.4	0.15	0.35
OSA1	0.71	0.64	100	2.5%	6.2	250	3.5%	20.0	Paved Areas	3.7	1.1	7.3	350	15.4	7.3	0.64	0.74
OSB6	0.21	0.53	75	2.5%	6.7	200	7.5%	20.0	Paved Areas	5.5	0.6	7.3	275	17.7	7.3	0.53	0.65
OSB7	0.05	0.92	84	4.0%	1.9	0	1.0%	20.0	Paved Areas	2.0	0.0	1.9	84	9.0	5.0	0.92	0.96
OSB8	0.47	0.65	90	2.5%	5.7	470	4.0%	20.0	Paved Areas	4.0	2.0	7.7	560	15.2	7.7	0.65	0.75
OSB5	0.06	0.70	60	7.0%	3.0	120	1.0%	20.0	Paved Areas	2.0	1.0	4.0	180	14.0	5.0	0.70	0.78



STANDARD FORM SF-2 - DEVELOPED TIME OF CONCENTRATION

PROJECT NAME: The Rock Commerce Center
 PROJECT NUMBER: 23009
 CALCULATED BY: CJS
 CHECKED BY: MC

DATE: 10/16/2023
 JURISDICTION: El Paso

SUB-BASIN DATA			INITIAL TIME (T _i)			TRAVEL TIME (T _t)						t _c CHECK (URBANIZED BASINS)			FINAL T _c	RUNOFF COEFFICIENT	
DESIGN BASIN (1)	AREA (AC) (2)	C ₁₀ (3)	LENGTH* (FT) (4)	SLOPE (%) (5)	T _i (MINUTES) (6)	LENGTH (FT) (7)	SLOPE (%) (8)	C _v (9)	Land Surface (10)	VEL (FPS) (11)	T _t (MINUTES) (12)	COMP. t _c (13)	TOTAL LENGTH (14)	REGIONAL t _c (15)	Min. t _c	C ₁₀	C ₁₀₀
B30	0.61	0.08	50	33.0%	4.1	200	1.0%	7.0	Short Pasture/Lawn	0.7	4.8	8.9	250	25.7	8.9	0.08	0.44
B31	0.02	0.87	100	7.0%	2.2	475	4.6%	7.0	Short Pasture/Lawn	1.5	5.3	7.5	575	9.3	7.5	0.87	0.90



STANDARD FORM SF-3 - DEVELOPED

STORM DRAINAGE DESIGN - RATIONAL METHOD 10 YEAR EVENT

PROJECT NAME: The Rock Commerce Center
 PROJECT NUMBER: 23009
 CALCULATED BY: CJS
 CHECKED BY: MC

P₁ (1-Hour Rainfall) = 1.75

DATE: 10/16/2023
 JURISDICTION: El Paso

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME				REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t _t (minutes)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
	1	B16	0.3	0.75	5.0	0.2	5.94	1.3	5.00	0.56	5.94	3.35										
	1	B1	0.5	0.64	5.0	0.3	5.94	2.0	5.00	0.56	5.94	3.35										
	2	B17	0.3	0.75	5.9	0.2	5.67	1.3	5.91	0.79	5.67	4.46										
	2	B18	0.3	0.75	5.0	0.2	5.94	1.3	5.91	0.79	5.67	4.46										
	2	B2	0.5	0.71	5.0	0.3	5.94	2.0	5.91	0.79	5.67	4.46										
	3	B19	0.3	0.75	5.9	0.2	5.67	1.3	5.89	0.49	5.67	2.78										
	3	B3	0.3	0.88	5.0	0.3	5.94	1.6	5.89	0.49	5.67	2.78										
	4	B20	0.3	0.75	5.0	0.2	5.94	1.3	5.00	0.44	5.94	2.63										
	4	B4	0.2	0.92	5.0	0.2	5.94	1.0	5.00	0.44	5.94	2.63										
	5	B21	0.3	0.75	5.0	0.2	5.94	1.3	5.00	0.54	5.94	3.19										
	5	B5	0.4	0.78	5.0	0.3	5.94	1.8	5.00	0.54	5.94	3.19										
	13	B27	0.3	0.75	5.0	0.2	5.94	1.3	15.40	0.84	3.92	3.30										
	7	B7	0.4	0.60	5.0	0.2	5.94	1.4	5.00	0.24	5.94	1.40										
	6	B6	0.3	0.68	5.0	0.2	5.94	1.2	5.00	0.21	5.94	1.24										
	8	B8	1.0	0.68	5.0	0.7	5.94	3.9	5.12	0.98	5.90	5.76										
	8	B22	0.4	0.75	5.1	0.3	5.90	1.8	5.12	0.98	5.90	5.76										
	9	B9	0.6	0.70	5.0	0.4	5.94	2.4	5.00	0.68	5.94	4.03										
	9	B23	0.4	0.75	5.0	0.3	5.94	1.6	5.00	0.68	5.94	4.03										
	10	B24	0.3	0.75	5.7	0.2	5.73	1.3	8.49	0.76	5.04	3.85										
	10	B10	0.7	0.79	5.1	0.5	5.89	3.1	8.49	0.76	5.04	3.85										



STANDARD FORM SF-3 - DEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 10 YEAR EVENT

PROJECT NAME: The Rock Commerce Center

DATE: 10/16/2023

PROJECT NUMBER: 23009

P₁ (1-Hour Rainfall) = 1.75

JURISDICTION: El Paso

CALCULATED BY: CJS

CHECKED BY: MC

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t _t (minutes)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	11	B25	0.3	0.75	5.0	0.2	5.94	1.3	11.80	0.54	4.42	2.39									
	12	B26	0.3	0.75	5.0	0.2	5.94	1.3	9.60	0.96	4.81	4.63									
	11	B11	0.4	0.72	5.0	0.3	5.94	1.6	11.80	0.54	4.42	2.39									
	12	B12	0.7	0.83	5.2	0.6	5.86	3.6	9.60	0.96	4.81	4.63									
	13	B13	0.4	0.77	5.0	0.3	5.94	2.0	15.40	0.84	3.92	3.30									
	14	B14	0.1	0.82	5.0	0.1	5.94	0.4	5.00	0.06	5.94	0.38									
	15	B15	0.1	0.90	5.0	0.1	5.94	0.6	5.00	0.14	5.94	0.85									
	C	C1	0.2	0.76	5.0	0.2	5.94	1.0	5.00	0.17	5.94	1.01									
	A	A1	0.1	0.15	12.0	0.0	4.39	0.1	11.99	0.47	4.39	2.05									
	RC1	B28	0.1	0.15	8.2	0.0	5.10	0.0	8.18	0.12	5.10	0.61									
	B	B29	0.4	0.15	12.0	0.1	4.39	0.2	12.04	0.38	4.39	1.66									
	10	OSB1	0.1	0.15	8.5	0.0	5.04	0.1	8.49	0.76	5.04	3.85									
	11	OSB2	0.3	0.15	11.8	0.1	4.42	0.2	11.80	0.54	4.42	2.39									
	12	OSB3	0.8	0.15	9.6	0.1	4.81	0.6	9.60	0.96	4.81	4.63									
	13	OSB4	1.9	0.15	15.4	0.3	3.92	1.1	15.40	0.84	3.92	3.30									
	A	OSA1	0.7	0.64	7.3	0.5	5.29	2.4	11.99	0.47	4.39	2.05									
	RC1	OSB6	0.2	0.53	7.3	0.1	5.31	0.6	8.18	0.12	5.10	0.61									
	4	OSB7	0.1	0.92	5.0	0.0	5.94	0.3	5.00	0.44	5.94	2.63									
	B	OSB8	0.5	0.65	7.7	0.3	5.21	1.6	12.04	0.38	4.39	1.66									
	15	OSB5	0.1	0.70	5.0	0.0	5.94	0.2	5.00	0.14	5.94	0.85									

Include design point in DP summary table on basin map



STANDARD FORM SF-3 - DEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 10 YEAR EVENT

PROJECT NAME: The Rock Commerce Center

DATE: 10/16/2023

PROJECT NUMBER: 23009

P_1 (1-Hour Rainfall) = 1.75

JURISDICTION: El Paso

CALCULATED BY: CJS

CHECKED BY: MC

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS	
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)		t _t (minutes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	16	B30	0.6	0.08	8.9	0.1	4.96	0.3	8.87	0.05	4.96	0.26									
	B	B31	0.0	0.87	7.5	0.0	5.26	0.1	12.04	0.38	4.39	1.66									



STANDARD FORM SF-3 - DEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: The Rock Commerce Center

DATE: 10/16/2023

PROJECT NUMBER: 23009

P_1 (1-Hour Rainfall) = 2.52

JURISDICTION: El Paso

CALCULATED BY: CJS

CHECKED BY: MC

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS	
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)		t _t (minutes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	1	B16	0.3	0.81	5.0	0.2	8.55	2.1	5.00	0.63	8.55	5.42									
	1	B1	0.5	0.74	5.0	0.4	8.55	3.4	5.00	0.63	8.55	5.42									
	2	B17	0.3	0.81	5.9	0.2	8.16	2.0	5.91	0.86	8.16	7.04									
	2	B18	0.3	0.81	5.0	0.2	8.55	2.1	5.91	0.86	8.16	7.04									
	2	B2	0.5	0.80	5.0	0.4	8.55	3.2	5.91	0.86	8.16	7.04									
	3	B19	0.3	0.81	5.9	0.2	8.17	2.0	5.89	0.52	8.17	4.28									
	3	B3	0.3	0.93	5.0	0.3	8.55	2.4	5.89	0.52	8.17	4.28									
	4	B20	0.3	0.81	5.0	0.2	8.55	2.1	5.00	0.47	8.55	4.03									
	4	B4	0.2	0.96	5.0	0.2	8.55	1.5	5.00	0.47	8.55	4.03									
	5	B21	0.3	0.81	5.0	0.2	8.55	2.1	5.00	0.58	8.55	4.98									
	5	B5	0.4	0.85	5.0	0.3	8.55	2.9	5.00	0.58	8.55	4.98									
	13	B27	0.3	0.81	5.0	0.2	8.55	2.1	15.40	1.27	5.65	7.16									
	7	B7	0.4	0.70	5.0	0.3	8.55	2.4	5.00	0.28	8.55	2.39									
	6	B6	0.3	0.77	5.0	0.2	8.55	2.0	5.00	0.24	8.55	2.02									
	8	B8	1.0	0.77	5.0	0.8	8.55	6.4	5.12	1.09	8.50	9.26									
	8	B22	0.4	0.81	5.1	0.3	8.50	2.9	5.12	1.09	8.50	9.26									
	9	B9	0.6	0.78	5.0	0.5	8.55	3.9	5.00	0.75	8.55	6.42									
	9	B23	0.4	0.81	5.0	0.3	8.55	2.5	5.00	0.75	8.55	6.42									
	10	B24	0.3	0.81	5.7	0.2	8.25	2.0	8.49	0.84	7.25	6.13									
	10	B10	0.7	0.85	5.1	0.6	8.49	4.9	8.49	0.84	7.25	6.13									



STANDARD FORM SF-3 - DEVELOPED STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: The Rock Commerce Center

DATE: 10/16/2023

PROJECT NUMBER: 23009

P₁ (1-Hour Rainfall) = 2.52

JURISDICTION: El Paso

CALCULATED BY: CJS

CHECKED BY: MC

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	t _t (minutes)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	11	B25	0.3	0.81	5.0	0.2	8.55	2.1	11.80	0.66	6.37	4.18									
	12	B26	0.3	0.81	5.0	0.2	8.55	2.1	9.60	1.18	6.93	8.16									
	11	B11	0.4	0.80	5.0	0.3	8.55	2.5	11.80	0.66	6.37	4.18									
	12	B12	0.7	0.89	5.2	0.7	8.44	5.6	9.60	1.18	6.93	8.16									
	13	B13	0.4	0.84	5.0	0.4	8.55	3.1	15.40	1.27	5.65	7.16									
	14	B14	0.1	0.88	5.0	0.1	8.55	0.6	5.00	0.07	8.55	0.58									
	15	B15	0.1	0.94	5.0	0.1	8.55	0.9	5.00	0.15	8.55	1.31									
	C	C1	0.2	0.84	5.0	0.2	8.55	1.6	5.00	0.19	8.55	1.60									
	A	A1	0.1	0.35	12.0	0.0	6.33	0.2	11.99	0.55	6.33	3.51									
	RC1	B28	0.1	0.35	8.2	0.0	7.35	0.1	8.18	0.16	7.35	1.15									
	B	B29	0.4	0.35	12.0	0.1	6.32	0.8	12.04	0.50	6.32	3.14									
	10	OSB1	0.1	0.35	8.5	0.0	7.25	0.2	8.49	0.84	7.25	6.13									
	11	OSB2	0.3	0.35	11.8	0.1	6.37	0.8	11.80	0.66	6.37	4.18									
	12	OSB3	0.8	0.35	9.6	0.3	6.93	1.9	9.60	1.18	6.93	8.16									
	13	OSB4	1.9	0.35	15.4	0.7	5.65	3.7	15.40	1.27	5.65	7.16									
	A	OSA1	0.7	0.74	7.3	0.5	7.62	4.0	11.99	0.55	6.33	3.51									
	RC1	OSB6	0.2	0.65	7.3	0.1	7.64	1.0	8.18	0.16	7.35	1.15									
	4	OSB7	0.1	0.96	5.0	0.1	8.55	0.4	5.00	0.47	8.55	4.03									
	B	OSB8	0.5	0.75	7.7	0.4	7.51	2.7	12.04	0.50	6.32	3.14									
	15	OSB5	0.1	0.78	5.0	0.0	8.55	0.4	5.00	0.15	8.55	1.31									



STANDARD FORM SF-3 - DEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: The Rock Commerce Center
 PROJECT NUMBER: 23009
 CALCULATED BY: CJS
 CHECKED BY: MC

P_1 (1-Hour Rainfall) = 2.52

DATE: 10/16/2023
 JURISDICTION: El Paso

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE		TRAVEL TIME			REMARKS	
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C ₁₀₀	t _c (minutes)	C*A(ac)	I (in/hr)	Q (cfs)	t _c (minutes)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs)	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)		t _t (minutes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	16	B30	0.6	0.44	8.9	0.3	7.14	1.9	8.87	0.27	7.14	1.92									
	B	B31	0.0	0.90	7.5	0.0	7.57	0.1	12.04	0.50	6.32	3.14									

BASIN SUMMARY - DEVELOPED



PROJECT NAME: The Rock Commerce Center DATE: 10/16/2023
 PROJECT NUMBER: 23009.000 JURISDICTION: El Paso
 CALCULATED BY: CJS
 CHECKED BY: 0

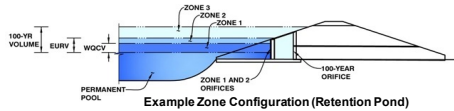
Basin Summary Table

Basin	Area (AC)	Runoff Coefficients		I (%)	Peak Flows (cfs)	
		C10	C100		Q10	Q100
B16	0.30	0.75	0.81	90%	1.3	2.1
B1	0.53	0.64	0.74	64%	2.0	3.4
B17	0.30	0.75	0.81	90%	1.3	2.0
B18	0.30	0.75	0.81	90%	1.3	2.1
B2	0.48	0.71	0.80	73%	2.0	3.2
B19	0.30	0.75	0.81	90%	1.3	2.0
B3	0.30	0.88	0.93	95%	1.6	2.4
B20	0.30	0.75	0.81	90%	1.3	2.1
B4	0.19	0.92	0.96	100%	1.0	1.5
B21	0.30	0.75	0.81	90%	1.3	2.1
B5	0.40	0.78	0.85	82%	1.8	2.9
B27	0.30	0.75	0.81	90%	1.3	2.1
B7	0.40	0.60	0.70	58%	1.4	2.4
B6	0.31	0.68	0.77	68%	1.2	2.0
B8	0.98	0.68	0.77	68%	3.9	6.4
B22	0.42	0.75	0.81	90%	1.8	2.9
B9	0.59	0.70	0.78	71%	2.4	3.9
B23	0.36	0.75	0.81	90%	1.6	2.5
B24	0.30	0.75	0.81	90%	1.3	2.0
B10	0.67	0.79	0.85	83%	3.1	4.9
B25	0.30	0.75	0.81	90%	1.3	2.1
B26	0.30	0.75	0.81	90%	1.3	2.1
B11	0.37	0.72	0.80	74%	1.6	2.5
B12	0.75	0.83	0.89	89%	3.6	5.6
B13	0.43	0.77	0.84	81%	2.0	3.1
B14	0.08	0.82	0.88	87%	0.4	0.6
B15	0.11	0.90	0.94	97%	0.6	0.9
C1	0.22	0.76	0.84	80%	1.0	1.6
A1	0.09	0.15	0.35	0%	0.1	0.2
B28	0.06	0.15	0.35	0%	0.0	0.1
B29	0.36	0.15	0.35	0%	0.2	0.8
OSB1	0.08	0.15	0.35	0%	0.1	0.2
OSB2	0.34	0.15	0.35	0%	0.2	0.8
OSB3	0.78	0.15	0.35	0%	0.6	1.9
OSB4	1.88	0.15	0.35	0%	1.1	3.7
OSA1	0.71	0.64	0.74	63%	2.4	4.0
OSB6	0.21	0.53	0.65	49%	0.6	1.0
OSB7	0.05	0.92	0.96	100%	0.3	0.4
OSB8	0.47	0.65	0.75	65%	1.6	2.7
OSB5	0.06	0.70	0.78	71%	0.2	0.4
B30	0.61	0.08	0.44	3%	0.3	1.9
B31	0.02	0.87	0.90	100%	0.1	0.1

BASINS TRIBUTARY TO POND		
BASIN	AREA	% IMPERVIOUS
B1	0.53	64%
B2	0.48	73%
B3	0.3	95%
B4	0.19	100%
B5	0.4	82%
B6	0.31	68%
B7	0.4	58%
B8	0.98	68%
B9	0.59	71%
B10	0.67	83%
B11	0.37	74%
B12	0.75	89%
B13	0.43	81%
B14	0.08	87%
B15	0.11	97%
B16	0.3	90%
B17	0.3	90%
B18	0.3	90%
B19	0.3	90%
B20	0.3	90%
B21	0.3	90%
B22	0.42	90%
B23	0.36	90%
B24	0.3	90%
B25	0.3	90%
B26	0.3	90%
B27	0.3	90%
B30	0.61	3%
TOTAL:	10.98	77%

MHFD-Detention, Version 4.06 (July 2022)

Basin ID: Basin B



Example Zone Configuration (Retention Pond)

Selected BMP Type =	EDB	
Watershed Area =	11.38	acres
Watershed Length =	1,550	ft
Watershed Length to Centroid =	775	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	77.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Group C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths = User Input		

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Water Quality Capture Volume (WQCV) =	0.294	acre-feet
Excess Urban Runoff Volume (EQRV) =	0.969	acre-feet
2-yr Runoff Volume ($P1 = 1.19$ in.) =	0.867	acre-feet
5-yr Runoff Volume ($P1 = 1.5$ in.) =	1.153	acre-feet
10-yr Runoff Volume ($P1 = 1.75$ in.) =	1.392	acre-feet
25-yr Runoff Volume ($P1 = 2$ in.) =	1.660	acre-feet
50-yr Runoff Volume ($P1 = 2.25$ in.) =	1.907	acre-feet
100-yr Runoff Volume ($P1 = 2.52$ in.) =	2.192	acre-feet
500-yr Runoff Volume ($P1 = 3.39$ in.) =	3.067	acre-feet
Approximate 2-yr Detention Volume =	0.765	acre-feet
Approximate 5-yr Detention Volume =	1.011	acre-feet
Approximate 10-yr Detention Volume =	1.261	acre-feet
Approximate 25-yr Detention Volume =	1.352	acre-feet
Approximate 50-yr Detention Volume =	1.405	acre-feet
Approximate 100-yr Detention Volume =	1.488	acre-feet

Zone 1 Volume (WQCV) =	0.294	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.675	acre-feet
Zone 3 Volume (100-year - Zone 1 & 2) =	0.518	acre-feet
Total Detention Basin Volume =	1.488	acre-feet
Initial Surcharge Volume (ISV) =	user	ft ³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Initial Surcharge Area (A_{SV})	=	user	ft ²
Surcharge Volume Length (L_{SV})	=	user	ft
Surcharge Volume Width (W_{SV})	=	user	ft
Depth of Basin Floor (H_{FLOOR})	=	user	ft
Length of Basin Floor (L_{FLOOR})	=	user	ft
Width of Basin Floor (W_{FLOOR})	=	user	ft
Area of Basin Floor (A_{FLOOR})	=	user	ft ²
Volume of Basin Floor (V_{FLOOR})	=	user	ft ³
Depth of Main Basin (H_{MAIN})	=	user	ft
Length of Main Basin (L_{MAIN})	=	user	ft
Width of Main Basin (W_{MAIN})	=	user	ft
Area of Main Basin (A_{MAIN})	=	user	ft ²
Volume of Main Basin (V_{MAIN})	=	user	ft ³
Calculated Total Basin Volume (V_{TOTAL})	=	user	acre-feet

	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.39	inches

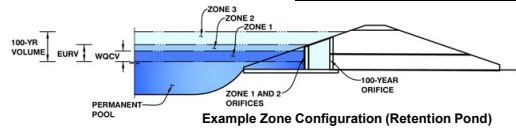
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DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: 23009 - The Rock Lot 1 Filing No. 1

Basin ID: Basin B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.32	0.294	Orifice Plate
Zone 2 (EURV)	5.88	0.675	Orifice Plate
Zone 3 (100-year)	7.41	0.518	Weir&Pipe (Restrict)
Total (all zones)		1.488	

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

Underdrain Orifice Invert Depth = N/A ft (distance below the filtration media surface)
Underdrain Orifice Diameter = N/A inches

Underdrain Orifice Area = N/A ft²
Underdrain Orifice Centroid = N/A feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 5.88 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = 1.30 sq. inches (diameter = 1-1/4 inches)

WQ Orifice Area per Row = 9.028E-03 ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.91	3.16	4.41				
Orifice Area (sq. inches)	1.30	1.30	1.30	1.30				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = N/A ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = N/A inches

Vertical Orifice Area = N/A ft²
Vertical Orifice Centroid = N/A feet

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Gate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

Overflow Weir Front Edge Height, H_o = 5.88 ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 3.00 feet
Overflow Weir Gate Slope = 4.00 H:V
Horiz. Length of Weir Sides = 4.00 feet
Overflow Gate Type = Type C Gate
Debris Clogging % = 0%

Height of Gate Upper Edge, H_t = 6.88 feet
Overflow Weir Slope Length = 4.12 feet
Gate Open Area / 100-yr Orifice Area = 10.48
Overflow Gate Open Area w/o Debris = 8.61 ft²
Overflow Gate Open Area w/ Debris = 8.61 ft²

Calculated Parameters for Overflow Weir

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

Depth to Invert of Outlet Pipe = 0.00 ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter = 18.00 inches
Restrictor Plate Height Above Pipe Invert = 8.50 inches

Outlet Orifice Area = 0.82 ft²
Outlet Orifice Centroid = 0.41 feet
Half-Central Angle of Restrictor Plate on Pipe = 1.52 radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 8.00 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 20.00 feet
Spillway End Slopes = 5.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Spillway Design Flow Depth = 0.62 feet
Stage at Top of Freeboard = 9.62 feet
Basin Area at Top of Freeboard = 0.46 acres
Basin Volume at Top of Freeboard = 2.41 acre-ft

Calculated Parameters for Spillway

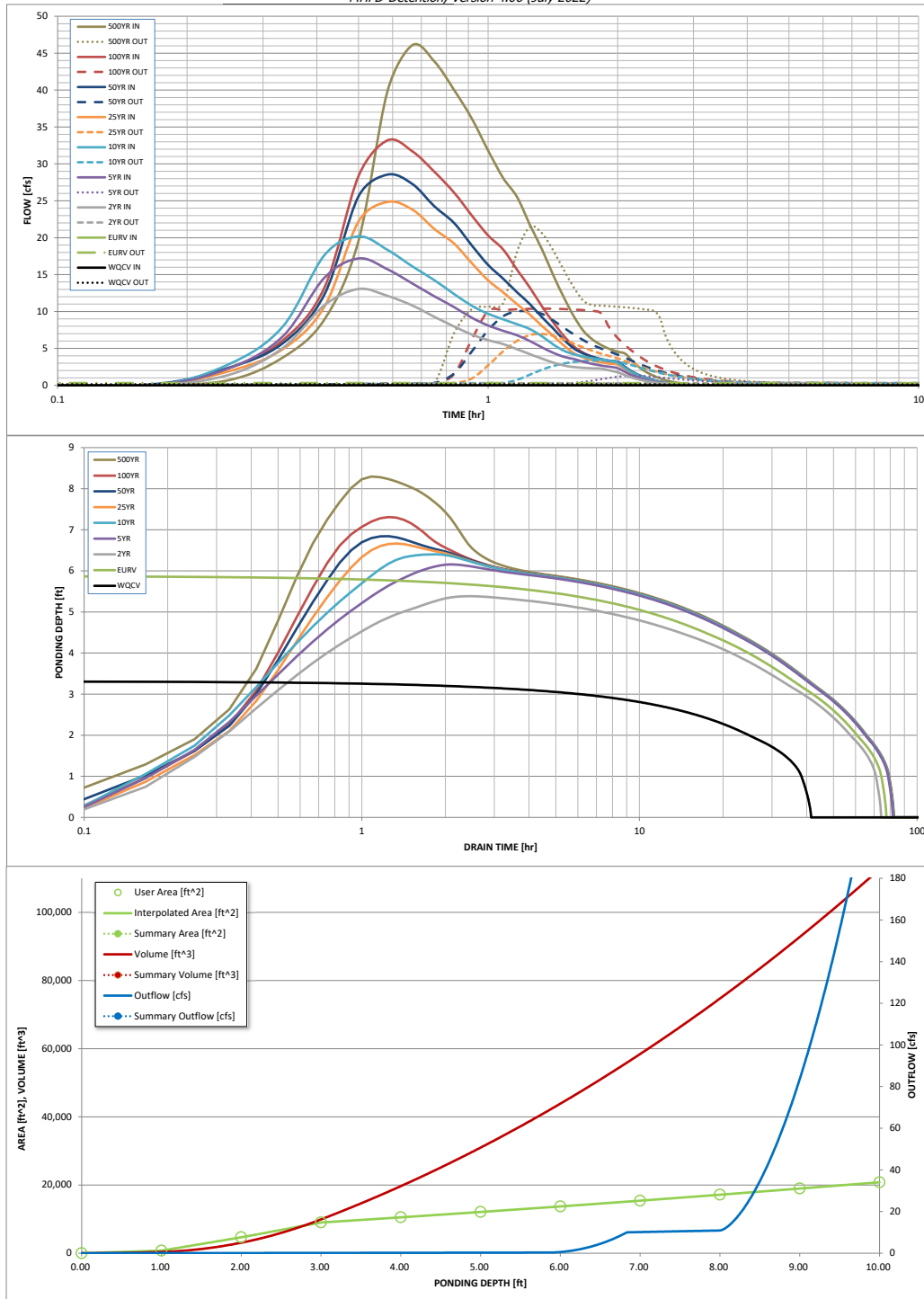
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.39
One-Hour Rainfall Depth (in) =	0.294	0.969	0.867	1.153	1.392	1.660	1.907	2.192	3.067
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.867	1.153	1.392	1.660	1.907	2.192	3.067
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.9	2.6	4.0	7.3	9.2	11.7	18.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.23	0.35	0.64	0.80	1.03	1.61
Peak Inflow Q (cfs) =	N/A	N/A	13.1	17.2	20.2	24.9	28.6	33.2	46.1
Peak Outflow Q (cfs) =	0.1	0.3	0.3	1.3	3.4	7.0	10.0	10.4	21.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.8	1.0	1.1	0.9	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.8	1.1	1.2	1.2
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	69	67	72	71	69	68	66	63
Time to Drain 99% of Inflow Volume (hours) =	40	74	71	78	78	77	76	76	74
Maximum Ponding Depth (ft) =	3.32	5.88	5.39	6.16	6.40	6.67	6.84	7.31	8.30
Area at Maximum Ponding Depth (acres) =	0.22	0.31	0.29	0.32	0.33	0.34	0.35	0.37	0.41
Maximum Volume Stored (acre-ft) =	0.295	0.970	0.819	1.055	1.136	1.224	1.285	1.453	1.831

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention_Version 4.06 (July 2022)



S-A-V-D Chart Axis Override
minimum bound

INLET MANAGEMENT

Worksheet Protected

INLET NAME	SD IN1	SD IN2	SD IN3
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT/Denver 13 Valley Grate	CDOT/Denver 13 Valley Grate	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows			
Minor Q_{Known} (cfs)	3.4	4.5	5.4
Major Q_{Known} (cfs)	5.4	7.0	8.3

Bypass (Carry-Over) Flow from Upstream	Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.		
Receive Bypass Flow from:	No Bypass Flow Received	User-Defined	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics			
Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile			
Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input			
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input			
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	3.4	4.5	5.4
Major Total Design Peak Flow, Q (cfs)	5.4	7.0	8.3
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

INLET MANAGEMENT

Worksheet Protected

INLET NAME	SD IN4	SD IN5	SD IN6
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT/Denver 13 Combination	CDOT/Denver 13 Valley Gate	CDOT/Denver 13 Valley Gate

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{known} (cfs)	3.2	1.2	1.4
Major Q_{known} (cfs)	5.0	2.0	2.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	3.2	1.2	1.4
Major Total Design Peak Flow, Q (cfs)	5.0	2.0	2.4
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

INLET MANAGEMENT

Worksheet Protected

INLET NAME	SD IN7	SD IN8	SD IN9
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	In Sump
Inlet Type	CDOT/Denver 13 Valley Grate	CDOT/Denver 13 Valley Grate	CDOT/Denver 13 Valley Grate

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{known} (cfs)	5.8	4.0	3.9
Major Q_{known} (cfs)	9.3	6.4	6.1

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	2.1
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	3.7

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	5.8	4.0	6.0
Major Total Design Peak Flow, Q (cfs)	9.3	6.4	9.8
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	2.1	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	3.7	N/A

INLET MANAGEMENT

Worksheet Protected

INLET NAME	SD IN10	SD IN11	SD IN12
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT/Denver 13 Combination	CDOT Type R Curb Opening

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{known} (cfs)	2.4	4.6	3.3
Major Q_{known} (cfs)	4.2	8.2	7.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.2
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	1.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.4	4.6	3.5
Major Total Design Peak Flow, Q (cfs)	4.2	8.2	8.2
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.2	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	1.0	N/A

INLET MANAGEMENT

Worksheet Protected

INLET NAME	SD IN13	SD IN14
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	On Grade	On Grade
Inlet Type	CDOT/Denver 13 Combination	CDOT/Denver 13 Combination

USER-DEFINED INPUT**User-Defined Design Flows**

Minor Q_{known} (cfs)	0.4	0.9
Major Q_{known} (cfs)	0.6	1.3

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.1

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

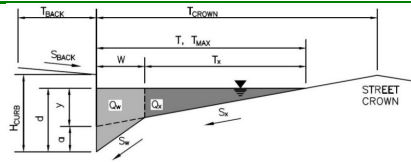
Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	0.4	0.9
Major Total Design Peak Flow, Q (cfs)	0.6	1.4
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.1	0.0

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN1****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK} =	0.0	ft
S_{BACK} =	0.050	ft/ft
n_{BACK} =	0.016	

H_{CURB} =	14.00	inches
T_{CROWN} =	18.0	ft
W =	2.00	ft
S_x =	0.035	ft/ft
S_w =	0.083	ft/ft
S_o =	0.000	ft/ft
n_{STREET} =	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX} =	18.0	18.0	ft
d_{MAX} =	6.0	14.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

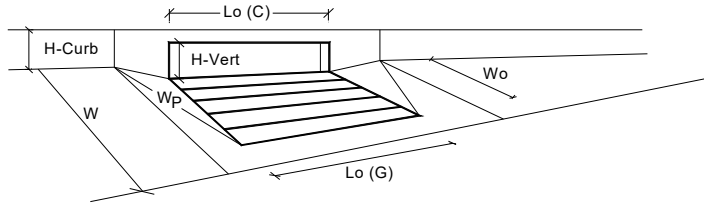
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

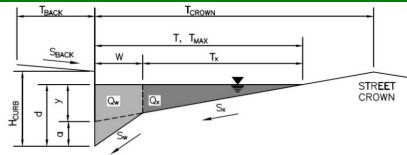
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.8	inches
Grate Information			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L _o (G) =	3.00	3.00	feet
Width of a Unit Grate		W _o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	0.52	0.59	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	0.57	0.64	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	4.4	5.9	cfs
		Q _{PEAK REQUIRED} =	3.4	5.4	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN2****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	0.0	ft
S_{BACK}	0.000	ft/ft
n_{BACK}	0.020	

H_{CURB}	14.00	inches
T_{CROWN}	18.0	ft
W	2.00	ft
S_x	0.030	ft/ft
S_w	0.083	ft/ft
S_o	0.000	ft/ft
n_{STREET}	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	18.0	18.0	ft
d_{MAX}	6.0	12.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Maximum Capacity for 1/2 Street based On Allowable SpreadWater Depth without Gutter Depression ($T * S_x * 12$)Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)Gutter Depression ($d_c - (W * S_x * 12)$)Water Depth at Gutter Flowline ($y + a$)Allowable Spread for Discharge outside the Gutter Section ($T - W$)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)

Discharge outside the Gutter Section, carried in Section T_x Discharge within the Gutter Section ($Q_T - Q_X - Q_{BACK}$)

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

 $V*d$ Product: Flow Velocity times Gutter Flowline Depth

	Minor Storm	Major Storm	
y	6.48	6.48	inches
d_c	2.0	2.0	inches
a	1.27	1.27	inches
d	7.75	7.75	inches
T_x	16.0	16.0	ft
E_o	0.304	0.304	
Q_X	0.0	0.0	cfs
Q_W	0.0	0.0	cfs
Q_{BACK}	0.0	0.0	cfs
Q_T	SUMP	SUMP	cfs
V	0.0	0.0	fps
$V*d$	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread

Theoretical Spread for Discharge outside the Gutter Section ($T - W$)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)

Theoretical Discharge outside the Gutter Section, carried in Section T_{XTH} Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})Discharge within the Gutter Section ($Q_d - Q_X$)

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor)

Average Flow Velocity Within the Gutter Section

 $V*d$ Product: Flow Velocity Times Gutter Flowline DepthSlope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$

Max Flow based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

	Minor Storm	Major Storm	
T_{TH}	13.1	29.8	ft
T_{XTH}	11.1	27.8	ft
E_o	0.411	0.184	
Q_{XTH}	0.0	0.0	cfs
Q_X	0.0	0.0	cfs
Q_W	0.0	0.0	cfs
Q_{BACK}	0.0	0.0	cfs
Q	SUMP	SUMP	cfs
V	0.0	0.0	fps
$V*d$	0.0	0.0	
R	SUMP	SUMP	
Q_d	SUMP	SUMP	cfs
d			inches
d_{CROWN}			inches

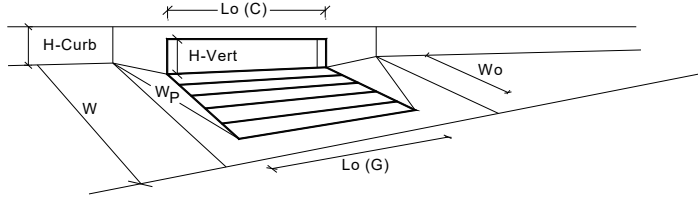
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

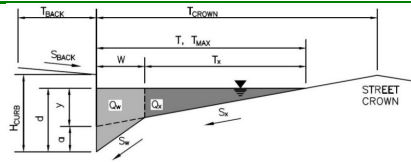
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.5	8.2	inches
Grate Information			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		L _o (G) =	3.00	3.00	feet
Width of a Unit Grate		W _o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	0.56	0.70	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	0.61	0.77	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _s =	5.3	9.2	cfs
		Q _{PEAK REQUIRED} =	4.5	7.0	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN3****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	4.0	ft
$S_{BACK} =$	0.010	ft/ft
$n_{BACK} =$	0.020	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	18.0	ft
$W =$	2.00	ft
$S_x =$	0.040	ft/ft
$S_y =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	6.3	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

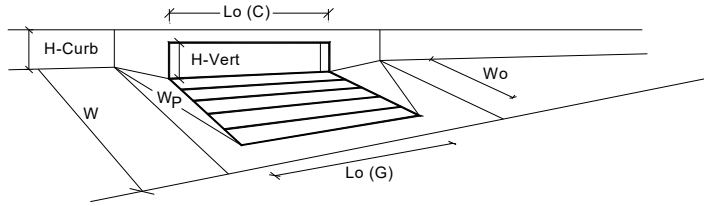
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

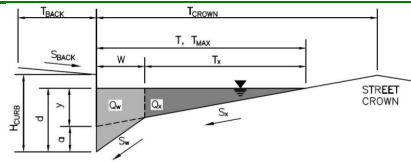


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.3	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	0.33	0.35	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	0.93	0.95	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	8.3	9.2	cfs
		Q _{PEAK REQUIRED} =	5.4	8.3	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **SD IN4****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	0.0	ft
S_{BACK}	=	0.000	ft/ft
n_{BACK}	=	0.012	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	13.0	ft
W	=	2.00	ft
S_x	=	0.030	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	13.0	13.0	ft
d_{MAX}	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

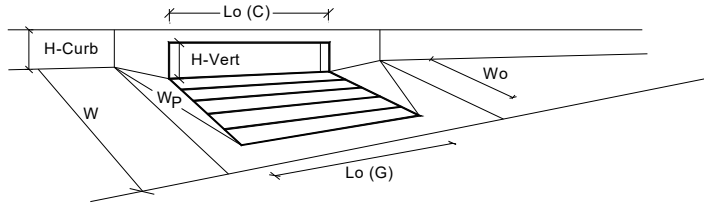
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

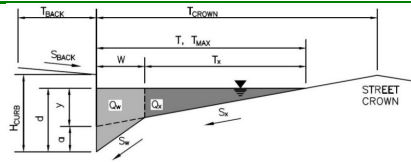
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Combination	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		N_o =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		$L_o (G)$ =	3.00	3.00	feet
Width of a Unit Grate		W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_f (G)$ =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G)$ =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G)$ =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o (C)$ =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_f (C)$ =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C)$ =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C)$ =	0.66	0.66	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.52	0.52	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.94	0.94	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q_a =	5.1	5.1	cfs
		$Q_{PEAK REQUIRED}$ =	3.2	5.0	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN5****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.000	ft/ft
$n_{BACK} =$	0.020	

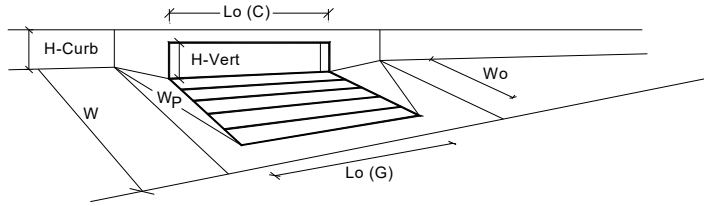
$H_{CURB} =$	12.00	inches
$T_{CROWN} =$	18.0	ft
$W =$	2.00	ft
$S_x =$	0.040	ft/ft
$S_y =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.020	

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	7.9	7.9	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

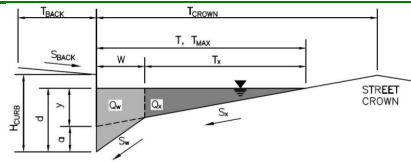
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	7.9	7.9	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L _o (G) =	3.00	3.00	feet
Width of a Unit Grate		W _o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	0.68	0.68	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	1.00	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	4.0	4.0	cfs
		Q _{PEAK REQUIRED} =	1.2	2.0	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN6****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.000	ft/ft
$n_{BACK} =$	0.020	

$H_{CURB} =$	12.00	inches
$T_{CROWN} =$	18.0	ft
$W =$	2.00	ft
$S_x =$	0.040	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.000	ft/ft
$n_{STREET} =$	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

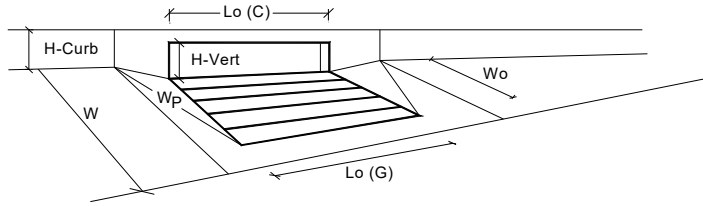
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

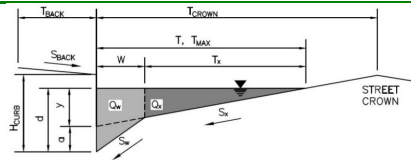


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		N_o =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L_o (G) =	3.00	3.00	feet
Width of a Unit Grate		W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.52	0.52	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q_a =	2.6	2.6	cfs
		$Q_{PEAK REQUIRED}$ =	1.4	2.4	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **SD IN7****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	0.0	ft
S_{BACK}	0.000	ft/ft
n_{BACK}	0.020	

H_{CURB}	11.00	inches
T_{CROWN}	25.0	ft
W	5.00	ft
S_x	0.040	ft/ft
S_w	0.083	ft/ft
S_d	0.000	ft/ft
n_{STREET}	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	12.5	18.0	ft
d_{MAX}	8.8	8.8	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Maximum Capacity for 1/2 Street based On Allowable SpreadWater Depth without Gutter Depression ($T * S_x * 12$)Vertical Depth between Gutter Lip and Gutter Flowline ($W * S_w * 12$)Gutter Depression ($d_c - (W * S_x * 12)$)Water Depth at Gutter Flowline ($y + a$)Allowable Spread for Discharge outside the Gutter Section ($T - W$)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)

Discharge outside the Gutter Section, carried in Section T_x Discharge within the Gutter Section ($Q_T - Q_x - Q_{BACK}$)

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Maximum Flow Based On Allowable Spread

Flow Velocity within the Gutter Section

 $V*d$ Product: Flow Velocity times Gutter Flowline Depth

	Minor Storm	Major Storm	
y	6.00	8.64	inches
d_c	5.0	5.0	inches
a	2.58	2.58	inches
d	8.58	11.22	inches
T_x	7.5	13.0	ft
E_o	0.815	0.646	
Q_x	0.0	0.0	cfs
Q_w	0.0	0.0	cfs
Q_{BACK}	0.0	#DIV/0!	cfs
Q_T	SUMP	SUMP	cfs
V	0.0	0.0	fps
$V*d$	0.0	0.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread

Theoretical Spread for Discharge outside the Gutter Section ($T - W$)

Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. 7-7)

Theoretical Discharge outside the Gutter Section, carried in Section T_{XTH} Actual Discharge outside the Gutter Section, (limited by distance T_{CROWN})Discharge within the Gutter Section ($Q_d - Q_x$)

Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

Total Discharge for Major & Minor Storm (Pre-Safety Factor)

Average Flow Velocity Within the Gutter Section

 $V*d$ Product: Flow Velocity Times Gutter Flowline DepthSlope-Based Safety Factor for Minor/Major Storm depth reduction, $d \geq 6"$

Max Flow based on Allowable Depth (Safety Factor Applied)

Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)

Resultant Flow Depth at Street Crown (Safety Factor Applied)

	Minor Storm	Major Storm	
T_{TH}	12.9	12.9	ft
T_{XTH}	7.9	7.9	ft
E_o	0.803	0.803	
Q_{XTH}	0.0	0.0	cfs
Q_x	0.0	0.0	cfs
Q_w	0.0	0.0	cfs
Q_{BACK}	0.0	0.0	cfs
Q	SUMP	SUMP	cfs
V	0.0	0.0	fps
$V*d$	0.0	0.0	
R	SUMP	SUMP	
Q_d	SUMP	SUMP	cfs
d			inches
d_{CROWN}			inches

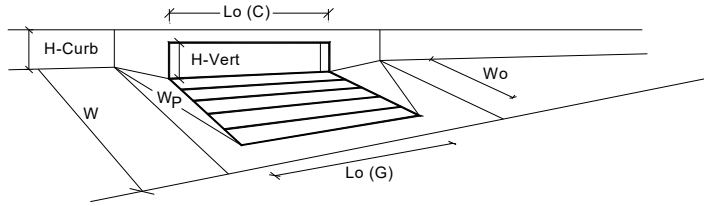
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

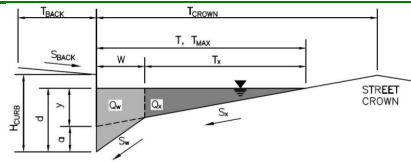
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	8.6	8.8	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L _o (G) =	3.00	3.00	feet
Width of a Unit Grate		W _o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C _f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L _o (C) =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C _f (C) =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d _{Grate} =	0.78	0.80	ft
Depth for Curb Opening Weir Equation		d _{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{Grate} =	1.00	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{Combination} =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _a =	9.4	9.7	cfs
		Q _{PEAK REQUIRED} =	5.8	9.3	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN8****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.0	ft
$S_{BACK} =$	0.000	ft/ft
$n_{BACK} =$	0.020	

$H_{CURB} =$	11.00	inches
$T_{CROWN} =$	18.0	ft
$W =$	5.00	ft
$S_x =$	0.040	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.005	ft/ft
$n_{STREET} =$	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	12.5	12.5	ft
$d_{MAX} =$	8.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

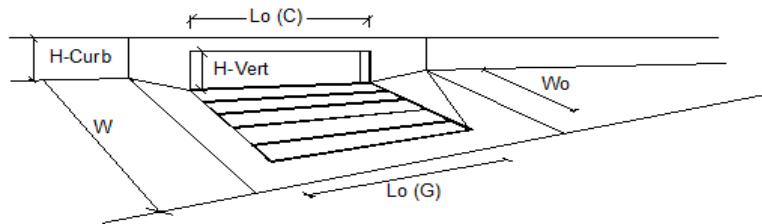
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	8.7	8.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.03 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 6.42 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

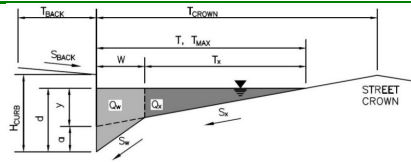
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		$N_o =$	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o =$	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o =$	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G) =$	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C) =$	N/A	N/A	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity			MINOR		MAJOR
Total Inlet Interception Capacity		$Q =$	2.0	2.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_o =$	2.1	3.7	cfs
Capture Percentage = Q_o/Q_o		$C\% =$	49	43	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN9****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

T_{BACK}	=	0.0	ft
S_{BACK}	=	0.000	ft/ft
n_{BACK}	=	0.020	

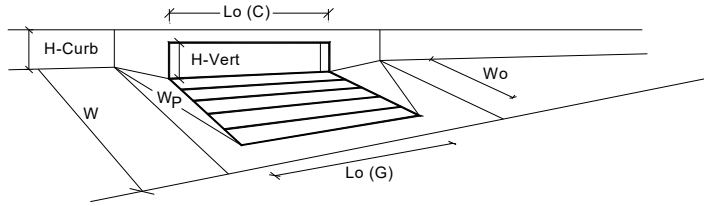
H_{CURB}	=	11.00	inches
T_{CROWN}	=	18.0	ft
W	=	5.00	ft
S_x	=	0.040	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.020	

	Minor Storm	Major Storm	
T_{MAX}	=	12.5	ft
d_{MAX}	=	10.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

	Minor Storm	Major Storm	
Q_{allow}	=	SUMP	cfs
	<input type="checkbox"/>	<input type="checkbox"/>	

INLET IN A SUMP OR SAG LOCATION

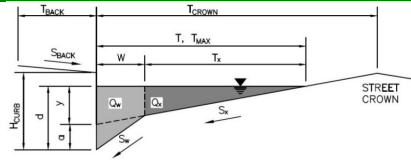
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Valley Grate	Type =	CDOT/Denver 13 Valley Grate		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)		N_o =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	8.6	8.6	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		$L_o (G)$ =	3.00	3.00	feet
Width of a Unit Grate		W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	0.43	0.43	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_f (G)$ =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G)$ =	3.30	3.30	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G)$ =	0.60	0.60	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o (C)$ =	N/A	N/A	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	N/A	N/A	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	N/A	N/A	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	N/A	N/A	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	N/A	N/A	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_f (C)$ =	N/A	N/A	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C)$ =	N/A	N/A	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C)$ =	N/A	N/A	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	0.78	0.78	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	N/A	N/A	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	0.81	0.81	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	11.4	11.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK REQUIRED}$ =	6.0	9.8	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN10****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	2.0	ft
S_{BACK}	=	0.070	ft/ft
n_{BACK}	=	0.020	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	30.0	ft
W	=	2.00	ft
S_X	=	0.040	ft/ft
S_W	=	0.083	ft/ft
S_D	=	0.000	ft/ft
n_{STREET}	=	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	20.0	20.0	ft
d_{MAX}	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

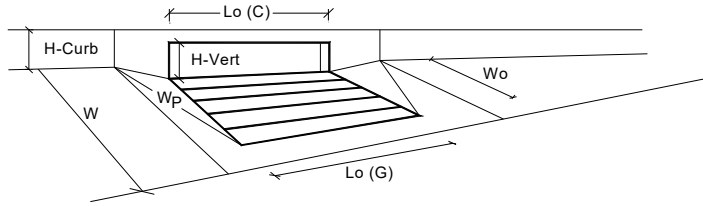
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

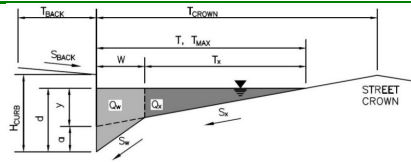
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.0	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_r (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_r (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	5.4	5.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK REQUIRED}$ =	2.4	4.2	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN11****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.1	ft
$S_{BACK} =$	0.100	ft/ft
$n_{BACK} =$	0.020	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	54.0	ft
$W =$	2.00	ft
$S_x =$	0.040	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.014	ft/ft
$n_{STREET} =$	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	15.0	15.0	ft
$d_{MAX} =$	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

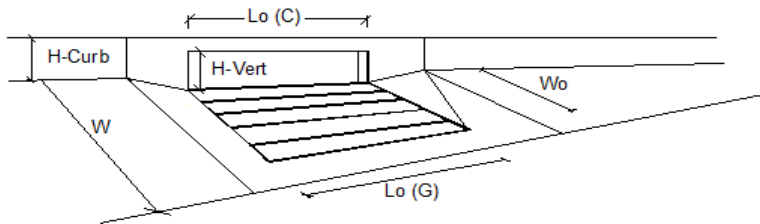
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	8.5	8.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.63 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.16 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

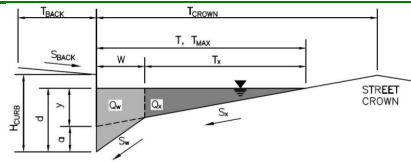
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Combination	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity			MINOR		MAJOR
Total Inlet Interception Capacity		Q =	4.4	7.2	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.2	1.0	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	96	88	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN12****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	2.0	ft
S_{BACK}	=	0.040	ft/ft
n_{BACK}	=	0.012	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	20.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	20.0	20.0	ft
d_{MAX}	6.0	7.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

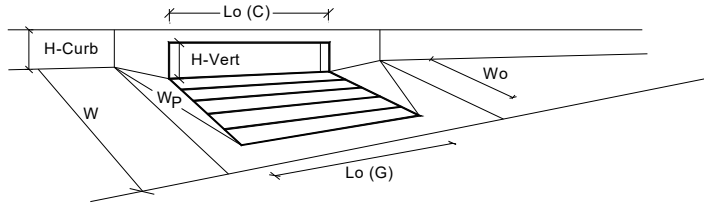
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

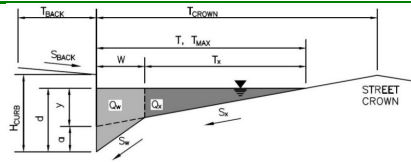
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.3	inches
Grate Information			MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	0.95	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	8.3	9.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK REQUIRED}$ =	3.5	8.2	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN13****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.1	ft
$S_{BACK} =$	0.100	ft/ft
$n_{BACK} =$	0.020	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	20.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.040	ft/ft
$n_{STREET} =$	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	20.0	20.0	ft
$d_{MAX} =$	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

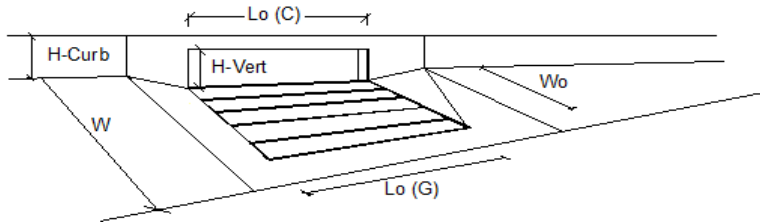
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	13.0	13.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.38 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.58 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

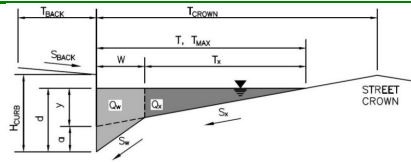
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Combination	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	0.4	0.5	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.0	0.1	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	94	90	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

Project:

Inlet ID: **SD IN14****Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} =$	0.1	ft
$S_{BACK} =$	0.100	ft/ft
$n_{BACK} =$	0.020	

$H_{CURB} =$	6.00	inches
$T_{CROWN} =$	24.0	ft
$W =$	2.00	ft
$S_x =$	0.020	ft/ft
$S_w =$	0.083	ft/ft
$S_o =$	0.040	ft/ft
$n_{STREET} =$	0.020	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

MINOR STORM Allowable Capacity is based on Depth Criterion

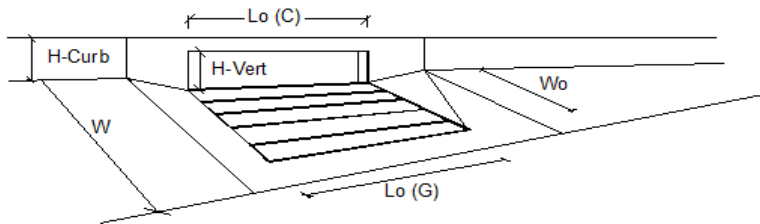
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	13.0	13.0	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.85 cfs on sheet 'Inlet Management'**Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.41 cfs on sheet 'Inlet Management'**

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

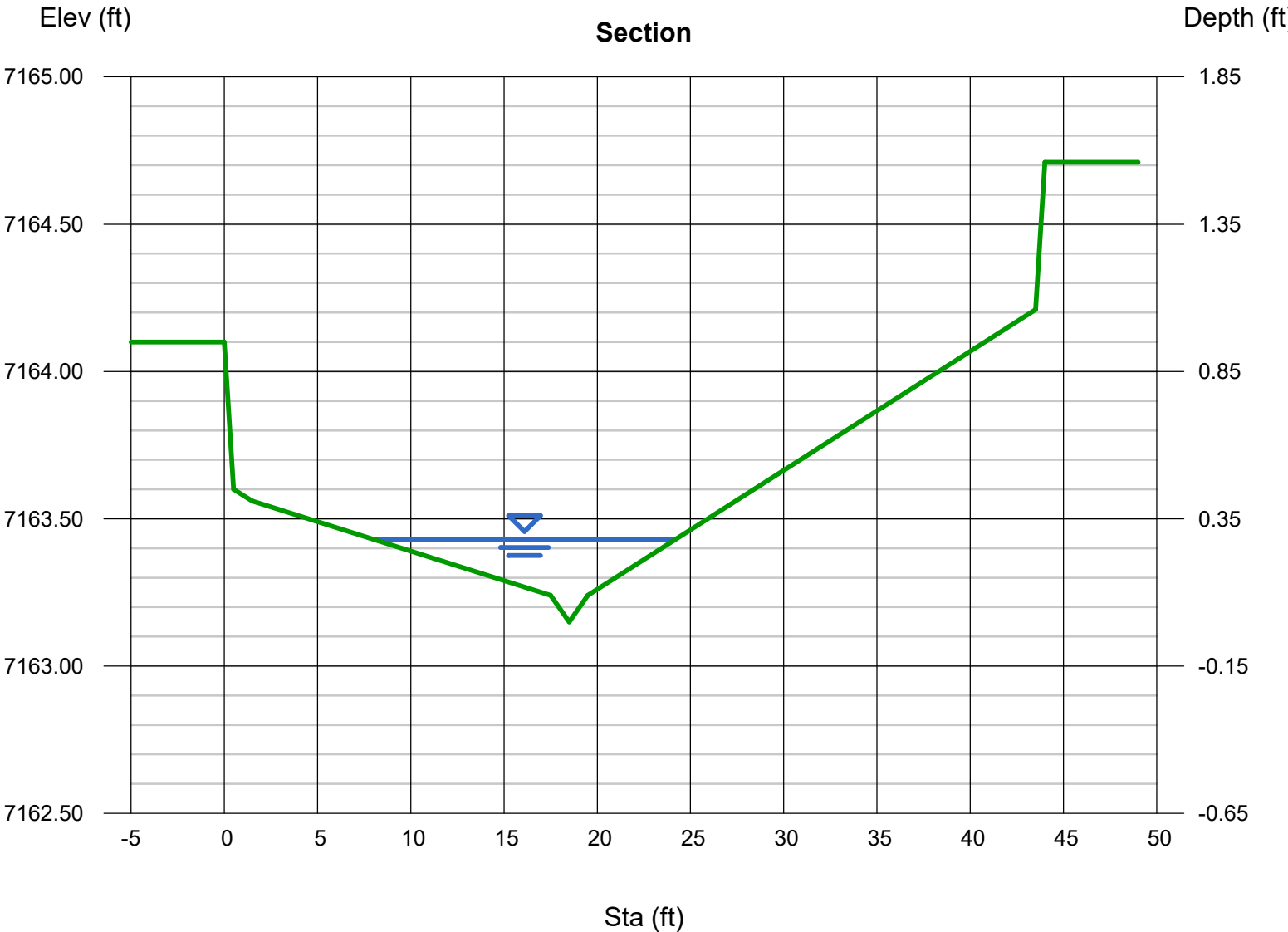


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT/Denver 13 Combination	Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		N_o =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_f (G)$ =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_f (C)$ =	0.10	0.10	
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity			MINOR		MAJOR
Total Inlet Interception Capacity		Q =	0.9	1.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_o =	0.0	0.0	cfs
Capture Percentage = Q_o/Q_o		$C\%$ =	104	97	%

Channel Report

Drainage Pan @ Design Point 1 - 10yr

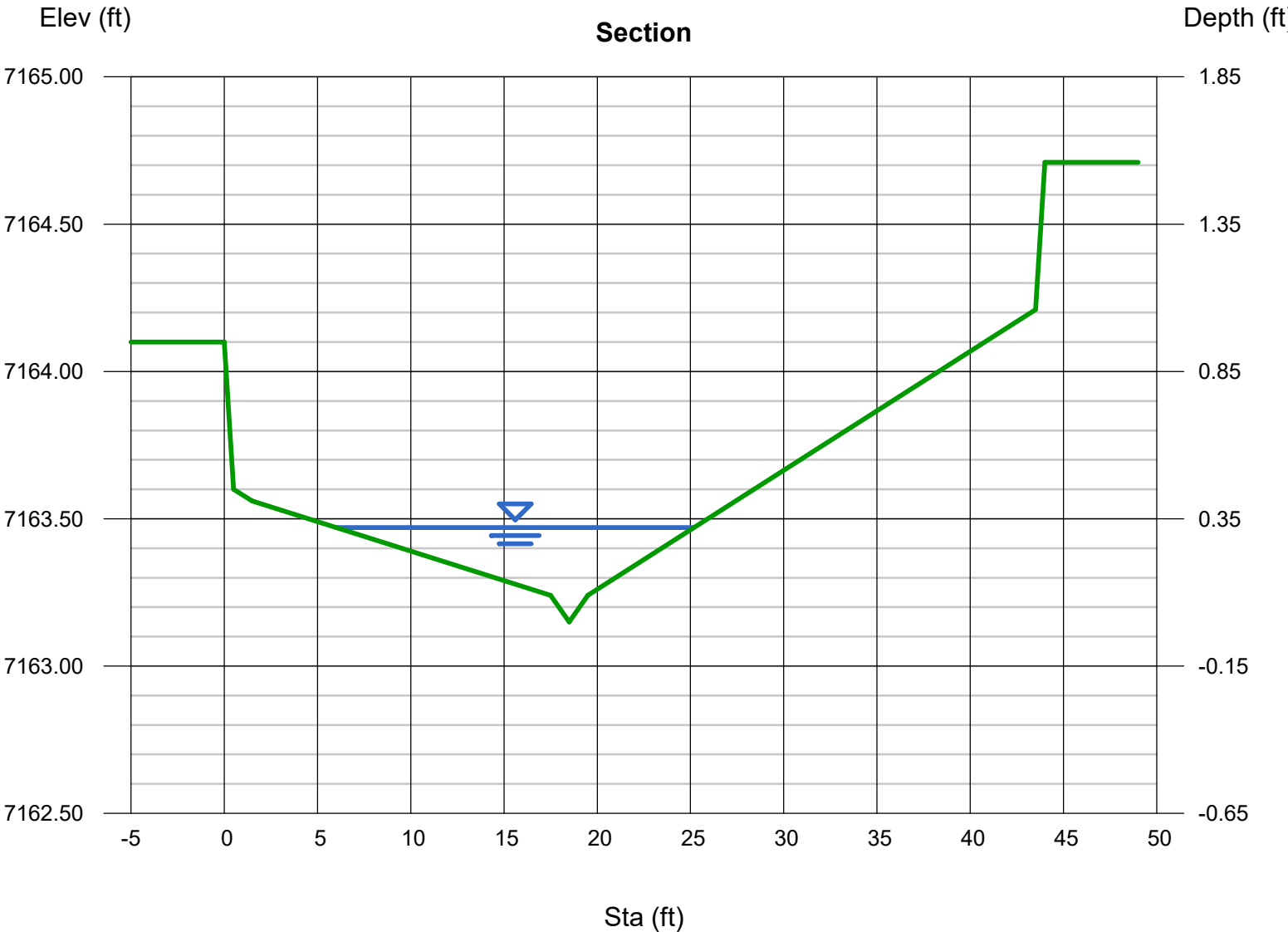
User-defined		Highlighted	
Invert Elev (ft)	= 7163.15	Depth (ft)	= 0.28
Slope (%)	= 0.60	Q (cfs)	= 3.400
N-Value	= 0.013	Area (sqft)	= 1.81
Calculations		Velocity (ft/s)	= 1.88
Compute by:	Known Q	Wetted Perim (ft)	= 16.18
Known Q (cfs)	= 3.40	Crit Depth, Yc (ft)	= 0.28
		Top Width (ft)	= 16.17
		EGL (ft)	= 0.33
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7164.10)-(0.50, 7163.60, 0.013)-(1.50, 7163.56, 0.013)-(17.50, 7163.24, 0.013)-(18.50, 7163.15, 0.013)-(19.50, 7163.24, 0.013)-(43.50, 7164.21, 0.013)			
-(44.00, 7164.71, 0.013)			



Channel Report

Drainage Pan @ Design Point 1 - 100yr

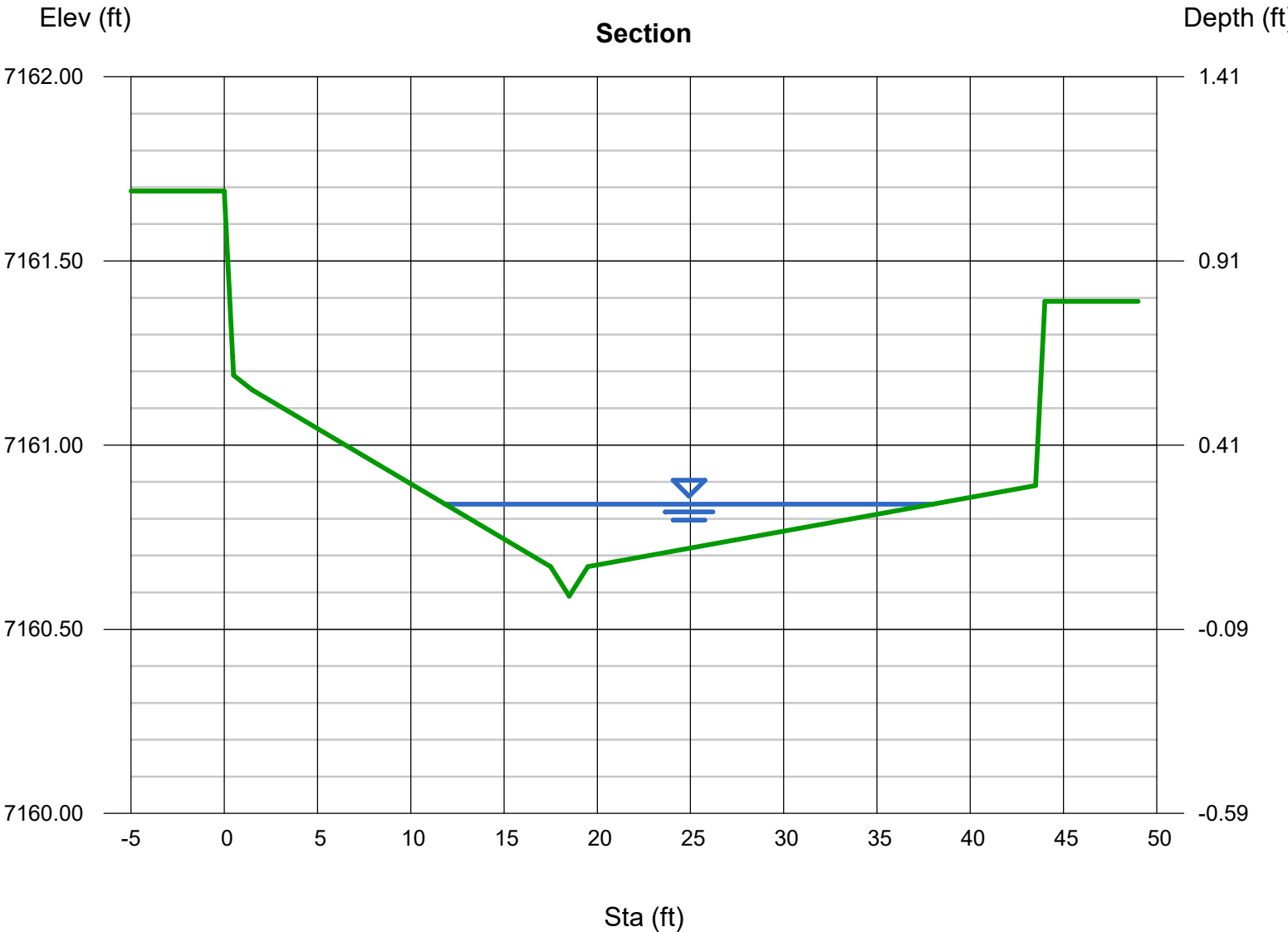
User-defined		Highlighted	
Invert Elev (ft)	= 7163.15	Depth (ft)	= 0.32
Slope (%)	= 0.60	Q (cfs)	= 5.400
N-Value	= 0.013	Area (sqft)	= 2.52
		Velocity (ft/s)	= 2.14
Calculations		Wetted Perim (ft)	= 19.18
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.33
Known Q (cfs)	= 5.40	Top Width (ft)	= 19.16
		EGL (ft)	= 0.39
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7164.10)-(0.50, 7163.60, 0.013)-(1.50, 7163.56, 0.013)-(17.50, 7163.24, 0.013)-(18.50, 7163.15, 0.013)-(19.50, 7163.24, 0.013)-(43.50, 7164.21, 0.013)			
-(44.00, 7164.71, 0.013)			



Channel Report

Drainage Pan @ Design Point 2 - 10yr

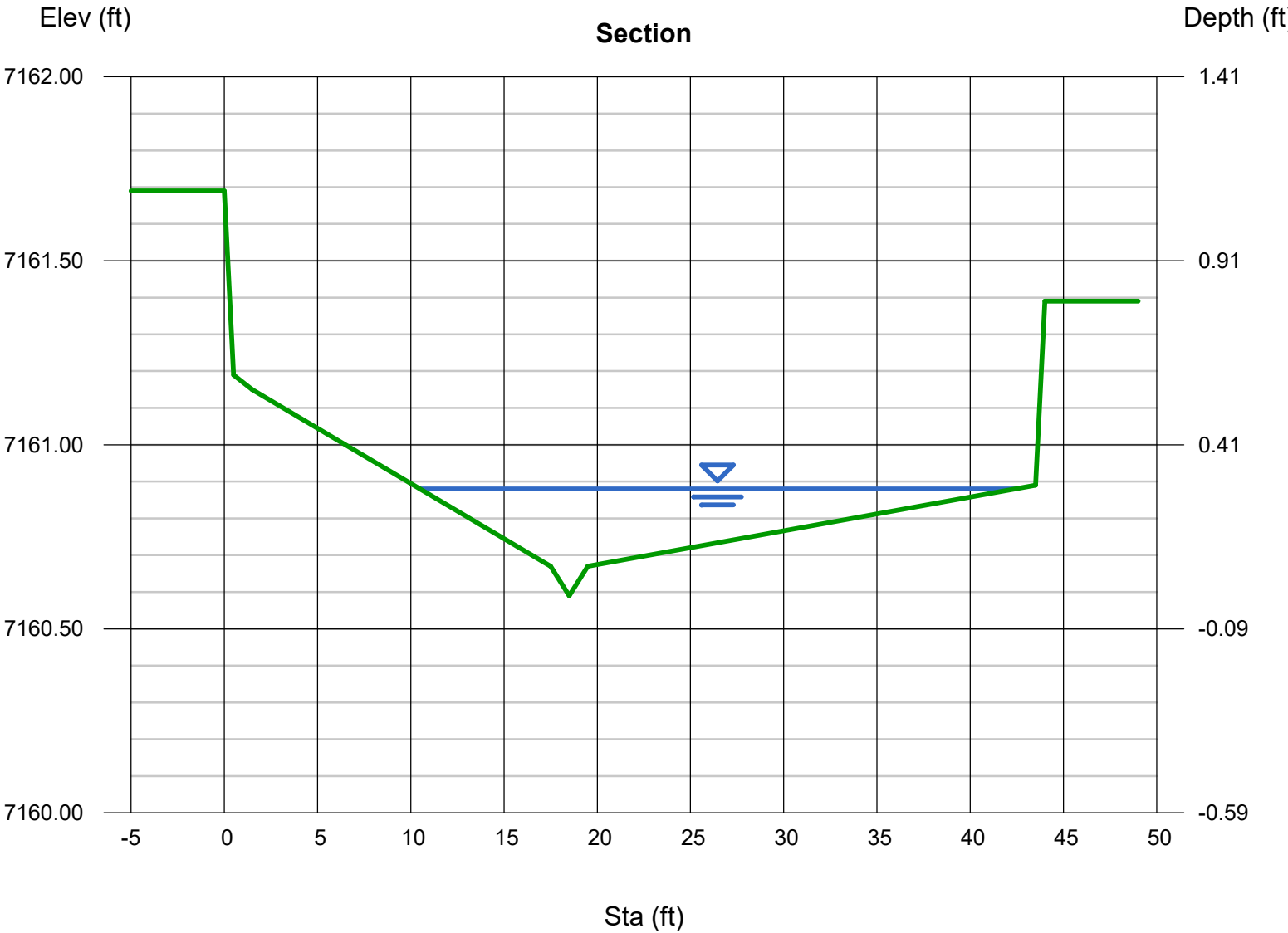
User-defined		Highlighted	
Invert Elev (ft)	= 7160.59	Depth (ft)	= 0.25
Slope (%)	= 0.60	Q (cfs)	= 4.500
N-Value	= 0.013	Area (sqft)	= 2.47
Calculations		Velocity (ft/s)	= 1.82
Compute by:	Known Q	Wetted Perim (ft)	= 26.19
Known Q (cfs)	= 4.50	Crit Depth, Yc (ft)	= 0.26
		Top Width (ft)	= 26.18
		EGL (ft)	= 0.30
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7161.69)-(0.50, 7161.19, 0.013)-(1.50, 7161.15, 0.013)-(17.50, 7160.67, 0.013)-(18.50, 7160.59, 0.013)-(19.50, 7160.67, 0.013)-(43.50, 7160.89, 0.013)			
-(44.00, 7161.39, 0.013)			



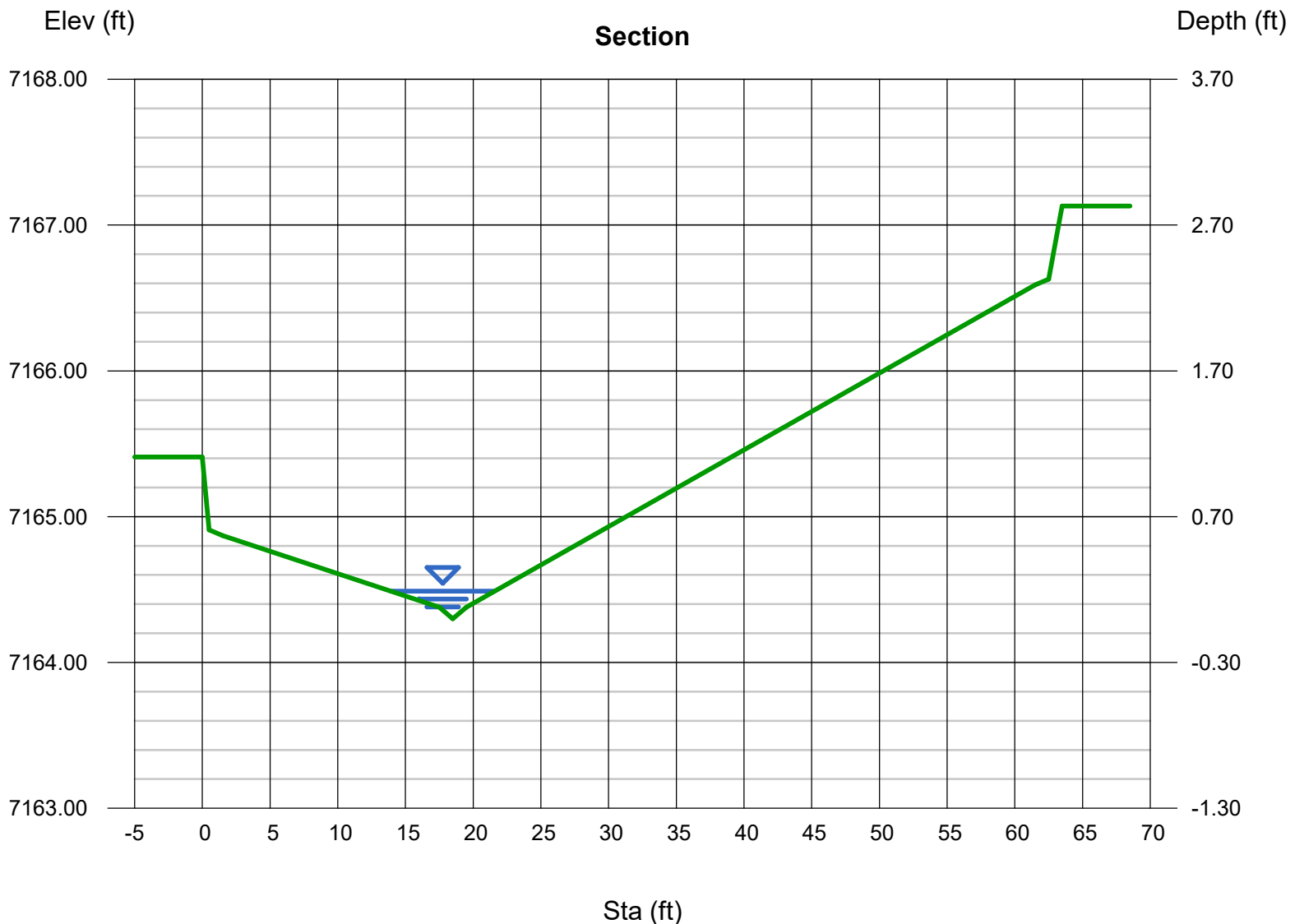
Channel Report

Drainage Pan @ Design Point 2 - 100yr

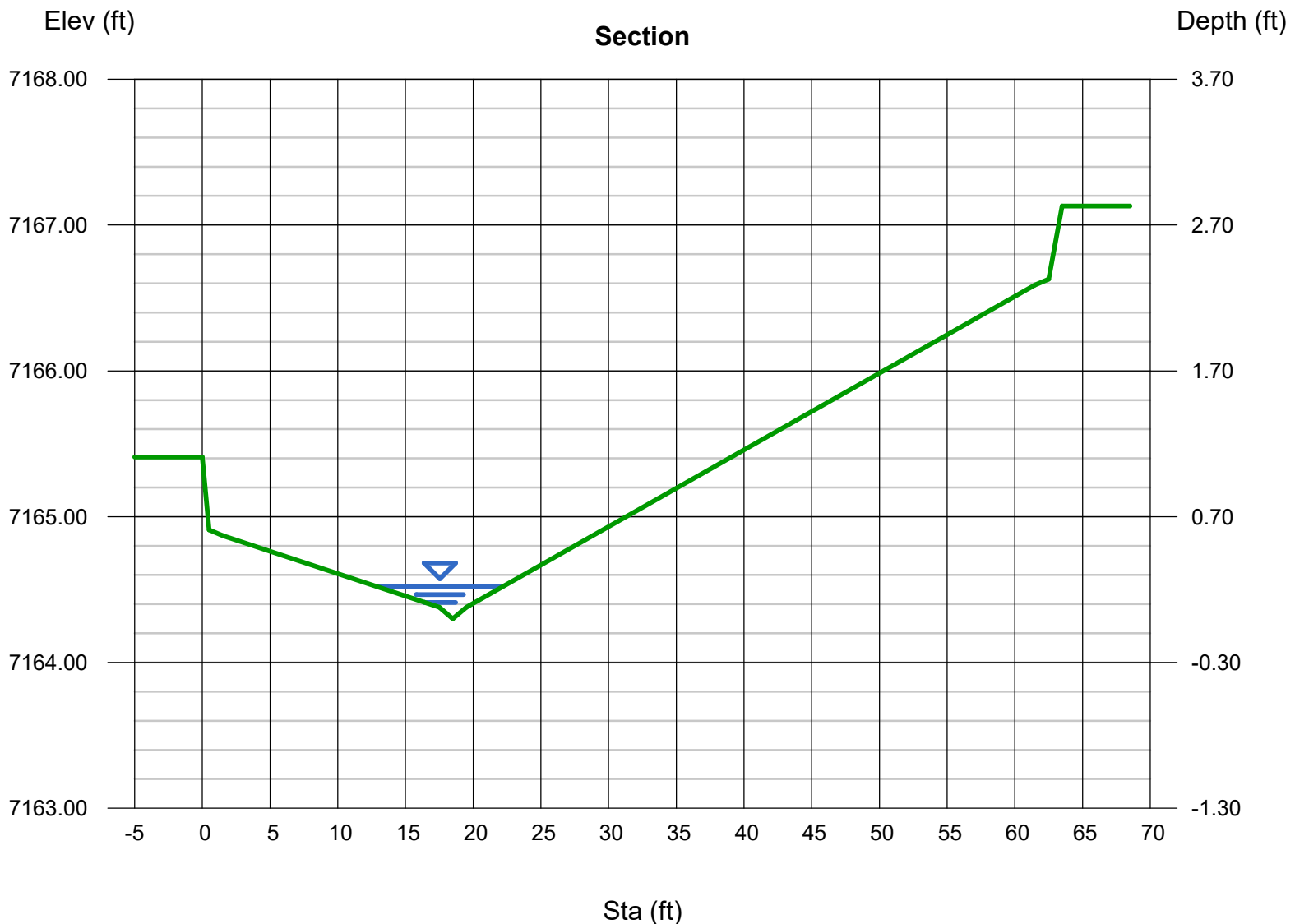
User-defined		Highlighted	
Invert Elev (ft)	= 7160.59	Depth (ft)	= 0.29
Slope (%)	= 0.60	Q (cfs)	= 7.000
N-Value	= 0.013	Area (sqft)	= 3.64
Calculations		Velocity (ft/s)	= 1.92
Compute by:	Known Q	Wetted Perim (ft)	= 31.89
Known Q (cfs)	= 7.00	Crit Depth, Yc (ft)	= 0.30
		Top Width (ft)	= 31.88
		EGL (ft)	= 0.35
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7161.69)-(0.50, 7161.19, 0.013)-(1.50, 7161.15, 0.013)-(17.50, 7160.67, 0.013)-(18.50, 7160.59, 0.013)-(19.50, 7160.67, 0.013)-(43.50, 7160.89, 0.013)			
-(44.00, 7161.39, 0.013)			



Sunday, Oct 15 2023



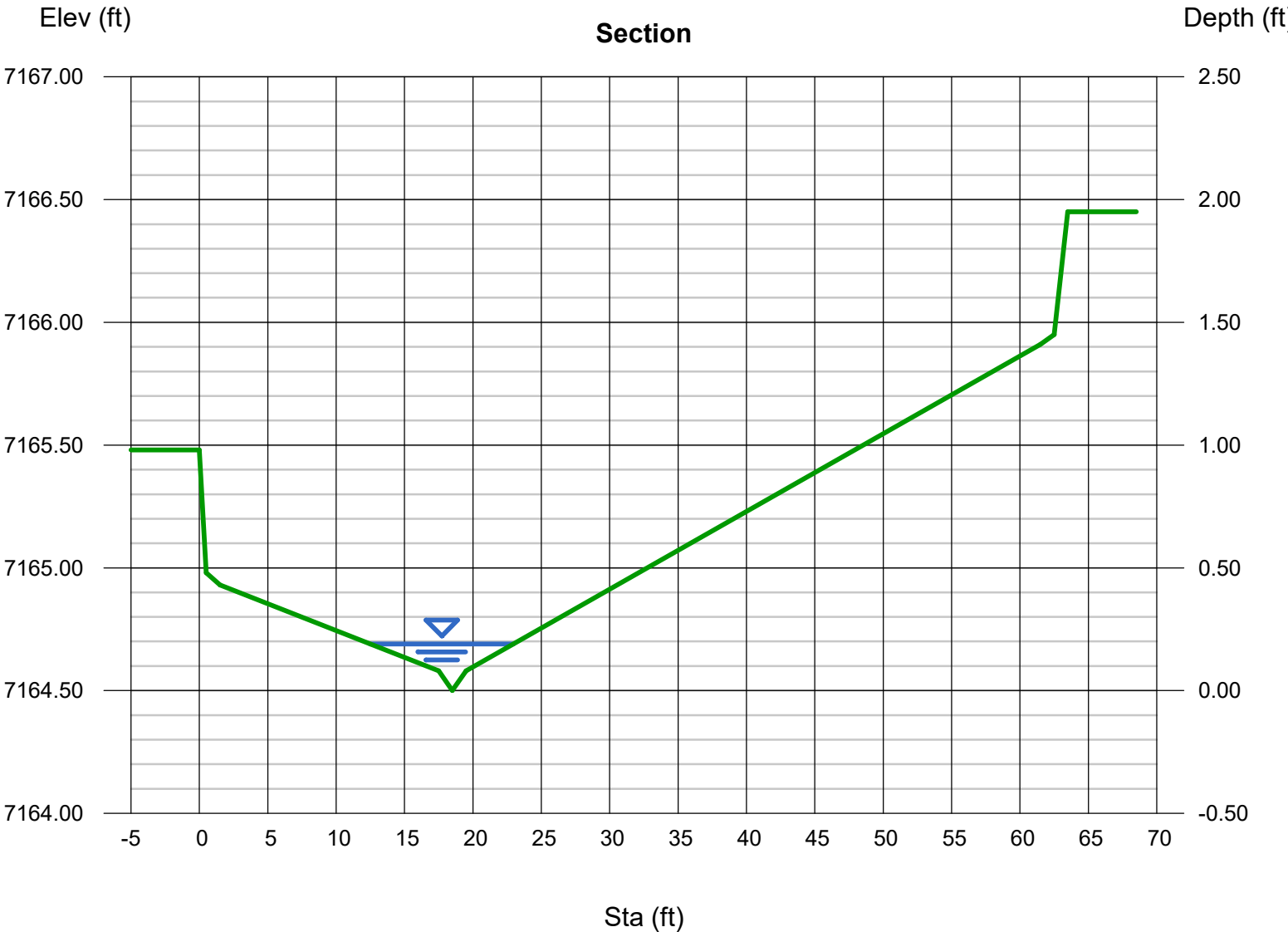
Sunday, Oct 15 2023



Channel Report

Drainage Pan @ Design Point 7 - 10yr

User-defined		Highlighted	
Invert Elev (ft)	= 7164.50	Depth (ft)	= 0.19
Slope (%)	= 1.00	Q (cfs)	= 1.400
N-Value	= 0.013	Area (sqft)	= 0.77
Calculations		Velocity (ft/s)	= 1.83
Compute by:	Known Q	Wetted Perim (ft)	= 10.50
Known Q (cfs)	= 1.40	Crit Depth, Yc (ft)	= 0.21
		Top Width (ft)	= 10.49
		EGL (ft)	= 0.24
(Sta, El, n)-(Sta, El, n)...			
(0.00, 7165.48)-(0.50, 7164.98, 0.013)-(1.50, 7164.93, 0.013)-(17.50, 7164.58, 0.013)-(18.50, 7164.50, 0.013)-(19.50, 7164.58, 0.013)-(61.50, 7165.91, 0.013)			
-(62.50, 7165.95, 0.013)-(63.50, 7166.45, 0.013)			



Sunday, Oct 15 2023

The diagram illustrates a cross-section of a channel. The horizontal axis represents the stationing (Sta) in feet, ranging from -5 to 70. The left vertical axis shows Elevation (ft) from 64.00 to 67.00. The right vertical axis shows Depth (ft) from -0.50 to 2.50. The channel bed profile is a green line, and the water surface is a blue line with a downward-pointing triangle. The channel is deepest at Sta 18, with a depth of approximately 0.5 ft.

Sta (ft)	Elev (ft)	Depth (ft)
-5	65.48	1.00
0	65.48	1.00
5	65.38	1.10
10	65.28	1.20
15	65.18	1.30
18	64.50	2.00
20	64.58	1.90
25	64.78	1.70
30	64.98	1.50
35	65.18	1.30
40	65.38	1.10
45	65.58	0.90
50	65.78	0.70
55	65.98	0.50
60	66.18	0.30
63	66.45	0.00
68	66.45	0.00

Channel Report

Drainage Pan @ Design Point 8 - 10yr

User-defined

Invert Elev (ft) = 7160.15
Slope (%) = 0.60
N-Value = 0.013

Calculations

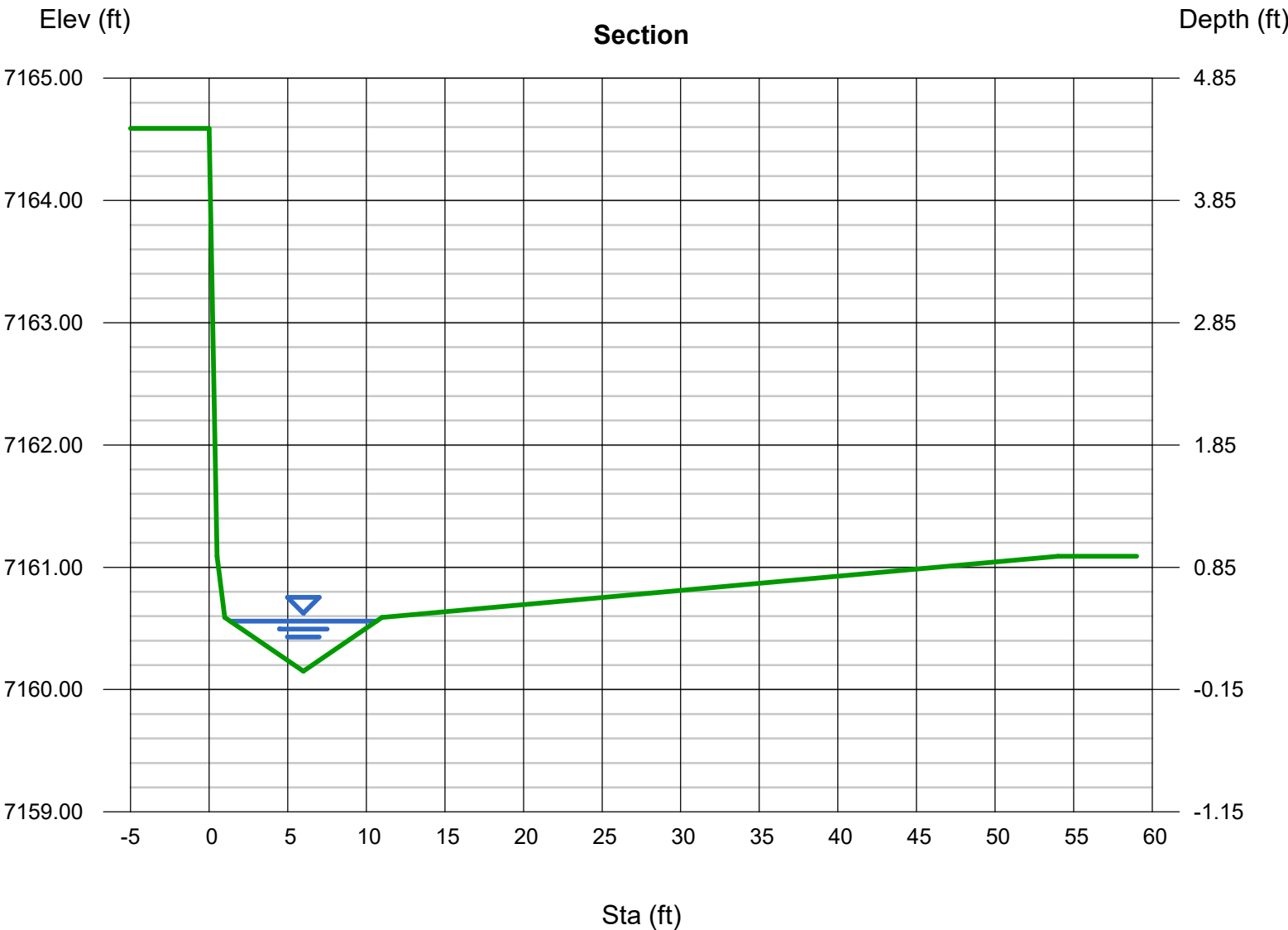
Compute by: Known Q
Known Q (cfs) = 5.80

Highlighted

Depth (ft) = 0.41
Q (cfs) = 5.800
Area (sqft) = 1.91
Velocity (ft/s) = 3.03
Wetted Perim (ft) = 9.36
Crit Depth, Yc (ft) = 0.44
Top Width (ft) = 9.32
EGL (ft) = 0.55

(Sta, El, n)-(Sta, El, n)...

(0.00, 7164.59)-(0.50, 7161.09, 0.013)-(1.00, 7160.59, 0.013)-(6.00, 7160.15, 0.013)-(11.00, 7160.59, 0.013)-(54.00, 7161.09, 0.013)



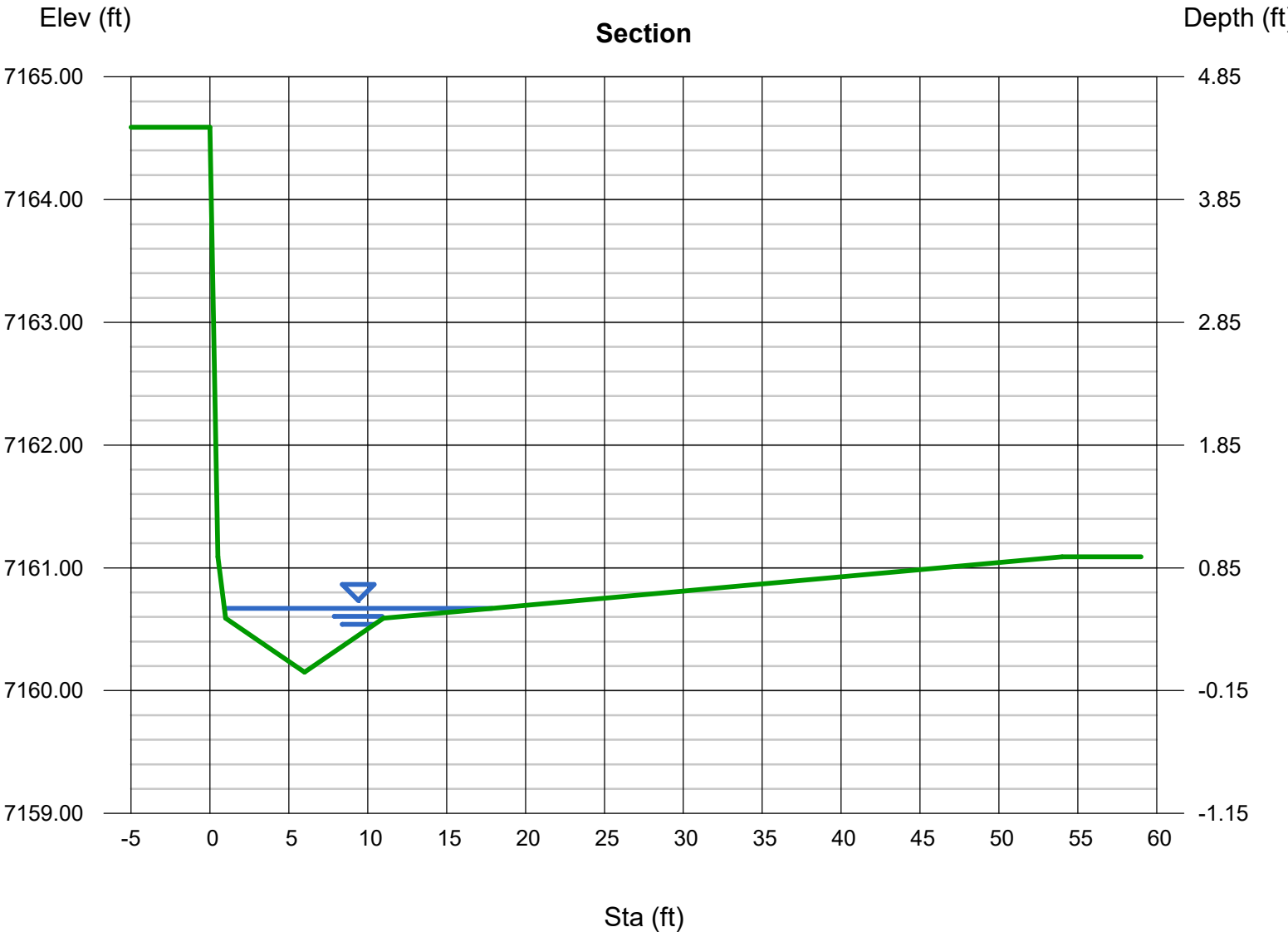
Channel Report

Drainage Pan @ Design Point 8 - 100yr

User-defined		Highlighted	
Invert Elev (ft)	= 7160.15	Depth (ft)	= 0.52
Slope (%)	= 0.60	Q (cfs)	= 9.300
N-Value	= 0.013	Area (sqft)	= 3.28
		Velocity (ft/s)	= 2.84
		Wetted Perim (ft)	= 17.04
		Crit Depth, Yc (ft)	= 0.55
		Top Width (ft)	= 16.97
		EGL (ft)	= 0.65

(Sta, El, n)-(Sta, El, n)...

(0.00, 7164.59)-(0.50, 7161.09, 0.013)-(1.00, 7160.59, 0.013)-(6.00, 7160.15, 0.013)-(11.00, 7160.59, 0.013)-(54.00, 7161.09, 0.013)



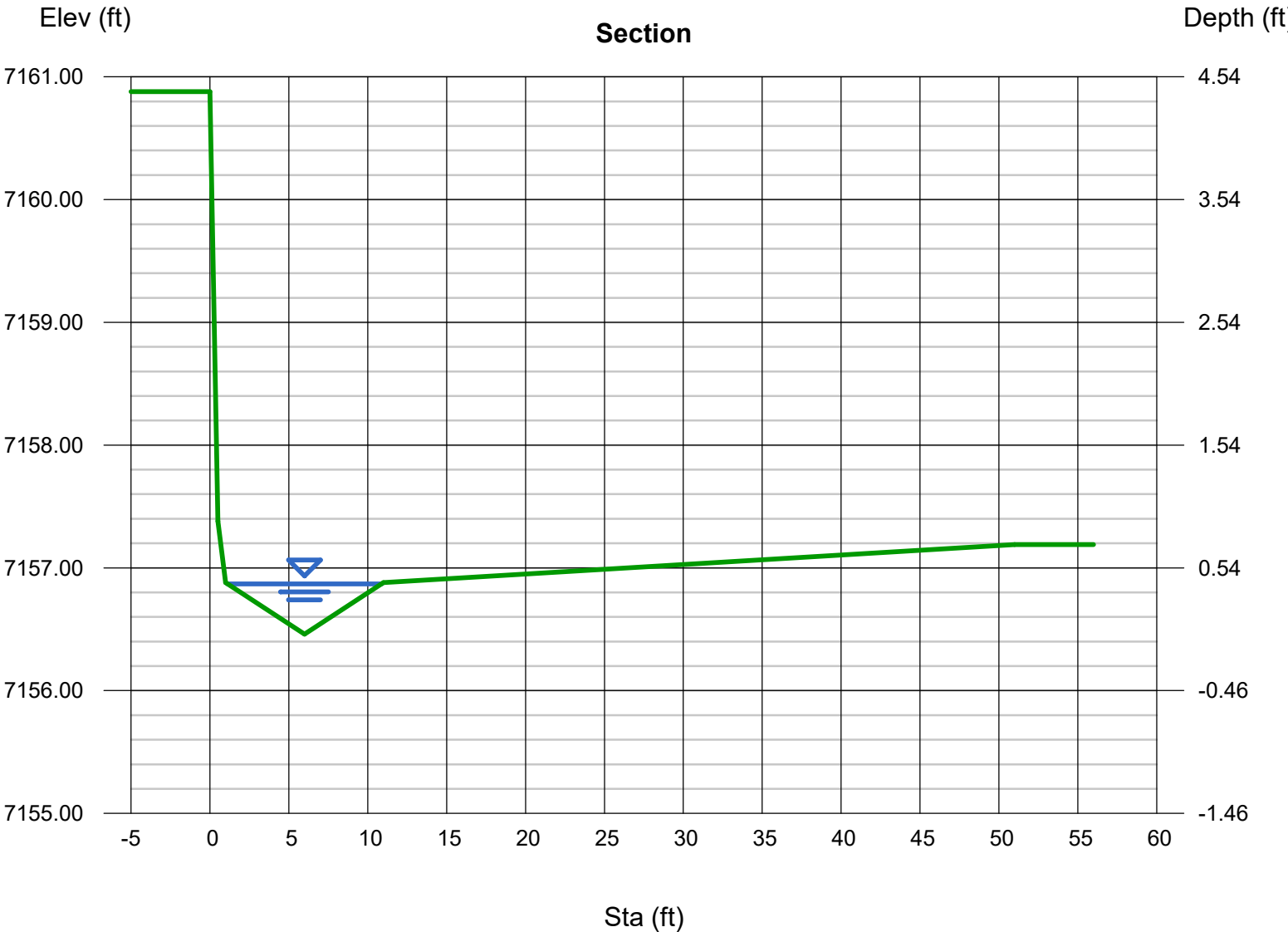
Channel Report

Drainage Pan @ Design Point 10 - 10yr

User-defined		Highlighted	
Invert Elev (ft)	= 7156.46	Depth (ft)	= 0.41
Slope (%)	= 0.60	Q (cfs)	= 6.000
N-Value	= 0.013	Area (sqft)	= 2.00
		Velocity (ft/s)	= 3.00
		Wetted Perim (ft)	= 9.80
		Crit Depth, Yc (ft)	= 0.46
		Top Width (ft)	= 9.77
		EGL (ft)	= 0.55

(Sta, El, n)-(Sta, El, n)...

(0.00, 7160.88)-(0.50, 7157.38, 0.013)-(1.00, 7156.88, 0.013)-(6.00, 7156.46, 0.013)-(11.00, 7156.88, 0.013)-(51.00, 7157.19, 0.013)



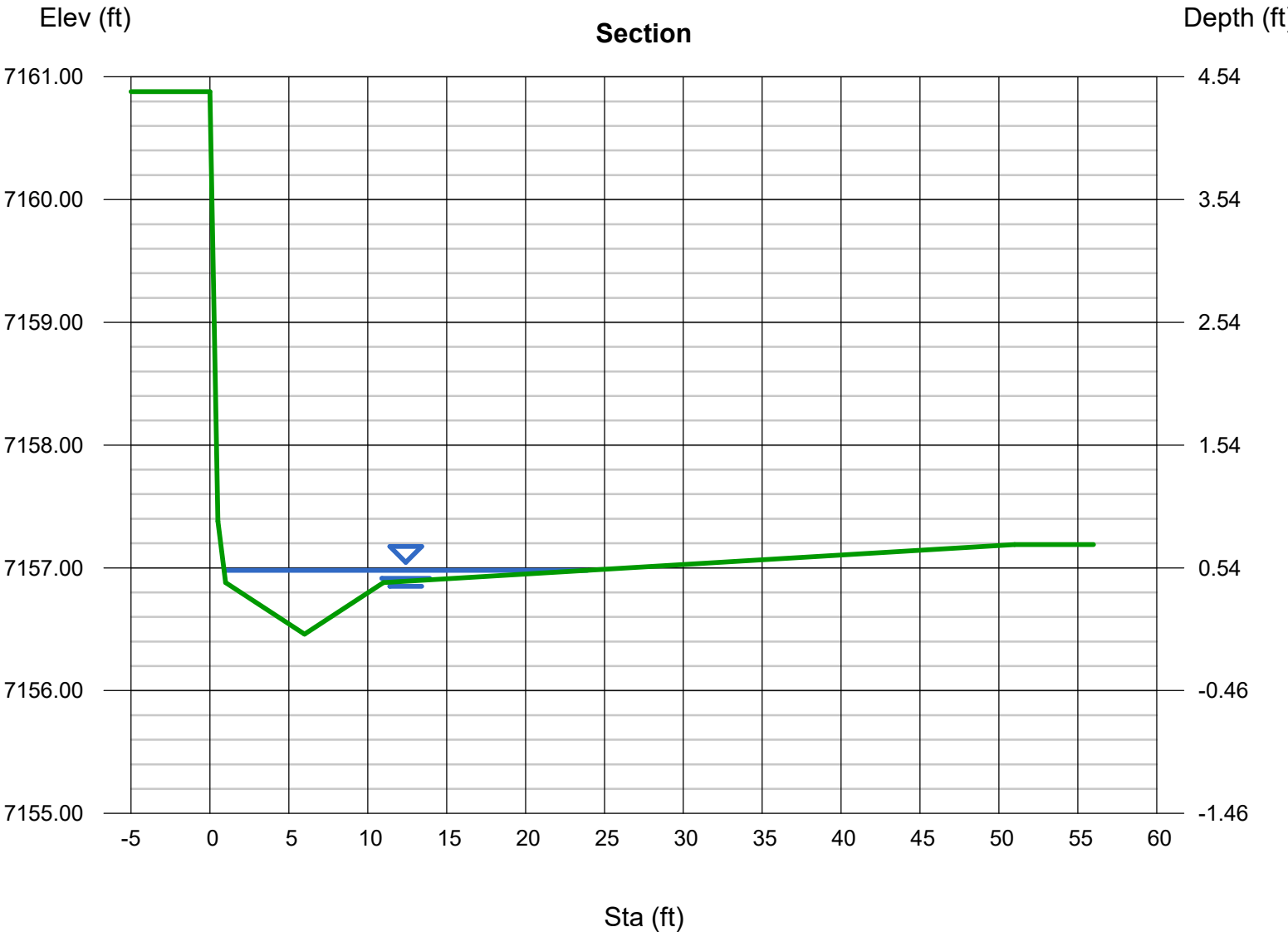
Channel Report

Drainage Pan @ Design Point 10 - 100yr

User-defined		Highlighted	
Invert Elev (ft)	= 7156.46	Depth (ft)	= 0.52
Slope (%)	= 0.60	Q (cfs)	= 9.800
N-Value	= 0.013	Area (sqft)	= 3.75
		Velocity (ft/s)	= 2.61
		Wetted Perim (ft)	= 23.09
		Crit Depth, Yc (ft)	= 0.55
		Top Width (ft)	= 23.01
		EGL (ft)	= 0.63

(Sta, El, n)-(Sta, El, n)...

(0.00, 7160.88)-(0.50, 7157.38, 0.013)-(1.00, 7156.88, 0.013)-(6.00, 7156.46, 0.013)-(11.00, 7156.88, 0.013)-(51.00, 7157.19, 0.013)



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Monday, Oct 16 2023

Drainage Chase @ Design Point 3

Invert Elev Dn (ft) = 7157.72
Pipe Length (ft) = 9.00
Slope (%) = 3.33
Invert Elev Up (ft) = 7158.02
Rise (in) = 6.0
Shape = Box
Span (in) = 36.0
No. Barrels = 1
n-Value = 0.013
Culvert Type = Rectangular Concrete
Culvert Entrance = Tapered inlet throat
Coeff. K,M,c,Y,k = 0.475, 0.667, 0.0179, 0.97, 0.2

Embankment

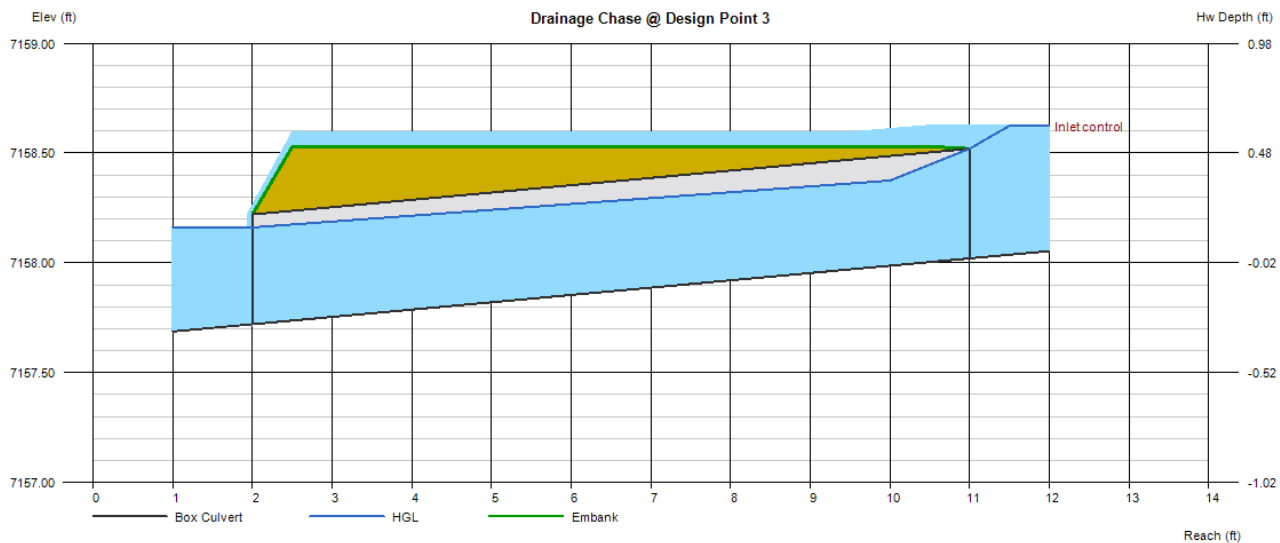
Top Elevation (ft) = 7158.53
Top Width (ft) = 8.00
Crest Width (ft) = 3.00

Calculations

Qmin (cfs) = 2.78
Qmax (cfs) = 4.28
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotat (cfs) = 4.24
Qpipe (cfs) = 4.01
Qovertop (cfs) = 0.23
Veloc Dn (ft/s) = 3.03
Veloc Up (ft/s) = 3.50
HGL Dn (ft) = 7158.16
HGL Up (ft) = 7158.40
Hw Elev (ft) = 7158.63
Hw/D (ft) = 1.21
Flow Regime = Inlet Control



Channel Report

Detention Pond Trickle Channel

Rectangular

Bottom Width (ft) = 4.00
Total Depth (ft) = 0.50

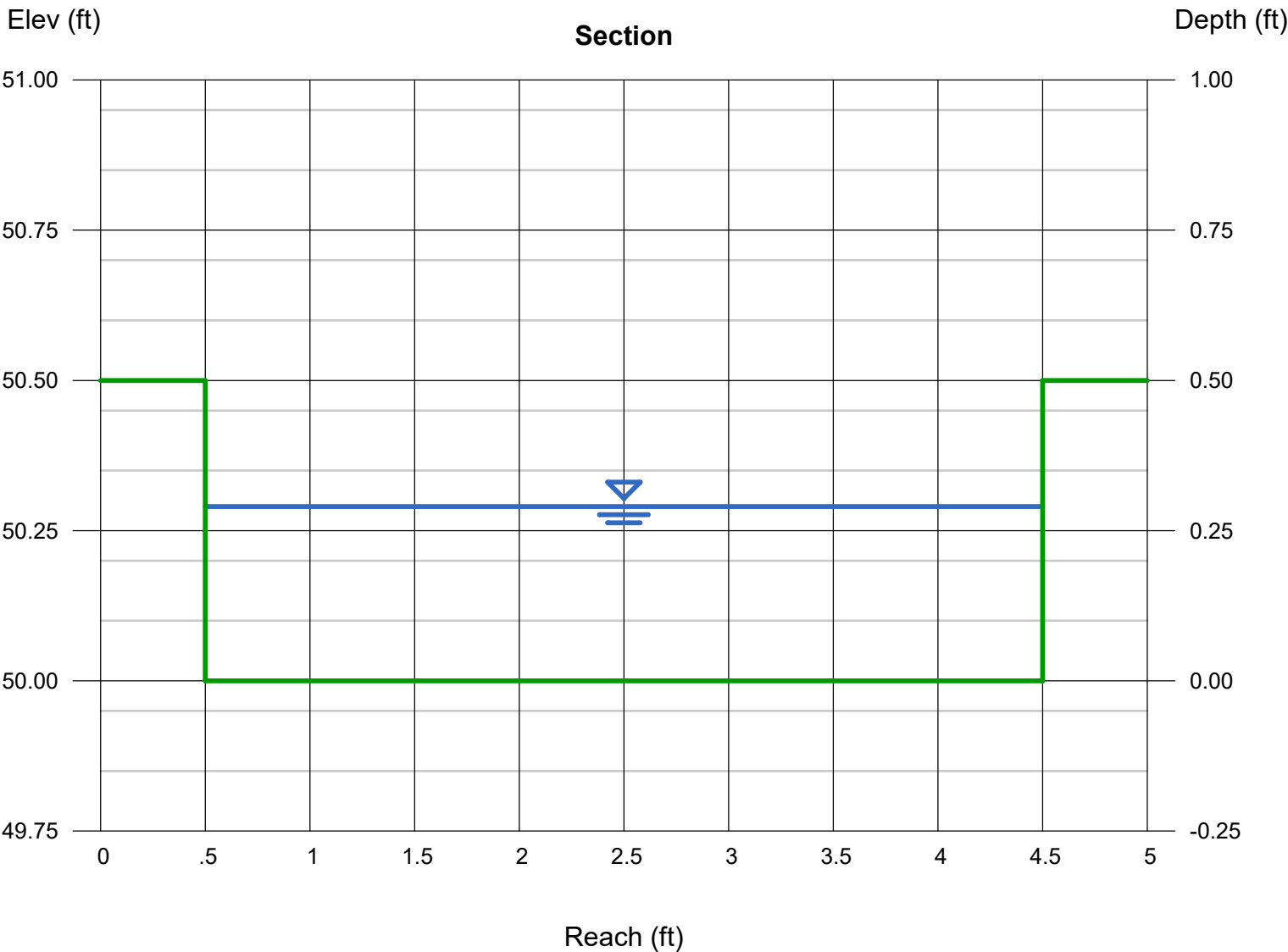
Invert Elev (ft) = 50.00
Slope (%) = 1.00
N-Value = 0.013

Calculations

Compute by: Known Q
Known Q (cfs) = 5.20

Highlighted

Depth (ft) = 0.29
Q (cfs) = 5.200
Area (sqft) = 1.16
Velocity (ft/s) = 4.48
Wetted Perim (ft) = 4.58
Crit Depth, Yc (ft) = 0.38
Top Width (ft) = 4.00
EGL (ft) = 0.60



Design Procedure Form: Grass Swale (GS)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: Cameron Salz

Company: Redland Consultants

Date: October 16, 2023

Project: The Rock Commerce Center

Location: Monument Hill Road - Road Side Ditch

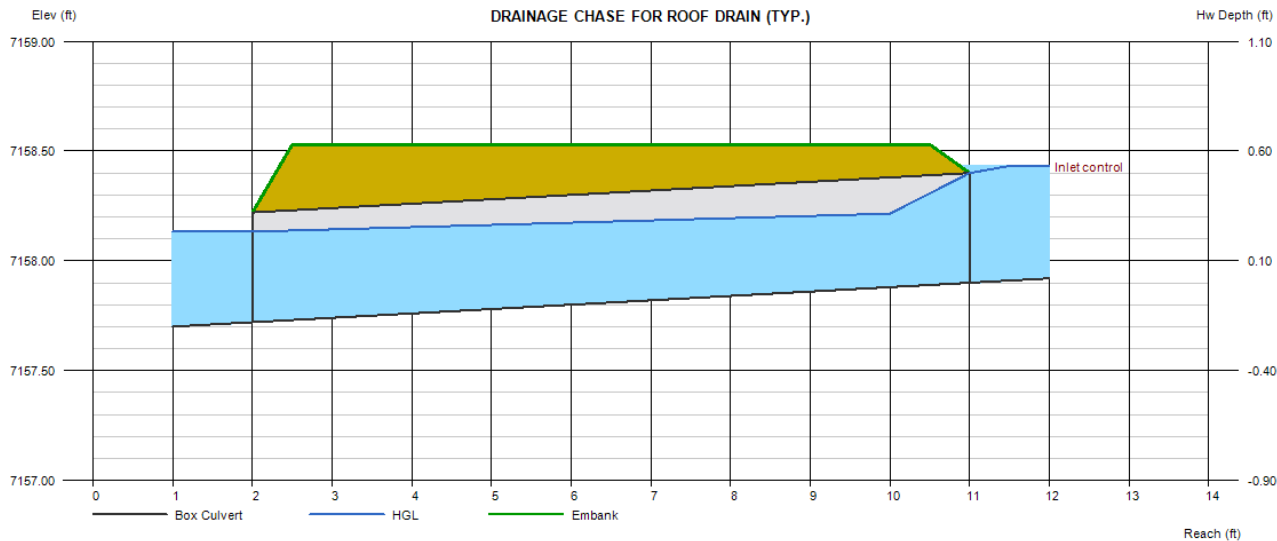
1. Design Discharge for 2-Year Return Period	$Q_2 =$ <input type="text" value="0.80"/> cfs
2. Hydraulic Residence Time A) : Length of Grass Swale B) Calculated Residence Time (based on design velocity below)	$L_S =$ <input type="text" value="940.0"/> ft $T_{HR} =$ <input type="text" value="17.2"/> minutes
3. Longitudinal Slope (vertical distance per unit horizontal) A) Available Slope (based on site constraints) B) Design Slope	$S_{avail} =$ <input type="text" value="0.033"/> ft / ft $S_D =$ <input type="text" value="0.033"/> ft / ft
4. Swale Geometry A) Channel Side Slopes (Z = 4 min., horiz. distance per unit vertical) B) Bottom Width of Swale (enter 0 for triangular section)	$Z =$ <input type="text" value="13.00"/> ft / ft $W_B =$ <input type="text" value="0.00"/> ft
5. Vegetation A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	Choose One <input checked="" type="radio"/> Grass From Seed <input type="radio"/> Grass From Sod
6. Design Velocity (1 ft / s maximum)	$V_2 =$ <input type="text" value="0.91"/> ft / s
7. Design Flow Depth (1 foot maximum) A) Flow Area B) Top Width of Swale C) Froude Number (0.50 maximum) D) Hydraulic Radius E) Velocity-Hydraulic Radius Product for Vegetal Retardance F) Manning's n (based on SCS vegetal retardance curve E for seeded grass) G) Cumulative Height of Grade Control Structures Required	$D_2 =$ <input type="text" value="0.26"/> ft $A_2 =$ <input type="text" value="0.9"/> sq ft $W_T =$ <input type="text" value="6.8"/> ft $F =$ <input type="text" value="0.44"/> $R_H =$ <input type="text" value="0.13"/> $VR =$ <input type="text" value="0.12"/> $n =$ <input type="text" value="0.075"/> $H_D =$ <input type="text" value="0.00"/> ft
8. Underdrain (Is an underdrain necessary?)	Choose One <input type="radio"/> YES <input checked="" type="radio"/> NO
9. Soil Preparation (Describe soil amendment)	
10. Irrigation	Choose One <input checked="" type="radio"/> Temporary <input type="radio"/> Permanent

Notes:

Culvert Report

DRAINAGE CHASE FOR ROOF DRAIN (TYP.)

Invert Elev Dn (ft)	= 7157.72	Calculations	
Pipe Length (ft)	= 9.00	Qmin (cfs)	= 1.30
Slope (%)	= 2.00	Qmax (cfs)	= 2.10
Invert Elev Up (ft)	= 7157.90	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 6.0		
Shape	= Box	Highlighted	
Span (in)	= 24.0	Qtotal (cfs)	= 2.10
No. Barrels	= 1	Qpipe (cfs)	= 2.10
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= 90D Headwall, Chamfered or Beveled Inlet Edges	Veloc Dn (ft/s)	= 2.54
		Veloc Up (ft/s)	= 3.23
Culvert Entrance	= 90D headwall w/3/4-in chamfers	HGL Dn (ft)	= 7158.13
Coeff. K,M,c,Y,k	= 0.515, 0.667, 0.0375, 0.79, 0.2	HGL Up (ft)	= 7158.23
		Hw Elev (ft)	= 7158.43
Embankment		Hw/D (ft)	= 1.06
Top Elevation (ft)	= 7158.53	Flow Regime	= Inlet Control
Top Width (ft)	= 8.00		
Crest Width (ft)	= 2.00		



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Monday, Oct 16 2023

Existing Culvert @ Design Point A

Invert Elev Dn (ft) = 7165.30
Pipe Length (ft) = 30.00
Slope (%) = 4.67
Invert Elev Up (ft) = 7166.70
Rise (in) = 18.0
Shape = Circular
Span (in) = 18.0
No. Barrels = 1
n-Value = 0.013
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

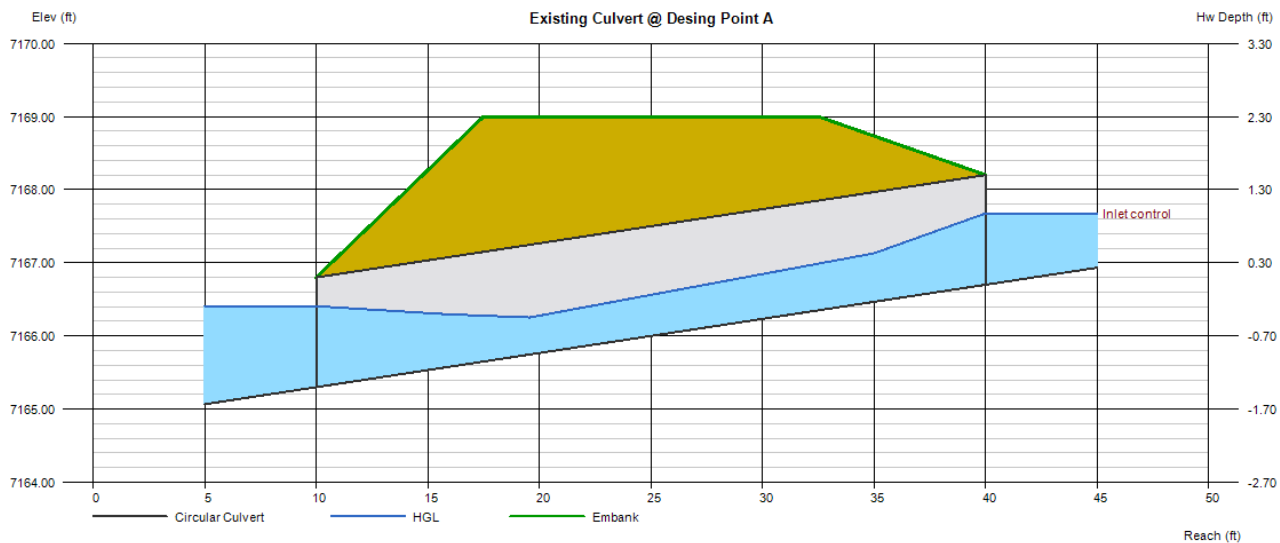
Top Elevation (ft) = 7169.00
Top Width (ft) = 15.00
Crest Width (ft) = 15.00

Calculations

Qmin (cfs) = 2.05
Qmax (cfs) = 3.51
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 3.51
Qpipe (cfs) = 3.51
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 2.51
Veloc Up (ft/s) = 4.23
HGL Dn (ft) = 7166.41
HGL Up (ft) = 7167.42
Hw Elev (ft) = 7167.68
Hw/D (ft) = 0.65
Flow Regime = Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Monday, Oct 16 2023

Existing Culvert @ Design Point B

Invert Elev Dn (ft) = 7131.50
Pipe Length (ft) = 65.00
Slope (%) = 1.08
Invert Elev Up (ft) = 7132.20
Rise (in) = 24.0
Shape = Circular
Span (in) = 24.0
No. Barrels = 1
n-Value = 0.013
Culvert Type = Circular Concrete
Culvert Entrance = Groove end projecting (C)
Coeff. K,M,c,Y,k = 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

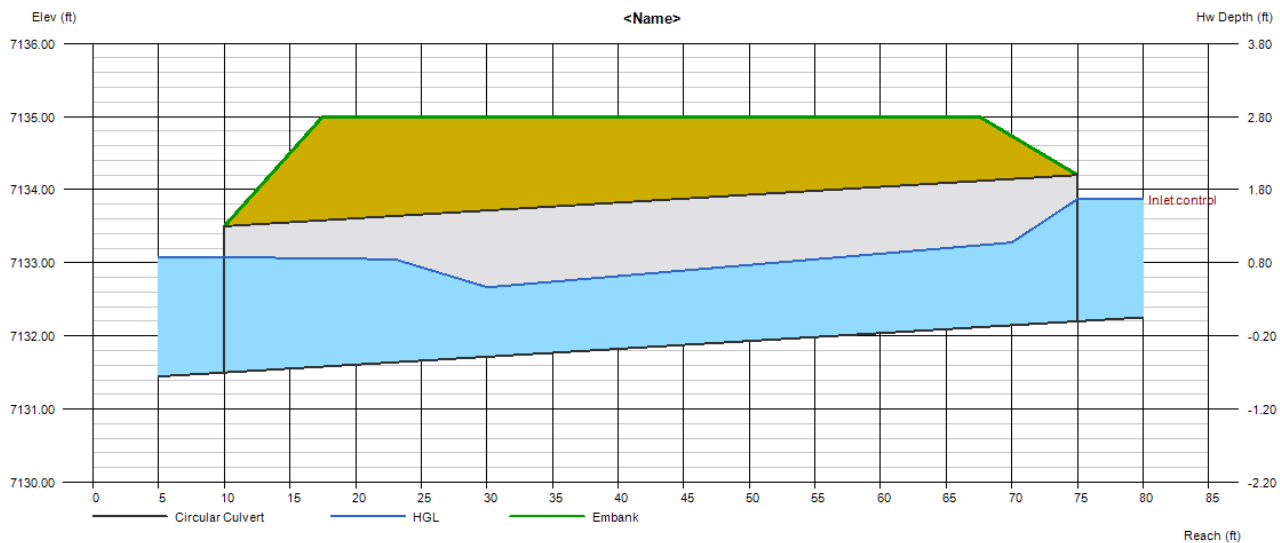
Top Elevation (ft) = 7135.00
Top Width (ft) = 50.00
Crest Width (ft) = 20.00

Calculations

Qmin (cfs) = 3.40
Qmax (cfs) = 10.40
Tailwater Elev (ft) = (dc+D)/2

Highlighted

Qtotal (cfs) = 10.40
Qpipe (cfs) = 10.40
Qovertop (cfs) = 0.00
Veloc Dn (ft/s) = 3.91
Veloc Up (ft/s) = 5.54
HGL Dn (ft) = 7133.08
HGL Up (ft) = 7133.35
Hw Elev (ft) = 7133.87
Hw/D (ft) = 0.83
Flow Regime = Inlet Control

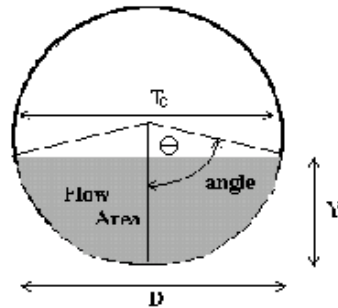


CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: P-23009 The Rock Commerce Center

Pipe ID: Pipe at Design Point O-2



Design Information (Input)

Pipe Invert Slope	$S_o =$	0.0059	ft/ft
Pipe Manning's n-value	$n =$	0.0130	
Pipe Diameter	$D =$	18.00	inches
Design discharge	$Q =$	1.31	cfs

Full-Flow Capacity (Calculated)

Full-flow area	$A_f =$	1.77	sq ft
Full-flow wetted perimeter	$P_f =$	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	$Q_f =$	8.09	cfs

Calculation of Normal Flow Condition

Half Central Angle ($0 < \theta < 3.14$)	Theta =	1.10	radians
Flow area	$A_n =$	0.39	sq ft
Top width	$T_n =$	1.34	ft
Wetted perimeter	$P_n =$	1.65	ft
Flow depth	$Y_n =$	0.41	ft
Flow velocity	$V_n =$	3.37	fps
Discharge	$Q_n =$	1.31	cfs
Percent of Full Flow	Flow =	16.2%	of full flow
Normal Depth Froude Number	$Fr_n =$	1.10	supercritical

Calculation of Critical Flow Condition

Half Central Angle ($0 < \theta_c < 3.14$)	Theta-c =	1.13	radians
Critical flow area	$A_c =$	0.42	sq ft
Critical top width	$T_c =$	1.36	ft
Critical flow depth	$Y_c =$	0.43	ft
Critical flow velocity	$V_c =$	3.15	fps
Critical Depth Froude Number	$Fr_c =$	1.00	

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 3

Designer: Cameron Salz
Company: Redland
Date: October 16, 2023
Project: The Rock Commerce Center
Location: El Paso County

1. Basin Storage Volume

- A) Effective Imperviousness of Tributary Area, I_a
- B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)
- C) Contributing Watershed Area
- D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm
- E) Design Concept
(Select EURV when also designing for flood control)
- F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)
- G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_b * (V_{DESIGN} / 0.43))$)
- H) User Input of Water Quality Capture Volume (WQCV) Design Volume
(Only if a different WQCV Design Volume is desired)
- I) NRCS Hydrologic Soil Groups of Tributary Watershed
i) Percentage of Watershed consisting of Type A Soils
ii) Percentage of Watershed consisting of Type B Soils
iii) Percentage of Watershed consisting of Type C/D Soils
- J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
- K) User Input of Excess Urban Runoff Volume (EURV) Design Volume
(Only if a different EURV Design Volume is desired)

$I_a = 77.0$ %

$i = 0.770$

Area = 11.380 ac

$d_b =$ in

Choose One

- ☐ Water Quality Capture Volume (WQCV)
☒ Excess Urban Runoff Volume (EURV)

$V_{DESIGN} = 0.294$ ac-ft

$V_{DESIGN\ OTHER} =$ ac-ft

$V_{DESIGN\ USER} =$ ac-ft

HSG A = 0 %

HSG B = 100 %

HSG C/D = 0 %

$EURV_{DESIGN} = 0.973$ ac-ft

$EURV_{DESIGN\ USER} =$ ac-ft

2. Basin Shape: Length to Width Ratio

(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 2.0 : 1

3. Basin Side Slopes

- A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 3.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

- A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

- A) Minimum Forebay Volume
($V_{MIN} = 3\%$ of the WQCV)
- B) Actual Forebay Volume
- C) Forebay Depth
($D_F = 18$ inch maximum)
- D) Forebay Discharge
i) Undetained 100-year Peak Discharge
ii) Forebay Discharge Design Flow
($Q_F = 0.02 * Q_{100}$)
- E) Forebay Discharge Design

$V_{MIN} = 0.009$ ac-ft

$V_F = 0.020$ ac-ft

$D_F = 18.0$ in

$Q_{100} = 54.14$ cfs

$Q_F = 1.08$ cfs

Choose One

- ☐ Berm With Pipe
☒ Wall with Rect. Notch
☐ Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches)

Calculated $D_P =$ in

G) Rectangular Notch Width

Calculated $W_N = 5.7$ in

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 2 of 3

Designer: Cameron Salz
 Company: Redland
 Date: October 16, 2023
 Project: The Rock Commerce Center
 Location: El Paso County

6. Trickle Channel

A) Type of Trickle Channel

F) Slope of Trickle Channel

Choose One

☒ Concrete

☐ Soft Bottom

S = 0.0100 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum)

B) Surface Area of Micropool (10 ft² minimum)

C) Outlet Type

D_M = 2.5 ft

A_M = 10 sq ft

Choose One

☒ Orifice Plate

☐ Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)

D_{orifice} = 1.36 inches

E) Total Outlet Area

A_{orifice} = 0.85 square inches

8. Initial Surge Volume

A) Depth of Initial Surge Volume (Minimum recommended depth is 4 inches)

B) Minimum Initial Surge Volume (Minimum volume of 0.3% of the WQCV)

C) Initial Surge Provided Above Micropool

D_{IS} = 4 in

V_{IS} = 38 cu ft

V_s = 3.3 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: A_t = A_{orifice} * 38.5 * (e^{-0.095D})

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open area to the total screen area for the material specified.)

Other (Y/N): N

A_t = 29 square inches

Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.

C) Ratio of Total Open Area to Total Area (only for type 'Other')

User Ratio =

D) Total Water Quality Screen Area (based on screen type)

A_{total} = 41 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)

H = 6.06 feet

F) Height of Water Quality Screen (H_{TR})

H_{TR} = 100.72 inches

G) Width of Water Quality Screen Opening (W_{opening}) (Minimum of 12 inches is recommended)

W_{opening} = 12.0 inches

VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 3

Designer: Cameron Salz
Company: Redland
Date: October 16, 2023
Project: The Rock Commerce Center
Location: El Paso County

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
 (Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One

☐ Irrigated

☒ Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

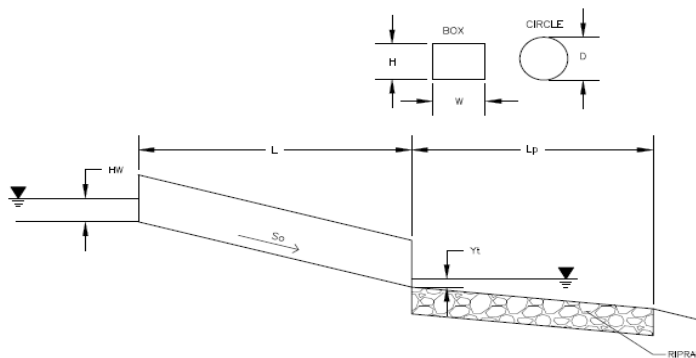
Notes:

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **P-23009 The Rock Commerce Center**

ID: **Pond Invert O-2**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge

Q = 1.31 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) =

Barrel Width (Span) in Feet

W (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

Barrels = 1

Inlet Elevation

Elev IN = 7137.26 ft

Outlet Elevation **OR** Slope

Elev OUT = 7137 ft

Culvert Length

L = 32 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Y_t Elevation = 7137.61 ft

Max Allowable Channel Velocity

V = 7 ft/s

Calculated Results:

Culvert Cross Sectional Area Available

A = 1.77 ft²

Culvert Normal Depth

Y_n = 0.36 ft

Culvert Critical Depth

Y_c = 0.43 ft

Froude Number

Fr = 1.39 **Supercritical!**

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.49

Sum of All Loss Coefficients

k_s = 1.69 ft

Headwater:

Inlet Control Headwater

HW_i = 0.58 ft

Outlet Control Headwater

HW_o = N/A ft

Design Headwater Elevation

HW = N/A ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = N/A

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:

Flow/(Diameter^{2.5})

Q/D^{2.5} = 0.48 ft^{0.5}/s

Tailwater Surface Height

Y_t = 0.61 ft

Tailwater/Diameter

Y_t/D = 0.41

Expansion Factor

1/(2*tan(θ)) = 6.70

Flow Area at Max Channel Velocity

A_t = 0.19 ft²

Width of Equivalent Conduit for Multiple Barrels

W_{eq} = - ft

Length of Riprap Protection

L_p = 5 ft

Width of Riprap Protection at Downstream End

T = 3 ft

Adjusted Diameter for Supercritical Flow

Da = 0.93 ft

Minimum Theoretical Riprap Size

d_{50 min} = 1 in

Nominal Riprap Size

d_{50 nominal} = 6 in

MHFD Riprap Type

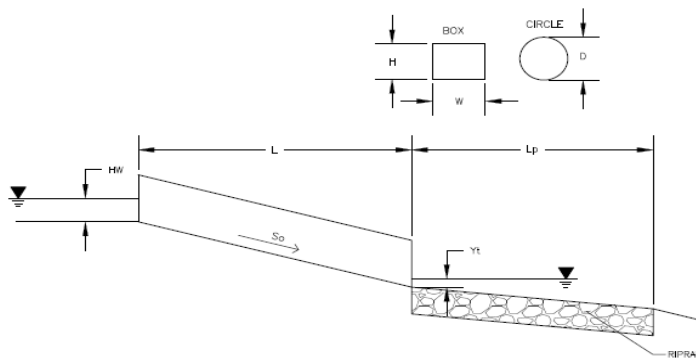
Type = VL

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **P-23009 The Rock Commerce Center**

ID: **Culvert at Design Point O-3**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge

Q = 1.15 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Beveled Edge (1:1)

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) =

Barrel Width (Span) in Feet

W (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

Barrels = 1

Inlet Elevation

Elev IN = 7156.62 ft

Outlet Elevation **OR** Slope

Elev OUT = 7153.87 ft

Culvert Length

L = 65.4 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Y_t Elevation =

Max Allowable Channel Velocity

V = 7 ft/s

Calculated Results:

Culvert Cross Sectional Area Available

A = 1.77 ft²

Culvert Normal Depth

Y_n = 0.23 ft

Culvert Critical Depth

Y_c = 0.40 ft

Froude Number

Fr = 3.06 **Supercritical!**

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 1.01

Sum of All Loss Coefficients

k_s = 2.21 ft

Headwater:

Inlet Control Headwater

HW_I = 0.53 ft

Outlet Control Headwater

HW_O = N/A ft

Design Headwater Elevation

HW = N/A ft

Headwater/Diameter **OR Headwater/Rise Ratio**

HW/D = N/A

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:

Flow/(Diameter^{2.5})

Q/D^{2.5} = 0.42 ft^{0.5}/s

Tailwater Surface Height

Y_t = 0.60 ft

Tailwater/Diameter

Y_t/D = 0.40

Expansion Factor

1/(2*tan(θ)) = 6.70

Flow Area at Max Channel Velocity

A_t = 0.16 ft²

Width of Equivalent Conduit for Multiple Barrels

W_{eq} = - ft

Length of Riprap Protection

L_p = 5 ft

Width of Riprap Protection at Downstream End

T = 3 ft

Adjusted Diameter for Supercritical Flow

Da = 0.86 ft

Minimum Theoretical Riprap Size

d₅₀ min = 1 in

Nominal Riprap Size

d₅₀ nominal = 6 in

MHFD Riprap Type

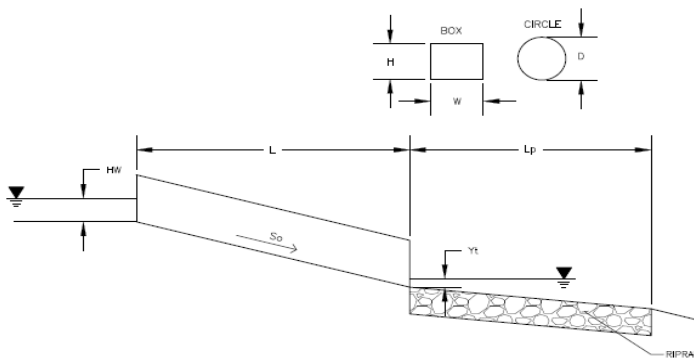
Type = VL

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **P-23009 The Rock Commerce Center**

ID: **Pond Outlet @ Design Point O-4**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Design Information:

Design Discharge

Q = 10.4 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) =

Barrel Width (Span) in Feet

W (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

Barrels = 1

Inlet Elevation

Elev IN = 7134.29 ft

Outlet Elevation OR Slope

Elev OUT = 7134 ft

Culvert Length

L = 41.25 ft

Manning's Roughness

n = 0.013

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Y_t Elevation =

Max Allowable Channel Velocity

V = 5 ft/s

Calculated Results:

Culvert Cross Sectional Area Available

A = 1.77 ft²

Culvert Normal Depth

Y_n = 1.50 ft

Culvert Critical Depth

Y_c = 1.24 ft

Froude Number

Fr = - Pressure flow!

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.75

Sum of All Loss Coefficients

k_s = 1.95 ft

Headwater:

Inlet Control Headwater

HW_I = 2.12 ft

Outlet Control Headwater

HW_O = 2.13 ft

Design Headwater Elevation

HW = 7136.42 ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = 1.42

Outlet Protection:

Flow/(Diameter^{2.5})

Q/D^{2.5} = 3.77 ft^{0.5}/s

Tailwater Surface Height

Y_t = 0.60 ft

Tailwater/Diameter

Y_t/D = 0.40

Expansion Factor

1/(2*tan(θ)) = 3.70

Flow Area at Max Channel Velocity

A_t = 2.08 ft²

Width of Equivalent Conduit for Multiple Barrels

W_{eq} = - ft

Length of Riprap Protection

L_p = 8 ft

Width of Riprap Protection at Downstream End

T = 4 ft

Adjusted Diameter for Supercritical Flow

Da = - ft

Minimum Theoretical Riprap Size

d_{50 min} = 5 in

Nominal Riprap Size

d_{50 nominal} = 6 in

MHFD Riprap Type

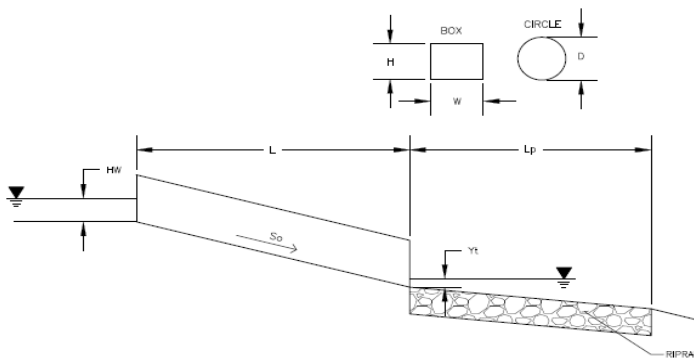
Type = VL

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **P-23009 The Rock Commerce Center**

ID: **Design Point C Run Down**



Soil Type:

Choose One:

☐ Sandy

☒ Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge

Q = 1.6 cfs

Circular Culvert:

Barrel Diameter in Inches

D = 18 inches

Inlet Edge Type (Choose from pull-down list)

Grooved Edge Projecting

OR:

Box Culvert:

Barrel Height (Rise) in Feet

H (Rise) =

Barrel Width (Span) in Feet

W (Span) =

Inlet Edge Type (Choose from pull-down list)

Number of Barrels

Barrels = 1

Inlet Elevation

Elev IN = 7134.54 ft

Outlet Elevation **OR** Slope

Elev OUT = 7133.19 ft

Culvert Length

L = 15 ft

Manning's Roughness

n = 0.012

Bend Loss Coefficient

k_b = 0

Exit Loss Coefficient

k_x = 1

Tailwater Surface Elevation

Y_t Elevation =

Max Allowable Channel Velocity

V = 7 ft/s

Calculated Results:

Culvert Cross Sectional Area Available

A = 1.77 ft²

Culvert Normal Depth

Y_n = 0.40 ft

Culvert Critical Depth

Y_c = 0.48 ft

Froude Number

Fr = 1.40 **Supercritical!**

Entrance Loss Coefficient

k_e = 0.20

Friction Loss Coefficient

k_f = 0.23

Sum of All Loss Coefficients

k_s = 1.43 ft

Headwater:

Inlet Control Headwater

HW_i = 0.65 ft

Outlet Control Headwater

HW_o = N/A ft

Design Headwater Elevation

HW = N/A ft

Headwater/Diameter OR Headwater/Rise Ratio

HW/D = N/A

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:

Flow/(Diameter^{2.5})

Q/D^{2.5} = 0.58 ft^{0.5}/s

Tailwater Surface Height

Y_t = 0.60 ft

Tailwater/Diameter

Y_t/D = 0.40

Expansion Factor

1/(2*tan(θ)) = 6.70

Flow Area at Max Channel Velocity

A_t = 0.23 ft²

Width of Equivalent Conduit for Multiple Barrels

W_{eq} = - ft

Length of Riprap Protection

L_p = 5 ft

Width of Riprap Protection at Downstream End

T = 3 ft

Adjusted Diameter for Supercritical Flow

Da = 0.95 ft

Minimum Theoretical Riprap Size

d_{50 min} = 1 in

Nominal Riprap Size

d_{50 nominal} = 6 in

MHFD Riprap Type

Type = VL

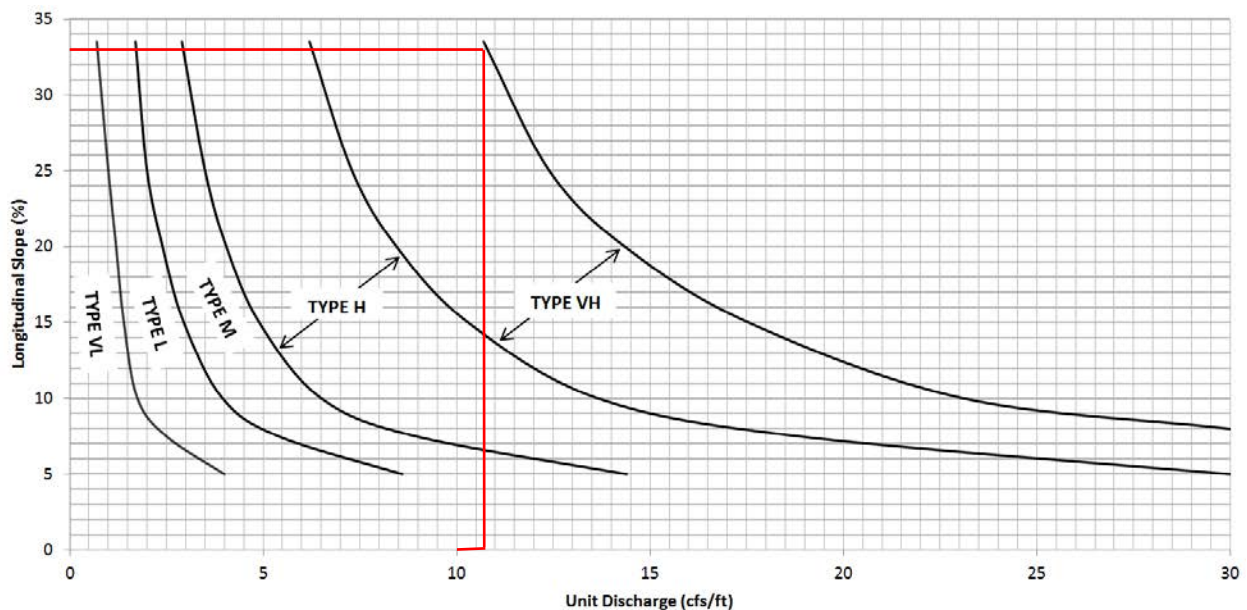
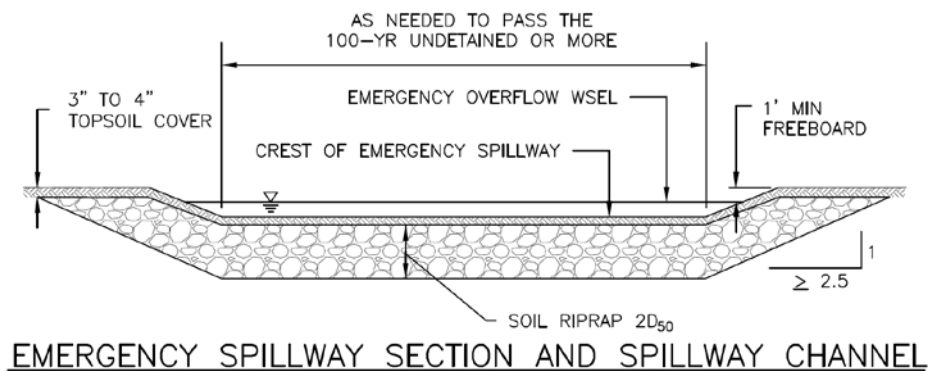
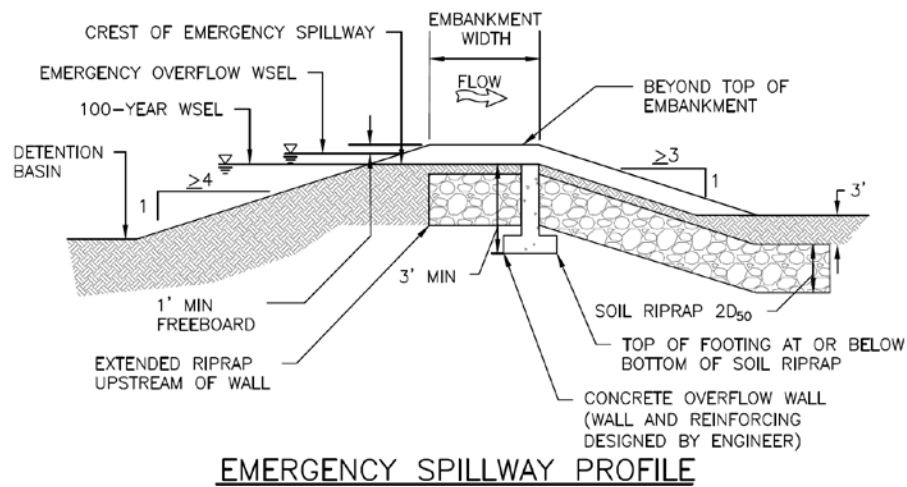
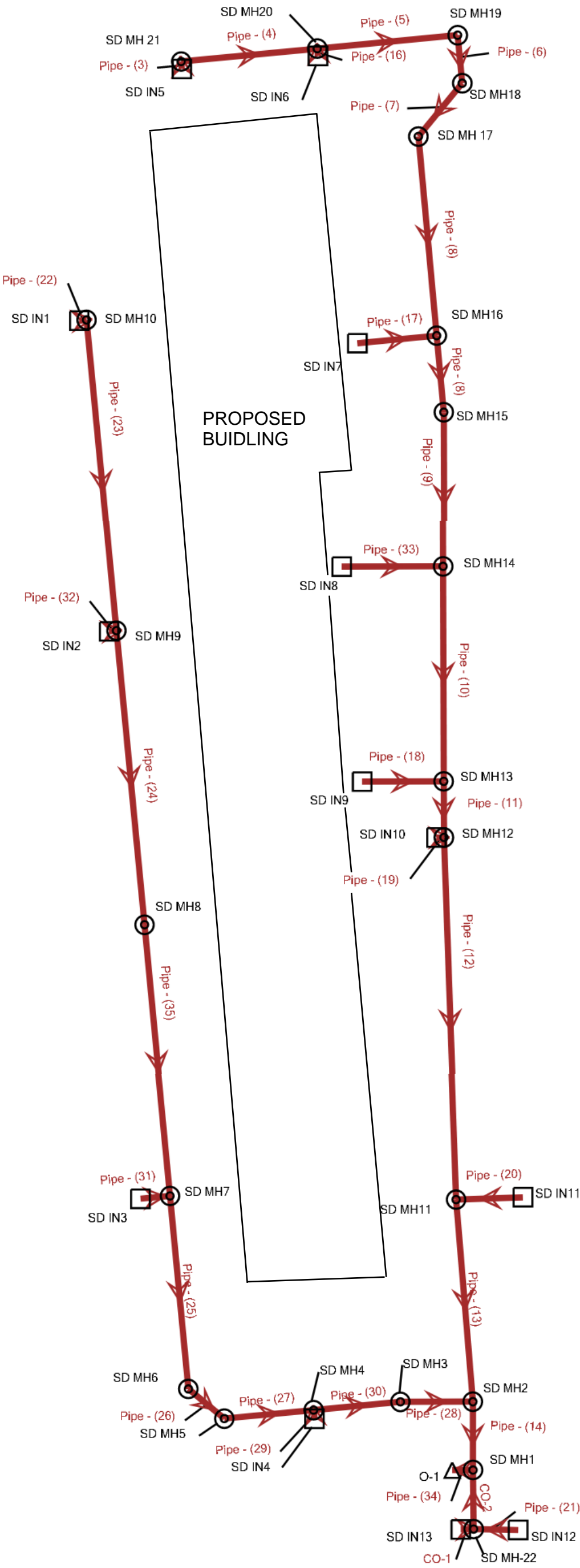
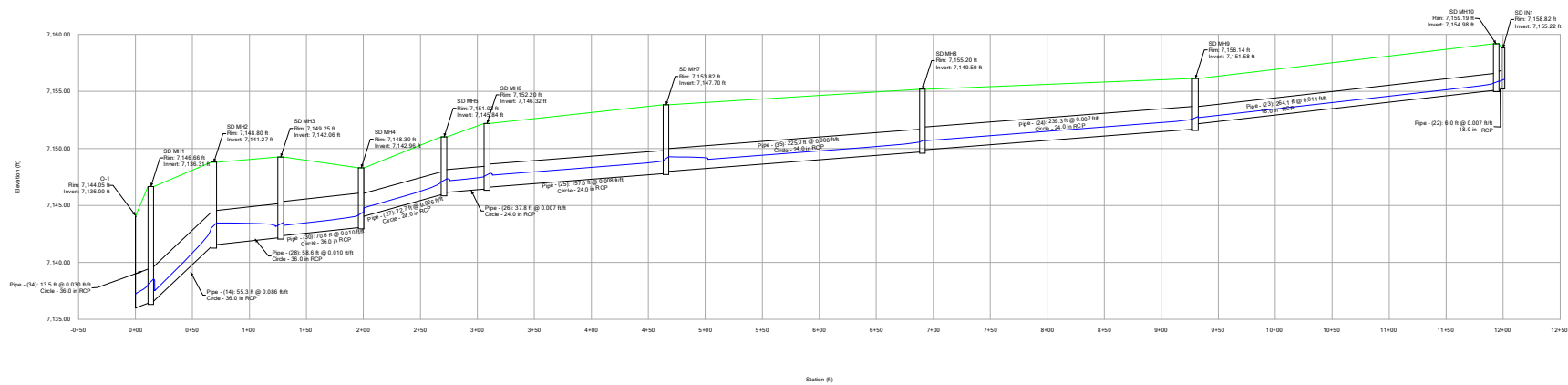


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

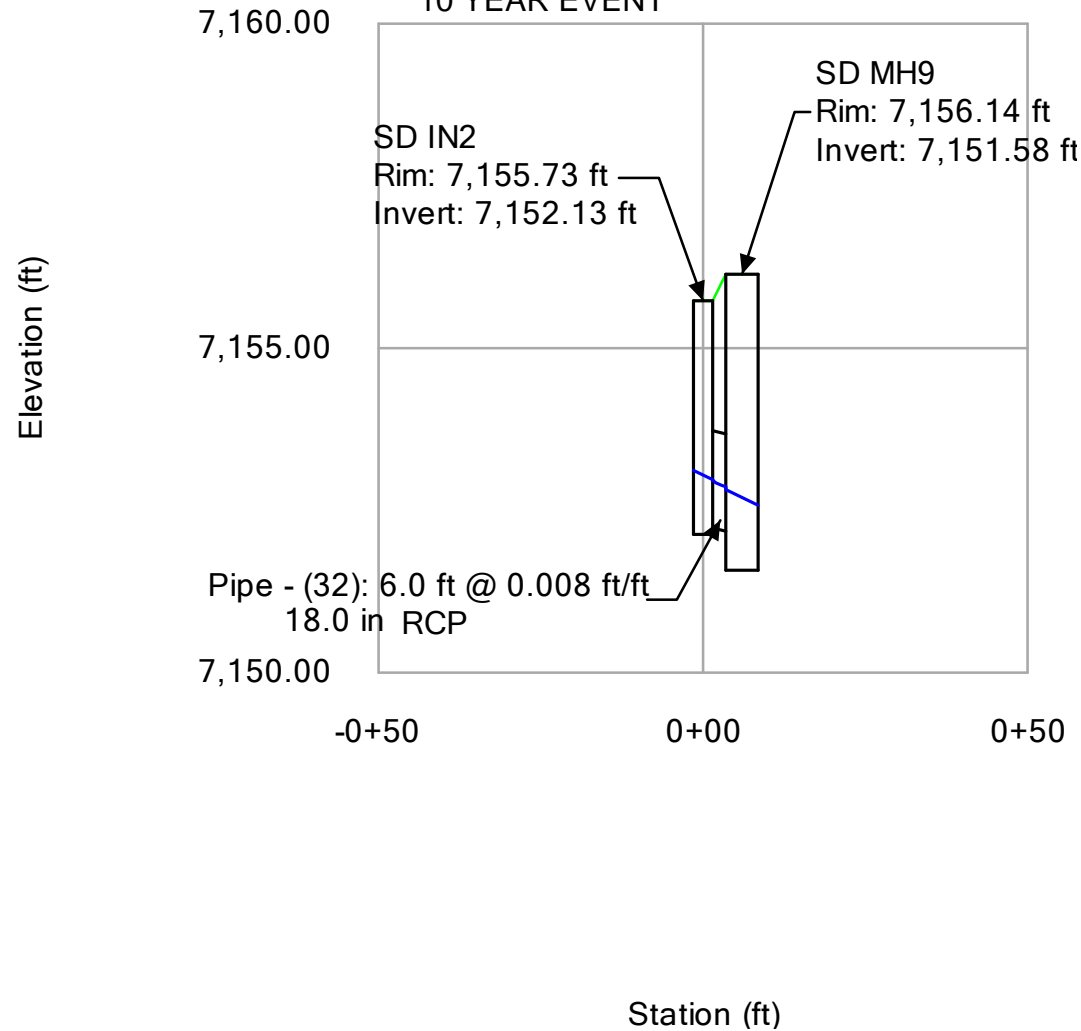
STORMCAD NETWORK PREVIEW FOR THE ROCK COMMERCE CENTER



Profile Report
Engineering Profile - O-1 to SD IN1 (Proposed Strom.stsw)
 10 YEAR EVENT

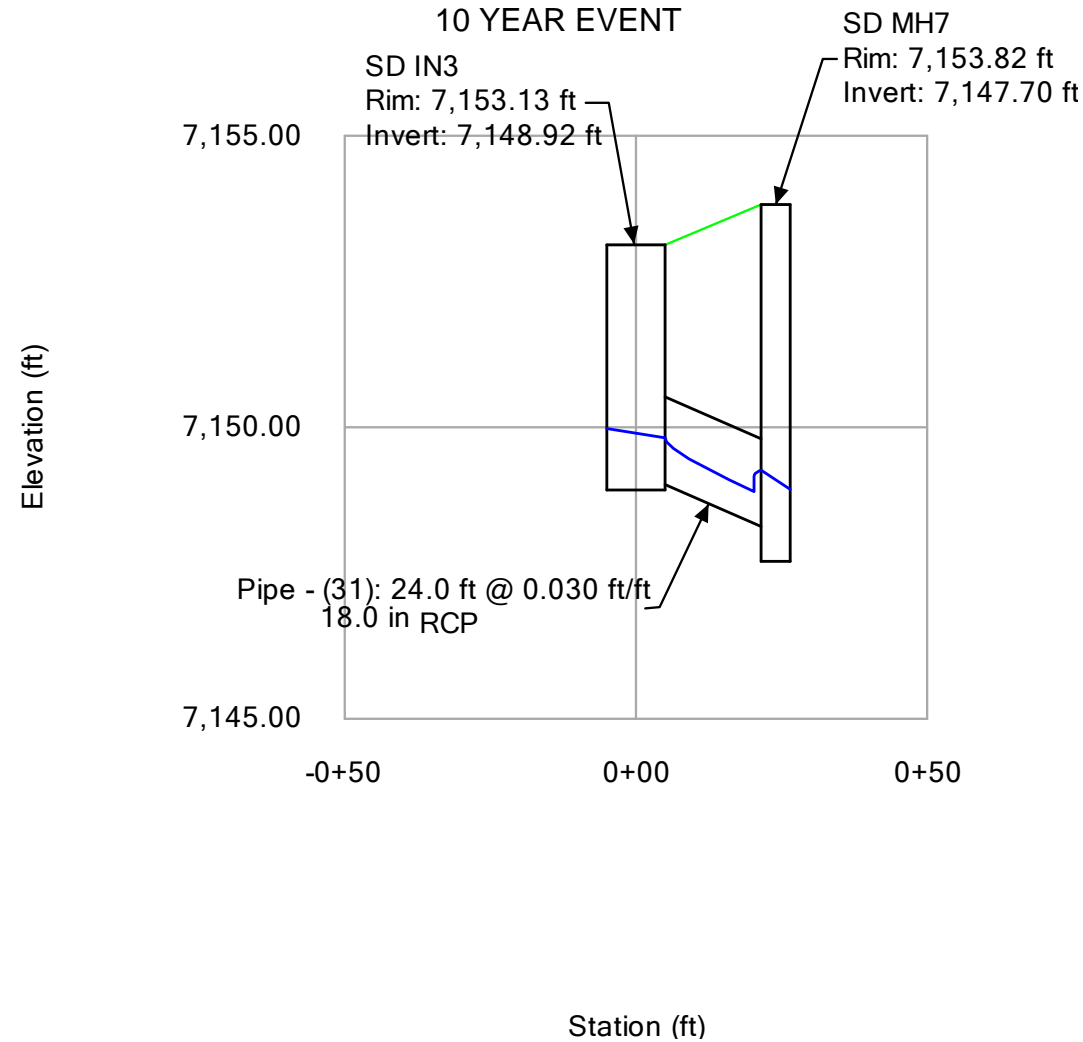


Profile Report
Engineering Profile - SD IN2 to SD MH9 (Proposed Strom.stsw)
 10 YEAR EVENT

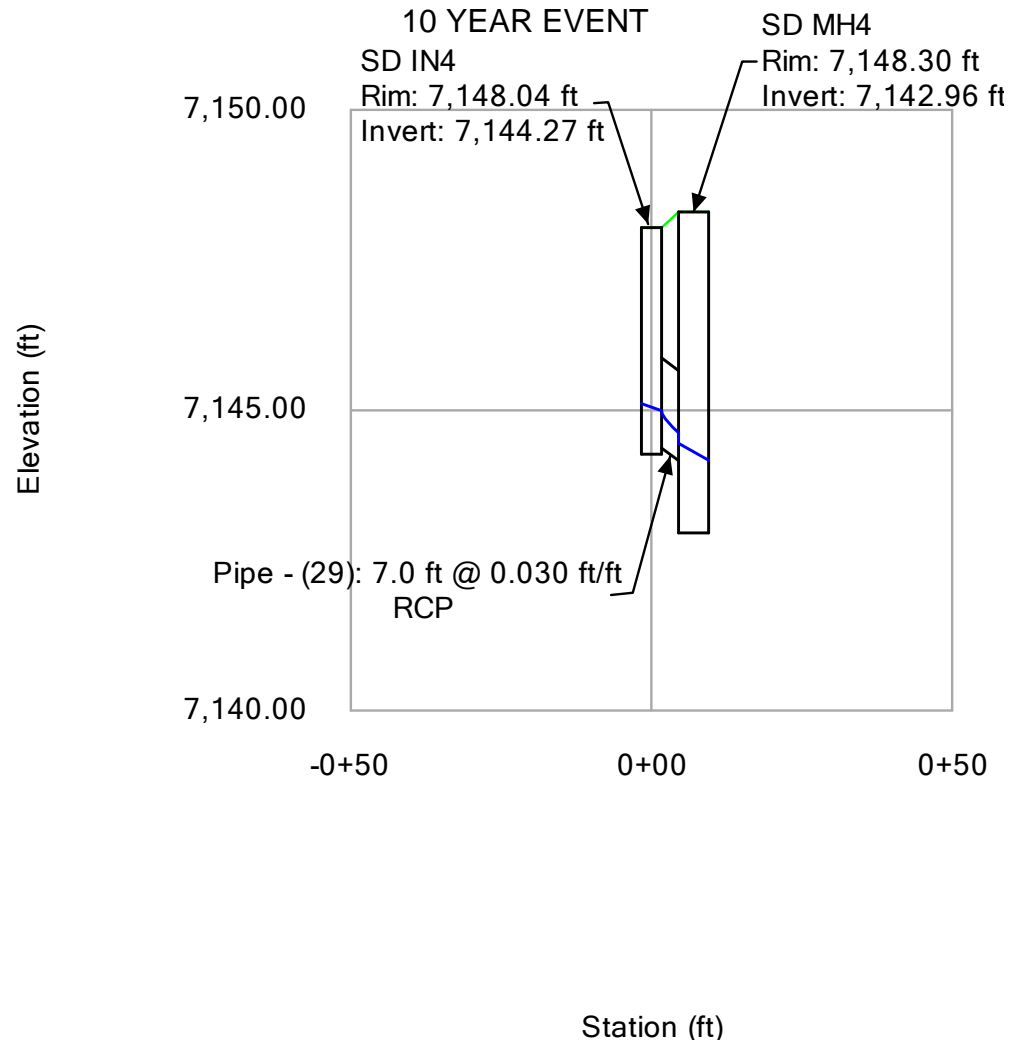


Profile Report

Engineering Profile - SDIN3 to SD MH7 (Proposed Strom.stsw)

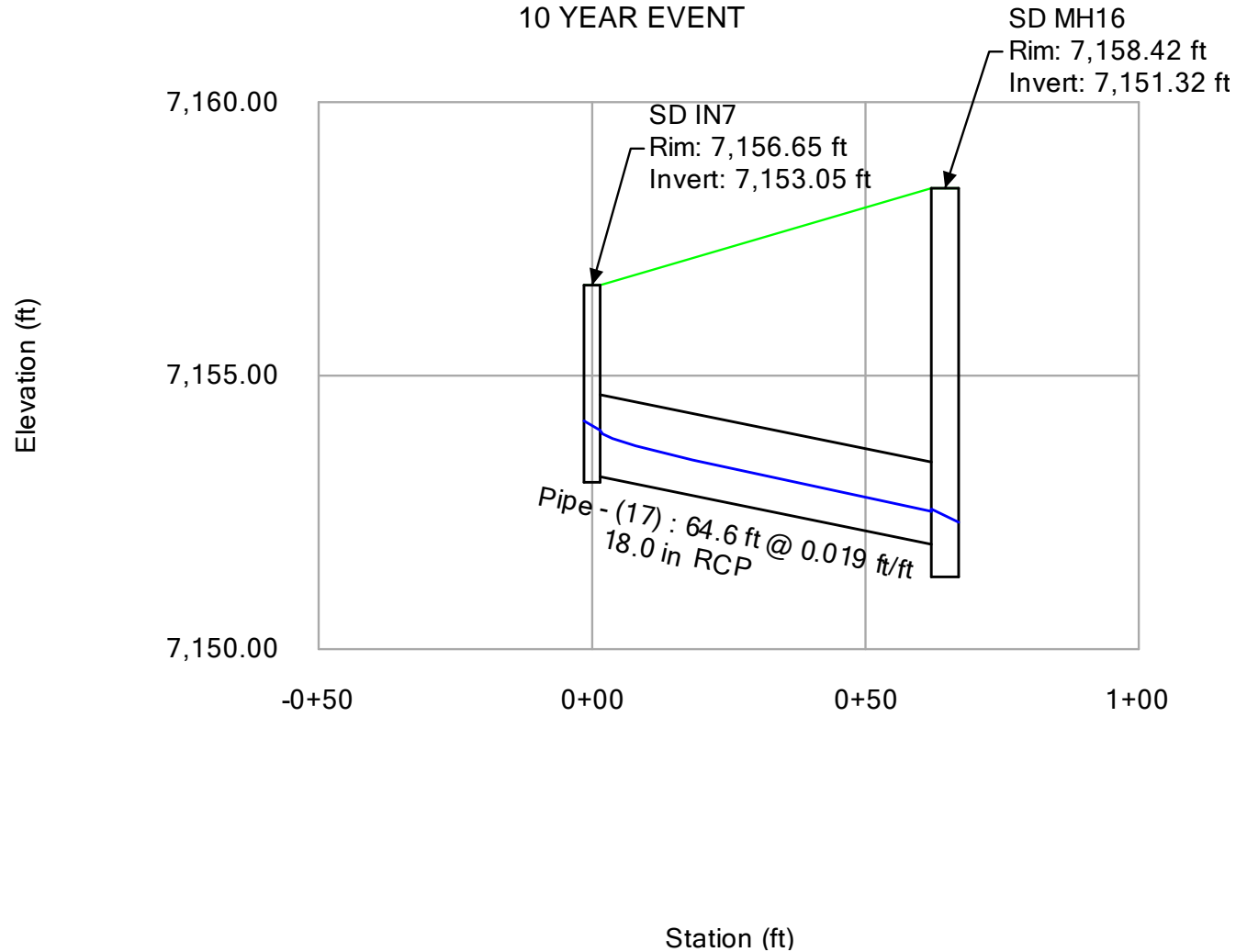


Profile Report
Engineering Profile - SD IN4 to SD MH4 (Proposed Strom.stsw)

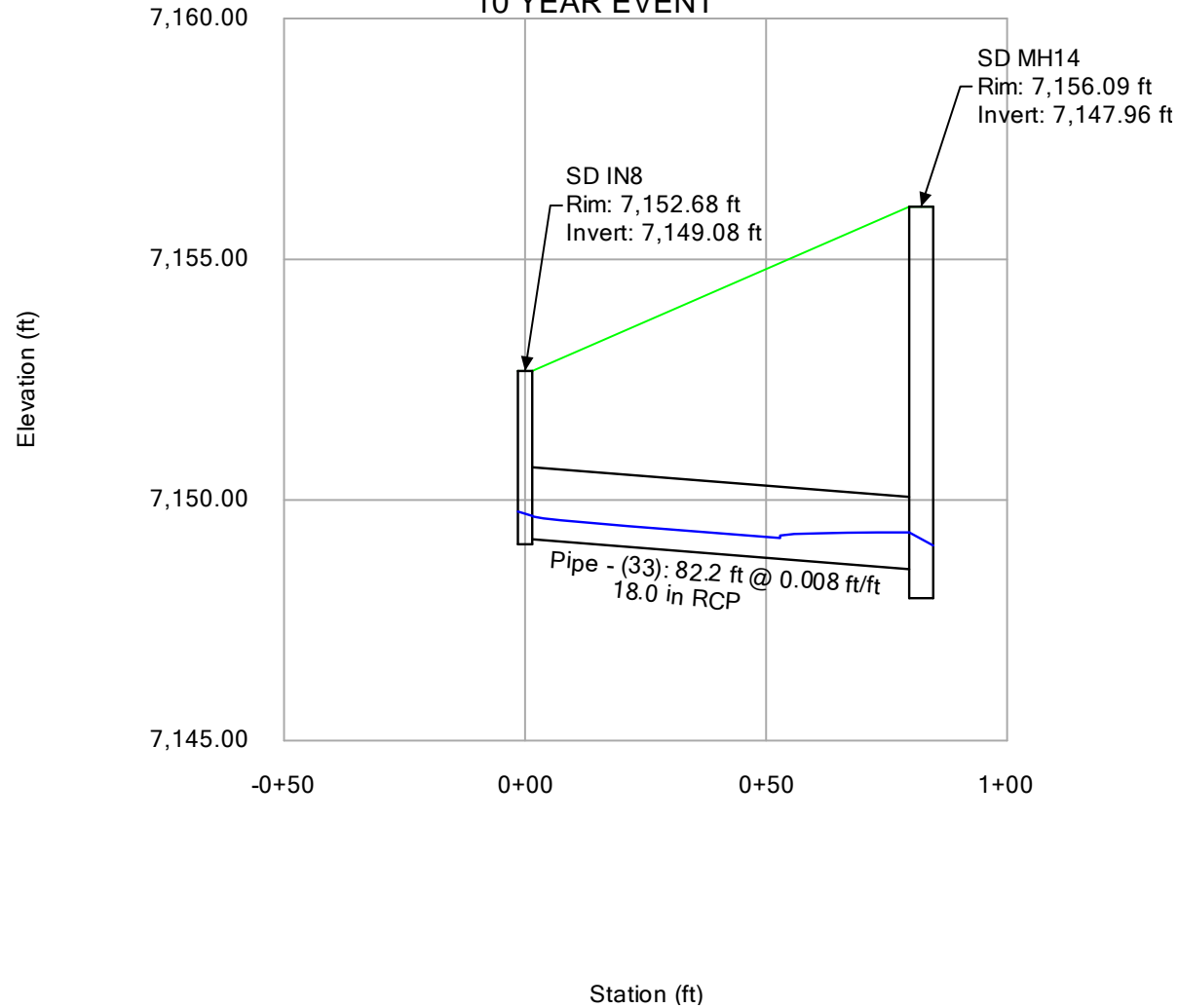


Profile Report
Engineering Profile - SD IN7 to SD MH16 (Proposed Strom.stsw)

10 YEAR EVENT



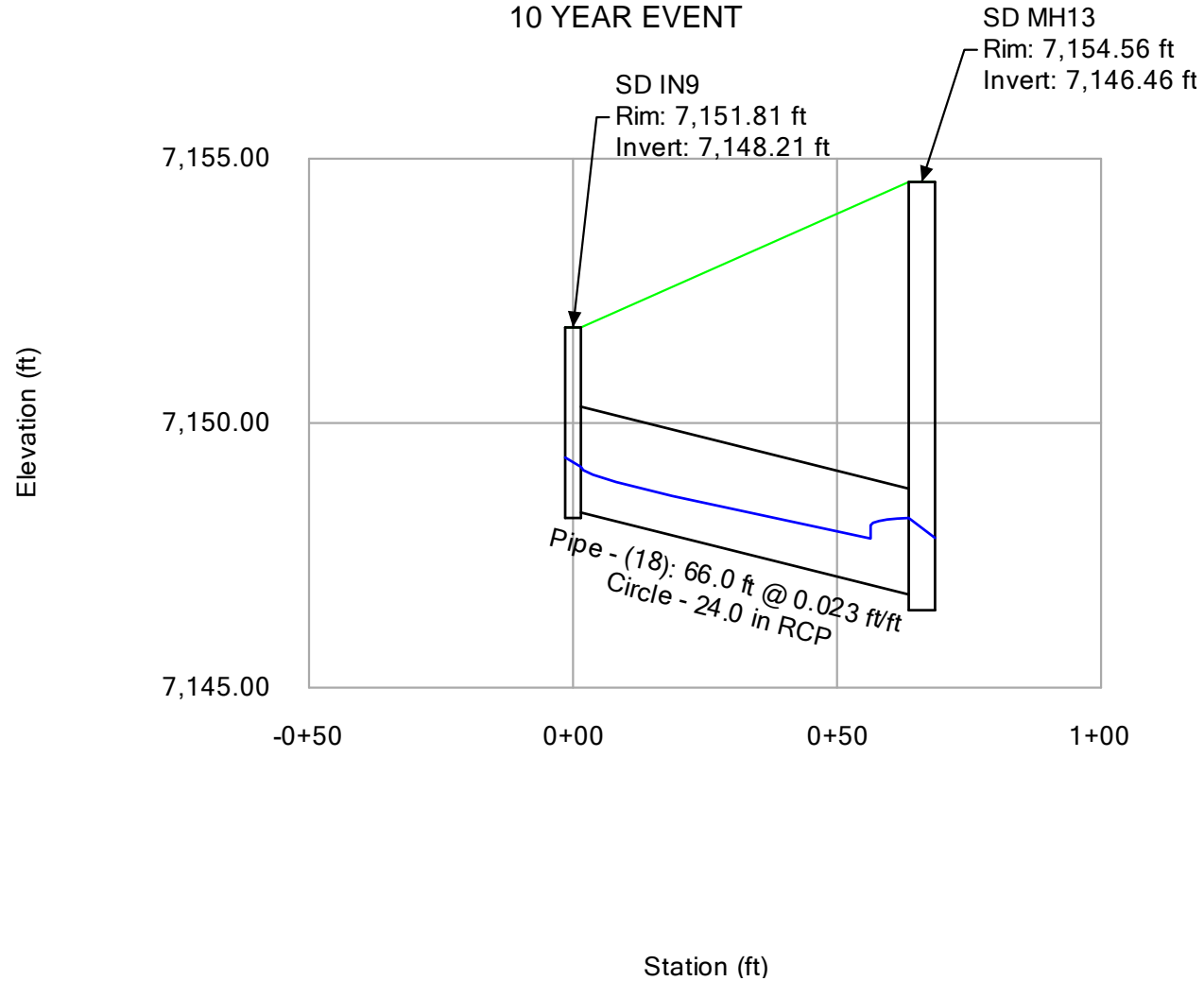
Profile Report **Engineering Profile - SD IN8 to SD MH14 (Proposed Strom.stsw)** **10 YEAR EVENT**



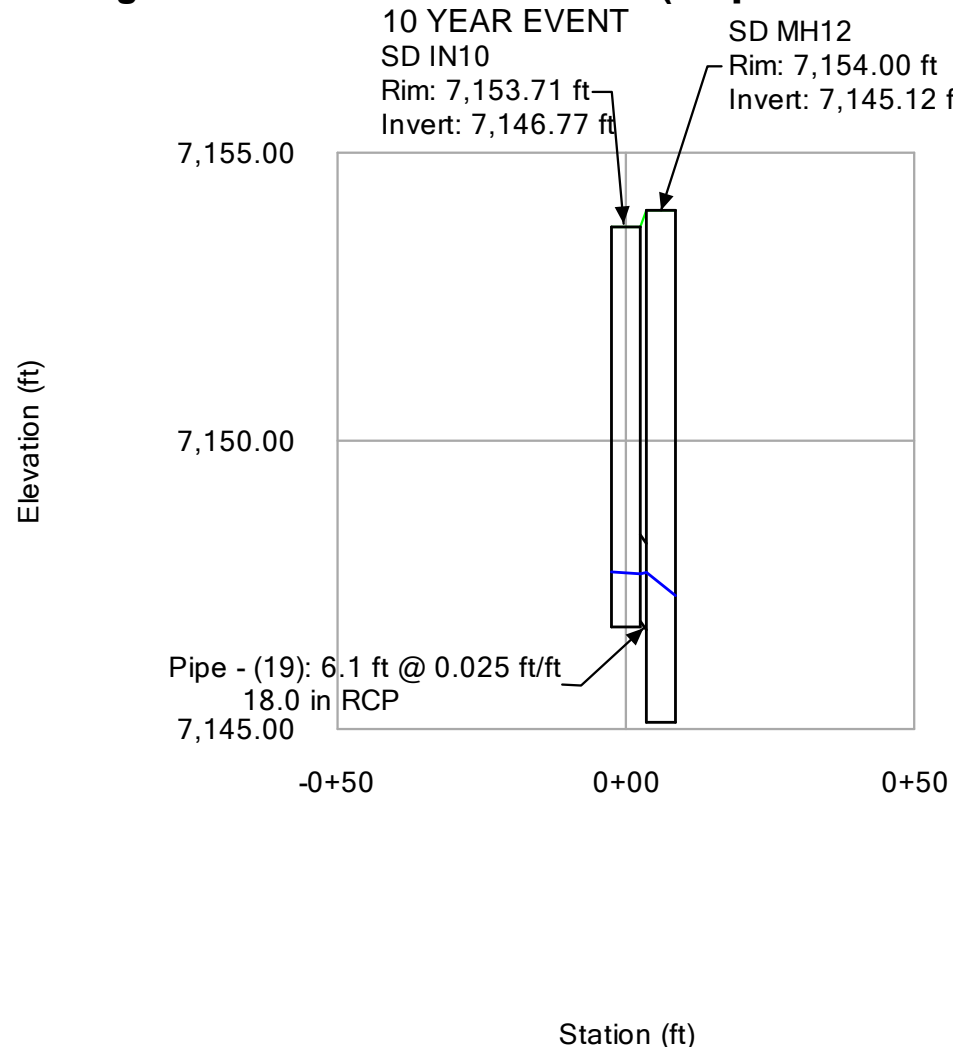
Profile Report

Engineering Profile - SD IN9 to SD MH13 (Proposed Strom.stsw)

10 YEAR EVENT



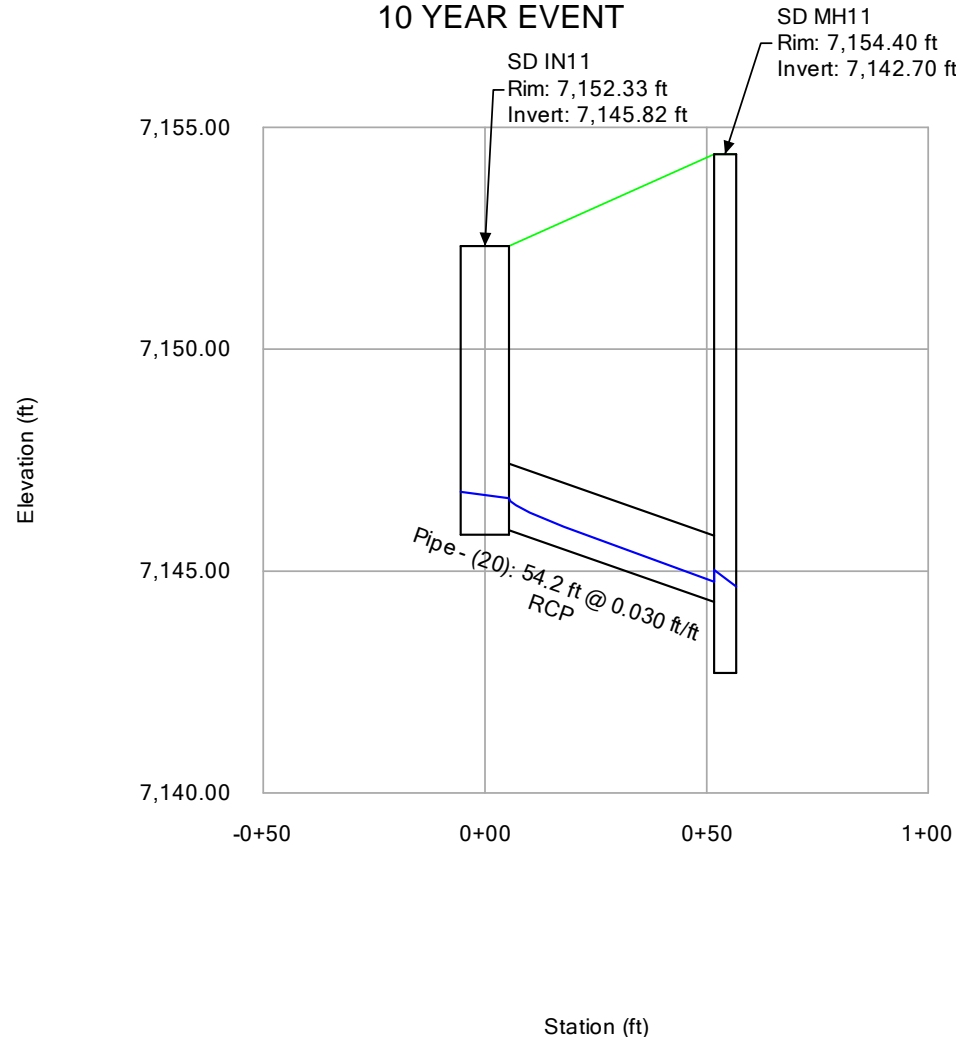
Profile Report
Engineering Profile - SD IN10 to SD MH12 (Proposed Strom.stsw)



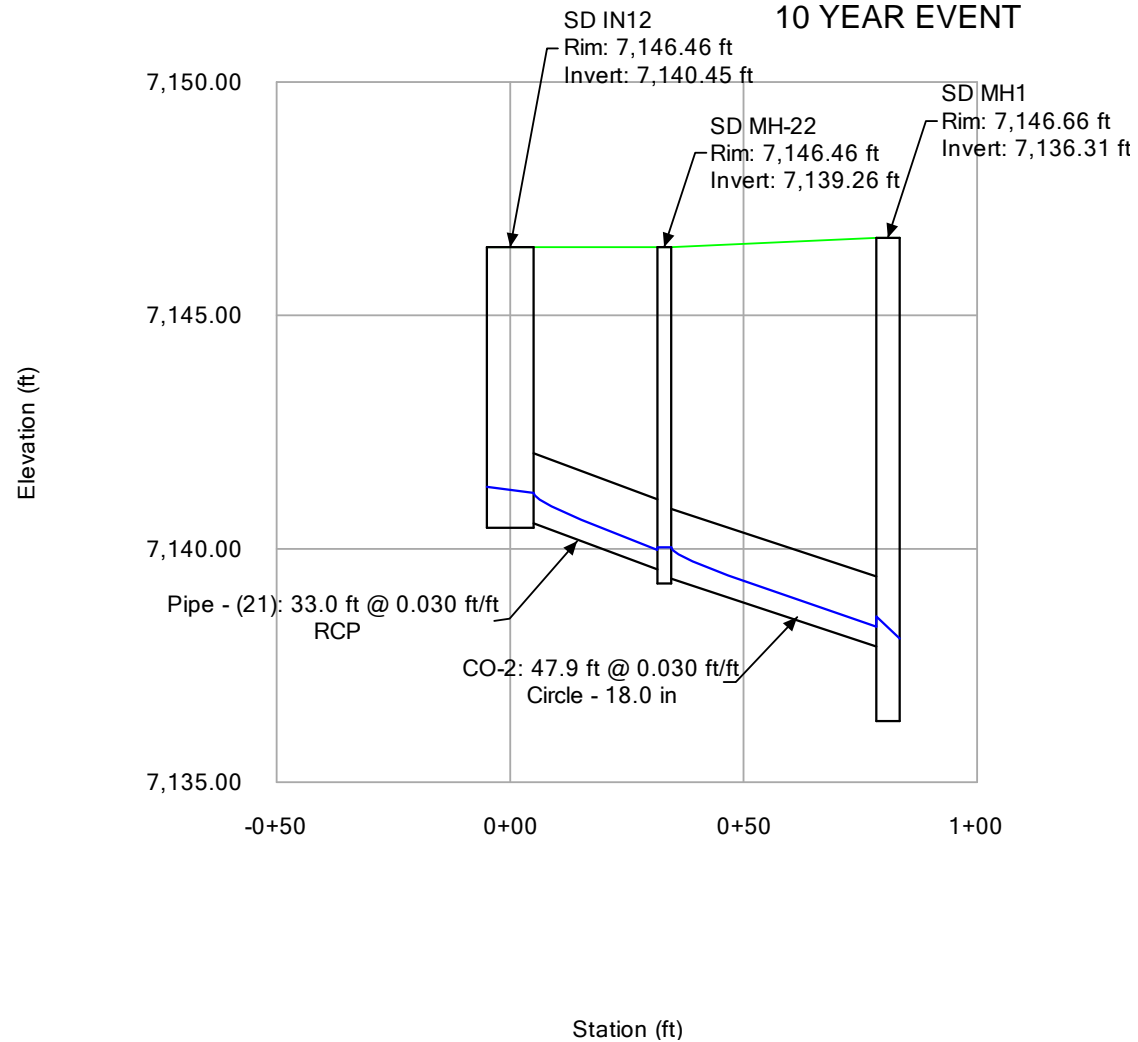
Profile Report

Engineering Profile - SD IN11 to SD MH11 (Proposed Strom.stsw)

10 YEAR EVENT

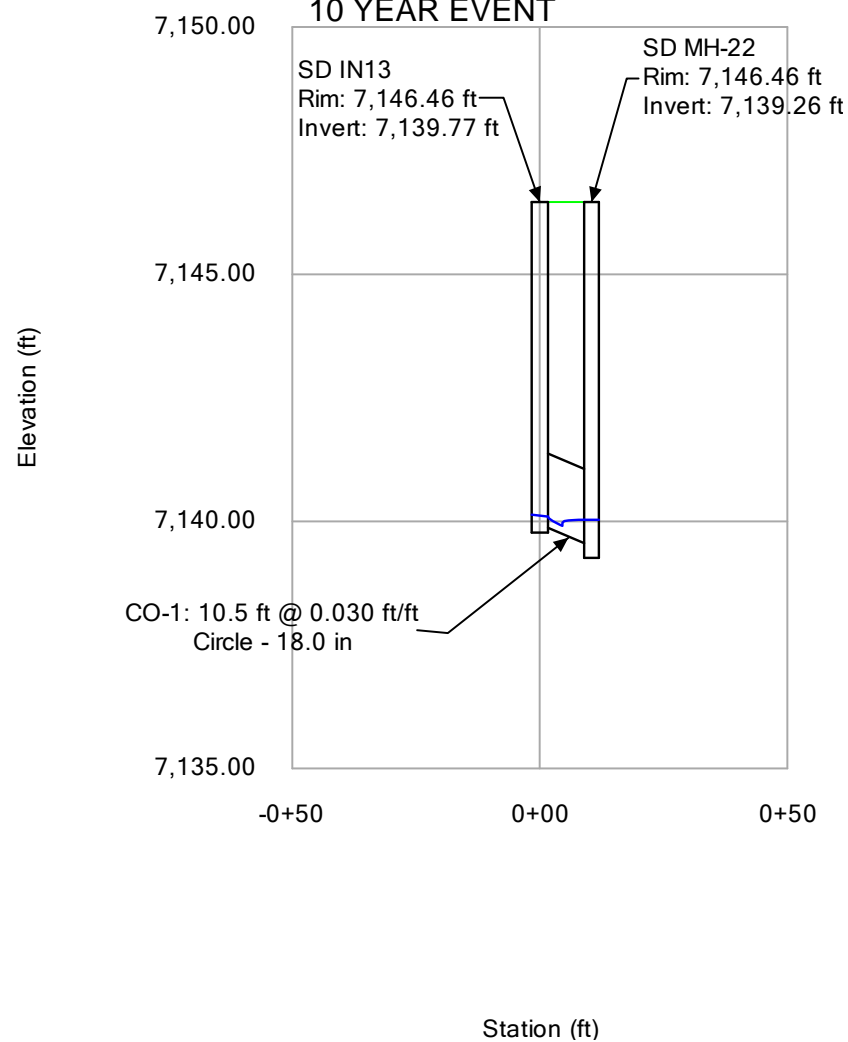


Profile Report **Engineering Profile - SD IN12 to SD MH1 (Proposed Strom.stsw)**



Profile Report

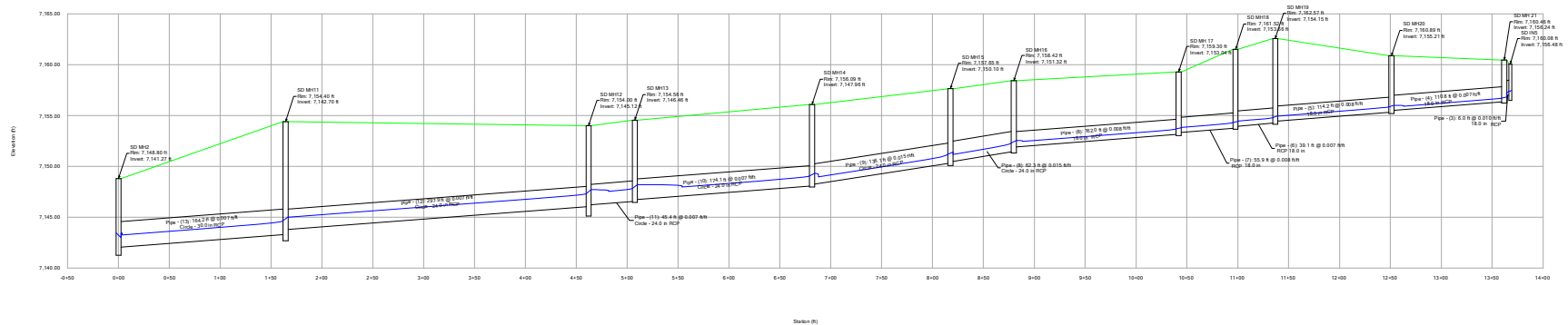
Engineering Profile - SDIN 13 to MH22 (Proposed Strom.stsw)



Profile Report

Engineering Profile - SD MH2 to SD IN5 (Proposed Strom.stsw)

10 YEAR EVENT



FlexTable: Catch Basin Table - 10 YEAR EVENT

Label	Notes	Elevation (Ground) (ft)	Headloss Method	Headloss Coefficient (Standard)	Headloss (ft)
SD IN11	CDOT Type 13 Combo	7,152.33	Standard	0.500	0.14
SD IN13	CDOT Type 13 Combo	7,146.46	Standard	0.500	0.01
SD IN12	CDOT Type R	7,146.46	Standard	0.500	0.12
SD IN4	CDOT Type 13 Combo	7,148.04	Standard	0.500	0.12
SD IN3	CDOT Type R	7,153.13	Standard	0.500	0.16
SD IN10	CDOT Type R	7,153.71	Standard	0.500	0.03
SD IN9	CDOT Type 13	7,151.81	Standard	0.500	0.15
SD IN8	CDOT Type 13	7,152.68	Standard	0.500	0.09
SD IN7	CDOT Type 13	7,156.65	Standard	0.500	0.17
SD IN6	CDOT Type 13	7,160.43	Standard	0.500	0.07
SD IN5	CDOT Type 13	7,160.08	Standard	0.500	0.07
SD IN1	CDOT Type 13	7,158.82	Standard	0.500	0.12
SD IN2	CDOT Type 13	7,155.73	Standard	0.500	0.15

FlexTable: Manhole Table - 10 YEAR EVENT

Label	Notes	Elevation (Rim) (ft)	Headloss Method	Headloss Coefficient (Standard)	Headloss (ft)
SD MH19	5' DIA MH	7,162.57	Standard	0.800	0.16
SD MH18	5' DIA MH	7,161.52	Standard	0.600	0.12
SD MH20	5' DIA MH	7,160.89	Standard	0.700	0.14
SD MH 21	5' DIA MH	7,160.46	Standard	0.800	0.11
SD MH 17	5' DIA MH	7,159.30	Standard	0.600	0.12
SD MH10	5' DIA MH	7,159.19	Standard	0.800	0.19
SD MH16	5' DIA MH	7,158.42	Standard	0.700	0.24
SD MH15	5' DIA MH	7,157.65	Standard	0.600	0.21
SD MH9	5' DIA MH	7,156.14	Standard	0.700	0.24
SD MH14	5' DIA MH	7,156.09	Standard	0.700	0.27
SD MH8	5' DIA MH	7,155.20	Standard	0.500	0.17
SD MH13	5' DIA MH	7,154.56	Standard	0.700	0.38
SD MH11	5' DIA MH	7,154.40	Standard	0.700	0.38
SD MH12	5' DIA MH	7,154.00	Standard	0.700	0.40
SD MH7	5' DIA MH	7,153.82	Standard	0.700	0.33
SD MH6	5' DIA MH	7,152.20	Standard	0.600	0.28
SD MH5	5' DIA MH	7,151.02	Standard	0.600	0.27
SD MH3	5' DIA MH	7,149.25	Standard	0.600	0.24
SD MH2	6' DIA MH	7,148.80	Standard	0.700	0.46
SD MH4	5' DIA MH	7,148.30	Standard	0.700	0.29
SD MH1	6' DIA MH	7,146.66	Standard	0.700	0.47
SD MH-22	5' DIA MH	7,146.46	Standard	0.700	0.18

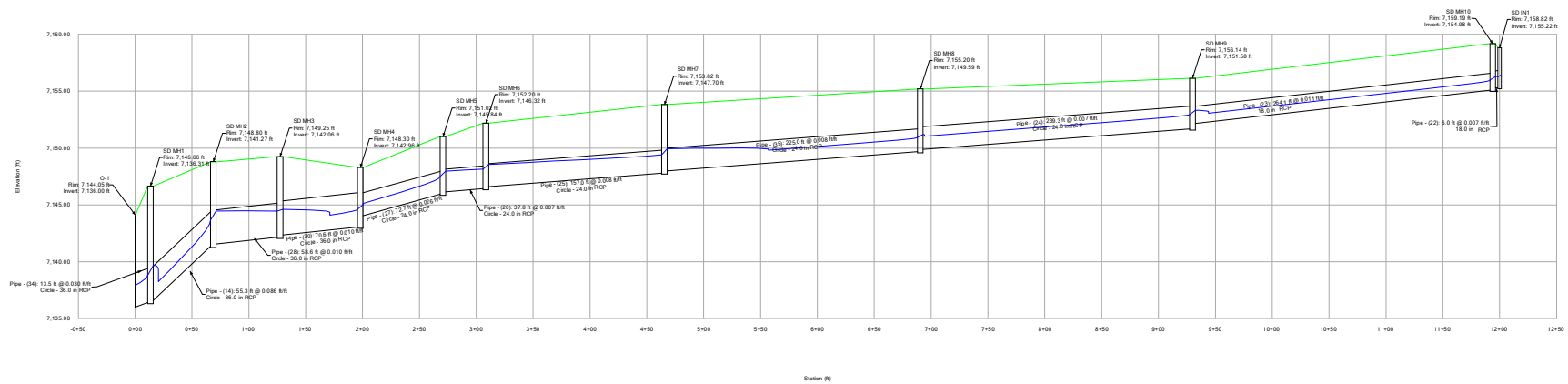
FlexTable: Conduit Table - 10 YEAR EVENT

Label	Diameter (in)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Manning's n	Flow (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Froude Number (Normal)
Pipe - (5)	18.0	0.008	4.23	7,155.31	7,154.45	0.013	2.18	7,155.87	7,154.95	7,156.07	7,155.23	1.236
Pipe - (6)	18.0	0.007	4.19	7,154.25	7,153.96	0.013	2.13	7,154.80	7,154.46	7,155.01	7,154.73	1.229
Pipe - (7)	18.0	0.008	4.20	7,153.76	7,153.34	0.013	2.12	7,154.31	7,153.83	7,154.51	7,154.11	1.237
Pipe - (4)	18.0	0.007	3.43	7,156.34	7,155.51	0.013	1.05	7,156.72	7,156.01	7,156.86	7,156.08	1.228
Pipe - (16)	18.0	0.010	3.95	7,155.80	7,155.74	0.013	1.20	7,156.21	7,156.10	7,156.36	7,156.31	1.418
Pipe - (3)	18.0	0.010	3.80	7,157.00	7,156.94	0.013	1.05	7,157.38	7,157.27	7,157.52	7,157.47	1.414
Pipe - (8)	18.0	0.008	4.19	7,153.14	7,151.92	0.013	2.09	7,153.69	7,152.56	7,153.89	7,152.69	1.239
Pipe - (22)	18.0	0.007	4.34	7,155.32	7,155.28	0.013	2.80	7,155.95	7,155.88	7,156.19	7,156.16	1.154
Pipe - (23)	18.0	0.011	5.20	7,155.08	7,152.18	0.013	2.79	7,155.71	7,152.82	7,155.95	7,153.05	1.493
Pipe - (8)	24.0	0.015	7.15	7,151.42	7,150.50	0.013	6.46	7,152.32	7,151.40	7,152.67	7,151.74	1.819
Pipe - (17)	18.0	0.019	7.39	7,153.15	7,151.92	0.013	4.86	7,154.00	7,152.52	7,154.34	7,153.37	1.948
Pipe - (9)	24.0	0.015	7.18	7,150.30	7,148.26	0.013	6.42	7,151.20	7,149.33	7,151.54	7,149.55	1.833
Pipe - (24)	24.0	0.007	5.58	7,151.68	7,149.89	0.013	6.43	7,152.58	7,150.68	7,152.92	7,151.16	1.282
Pipe - (32)	18.0	0.008	5.10	7,152.23	7,152.18	0.013	3.77	7,152.97	7,152.86	7,153.26	7,153.22	1.275
Pipe - (10)	24.0	0.007	5.87	7,148.06	7,146.76	0.013	7.81	7,149.05	7,148.21	7,149.44	7,148.37	1.265
Pipe - (33)	18.0	0.008	3.94	7,149.18	7,148.56	0.013	1.68	7,149.67	7,149.33	7,149.84	7,149.38	1.240
Pipe - (35)	24.0	0.008	5.54	7,149.69	7,148.00	0.013	6.21	7,150.57	7,149.26	7,150.91	7,149.40	1.286
Pipe - (11)	24.0	0.007	6.60	7,146.56	7,146.22	0.013	12.45	7,147.83	7,147.71	7,148.37	7,148.09	1.190
Pipe - (18)	24.0	0.023	7.86	7,148.31	7,146.76	0.013	5.04	7,149.10	7,148.21	7,149.40	7,148.28	2.290
Pipe - (12)	24.0	0.007	6.65	7,146.02	7,143.80	0.013	13.00	7,147.32	7,144.99	7,147.88	7,145.68	1.175
Pipe - (13)	30.0	0.007	7.03	7,143.30	7,142.07	0.013	15.90	7,144.65	7,143.47	7,145.19	7,143.96	1.303
Pipe - (20)	18.0	0.030	8.01	7,145.92	7,144.30	0.013	3.61	7,146.65	7,144.75	7,146.93	7,145.75	2.469
Pipe - (19)	18.0	0.025	6.33	7,146.87	7,146.72	0.013	2.01	7,147.70	7,147.71	7,147.76	7,147.75	2.234
Pipe - (25)	24.0	0.008	6.29	7,147.80	7,146.62	0.013	10.07	7,148.94	7,147.82	7,149.40	7,148.23	1.238
Pipe - (31)	18.0	0.030	8.44	7,149.02	7,148.30	0.013	4.33	7,149.82	7,149.26	7,150.14	7,149.47	2.467
Pipe - (26)	24.0	0.007	6.23	7,146.42	7,146.14	0.013	9.88	7,147.54	7,147.34	7,148.00	7,147.73	1.232
Pipe - (27)	24.0	0.026	9.84	7,145.94	7,144.06	0.013	9.84	7,147.06	7,144.78	7,147.52	7,146.22	2.400
Pipe - (30)	36.0	0.010	7.15	7,143.06	7,142.36	0.013	12.13	7,144.17	7,143.51	7,144.57	7,143.88	1.596
Pipe - (28)	36.0	0.010	7.17	7,142.16	7,141.57	0.013	12.04	7,143.26	7,143.47	7,143.67	7,143.57	1.608
Pipe - (14)	36.0	0.086	19.16	7,141.37	7,136.61	0.013	25.69	7,143.01	7,138.56	7,143.67	7,138.99	4.684
Pipe - (29)	18.0	0.030	7.38	7,144.37	7,144.16	0.013	2.70	7,144.99	7,144.62	7,145.23	7,145.15	2.470
Pipe - (21)	18.0	0.030	7.57	7,140.55	7,139.56	0.013	2.95	7,141.20	7,140.21	7,141.45	7,140.46	2.472
Pipe - (34)	36.0	0.030	13.35	7,136.41	7,136.00	0.013	26.72	7,138.08	7,137.27	7,138.76	7,138.64	2.790
CO-1	18.0	0.030	3.83	7,139.87	7,139.56	0.013	0.30	7,140.20	7,140.21	7,140.22	7,140.22	2.236
CO-2	18.0	0.030	7.74	7,139.36	7,137.91	0.013	3.14	7,140.03	7,138.33	7,140.29	7,139.25	2.486

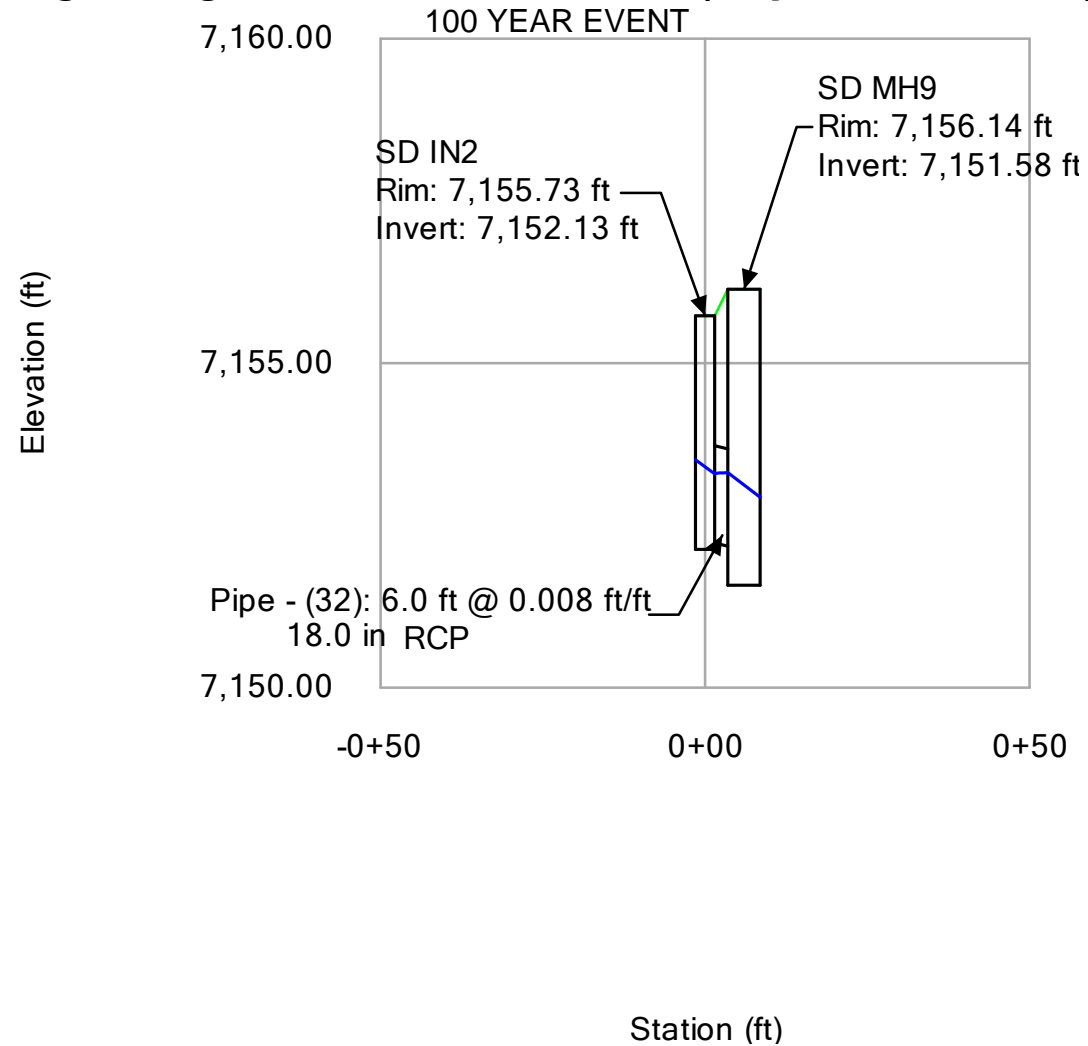
Profile Report

Engineering Profile - O-1 to SD IN1 (Proposed Strom.stsw)

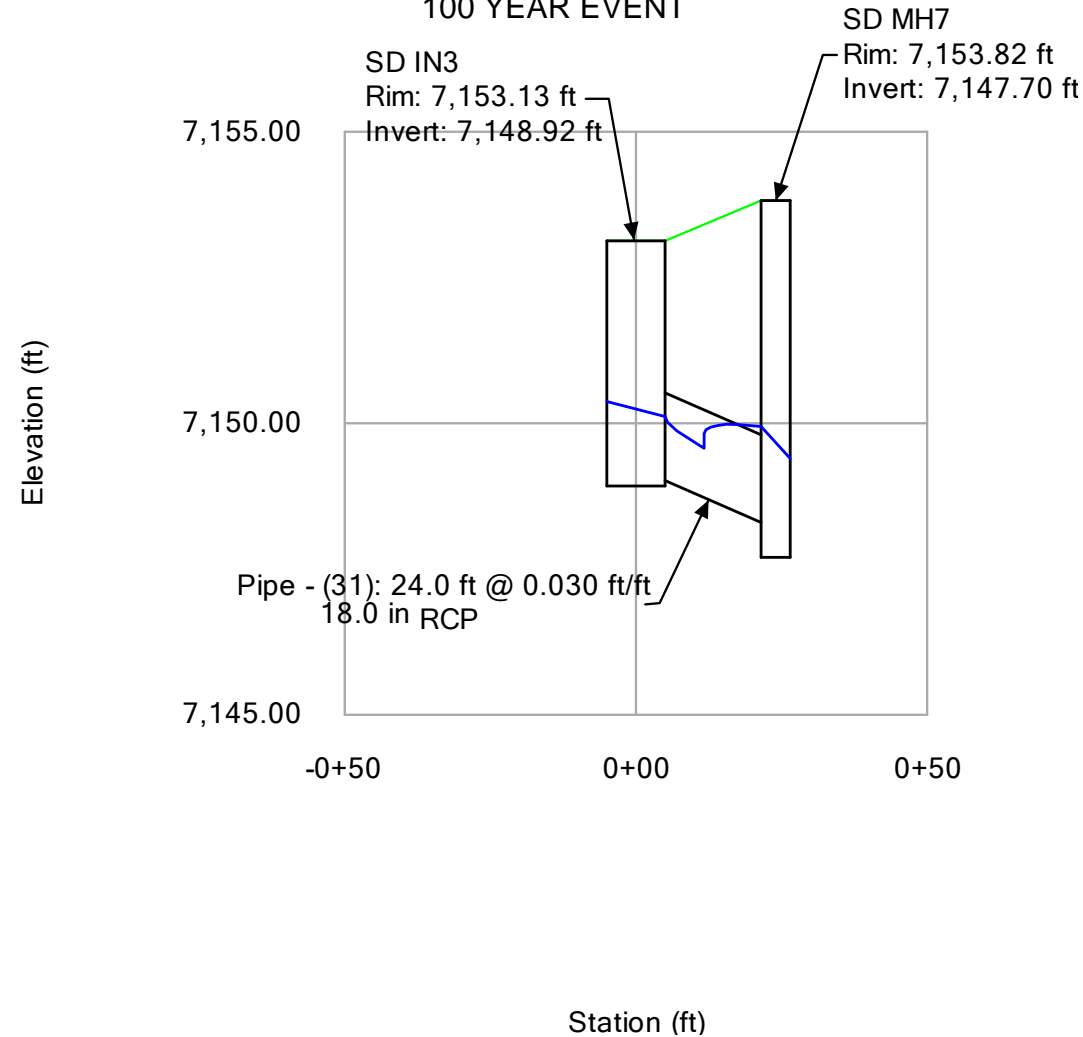
100 YEAR EVENT



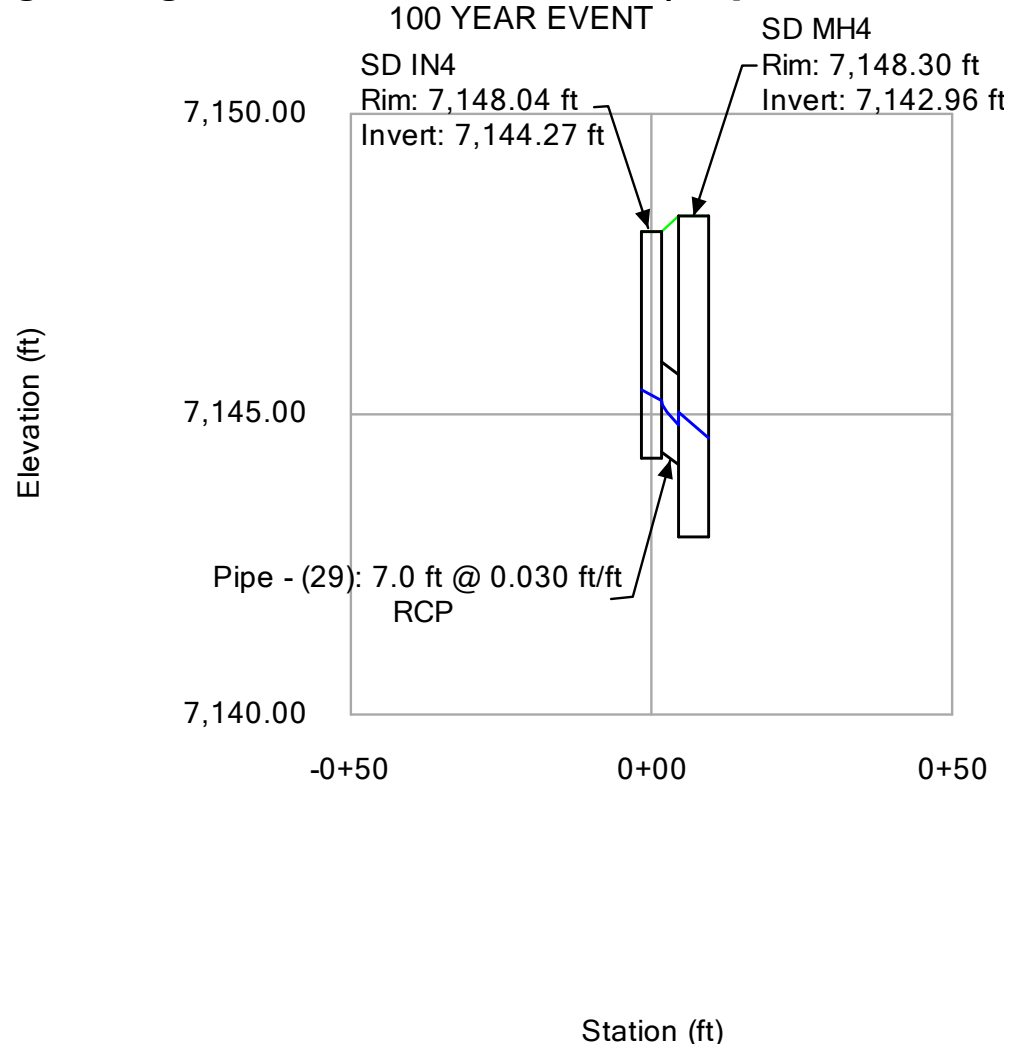
Profile Report **Engineering Profile - SD IN2 to SD MH9 (Proposed Strom.stsw)**



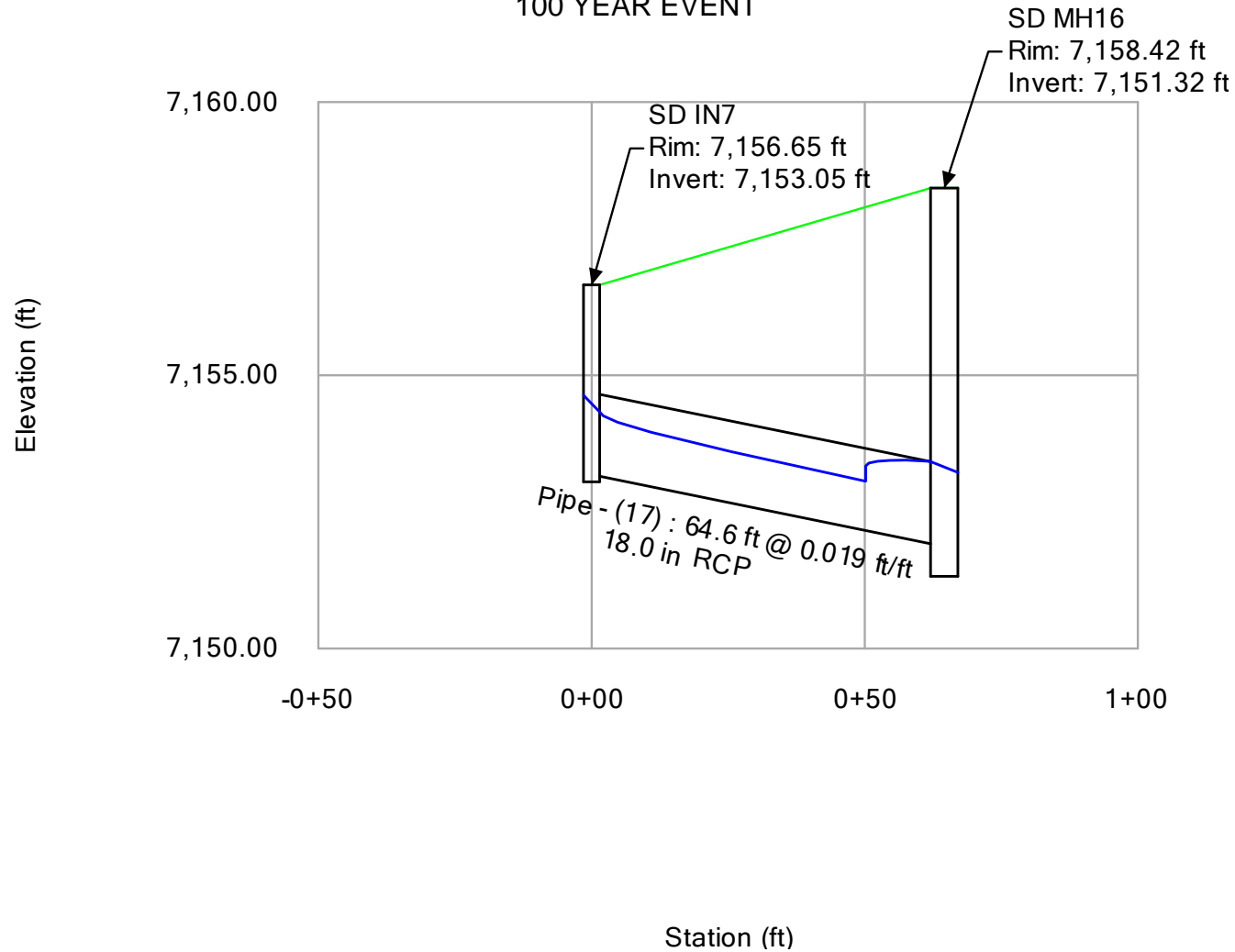
Profile Report **Engineering Profile - SDIN3 to SD MH7 (Proposed Strom.stsw)** 100 YEAR EVENT



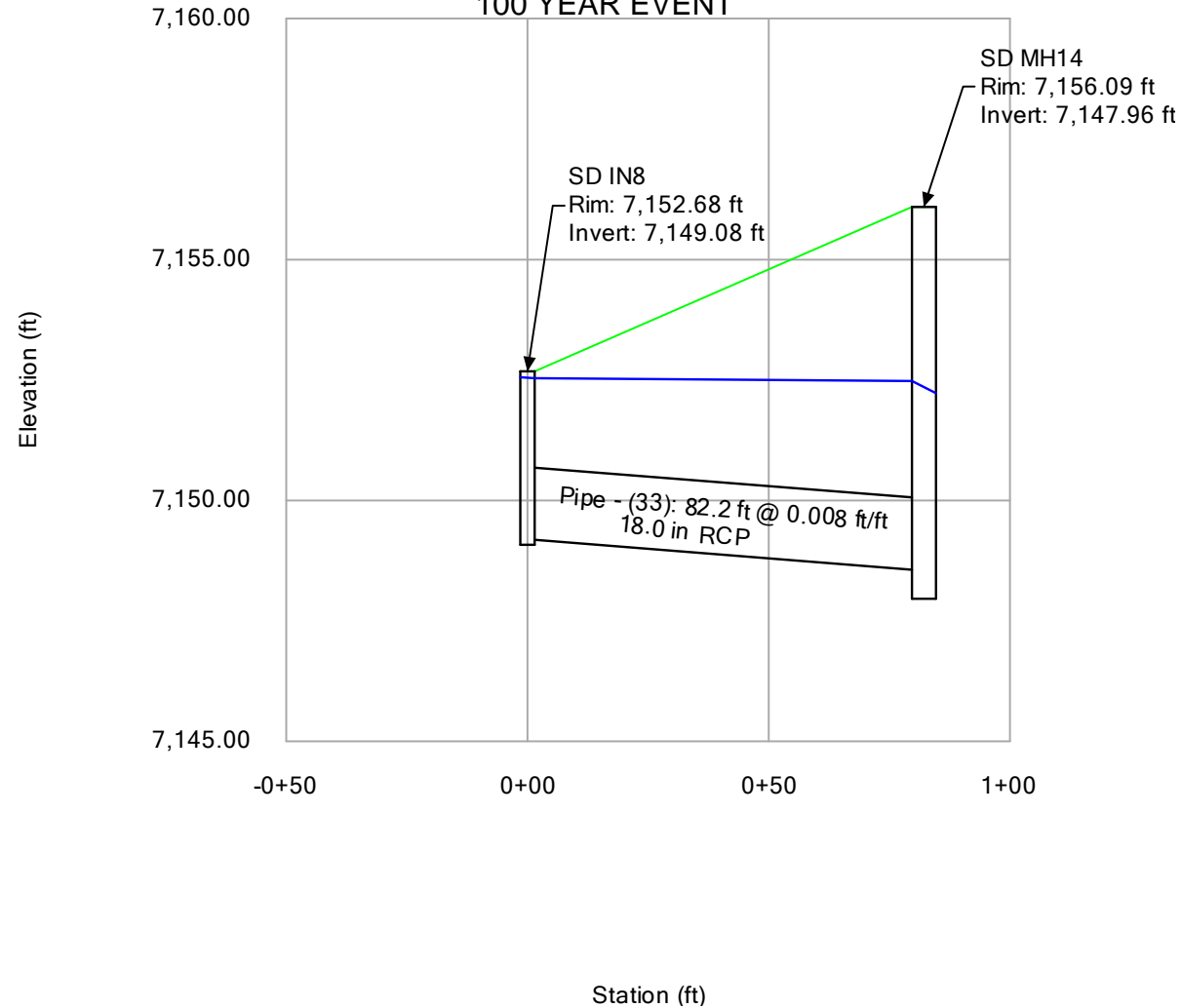
Profile Report
Engineering Profile - SD IN4 to SD MH4 (Proposed Strom.stsw)



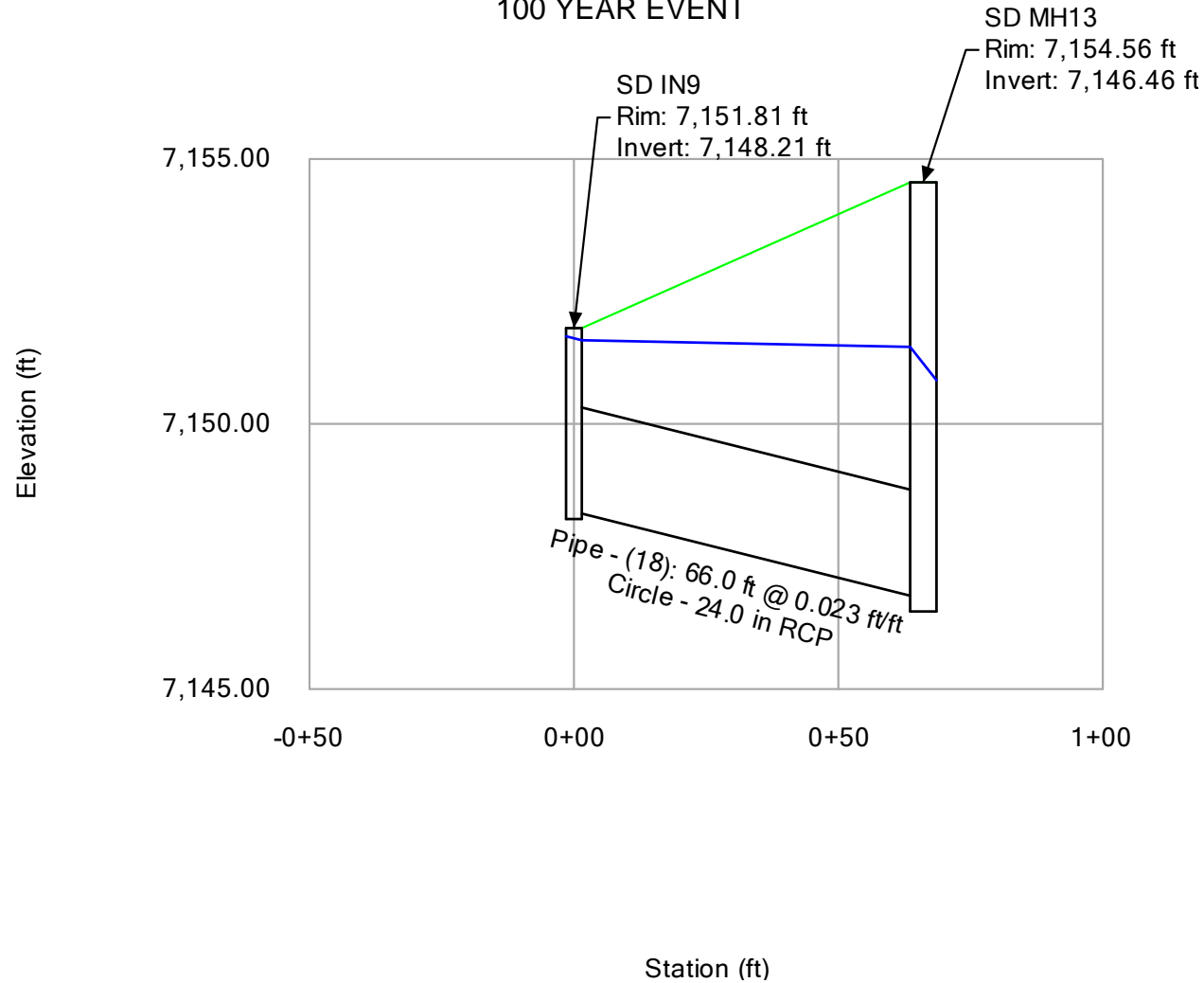
Profile Report **Engineering Profile - SD IN7 to SD MH16 (Proposed Strom.stsw)** 100 YEAR EVENT



Profile Report **Engineering Profile - SD IN8 to SD MH14 (Proposed Strom.stsw)** **100 YEAR EVENT**

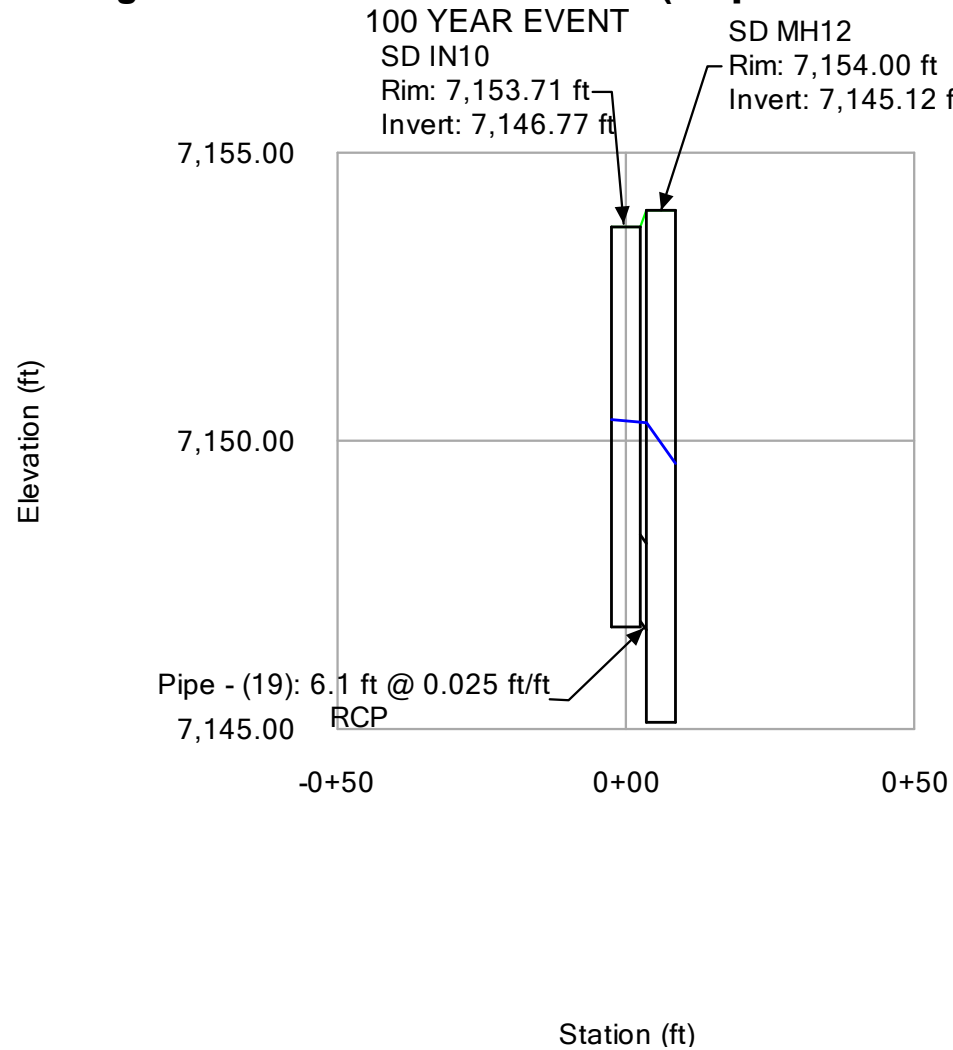


Profile Report
Engineering Profile - SD IN9 to SD MH13 (Proposed Strom.stsw)
100 YEAR EVENT



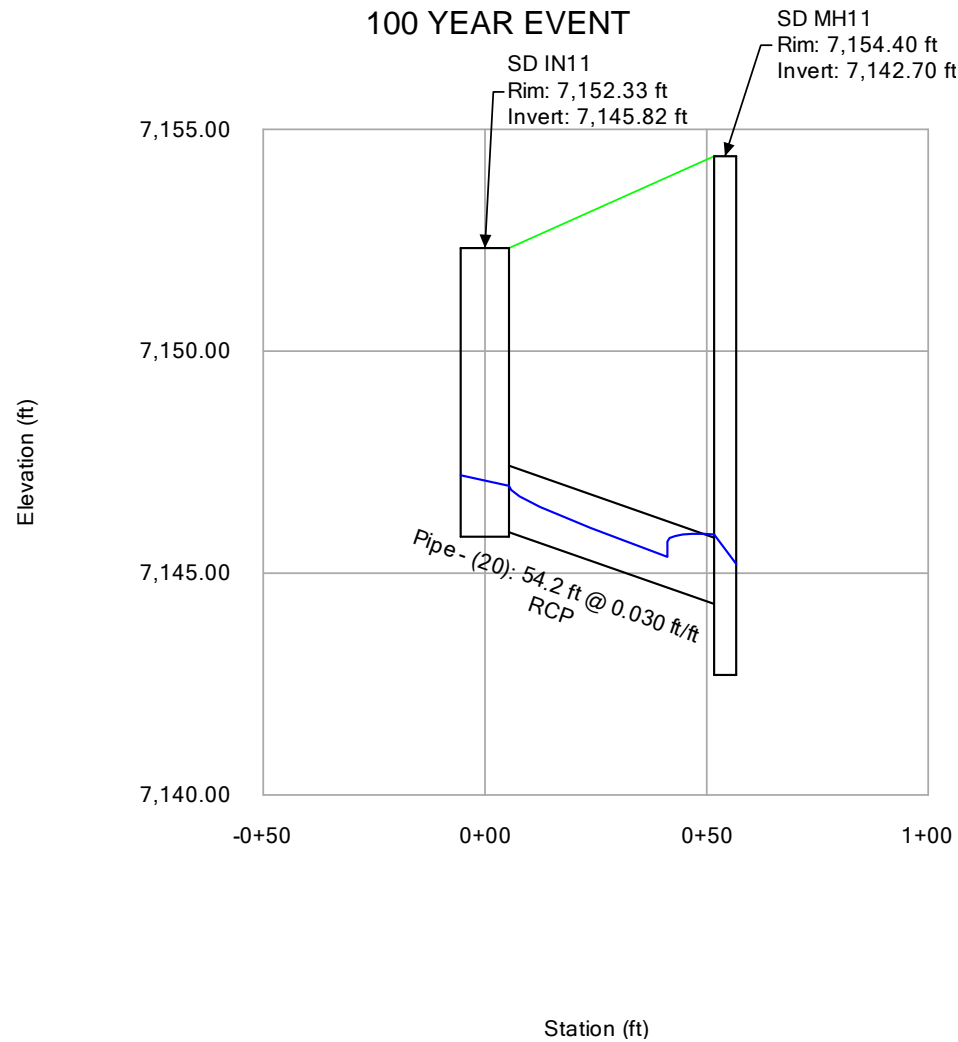
Profile Report

Engineering Profile - SD IN10 to SD MH12 (Proposed Strom.stsw)

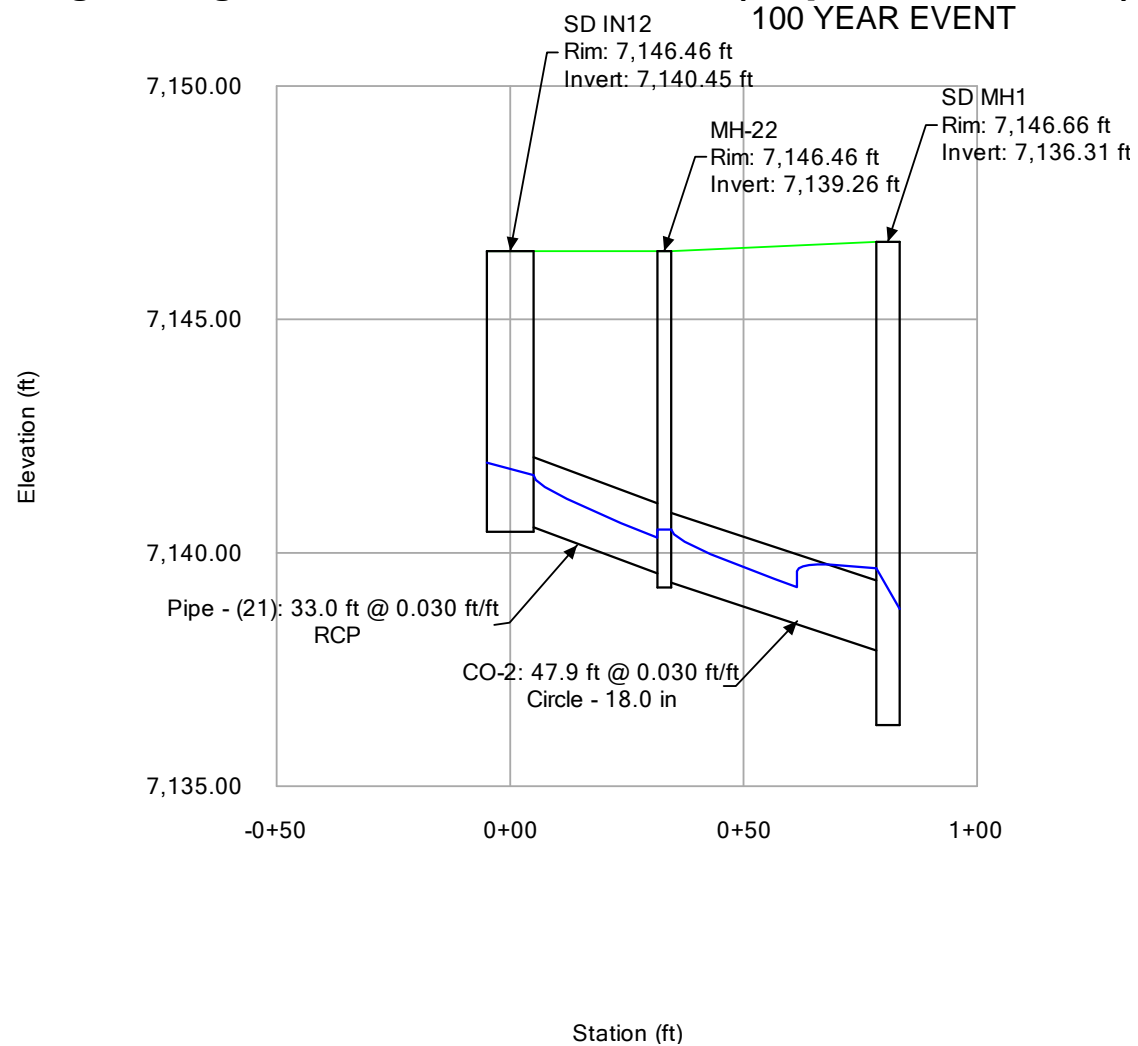


Profile Report

Engineering Profile - SD IN11 to SD MH11 (Proposed Strom.stsw)

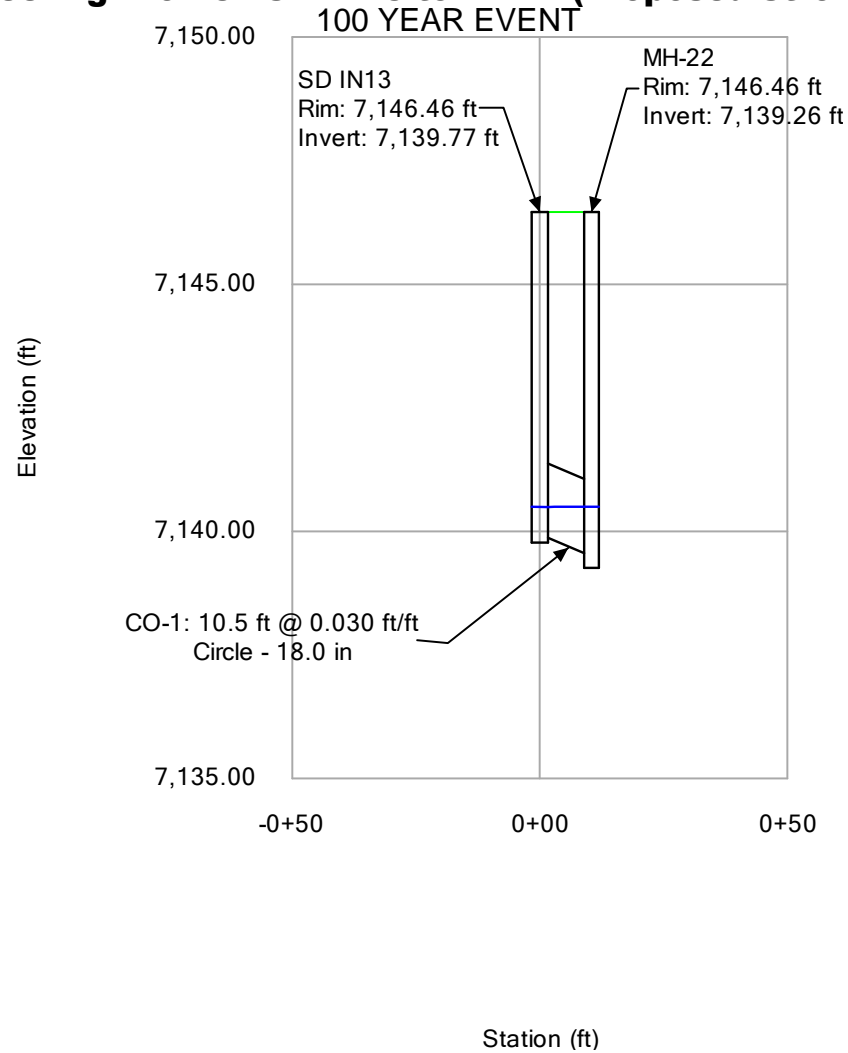


Profile Report **Engineering Profile - SD IN12 to SD MH1 (Proposed Strom.stsw)**



Profile Report

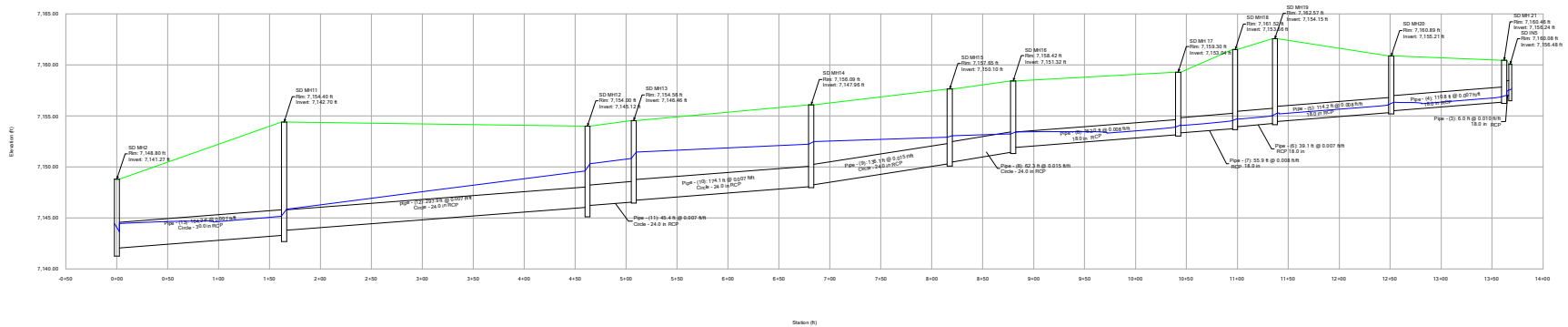
Engineering Profile - SDIN 13 to MH22 (Proposed Strom.stsw)



Profile Report

Engineering Profile - SD MH2 to SD IN5 (Proposed Strom.stsw)

100 YEAR EVENT



FlexTable: Catch Basin Table - 100 YEAR EVENT

Label	Notes	Elevation (Ground) (ft)	Headloss Method	Headloss Coefficient (Standard)	Headloss (ft)
SD IN11	CDOT Type 13 Combo	7,152.33	Standard	0.500	0.24
SD IN13	CDOT Type 13 Combo	7,146.46	Standard	0.500	0.01
SD IN12	CDOT Type R	7,146.46	Standard	0.500	0.27
SD IN4	CDOT Type 13 Combo	7,148.04	Standard	0.500	0.18
SD IN3	CDOT Type R	7,153.13	Standard	0.500	0.26
SD IN10	CDOT Type R	7,153.71	Standard	0.500	0.04
SD IN9	CDOT Type 13	7,151.81	Standard	0.500	0.08
SD IN8	CDOT Type 13	7,152.68	Standard	0.500	0.02
SD IN7	CDOT Type 13	7,156.65	Standard	0.500	0.30
SD IN6	CDOT Type 13	7,160.43	Standard	0.500	0.11
SD IN5	CDOT Type 13	7,160.08	Standard	0.500	0.10
SD IN1	CDOT Type 13	7,158.82	Standard	0.500	0.16
SD IN2	CDOT Type 13	7,155.73	Standard	0.500	0.22

FlexTable: Manhole Table - 100 YEAR EVENT

Label	Notes	Elevation (Rim) (ft)	Headloss Method	Headloss Coefficient (Standard)	Headloss (ft)
SD MH19	5' DIA MH	7,162.57	Standard	0.800	0.25
SD MH18	5' DIA MH	7,161.52	Standard	0.600	0.19
SD MH20	5' DIA MH	7,160.89	Standard	0.700	0.22
SD MH 21	5' DIA MH	7,160.46	Standard	0.800	0.16
SD MH 17	5' DIA MH	7,159.30	Standard	0.600	0.19
SD MH10	5' DIA MH	7,159.19	Standard	0.800	0.30
SD MH16	5' DIA MH	7,158.42	Standard	0.700	0.20
SD MH15	5' DIA MH	7,157.65	Standard	0.600	0.15
SD MH9	5' DIA MH	7,156.14	Standard	0.700	0.38
SD MH14	5' DIA MH	7,156.09	Standard	0.700	0.25
SD MH8	5' DIA MH	7,155.20	Standard	0.500	0.26
SD MH13	5' DIA MH	7,154.56	Standard	0.700	0.63
SD MH11	5' DIA MH	7,154.40	Standard	0.700	0.66
SD MH12	5' DIA MH	7,154.00	Standard	0.700	0.71
SD MH7	5' DIA MH	7,153.82	Standard	0.700	0.55
SD MH6	5' DIA MH	7,152.20	Standard	0.600	0.40
SD MH5	5' DIA MH	7,151.02	Standard	0.600	0.47
SD MH3	5' DIA MH	7,149.25	Standard	0.600	0.14
SD MH2	6' DIA MH	7,148.80	Standard	0.700	0.80
SD MH4	5' DIA MH	7,148.30	Standard	0.700	0.43
SD MH1	6' DIA MH	7,146.66	Standard	0.700	0.88
SD MH-22	5' DIA MH	7,146.46	Standard	0.700	0.39

FlexTable: Conduit Table - 100 YEAR EVENT

Label	Diameter (in)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Manning's n	Flow (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Froude Number (Normal)
Pipe - (5)	18.0	0.008	5.11	7,155.31	7,154.45	0.013	4.37	7,156.11	7,155.30	7,156.43	7,155.58	1.191
Pipe - (6)	18.0	0.007	5.06	7,154.25	7,153.96	0.013	4.29	7,155.04	7,154.69	7,155.36	7,155.08	1.184
Pipe - (7)	18.0	0.008	5.07	7,153.76	7,153.34	0.013	4.27	7,154.55	7,154.06	7,154.87	7,154.46	1.193
Pipe - (4)	18.0	0.007	4.16	7,156.34	7,155.51	0.013	2.07	7,156.88	7,156.34	7,157.08	7,156.40	1.234
Pipe - (16)	18.0	0.010	4.83	7,155.80	7,155.74	0.013	2.41	7,156.39	7,156.34	7,156.61	7,156.55	1.428
Pipe - (3)	18.0	0.010	4.62	7,157.00	7,156.94	0.013	2.07	7,157.54	7,157.42	7,157.74	7,157.70	1.428
Pipe - (8)	18.0	0.008	5.06	7,153.14	7,151.92	0.013	4.23	7,153.93	7,153.42	7,154.24	7,153.51	1.196
Pipe - (22)	18.0	0.007	5.14	7,155.32	7,155.28	0.013	5.43	7,156.27	7,156.28	7,156.60	7,156.57	1.072
Pipe - (23)	18.0	0.011	6.21	7,155.08	7,152.18	0.013	5.42	7,155.98	7,153.31	7,156.35	7,153.54	1.434
Pipe - (8)	24.0	0.015	8.59	7,151.42	7,150.50	0.013	12.76	7,153.23	7,153.06	7,153.51	7,153.32	1.757
Pipe - (17)	18.0	0.019	8.71	7,153.15	7,151.92	0.013	9.33	7,154.33	7,153.42	7,154.94	7,153.86	1.805
Pipe - (9)	24.0	0.015	8.62	7,150.30	7,148.26	0.013	12.69	7,152.91	7,152.48	7,153.16	7,152.73	1.772
Pipe - (24)	24.0	0.007	6.57	7,151.68	7,149.89	0.013	12.23	7,152.94	7,151.19	7,153.47	7,151.69	1.194
Pipe - (32)	18.0	0.008	5.93	7,152.23	7,152.18	0.013	7.06	7,153.29	7,153.31	7,153.73	7,153.69	1.152
Pipe - (10)	24.0	0.007	6.87	7,148.06	7,146.76	0.013	15.08	7,152.23	7,151.46	7,152.59	7,151.81	1.125
Pipe - (33)	18.0	0.008	4.55	7,149.18	7,148.56	0.013	2.82	7,152.54	7,152.48	7,152.58	7,152.52	1.229
Pipe - (35)	24.0	0.008	6.54	7,149.69	7,148.00	0.013	11.87	7,150.93	7,149.94	7,151.45	7,150.17	1.205
Pipe - (11)	24.0	0.007	7.61	7,146.56	7,146.22	0.013	23.92	7,150.82	7,150.32	7,151.73	7,151.22	0.949
Pipe - (18)	24.0	0.023	9.51	7,148.31	7,146.76	0.013	9.88	7,151.58	7,151.46	7,151.73	7,151.61	2.283
Pipe - (12)	24.0	0.007	8.07	7,146.02	7,143.80	0.013	25.35	7,149.61	7,145.87	7,150.62	7,146.88	1.006
Pipe - (13)	30.0	0.007	8.16	7,143.30	7,142.07	0.013	31.32	7,145.21	7,144.47	7,146.15	7,145.12	1.095
Pipe - (20)	18.0	0.030	9.70	7,145.92	7,144.30	0.013	7.25	7,146.96	7,145.87	7,147.44	7,146.13	2.413
Pipe - (19)	18.0	0.025	7.82	7,146.87	7,146.72	0.013	4.24	7,150.33	7,150.32	7,150.42	7,150.41	2.238
Pipe - (25)	24.0	0.008	7.11	7,147.80	7,146.62	0.013	19.09	7,149.39	7,148.54	7,150.18	7,149.13	0.971
Pipe - (31)	18.0	0.030	9.96	7,149.02	7,148.30	0.013	7.99	7,150.12	7,149.94	7,150.63	7,150.26	2.399
Pipe - (26)	24.0	0.007	7.06	7,146.42	7,146.14	0.013	18.78	7,148.15	7,147.97	7,148.81	7,148.57	0.976
Pipe - (27)	24.0	0.026	11.66	7,145.94	7,144.06	0.013	18.70	7,147.50	7,145.12	7,148.29	7,147.02	2.296
Pipe - (30)	36.0	0.010	8.54	7,143.06	7,142.36	0.013	23.00	7,144.60	7,144.60	7,145.22	7,144.86	1.575
Pipe - (28)	36.0	0.010	8.57	7,142.16	7,141.57	0.013	22.86	7,144.46	7,144.47	7,144.70	7,144.63	1.587
Pipe - (14)	36.0	0.086	23.13	7,141.37	7,136.61	0.013	49.84	7,143.67	7,139.68	7,144.81	7,140.45	4.689
Pipe - (29)	18.0	0.030	8.78	7,144.37	7,144.16	0.013	5.00	7,145.23	7,145.03	7,145.58	7,145.37	2.462
Pipe - (21)	18.0	0.030	10.05	7,140.55	7,139.56	0.013	8.27	7,141.66	7,140.32	7,142.20	7,141.62	2.391
Pipe - (34)	36.0	0.030	16.15	7,136.41	7,136.00	0.013	54.16	7,138.80	7,137.92	7,140.05	7,139.92	2.692
CO-1	18.0	0.030	4.73	7,139.87	7,139.56	0.013	0.60	7,140.49	7,140.50	7,140.50	7,140.50	2.329
CO-2	18.0	0.030	10.20	7,139.36	7,137.91	0.013	8.65	7,140.50	7,139.68	7,141.06	7,140.05	2.393

Appendix D - Reference Documents

2.1. - Rainfall Depths

Rainfall depths must be determined based on the duration and return period of the design storm and the size of the drainage basin being evaluated. Depths can be derived by the methods described in the NOAA Atlas. The depths reported in the NOAA Atlas represent probable total depths for each duration and return period at a point on the ground. An extensive evaluation of available rain gage data was completed with the Carlton Study. While some increase in recorded depths was noted from the airport gage data, the other long-term gage locations showed that depths consistent with the NOAA Atlas can be expected. Since the NOAA Atlas is in the process of being updated, it was determined that the published atlas should continue to be used as the source of rainfall depths until this publication is revised or replaced.

The methods described in this Manual require only that the 1-hour, 6-hour and 24-hours depths be used as input. The storm return periods required for the application of methods in this Manual are the 2-, 5-, 10-, 25-, 50- and 100-year events. The 6-hour and 24-hour depths for these return periods can be read directly from Figures 6-6 through 6-17 at the end of this chapter. The 1-hour depth for return periods can be calculated for all design return periods following this procedure:

Step 1: Calculate 2-year, 1-hour rainfall based on 2-year, 6-hour and 24-hour values.

$$Y_2 = 0.218 + 0.709 \cdot (X_1 \cdot X_1 / X_2) \quad (\text{Eq. 6-1})$$

Where:

Y_2 = 2-year, 1-hour rainfall (in)

X_1 = 2-year, 6-hour rainfall (in) from Figure 6-6

X_2 = 2-year, 24-hour rainfall (in) from Figure 6-12

Step 2: Calculate 100-year, 1-hour rainfall based on 2-year 6-hour and 24-hour values

$$Y_{100} = 1.897 + 0.439 \cdot (X_3 \cdot X_3 / X_4) - 0.008Z \quad (\text{Eq. 6-2})$$

Where:

Y_{100} = 100-year, 1-hour rainfall (in)

X_3 = 100-year, 6-hour rainfall (in) from Figure 6-11

X_4 = 100-year, 24-hour rainfall (in) from Figure 6-17

Z = Elevation in hundreds of feet above sea level

3.0. - RATIONAL METHOD

The Rational Method is used to determine runoff peak discharges for drainage basins up to and including 130 acres in size and when hydrologic routing is relatively simple. However, the drainage area should be divided into sub-basins that represent homogeneous land uses, soil types or land cover. The Rational Method is most typically applied for inlet and storm drain sizing.

The Rational Method is based on the direct relationship between rainfall and runoff, and is expressed by the following equation:

$$Q = C \cdot I \cdot A \quad (\text{Eq. 6-5})$$

In which:

Q = the maximum rate of runoff (cubic feet per second [cfs])

C = the runoff coefficient that is the ratio between the runoff volume from an area and the average rainfall depth over a given duration for that area

I = the average intensity of rainfall for a duration equal to the time of concentration (in/hr)

A = drainage basin area (acres)

The assumptions and limitations of the Rational Method are described in the UDFCD Manual, Volume 1, Runoff chapter. Standard Form 1 (SF-1) and Standard Form 2 (SF-2) are provided at the end of this chapter as Figure 6-23 and Figure 6-24, respectively to provide a standard format for Rational Method calculations. The SF-1 Form is used for calculating the time of concentration, and the SF-2 form is used to estimate accumulated peak discharges from multiple basins as storm runoff flows downstream in a channel or pipe. Results from the Rational Method calculations shall be included with the drainage report submittal. As an alternative to SF-1 and SF-2, the UD-Rational spreadsheet can be used to document basin parameters and calculations or other spreadsheets or programs can be used as long as the information and format is the similar to that shown in these standard forms.

3.1. - Rational Method Runoff Coefficient (C)

The runoff coefficient represents the integrated effects of infiltration, detention storage, evaporation, retention, flow routing, and interception, all of which affect the time distribution and peak rate of runoff. Runoff coefficients are based on the imperviousness of a particular land use and the hydrologic soil type of the area and are to be selected in accordance with Table 6-6.

The procedure for determining the runoff coefficient includes these steps:

1. Categorize the site area into one or more similar land uses, each with a representative imperviousness, according to the information in Table 6-6.
2. Based on the dominant hydrologic soil type in the area, use Table 6-6 to estimate the runoff coefficient for the particular land use category for the design storms of interest.
3. Calculate an area-weighted average runoff coefficient for the site based on the runoff coefficients from individual land use areas of the site.

When analyzing an area for design purposes, urbanization of the full watershed, including both on-site and off-site areas, shall be assumed.

Gravel parking areas, storage areas, and access drives proposed on Site Improvement Plans shall be analyzed based on an imperviousness of 80%. This is due to the potential for gravel areas being paved over time by property owners and the resulting adverse impacts on the stormwater management facilities and adjacent properties.

There are some circumstances where the selection of impervious percentage values may require additional investigation due to unique land characteristics (e.g., recent burn areas). When these circumstances arise, it is the designer's responsibility to verify that the correct land use assumptions are made.

When multiple sub-basins are delineated, the composite C value calculation is:

$$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + \dots C_i A_i) / A_t \quad (\text{Eq. 6-6})$$

Where:

C_c = composite runoff coefficient for total area

C_i = runoff coefficient for subarea corresponding to surface type or land use

A_i = area of surface type corresponding to C_i (units must be the same as those used for total area)

A_t = total area of all subareas for which composite runoff coefficient applies

i = number of surface types in the drainage area

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

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
½ Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
¼ Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
⅓ Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57

½ Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis— Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96

Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2. - Time of Concentration

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

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

$$t_c = t_i + t_t \quad (\text{Eq. 6-7})$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min) ;0h5; 3.2.1.\Overland (Initial) Flow Time

The overland flow time, t_i , may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad (\text{Eq. 6-8})$$

Where:

t_i = overland (initial) flow time (min)

C_5 = runoff coefficient for 5-year frequency (see Table 6-6)

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize. ;0h5; 3.2.2.\Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t , can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad (\text{Eq. 6-9})$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried) *	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20
* For buried riprap, select C_v value based on type of vegetative cover.	

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = L / 180 + 10 \quad (\text{Eq. 6-10})$$

2.1. - DESIGN STORM WATER RUNOFF DETERMINATION

The City/County drainage policy permits the Rational Method and the Soil Conservation Service (SCS) Hydrograph Method as models to be used by designers in estimating storm water runoff for project purposes. The Rational Method is required for drainage basins of 100 acres or less. The SCS Hydrograph Method is required for drainage basins greater than 100 acres. For large complex Drainage Basin Planning Studies, computer models may be utilized following approval by City/County. Necessary data requirements, assumptions and detailed procedures for using models are discussed Section II. All drainage systems must be planned, designed and constructed to handle runoff from both the initial and major design storms. The initial design storm shall be the 10 year event. The major design storm shall be the 100-year event.

Normally in a roadway section, the initial drainage system should convey a substantial portion of the minor storm flows with the more intense or major storm flows conveyed by the available street capacity. Out of roadway sections, storm drain systems combined with overflow swales or drainageway or channel sections must be of adequate capacity to convey both design storms and protect adjacent properties.



NOAA Atlas 14, Volume 8, Version 2
Location name: Monument, Colorado, USA*
Latitude: 39.1092°, Longitude: -104.864°
Elevation: 7156 ft**

* source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.244 (0.200-0.297)	0.312 (0.256-0.379)	0.426 (0.348-0.518)	0.523 (0.424-0.638)	0.659 (0.517-0.830)	0.768 (0.587-0.974)	0.878 (0.648-1.14)	0.993 (0.702-1.31)	1.15 (0.780-1.55)	1.27 (0.839-1.73)
10-min	0.358 (0.293-0.434)	0.457 (0.375-0.555)	0.624 (0.509-0.759)	0.765 (0.621-0.934)	0.966 (0.757-1.22)	1.12 (0.859-1.43)	1.29 (0.949-1.66)	1.45 (1.03-1.92)	1.68 (1.14-2.27)	1.86 (1.23-2.53)
15-min	0.436 (0.358-0.530)	0.558 (0.457-0.677)	0.761 (0.621-0.926)	0.933 (0.757-1.14)	1.18 (0.923-1.48)	1.37 (1.05-1.74)	1.57 (1.16-2.03)	1.77 (1.25-2.34)	2.05 (1.39-2.76)	2.27 (1.50-3.09)
30-min	0.575 (0.471-0.698)	0.736 (0.603-0.894)	1.00 (0.820-1.22)	1.23 (1.00-1.51)	1.56 (1.22-1.96)	1.81 (1.38-2.30)	2.07 (1.53-2.68)	2.34 (1.65-3.09)	2.70 (1.84-3.64)	2.99 (1.97-4.06)
60-min	0.727 (0.596-0.882)	0.897 (0.735-1.09)	1.20 (0.975-1.45)	1.46 (1.18-1.78)	1.85 (1.46-2.35)	2.17 (1.67-2.78)	2.52 (1.86-3.27)	2.88 (2.04-3.82)	3.39 (2.31-4.59)	3.80 (2.51-5.17)
2-hr	0.878 (0.725-1.06)	1.06 (0.872-1.27)	1.38 (1.14-1.67)	1.69 (1.38-2.04)	2.15 (1.71-2.72)	2.54 (1.97-3.23)	2.96 (2.21-3.84)	3.42 (2.45-4.52)	4.08 (2.80-5.50)	4.61 (3.07-6.24)
3-hr	0.987 (0.818-1.18)	1.16 (0.958-1.39)	1.48 (1.22-1.78)	1.80 (1.48-2.17)	2.30 (1.85-2.92)	2.74 (2.14-3.49)	3.22 (2.42-4.18)	3.76 (2.71-4.97)	4.54 (3.14-6.12)	5.19 (3.46-6.99)
6-hr	1.20 (1.00-1.42)	1.39 (1.16-1.65)	1.76 (1.46-2.09)	2.13 (1.75-2.54)	2.72 (2.21-3.43)	3.24 (2.55-4.10)	3.83 (2.90-4.93)	4.48 (3.25-5.89)	5.44 (3.78-7.29)	6.24 (4.19-8.35)
12-hr	1.46 (1.22-1.71)	1.72 (1.44-2.02)	2.20 (1.84-2.60)	2.66 (2.21-3.15)	3.37 (2.74-4.19)	3.98 (3.14-4.98)	4.65 (3.54-5.92)	5.39 (3.92-7.00)	6.44 (4.50-8.55)	7.31 (4.94-9.72)
24-hr	1.76 (1.48-2.05)	2.09 (1.76-2.44)	2.68 (2.25-3.13)	3.22 (2.69-3.77)	4.02 (3.28-4.93)	4.70 (3.73-5.80)	5.43 (4.15-6.83)	6.22 (4.55-8.00)	7.33 (5.15-9.64)	8.23 (5.61-10.9)
2-day	2.09 (1.77-2.41)	2.44 (2.07-2.82)	3.08 (2.60-3.56)	3.65 (3.07-4.24)	4.51 (3.69-5.47)	5.23 (4.17-6.39)	6.00 (4.61-7.48)	6.82 (5.02-8.70)	8.00 (5.65-10.4)	8.94 (6.13-11.7)
3-day	2.26 (1.92-2.59)	2.65 (2.26-3.05)	3.34 (2.83-3.85)	3.95 (3.33-4.57)	4.86 (3.99-5.85)	5.61 (4.49-6.82)	6.41 (4.94-7.95)	7.26 (5.36-9.21)	8.46 (6.00-11.0)	9.42 (6.48-12.3)
4-day	2.39 (2.05-2.74)	2.81 (2.40-3.22)	3.54 (3.01-4.06)	4.18 (3.54-4.82)	5.13 (4.22-6.14)	5.91 (4.74-7.15)	6.73 (5.20-8.31)	7.61 (5.63-9.61)	8.83 (6.28-11.4)	9.81 (6.77-12.8)
7-day	2.79 (2.40-3.17)	3.23 (2.77-3.67)	4.00 (3.42-4.56)	4.68 (3.98-5.36)	5.70 (4.71-6.77)	6.53 (5.26-7.84)	7.42 (5.76-9.10)	8.36 (6.22-10.5)	9.68 (6.92-12.5)	10.7 (7.45-13.9)
10-day	3.15 (2.72-3.56)	3.62 (3.11-4.09)	4.43 (3.80-5.02)	5.15 (4.40-5.87)	6.23 (5.17-7.37)	7.11 (5.75-8.50)	8.05 (6.28-9.83)	9.05 (6.76-11.3)	10.5 (7.50-13.4)	11.6 (8.06-15.0)
20-day	4.17 (3.62-4.67)	4.77 (4.14-5.35)	5.80 (5.01-6.52)	6.69 (5.74-7.55)	7.97 (6.63-9.30)	8.99 (7.30-10.6)	10.1 (7.88-12.1)	11.2 (8.39-13.8)	12.7 (9.17-16.1)	13.9 (9.76-17.9)
30-day	5.00 (4.35-5.57)	5.73 (4.99-6.39)	6.95 (6.03-7.77)	7.98 (6.88-8.96)	9.42 (7.85-10.9)	10.5 (8.58-12.3)	11.7 (9.18-14.0)	12.9 (9.68-15.8)	14.4 (10.4-18.2)	15.7 (11.0-20.0)
45-day	6.03 (5.28-6.68)	6.92 (6.05-7.68)	8.36 (7.28-9.30)	9.55 (8.27-10.7)	11.2 (9.31-12.8)	12.4 (10.1-14.4)	13.6 (10.7-16.2)	14.8 (11.2-18.0)	16.4 (11.9-20.5)	17.6 (12.4-22.4)
60-day	6.90 (6.06-7.62)	7.92 (6.94-8.75)	9.54 (8.33-10.6)	10.8 (9.41-12.1)	12.6 (10.5-14.3)	13.9 (11.3-16.0)	15.1 (11.9-17.8)	16.3 (12.3-19.8)	17.9 (13.0-22.2)	19.0 (13.5-24.1)

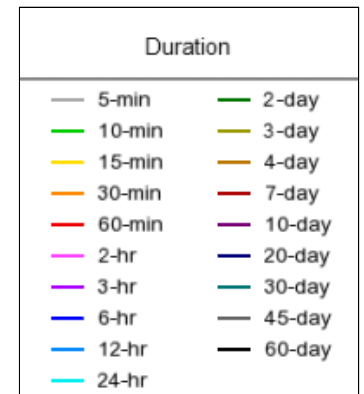
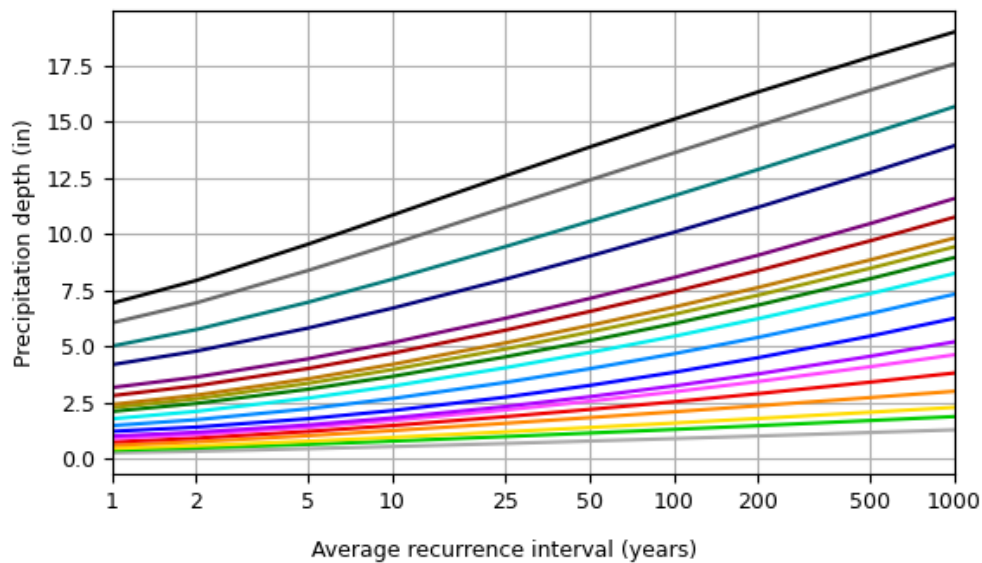
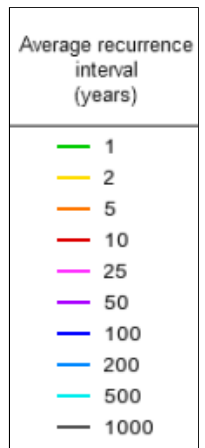
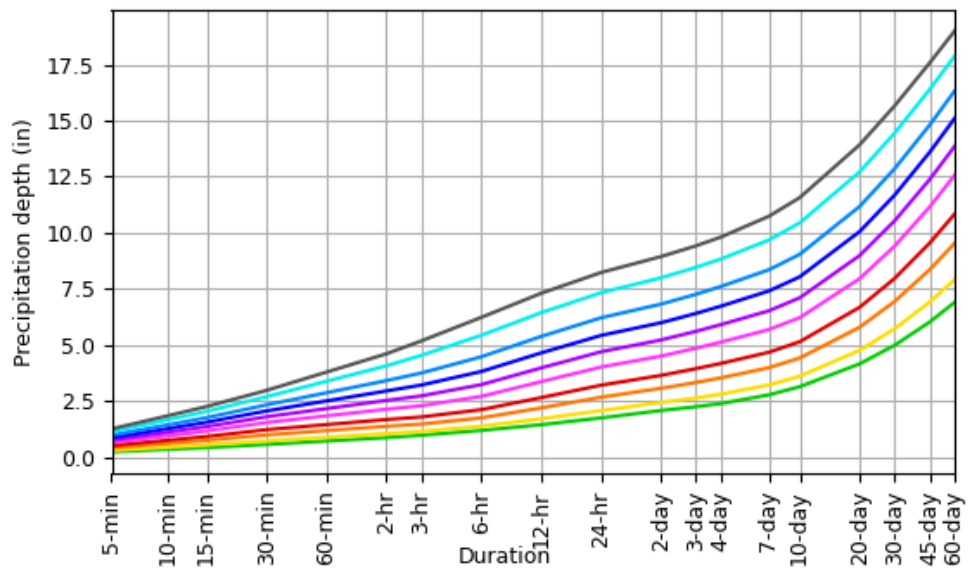
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 39.1092°, Longitude: -104.8640°



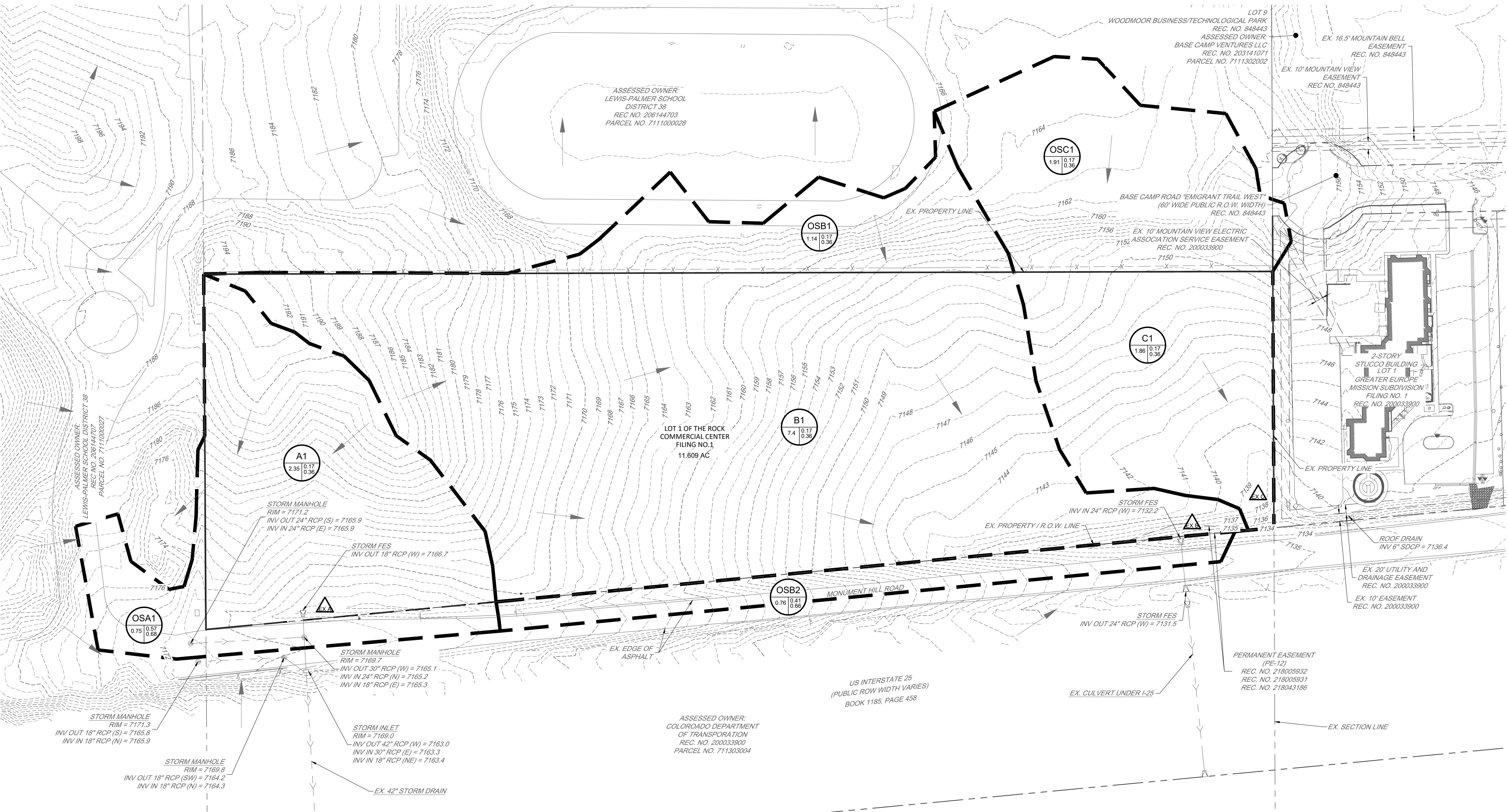
NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Thu Jun 8 22:07:23 2023

[Back to Top](#)**Maps & aerals****Small scale terrain**

Appendix E - Drainage Maps

I:\2023\23009 - The Rock Commerce Center\cadd\Sheet Sets\Drainage\The Rock\23009 - Existing Drainage Map.dwg tab: Proposed Drainage Map.dwg Oct 20, 2023 - 10:22am csaiz



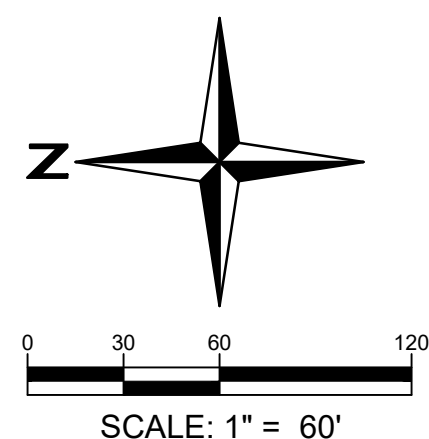
DRAINAGE LEGEND

- 5281--- EXISTING MINOR CONTOUR
- 5280--- EXISTING MAJOR CONTOUR
- - - - - EXISTING STORM SEWER LINE
- - - - - FEMA 100-YEAR FLOOD PLAIN
- - - - - FEMA ZONE X
- - - - - SUB-BASIN BOUNDARY
- - - - - MAJOR BASIN BOUNDARY
- - - - - PROPERTY LINE
- A1
0.00 0.00 0.00
0.00 0.00 0.00
EXISTING BASIN ID
EXISTING 10 YEAR RUNOFF COEFFICIENT
EXISTING 100 YEAR RUNOFF COEFFICIENT
BASIN AREA (ACRES)
- EXISTING GRADE FLOW ARROW
- EXISTING DESIGN POINT

BASIN PEAK FLOW SUMMARY		
BASIN	Q10	Q100
A1	1.5	4.6
OSA1	2.0	3.4
B1	3.7	11.4
OSB1	0.8	2.5
OSB2	1.5	2.6
C1	1.1	3.4
OSC1	1.0	3.0

DESIGN POINT FLOW SUMMARY		
DESIGN POINT	Q10	Q100
A	3.07	7.27
B	5.53	15.26
C	1.97	6.02

PCD FILE NO. PPR2329



LOT 1 OF THE ROCK COMMERCE CENTER FILING NO. 1

DRAINAGE MAPS
EXISTING DRAINAGE MAP

SHEET

DNG-1

**NOT FOR
CONSTRUCTION**

15 Redland
YEARS
WHERE GREAT PLACES BEGIN
720.283.6783
REDLAND.CO
Land Planning
Landscape Architecture
Civil Engineering
Construction Management

NOTES

NO.

DATE

NOTES

1ST SUBMITTAL

2ND SUBMITTAL

PROJECT NO. 23009

DATE

NO.

NOTES

1ST SUBMITTAL

2ND SUBMITTAL

PROJECT NO. 23009

DATE

NO.

NOTES

1ST SUBMITTAL

2ND SUBMITTAL

PROJECT NO. 23009

DATE

NO.

NOTES

1ST SUBMITTAL

2ND SUBMITTAL

PROJECT NO. 23009

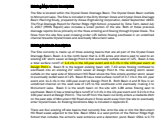
DATE

NO.

NOTES

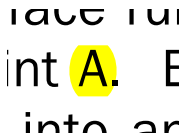
V2_Final Drainage Report Comments.pdf Markup Summary

Carlos (3)



Subject: Highlight
Page Label: 5
Author: Carlos
Date: 11/7/2023 5:46:49 PM
Color:

1.4 cfs in the 10-year event and 4.3 cfs in the 100-year event at Design Point



Subject: Highlight
Page Label: 5
Author: Carlos
Date: 11/7/2023 5:46:53 PM
Color:

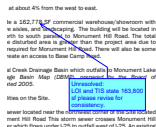
A



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Page Label: 5
Author: Carlos
Date: 11/8/2023 2:45:43 PM
Color:

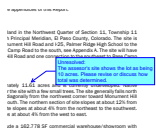
The design point flow summary states 3.07 & 7.27 cfs for the 10 & 100 year storms at Design Point A. Please revise statement if you are referring to basin flow only. Similar comment for other basins described in this section.

CDurham (6)



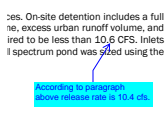
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Author: CDurham
Date: 11/8/2023 10:53:34 AM
Color:

Unresolved:
LOI and TIS state 163,800 sf please revise for consistency.



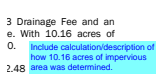
Subject: Callout
Page Label: 4
Author: CDurham
Date: 11/8/2023 10:53:59 AM
Color:

Unresolved:
The assessor's site shows the lot as being 10 acres. Please revise or discuss how total was determined.



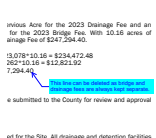
Subject: Callout
Page Label: 7
Author: CDurham
Date: 11/8/2023 10:56:58 AM
Color:

According to paragraph above release rate is 10.4 cfs.



Subject: Text Box
Page Label: 23
Author: CDurham
Date: 11/8/2023 11:00:48 AM
Color:

Include calculation/description of how 10.16 acres of impervious area was determined.




Subject: Callout
Page Label: 23
Author: CDurham
Date: 11/8/2023 11:01:28 AM
Color:

This line can be deleted as bridge and drainage fees are always kept separate.

	A	OS41	0
	RC1	OS86	0
	4	OS87	0
	B	OS88	0
	C	OS85	0

Include design point in DP summary table on basin map

Subject: Callout
Page Label: 45
Author: CDurham
Date: 11/8/2023 11:37:51 AM
Color: 

Include design point in DP summary table on basin map

2023 Financial Assurance Estimate Form (with pre-plat construction)

Updated: 12/8/2022

PROJECT INFORMATION			
The Rock Commerce Center Subdivision Filing No. 1	8/10/2023	PPR2329	
Project Name	Date	PCD File No.	

Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction) % Complete	Remaining
SECTION 1 - GRADING AND EROSION CONTROL (Construction and Permanent BMPs)							
Earthwork							
less than 1,000; \$5,300 min		CY	\$ 8.00	=	\$ -		\$ -
1,000-5,000; \$8,000 min		CY	\$ 6.00	=	\$ -		\$ -
5,001-20,000; \$30,000 min		CY	\$ 5.00	=	\$ -		\$ -
20,001-50,000; \$100,000 min		CY	\$ 3.50	=	\$ -		\$ -
50,001-200,000; \$175,000 min	109,166	CY	\$ 2.50	=	\$ 272,915.00		\$ 272,915.00
greater than 200,000; \$500,000 min		CY	\$ 2.00	=	\$ -		\$ -
Permanent Erosion Control Blanket		SY	\$ 8.00	=	\$ -		\$ -
Permanent Seeding (inc. noxious weed mgmnt.) & Mulching	2.4	AC	\$ 1,875.00	=	\$ 4,537.50		\$ 4,537.50
Permanent Pond/BMP (provide engineer's estimate)	1	EA	\$ 372,900.00	=	\$ 372,900.00		\$ 372,900.00
Concrete Washout Basin	1	EA	\$ 1,089.00	=	\$ 1,089.00		\$ 1,089.00
Inlet Protection	24	EA	\$ 202.00	=	\$ 4,848.00		\$ 4,848.00
Rock Check Dam		EA	\$ 605.00	=	\$ -		\$ -
Safety Fence		LF	\$ 3.00	=	\$ -		\$ -
Sediment Basin	2	EA	\$ 2,132.00	=	\$ 4,264.00		\$ 4,264.00
Sediment Trap		EA	\$ 500.00	=	\$ -		\$ -
Silt Fence	1,071	LF	\$ 3.00	=	\$ 3,213.00		\$ 3,213.00
Slope Drain		LF	\$ 40.00	=	\$ -		\$ -
Straw Bale		EA	\$ 31.00	=	\$ -		\$ -
Straw Wattle/Rock Sock	5	LF	\$ 7.00	=	\$ 35.00		\$ 35.00
Surface Roughening	2.4	AC	\$ 250.00	=	\$ 600.00		\$ 600.00
Temporary Erosion Control Blanket	72,419.0	SY	\$ 3.00	=	\$ 217,257.00		\$ 217,257.00
Temporary Seeding and Mulching	2.4	AC	\$ 1,666.00	=	\$ 3,998.40		\$ 3,998.40
Vehicle Tracking Control	1	EA	\$ 2,867.00	=	\$ 2,867.00		\$ 2,867.00
Saw Cut	525	LF	\$ 5.00	=	\$ 2,625.00		\$ 2,625.00
<i>[insert items not listed but part of construction plans]</i>				=	\$ -		\$ -
MAINTENANCE (35% of Construction BMPs)					\$ 83,897.59		\$ 83,897.59
Section 1 Subtotal					\$ 975,046.49		\$ 975,046.49

SECTION 2 - PUBLIC IMPROVEMENTS *							
ROADWAY IMPROVEMENTS							
Construction Traffic Control	1.0	LS	\$ 4,500.00	=	\$ 4,500.00		\$ 4,500.00
Aggregate Base Course (135 lbs/cf)		Tons	\$ 34.00	=	\$ -		\$ -
Aggregate Base Course (135 lbs/cf)	5,400.0	CY	\$ 61.00	=	\$ 329,400.00		\$ 329,400.00
Asphalt Pavement (3" thick)		SY	\$ 17.00	=	\$ -		\$ -
Asphalt Pavement (4" thick)		SY	\$ 23.00	=	\$ -		\$ -
Asphalt Pavement (6" thick)	5,400.0	SY	\$ 35.00	=	\$ 189,000.00		\$ 189,000.00
Asphalt Pavement (147 lbs/cf) 4" thick		Tons	\$ 106.00	=	\$ -		\$ -
Raised Median, Paved		SF	\$ 10.00	=	\$ -		\$ -
Regulatory Sign/Advisory Sign	3.0	EA	\$ 364.00	=	\$ 1,092.00		\$ 1,092.00
Guide/Street Name Sign		EA		=	\$ -		\$ -
Epoxy Pavement Marking	55.0	SF	\$ 16.00	=	\$ 880.00		\$ 880.00
Thermoplastic Pavement Marking		SF	\$ 28.00	=	\$ -		\$ -
Barricade - Type 3		EA	\$ 241.00	=	\$ -		\$ -
Delineator - Type I		EA	\$ 29.00	=	\$ -		\$ -
Curb and Gutter, Type A (6" Vertical)		LF	\$ 35.00	=	\$ -		\$ -
Curb and Gutter, Type B (Median)		LF	\$ 35.00	=	\$ -		\$ -
Curb and Gutter, Type C (Ramp)		LF	\$ 35.00	=	\$ -		\$ -
4" Sidewalk (common areas only)		SY	\$ 58.00	=	\$ -		\$ -
5" Sidewalk		SY	\$ 72.00	=	\$ -		\$ -
6" Sidewalk		SY	\$ 87.00	=	\$ -		\$ -
8" Sidewalk		SY	\$ 116.00	=	\$ -		\$ -
Pedestrian Ramp	3.0	EA	\$ 1,390.00	=	\$ 4,170.00		\$ 4,170.00
Cross Pan, local (8" thick, 6' wide to include return)		LF	\$ 73.00	=	\$ -		\$ -
Cross Pan, collector (9" thick, 8' wide to include return)		LF	\$ 111.00	=	\$ -		\$ -
Curb Opening with Drainage Chase	1.0	EA	\$ 1,790.00	=	\$ 1,790.00		\$ 1,790.00
Guardrail Type 3 (W-Beam)		LF	\$ 60.00	=	\$ -		\$ -
Guardrail Type 7 (Concrete)		LF	\$ 87.00	=	\$ -		\$ -
Guardrail End Anchorage		EA	\$ 2,538.00	=	\$ -		\$ -
Guardrail Impact Attenuator		EA	\$ 4,556.00	=	\$ -		\$ -
Sound Barrier Fence (CMU block, 6' high)		LF	\$ 95.00	=	\$ -		\$ -
Sound Barrier Fence (panels, 6' high)		LF	\$ 97.00	=	\$ -		\$ -
Electrical Conduit, Size =		LF	\$ 20.00	=	\$ -		\$ -
Traffic Signal, (provide engineer's estimate)		EA		=	\$ -		\$ -

Verify quantity - not found on plans

These ramps are located in between the building and the front parking lot for the accessible spaces.

PROJECT INFORMATION							
The Rock Commerce Center Subdivision Filing No. 1			8/10/2023			PPR2329	
Project Name			Date			PCD File No.	
Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction) % Complete	Remaining
[insert items not listed but part of construction plans]				=	\$ -		\$ -
[insert items not listed but part of construction plans]				=	\$ -		\$ -
STORM DRAIN IMPROVEMENTS							
Concrete Box Culvert (M Standard), Size (W x H)		LF		=	\$ -		\$ -
18" Reinforced Concrete Pipe	1,150	LF	\$ 76.00	=	\$ 87,400.00		\$ 87,400.00
24" Reinforced Concrete Pipe	1,150	LF	\$ 91.00	=	\$ 104,622.70		\$ 104,622.70
30" Reinforced Concrete Pipe		LF	\$ 114.00	=	\$ -		\$ -
36" Reinforced Concrete Pipe	654	LF	\$ 140.00	=	\$ 91,621.60		\$ 91,621.60
42" Reinforced Concrete Pipe		LF	\$ 187.00	=	\$ -		\$ -
48" Reinforced Concrete Pipe		LF	\$ 228.00	=	\$ -		\$ -
54" Reinforced Concrete Pipe		LF	\$ 297.00	=	\$ -		\$ -
60" Reinforced Concrete Pipe		LF	\$ 348.00	=	\$ -		\$ -
66" Reinforced Concrete Pipe		LF	\$ 402.00	=	\$ -		\$ -
72" Reinforced Concrete Pipe		LF	\$ 460.00	=	\$ -		\$ -
18" Corrugated Steel Pipe		LF	\$ 98.00	=	\$ -		\$ -
24" Corrugated Steel Pipe		LF	\$ 112.00	=	\$ -		\$ -
30" Corrugated Steel Pipe		LF	\$ 143.00	=	\$ -		\$ -
36" Corrugated Steel Pipe		LF	\$ 171.00	=	\$ -		\$ -
42" Corrugated Steel Pipe		LF	\$ 197.00	=	\$ -		\$ -
48" Corrugated Steel Pipe		LF	\$ 207.00	=	\$ -		\$ -
54" Corrugated Steel Pipe		LF	\$ 304.00	=	\$ -		\$ -
60" Corrugated Steel Pipe		LF	\$ 328.00	=	\$ -		\$ -
66" Corrugated Steel Pipe		LF	\$ 397.00	=	\$ -		\$ -
72" Corrugated Steel Pipe		LF	\$ 467.00	=	\$ -		\$ -
78" Corrugated Steel Pipe		LF	\$ 537.00	=	\$ -		\$ -
84" Corrugated Steel Pipe		LF	\$ 642.00	=	\$ -		\$ -
Flared End Section (FES) RCP Size = 18" (unit cost = 6x pipe unit cost)	4	EA	\$ 1,350.00	=	\$ 5,400.00		\$ 5,400.00
Flared End Section (FES) CSP Size = (unit cost = 6x pipe unit cost)		EA		=	\$ -		\$ -
End Treatment- Headwall		EA		=	\$ -		\$ -
End Treatment- Wingwall		EA		=	\$ -		\$ -
End Treatment - Cutoff Wall	1	EA	\$ 12,500.00	=	\$ 12,500.00		\$ 12,500.00
Curb Inlet (Type R) L=5', Depth < 5'		EA	\$ 6,703.00	=	\$ -		\$ -
Curb Inlet (Type R) L=5', 5' ≤ Depth < 10'		EA	\$ 8,715.00	=	\$ -		\$ -
Curb Inlet (Type R) L =5', 10' ≤ Depth < 15'		EA	\$ 10,092.00	=	\$ -		\$ -
Curb Inlet (Type R) L =10', Depth < 5'		EA	\$ 9,224.00	=	\$ -		\$ -
Curb Inlet (Type R) L =10', 5' ≤ Depth < 10'	1	EA	\$ 9,507.00	=	\$ 9,507.00		\$ 9,507.00
Curb Inlet (Type R) L =10', 10' ≤ Depth < 15'		EA	\$ 11,901.00	=	\$ -		\$ -
Curb Inlet (Type R) L =15', Depth < 5'		EA	\$ 11,995.00	=	\$ -		\$ -
Curb Inlet (Type R) L =15', 5' ≤ Depth < 10'		EA	\$ 12,858.00	=	\$ -		\$ -
Curb Inlet (Type R) L =15', 10' ≤ Depth < 15'		EA	\$ 14,061.00	=	\$ -		\$ -
Curb Inlet (Type R) L =20', Depth < 5'		EA	\$ 12,783.00	=	\$ -		\$ -
Curb Inlet (Type R) L =20', 5' ≤ Depth < 10'		EA	\$ 14,109.00	=	\$ -		\$ -
Grated Inlet (Type 13), Depth < 5'	22	EA	\$ 5,611.00	=	\$ 123,442.00		\$ 123,442.00
Grated Inlet (Type D), Depth < 5'		EA	\$ 6,931.00	=	\$ -		\$ -
Storm Sewer Manhole, Box Base		EA	\$ 14,061.00	=	\$ -		\$ -
Storm Sewer Manhole, Slab Base	22	EA	\$ 7,734.00	=	\$ 170,148.00		\$ 170,148.00
Geotextile (Erosion Control)		SY	\$ 8.00	=	\$ -		\$ -
Rip Rap, d50 size from 6" to 24"	275.0	Tons	\$ 97.00	=	\$ 26,675.00		\$ 26,675.00
Rip Rap, Grouted		Tons	\$ 115.00	=	\$ -		\$ -
Drainage Channel Construction, Size (W x H)		LF	\$ -	=	\$ -		\$ -
Drainage Channel Lining, Concrete	30	CY	\$ 689.00	=	\$ 20,670.00		\$ 20,670.00
Drainage Channel Lining, Rip Rap		CY	\$ 135.00	=	\$ -		\$ -
Drainage Channel Lining, Grass		AC	\$ 1,776.00	=	\$ -		\$ -
Drainage Channel Lining, Other Stabilization				=	\$ -		\$ -
[insert items not listed but part of construction plans]				=	\$ -		\$ -
Section 2 Subtotal				=	\$ 1,182,818.30		\$ 1,182,818.30

* - Subject to defect warranty financial assurance. A minimum of 20% shall be retained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)

PROJECT INFORMATION							
The Rock Commerce Center Subdivision Filing No. 1			8/10/2023			PPR2329	
Project Name			Date			PCD File No.	
Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction)	
						% Complete	Remaining
SECTION 3 - COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPC)**							
ROADWAY IMPROVEMENTS							
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
STORM DRAIN IMPROVEMENTS (Exception: Permanent Pond/BMP shall be itemized under Section 1)							
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
				=	\$ -		\$ -
WATER SYSTEM IMPROVEMENTS							
Water Main Pipe (PVC), Size 8"	3,769	LF	\$ 78.00	=	\$ 293,982.00		\$ 293,982.00
Water Main Pipe (Ductile Iron), Size 8"		LF	\$ 91.00	=	\$ -		\$ -
Gate Valves, 8"	12	EA	\$ 2,247.00	=	\$ 26,964.00		\$ 26,964.00
Fire Hydrant Assembly, w/ all valves	6	EA	\$ 7,978.00	=	\$ 47,868.00		\$ 47,868.00
Water Service Line Installation, inc. tap and valves	1	EA	\$ 1,601.00	=	\$ 1,601.00		\$ 1,601.00
Fire Cistern Installation, complete	1	EA		=	\$ -		\$ -
Water Main Pipe (Ductile Iron), Size 6"	174	LF	\$ 91.00	=	\$ 15,834.00		\$ 15,834.00
[insert items not listed but part of construction plans]				=	\$ -		\$ -
SANITARY SEWER IMPROVEMENTS							
Sewer Main Pipe (PVC), Size 6"	83	LF	\$ 78.00	=	\$ 6,474.00		\$ 6,474.00
Sanitary Sewer Manhole, Depth < 15 feet	1	EA	\$ 5,305.00	=	\$ 5,305.00		\$ 5,305.00
Sanitary Service Line Installation, complete	1	EA	\$ 1,696.00	=	\$ 1,696.00		\$ 1,696.00
Sanitary Sewer Lift Station, complete		EA		=	\$ -		\$ -
				=	\$ -		\$ -
[insert items not listed but part of construction plans]				=	\$ -		\$ -
LANDSCAPING IMPROVEMENTS (For subdivision specific condition of approval, or PUD)							
		EA		=	\$ -		\$ -
		EA		=	\$ -		\$ -
		EA		=	\$ -		\$ -
		EA		=	\$ -		\$ -
		EA		=	\$ -		\$ -
Section 3 Subtotal				=	\$ 399,724.00		\$ 399,724.00

** - Section 3 is not subject to defect warranty requirements

Unresolved Review
Comment:
Provide landscaping
quantities.

Landscaping
Quantities were
added to this
estimate.

PROJECT INFORMATION		
The Rock Commerce Center Subdivision Filing No. 1	8/10/2023	PPR2329
Project Name	Date	PCD File No.

Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction)	
						% Complete	Remaining
AS-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)		LS		=	\$ -		\$ -
POND/BMP CERTIFICATION (inc. elevations and volume calculations)		LS		=	\$ -		\$ -
<div> <div>Add cost for As-Built Plans & Pond Certification Letter</div> <div>These estimates were added as requested.</div> </div>						Total Construction Financial Assurance \$ 2,557,588.79 (Sum of all section subtotals plus as-builts and pond/BMP certification)	
						Total Remaining Construction Financial Assurance (with Pre-Plat Construction) \$ 2,557,588.79 (Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)	
						Total Defect Warranty Financial Assurance \$ 366,634.16 (20% of all items identified as (*). To be collateralized at time of preliminary acceptance)	

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

 Engineer (P.E. Seal Required)

 Approved by Owner / Applicant

 Approved by El Paso County Engineer / ECM Administrator

 Date

 Date

V2_Financial Assurance Forms Comments.pdf Markup Summary

Carlos (2)



Subject: Callout
Page Label: 1
Author: Carlos
Date: 11/8/2023 3:41:39 PM
Status:
Color: ■

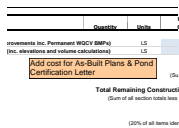
Verify quantity - not found on plans



Subject: Text Box
Page Label: 3
Author: Carlos
Date: 11/8/2023 4:19:21 PM
Status:
Color: ■

Unresolved Review Comment:
Provide landscaping quantities.

Christina Prete (1)



Subject: Text Box
Page Label: 4
Author: Christina Prete
Date: 11/7/2023 12:15:23 PM
Status:
Color: ■

Add cost for As-Built Plans & Pond Certification Letter

13. THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO FOR THE LOCATION OF UNDERGROUND GAS, ELECTRIC AND COMMUNICATION UTILITIES AT LEAST 48 HOURS PRIOR TO CONSTRUCTION (CALL 811 OR 1-800-922-1987). THE CONTRACTOR SHALL ALSO NOTIFY OTHER APPLICABLE UTILITY COMPANIES TO OBTAIN FIELD LOCATES OF ALL EXISTING UTILITIES PRIOR TO

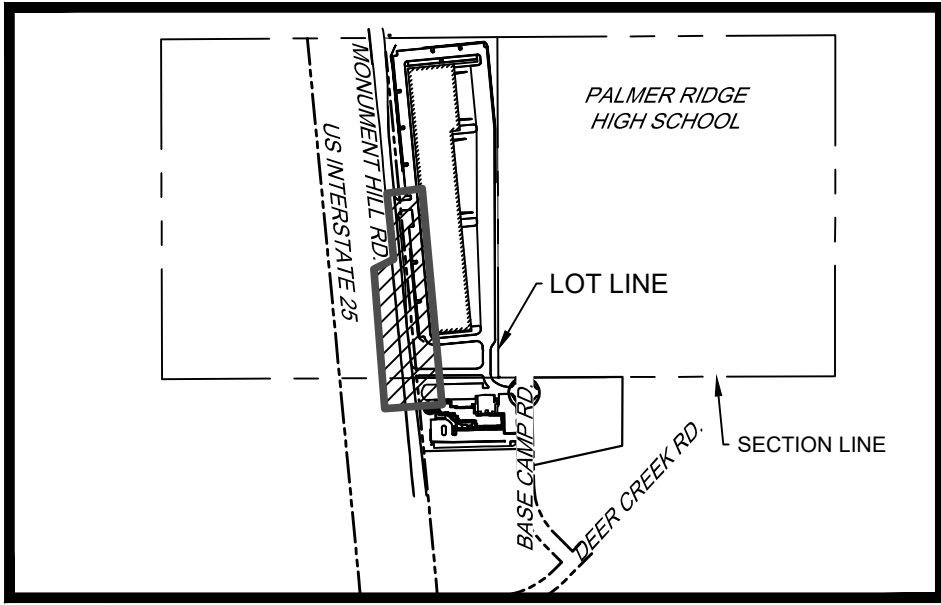
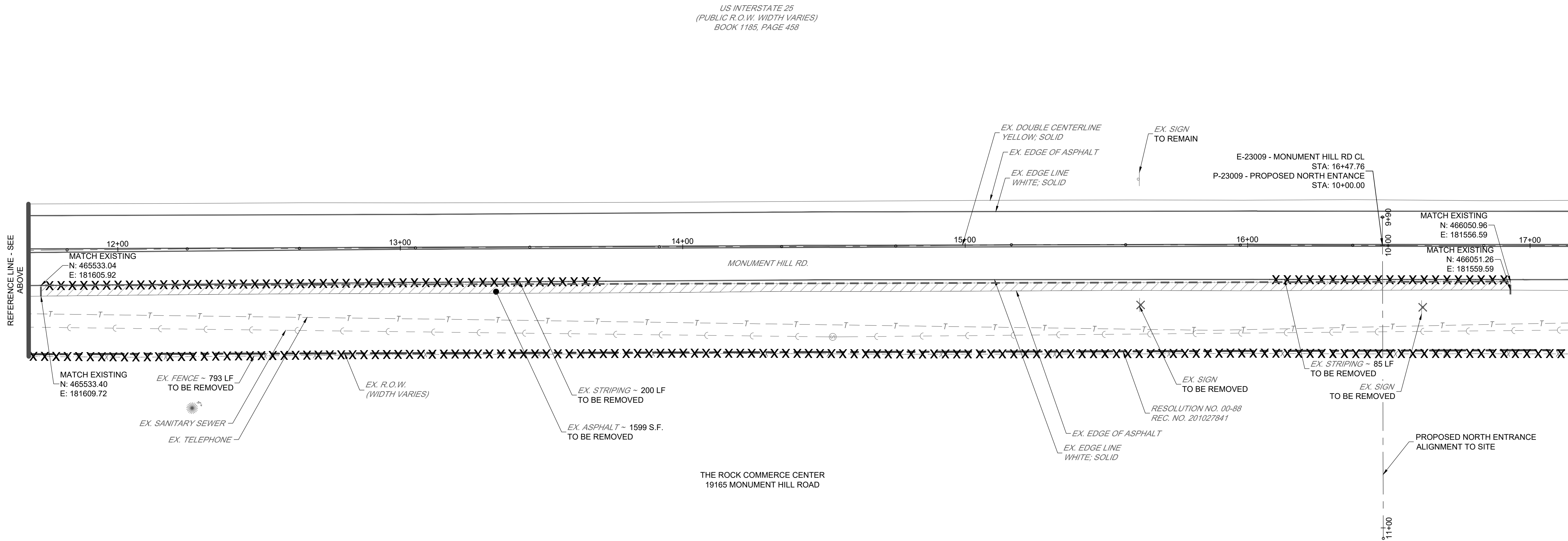
	PROPERTY LINE
	R.O.W.
	LOT LINE
	SETBACK
	EASEMENT
	ROAD CENTERLINE
	CURB AND GUTTER (CATCH)
	CURB AND GUTTER (SPILL)
	SIDEWALK
	STORM SEWER
	SANITARY SEWER
	TRENCH DRAIN
	WATER LINE
	IRRIGATION LINE
	NONPOTABLE WATER LINE
	RAW WATER LINE
	MANHOLE w/ DIA. (FT.)
	INLET
	FLARED END SECTION
	WATER BEND
	WATER CROSS
	WATER TEE
	WATER REDUCER
	WATER VALVE
	FIRE HYDRANT
	PLUG/CAP
	SANITARY SEWER SERVICE (* INDICATES NON-TYPICAL LOCATION)
	WATER SERVICE (* INDICATES NON-TYPICAL LOCATION)
	UTILITY CROSSING
	UNDERDRAIN w/ SIZE (IN.)
	RETAINING WALL
	CONTOUR MAJOR
	CONTOUR MINOR
	SPOT ELEVATION
	SLOPE ARROW (4:1 MAX UNLESS NOTED OTHERWISE)
	LIMITS OF CONSTRUCTION / SAWCUT
	PEDESTRIAN ACCESSIBLE ROUTE
	LOT TYPE
	LINE OF SIGHT
	OVER FLOW ARROW
	DEMOLITION

ABC	AGGREGATE BASE COARSE
ARV	AIR RELEASE VALVE
BB MH	BOX BASE MANHOLE
BC	BUILDING CORNER
BFE	BASEMENT FLOOR ELEVATION
B.O.P.	BOTTOM OF PIPE (ELEVATION)
BW	BOTTOM OF WALL
CATV	CABLE TELEVISION
CL	CENTERLINE
COMP	CORRUGATED METAL PIPE
CONC	CONCRETE
D.E.	DRAINAGE EASEMENT
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	DOMESTIC WATER
E	EAST
EC	END CURVE RETURN
EG	EXISTING GRADE/GROUND
ELEC	ELECTRIC OR ELECTRICAL
ELEV	ELEVATION
EOP	EDGE OF PAVEMENT
ESMT	EASEMENT
EX.	EXISTING
FFE	FINISH FLOOR ELEVATION
FG	FINISH GRADE
FL	FLOWLINE
FM	FORCE MAIN
FO	FIBER OPTIC
G.E.	GAS EASEMENT
GB	GRADE BREAK
GFE	GARAGE FINISH FLOOR
GM	GAS METER
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HP	HIGH POINT
IBV	INLINE BUTTERFLY VALVE
INV	INVERT (ELEVATION)
IRR	IRRIGATION
L	LEFT
LF	LINEAR FEET/FOOT
LP	LOW POINT
MAX	MAXIMUM
ME	MATCH EXISTING
MH	MANHOLE
MIN	MINIMUM
N	NORTH
PC	POINT ON CURVE
PCC	POINT OF COMPOUND CURVE
PCR	POINT OF CURVE RETURN
PL	PROPERTY LINE
PRC	POINT OF REVERSE CURVE
PROP.	PROPOSED
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE PIPE
R	RADIUS OR RIGHT
R.O.W.	RIGHT OF WAY
RCP	REINFORCED CONCRETE PIPE
S	SOUTH
S.D.M.E.	SIDEWALK, DRAINAGE, AND MAINTENANCE EASEMENT
S.M.E.	SIDEWALK AND MAINTENANCE EASEMENT
S.W.E.	SIDEWALK EASEMENT
SD	STORM DRAIN
SS	SANITARY SEWER
SSMH	SANITARY SEWER MANHOLE
STA	STATION
STM	STORMWATER
STM MH	STORMWATER MANHOLE
TBC	TOP BACK OF CURB
TBW	TOP BACK OF WALK
TC	TOP OF CURB
TOF	TOP OF FOUNDATION
T.O.P.	TOP OF PIPE (ELEVATION)
TW	TOP OF WALL
TYP	TYPICAL
U.E.	UTILITY EASEMENT
VC	VERTICAL CURVE
W	WEST
WL	WATERLINE
WM	WATER METER
WV	WATER VALVE

[illegible]

C1.1

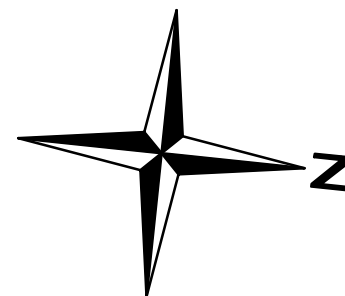
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KEYMAP
SCALE = 1" = 750'



Know what's below.
Call before you dig.



SCALE: 1" = 20'

THE ROCK COMMERCE CENTER
PUBLIC IMPROVEMENTS PLAN
CONSTRUCTION DODUMENTS
DEMOLITION PLAN

SHEET

C2.0



NOT FOR
CONSTRUCTION

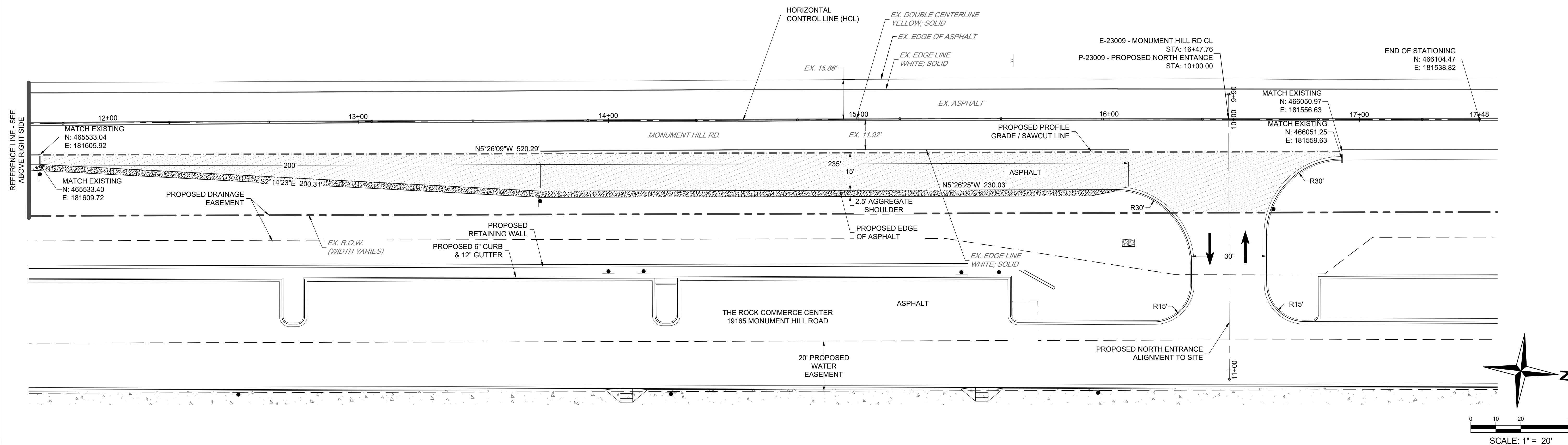
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DATE	NO.	NOTES		
07/28/2023	1	1ST SUBMITTAL		
10/20/2023	2	2ND SUBMITTAL		

15 Redland YEARS
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Know what's **below**.
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PAVING LEGEND	
	PROPOSED ASPHALT PAVEMENT 7.5-INCHES ASPHALT OVER 10-INCHES COMPACTED CLASS 6 AGGREGATE BASE COURSE.
	PROPOSED SHOULDER MATCH EXISTING



15 YEARS
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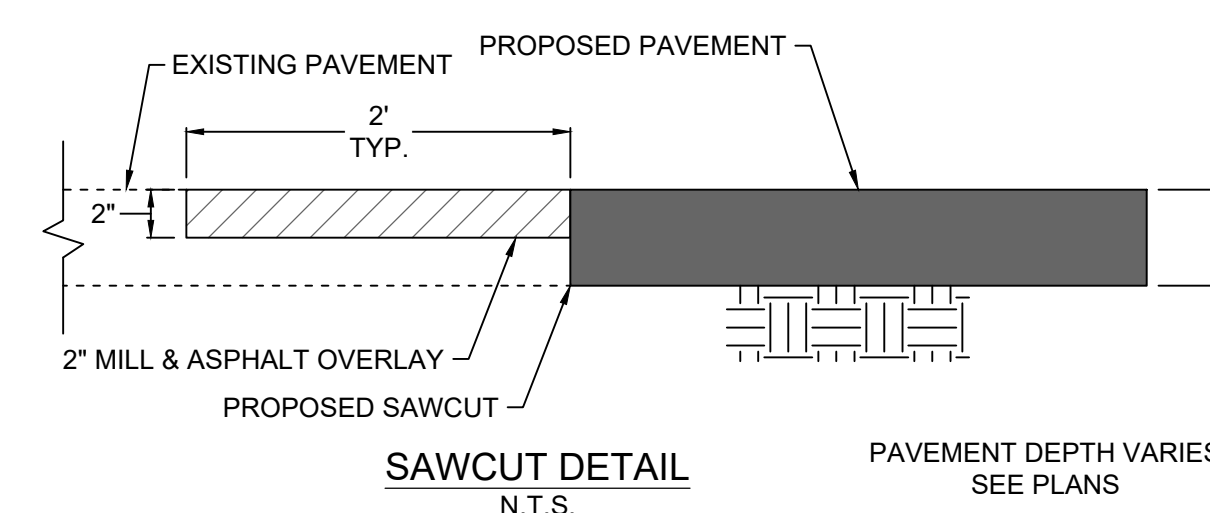
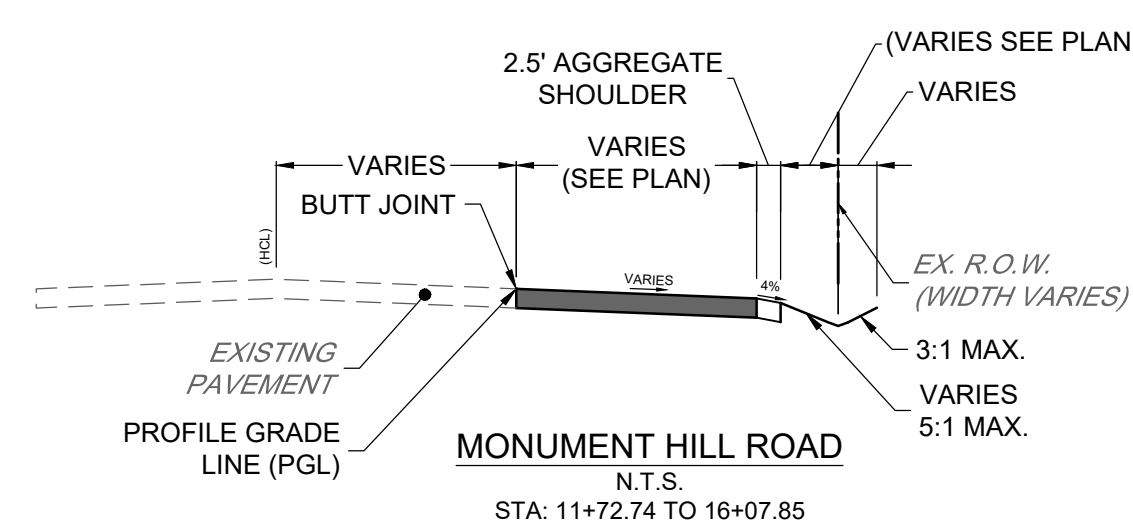
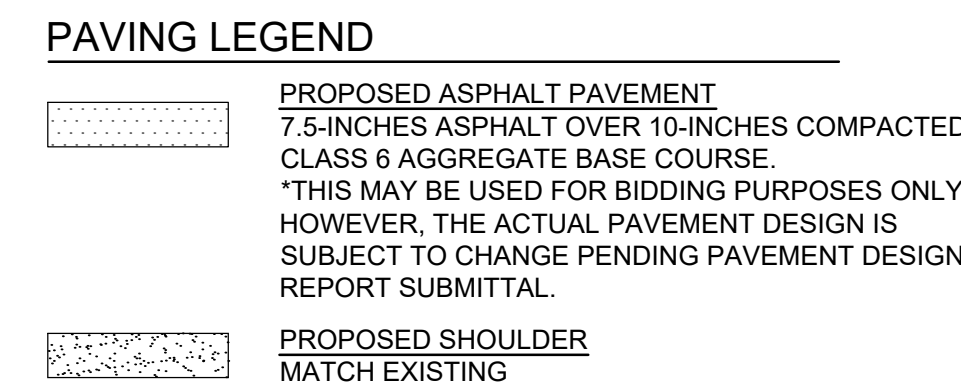
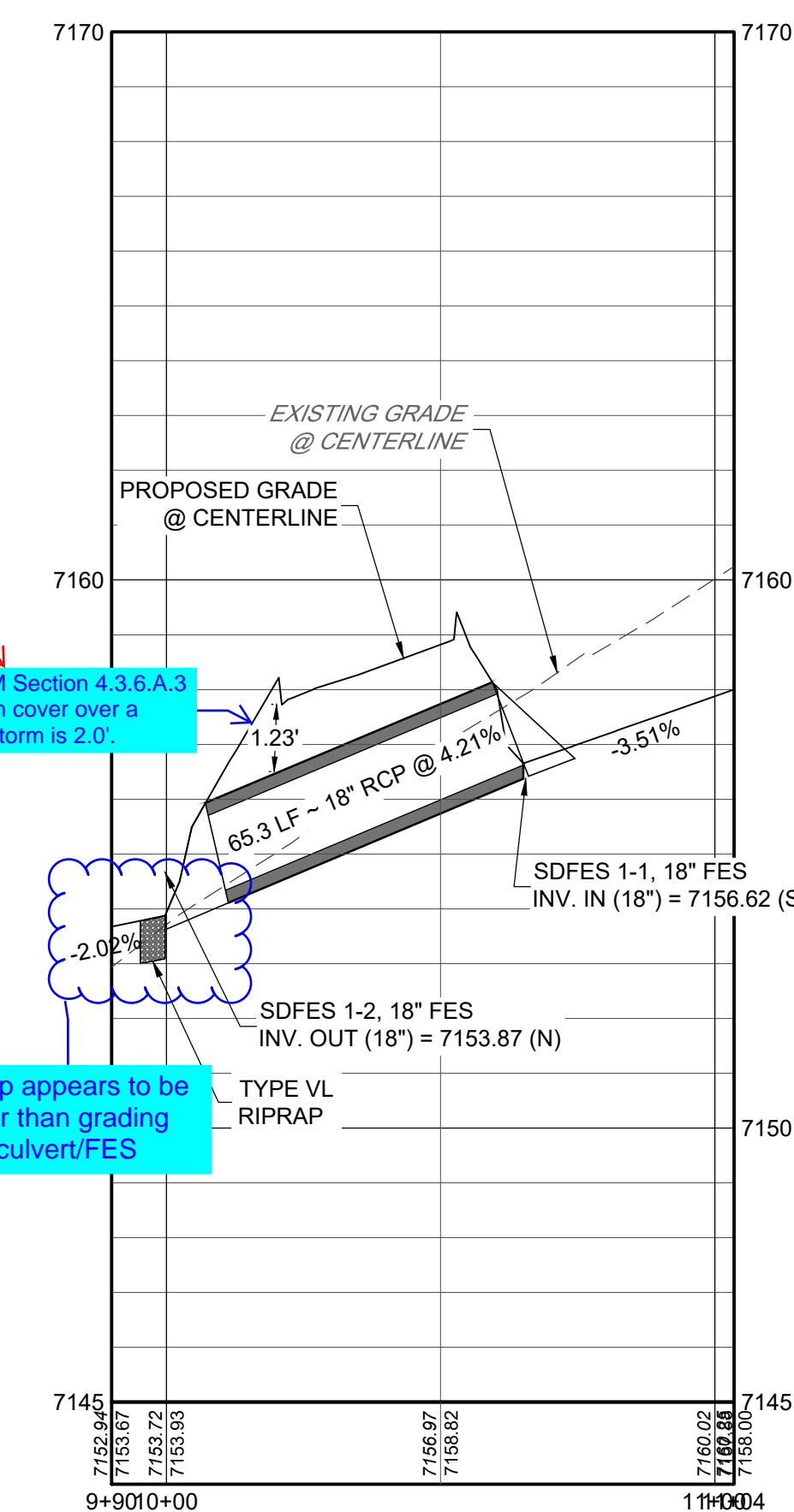
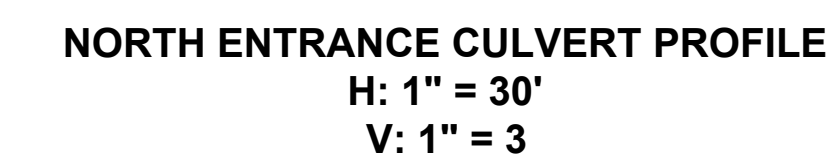
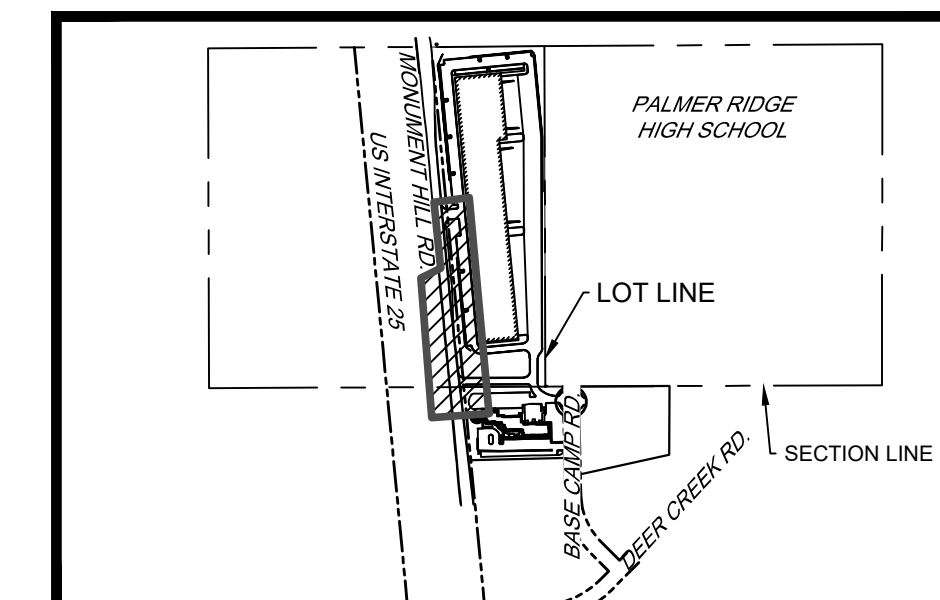
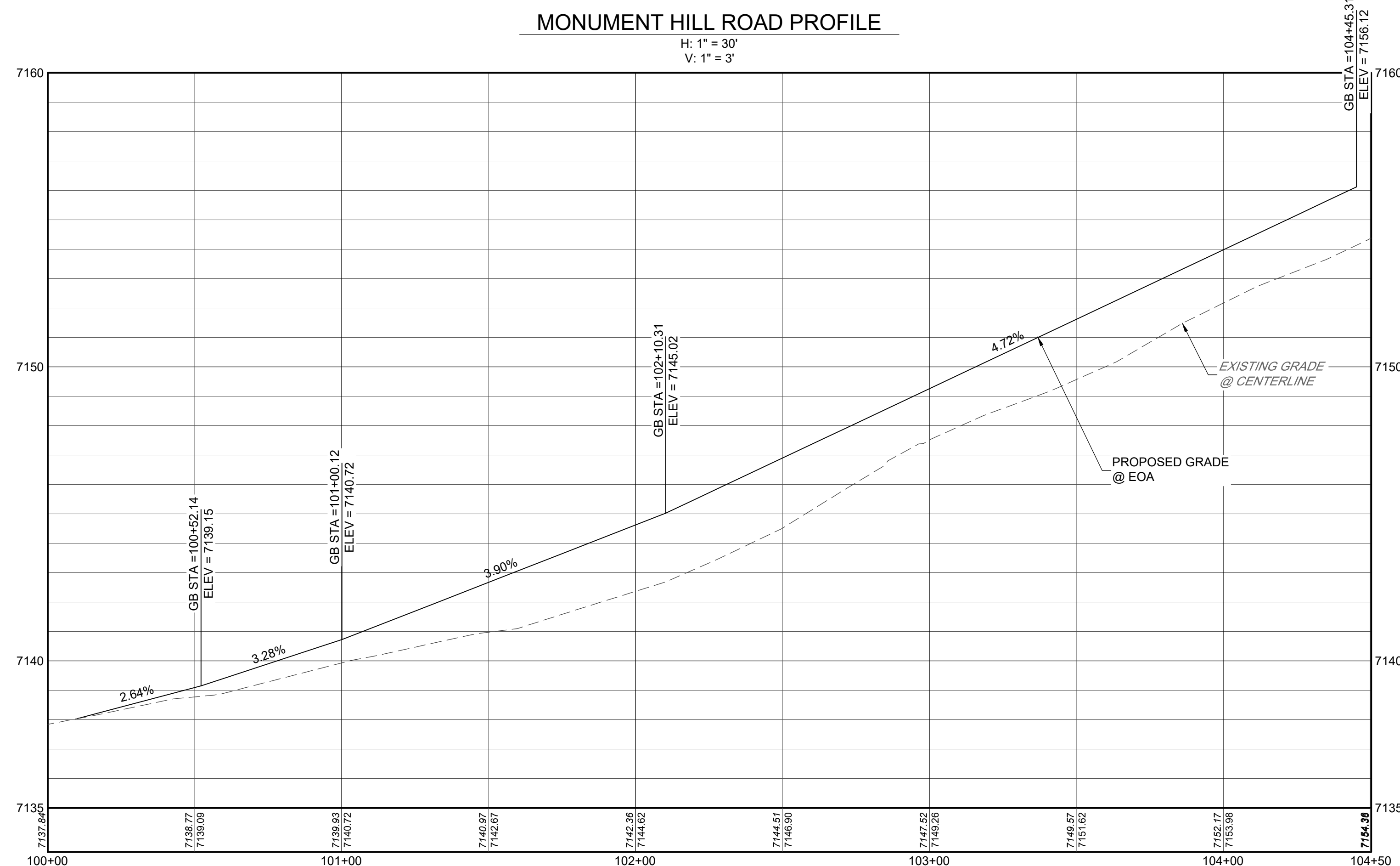
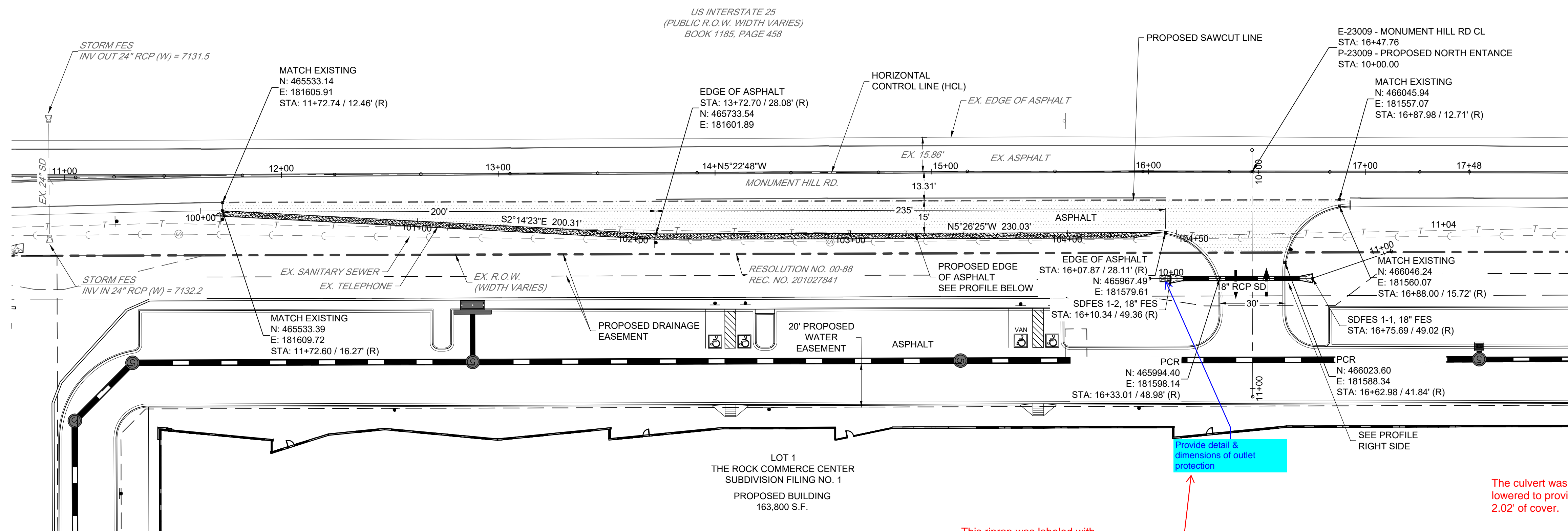
**NOT FOR
CONSTRUCTION**

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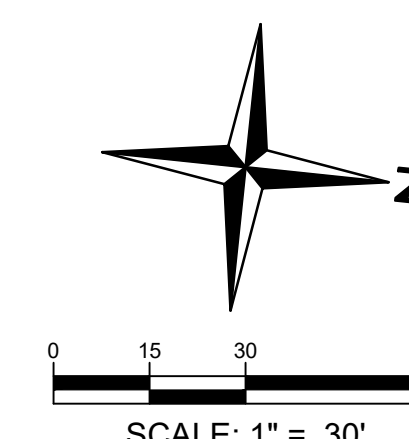
THE ROCK COMMERCE CENTER
PUBLIC IMPROVEMENTS PLAN
CONSTRUCTION DOCUMENTS
HORIZONTAL CONTROL PLAN

SHEET

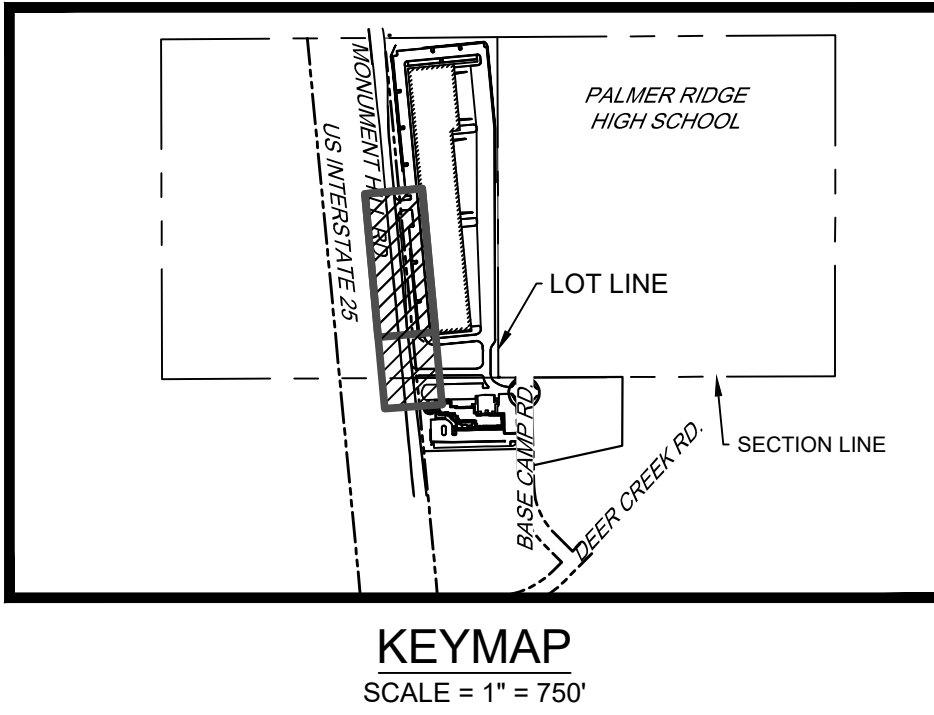
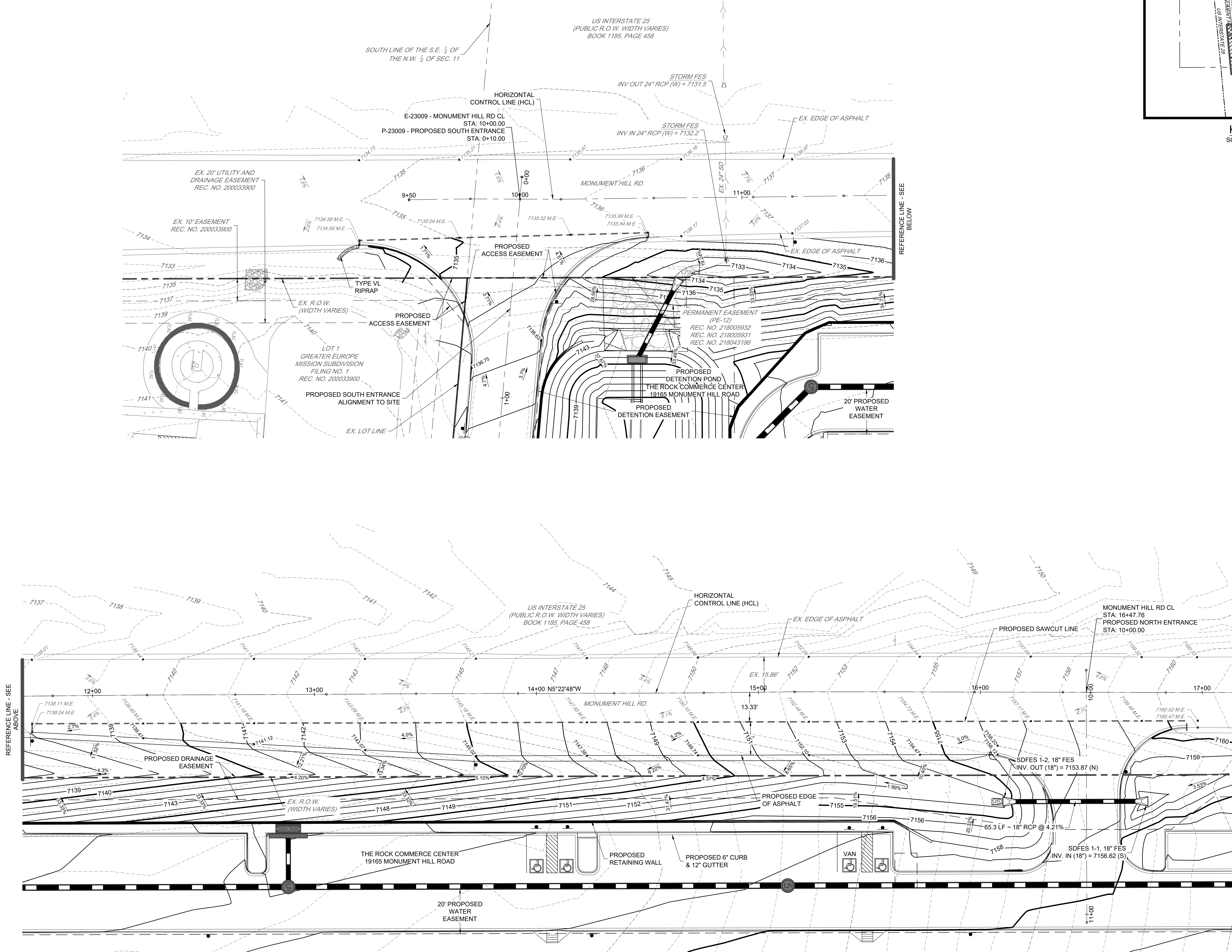
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Know what's **below**.
Call before you dig.



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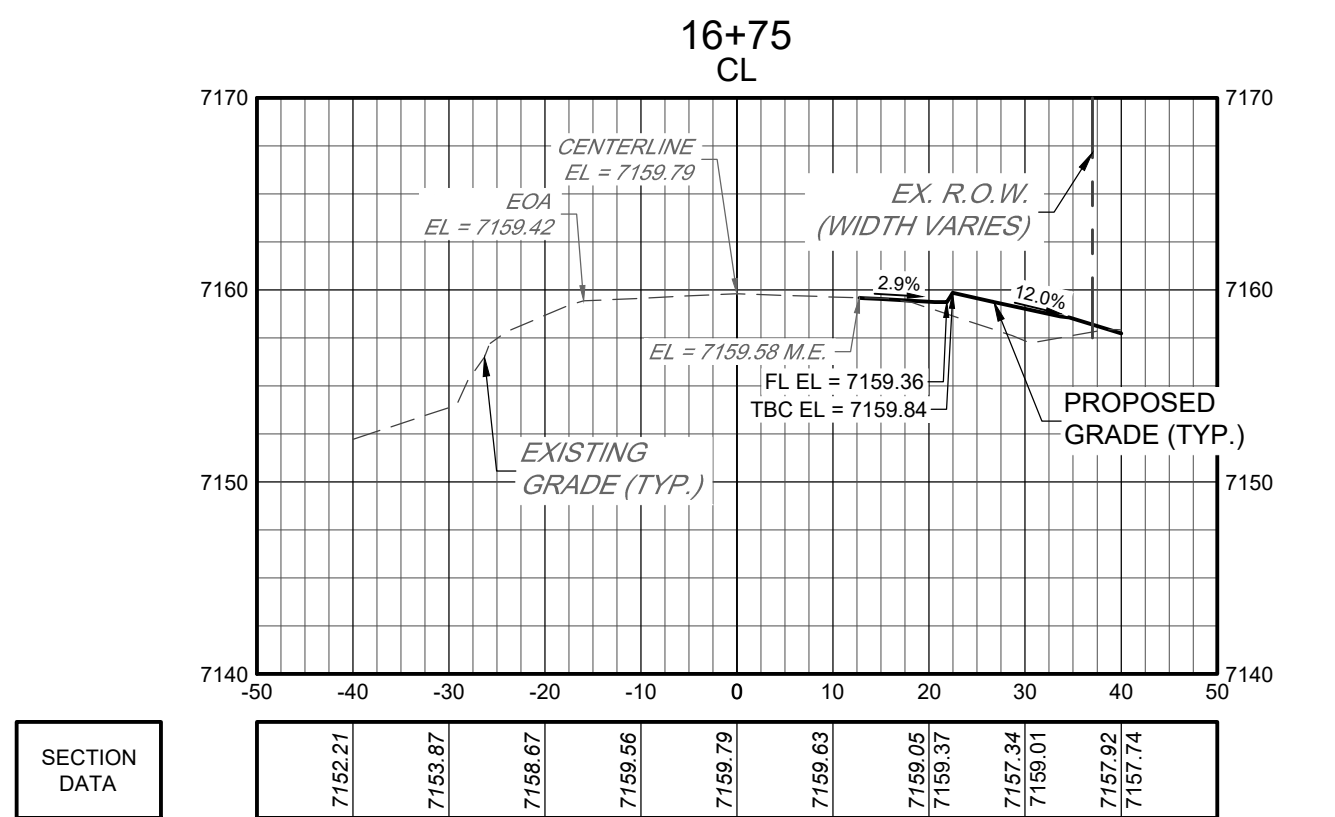
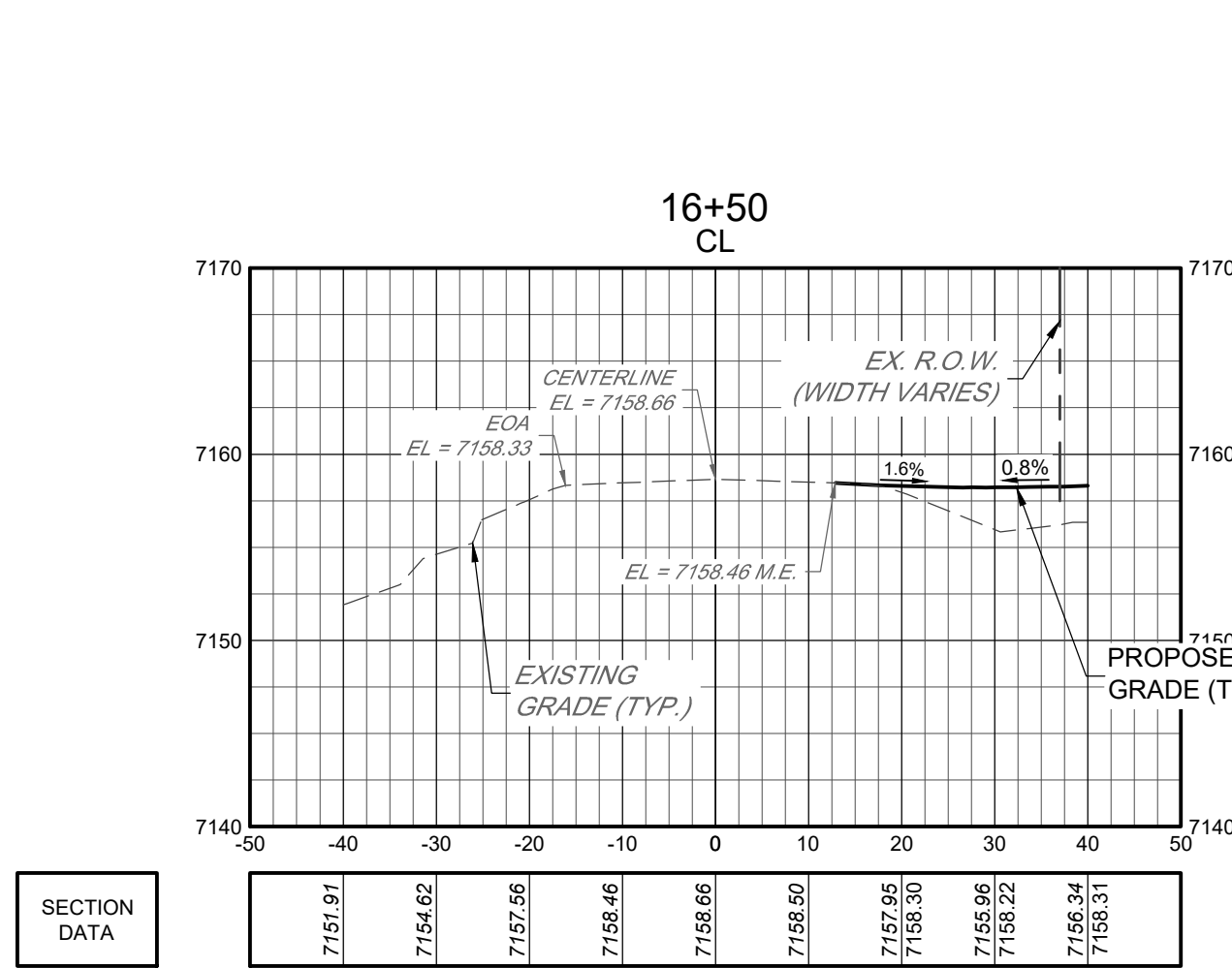
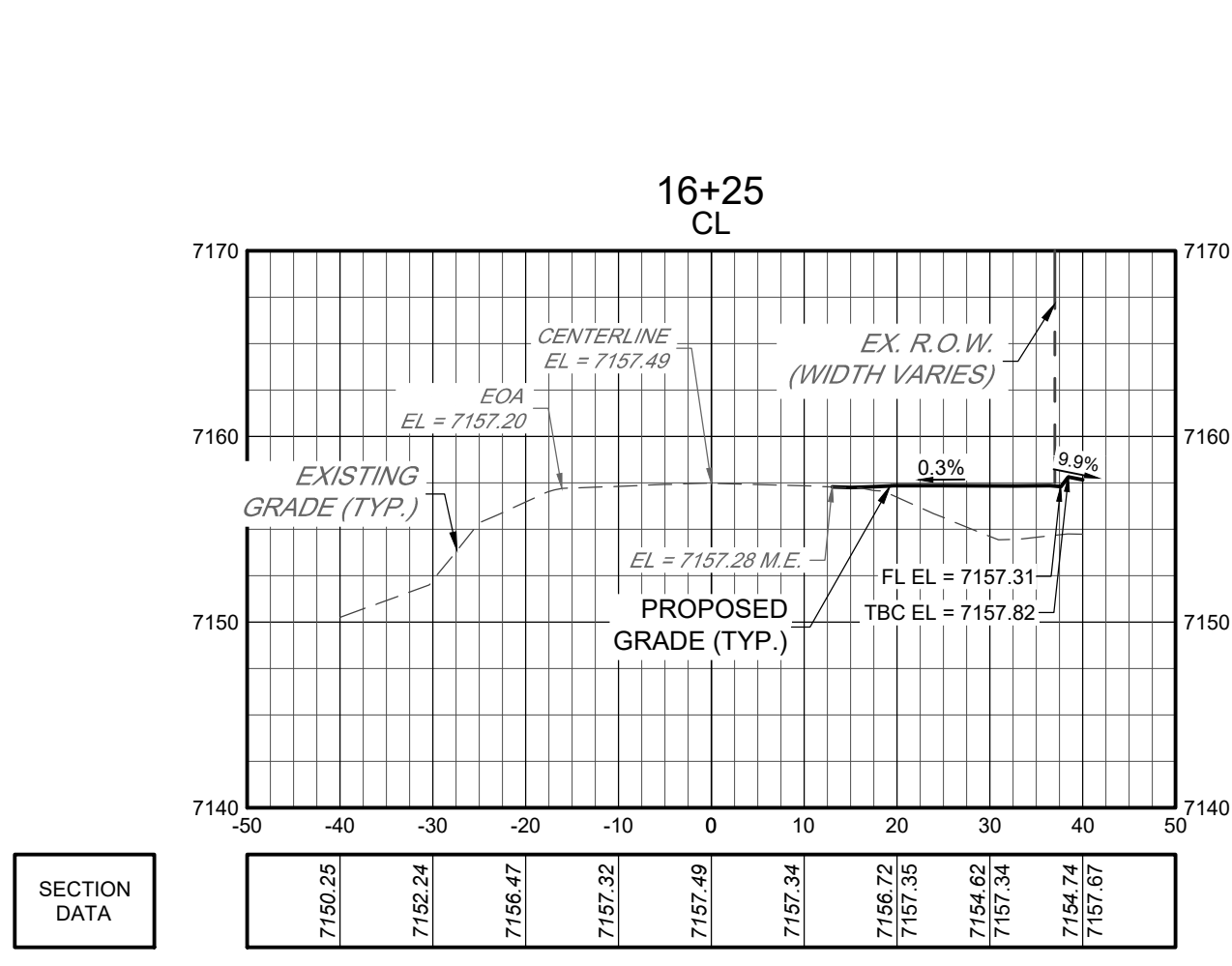
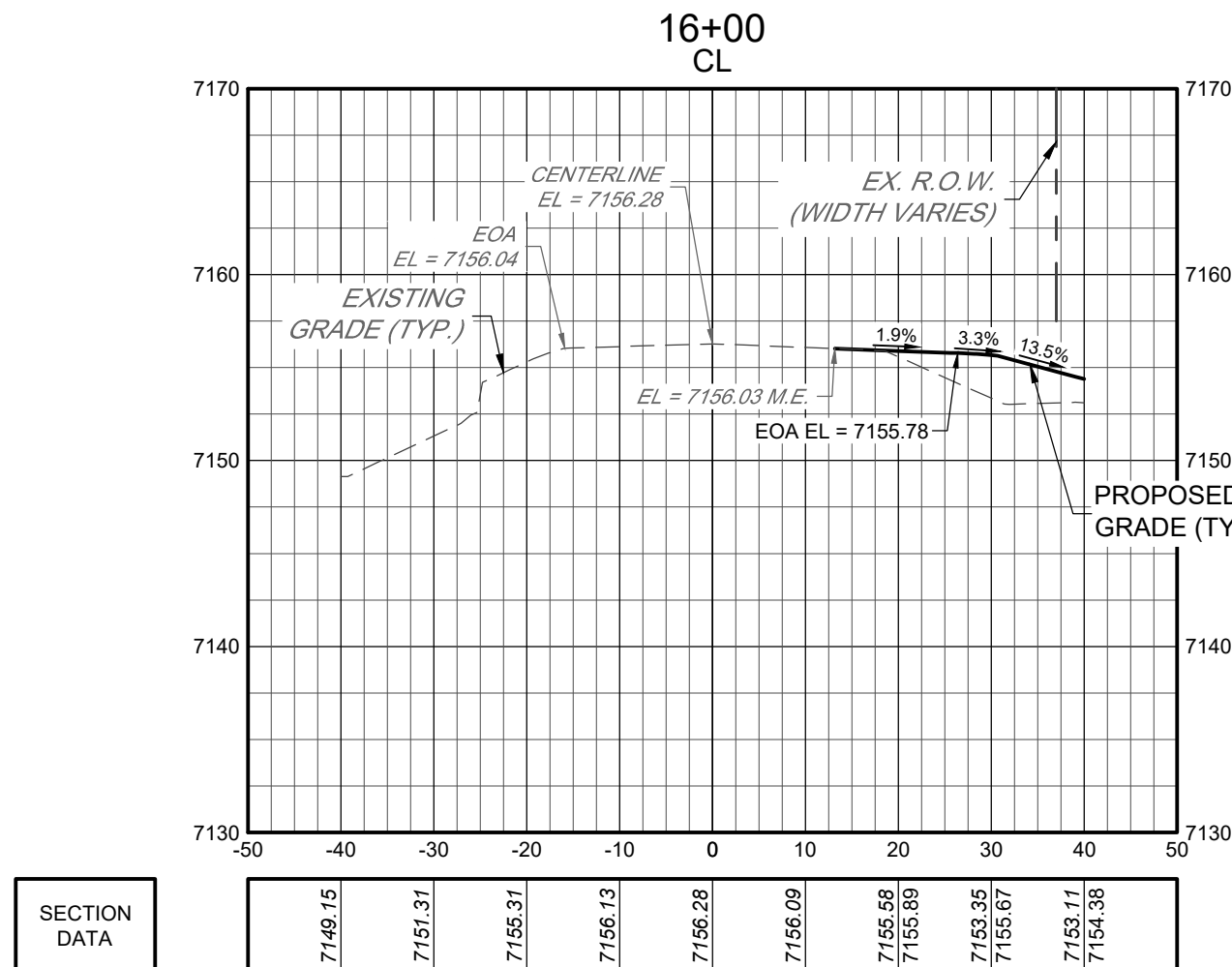
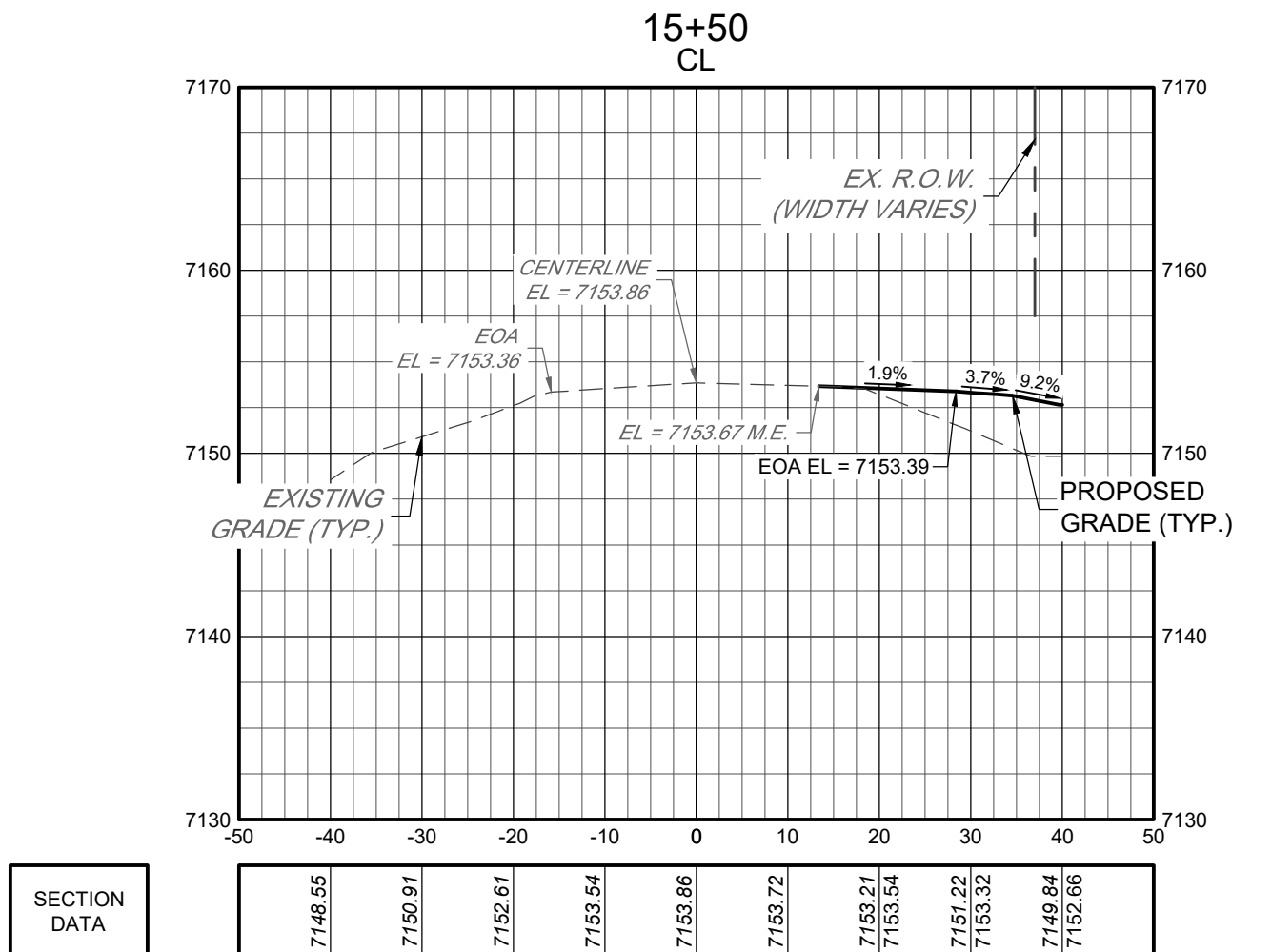
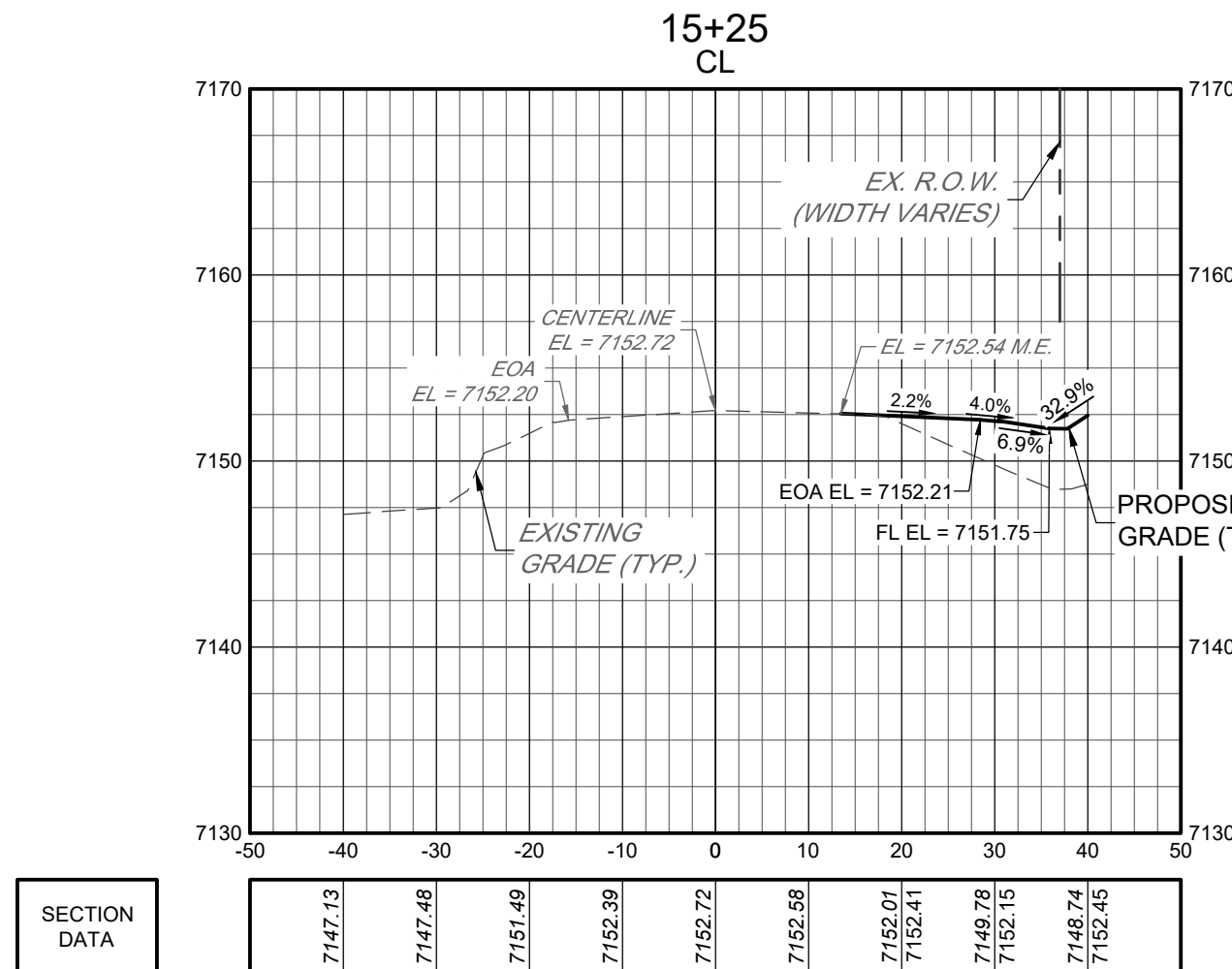
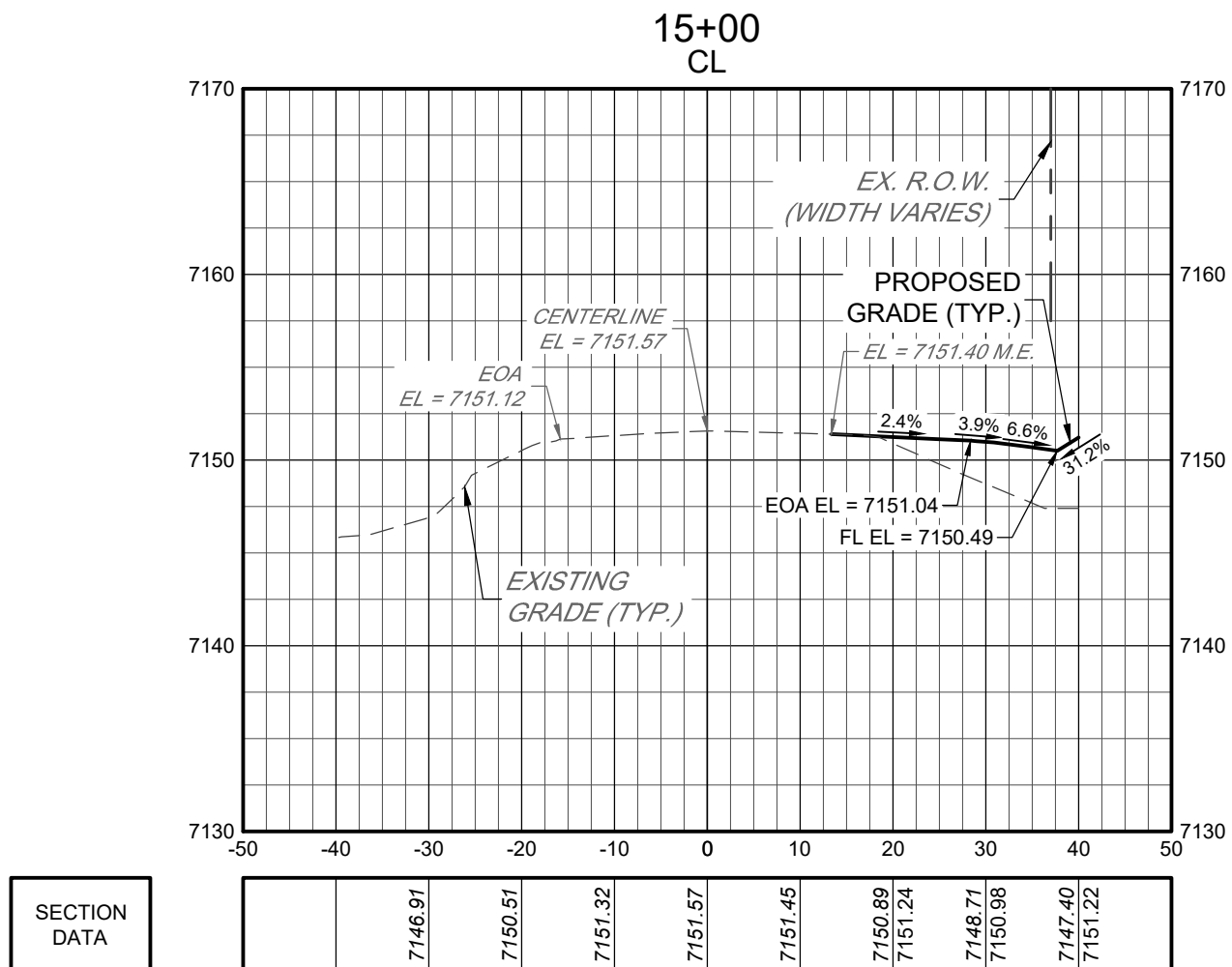
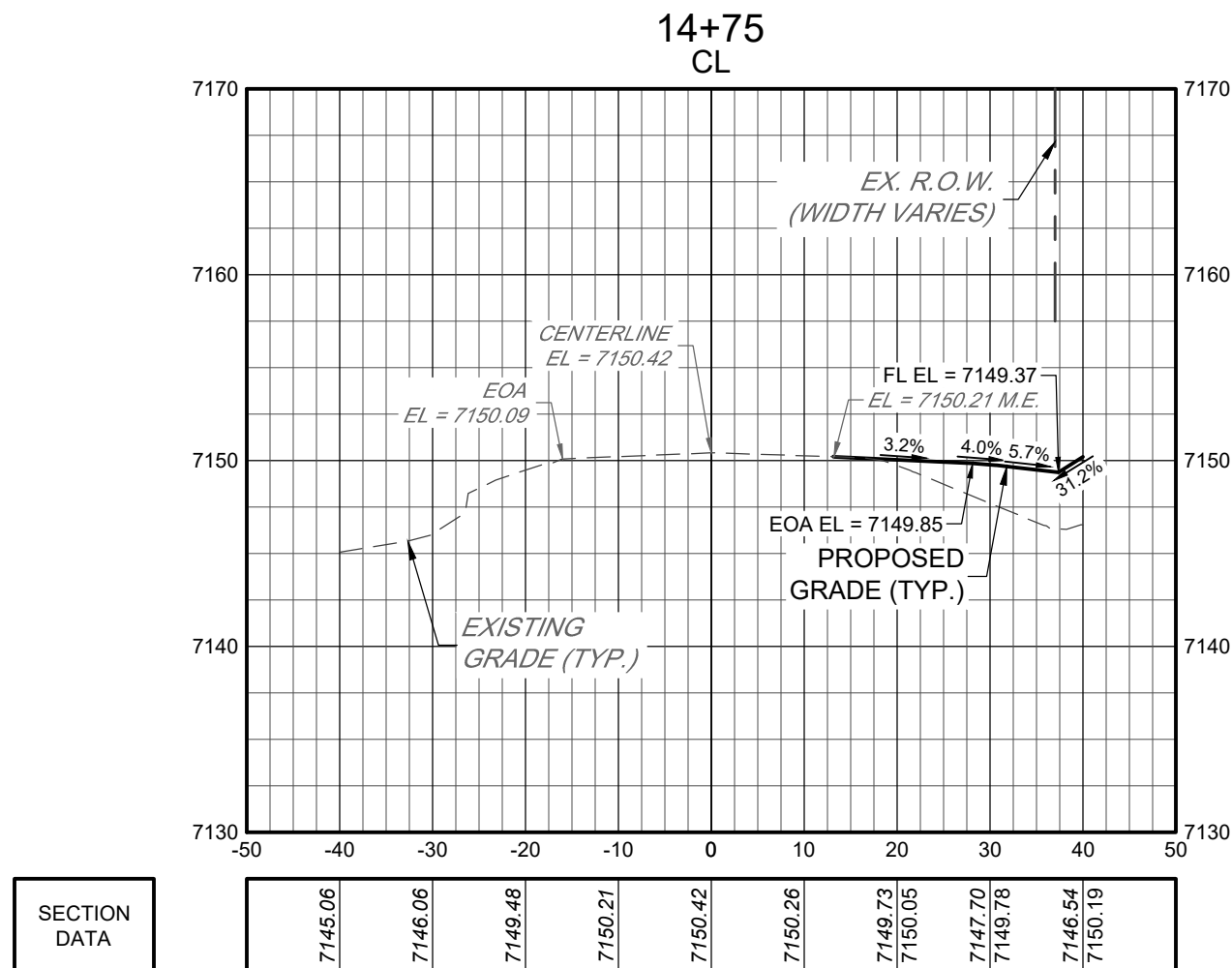
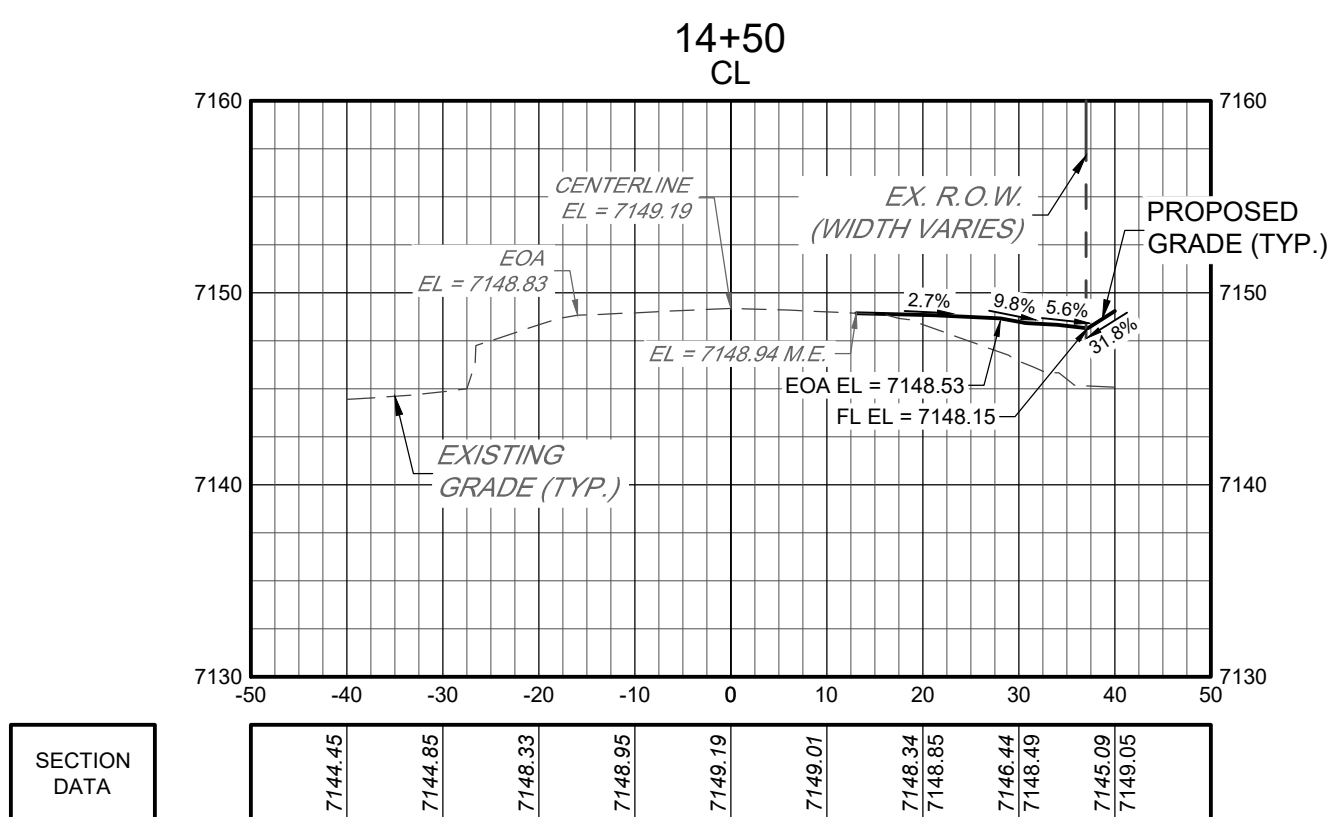
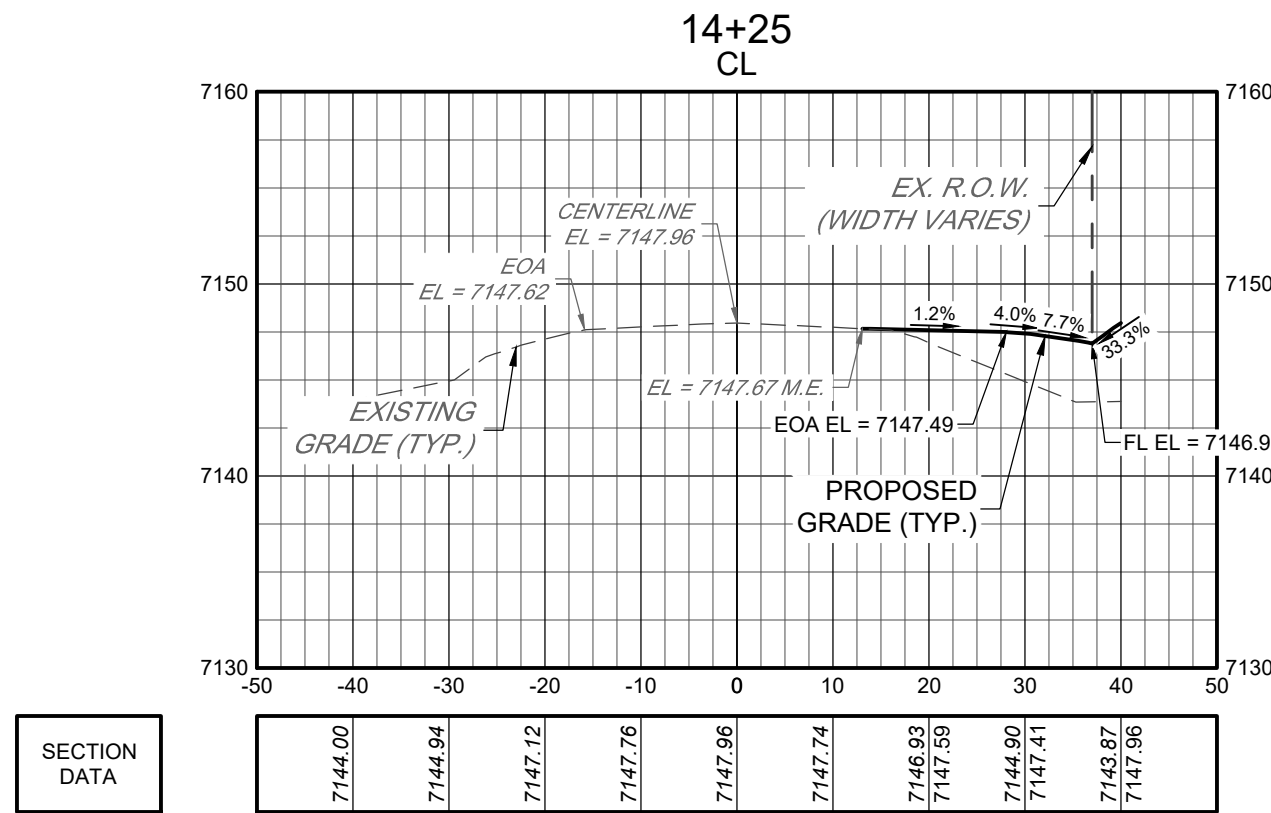
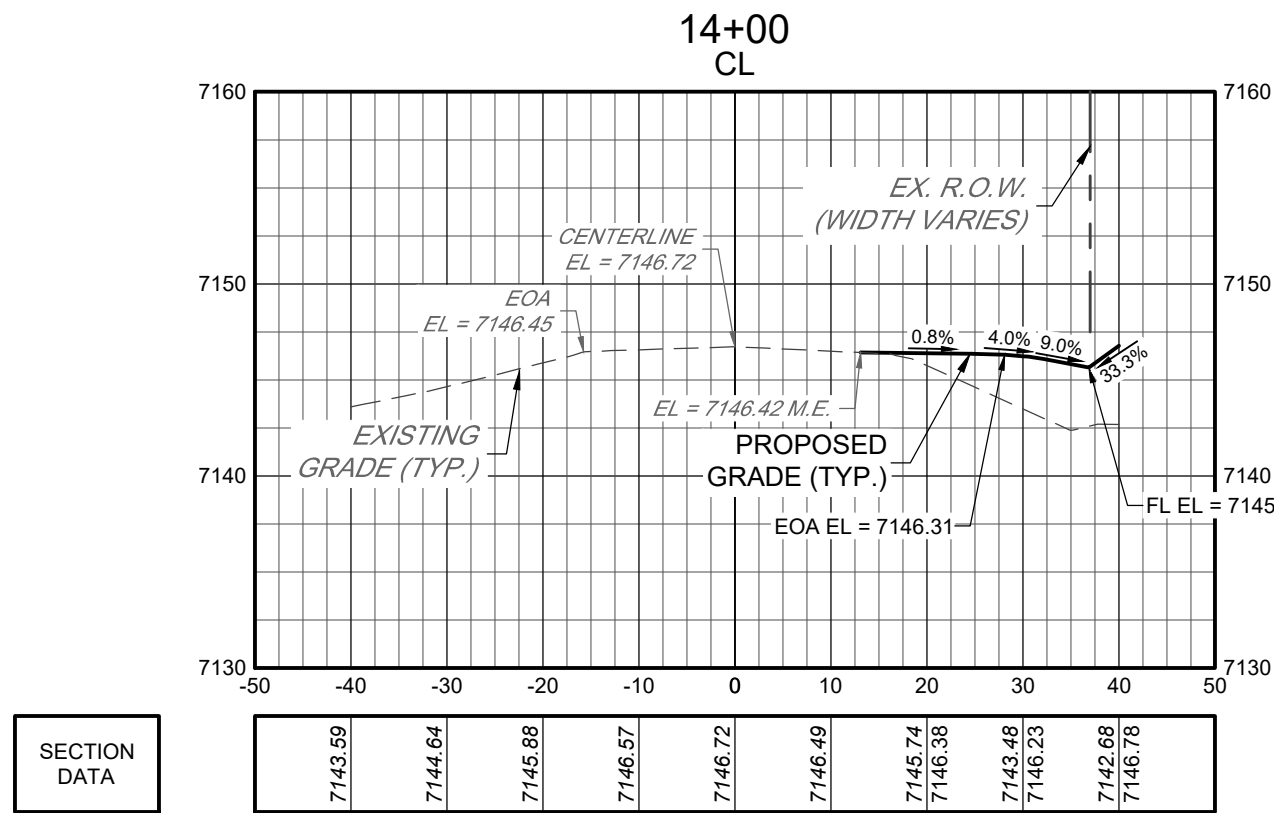
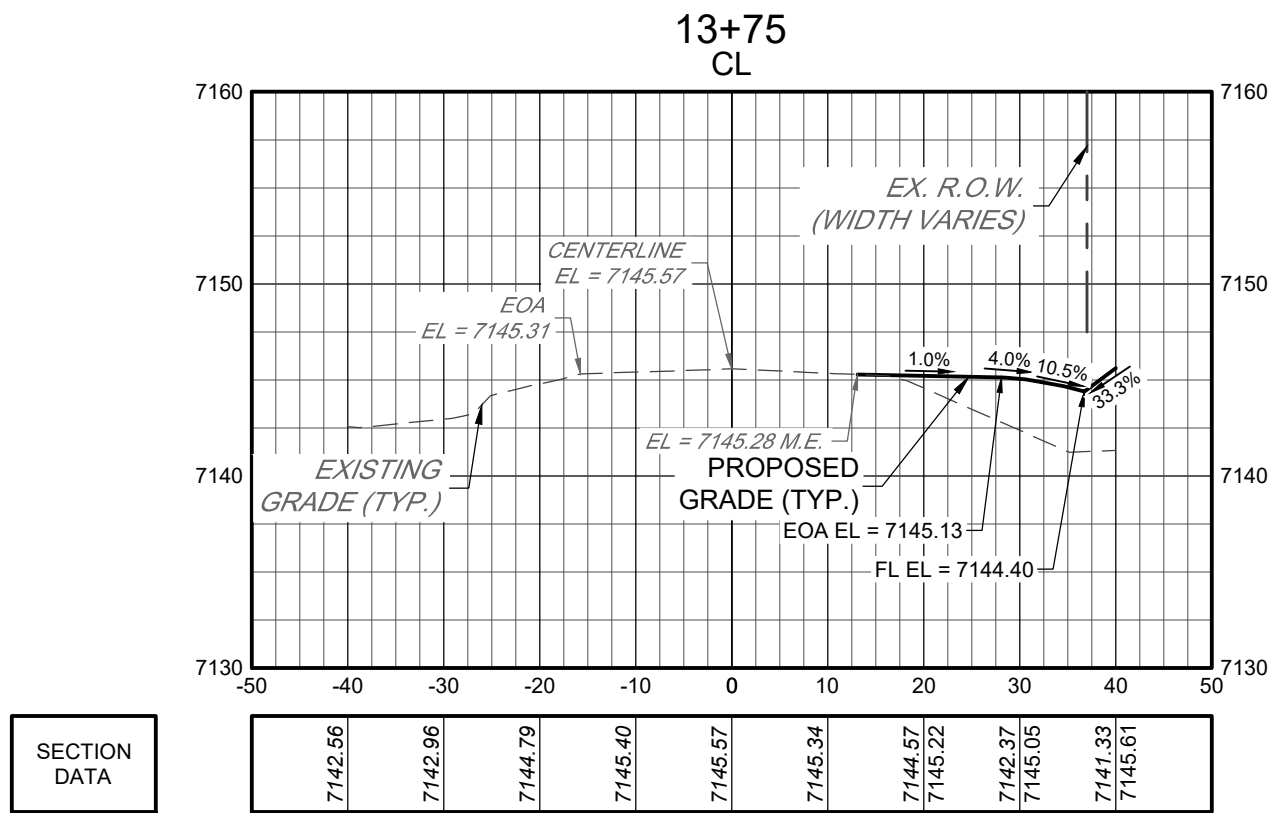
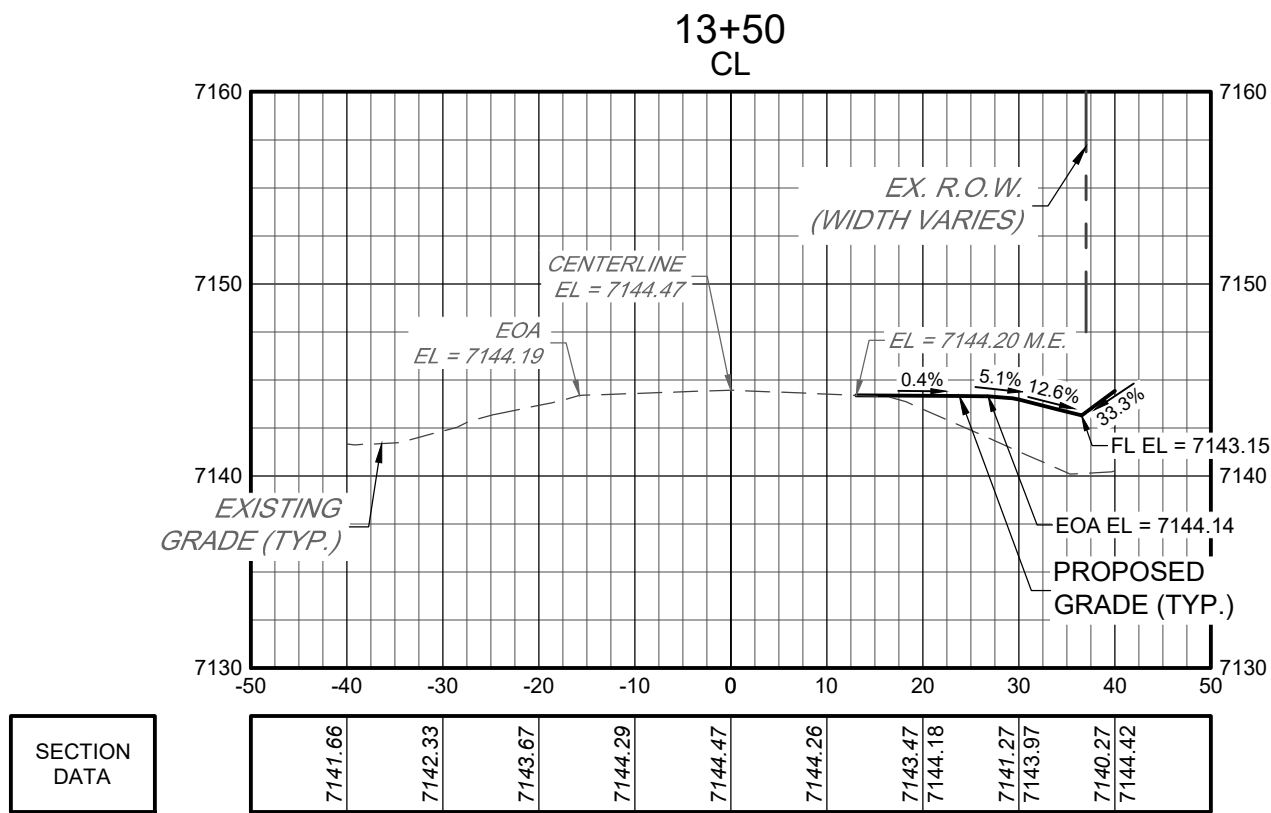
NOT FOR
CONSTRUCTION

PROJECT NO.	23009	DATE	NO.	NOTES
DATE	NO.	NOTES		
07/28/2023	1	1ST SUBMITTAL		
10/20/2023	2	2ND SUBMITTAL		

THE ROCK COMMERCE CENTER
PUBLIC IMPROVEMENTS PLAN
CONSTRUCTION DODUMENTS
GRADING PLAN

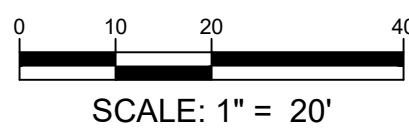
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SECTION VIEWS

H: 1" = 20'
V: 1" = 10'



THE ROCK COMMERCE CENTER
PUBLIC IMPROVEMENTS PLAN
CONSTRUCTION DOCUMENTS
ROAD CROSS SECTIONS

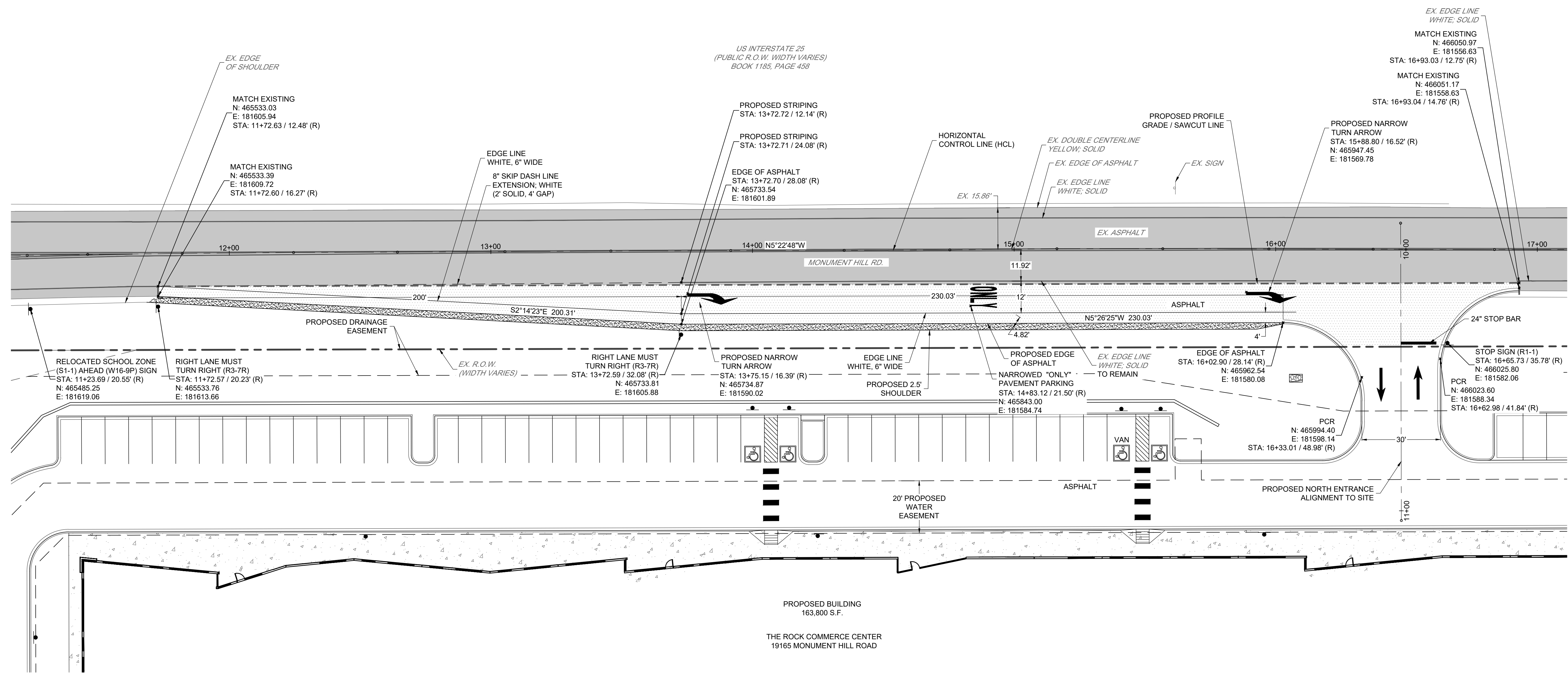
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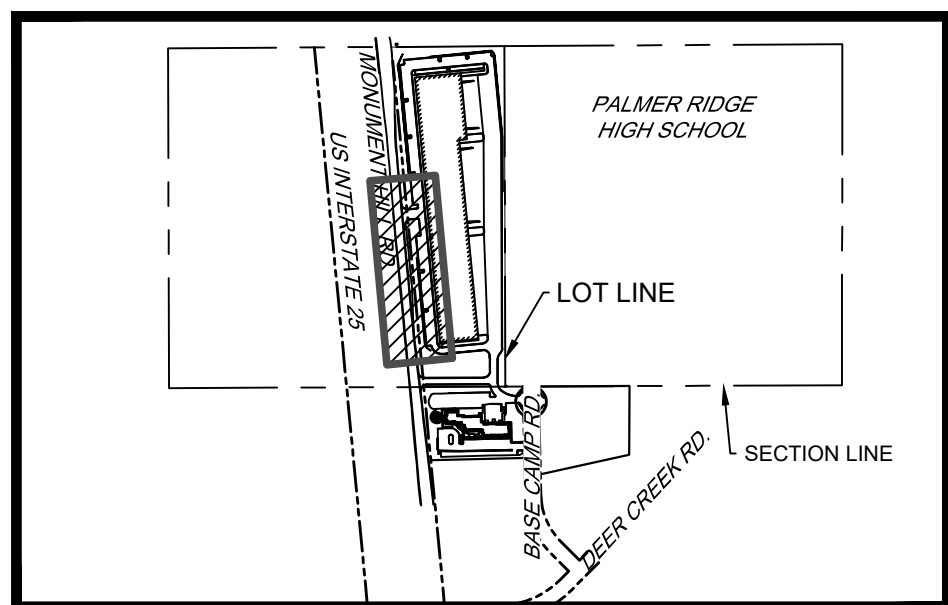
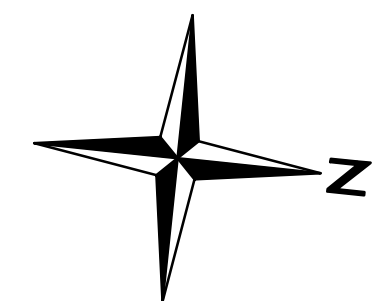
NOT FOR
CONSTRUCTION

PROJECT NO.	23009	DATE	NO.	NOTES
DATE	07/28/2023	1	1ST SUBMITTAL	
DATE	10/20/2023	2	2ND SUBMITTAL	

15 YEARS
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• Construction Management



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KEYMAP
SCALE = 1" = 750'

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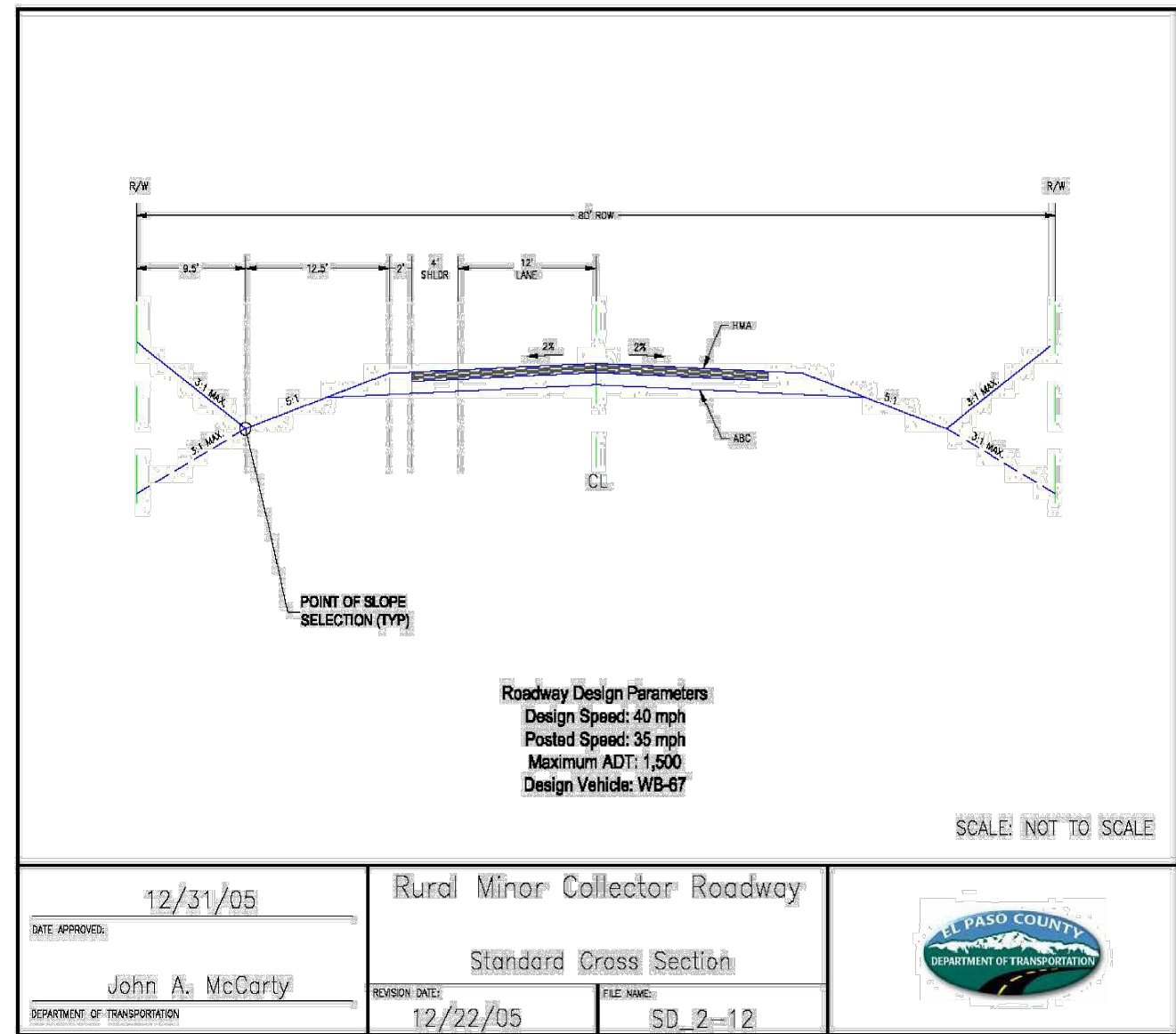
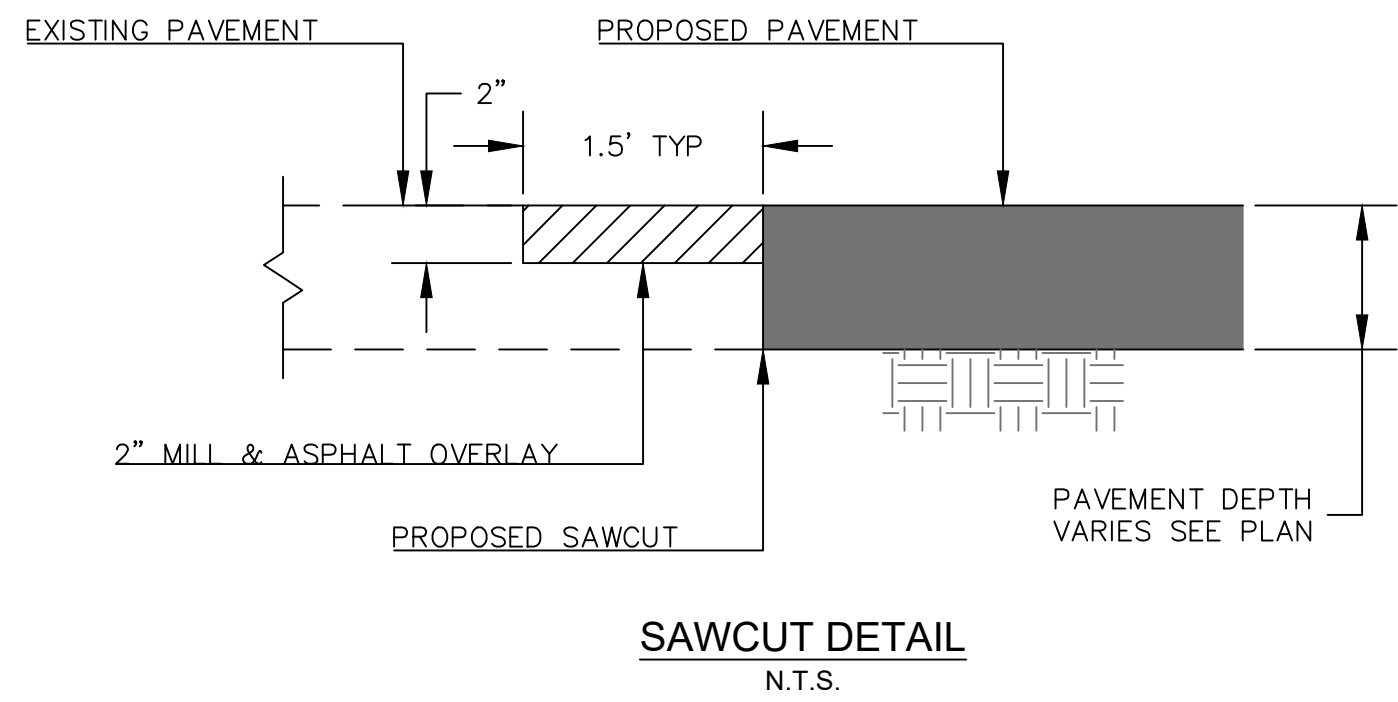
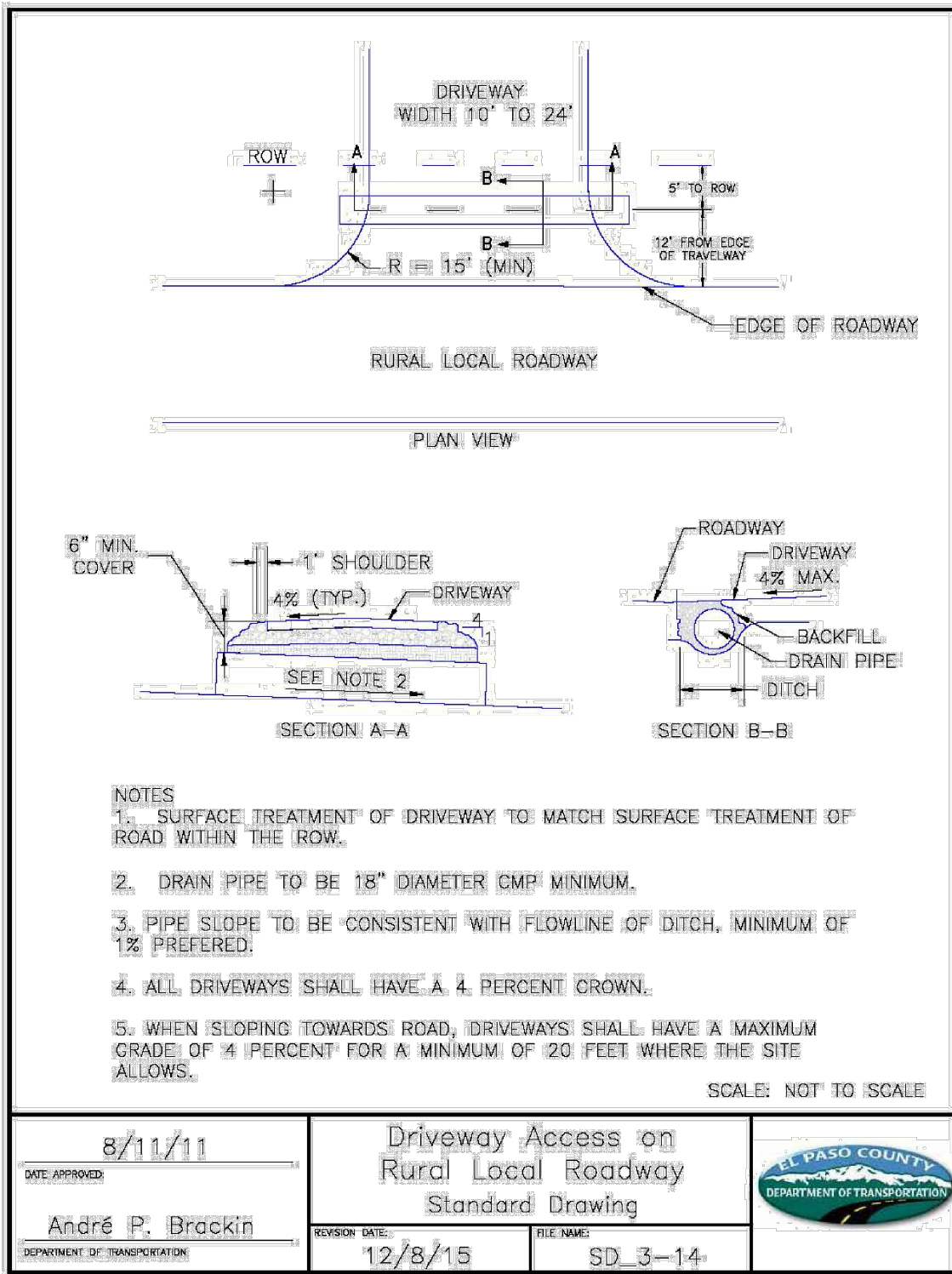
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THE ROCK COMMERCE CENTER
PUBLIC IMPROVEMENTS PLAN
CONSTRUCTION DOCUMENTS
SIGNAGE AND STRIPING PLAN

SHEET

C8.0



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Land Planning

Civil Engineering

Landscape Architecture

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PROJECT NO.	DATE	NO.	NOTES
23009	07/28/2023	1	1ST SUBMITTAL
	10/20/2023	2	2ND SUBMITTAL

THE ROCK COMMERCE CENTER

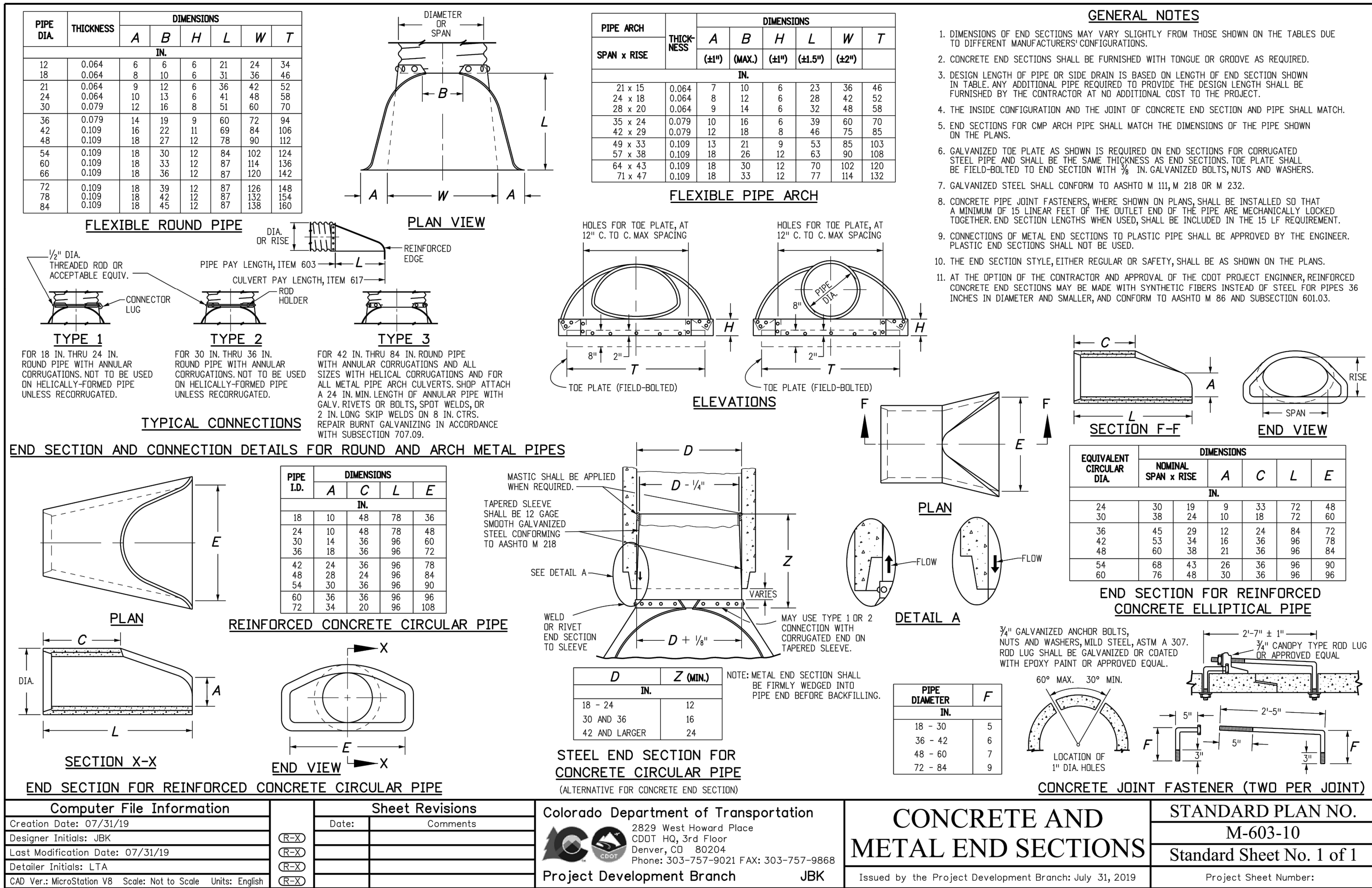
PUBLIC IMPROVEMENTS PLAN

CONSTRUCTION DOCUMENTS

SITE DETAILS

SHEET

C9.1



I:\2023\23009 - The Rock Commerce Center\CA00\Sheet Sets\CA00_PIP\23009_Details.dwg Job: Details--2 Oct 20, 2023 -- 2:34pm ccsz

Inlet Protection (IP)

SC-6

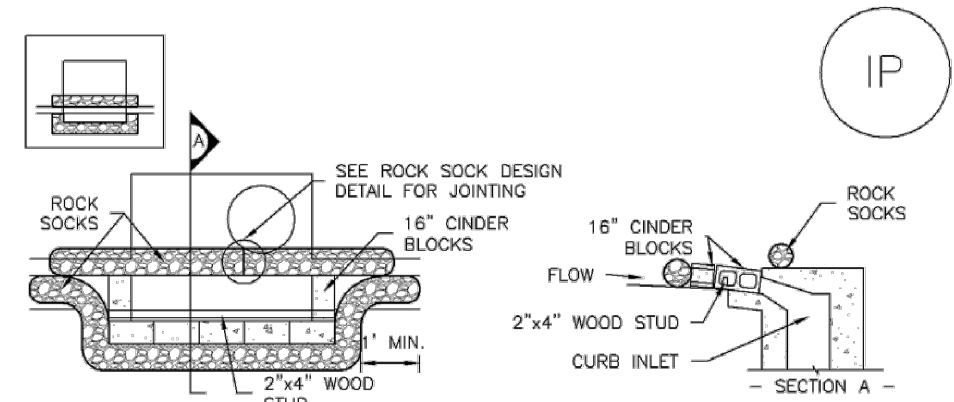
- Remove sediment accumulation from the area upstream of the inlet protection, as needed to maintain BMP effectiveness, typically when it reaches to more than half the storage capacity of the inlet protection. For silt fence, remove sediment when it accumulates to a depth of no more than 6 inches. Remove sediment accumulation from the area upstream of the inlet protection as needed to maintain the functionality of the BMP.

- Propriety inlet protection devices should be inspected and maintained in accordance with manufacturer specifications. If proprietary inlet insert devices are used, sediment should be removed in a timely manner to prevent devices from breaking and spilling sediment into the storm drain.

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

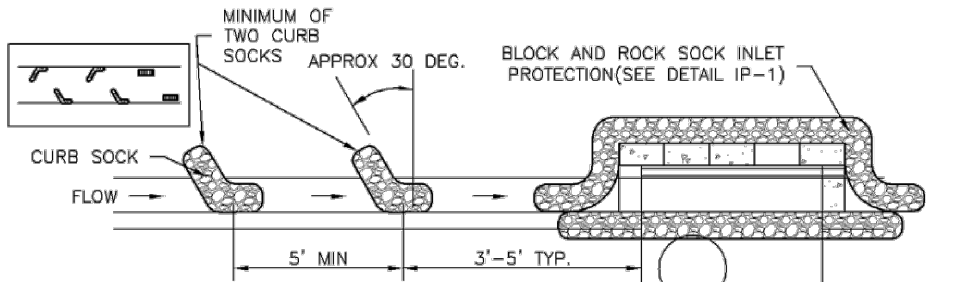
SC-6

Inlet Protection (IP)



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

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



IP-2. CURB ROCK SOCKS UPSTREAM OF INLET PROTECTION

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

Inlet Protection (IP)

SC-6

Description

Inlet protection consists of permeable barriers installed around an inlet to filter runoff and remove sediment prior to entering a storm drain inlet. Inlet protection can be constructed from rock socks, sediment control logs, silt fence, block and rock socks, or other materials approved by the local jurisdiction. Area inlets can also be protected by over-excavating around the inlet to form a sediment trap.

Appropriate Uses

Install protection at storm sewer inlets that are operable during construction. Consider the potential for tracked-out sediment or temporary stockpile areas to contribute sediment to inlets when determining which inlets must be protected. This may include inlets in the general proximity of the construction area, not limited to downgradient inlets. Inlet protection is not a stand-alone BMP and should be used in conjunction with other upgradient BMPs.

Design and Installation

To function effectively, inlet protection measures must be installed to ensure that flows do not bypass the inlet protection and enter the storm drain without treatment. However, designs must also enable the inlet to function without completely blocking flows into the inlet in a manner that causes localized flooding. When selecting the type of inlet protection, consider factors such as type of inlet (e.g., curb or area, sump or on-grade conditions), traffic, anticipated flows, ability to secure the BMP properly, safety and other site-specific conditions. For example, block and rock socks will be better suited to a curb and gutter along a roadway, as opposed to silt fence or sediment control logs, which cannot be properly secured in a curb and gutter setting, but are effective area inlet protection measures.

Several inlet protection designs are provided in the Design Details. Additionally, a variety of proprietary products are available for inlet protection that may be approved for use by local governments. If proprietary products are used, design details and installation procedures from the manufacturer must be followed. Regardless of the type of inlet protection selected, inlet protection is most effective when combined with other BMPs such as curb socks and check dams. Inlet protection is often the last barrier before runoff enters the storm sewer or receiving water.

Design details with notes are provided for these forms of inlet protection:

IP-1. Block and Rock Sock Inlet Protection for Sump or On-grade Inlets

IP-2. Curb (Rock) Socks Upstream of Inlet Protection, On-grade Inlets

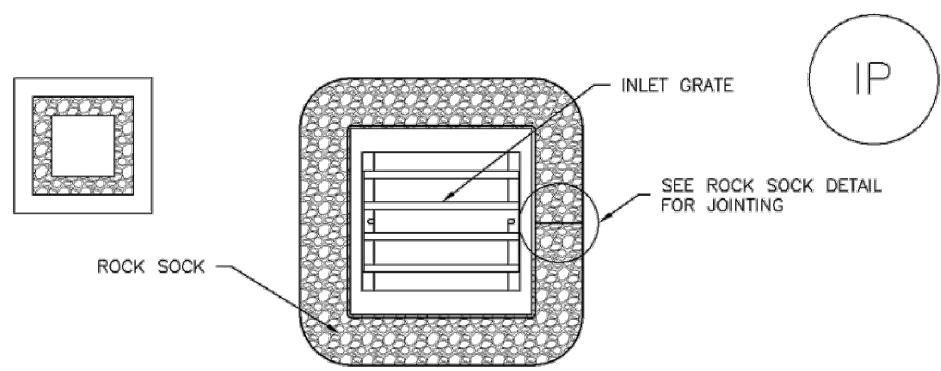
Inlet Protection (various forms)	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No



Photograph IP-1. Inlet protection for a curb opening inlet.

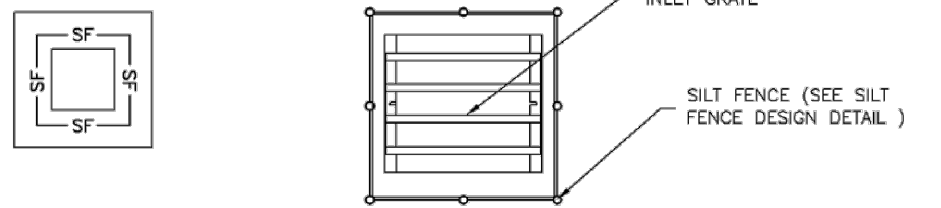
Inlet Protection (IP)

SC-6



IP-3. ROCK SOCK SUMP/AREA INLET PROTECTION

- ROCK SOCK SUMP/AREA INLET PROTECTION INSTALLATION NOTES**
- SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
 - STRAW WATLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF ROCK SOCKS FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



IP-4. SILT FENCE FOR SUMP INLET PROTECTION

- SILT FENCE INLET PROTECTION INSTALLATION NOTES**
- SEE SILT FENCE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
 - POSTS SHALL BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.
 - STRAW WATLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF SILT FENCE FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.

SC-6

Inlet Protection (IP)

IP-3. Rock Sock Inlet Protection for Sump/Area Inlet

IP-4. Silt Fence Inlet Protection for Sump/Area Inlet

IP-5. Over-excavation Inlet Protection

IP-6. Straw Bale Inlet Protection for Sump/Area Inlet

CIP-1. Culvert Inlet Protection

Propriety inlet protection devices should be installed in accordance with manufacturer specifications.

More information is provided below on selecting inlet protection for sump and on-grade locations.

Inlets Located in a Sump

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

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

Inlets Located on a Slope

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

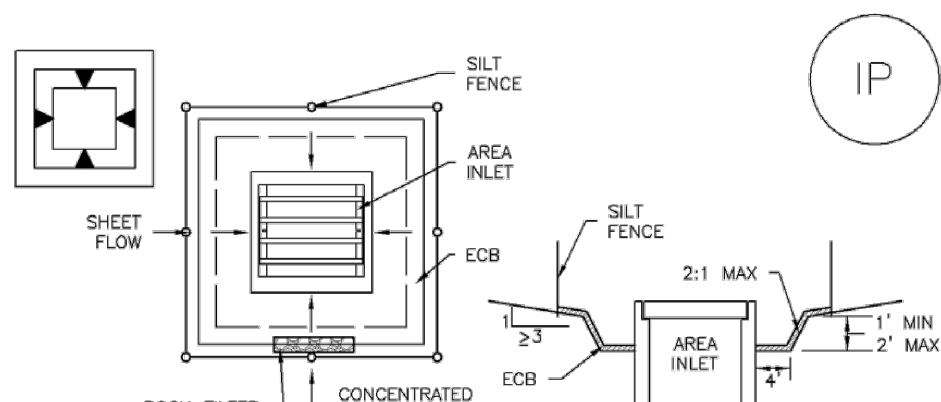
Maintenance and Removal

Inspect inlet protection frequently. Inspection and maintenance guidance includes:

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

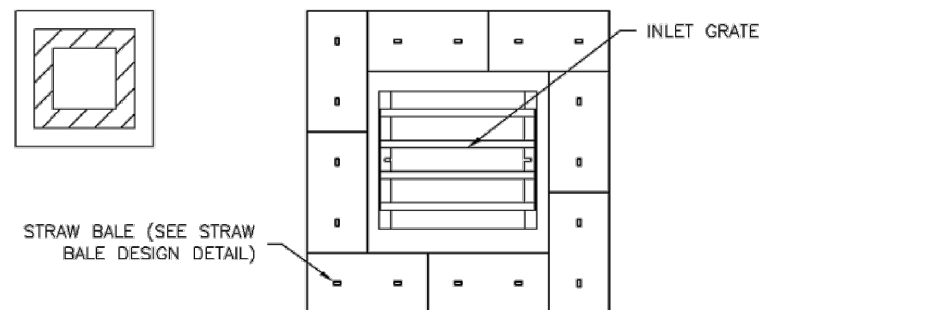
SC-6

Inlet Protection (IP)



IP-5. OVEREXCAVATION INLET PROTECTION

- OVEREXCAVATION INLET PROTECTION INSTALLATION NOTES**
- THIS FORM OF INLET PROTECTION IS PRIMARILY APPLICABLE FOR SITES THAT HAVE NOT YET REACHED FINAL GRADE AND SHOULD BE USED ONLY FOR INLETS WITH A RELATIVELY SMALL CONTRIBUTING DRAINAGE AREA.
 - WHEN USING FOR CONCENTRATED FLOWS, SHAPE BASIN IN 2:1 RATIO WITH LENGTH ORIENTED TOWARDS DIRECTION OF FLOW.
 - SEDIMENT MUST BE PERIODICALLY REMOVED FROM THE OVEREXCAVATED AREA.



IP-6. STRAW BALE FOR SUMP INLET PROTECTION

- STRAW BALE BARRIER INLET PROTECTION INSTALLATION NOTES**
- SEE STRAW BALE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.
 - BALES SHALL BE PLACED IN A SINGLE ROW AROUND THE INLET WITH ENDS OF BALES TIGHTLY ABUTTING ONE ANOTHER.

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PROJECT NO. 23009		NOTES	
DATE	NO.	DATE	NO.
07/28/2023	1		
10/20/2023	2		

THE ROCK COMMERCE CENTER
PUBLIC IMPROVEMENTS PLAN
CONSTRUCTION DODUMENTS
EROSION CONTROL DETAILS

SHEET

C9.2

LOCATED IN THE SOUTHWEST QUARTER OF THE
NORTHWEST QUARTER OF SECTION 11, TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
EL PASO COUNTY, STATE OF COLORADO.

OWNER / DEVELOPER

CENTRAL DEVELOPMENT, LLC
1600 S. ALBON ST., #200
DENVER, CO 80222
303.628.0200 voice
CONTACT: JEREMY RECORDS

CIVIL ENGINEER

REDLAND
1500 W. CANAL CT.
LITTLETON, CO 80120
720.283.6783 voice
CONTACT: MARK CEVAAL, P.E.
EMAIL: mcevaal@redland.com

ARCHITECT

INTERGROUP ARCHITECTS
2000 W. LITTLETON BLVD.
LITTLETON, CO 80120
303.407.1157 voice
CONTACT: BILL SMITH, AIA

LANDSCAPE ARCHITECT

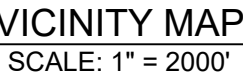
STACKLOT
5369 S. CURTICE ST.
LITTLETON, CO 80120
303.808.4523 voice
CONTACT: STEVE WIENS
EMAIL: steve@stacklot.com

LEGAL DESCRIPTION:

PARCEL B:

THAT PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11, TOWNSHIP 11 NORTH, RANGE 67 WEST OF THE 6TH P.M. LYING EAST OF THE EAST LINE OF THAT TRACT CONVEYED TO THE STATE HIGHWAY DEPARTMENT BY QUICCLAIM DEED RECORDED SEPTEMBER 8, 1948 IN BOOK 1185, PAGE 268, AND DESCRIBED AS THAT PART OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11, TOWNSHIP 11 NORTH, RANGE 67 WEST OF THE P.M., COUNTY OF EL PASO, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHWEST CORNER OF SAID NORTHWEST QUARTER; THENCE EASTERLY ALONG THE SOUTHERLY LINE OF SAID NORTHWEST QUARTER A DISTANCE OF 996.04 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY OF INTERSTATE HIGHWAY 25 DESCRIBED IN THAT DEED TO THE STATE HIGHWAY DEPARTMENT RECORDED SEPTEMBER 8, 1948 IN BOOK 1185, PAGE 268, AND BEING THE POINT OF BEGINNING OF THE CINDER PAVEMENT; THENCE ALONG THE EASTERLY RIGHT-OF-WAY OF SAID INTERSTATE HIGHWAY THE PARCEL TO BE DESCRIBED; THENCE ON A DEFLECTION ANGLE TO THE LEFT 95°08'20" AND ALONG SAID EASTERLY RIGHT OF WAY LINE A DISTANCE OF 1334.24 FEET TO A POINT ON THE NORTHERLY LINE OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER; THENCE ON A DEFLECTION ANGLE TO THE RIGHT 95°00'36" AND ALONG SAID NORTHERLY LINE 441.95 FEET TO THE NORTHEAST CORNER OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER; THENCE ON A DEFLECTION ANGLE TO THE RIGHT 90°16'15" AND ALONG THE EASTERLY LINE OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER A DISTANCE OF 107.88 FEET TO THE NORTHEAST CORNER OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER; THENCE ON A DEFLECTION ANGLE TO THE RIGHT 89°51'29" AND ALONG THE SOUTHERLY LINE OF SAID SOUTHWEST QUARTER OF THE NORTHWEST QUARTER A DISTANCE OF 319.15 FEET TO THE POINT OF BEGINNING.



BENCHMARK

NGS CONTROL POINT T 395 BEING A STANDARD NGS STEEL ROD IN A LOGO MONUMENT BOX LOCATED 20 MILES NORTH OF COLORADO SPRINGS ON THE EAST SIDE OF I-25, 1,200 FEET NORTH OF THE WEIGH STATION BUILDING, AND 20.5 FEET EAST OF THE EASTERLY EDGE OF OIL OF THE NORTHBOUND LANES OF I-25.

NAVD88. ELEV = 7111.32'

BASIS OF BEARINGS

BEARINGS SHOWN HEREON ARE REFERENCED TO THE SOUTHERLY
BOUNDARY OF LOT 1, GREATER EUROPE MISSION SUBDIVISION
FILING NO. 1, BEING MONUMENTED AS SHOWN HEREON,
ASSUMED TO BEAR SOUTH 80°00'37" WEST, A DISTANCE OF
358.79 FEET.

Sheet Number	Sheet Title
1 OF 20	COVER SHEET
2 OF 20	OVERALL SITE PLAN
3 OF 20	SITE PLAN
4 OF 20	SITE PLAN
5 OF 20	GRADING PLAN
6 OF 20	GRADING PLAN
7 OF 20	UTILITY PLAN
8 OF 20	UTILITY PLAN
9 OF 20	LANDSCAPE PLAN 'A'
10 OF 20	LANDSCAPE PLAN 'B'
11 OF 20	LANDSCAPE PLAN 'C'
12 OF 20	LANDSCAPE NOTES
13 OF 20	LANDSCAPE DETAILS
14 OF 20	EXTERIOR ELEVATIONS
15 OF 20	EXTERIOR ELEVATIONS
16 OF 20	EXTERIOR ELEVATIONS
17 OF 20	EXTERIOR PERSPECTIVES
18 OF 20	SITE DETAILS
19 OF 20	PHOTOMETRIC SITE PLAN
20 OF 20	PHOTOMETRIC DETAILS

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THE ROCK COMMERCE CENTER
SITE DEVELOPMENT PLAN
COVER SHEET

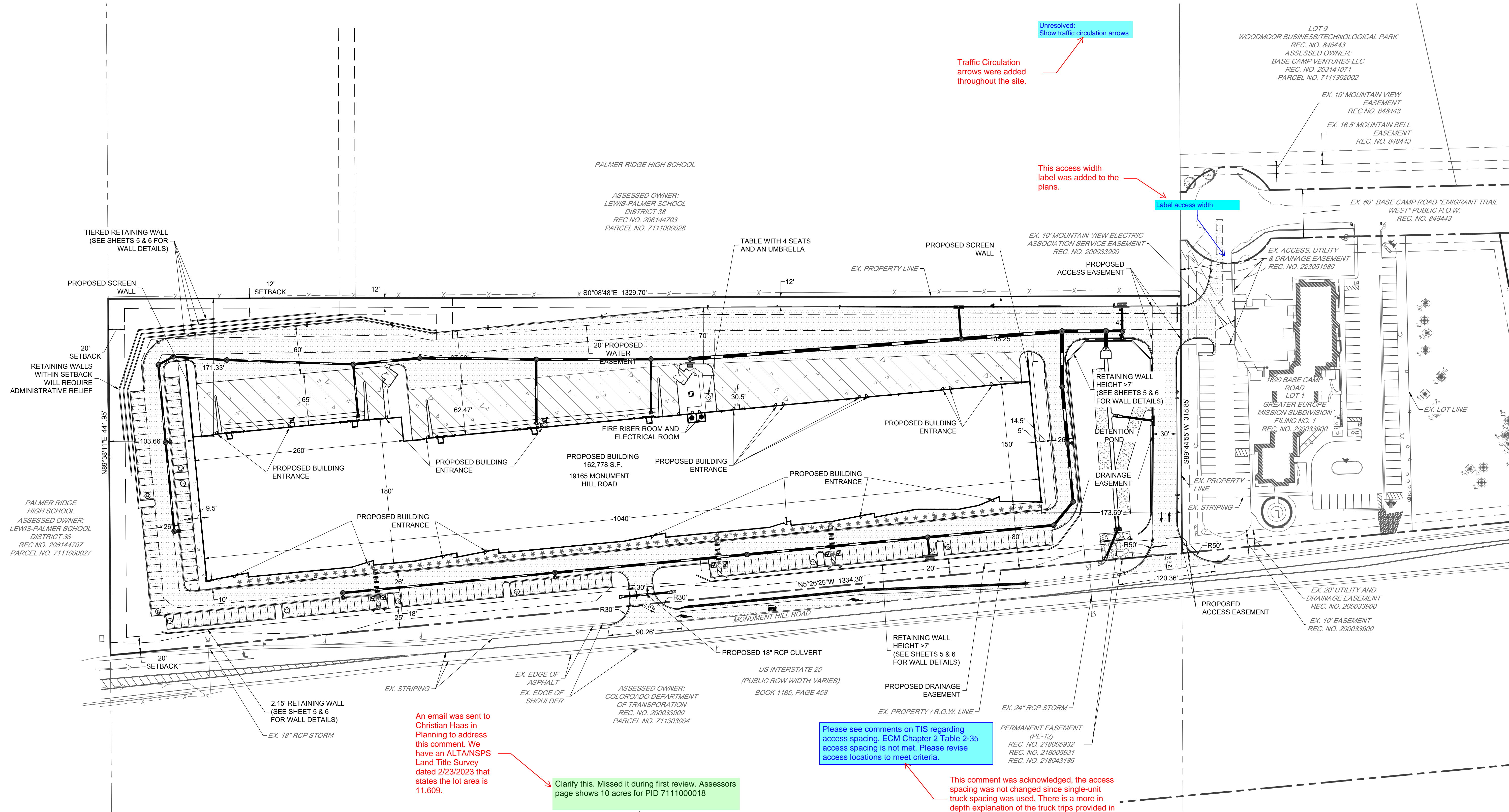
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THE ROCK COMMERCE CENTER
SITE DEVELOPMENT PLAN
OVERALL SITE PLAN









2 OF 20













NOTE:

1. ANY WORK WITHIN EL PASO COUNTY RIGHT-OF-WAY REQUIRES A WORK IN RIGHT-OF-WAY PERMIT FROM EL PASO COUNTY DEPARTMENT OF PUBLIC WORKS.
2. A BUILDING PERMIT FORM PIKES PEAK REGIONAL BUILDING DEPARTMENT IS REQUIRED FOR RETAINING WALLS GREAT THAN 4 FEET IN HEIGHT.

PROPOSED LEGEND

	EASEMENT
	CURB AND GUTTER
	SIDEWALK
	CONCRETE PAVEMENT
	ASPHALT PAVEMENT
	LIMITS OF CONSTRUCTION / SAWCUT
	PEDESTRIAN ACCESSIBLE ROUTE
	RETAINING WALL

EXISTING LEGEND

	PROPERTY LINE
	R.O.W.
	LOT LINE
	EASEMENT LINE
	SECTION LINE
	EDGE OF PAVEMENT
	CURB AND GUTTER
	CONCRETE
	FENCE
	SETBACK

SITE DATA TABLE		
LOT 1, THE ROCK COMMERCE CENTER SUBDIVISION FILING NO.1	REQUIRED	PROPOSED
ZONING	CS	CS
PARCEL AREA	11.61 AC. (505,680 S.F.)	11.61 AC. (505,680 S.F.)
BUILDING AREA	-	163,800 S.F.
BUILDING HEIGHT	40' MAX.	36'
STANDARD SPACES	*RETAIL = 27 SPACES *WAREHOUSE = 147 SPACES TOTAL = 175 SPACES TOTAL W/ 12.5% REDUCTION= 153 SPACES	PROPOSED PARKING = 153 SPACES
ACCESSIBLE SPACES	6 ACCESSIBLE SPACES	6 ACCESSIBLE SPACES
VAN ACCESSIBLE	1 VAN ACCESSIBLE SPACE	1 VAN ACCESSIBLE SPACES
LANDSCAPE AREA	-	2.4 AC. (105
HARDSCAPE AREA	-	9.2 AC. (400

- * RETAIL = 10% OF BLDG S.F. @ 1/600 S.F.
- * WAREHOUSE = 90% OF BLDG S.F. @ 1/1000 S.F. ←
- * 12.5% REDUCTION IN PARKING REQUIREMENT IS WITHIN THE 20% ALLOWED UNDER THE ADMINISTRATIVE RELIEF SECTION IN THE CODE .

SITE DATA TABLE
LOT 1, GREATER EUROPE MISSION FILING NO. 1
CS
3.59 AC. (156,422 S.F.)
+11,784 S.F.
45' MAX.
REQUIRED = 59 SPACES
EXISTING = 96 SPACES
PROPOSED = 88 SPACES
3 ACCESSIBLE SPACES
1 VAN ACCESSIBLE

Consider requesting Alternative Parking Ratio (Section 6.2.5.D.vi). If you can meet those standards, a modified parking ratio of 1 per 1,200 sqft for Warehouse & Distribution would result in a total required parking of 150 spaces. Easier than processing and paying for a separate Admin Relief Application.

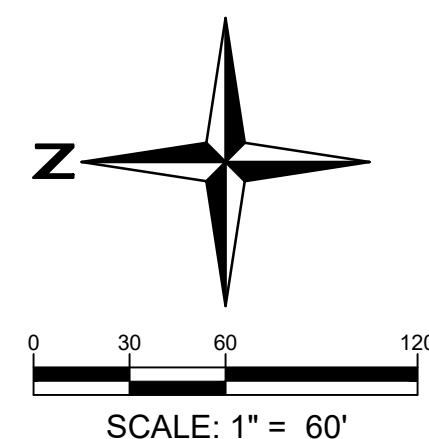
Just add note to this section.

$$147,420 / 1,200 = 122.85$$

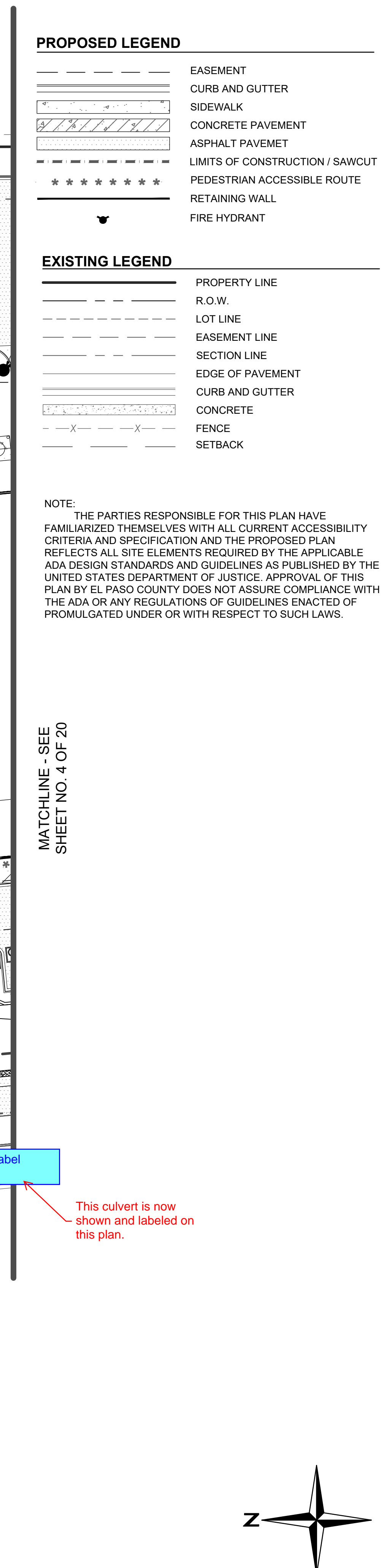
Total Required with Alternative Parking Ratio = 150 Spaces

NOTE: THE PARTIES RESPONSIBLE FOR THIS PLAN HAVE FAMILIARIZED THEMSELVES WITH ALL CURRENT ACCESSIBILITY CRITERIA AND SPECIFICATION AND THE PROPOSED PLAN REFLECTS ALL SITE ELEMENTS REQUIRED BY THE APPLICABLE ADA DESIGN STANDARDS AND GUIDELINES AS PUBLISHED BY THE UNITED STATES DEPARTMENT OF JUSTICE. APPROVAL OF THIS PLAN BY EL PASO COUNTY DOES NOT ASSURE COMPLIANCE WITH THE ADA OR ANY REGULATIONS OF GUIDELINES ENACTED OF PROMULGATED UNDER OR WITH RESPECT TO SUCH LAWS.

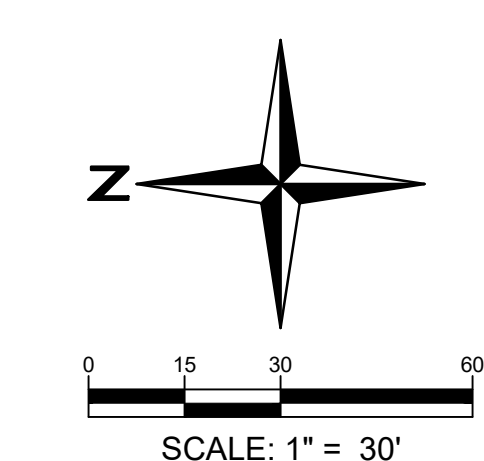
We will request an Alternative Parking Ratio to change the warehouse parking requirements to 1 per 1,200 S.F.



PCD FILE NO. PPR2329

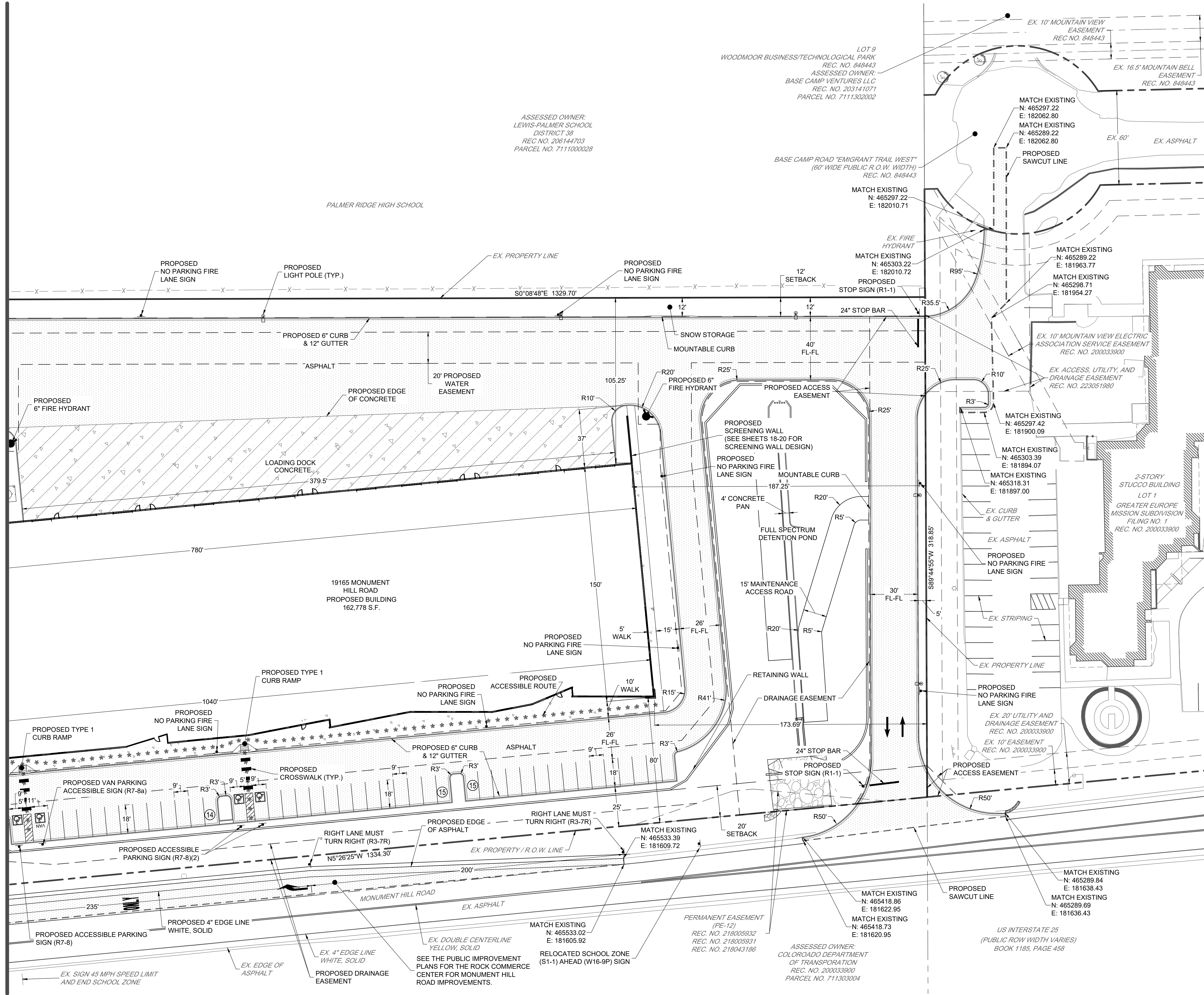


This culvert is now shown and labeled on this plan.



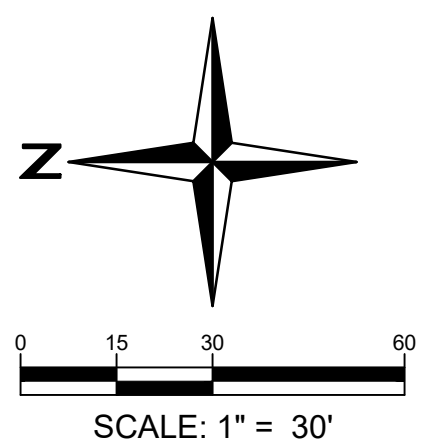
I:\2023\23009 - The Rock Commerce Center\cadd\Sheet Sets\Site Plan\The Rock\23009_Site Plan.dwg tab: 4 OF 24 SITE PLAN Oct 20, 2023 -- 3:30pm csolz

MATCHLINE - SEE
SHEET NO. 3 OF 20



- PROPOSED LEGEND**
- EASEMENT
 - CURB AND GUTTER
 - SIDEWALK
 - CONCRETE PAVEMENT
 - ASPHALT PAVEMENT
 - LIMITS OF CONSTRUCTION / SAWCUT
 - PEDESTRIAN ACCESSIBLE ROUTE
 - RETAINING WALL
 - FIRE HYDRANT
- EXISTING LEGEND**
- PROPERTY LINE
 - R.O.W.
 - LOT LINE
 - EASEMENT LINE
 - SECTION LINE
 - EDGE OF PAVEMENT
 - CURB AND GUTTER
 - CONCRETE
 - FENCE
 - SETBACK

NOTE:
THE PARTIES RESPONSIBLE FOR THIS PLAN HAVE FAMILIARIZED THEMSELVES WITH ALL CURRENT ACCESSIBILITY CRITERIA AND SPECIFICATION AND THE PROPOSED PLAN REFLECTS ALL SITE ELEMENTS REQUIRED BY THE APPLICABLE ADA DESIGN STANDARDS AND GUIDELINES AS PUBLISHED BY THE UNITED STATES DEPARTMENT OF JUSTICE. APPROVAL OF THIS PLAN BY EL PASO COUNTY DOES NOT ASSURE COMPLIANCE WITH THE ADA OR ANY REGULATIONS OF GUIDELINES ENACTED OF PROMULGATED UNDER OR WITH RESPECT TO SUCH LAWS.



PCD FILE NO. PPR2329

THE ROCK COMMERCE CENTER
SITE DEVELOPMENT PLAN
SITE PLAN

SHEET

4 OF 20

PROJECT NO.	23009	DATE	NO.	NOTES
DATE	09/09/2023	1	1ST SUBMITTAL	
	10/20/2023	2	2ND SUBMITTAL	

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I:\2023\23009 - The Rock Commerce Center\Grading Plan.dwg Oct 20, 2023 - 3:30pm csalz

ASSESSED OWNER:
LEWIS-PALMER SCHOOL DISTRICT 38
REC NO. 206144707
PARCEL NO. 7111000027

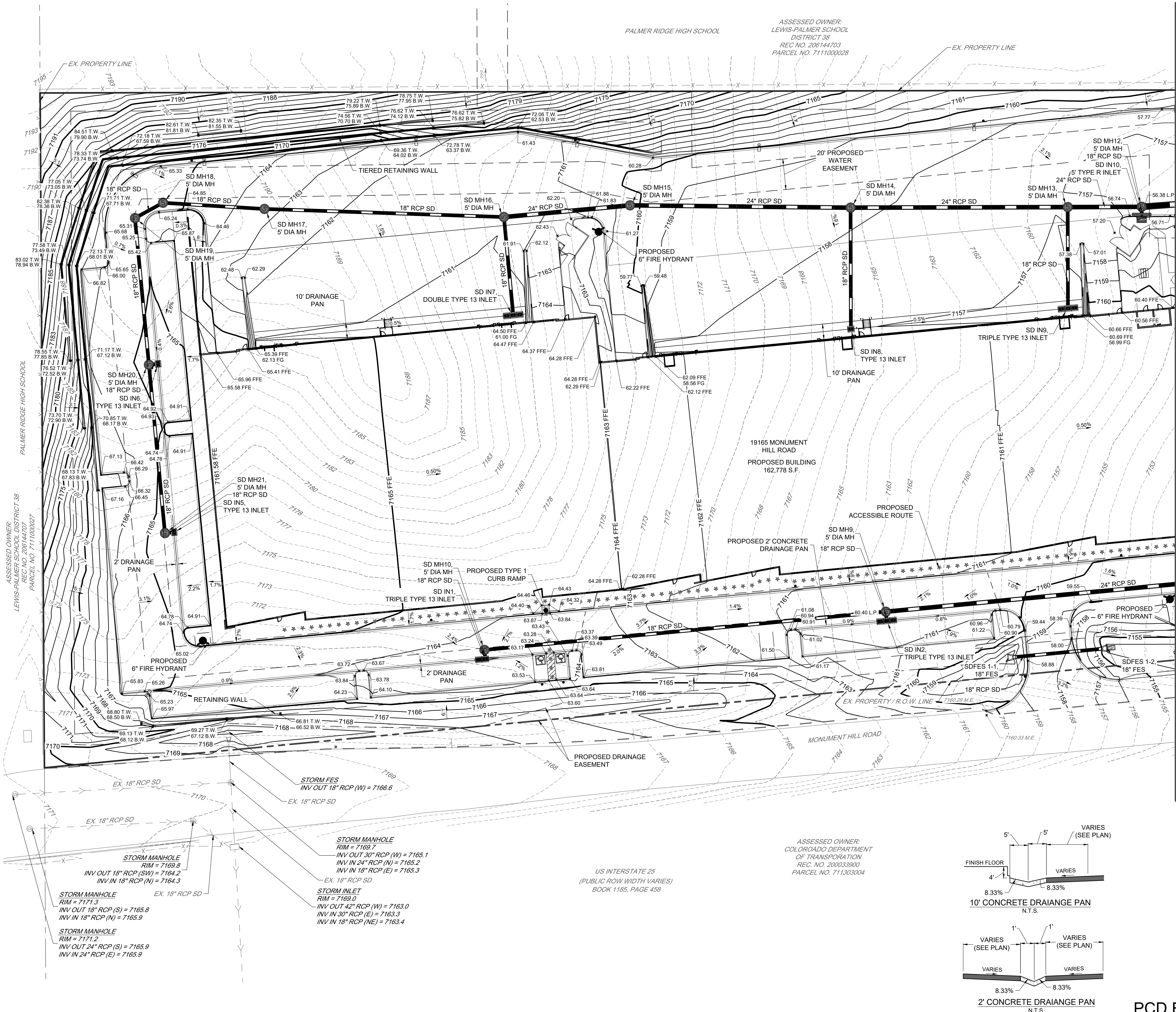
ASSESSED OWNER:
LEWIS-PALMER SCHOOL DISTRICT 38
REC NO. 206144707
PARCEL NO. 7111000027

ASSESSED OWNER:
LEWIS-PALMER SCHOOL DISTRICT 38
REC NO. 206144707
PARCEL NO. 7111000027

PALMER RIDGE HIGH SCHOOL

ASSESSED OWNER:
LEWIS-PALMER SCHOOL
DISTRICT 38
REC NO. 206144703
PARCEL NO. 7111000028

EX. PROPERTY LINE



PROPOSED LEGEND

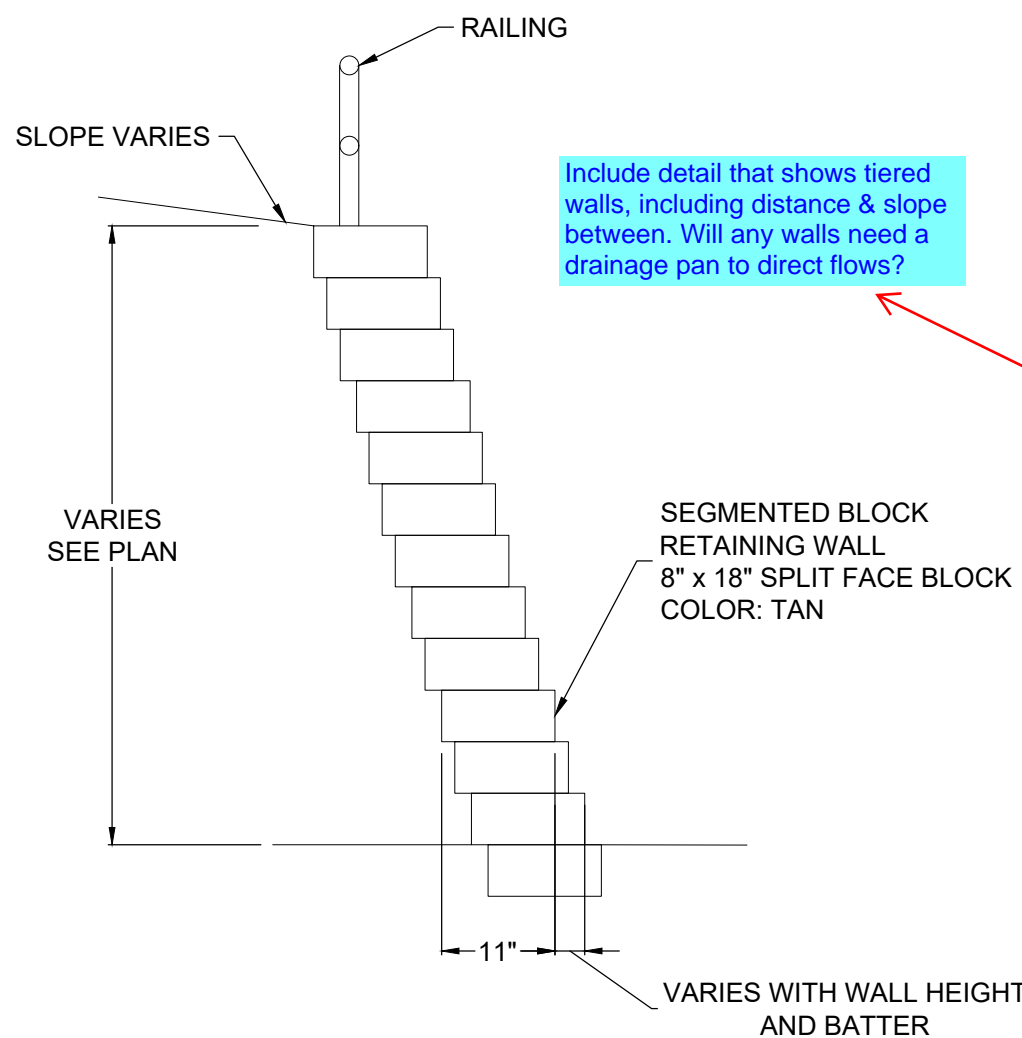
	EASEMENT
	CURB AND GUTTER
	FIRE HYDRANT
	LIMITS OF CONSTRUCTION / SAWCUT
	PEDESTRIAN ACCESSIBLE ROUTE
	STORM SEWER
	TRENCH DRAIN
	MANHOLE w/ DIA. (FT.)
	INLET
	FLARED END SECTION
	RETAINING WALL
	CONTOUR MAJOR
	CONTOUR MINOR
	SPOT ELEVATION
	SLOPE ARROW (4:1 MAX UNLESS NOTED OTHERWISE)

EXISTING LEGEND

	PROPERTY LINE
	R.O.W.
	LOT LINE
	EASEMENT LINE
	SETBACK
	SECTION LINE
	EDGE OF PAVEMENT
	CURB AND GUTTER
	CONCRETE
	FENCE
	RETAINING WALL
	STORM SEWER
	GAS LINE
	CONTOUR MAJOR
	CONTOUR MINOR

NOTE:

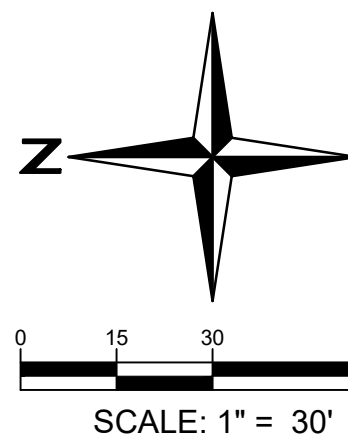
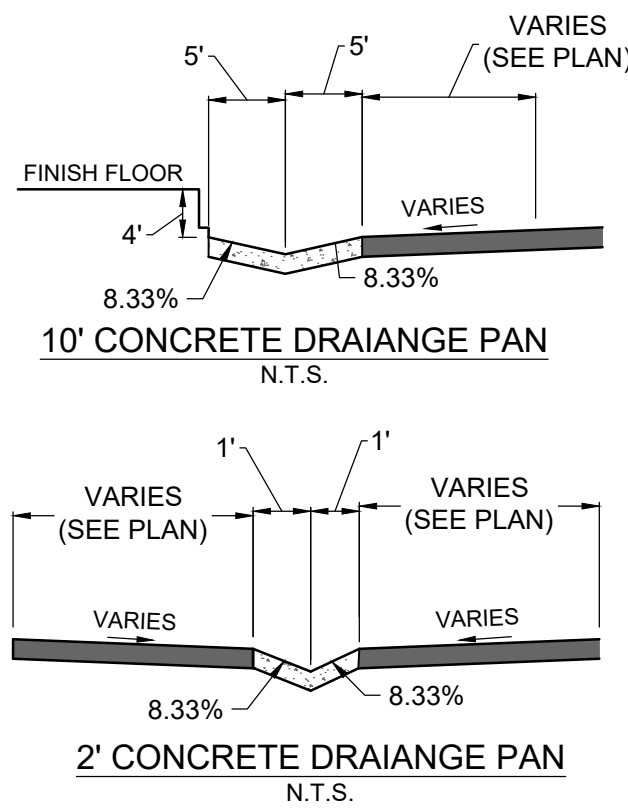
- THE PARTIES RESPONSIBLE FOR THIS PLAN HAVE FAMILIARIZED THEMSELVES WITH ALL CURRENT ACCESSIBILITY CRITERIA AND SPECIFICATION AND THE PROPOSED PLAN REFLECTS ALL SITE ELEMENTS REQUIRED BY THE APPLICABLE ADA DESIGN STANDARDS AND GUIDELINES AS PUBLISHED BY THE UNITED STATES DEPARTMENT OF JUSTICE. APPROVAL OF THIS PLAN BY EL PASO COUNTY DOES NOT ASSURE COMPLIANCE WITH THE ADA OR ANY REGULATIONS OF GUIDELINES ENACTED OF PROMULGATED UNDER OR WITH RESPECT TO SUCH LAWS.
- REGIONAL BUILDING DEPARTMENT PERMIT REQUIRED FOR ALL RETAINING WALLS GREATER THAN OR EQUAL TO 4 FT IN HEIGHT.
- SEE SHEETS 18-21 FOR SCREENING WALL DETAILS BY ARCH.
- NO BATCH PLANTS WILL BE UTILIZED ONSITE.



TYPICAL MODULAR BLOCK WALL DETAIL

NOT TO SCALE

NOTE: RETAINING WALL WILL REQUIRE A SEPARATE BUILDING PERMIT



PCD FILE NO. PPR2329

15 Redland
WHERE GREAT PLACES BEGIN
YEARS
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Landscaping Architecture
Land Planning
Civil Engineering
Construction Management

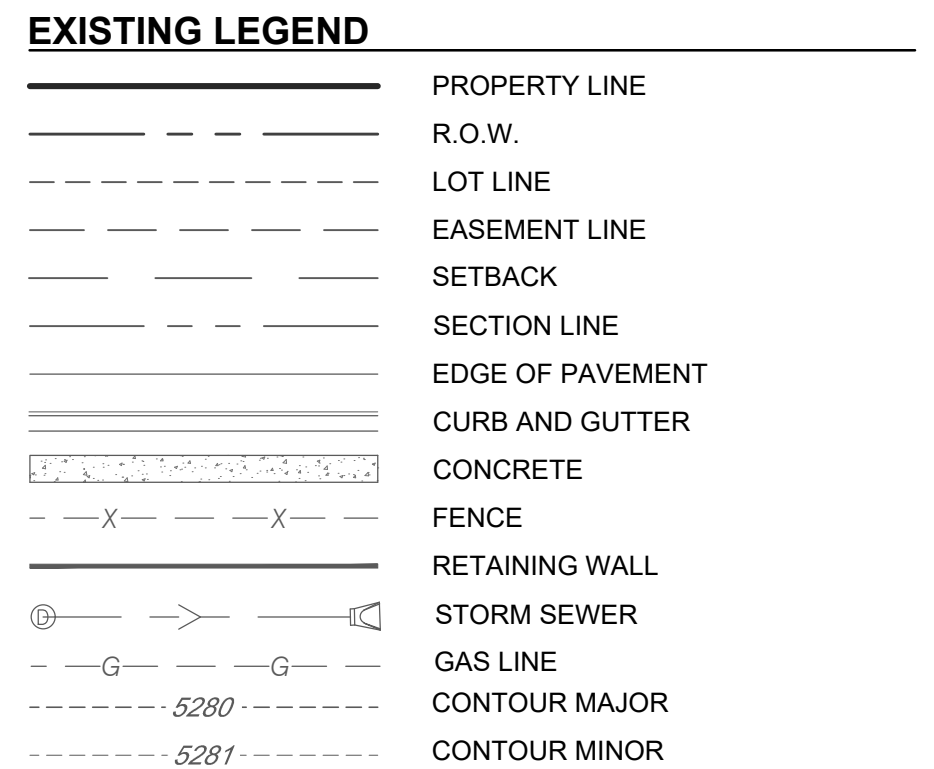
NOT FOR
CONSTRUCTION

PROJECT NO.	23009	DATE	NO.	DATE	NO.	DATE	NO.	DATE	NO.
DATE	09/09/2023	1ST SUBMITTAL	10/20/2023	2ND SUBMITTAL					

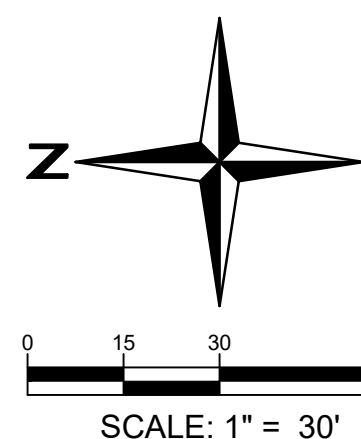
This detail was updated to show the tiered wall and the detail on page 6 remains showing a single tier wall.

THE ROCK COMMERCE CENTER
SITE DEVELOPMENT PLAN
GRADING PLAN

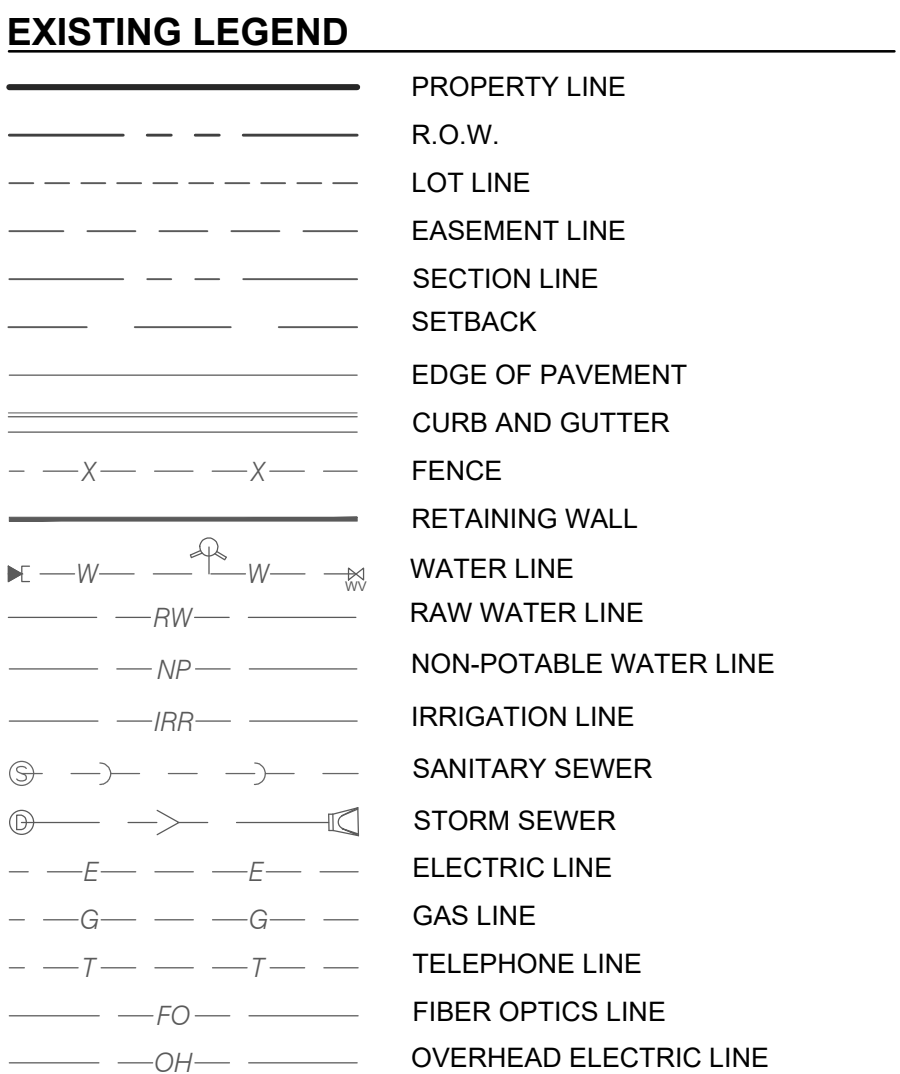
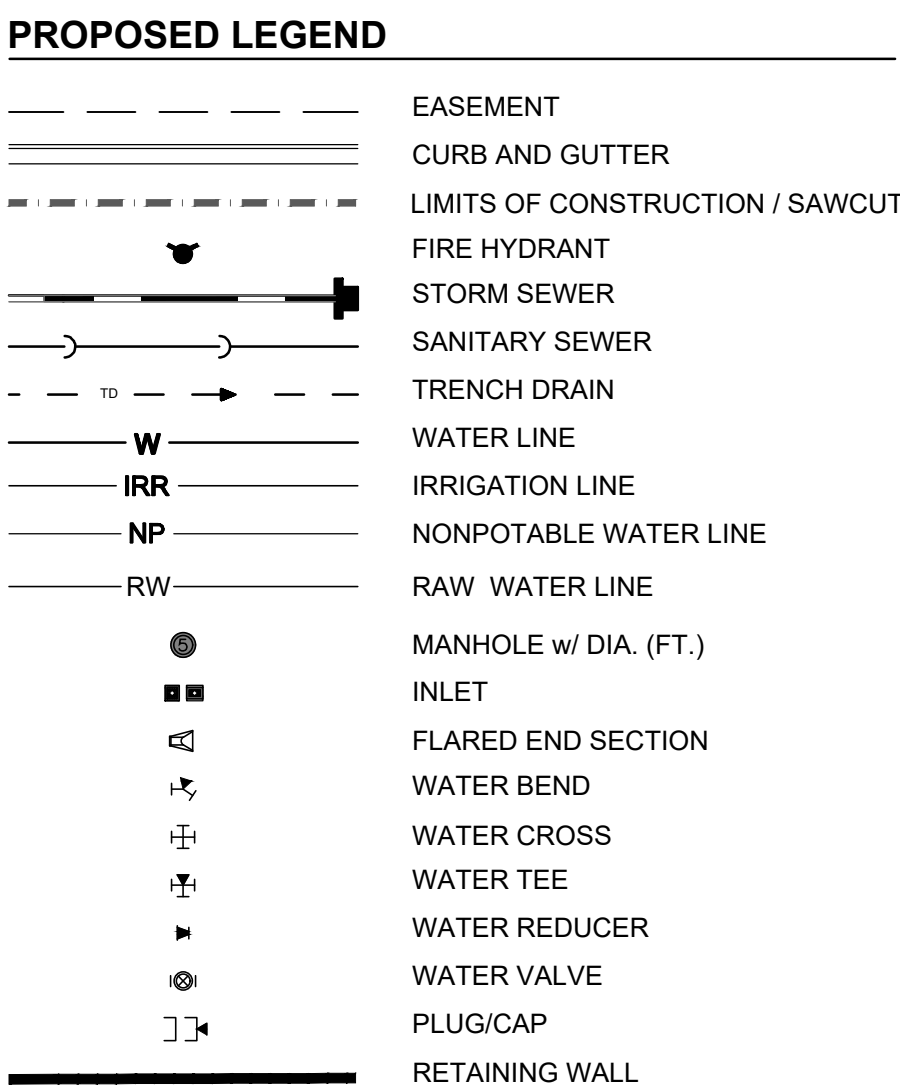
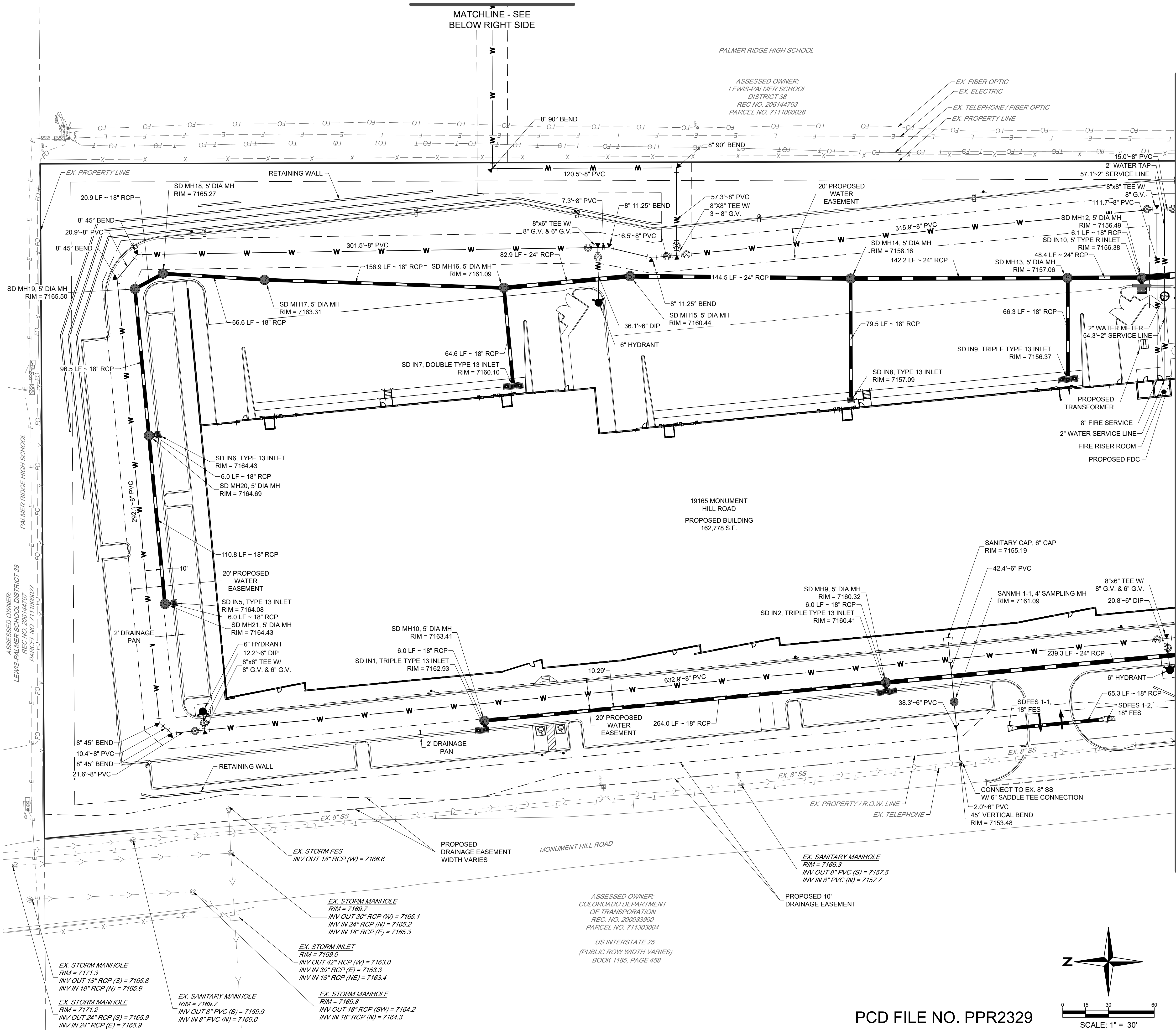
SHEET
5 OF 20



1. THE PARTIES RESPONSIBLE FOR THIS PLAN HAVE FAMILIARIZED THEMSELVES WITH ALL CURRENT ACCESSIBILITY CRITERIA AND SPECIFICATION AND THE PROPOSED PLAN REFLECTS ALL SITE ELEMENTS REQUIRED BY THE APPLICABLE ADA DESIGN STANDARDS AND GUIDELINES AS PUBLISHED BY THE UNITED STATES DEPARTMENT OF JUSTICE. APPROVAL OF THIS PLAN BY EL PASO COUNTY DOES NOT ASSURE COMPLIANCE WITH THE ADA OR ANY REGULATIONS OF GUIDELINES ENACTED OR PROMULGATED UNDER OR WITH RESPECT TO SUCH LAWS.
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3. SEE SHEETS 18-21 FOR SCREENING WALL DETAILS BY ARCH.
4. NO BATCH PLANTS WILL BE UTILIZED ONSITE.



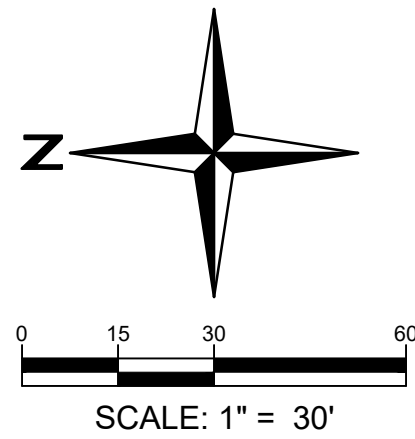
I:\2023\23009 - The Rock Commerce Center\CA00\Sheet Set\Site Plan\The Rock\23009_Utility Plan.dwg Tab: 11 OF 24 UTILITY PLAN Oct 20, 2023 - 3:30pm casz



NOTE: THE PARTIES RESPONSIBLE FOR THIS PLAN HAVE FAMILIARIZED THEMSELVES WITH ALL CURRENT ACCESSIBILITY CRITERIA AND SPECIFICATION AND THE PROPOSED PLAN REFLECTS ALL SITE ELEMENTS REQUIRED BY THE APPLICABLE ADA DESIGN STANDARDS AND GUIDELINES AS PUBLISHED BY THE UNITED STATES DEPARTMENT OF JUSTICE. APPROVAL OF THIS PLAN BY EL PASO COUNTY DOES NOT ASSURE COMPLIANCE WITH THE ADA OR ANY REGULATIONS OF GUIDELINES ENACTED OF PROMULGATED UNDER OR WITH RESPECT TO SUCH LAWS.

MATCHLINE - SEE SHEET NO. 8 OF 20

MATCHLINE - SEE ABOVE EAST SIDE OF SITE



PCD FILE NO. PPR2329

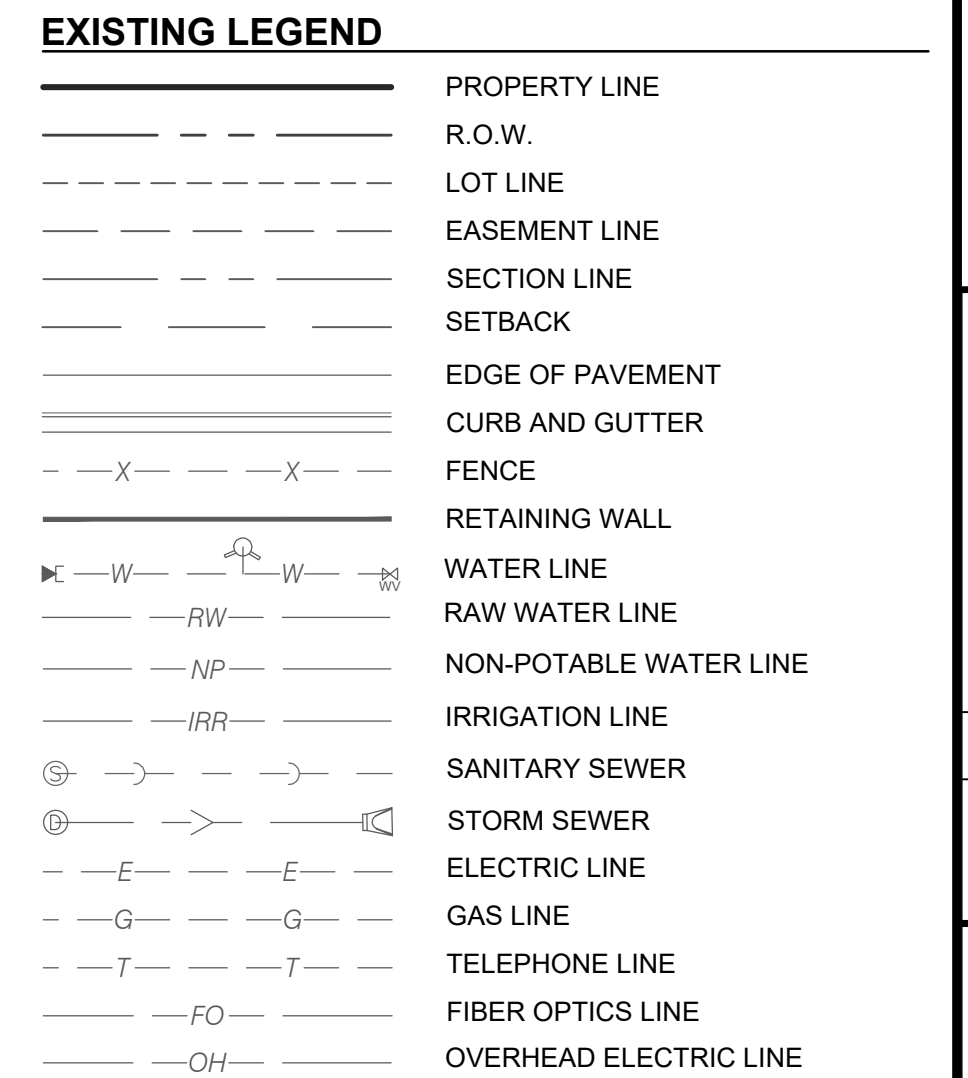
15 Redland
YEARS WHERE GREAT PLACES BEGIN

NOT FOR CONSTRUCTION

PROJECT NO. 23009		NOTES	
DATE	NO.	1ST SUBMITTAL	2ND SUBMITTAL
09/02/2023	1		
10/20/2023	2		

THE ROCK COMMERCE CENTER
SITE DEVELOPMENT PLAN
UTILITY PLAN

SHEET
7 OF 20



NOT FOR
CONSTRUCTION

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THE ROCK COMMERCE CENTER

SITE DEVELOPMENT PLAN

UTILITY PLAN

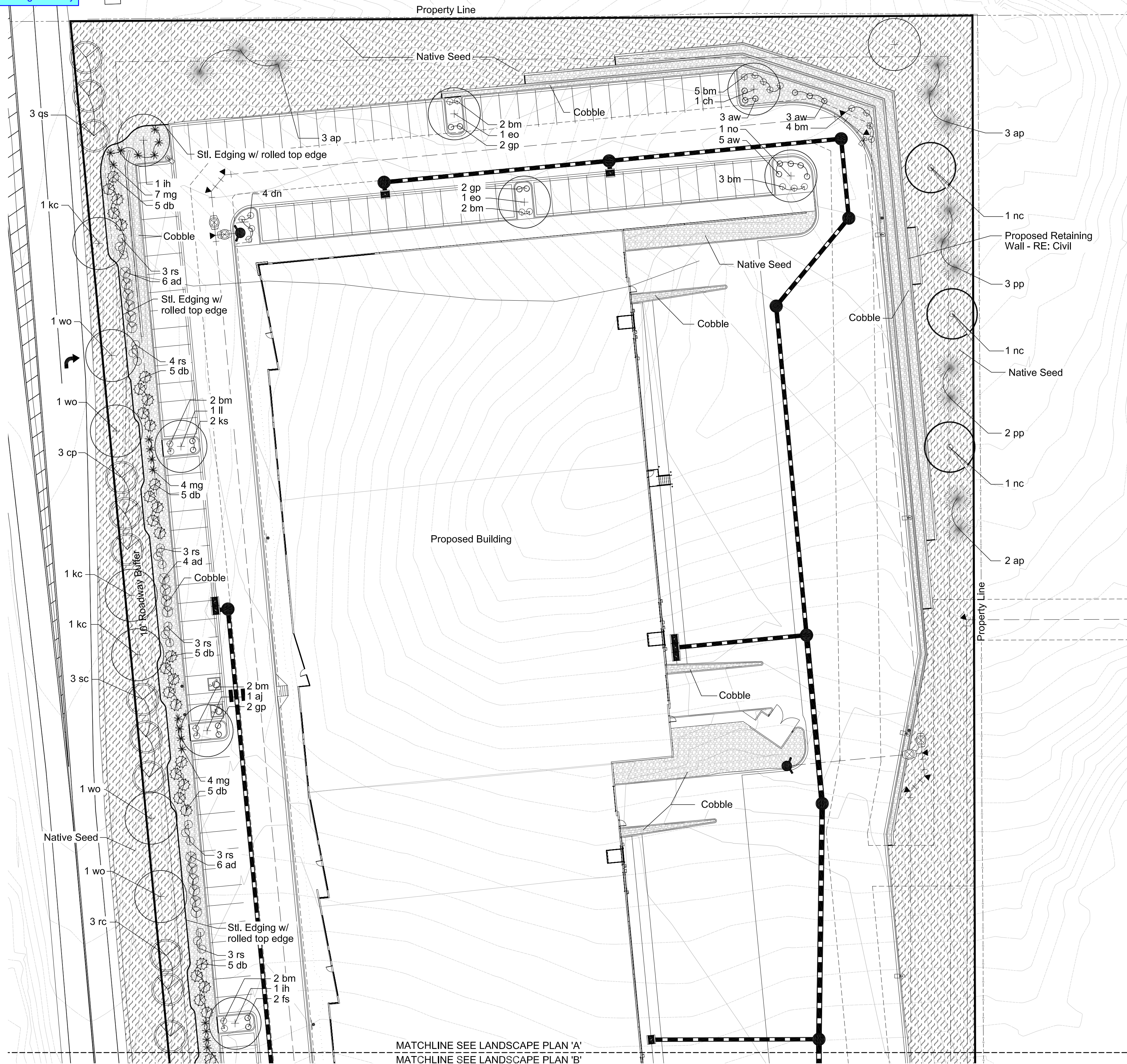
SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO

The right of way label
was added to this plan.

Show and label right-of-way



LANDSCAPE LEGEND:

- DECIDUOUS TREE
- ORNAMENTAL TREE
- EVERGREEN TREE
- SHRUB
- ORNAMENTAL GRASS / PERENNIAL

NATIVE SEED MIX NON-IRRIGATED		% OF TOTAL	PLS PER ACRE
COMMON NAME	SCIENTIFIC NAME		
BLUE GRAMA	BOUTELOUA GRACILIS	25%	1.8 LBS.
SAND DROPSEED	SPOROBOLUS CRYPTANDRUS	20%	0.20 LBS.
SIDEOATS GRAMA	BOUTELOUA CURTIPENDULA	20%	6.3 LBS.
WESTERN WHEATGRASS	PASCOPYRUM SMITHII	15%	8.2 LBS.
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PASTURE SAGE	ARTEMISIA FRIGIDA	1%	0.01 LBS.
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PRAIRIE CONEFLOWER	RATIBIDA COLUMNIFERA	1%	0.1 LBS.
PURPLE PRAIRIECLOVER	DALEA PURPUREA	1%	0.3 LBS.
BLUE FLAX	LINUM LEWISII	1%	0.4 LBS.

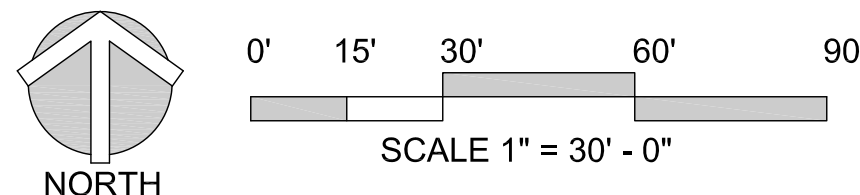
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4"-8" ROUND COBBLE OVER FILTER FABRIC

NON-HATCH PLANTING AREAS
2"-4" ROUND COBBLE OVER FILTER FABRIC

STEEL EDGING w/ ROLLED TOP EDGE
RETAINING WALL - RE: CIVIL

LANDSCAPE PLAN 'A'



STACKlot
5639 SOUTH CURTICE STREET
LITTLETON, COLORADO 80120
phone. 303.808.4523

PCD FILE NO: PPR2329

REVISIONS		DATE	DESCRIPTION
BY	10/23/23	RESUBMITTAL	

DRAWN	sdw
CHECKED	jah
DESIGNED	sdw
FILENAME	

SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER
LANDSCAPE PLAN 'A'

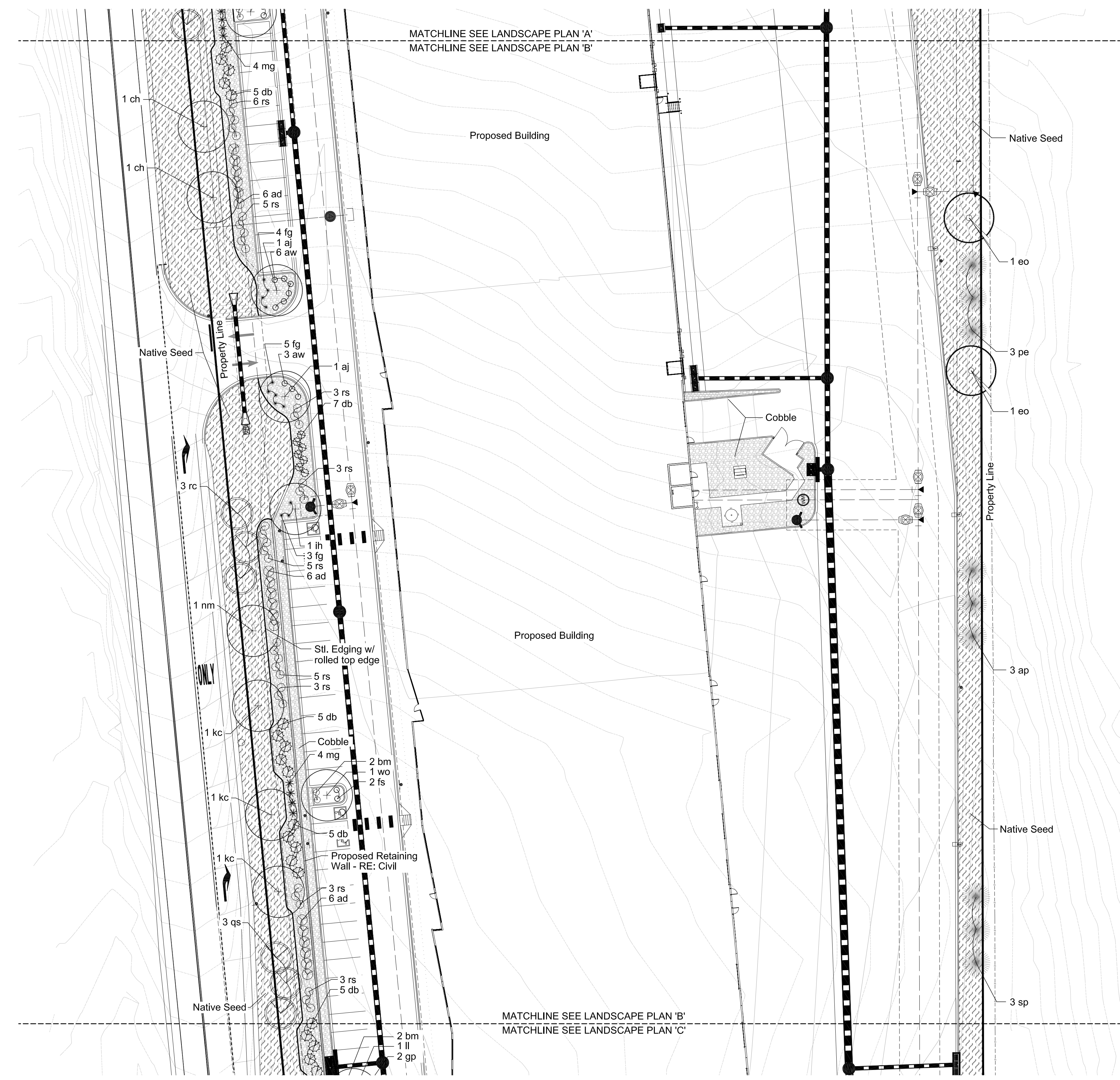


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SCALE	AS SHOWN
DATE	07/28/2023
SHEETS	20
SHEET	9

SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO



LANDSCAPE LEGEND:

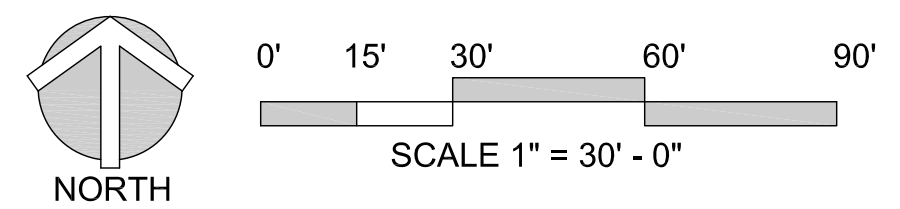
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- 2"-4" ROUND COBBLE OVER FILTER FABRIC
- STEEL EDGING w/ ROLLED TOP EDGE
- RETAINING WALL - RE: CIVIL

LANDSCAPE PLAN 'A'



STACKlot
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LITTLETON, COLORADO 80120
phone. 303.808.4523

PCD FILE NO: PPR2329

REVISIONS		DESCRIPTION
DATE	BY	
10/23/23		RESUBMITTAL

DRAWN
sdw
CHECKED
jah
DESIGNED
sdw
FILENAME

SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER
LANDSCAPE PLAN 'B'



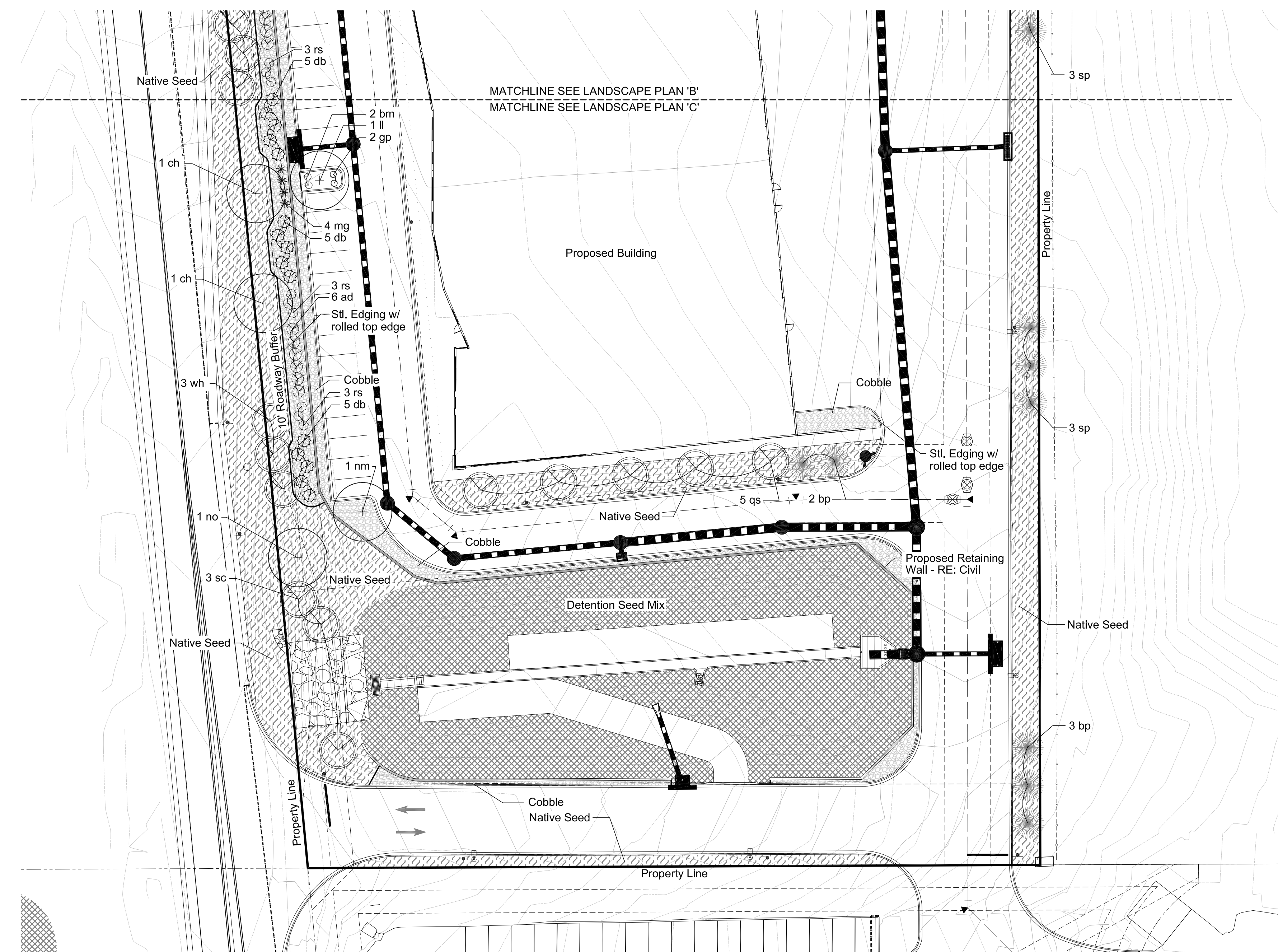
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SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO



LANDSCAPE LEGEND:

DECIDUOUS TREE

ORNAMENTAL TREE

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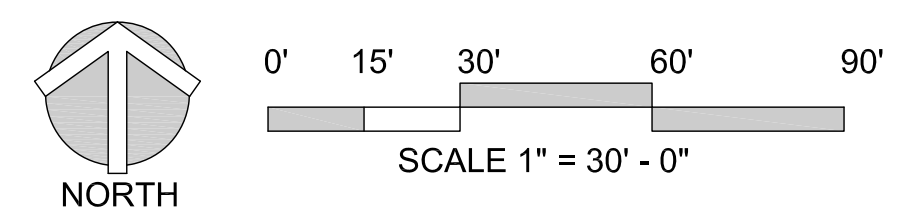
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4"-8" ROUND COBBLE OVER FILTER FABRIC

2"-4" ROUND COBBLE OVER FILTER FABRIC

STEEL EDGING w/ ROLLED TOP EDGE

RETAINING WALL - RE: CIVIL



LANDSCAPE PLAN 'A'

STACKlot

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LITTLETON, COLORADO 80120
phone. 303.808.4523

PCD FILE NO: PPR2329

REVISIONS		DESCRIPTION
DATE	BY	RESUBMITTAL
10/23/23		

DRAWN: sdw

CHECKED: jah

DESIGNED: sdw

FILENAME:

SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER

LANDSCAPE PLAN 'C'

INTERGROUP ARCHITECTS

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JOB NO.: XX-XXXX

SCALE: AS SHOWN

DATE: 07/28/2023

SHEETS: 20 SHEET: 11

SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO

GENERAL PLANTING NOTES:

- PRIOR TO BEGINNING ANY WORK ON THE SITE THE LANDSCAPE CONTRACTOR SHALL CONTACT THE OFFICE OF THE GENERAL CONTRACTOR AND LANDSCAPE ARCHITECT FOR SPECIFIC INSTRUCTIONS RELEVANT TO THE SEQUENCING OF WORK.
- LANDSCAPE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS AND SERVICE NECESSARY TO FURNISH AND INSTALL PLANTINGS AND MATERIALS AS SPECIFIED HEREIN AND AS SHOWN ON PLANS.
- NO MATERIAL SUBSTITUTIONS SHALL BE MADE WITHOUT THE LANDSCAPE ARCHITECTS APPROVAL IN WRITING. ALTERNATE MATERIALS OF SIMILAR SIZE AND CHARACTER MAY BE CONSIDERED IF SPECIFIED PLANT MATERIALS CANNOT BE OBTAINED.
- LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REVISE PLANT MATERIAL LIST AS DEEMED NECESSARY.
- ALL PLANT LOCATIONS ARE APPROXIMATE. ADJUST AS NECESSARY TO AVOID CONFLICTS.
- QUANTITIES OF MATERIALS SHOWN ON THE PLANTING PLAN TAKE PRECEDENCE OVER QUANTITIES SHOWN ON THE PLANT MATERIAL SCHEDULE. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFY ALL QUANTITIES ON THE PLANTING PLAN(S).
- LANDSCAPE CONTRACTOR SHALL LOCATE ALL UTILITIES BEFORE COMMENCEMENT OF WORK. VERIFY EXACT LOCATION OF ALL UTILITIES BY CONTACTING APPROPRIATE UTILITY COMPANIES. LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR THE REPAIR / REPLACEMENT FOR ANY DAMAGE CAUSED TO UTILITIES.
- FINISH GRADE SHALL BE ADJUSTED FOR TURF THICKNESS.
- ALL PLANT MATERIALS SHALL HAVE BACKFILL, CAREFULLY PLACED AROUND BASE AND IDES OF BALL TO TWO-THIRDS (⅔) DEPTH OF BALL THEN THOROUGHLY SOAKED WITH WATER TO ALLOW SETTLEMENT. ALL WIRE, BURLAP FASTENERS, TOP ONE-THIRD (⅓) OF BURLAP AND LOOSE BURLAP SHALL BE REMOVED AT THIS TIME THE REMAINDER OF HE PIT SHALL THEN BE BACKFILLED, ALLOWING FOR THE DEPTH OF THE MULCH SAUCER AND SETTLEMENT OF BACKFILL. BACKFILL SHALL THEN BE THOROUGHLY WATERED ONCE AGAIN.
- AFTER PLANTING IS COMPLETED REPAIR INJURIES TO ALL PLANTS AS REQUIRED. LIMIT AMOUNT OF PRUNING TO A MINIMUM NECESSARY TO REMOVE DEAD OR INJURED TWIGS AND BRANCHES. PRUNE IN SUCH A MANNER AS NOT TO CHANGE THE NATURAL GROWING HABIT OR SHAPE OF THE PLANT. MAKE ALL CUTS FLUSH, LEAVING NO STUBS. CENTRAL LEADERS SHALL NOT BE REMOVED. IF THE CENTRAL LEADER OF A PLANT IS DEAD THE PLANT SHALL BE REPLACED.
- PLANT SPECIFIED GROUND COVERS WITHIN ONE FOOT OF TRUCK OF TREES AND SHRUBS PLANTED WITHIN THE AREA. PLANTING ARRANGEMENTS SHALL BE TRIANGULAR WITH PROPER SPACING BETWEEN PLANTS.
- COMMERCIAL GRADE ⅜ INCH BY 4" POWDER COATED STEEL EDGING SHALL BE USED TO SEPARATE ALL TURF AREAS FROM PLANTING BEDS. PLACE EDGING FLUSH WITH GRADE AND STAKE TO GROUND PER MANUFACTURES RECOMMENDATIONS.
- LANDSCAPE CONTRACTOR TO PROVIDE THE LANDSCAPE CONTRACTOR A SAMPLE OF PROPOSED STEEL EDGING FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
- USE SHREDDED CEDAR MULCH IN ALL PLANTING BEDS AND TREE SAUCERS. LANDSCAPE CONTRACTOR SHALL PROVIDE A 1 CUBIC FOOT SAMPLE OF PROPOSED MULCH TO LANDSCAPE ARCHITECT FOR REVIEW AND APPROVAL.
- PLACE FOUR INCHES OF MULCH IN ALL SHRUB BEDS, PLACE FOUR INCHES OF MULCH IN ALL GROUND COVER, PERENNIAL BEDS AND PLACE 4 INCHES OF MULCH AT ALL TREE SAUCERS.
- PLANTING BEDS RECEIVING MULCH MULCH ARE TO BE FREE OF WEEDS AND GRASS. TREAT BEDS WITH A PRE-EMMERGENT HERBICIDE PRIOR TO PLANTING AND MULCH PLACEMENT. DO NOT APPLY HERBICIDE IN PERENNIAL OR ANNUAL BEDS.
- LANDSCAPE CONTRACTOR TO REMOVE TREE STAKES AND ALL DEAD WOOD ON TREES AND SHRUBS ONE YEAR AFTER SUBSTANTIAL COMPLETION IS GRANTED ON THE COMPLETE PROJECT.
- REPORT ANY DISCREPANCIES IN THE PLANTING PLAN TO THE LANDSCAPE ARCHITECT PRIOR TO STARTING CONSTRUCTION.
- ALL LANDSCAPE AREAS SHALL BE IRRIGATED BY AN UNDERGROUND AUTOMATIC UNDERGROUD IRRIGATION SYSTEM. WITH SEPARATE ZONES FOR TURF AND SHRUBS / TREES / GROUNDCOVER.
- IF TRANSFORMERS, GROUND MOUNTED HVAC EQUIPMENT, UTILITY PEDESTALS, ETC. ARE NOT SHOWN ON THE SITE IMPROVEMENT PLAN, ADDITIONAL LANDSCAPE/SCREENING MAY BE REQUIRED BASED UPON FIELD CONDITIONS DISCOVERED VIA THE SITE INSPECTION BY STAFF, MADE PRIOR TO THE ISSUANCE OF CERTIFICATE OF OCCUPANCY, OR FINAL INSPECTION AS APPLICABLE.

SOIL ANALYSIS CONTRACTOR REQUIREMENT

"THE REQUIRED SOIL ANALYSIS REPORT IS REQUIRED TO BE SUBMITTED AND APPROVED WITH THE IRRIGATION PLAN SUBMITTAL AND BEFORE ANY LANDSCAPE CONSTRUCTION. THIS WOULD INCLUDE COMPLETING THE SOIL SAMPLING AND SUBMITTING THE SAMPLES TO A SOILS LAB FOR TESTING. A SEPARATE LAB TEST REPORT AND SOIL PREPARATION RECOMMENDATIONS (AMENDMENT/FERTILIZER AMOUNTS AND APPLICATION RATES) FOR EACH TYPE OF PROPOSED LANDSCAPING (SHRUB BEDS/SOD/NATIVE SEED) WILL NEED TO BE PROVIDED TO CITY STAFF FOR REVIEW AND APPROVAL."

SOIL AMENDMENTS

PRIOR TO PLANTING, ALL SITES FOR PLANTINGS SHALL INCORPORATE SOIL AMENDMENTS AT A RATE OF 3 CUBIC YARDS PER 1000 SQUARE FEET TO A MINIMUM DEPTH OF 6". A LESSER AMOUNT SHALL BE ALLOWED IF A SOIL TEST SHOWS THAT 3 CUBIC YARDS PER 1000 SQUARE FEET IS NOT NECESSARY FOR WATER RETENTION AND DEEP ROOTING OF PLANT MATERIALS. IF THE SPECIFIED PLANT MATERIAL REQUIRES LESS FERTILE SOIL, THOSE AREAS MAY HAVE LESS SOIL AMENDMENTS INSTALLED IF APPROVED BY THE COMMUNITY DEVELOPMENT DIRECTOR. THESE AREAS SHALL BE IDENTIFIED ON THE LANDSCAPE PLAN. EXISTING TOPSOIL SHALL BE SALVAGED AND STOCKPILED FOR USE AS SOIL AMENDMENTS OR TOPSOIL. NO TOPSOIL SHALL BE REMOVED FROM THE SITE UNLESS THE CITY APPROVES THE TRANSFER OF TOPSOIL TO A CITY-OWNED PARK OR OPEN SPACE AREA. A NOTE SHALL BE PLACED ON THE LANDSCAPE PLAN REFLECTING THE ABOVE REQUIREMENTS REGARDING SOIL AMENDMENTS AND TOPSOIL. EXAMPLES OF ACCEPTABLE SOIL AMENDMENTS INCLUDE COMPOST AND AGED MANURE. MOUNTAIN PEAT AND INORGANIC MATERIALS SUCH AS SAND, GYPSUM AND LIME ARE PROHIBITED SOIL AMENDMENTS. ALL SITES ARE SUBJECT TO INSPECTION BY THE CITY FOR COMPLIANCE WITH SOIL AMENDMENT REQUIREMENTS.

PLANT MATERIAL SCHEDULE:

SYMBOL	QTY.	I.D.	COMMON NAME	BOTANICAL NAME	SIZE	COND.
SHADE TREES						
	2	nm	NORWAY MAPLE	ACER PLATANOIDES	1 1/2" CAL.	B & B
	3	aj	AUTUMN BLAZE MAPLE	ACER X FREEMANII 'JEFFERSRED'	1 1/2" CAL.	B & B
	5	ch	COMMON HACKBERRY	CELTIS OCCIDENTALIS	1 1/2" CAL.	B & B
	3	ih	IMPERIAL HONEY LOCUST	GLEDITSIA TRIACANTHOS INERMIS 'IMPERIAL'	1 1/2" CAL.	B & B
	6	kc	KENTUCKY COFFEE TREE	GYMNOCLADUS DIOICUS	1 1/2" CAL.	B & B
	3	nc	NARROWLEAF COTTONWOOD	NARROWLEAF COTTONWOOD	1 1/2" CAL.	B & B
	5	wo	SWAMP WHITE OAK	QUERCUS BICOLOR	1 1/2" CAL.	B & B
	2	no	NORTHERN RED OAK	QUERCUS RUBRA	1 1/2" CAL.	B & B
	2	ll	LITTLELEAF LINDEN	TILIA CORDATA	1 1/2" CAL.	B & B
	4	eo	ENGLISH OAK	QUERCUS ROBUR	1 1/2" CAL.	B & B
ORNAMENTAL TREES						
	3	wh	WASHINGTON HAWTHORN	CRATAEGUS PHAENOPYRUM	1" CAL.	B & B
	6	rc	RADIANT CRABAPPLE	MALAU 'RADIANT'	1" CAL.	B & B
	6	sc	SPRING SNOW CRABAPPLE	MALUS 'SPRING SNOW' '	1" CAL.	B & B
	3	cp	CHANTICLEER PEAR	PYRUS CALLERYANA	1" CAL.	B & B
	11	qs	CRIMSON SPIRE OAK	QUERCUS X BIMUNDORUM 'CRIMSCHMIDT'	1" CAL.	B & B
EVERGREEN TREES						
	3	pe	PINON PINE	PINUS EDULIS	6' HT.	B & B
	11	ap	AUSTRIAN PINE	PINUS NIGRA	6' HT.	B & B
	5	pp	PONDEROSA PINE	PINUS PONDEROSA	6' HT.	B & B.
	6	sp	SOUTHWESTERN WHITE PINE	PINUS STROBIFORMIS	6' HT.	B & B
	5	bp	BOSNIA PINE	PINUS HELDREICHII	6' HT.	B & B
SHRUBS						
	2	ks	DARK KNIGHT SPIREA	CARYOPTERIS X CLANDONENSIS 'DARK KNIGHT'	5 GAL.	CONT.
	20	aw	ANOTHONY WATERER SPIREA	SPIREA JAPONICA 'ANTHONY WATER'	5 GAL.	CONT.
	4	fs	GOLD FLAME SPIREA	SPIREA JAPONICA 'GOLDFLAME'	5 GAL.	CONT.
	8	gp	GOLD DROP POTENTILLA	POTENTILLA FRUITICOSA 'GOLD DROP'	5 GAL.	CONT.
	26	bm	BLUE MIST SPIREA	CARYOPTERIS X CLANDONENSIS	5 GAL.	CONT.
	67	db	DWARF BURNING BUSH	EOUNYMUS ALATA 'DWARF NANA'	5 GAL.	CONT.
	61	rs	RUSSIAN SAGE	PEROVSKIA ATRIPLICIFOLIA	5 GAL.	CONT.
	40	ad	ARCTIC FIRE DOGWOOD	CORNUS STOLONIFERA 'FARROW'	5 GAL.	CONT.
	4	dn	DWARF NINEBARK	PHYSOCARPUS-OPULIFOLIUS 'NANUS'	5 GAL.	CONT.
ORNAMENTAL GRASSES						
	27	mg	MAIDEN GRASS	MISCANTHUS SINENSIS 'GRACILLIMUS'	1 GAL.	CONT.
	12	fg	MEXICAN FEATHER GRASS	NESSELLA TENUISSIMA	1 GAL.	CONT.

Roadway Buffer

MONUMENT HILL ROAD NON-ARTERIAL	REQUIRED ROADWAY BUFFER	PROVIDED ROADWAY BUFFER	REQUIRED TREES 1 TREE / 30 LN.FT.	PROVIDED TREES
1,175 LN.FT.	10 FEET	10 FEET	40	40

Internal Landscaping

SITE AREA	INTERNAL LANDSCAPE AREA REQUIRED - (%)	INTERNAL LANDSCAPE AREA PROVIDED	REQUIRED TREES 1 TREE / 500 SF	PROVIDED TREES
505,679 SF.	25,284 SF.	115,434 SF.	51	54

STACKlot

5639 SOUTH CURTICE STREET
LITTLETON, COLORADO 80120
phone. 303.808.4523

PCD FILE NO: PPR2329

REVISIONS		DESCRIPTION
BY	DATE	RESUBMITTAL
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SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

LANDSCAPE NOTES



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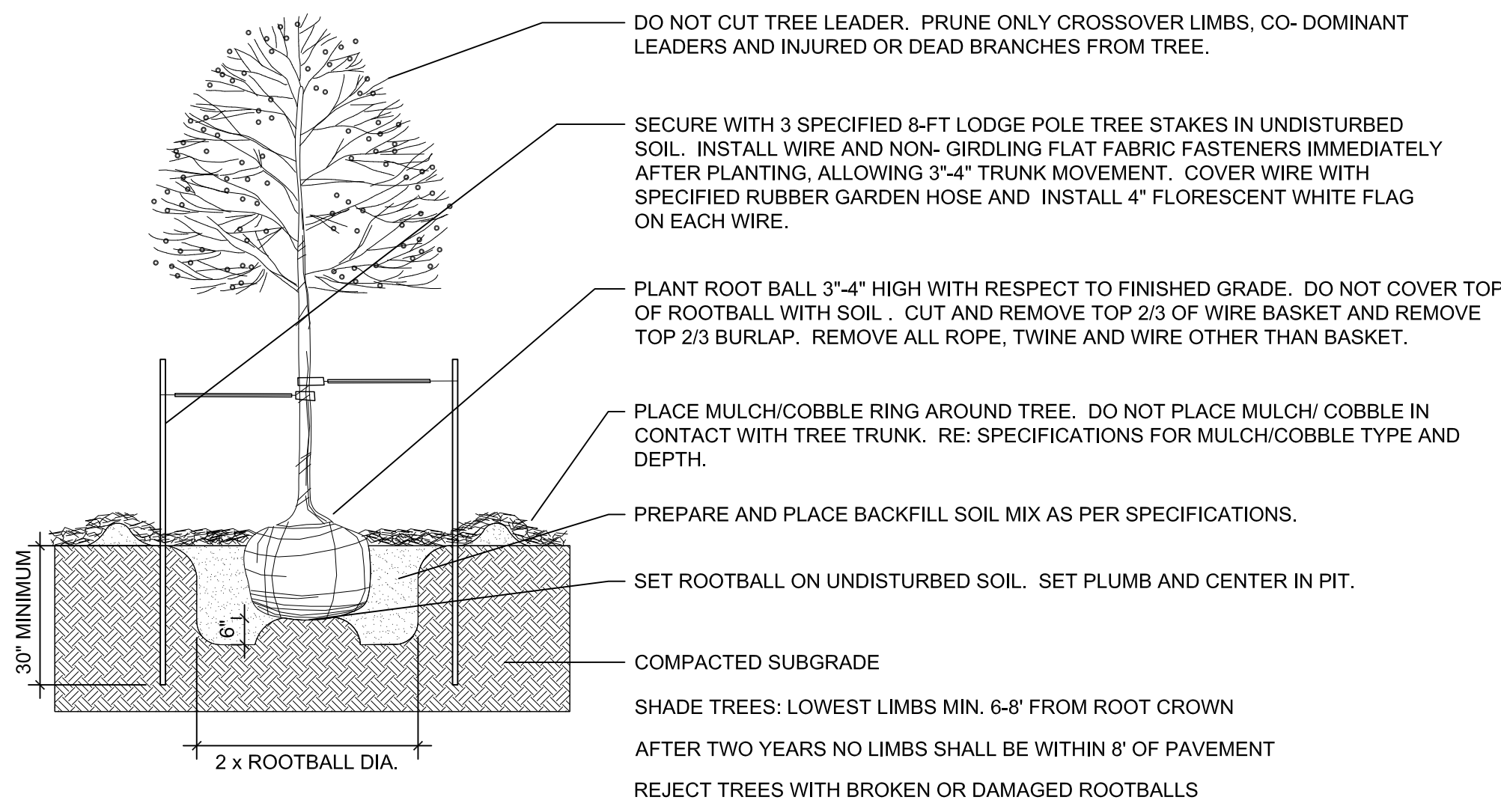
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SCALE	AS SHOWN
DATE	07/28/2023
SHEETS	SHEET
20	12

SITE DEVELOPMENT PLAN

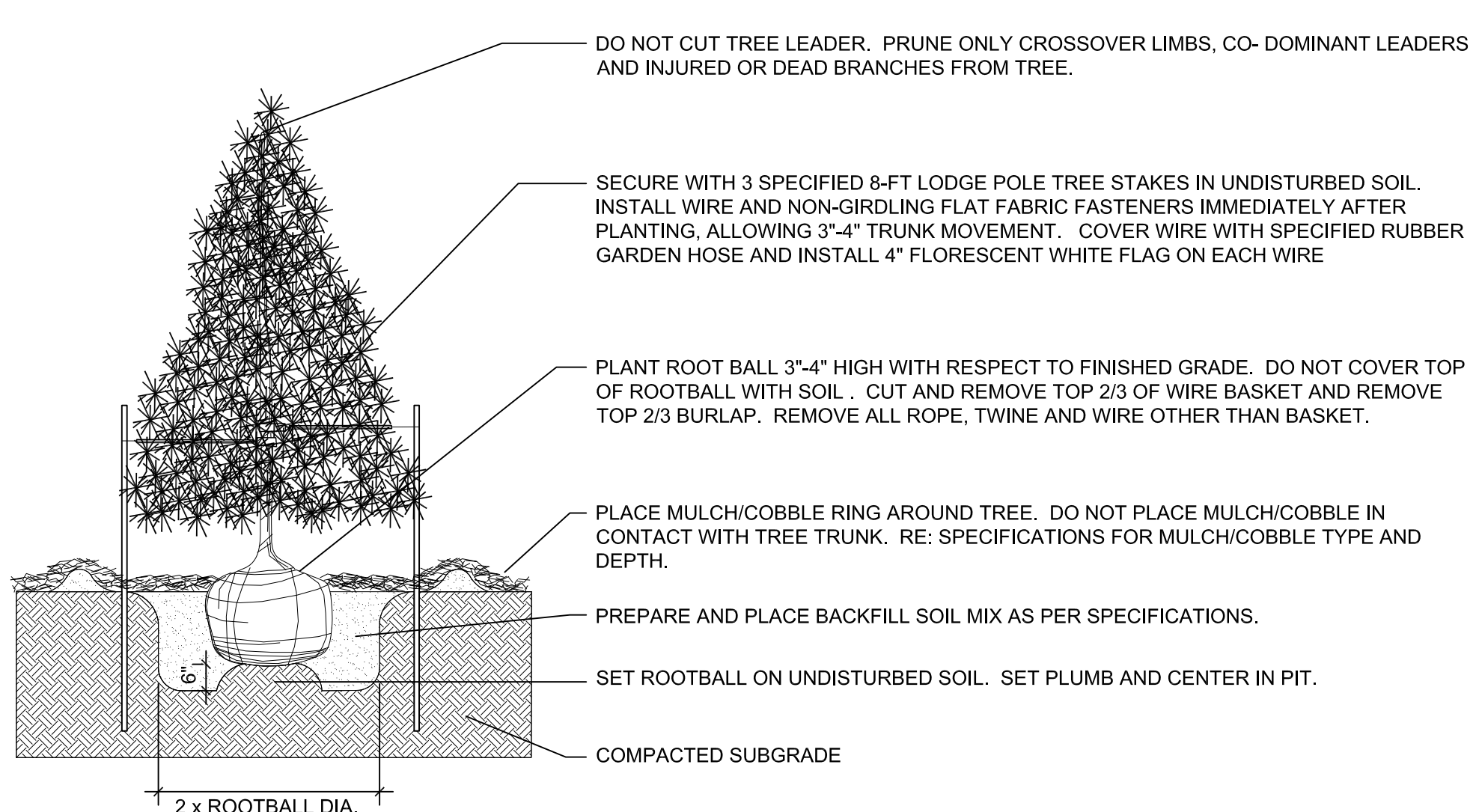
THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
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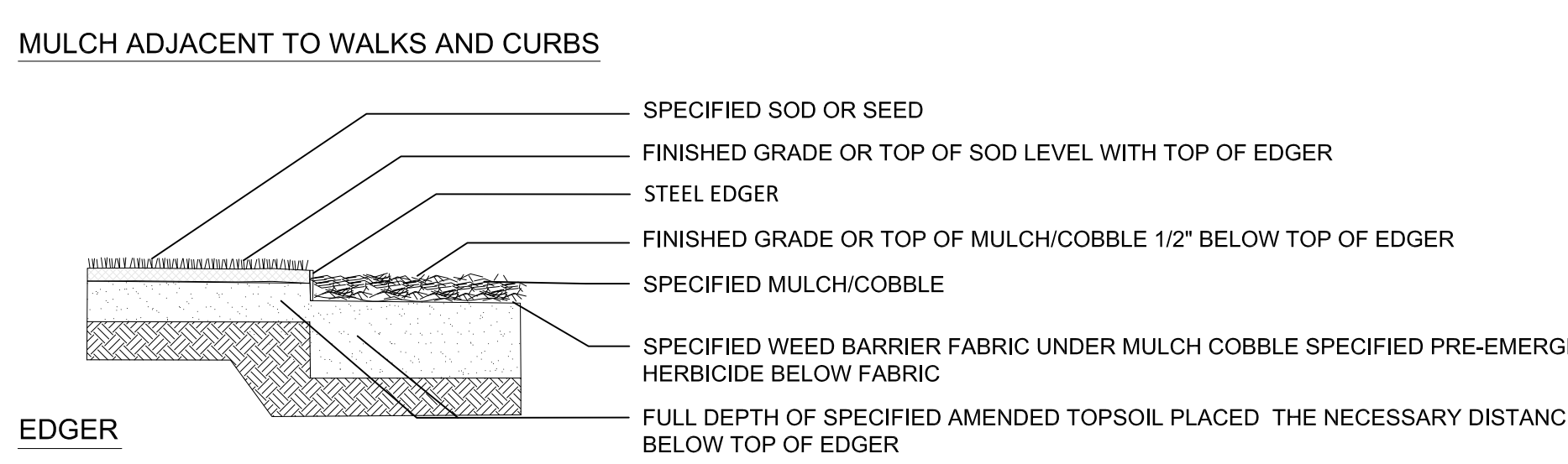
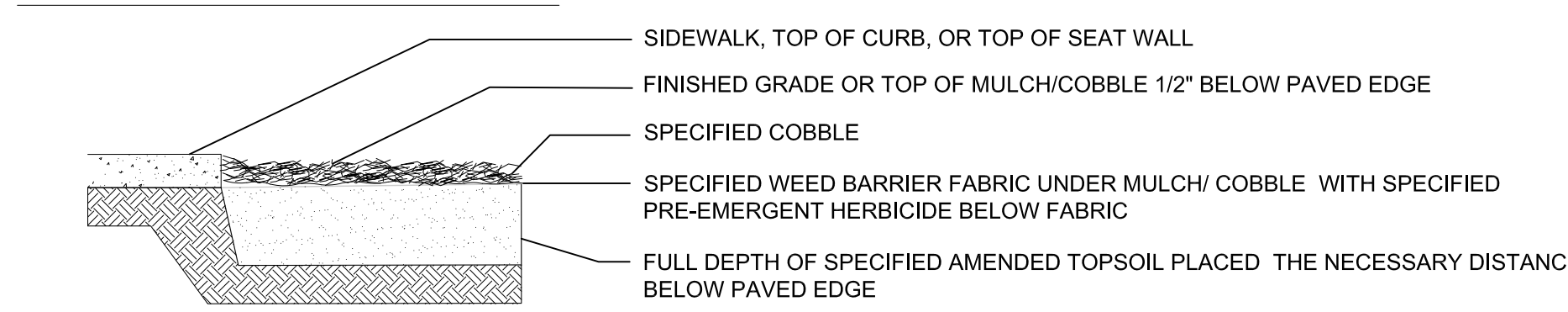
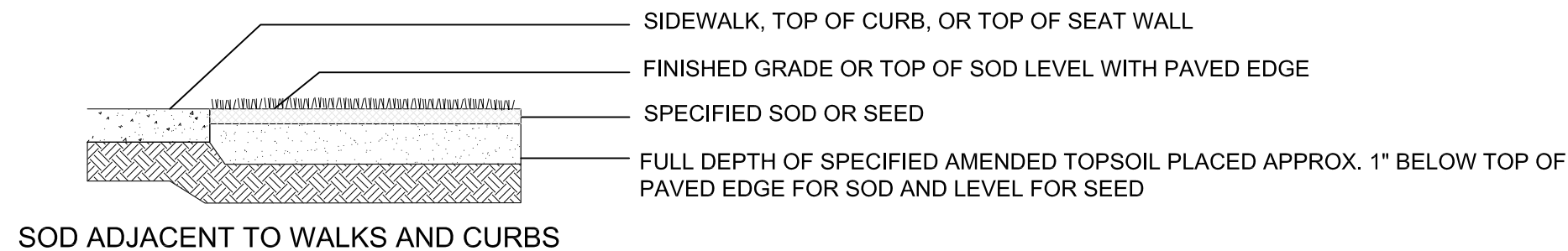
1 DECIDUOUS TREE

NOT TO SCALE



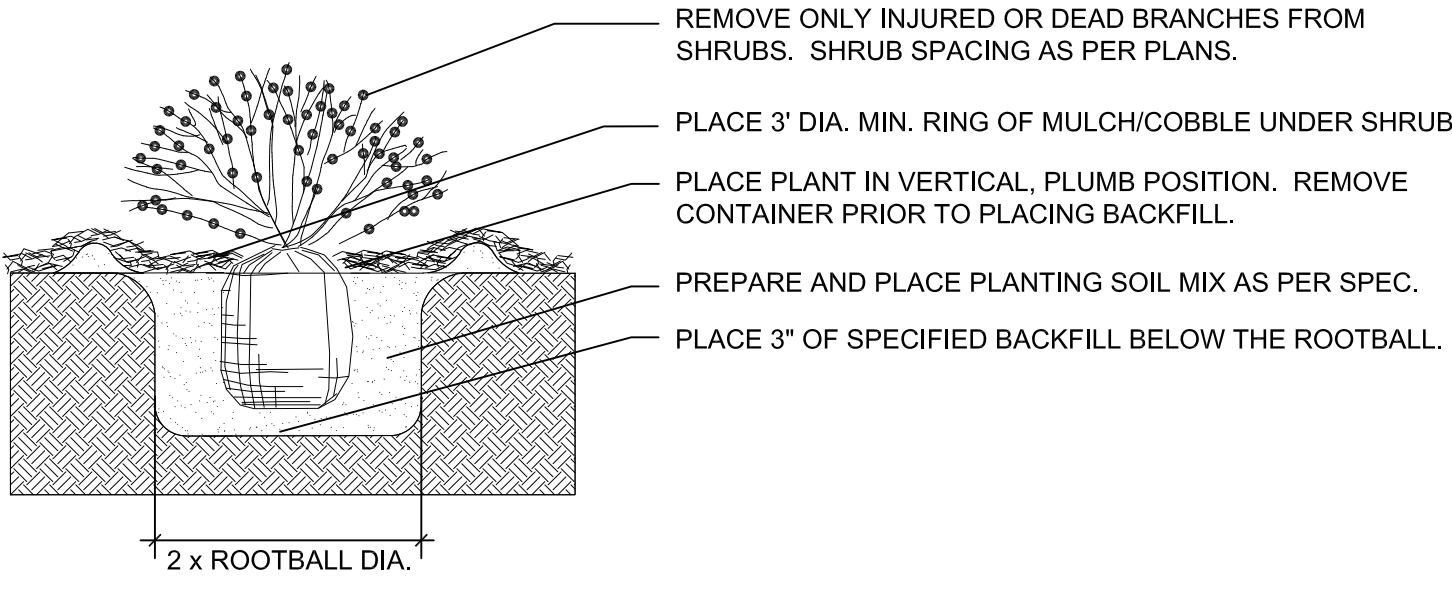
2 EVERGREEN TREE PLANTING

NOT TO SCALE



3 EDGE TREATMENT

NOT TO SCALE



4 SHRUB PLANTING

NOT TO SCALE

STACKlot

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PCD FILE NO: PPR2329

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DESIGNED	sdw
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SITE DEVELOPMENT PLAN	LANDSCAPE DETAILS
THE ROCK COMMERCE CENTER	



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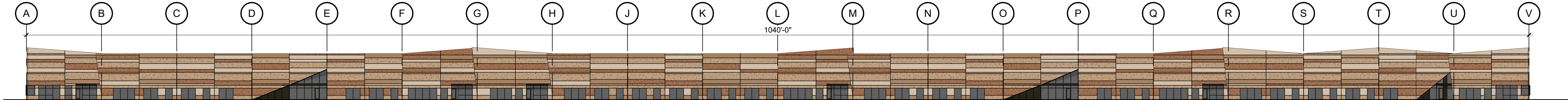
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DATE	07/28/2023
SHEETS	20
SHEET	13

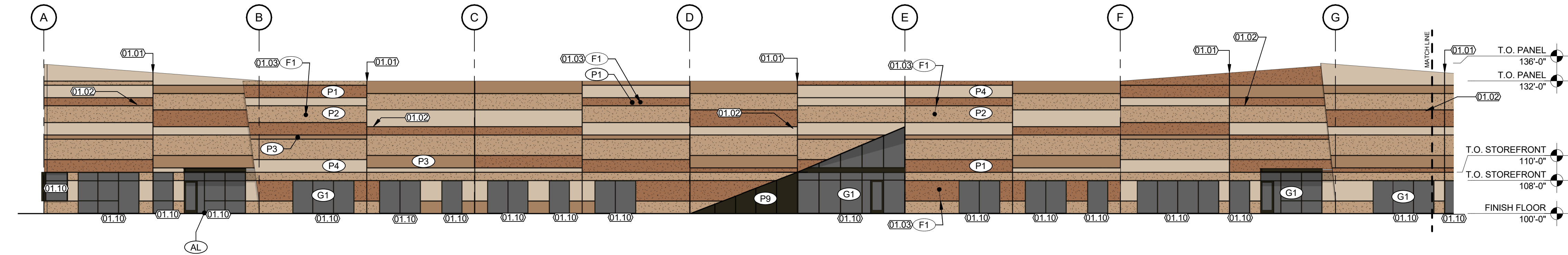
SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

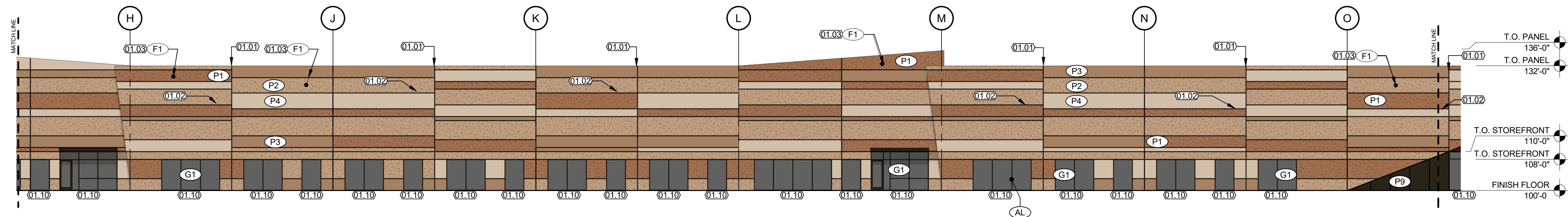
A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO



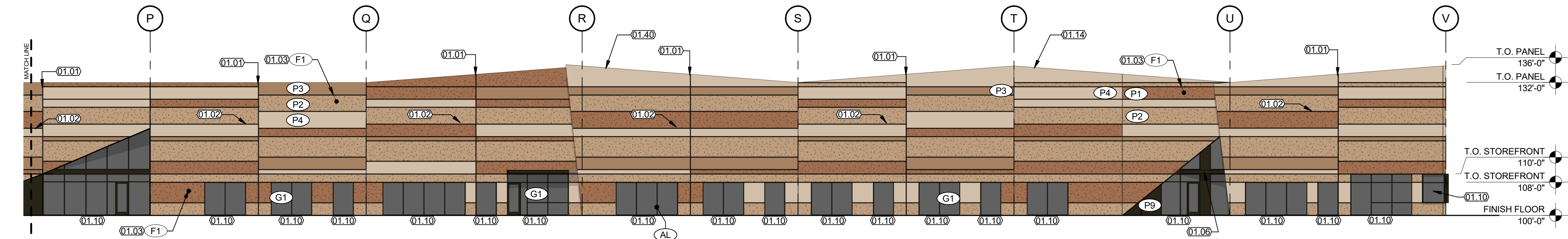
1 OVERALL WEST ELEVATION
SCALE: 1" = 40'-0"



2 ENLARGED WEST ELEVATION - NORTH
SCALE: 1/16" = 1'-0"



3 ENLARGED WEST ELEVATION - MID
SCALE: 1/16" = 1'-0"



4 ENLARGED WEST ELEVATION - SOUTH
SCALE: 1/16" = 1'-0"

KEYNOTES:

- 01.01 CONCRETE PANEL JOINT WITH 3/4" CHAMFERED EDGES, BACKER ROD & SEALANT FULL LENGTH.
01.02 3/4" x 2 1/4" REVEAL, PAINTED.
01.03 US FORMLINER 2/156 STEINWALD.
01.06 STEEL CHANNEL ENTRY CANOPY TO ATTACH TO CONC. TILT-UP WALL WITH T.S. SUPPORTS, PAINTED.
01.10 INSULATED TINTED GLAZING IN ANODIZED ALUMINUM STOREFRONT SYSTEM, SEE FINISH LEGEND.
01.14 SITE CAST TILT-UP CONCRETE PANEL, PAINTED WITH MEDIUM TEXTURED PAINT. SEE EXTERIOR FINISH LEGEND FOR SPECIFIC COLORS.
01.40 PREFINISHED METAL CAP FLASHING, TYP @ ALL CONCRETE PANELS.

EXTERIOR FINISH LEGEND

KEY	DESCRIPTION	IMAGE	MANUFACTURER	REMARKS / COMMENTS
P1	EXTERIOR PAINT		GLIDDEN #50YR 18/223 "SOFT COPPER"	MEDIUM TEXTURE @ CONC. PANEL
F1	CONCRETE TILT UP ACCENT		US FORMLINER	2/156 STEINWALD ROCK PATTERN
P2	EXTERIOR PAINT		GLIDDEN #10YY 41/175 "HIGHLAND PLAINS"	MEDIUM TEXTURE @ CONC. PANEL
P3	EXTERIOR PAINT		GLIDDEN #20YY 33/145 "DEACON'S BENCH"	MEDIUM TEXTURE @ CONC. PANEL
P4	EXTERIOR PAINT		GLIDDEN #20YY 51/098 "LEGEND TAN"	MEDIUM TEXTURE @ CONC. PANEL
P5	EXTERIOR PAINT		GLIDDEN #30YY 46/036 "ZEPPELIN"	MEDIUM TEXTURE @ CONC. PANEL
F2	CONCRETE TILT UP ACCENT		US FORMLINER	2/75 KOCHER - HORIZONTAL
P6	EXTERIOR PAINT		GLIDDEN #30YY 33/047 "OLD MONTEREY"	MEDIUM TEXTURE @ CONC. PANEL
P7	EXTERIOR PAINT		GLIDDEN #30YY 20/029 "MANSARD STONE"	MEDIUM TEXTURE @ CONC. PANEL
P8	EXTERIOR PAINT		GLIDDEN #30YY 10/038 "FOREST BLACK"	MEDIUM TEXTURE @ CONC. PANEL
P9	EXTERIOR PAINT		GLIDDEN #30YY 05/044 "THE DARK SIDE"	MEDIUM TEXTURE @ CONC. PANEL
G1	GLAZING		VITRO GLASS - SOLARGRAY	
AL	STOREFRONT FRAME		DARK BRONZE	

PCD FILE NO: PPR2329

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DATE	RESUBMITTAL
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BY	

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SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER
EXTERIOR ELEVATIONS



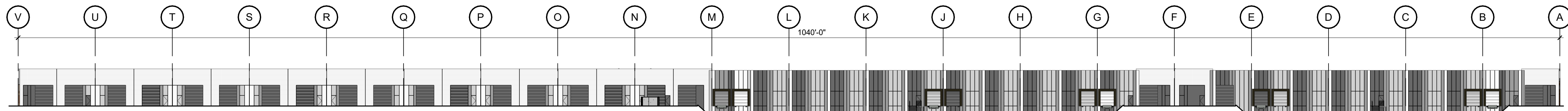
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SHEETS	20
SHEET	14

SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO

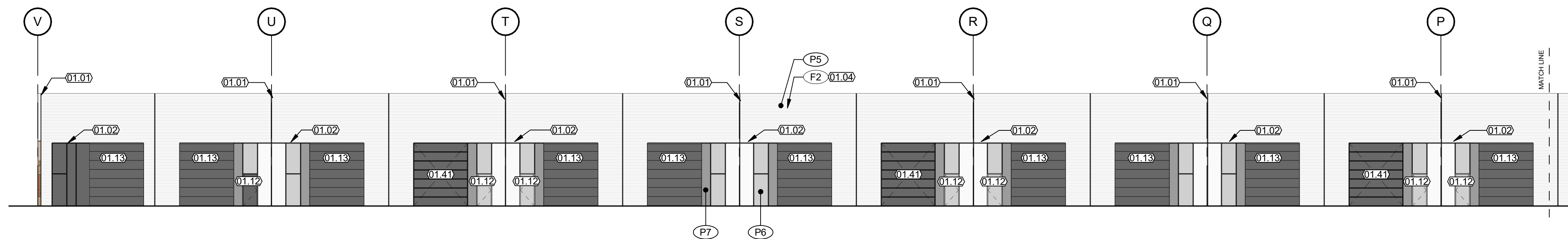


1 OVERALL EAST ELEVATION

SCALE: 1" = 40'-0"

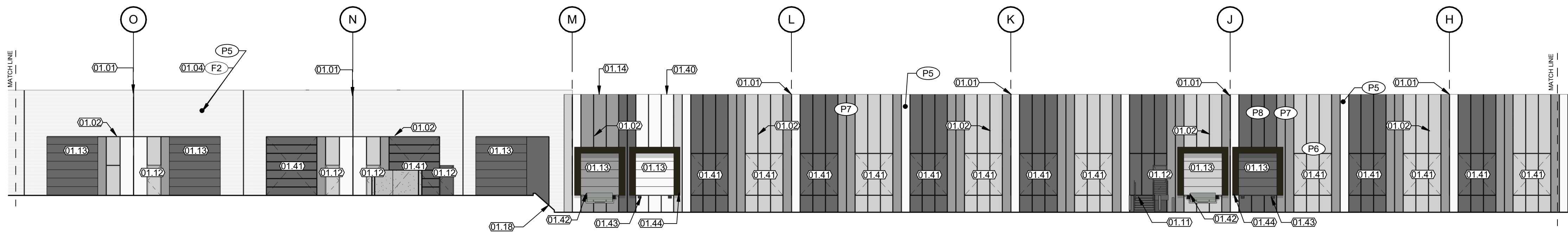
KEYNOTES:

- 01.01 CONCRETE PANEL JOINT WITH 3/4" CHAMFERED EDGES, BACKER ROD & SEALANT FULL LENGTH.
01.02 3/4" x 2 1/4" REVEAL, PAINTED.
01.04 US FORMLINER 2/75 KOCHER - ORIENTATION HORIZONTAL.
01.11 EXTERIOR STEEL STAIRS, LANDING, GUARDRAIL & HANDRAILS. TREAD & LANDING TO BE 1" DEEP OPEN GRATING WITH LONG DIM. PERP. TO PATH OF TRAVEL. GUARDRAIL TO BE 1 1/2"Ø x 42"H. WITH 1 1/2"Ø x 34"H. HANDRAIL, PAINTED.
01.12 INSULATED H.M. MAN DOOR, PAINT TO MATCH ADJACENT WALL SURFACE COLOR, U.N.O.
01.13 INSULATED STEEL O.H. DOOR, PAINTED - SEE FINISH LEGEND.
01.14 SITE CAST TILT-UP CONCRETE PANEL, PAINTED WITH MEDIUM TEXTURED PAINT. SEE EXTERIOR FINISH LEGEND FOR SPECIFIC COLORS.
01.18 SLOPING CONCRETE RETAINING WALL.
01.40 PREFINISHED METAL CAP FLASHING, TYP @ ALL CONCRETE PANELS. AREA TO BE KNOCK-OUT FOR FUTURE DOCK DOOR, PROVIDE 1 1/2" DEEP RECESS. TYPICAL 3/4" x 2 1/4" REVEALS WITHIN RECESS TO PROVIDE THE O.H. DOOR APPEARANCE.
01.42 6' x 8' DOCK LEVELER
01.43 DOCK BUMPER, TYP. @ DOCK LEVELER
01.44 DOCK SEAL, TYP @ DOCK HEIGHT O.H. DOORS



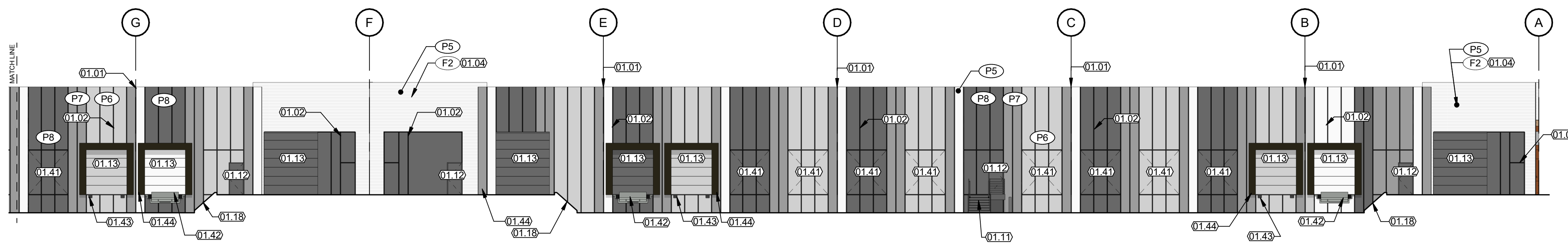
2 ENLARGED EAST ELEVATION - SOUTH

SCALE: 1/16" = 1'-0"



3 ENLARGED EAST ELEVATION - MID

SCALE: 1/16" = 1'-0"



4 ENLARGED EAST ELEVATION - NORTH

SCALE: 1/16" = 1'-0"

EXTERIOR FINISH LEGEND

KEY	DESCRIPTION	IMAGE	MANUFACTURER	REMARKS / COMMENTS
P1	EXTERIOR PAINT		GLIDDEN #50YR 18/223 "SOFT COPPER"	MEDIUM TEXTURE @ CONC. PANEL
F1	CONCRETE TILT UP ACCENT		US FORMLINER	2/156 STEINWALD ROCK PATTERN
P2	EXTERIOR PAINT		GLIDDEN #10YY 41/175 "HIGHLAND PLAINS"	MEDIUM TEXTURE @ CONC. PANEL
P3	EXTERIOR PAINT		GLIDDEN #20YY 33/145 "DEACON'S BENCH"	MEDIUM TEXTURE @ CONC. PANEL
P4	EXTERIOR PAINT		GLIDDEN #20YY 51/098 "LEGEND TAN"	MEDIUM TEXTURE @ CONC. PANEL
P5	EXTERIOR PAINT		GLIDDEN #30YY 46/036 "ZEPPELIN"	MEDIUM TEXTURE @ CONC. PANEL
F2	CONCRETE TILT UP ACCENT		US FORMLINER	2/75 KOCHER - HORIZONTAL
P6	EXTERIOR PAINT		GLIDDEN #30YY 33/047 "OLD MONTEREY"	MEDIUM TEXTURE @ CONC. PANEL
P7	EXTERIOR PAINT		GLIDDEN #30YY 20/029 "MANSARD STONE"	MEDIUM TEXTURE @ CONC. PANEL
P8	EXTERIOR PAINT		GLIDDEN #30YY 10/036 "FOREST BLACK"	MEDIUM TEXTURE @ CONC. PANEL
P9	EXTERIOR PAINT		GLIDDEN #30YY 05/044 "THE DARK SIDE"	MEDIUM TEXTURE @ CONC. PANEL
G1	GLAZING		VITRO GLASS - SOLARGRAY	
AL	STOREFRONT FRAME		DARK BRONZE	

PCD FILE NO: PPR2329

REVISIONS	DESCRIPTION
DATE	10/20/2023
BY	

DRAWN

CBW

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BS

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KS

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SITE DEVELOPMENT PLAN
THE ROCK COMMERCE CENTER



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SHEET

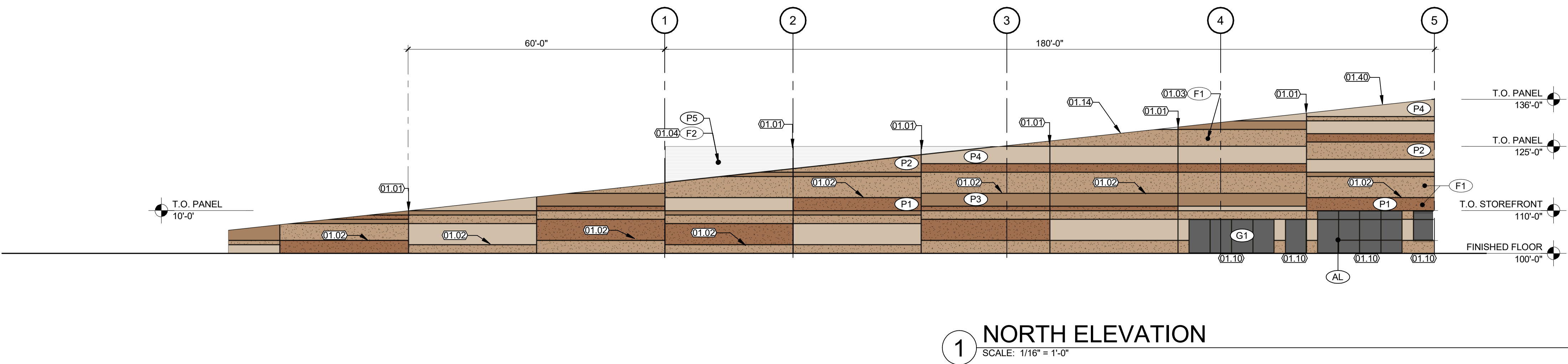
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15

SITE DEVELOPMENT PLAN

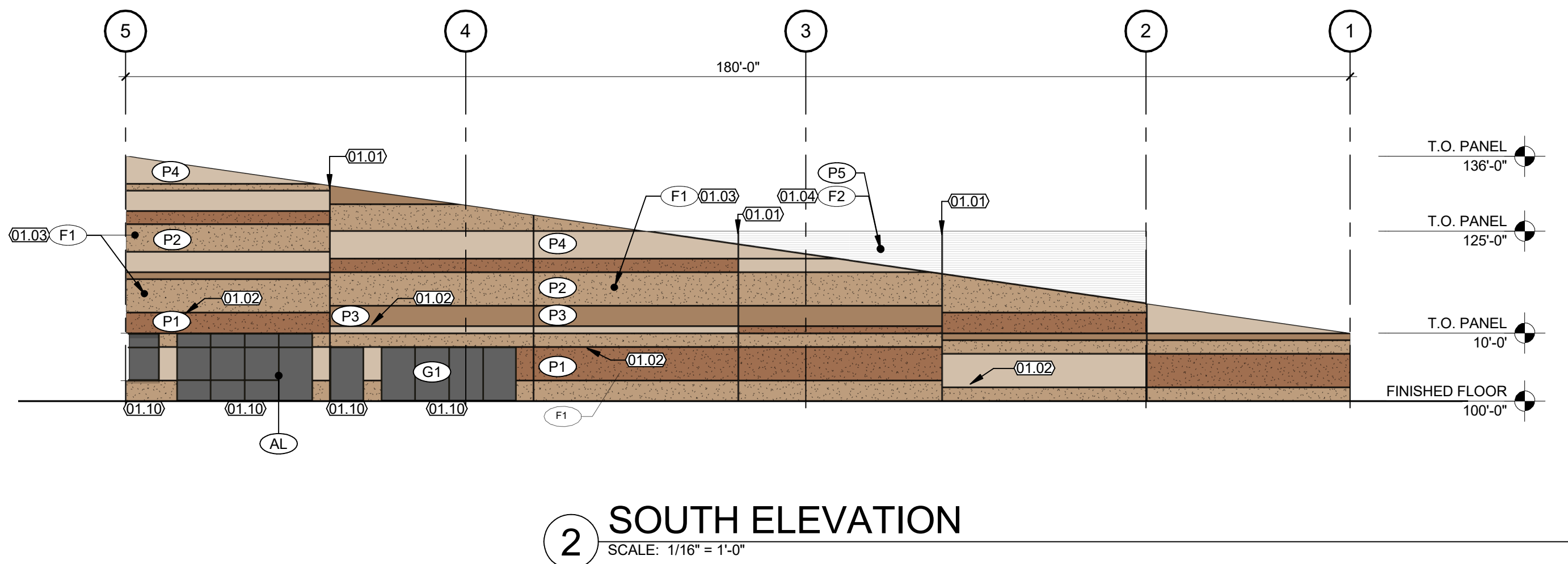
THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO



KEYNOTES:

- 01.01 CONCRETE PANEL JOINT WITH 3/4" CHAMFERED EDGES, BACKER ROD & SEALANT FULL LENGTH.
- 01.02 3/4" x 2 1/4" REVEAL, PAINTED.
- 01.03 US FORMLINER 2/156 STEINWALD.
- 01.04 US FORMLINER 2/75 KOCHER - ORIENTATION HORIZONTAL.
- 01.10 INSULATED TINTED GLAZING IN ANODIZED ALUMINUM STOREFRONT SYSTEM. SEE FINISH LEGEND.
- 01.14 SITE CAST TILT-UP CONCRETE PANEL, PAINTED WITH MEDIUM TEXTURED PAINT. SEE EXTERIOR FINISH LEGEND FOR SPECIFIC COLORS.
- 01.40 PREFINISHED METAL CAP FLASHING, TYP @ ALL CONCRETE PANELS.



EXTERIOR FINISH LEGEND				
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P1	EXTERIOR PAINT		GLIDDEN #50YR 18/223 "SOFT COPPER"	MEDIUM TEXTURE @ CONC. PANEL
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G1	GLAZING		VITRO GLASS - SOLARGRAY	
AL	STOREFRONT FRAME		DARK BRONZE	

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SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

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SHEETS	20
SHEET	16

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SITE DEVELOPMENT PLAN

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2 NORTH END CAP PERSPECTIVE
SCALE: 1/2" = 1'-0"



1 SOUTH TENANT PERSPECTIVE
SCALE: 1/2" = 1'-0"

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SITE DEVELOPMENT PLAN	EXTERIOR PERSPECTIVES
THE ROCK COMMERCE CENTER	



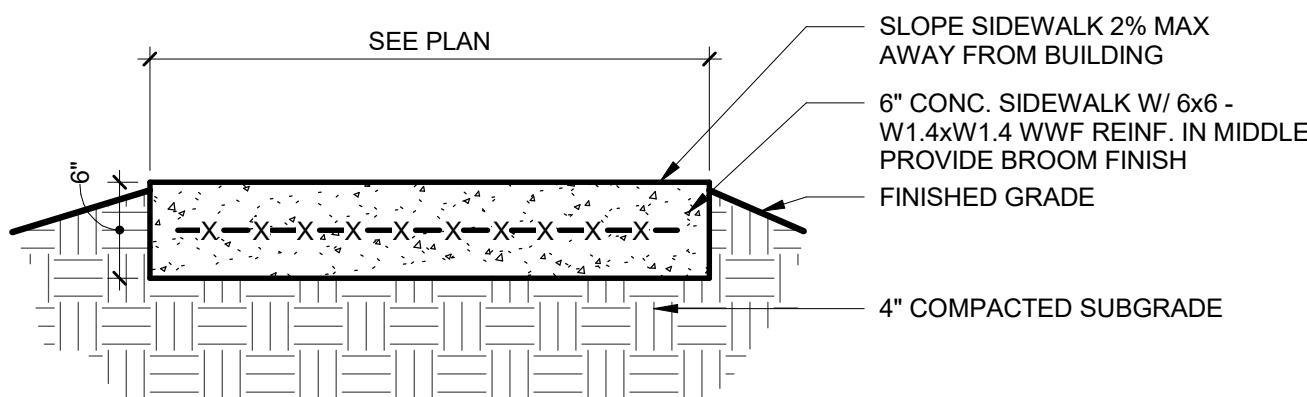
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SHEETS	SHEET
20	17

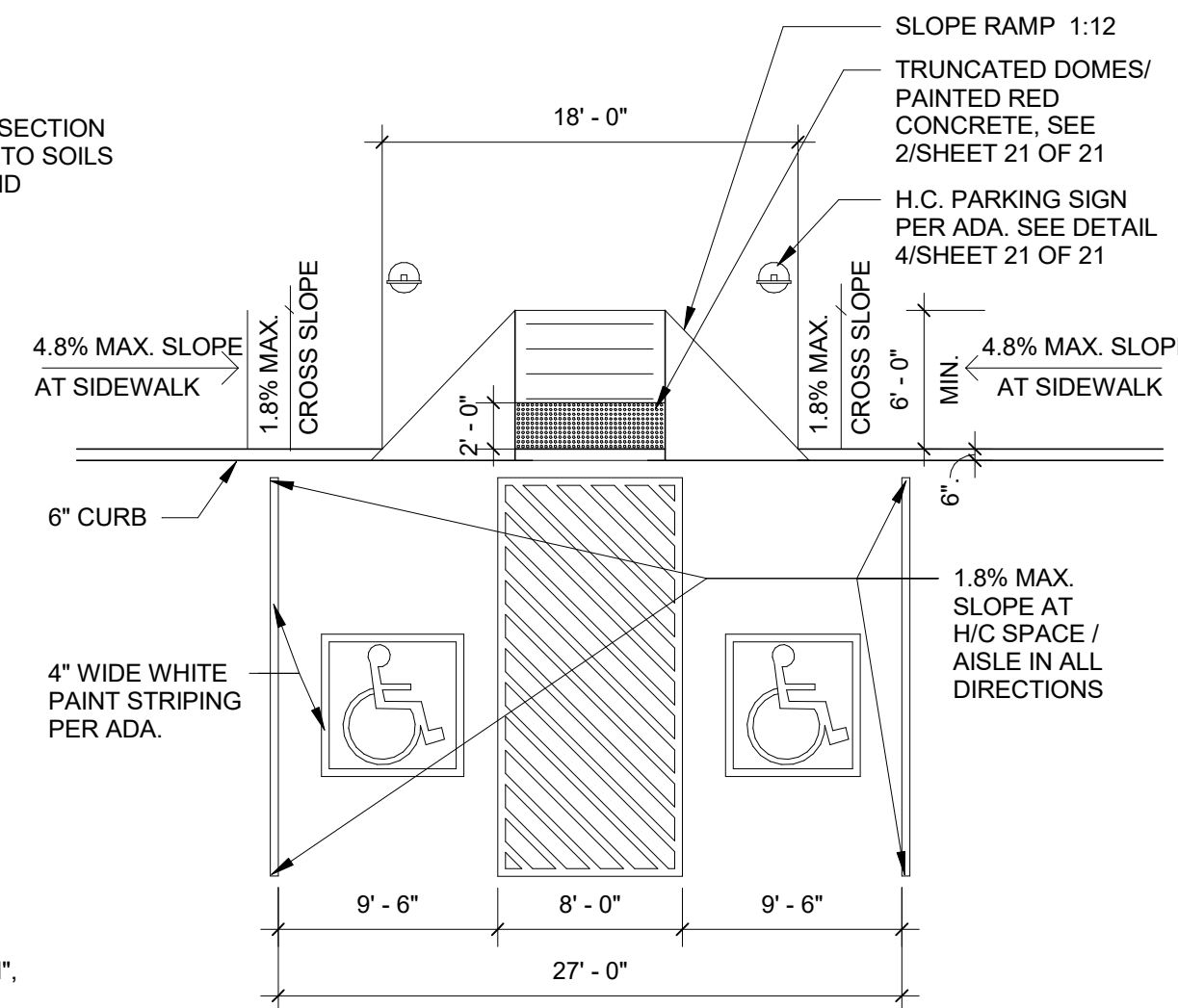
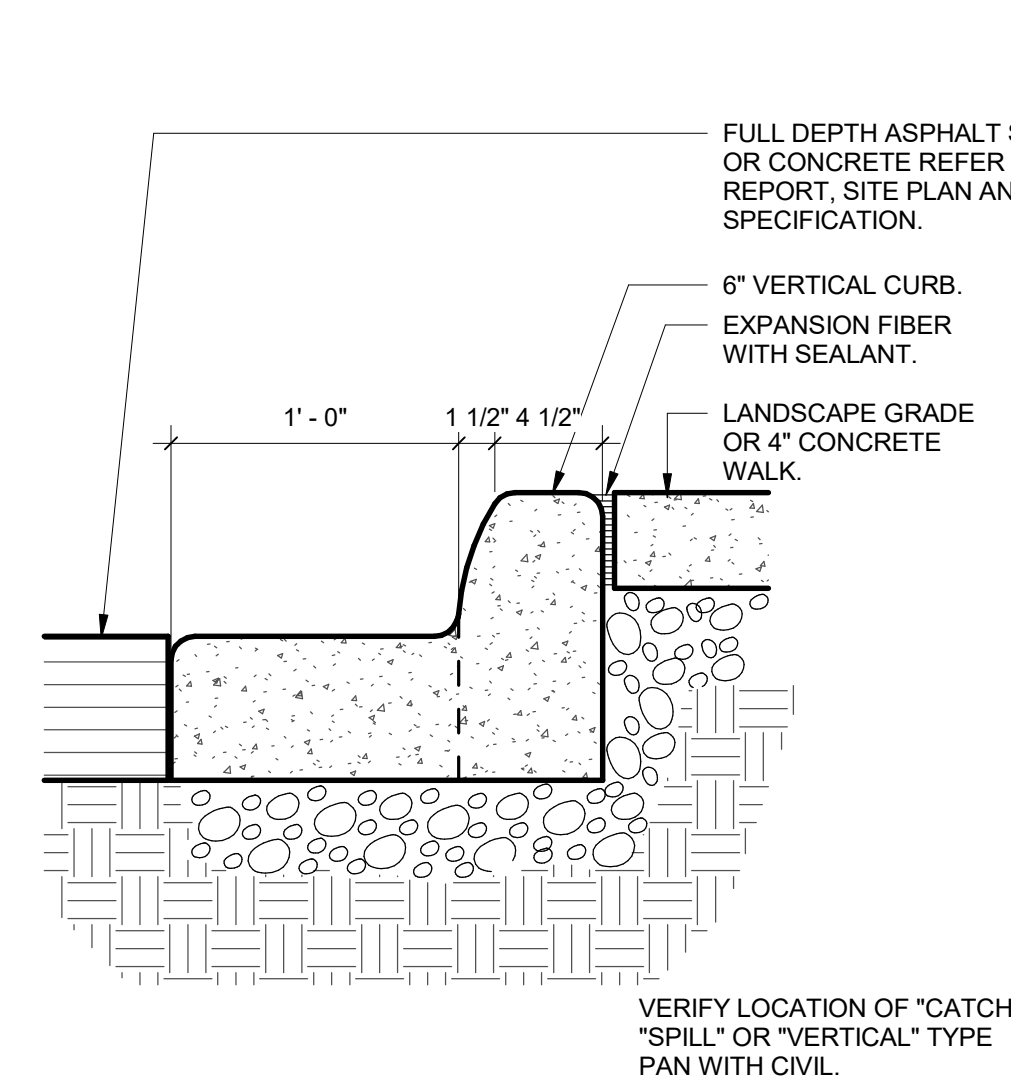
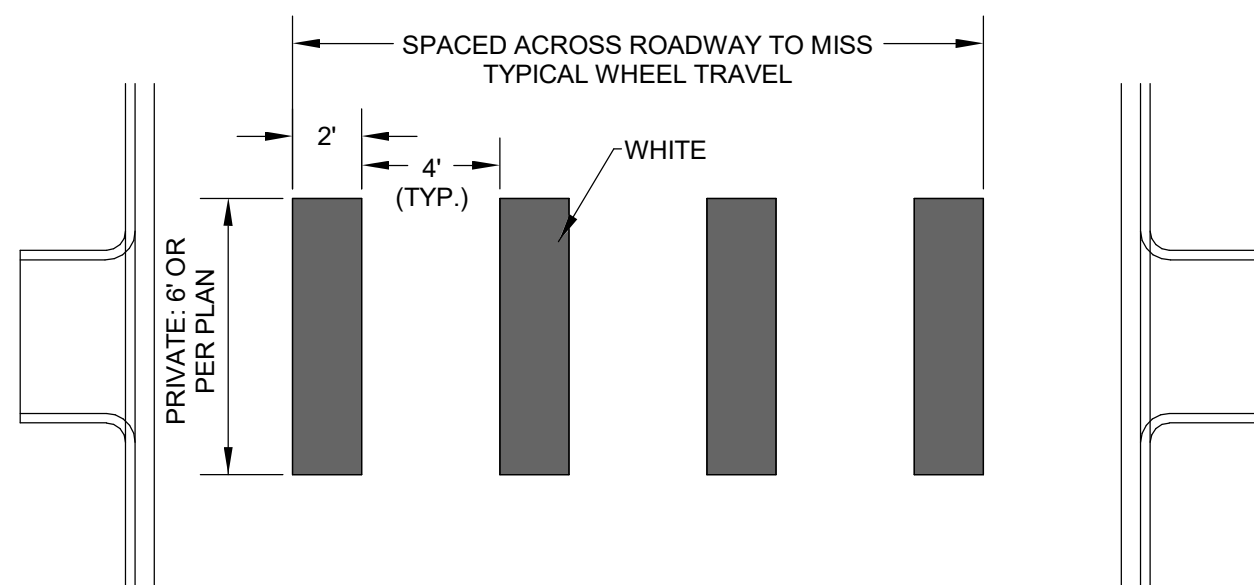
SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

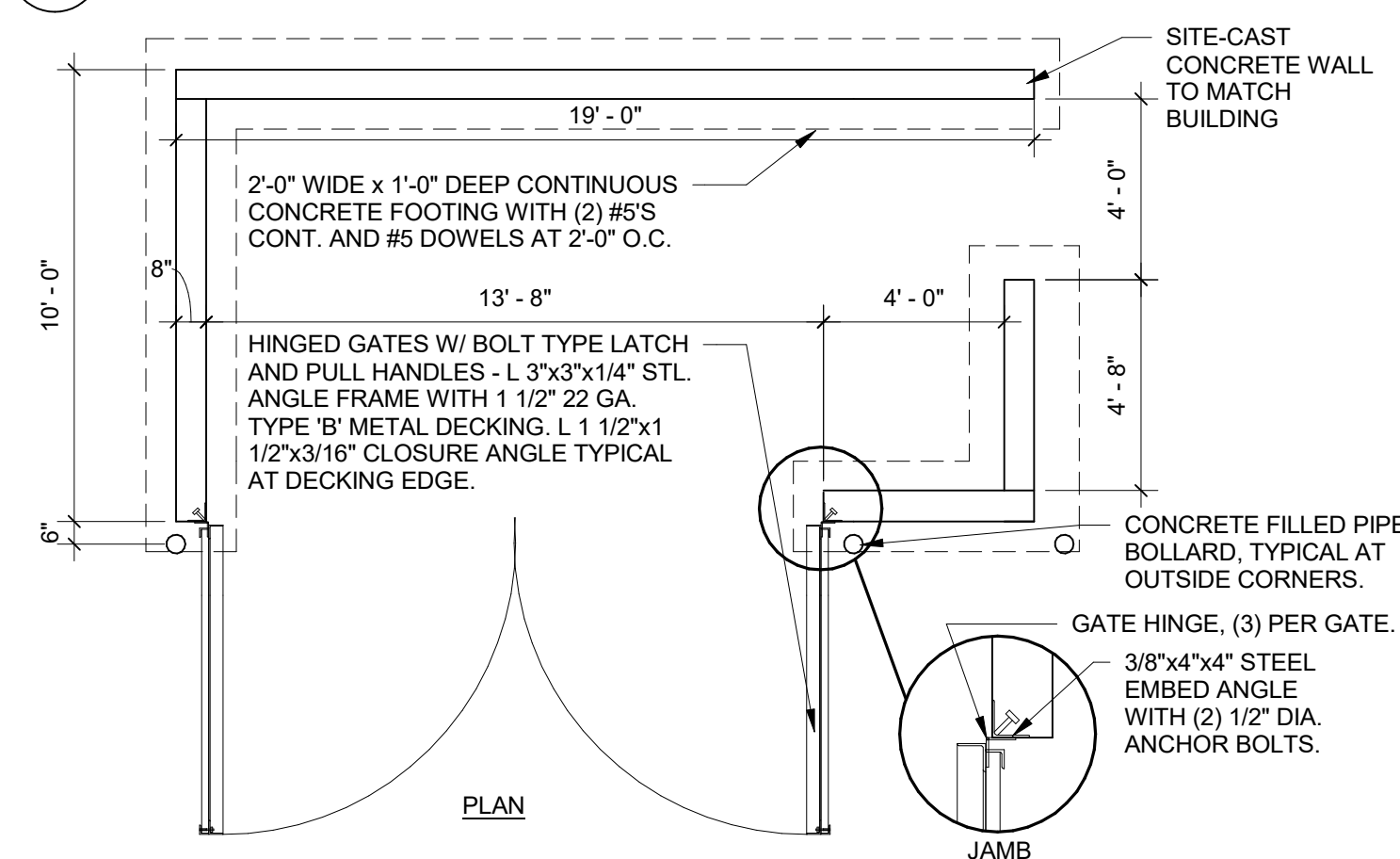
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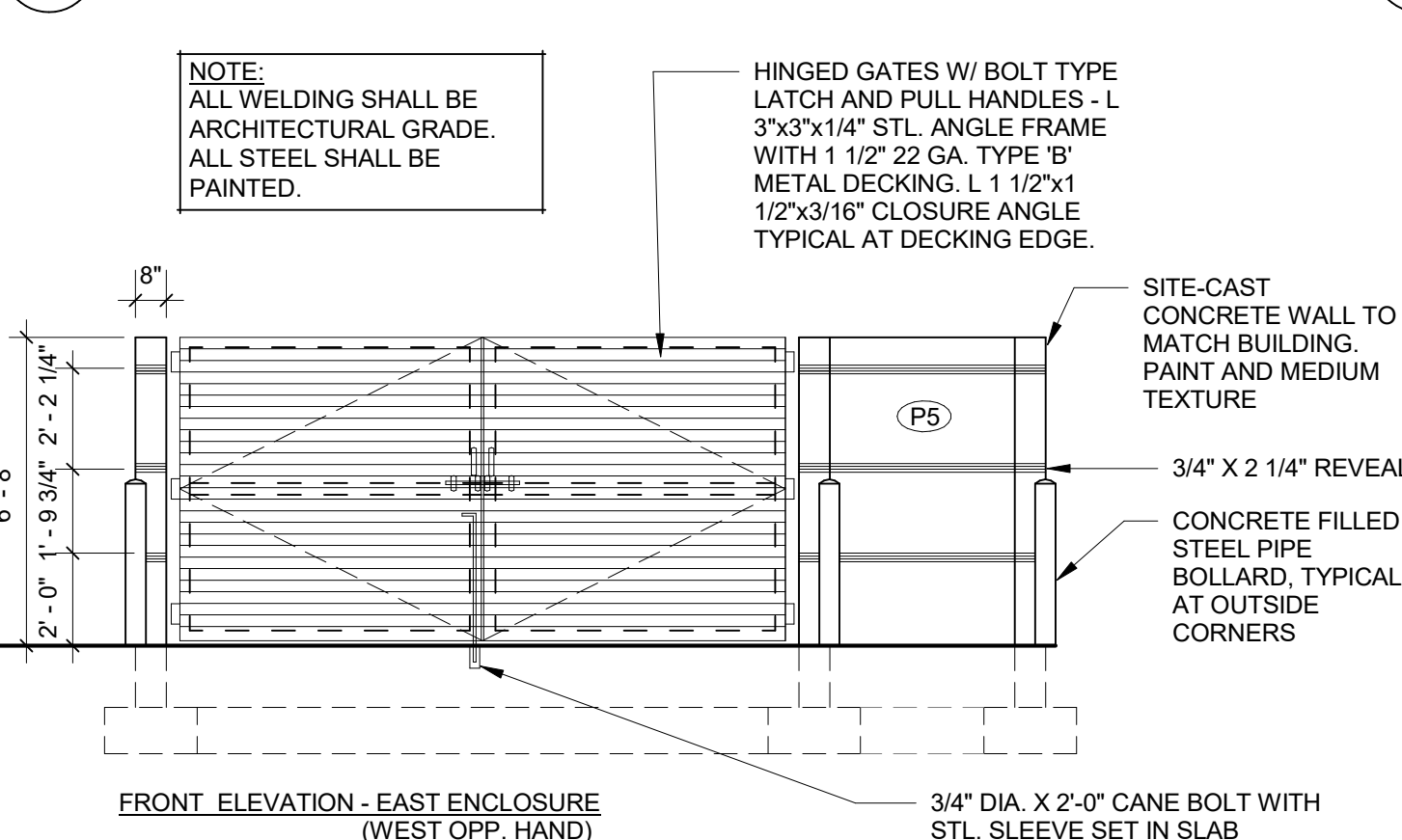
NOTE: PROVIDE HAND TOOLED TRANSVERSE & LONGITUDINAL CONTRACTION JOINTS @ 5'-0" O.C. MAX., 3/8" EXPANSION JOINTS @ 25'-0" O.C. MAX.



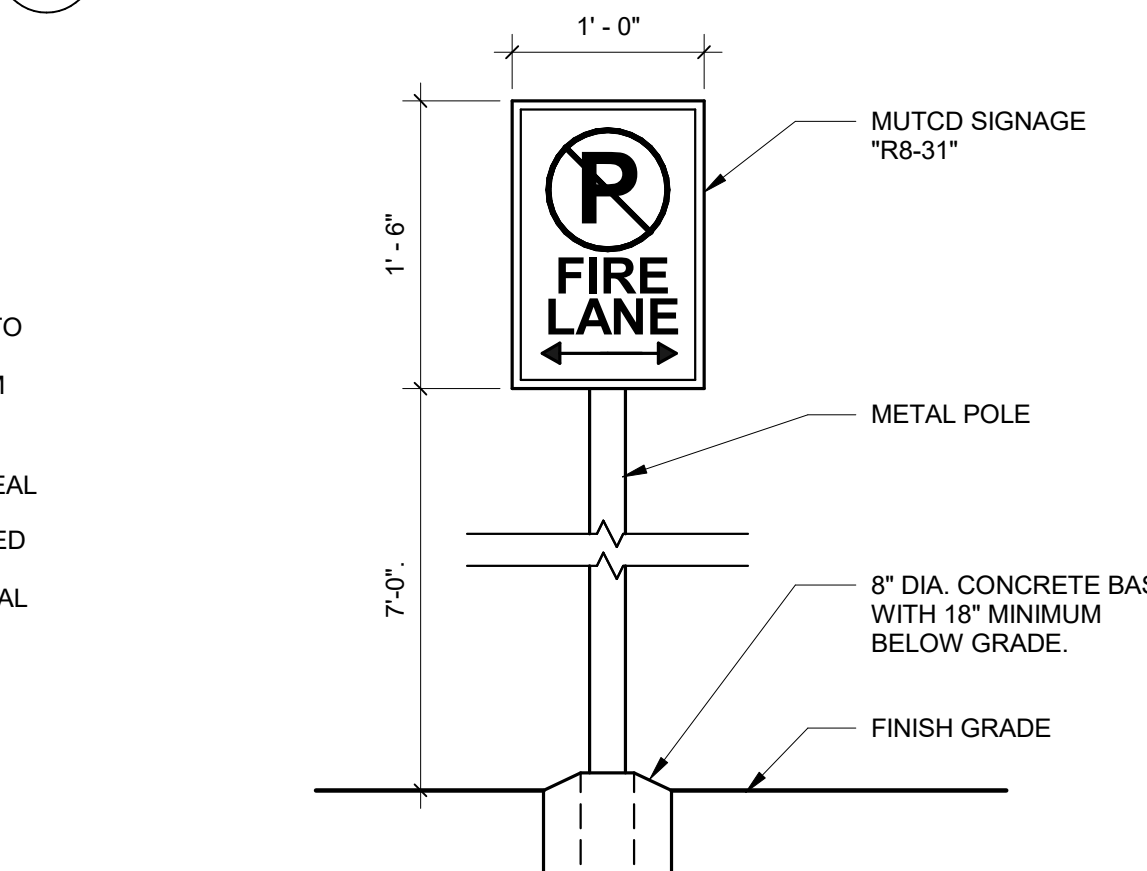
12 EXTERIOR CONC. SIDEWALK
SCALE: 1" = 1'-0"



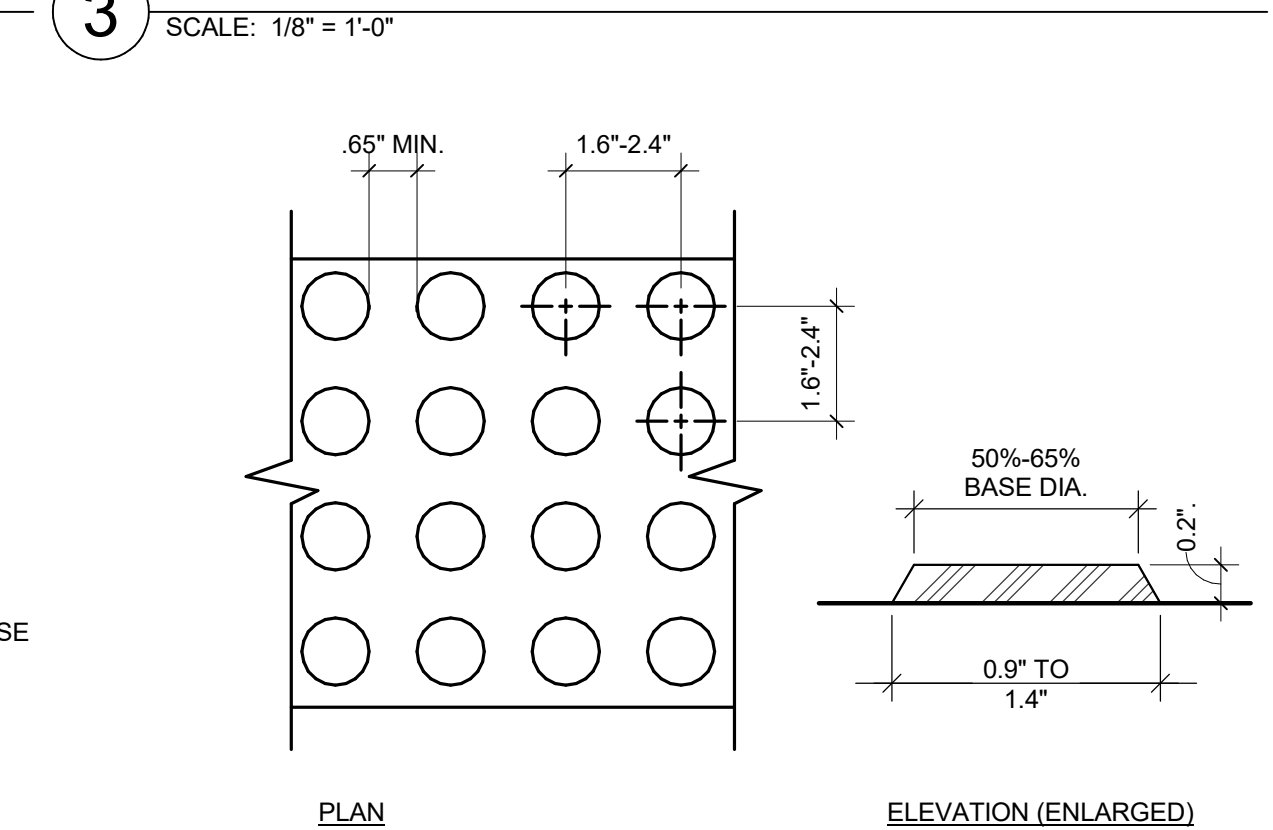
9 CROSS WALK STRIPING DETAIL
SCALE: 12" = 1'-0"



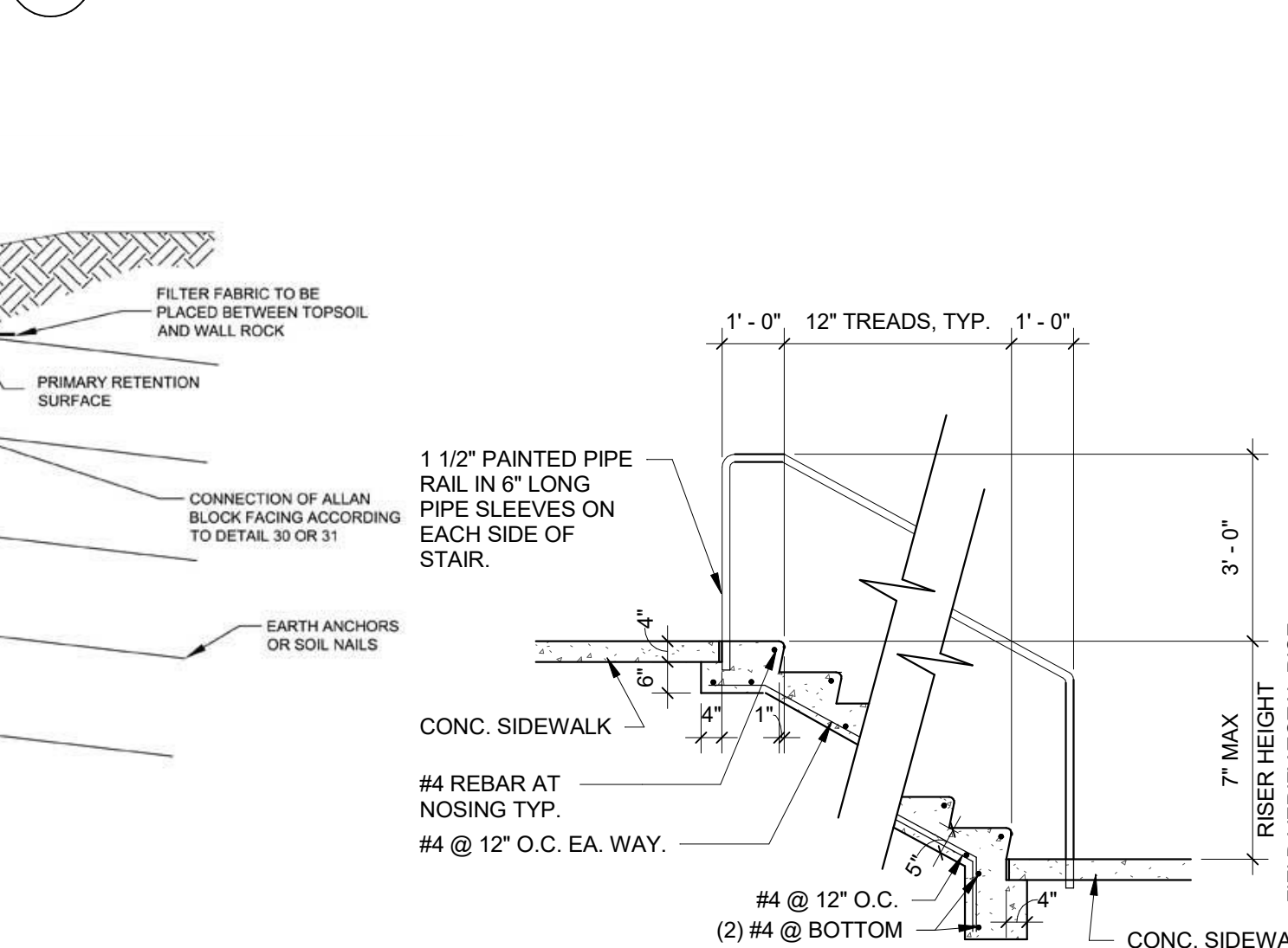
6 CURB DETAIL
SCALE: 1 1/2" = 1'-0"



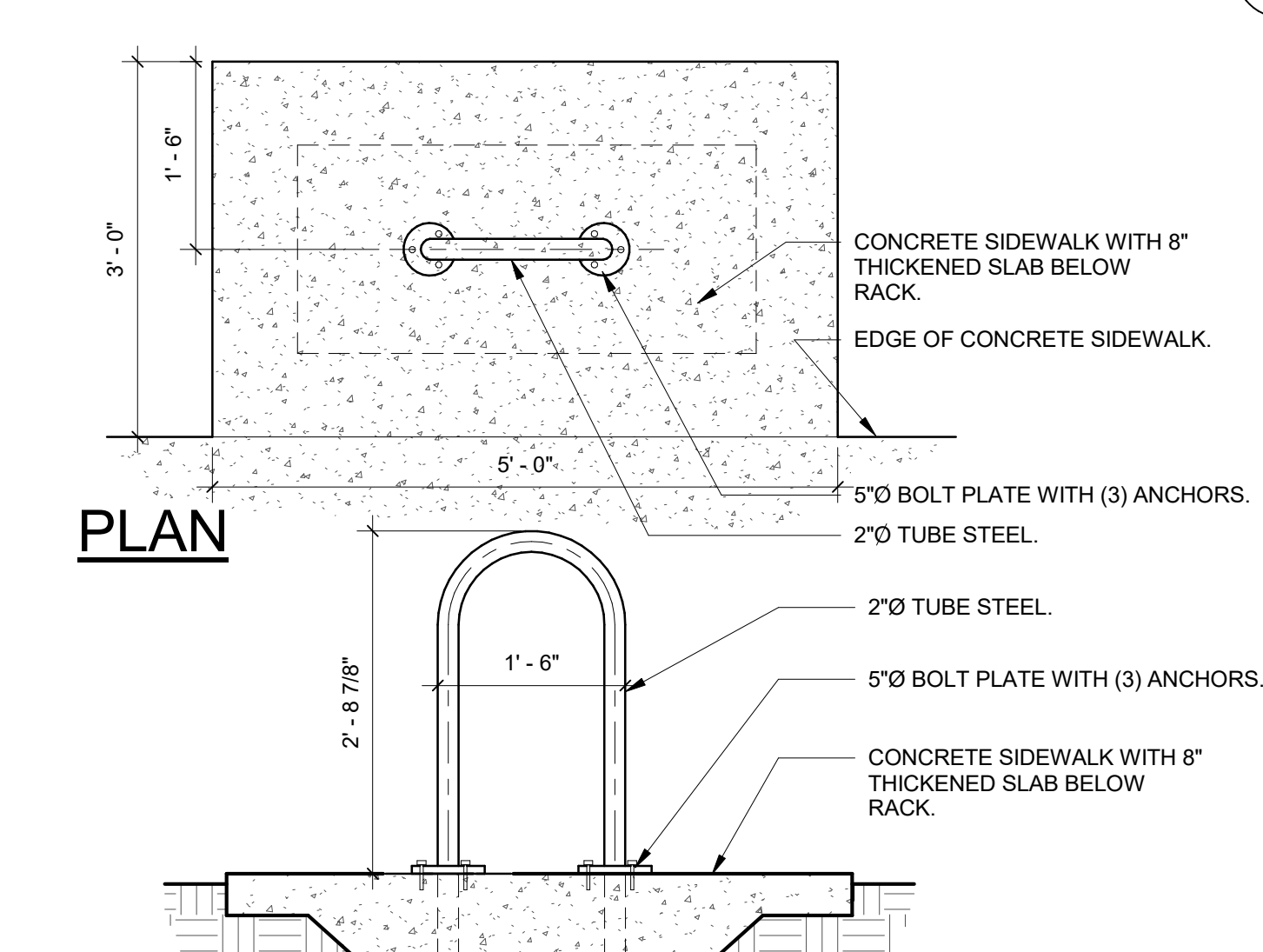
3 ACCESSIBLE PARKING ENLARGED PLAN
SCALE: 1/8" = 1'-0"



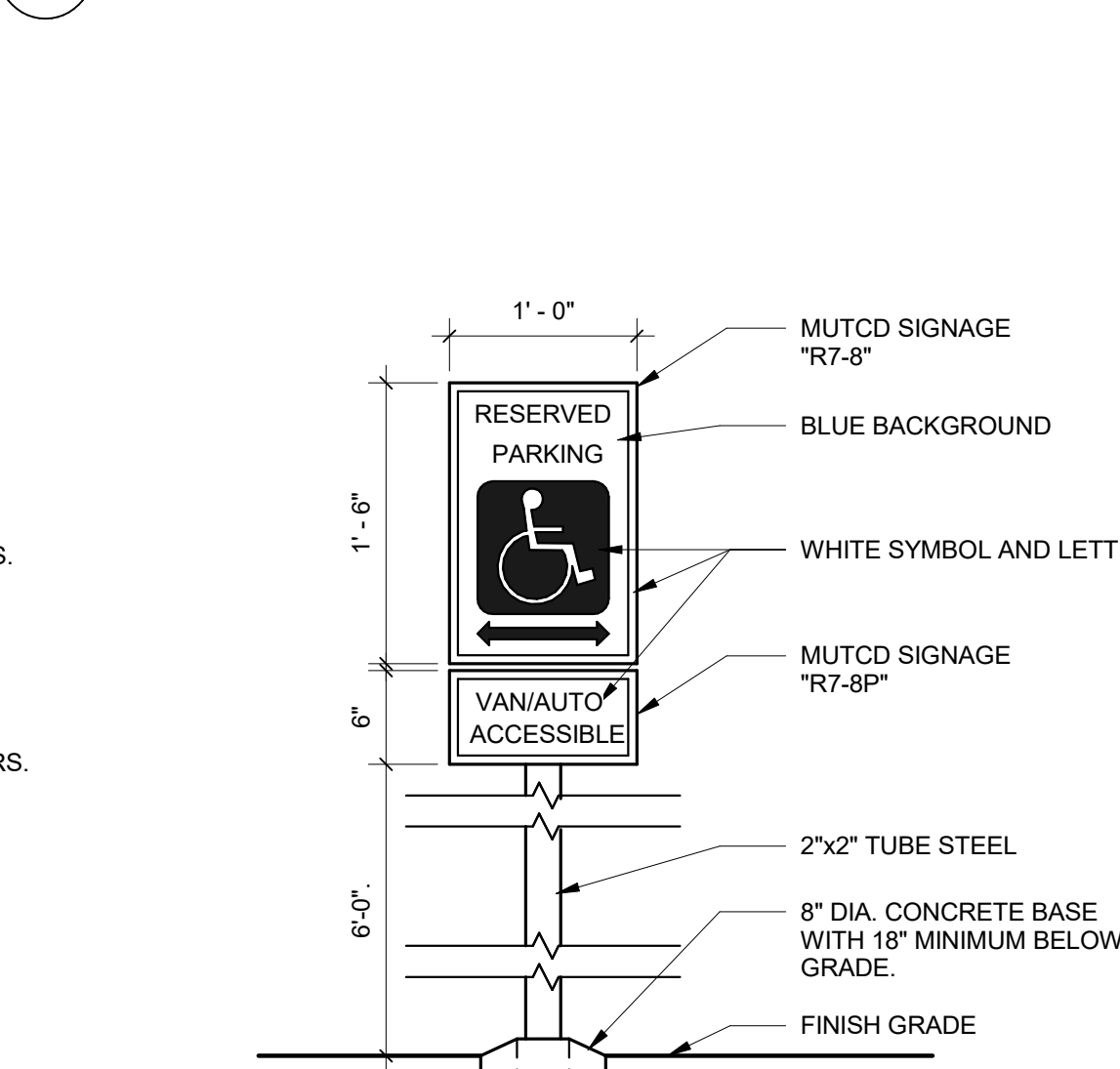
11 TRASH ENCLOSURE DETAIL
SCALE: 1/4" = 1'-0"



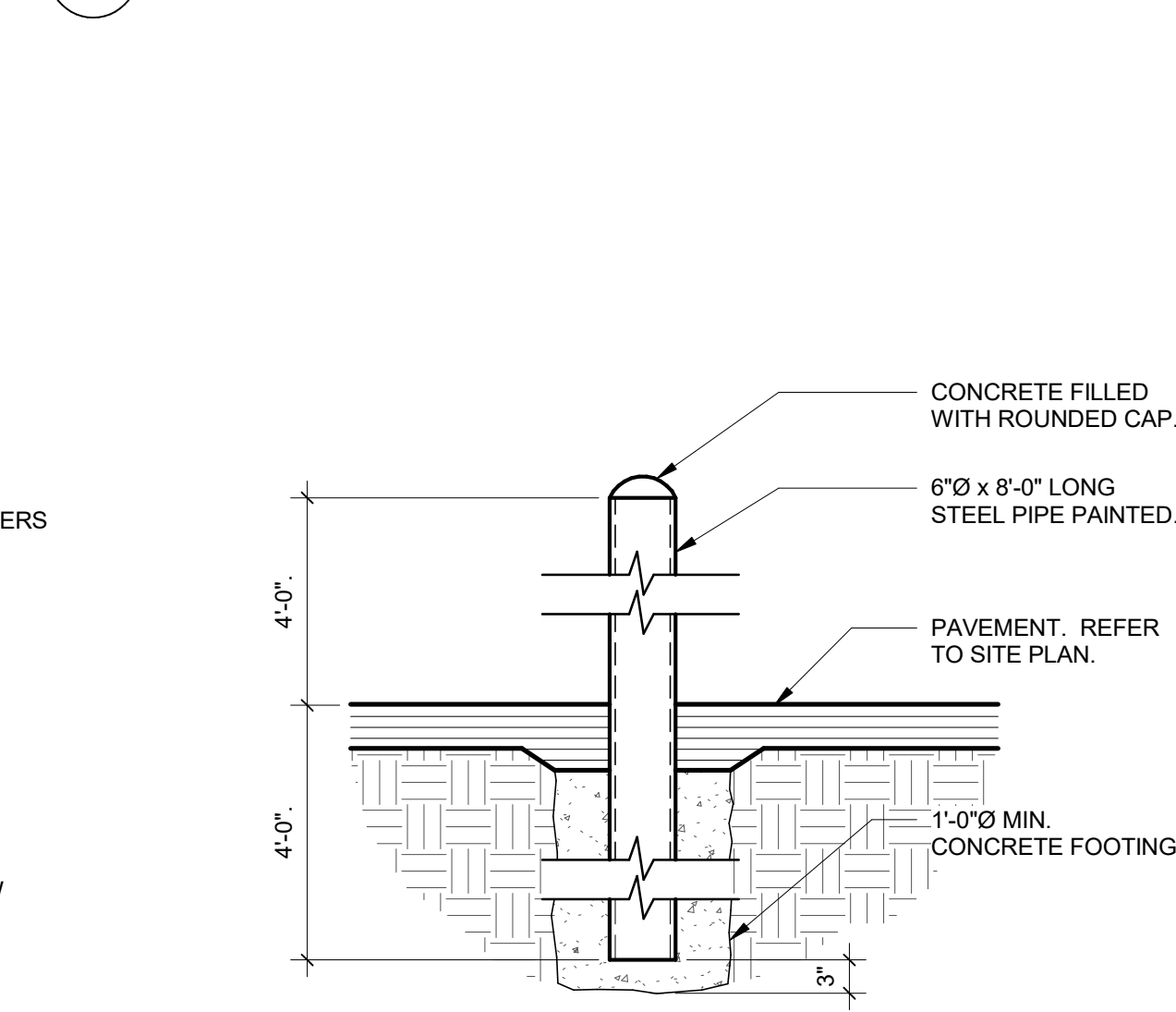
9 CROSS WALK STRIPING DETAIL
SCALE: 12" = 1'-0"



5 FIRE LANE SIGN DETAIL
SCALE: 1" = 1'-0"



2 TRUNCATED DOME SIZING & SPACING
SCALE: 3" = 1'-0"



13 SEGMENTED BLOCK RETAINING WALL
SCALE: 3/4" = 1'-0"



10 LANDSCAPE STAIR DETAIL
SCALE: 3/8" = 1'-0"



7 BIKE RACK DETAIL
SCALE: 3/4" = 1'-0"



4 HC PARKING SIGN
SCALE: 1" = 1'-0"



1 BOLLARD DETAIL
SCALE: 3/4" = 1'-0"



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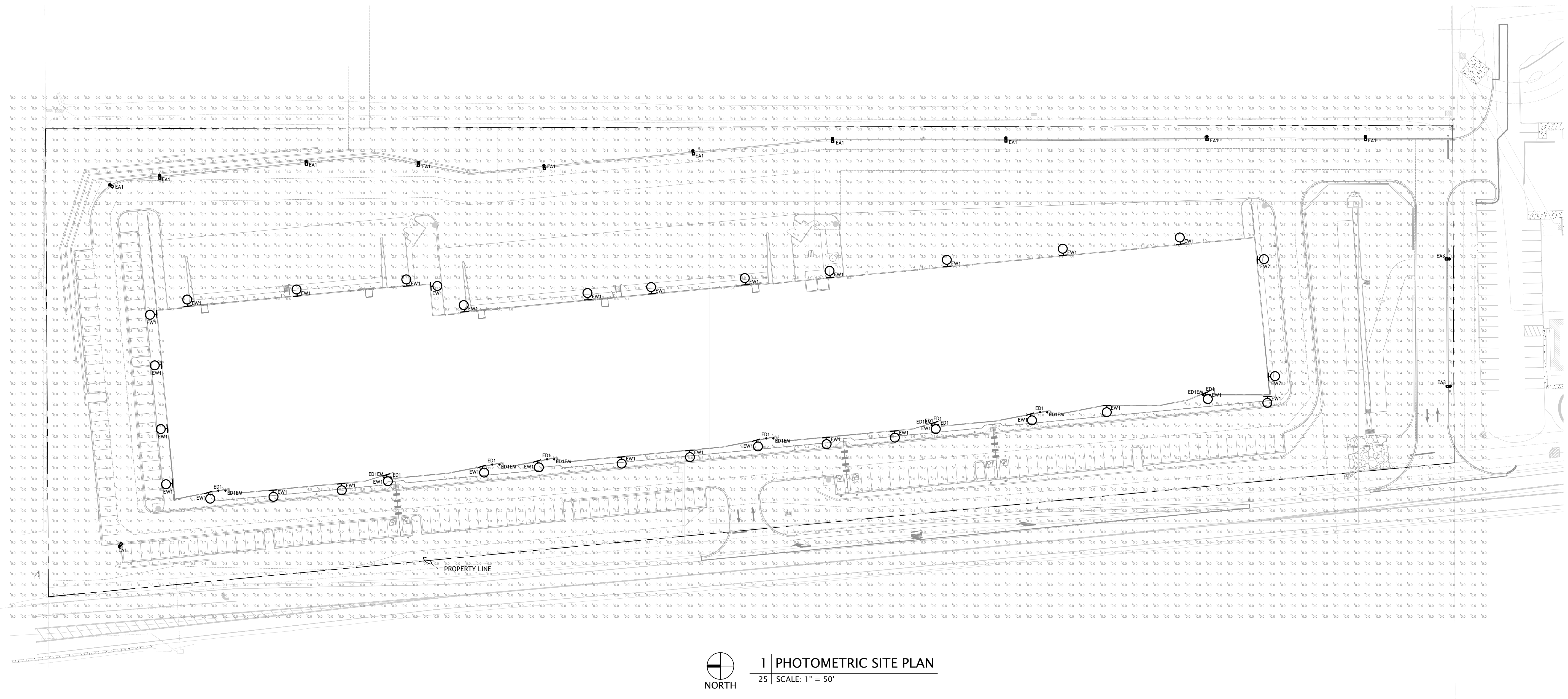
INTERGROUP

ARCHITECTS

SITE DEVELOPMENT PLAN

THE ROCK COMMERCE CENTER

A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO



NORTH

1	PHOTOMETRIC SITE PLAN
25	SCALE: 1" = 50'

REVISIONS		
BY	DATE	DESCRIPTION
	10/23/23	RESUBMITTAL

RAWN
HJ, HK

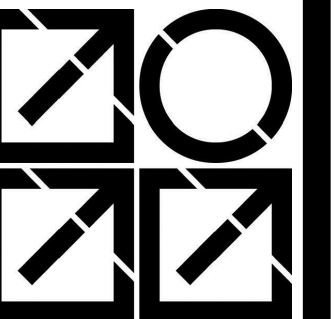
HECKED
EDR

DESIGNED
HJ, HK

LENAM
PPR2329

SITE DEVELOPMENT PLAN THE ROCK COMMERCE CENTER

PHOTOMETRIC SITE PLAN



INTERGROUP
ARCHITECTS

- architecture
- planning
- interiors

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6411.00

AS SHOWN

07/28/2023

SHEETS	SHEET
20	10

20 | 19

AE DESIGN
Integrated Lighting, Technology, and Electrical Solutions
1900 Wazee Street #205 | Denver, CO 80202 | 303.296.3034
aedesign-inc.com Project #: 6411.00

PCD FILE NO: PPR2329

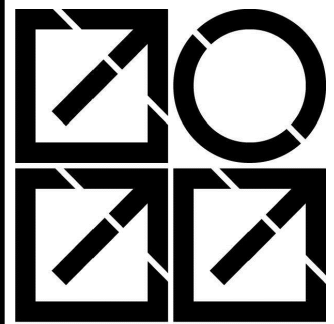
A PORTION OF THE SOUTHWEST QUARTER OF THE NORTHWEST QUARTER OF SECTION 11,
TOWNSHIP 11 SOUTH, RANGE 67 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
COUNTY OF EL PASO, STATE OF COLORADO

REVISIONS		
BY	DATE	DESCRIPTION
	10/23/23	RESUBMITTAL

HJ, HK
FILENAME

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PHOTOMETRIC DETAILS



■ architecture
■ planning
■ interiors

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20 | 2



ABBREVIATIONS: BOF - BOTTOM OF FIXTURE, RFD - RECESSED FIXTURE DEPTH, OFH - OVERALL FIXTURE HEIGHT, AFF(AFG) - ABOVE FINISHED FLOOR (GRADE), WFD - WALL FIXTURE DEPTH

A. ALL REFLECTOR LAMPS SHALL BE PROVIDED AS WIDE FLOOD DISTRIBUTION, VON.
B. LUMENS LISTED ARE DELIVERED LUMENS, NOT INITIAL.
C. FOR ALL SPECIFIED LUMINAIRES, THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL MOUNTING HARDWARE, ACCESSORIES, COMPONENTS, LEADER/JUMPER CABLES, WIRE FEED, CONNECTORS, END CAPS, REMOTE POWER SUPPLIES, AND ANY OTHER NECESSARY COMPONENT AS REQUIRED FOR INSTALLING A SECURE AND FULLY FUNCTIONAL SYSTEM.
D. ALL FINISH SELECTIONS SHALL BE VERIFIED BY ARCHITECT/INTERIOR DESIGNER/OWNER AS PART OF THE SUBMITTAL PROCESS. UNLESS OTHERWISE NOTED, EC SHALL ASSUME STANDARD LUMINAIRE FINISH OPTION FOR PRICING.
E. EC SHALL VERIFY ALL FIXTURE MOUNTING HEIGHTS WITH ARCHITECTURAL ELEVATIONS PRIOR TO ANY ROUGH-IN.
F. EXTERIOR LUMINAIRES SHALL BE COLD WEATHER RATED FOR 0 DEG. F / -10 DEG. C., AND RATED FOR OUTDOOR USE.

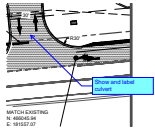
V2_Site Development Plan Comments Engr..pdf Markup Summary

Carlos (3)



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Author: Carlos
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Please see comments on TIS regarding access spacing. ECM Chapter 2 Table 2-35 access spacing is not met. Please revise access locations to meet criteria.



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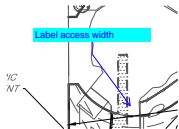
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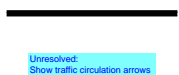
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CDurham (3)



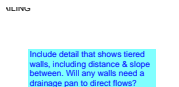
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Label access width



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Author: CDurham
Date: 11/6/2023 5:12:45 PM
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Unresolved:
Show traffic circulation arrows



Subject: Text Box
Page Label: [5] 5 OF 20 GRADING PLAN
Author: CDurham
Date: 11/6/2023 5:17:03 PM
Color: ■

Include detail that shows tiered walls, including distance & slope between. Will any walls need a drainage pan to direct flows?