January 7, 2022

Lupe Packman
El Paso County
Planning and Community Development
2880 International Circle, Suite 110
Colorado Springs, CO 80910

Re: ***Final Drainage Report, Colorado Springs Utilities Northeast Gravel Staging Area***

Dear Ms. Packman:

On behalf of Colorado Springs Utilities, Burns & McDonnell Engineering Company Inc. (Burns & McDonnell) is submitting this Final Drainage Report for the Colorado Springs Utilities (Utilities) Northeast Gravel Staging Area. It has been prepared as a submittal in accordance with the list of required documents provided by the El Paso County Planning and Community Development Department during the Pre-Application meeting for this project.

This Final Drainage Report has been prepared to present proposed stormwater management improvements associated with the development of the Northeast Gravel Staging Area, as it alters the grading and imperviousness of the site. Standards presented in the El Paso County Drainage Criteria Manual, Volumes 1 and 2 were adhered to in this Report and its analysis.

Closing
Please feel free to contact the undersigned at jllee@burnsmcd.com or 720-826-9882 should you have any questions.

Sincerely,

Joshua Lee

Joshua Lee, PE
Senior Civil Engineer

Attachments:
Attachment 1 – Colorado Springs Utilities Northeast Gravel Staging Area Final Drainage Report, Revision 1
Attachment 2 – El Paso County PCD Final Drainage Report (FDR) Checklist

9785 Maroon Circle \ Suite 400 \ Centennial, CO 80112
O 303-721-9292 \ F 303-721-0563 \ burnsmcd.com

BURNS McDONNELL

Final Drainage Report

Colorado Springs Utilities
It's how we're all connected

Colorado Springs Utilities

Northeast Gravel Staging Area
Project No. 128056
Document No. LP-PLAT-RT-0002

Revision 1
1/7/2022

PCD Filing No.: PPR-21-050

Final Drainage Report

prepared for

Colorado Springs Utilities
Northeast Gravel Staging Area
El Paso, Colorado

Project No. 128056

Revision 1
1/7/2022

prepared by

Burns & McDonnell Engineering Company, Inc.
Denver, CO

INDEX AND CERTIFICATION

Final Drainage Report

Project No. 128056

Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Colorado, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the Colorado Springs Utilities or others without specific verification or adaptation by the Engineer.

Joshua Lee

Digitally signed by Joshua Lee
DN: C=US, E=jllee@burnsmcd.com, O=Burns & McDonnell Engineering, OU=Environmental, CN=Joshua Lee
Reason: I have reviewed this document
Date: 2022.01.20 16:44:44-07'00'

Joshua Lee, PE
Senior Civil Engineer

Date: January 13, 2022

EL PASO COUNTY DRAINAGE STATEMENTS

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 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.

Joshua Lee P.E. 45206

Name

Developer's Statement

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

COLORADO SPRINGS UTILITIES

Business Name

By: CLINT BARDEN

Title: PROJECT MANAGER 1

Address: 456 W. FONTANERO ST.

COLORADO SPRINGS, CO 80907

El Paso County Statement

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.

APPROVED
Engineering Department
01/25/2022 5:02:40 PM
dsdnijkamp
EPC Planning & Community Development Department

Jennifer Irvine, P.E.

County Engineer / ECM Administrator

Conditions:

TABLE OF CONTENTS

Page No.

LIST OF TABLES

Page No.

LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
BMcD	Burns & McDonnell
CDPHE	Colorado Department of Public Health and Environment
CMP	Corrugated Metal Pipe
cfs	Cubic feet per second
EURV	Excess Urban Runoff Volume
FDR	Final Drainage Report
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Association
fps	feet per second
ft	feet
GPAP	Gas Propane Air Plant
HEC	Hydraulic Engineering Circular
MHFD	Mile High Flood District
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
SCS	Soil Conservation Service
Utilities	Colorado Springs Utilities
WQCD	Water Quality Control Division
WQCV	Water Quality Capture Volume

1.0 GENERAL LOCATION AND DESCRIPTION

This Final Drainage Report (FDR) is being prepared as part of the required submittal documents to El Paso County for the Northeast Gravel Staging Area Relocation in conjunction with the Colorado Springs Utilities (Utilities) Site Development Plan.

1.1 Site Location

The Utilities site is bounded by North Carefree Circle to the north, the Gas Propane Air Plant (GPAP) to the east, the El Paso County Department of Public Works facility to the south, and residential development to the west. The Northeast Gravel Staging Area Relocation is planned to be within the NE 1/4 of the SE 1/4 of Section 29, T13S, R65W in El Paso County, Colorado. The site is an undeveloped parcel located at 7723 North Carefree Circle, southwest of the intersection of North Carefree Circle and Akers Drive. The proposed location is just west of the Utilities' existing GPAP. A map showing the Staging Area location is provided as Figure 1 in Appendix F.

The Staging Area is located within a RR-5 (residential rural 5-acres intended to accommodate low-density, rural, single family residential development) CAD-O (commercial airport overlay district) zoned area of the City of Colorado Springs. The surrounding platted developments include The Gardens at North Carefree Circle (Plat No. 14488) to the west and a storage warehouse (Plat No. 2510) to the southeast of the site.

1.2 Description of Property

1.2.1 Existing Site

The proposed Staging Area is located on a 9.58-acre parcel owned by City of Colorado Springs. The parcel is undeveloped with a ground cover consisting of rangeland grass. No groundwater characterization has been accomplished to date. Stormwater features constructed in 1996 were constructed to capture the flows from the western portion of the GPAP site and the property on which the Staging Area will be built. The features constructed included a detention pond in the northeast part of the GPAP property and berm running north and south along the western boundary of the GPAP property. The work also included the construction of a concrete lined channel to collect and convey flows from the western portion of the GPAP site to the detention pond. Figure 2 in Appendix F show the existing stormwater features.

1.2.2 Existing Site Drainage

Topographic data consisting of 2-foot contours was used as a basis of analysis for the project and shows the site sloping west to east ranging from 0-4 percent. Offsite flows are shown on Figure 2 in Appendix F. A portion of flows from the western portion of the site flow west toward Akers Drive. Flows from the majority of the site are captured by the berm along the eastern boundary and are conveyed to an 18-inch corrugated steel culvert that discharges through the berm into the existing detention pond. According to the details on Figure 2, the existing detention pond has a bottom elevation of approximately 6569 and a depth of approximately ten feet. An elliptical 18-inch by 29-inch corrugated steel outlet pipe was installed to discharge flows from the detention pond to the existing GPAP retention pond.

1.2.3 Natural Resources Conservations Service (NRCS) Soil Survey

Soil data was obtained from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) website – Web Soil Survey Tool. The site soil is Truckton sandy loam which is classified under Hydrologic Soil Group (HSG) A. This soil exhibits low runoff rates and high infiltration rates. The NRCS soil survey report for the project area is provided in Appendix A.

Table 1-1: NRCS Soil Report Summary

Soil Type	Map Unit Symbol	Hydrologic Soil Group
Truckton sandy loam, 3 to 9 percent slopes	97	A

1.2.4 Project Description

Utilities is expanding the existing Briargate substation, located at the John Pinkerton site (East Woodmen Road and North Powers Blvd.), into the adjacent parcel that currently contains Utilities' Northeast gravel staging area. As a result of the substation expansion, Utilities is looking to relocate the Staging Area. The relocated Storage Area will include grading and surfacing of the north 5 acres of the parcel to accommodate the storing of material. Other improvements include the installation of a 7-foot chain link fence, a new asphalt driveway and tracking pad, a new gate, and a new scale and scale house. Excess material from the site grading will be used for the creation of a berm along the north and west side of the site. The new driveway will come off the existing driveway for the GPAP. The post-development conditions are shown on Figure 3 in Appendix F.

2.0 DRAINAGE BASINS AND SUB-BASINS

2.1 Major Basin Descriptions

The project area is within the Sand Creek (FOFO4000) El Paso County drainage basin. The basin slopes from north to south with flow eventually draining into the Sand Creek Main Stem. The average channel slope is approximately 1.5 percent.

The Sand Creek Drainage Basin Planning Study (Stantec, HDR and Dewberry, 2021) stated that the basin is heavily impacted by sedimentation. The project location, however, is not within any areas of concern for the basin. Recommendations provided in the drainage basin planning study include maintaining current reach improvements. No specific improvements will be required for this development.

Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Map No. 08041C0543G for El Paso County, Colorado, Effective Date December 7, 2018, the development is located within Zone X. Zone X is an area of minimal flood hazard. The flood hazard map is provided in Appendix B.

2.2 Sub-Basin Descriptions

Pre-development drainage, within the project area, flows from west to east toward an existing swale just outside the east property line. Flow is then conveyed from the property into an existing 18-inch culvert and into an existing detention pond on the adjacent parcel. As described in Section 1.2.3, the basin is HSG Type A soil, with primarily native vegetation ground cover. These conditions create low runoff potential and high infiltration rates.

The detention pond is a part of a stormwater facility that handles flows from the western portion of the GPAP property. Flows from the western area of the GPAP property are captured and conveyed by a concrete flow pan extending from the southern portion of the site to the pond. Based on the existing drainage design shown in Figure 2 of Appendix F the pond capacity is approximately 24,667 cubic feet at a depth 10-feet. The pond is lined with 12-inches of rip rap and discharges flows through an 18-inch x 29-inch elliptical pipe to the retention basin in the GPAP active area. The active areas of the GPAP facility are bounded by rectangular concrete ditches that collect flows and convey them to a lined retention pond. Pre-development drainage patterns and the culvert location are shown on Figure 2 in Appendix F.

3.0 DRAINAGE DESIGN CRITERIA

3.1 Development Criteria Reference

The design criteria for the proposed drainage system for the CSU Northeast Gravel Staging Area are in accordance with El Paso County's *Drainage Criteria Manual, Volumes 1 and 2* (El Paso County 1994, 2002). Criteria from the Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM), Volume 2 was also utilized in the design of the proposed drainage system. The Sand Creek Drainage Basin Planning Study was also referenced while developing the drainage plan for CSU. Based on the Project location in a Type 1 – improved – no modelled problems area, recommendations were to maintain current improvements.

3.2 Hydrologic Criteria

Hydrologic calculations used in the analysis presented in this drainage report can be found in Appendix C. Peak runoff rates for the existing conditions 5-year and 100-year storm events are shown on Figure 2 in Appendix F and were found to be reasonable as the site conditions have not changed. Therefore, the 100-year design flow rates from Figure 2 is considered the pre-development flow rates for the project. To evaluate the existing culvert a 10-year pre-development flow rate was calculated. Flow rates were calculated for the post-development site conditions using the rational method option in Hydraflow Hydrographs extension of Autodesk Civil 3D. Time of concentration for the basin was calculated using Technical Release 55 (TR55) within the Hydrographs program. Runoff coefficients used in the calculations were obtained from Table 6-6 of the El Paso County Drainage Criteria Manual, Volume 1. Rainfall depths were sourced from Table 6-2 of the El Paso County Drainage Criteria Manual, Volume 1 and are shown below in Table 3-1.

Table 3-1: Rainfall Depths for Colorado Springs

Duration	Average Recurrence Interval (Years)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
1-Hour	1.19	1.50	1.75	2.00	2.25	2.52
6-Hour	1.70	2.10	2.40	2.90	3.20	3.50
24-Hour	2.10	2.70	3.20	3.60	4.20	4.60

3.3 Hydraulic Criteria

As described above the Staging Area will be constructed in an area that has existing stormwater controls to capture, convey, and store the stormwater runoff from the project. The existing detention basin and retention basin will control 100 percent of the runoff from the project. The controls hydraulic

performance will be evaluated using the post-development flow rates from the project to verify the capacity to accommodate the increased flows. Proposed soil disturbance is approximately 4.40 acres.

3.4 Water Quality Management

To verify compliance with the County's criteria and promote enhanced water quality in stormwater leaving the site, Best Management Practices (BMP's) were utilized. A Four-Step Process for water quality control BMP selection is provided in Appendix I of the El Paso County Engineering Criteria Manual (El Paso County, 2016). The Four-Step Process was adhered to in the drainage design and is discussed below.

3.4.1 Water Quality Control BMP Selection

3.4.1.1 Employ Runoff Reduction Practices

The first step of the BMP selection process is to reduce runoff from the proposed facility by reducing impervious areas to the extent practicable and routing runoff from impervious spaces over grass-lined areas. The proposed drainage design does increase impervious land cover. To counteract this change, the site drainage is directed into grass swales to promote infiltration prior to entering the existing culvert.

3.4.1.2 Stabilize Drainageways

The second step of the BMP selection process is to choose appropriate stabilization methods for existing and new drainageways to prevent erosion. No new drainageways are included in the construction of the Staging Area. The Staging Area is being constructed at the top of the drainage basin and existing vegetated swales will remain in place for receiving runoff from the new gravel area.

3.4.1.3 Provide Water Quality Capture Volume (WQCV)

In accordance with Section I.7.1C of Appendix I of the El Paso County Engineering Criteria Manual, the drainage basin that contains the new Staging Area is required to meet the "base design standard". Although the existing detention basin is already present on site and receives runoff from the tributary area, it does not provide any treatment for the WQCV. The inlet of the discharge pipe from the detention pond is placed 2-feet above the bottom of the pond to accommodate a water quality volume. The grass buffer between the new Staging Area and existing culvert will also aid in water quality by reducing runoff discharging to the existing pond. Runoff reduction calculations were completed to evaluate the grass buffer downstream of the new impervious area. Based on calculations the WQCV is reduced by 88% by the grass buffer. The runoff reduction calculations are included in Appendix D. The balance of the WQCV will be treated by the detention basin.

3.4.1.4 Consider Need for Industrial and Commercial BMPs

In accordance with Appendix I of the El Paso County Engineering Criteria Manual, the need for specialized BMPs must be considered if redevelopment activity will be significant. Due to the nature of the construction activities taking place on the project area, no specialized BMPs will be required.

4.0 DRAINAGE FACILITY DESIGN

4.1 General Concept

The relocated Storage Area will include grading and surfacing of the north 5 acres of the parcel to accommodate the storing of material. Excess material from the site grading will be used for the creation of a berm along the north and west side of the site. The berm will not change existing drainage patterns significantly, it will only increase the barrier between the west bordering property, further decreasing the possibility of offsite flow onto the project. There is no change in site outfall overall, even though there is an increase in impervious landcover and changes in slope. The drainage into the existing detention pond will increase but will be mitigated using a grass swale. As described above the grass buffer between the new impervious area and the detention pond will reduce the WQCV. The existing swale discharging into the existing culvert has sufficient capacity to convey the additional flows created by the new impervious area. During construction activities, no special measures will be taken to prevent additional runoff from the site. There will be an adherence to the current Site SWMP plan to prevent any additional flow.

4.2 Existing Drainage Patterns

Table 4-1 – Predevelopment Hydrologic Conditions, shown below, provides a summary of the predevelopment runoff calculations included in Appendix C and shown on Figure 2 in Appendix F.

Table 4-1: Pre-Development Hydrologic Conditions

Minor Drainage Basin	Runoff Coefficient 10-year [1]	Runoff Coefficient 100-year	Area (Acres)	Time of Concentration, T_c	10-Year, 24-Hour Flow [2] (cfs)	100-Year, 24-Hour Flow [3] (cfs)
EX-1	0.35	--	6.43	23	7.4	10.7
EX-2	0.35	--	3.58	21	4.5	6.4

[1] – Runoff coefficients chosen to achieve flow rates equal to those shown on Figure 2 of Appendix F then used to calculate to 10-year rates.

[2] – 10-year flow rates calculation in Appendix C.

[3] – 100-year flow rates from previous design shown in Figure 2 of Appendix F.

4.3 Improvements Analysis

The drainage patterns in the post development condition will remain like the pre-development condition with runoff flowing east toward the existing swale and culvert along the eastern boundary. The berm along the north and west boundary will create a drainage divide between the project site and adjacent property. The addition of the gravel surface and decrease in the vegetative cover will increase the imperviousness of the site. The proposed condition C-values were weighted based on the new gravel surfacing and remaining vegetated areas. Rational method calculations for the post-development

conditions are included in Appendix C and summarized below in Table 4-2 - Post-Development Hydrologic Conditions.

Table 4-2: Post-Development Hydrologic Conditions

Minor Drainage Basin	Runoff Coefficient 10-year	Runoff Coefficient 100-year	Area (Acres)	Time of Concentration, T_c	10-Year, 24-Hour Flow (cfs)	100-Year, 24-Hour Flow (cfs)
PD-1	0.34	0.49	8.21	22	9.4	19.3
Pond Inflow[1]	--	--	11.79	--	13.6	25.5

[1] – Pond Inflow represents all flows to pond from combined hydrographs for EX-2 and PD-1.

4.4 Hydraulic Structures

The existing swale adjacent to the new impervious area that conveys flows to the existing culvert will be used handle the post-development flows. The post-development 100-year flow results in a flow depth of 0.49 feet and a velocity of 4.22 feet per second. The established vegetation in the swale is sufficient to control erosion and no additional stabilization of the swale is needed. Calculations for the existing swale are located in Appendix D.

The analysis of the existing 18-inch culvert includes post-development flows for the 10-year flow storm event. The analysis shows the culvert has the capacity to convey the post-development 10-year storm in an inlet condition with the headwater depth of approximately 2.3 feet. In the event of a 100-year storm in the post-development condition flows would be conveyed by the culvert and would most likely flow around the northern end of the berm and sheet flow toward the GPAP where it would be captured by the concrete ditches and routed to the retention pond. Calculations for the existing culvert are provided in Appendix D.

4.4.1 Detention Pond

The post-development flows from the site and the offsite area will be conveyed to the existing detention pond. The pond has a footprint of roughly 5,000 square feet measured at the top of the pond, which is at elevation 6579, and a volume of 24,667 cubic feet. Based on visual inspection, the existing detention pond appears to have sufficient capacity and no additional maintenance will be required. The existing detention pond is partially lined with rip rap and has some vegetation, so a negligible amount of stormwater will be lost to infiltration and therefore not discharged from the pond. For purposes of the calculations, the loss to infiltration is ignored and the full volume is analyzed for detention. The existing pond is sufficiently sized to hold the 100-year, 24-hour storm event even with the increase in post-

development runoff from pre-development conditions. The drainage area for the detention pond includes basins PD-1 and EX-2 (11.79 total acres). The 100-year storage volume is based on a peak inflow, calculated by the Hydraflow Hydrographs software, of 25.5 cfs and results in maximum storage volume of 6,324 cubic feet at an elevation of 6573.39.

The existing 18-inch x 29-inch elliptical CMP will be maintained as the outlet pipe for the detention pond. The discharge pipe is capable of conveying the increased runoff from the 10-year and 100-year storm events from the Staging Area project. Appendix D contains the hydraulic calculations for the culvert, detention pond, and discharge pipe.

4.4.2 Cost Estimate of Proposed Facilities

The cost estimate for all proposed facilities associated with the Staging Area is included in Appendix E.

4.4.3 Cost of Drainage and Bridge Fees

Drainage fees for the project area as of 2021 are $20,387. Bridge fees as of 2021 are $8,339.

4.5 Other Government Agency Requirements

Construction activities involved with the CSU Northeast Gravel Staging Area relocation are also governed by the Colorado Department of Public Health (CDPHE) Water Quality Control Division (WQD).

5.0 CONCLUSIONS

5.1 Compliance with Standards

In review of the proposed development for the Staging Area relocation, the improvements were found to be compliant with the El Paso County Land Development Code 2016 and the Urban Drainage and Flood Control District's Urban Storm Drainage Criteria Manual (USDCM) requirements.

6.0 REFERENCES

El Paso County, 1994. *Drainage Criteria Manual Volume 1*. October.

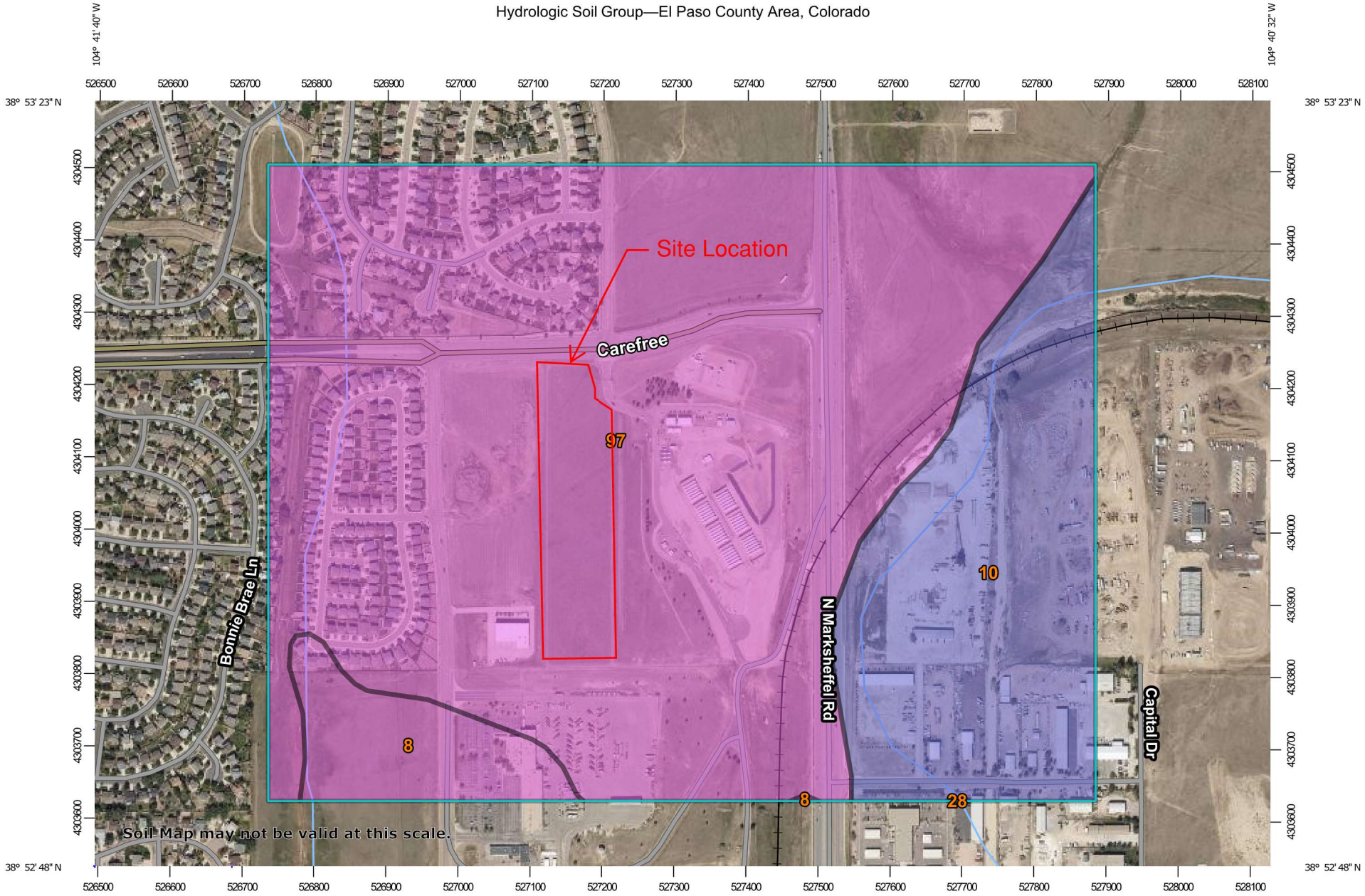
El Paso County, 2002. *Drainage Criteria Manual Volume 2.* November 1.

El Paso County, 2016. *Engineering Criteria Manual*. December 13.

GMS, 2008. *Final Drainage Report for Black Squirrel Creek Wastewater Treatment Plant*. March.

MHFD, 2010. *Urban Storm Drainage Criteria Manual, Volume 3.* November

APPENDIX A – NRCS SOILS REPORT



Map Scale: 1:7,470 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil 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 18, Jun 5, 2020

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	12.6	5.0%
10	Blendon sandy loam, 0 to 3 percent slopes	B	51.4	20.5%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	0.0	0.0%
97	Truckton sandy loam, 3 to 9 percent slopes	A	187.0	74.5%
Totals for Area of Interest			**251.1**	**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 – FEMA FLOODPLAIN MAP

National Flood Hazard Layer FIRMette

FEMA

104°41'23"W 38°53'18"N

104°40'46"W 38°52'50"N

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

1:6,000

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

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/26/2021 at 12:42 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

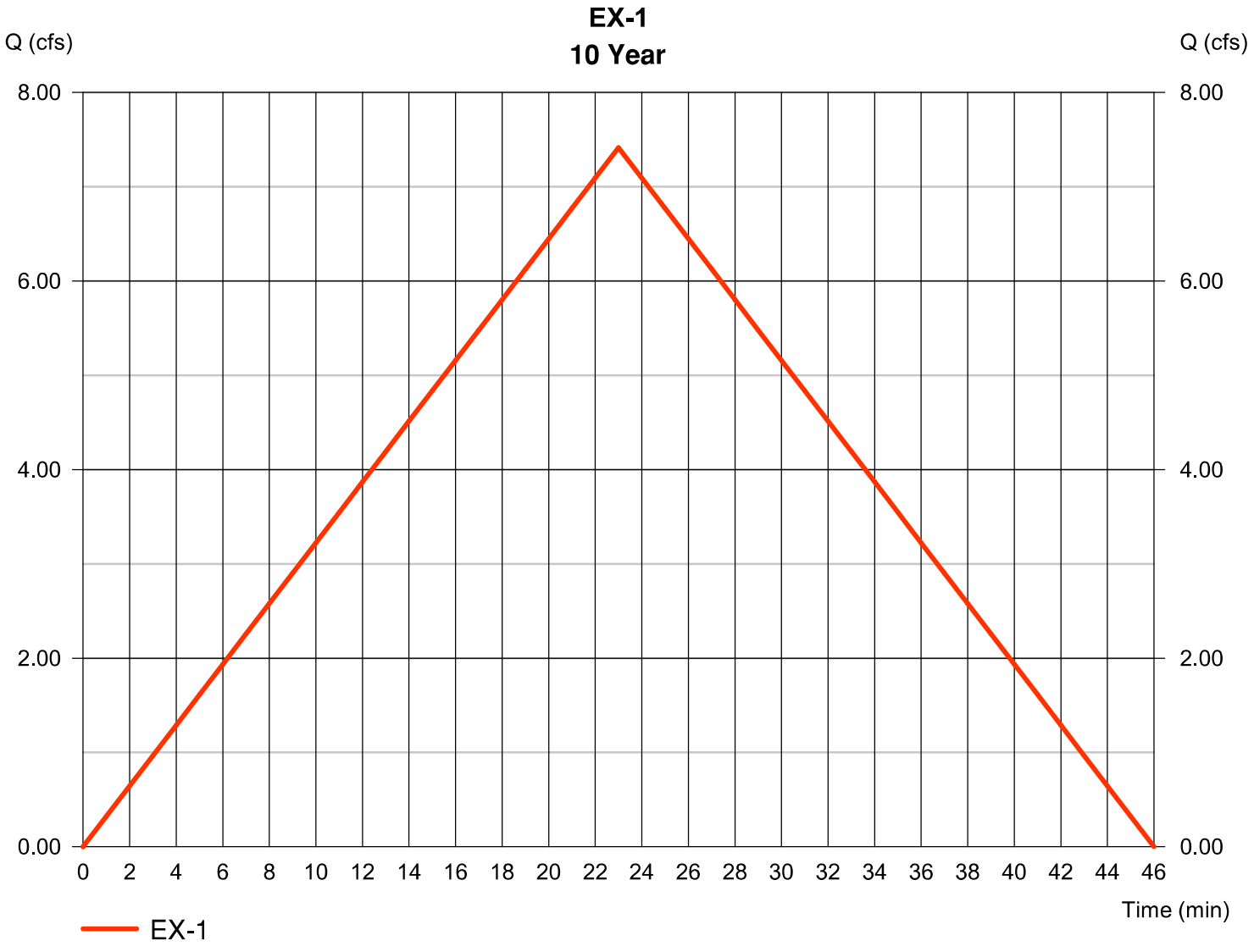
APPENDIX C – HYDROLOGIC CALCULATIONS

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

EX-1

Hydrograph type	=	Rational	Peak discharge	=	7.415 cfs
Storm frequency	=	10 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	10,233 cuft
Drainage area	=	6.430 ac	Runoff coeff.	=	0.35
Intensity	=	3.295 in/hr	Tc by TR55	=	23.00 min
IDF Curve	=	CSU Storage Yard.IDF	Asc/Rec limb fact	=	1/1

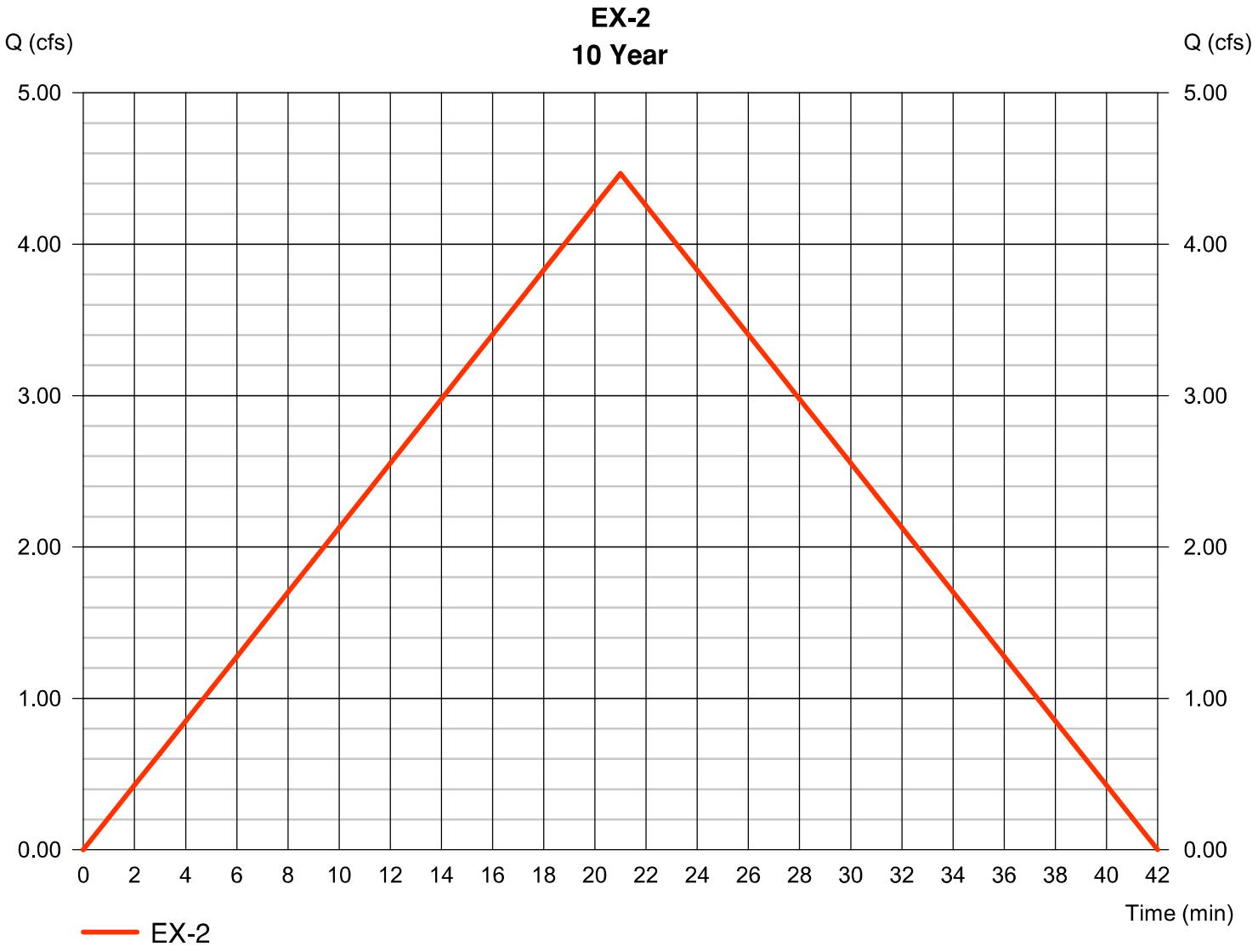


Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

EX-2

Hydrograph type	=	Rational	Peak discharge	=	4.467 cfs
Storm frequency	=	10 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	5,629 cuft
Drainage area	=	3.580 ac	Runoff coeff.	=	0.36
Intensity	=	3.466 in/hr	Tc by TR55	=	21.00 min
IDF Curve	=	CSU Storage Yard.IDF	Asc/Rec limb fact	=	1/1



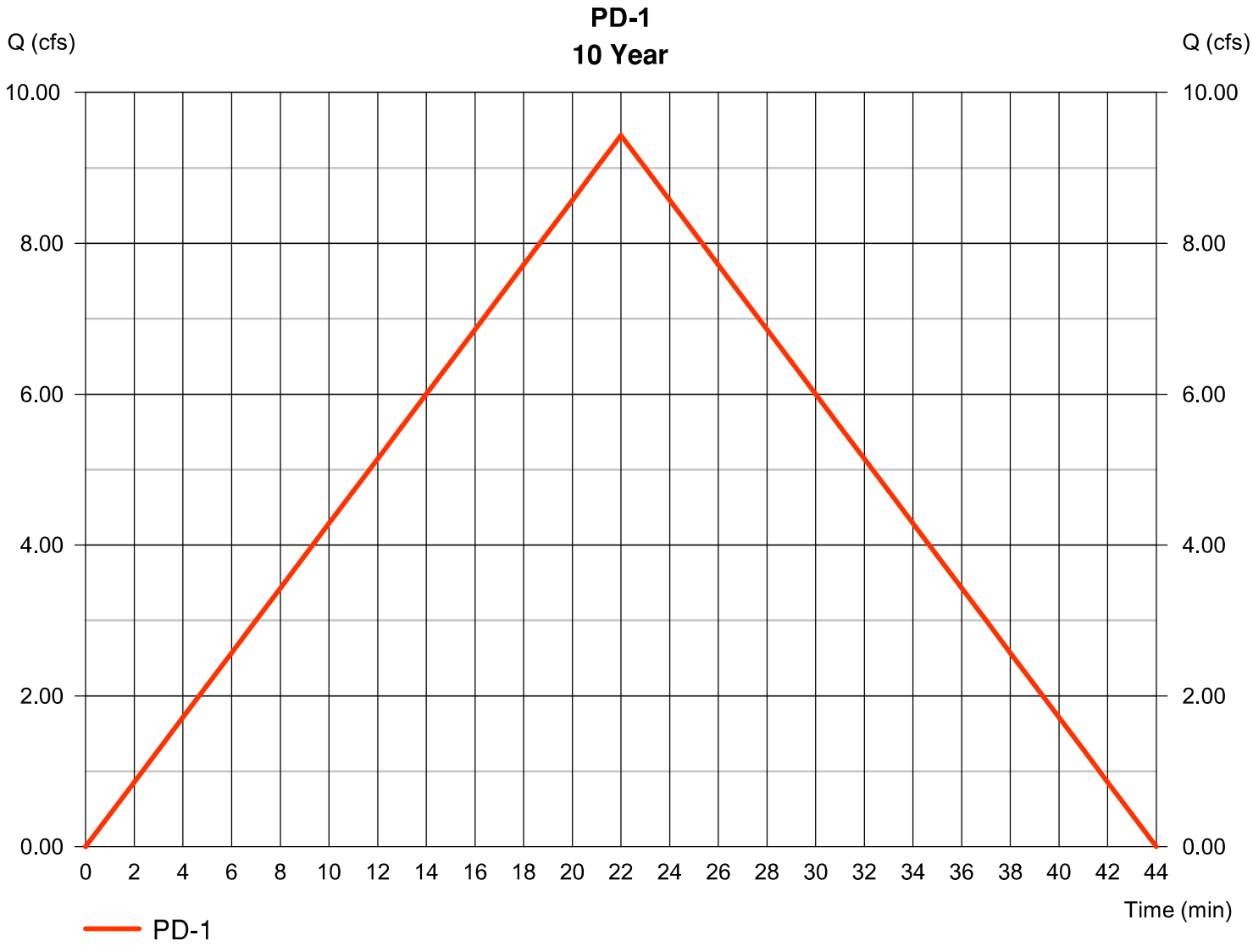
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

PD-1

Hydrograph type	=	Rational	Peak discharge	=	9.430 cfs
Storm frequency	=	10 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	12,447 cuft
Drainage area	=	8.210 ac	Runoff coeff.	=	0.34*
Intensity	=	3.378 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	CSU Storage Yard.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(3.330 x 0.63) + (4.880 x 0.15)] / 8.210



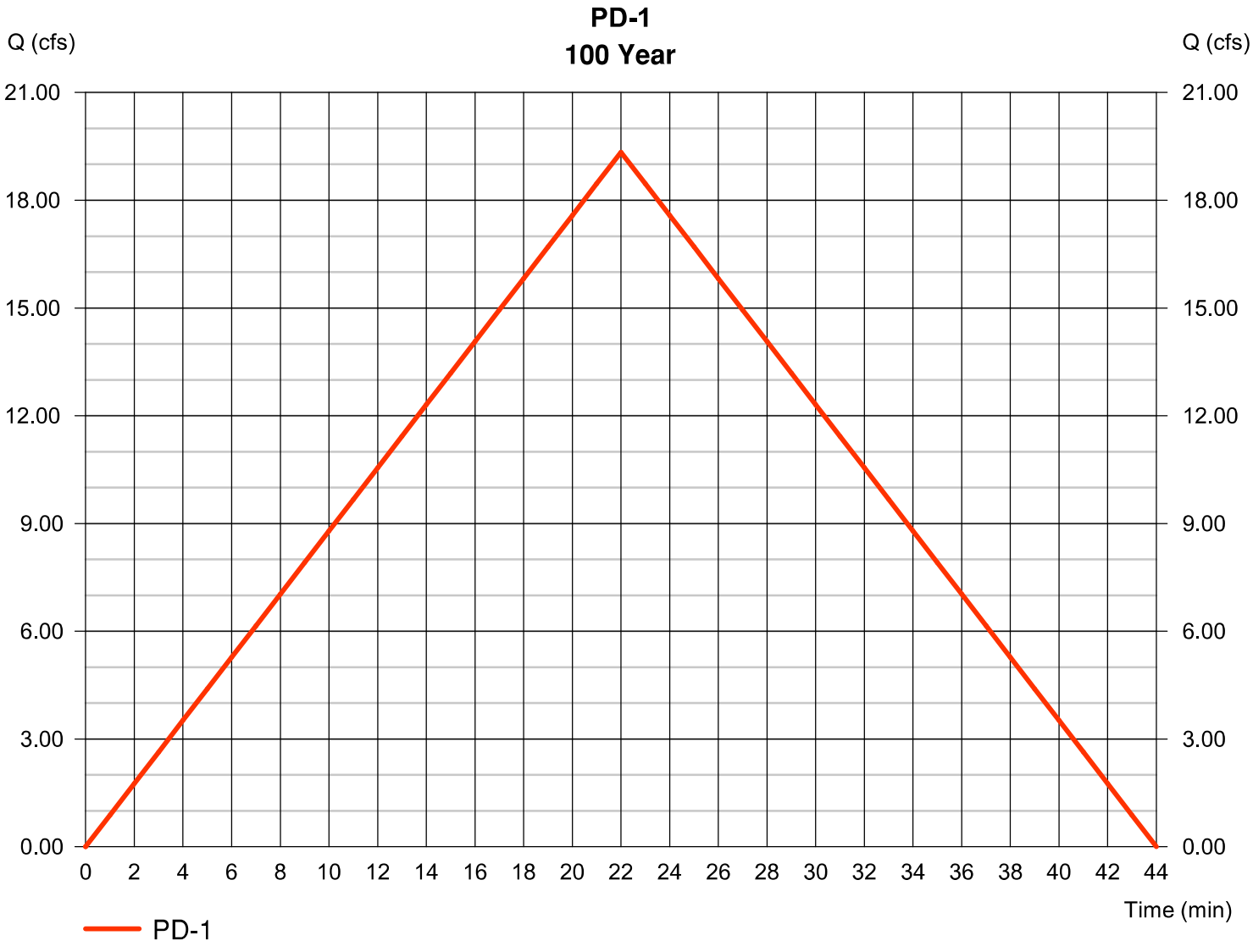
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

PD-1

Hydrograph type	=	Rational	Peak discharge	=	19.34 cfs
Storm frequency	=	100 yrs	Time to peak	=	22 min
Time interval	=	1 min	Hyd. volume	=	25,527 cuft
Drainage area	=	8.210 ac	Runoff coeff.	=	0.49*
Intensity	=	4.807 in/hr	Tc by TR55	=	22.00 min
IDF Curve	=	CSU Storage Yard.IDF	Asc/Rec limb fact	=	1/1

* Composite (Area/C) = [(3.330 x 0.70) + (4.880 x 0.35)] / 8.210



APPENDIX D – HYDRAULIC CALCULATIONS

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) — Sheet 1 of 1

Designer:
Company: Burns and McDonnell
Date: January 5, 2022
Project: Colorado Springs Utilities Briargate Storage Yard Relocation
Location: El Paso County, CO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	SPA								
Area ID	1	2	3									
Downstream Design Point ID	POI-1	POI-1	POI-1	POI-2								
Downstream BMP Type	EDB	EDB	EDB	EDB								
DCIA (ft^2)	--	--	--	--								
UIA (ft^2)	67,106	66,249	47,775	--								
RPA (ft^2)	11,942	11,206	19,038	--								
SPA (ft^2)	--	--	--	305,298								
HSG A (%)	100%	100%	100%	100%								
HSG B (%)	0%	0%	0%	0%								
HSG C/D (%)	0%	0%	0%	0%								
Average Slope of RPA (ft/ft)	0.030	0.005	0.060	--								
UIA:RPA Interface Width (ft)	414.00	233.00	229.50	--								

CALCULATED RUNOFF RESULTS

Area ID	1	2	3									
UIA:RPA Area (ft^2)	79,048	77,455	66,813	--								
L / W Ratio	0.46	1.43	1.27	--								
UIA / Area	0.8489	0.8553	0.7151	--								
Runoff (in)	0.07	0.08	0.00	0.00								
Runoff (ft^3)	443	497	0	0								
Runoff Reduction (ft^3)	2353	2264	1991	15265								

CALCULATED WQCV RESULTS

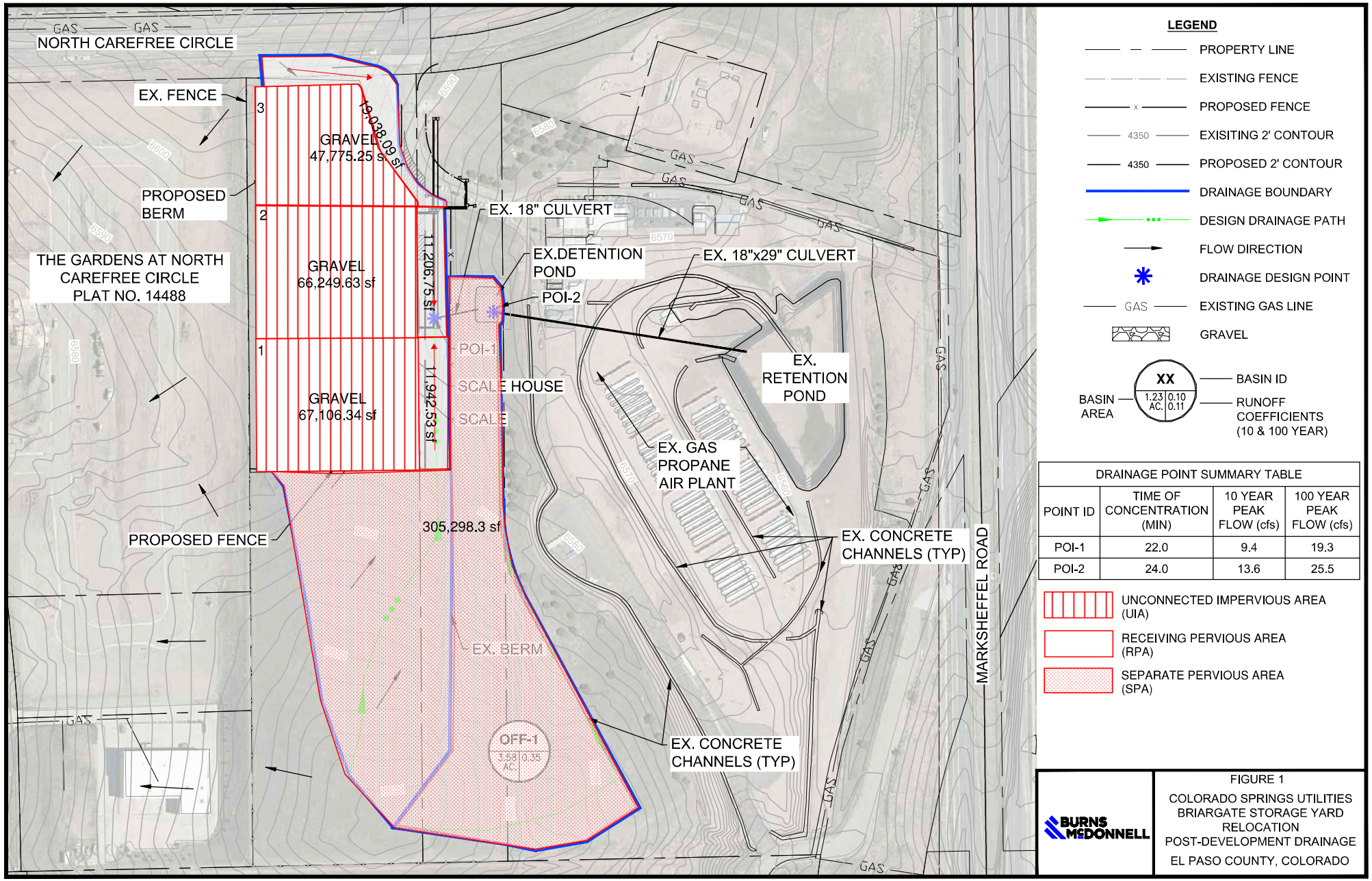
Area ID	1	2	3									
WQCV (ft^3)	2796	2760	1991	0								
WQCV Reduction (ft^3)	2353	2264	1991	0								
WQCV Reduction (%)	84%	82%	100%	0%								
Untreated WQCV (ft^3)	443	497	0	0								

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	POI-1	POI-2										
DCIA (ft^2)	0	0										
UIA (ft^2)	181,130	0										
RPA (ft^2)	42,186	0										
SPA (ft^2)	0	305,298										
Total Area (ft^2)	223,316	305,298										
Total Impervious Area (ft^2)	181,130	0										
WQCV (ft^3)	7,547	0										
WQCV Reduction (ft^3)	6,608	0										
WQCV Reduction (%)	88%	0%										
Untreated WQCV (ft^3)	939	0										

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	528,614
Total Impervious Area (ft^2)	181,130
WQCV (ft^3)	7,547
WQCV Reduction (ft^3)	6,608
WQCV Reduction (%)	88%
Untreated WQCV (ft^3)	939



DRAINAGE POINT SUMMARY TABLE			
POINT ID	TIME OF CONCENTRATION (MIN)	10 YEAR PEAK FLOW (cfs)	100 YEAR PEAK FLOW (cfs)
POI-1	22.0	9.4	19.3
POI-2	24.0	13.6	25.5

UNCONNECTED IMPERVIOUS AREA (UIA)

RECEIVING PERVIOUS AREA (RPA)

SEPARATE PERVIOUS AREA (SPA)

BURNS McDONNELL

FIGURE 1

COLORADO SPRINGS UTILITIES
BRIARGATE STORAGE YARD RELOCATION
POST-DEVELOPMENT DRAINAGE

EL PASO COUNTY, COLORADO

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 7 2022

Grass Swale

User-defined

Invert Elev (ft)	= 6594.50
Slope (%)	= 5.00
N-Value	= 0.030

Calculations

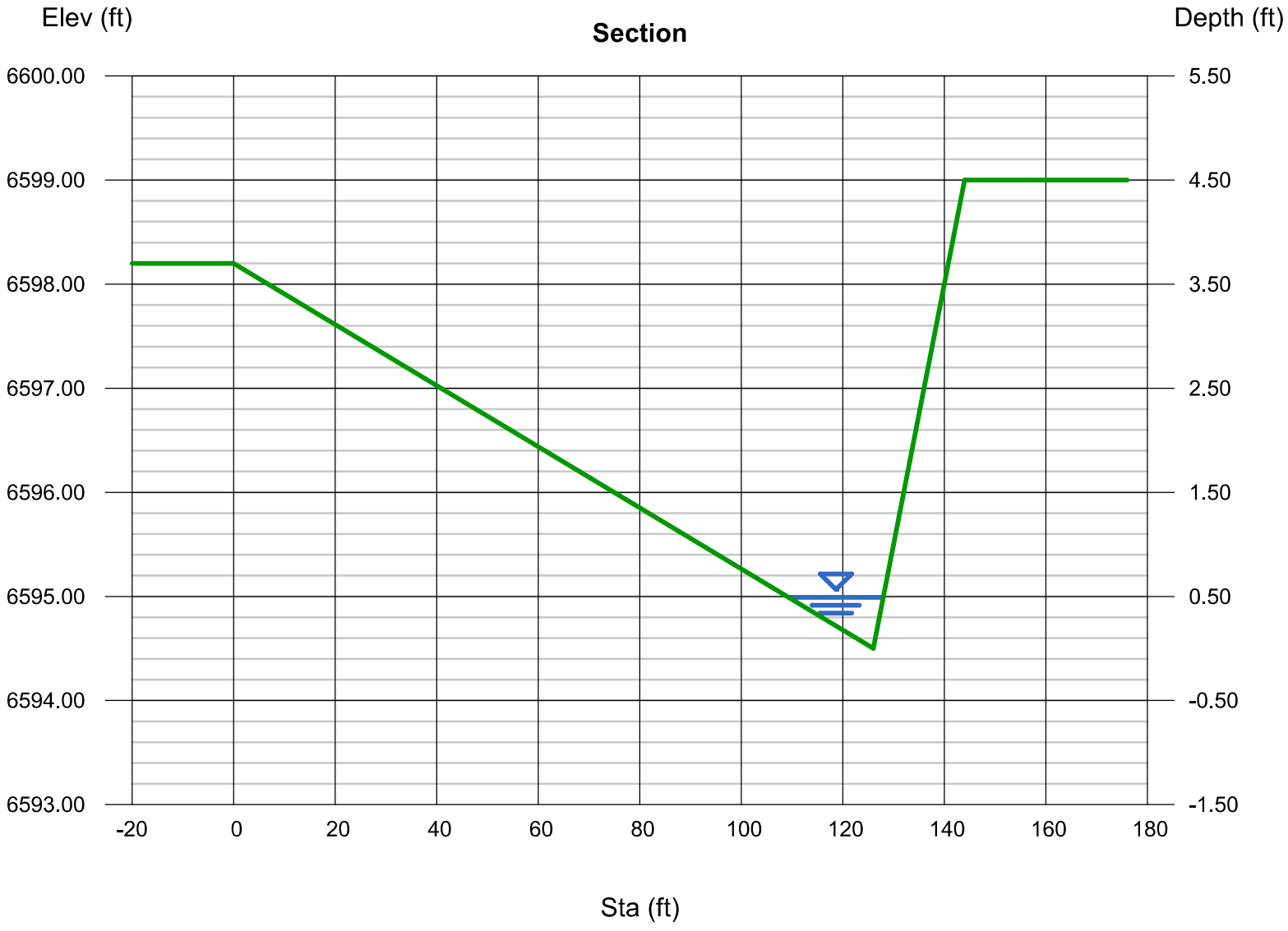
Compute by:	Known Q
Known Q (cfs)	= 19.30

Highlighted

Depth (ft)	= 0.49
Q (cfs)	= 19.30
Area (sqft)	= 4.57
Velocity (ft/s)	= 4.22
Wetted Perim (ft)	= 18.72
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 18.65
EGL (ft)	= 0.77

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

(0.00, 6598.20)-(126.00, 6594.50, 0.030)-(144.00, 6599.00, 0.030)-(156.00, 6599.00, 0.030)



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 22 2021

Ex. 18-inch CMP

Invert Elev Dn (ft)	=	6577.50
Pipe Length (ft)	=	95.00
Slope (%)	=	8.00
Invert Elev Up (ft)	=	6585.10
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

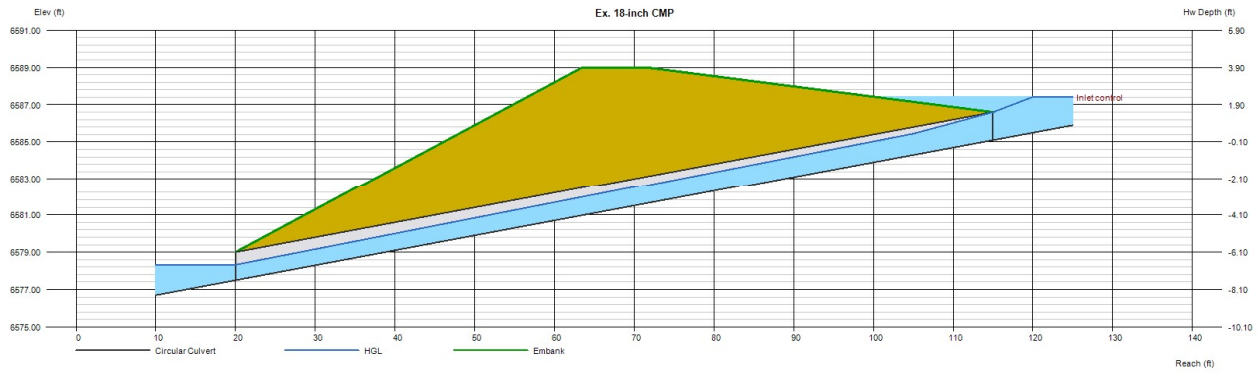
Top Elevation (ft)	=	6589.00
Top Width (ft)	=	8.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	9.00
Qmax (cfs)	=	10.00
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	9.40
Qpipe (cfs)	=	9.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.45
Veloc Up (ft/s)	=	6.28
HGL Dn (ft)	=	6578.32
HGL Up (ft)	=	6586.28
Hw Elev (ft)	=	6587.42
Hw/D (ft)	=	1.54
Flow Regime	=	Inlet Control

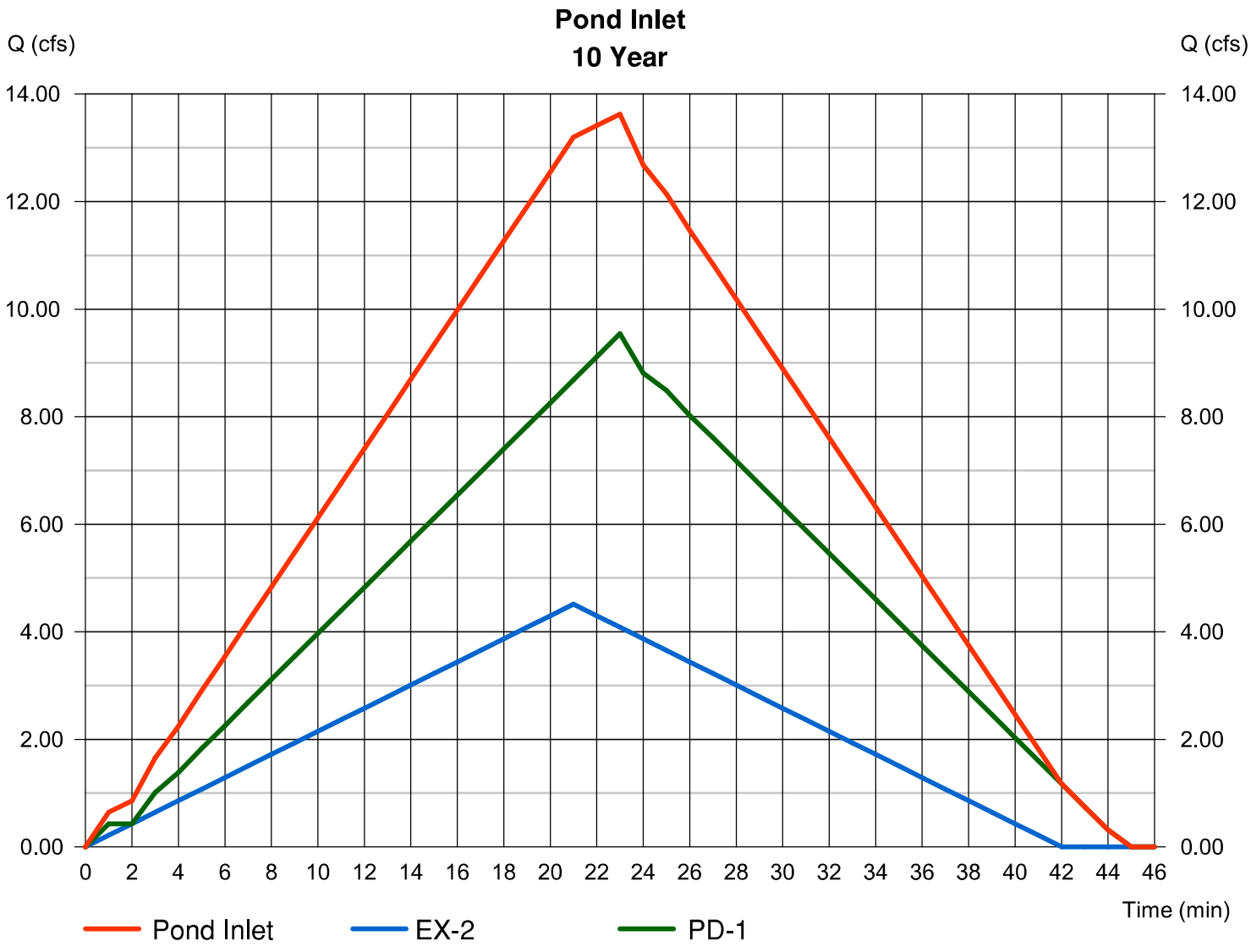


Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

Pond Inlet

Hydrograph type	=	Combine	Peak discharge	=	13.63 cfs
Storm frequency	=	10 yrs	Time to peak	=	23 min
Time interval	=	1 min	Hyd. volume	=	18,159 cuft
Inflow hyds.	=	2, 3	Contrib. drain. area	=	3.830 ac

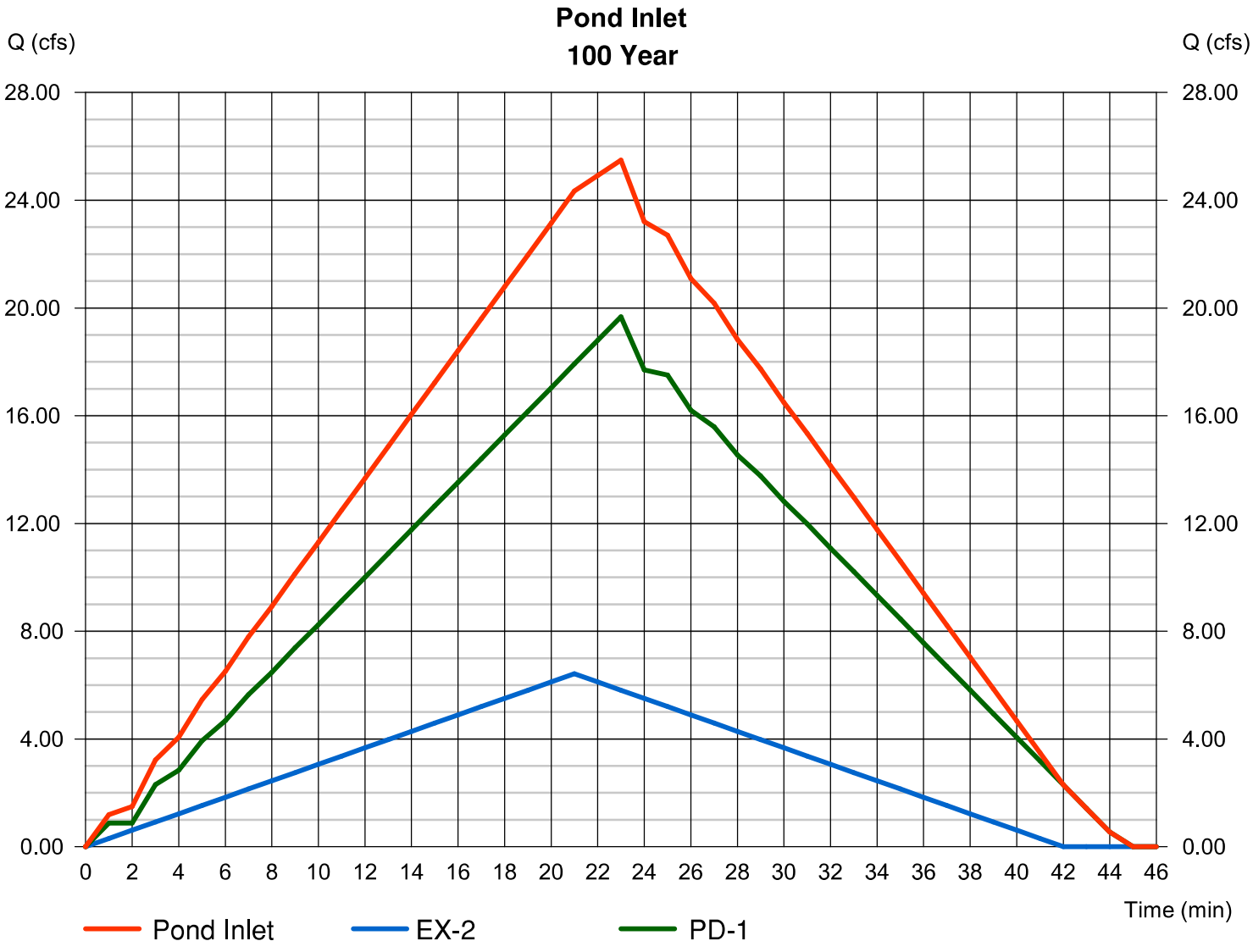


Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

Pond Inlet

Hydrograph type	= Combine	Peak discharge	= 25.49 cfs
Storm frequency	= 100 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 33,665 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.830 ac



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

Pond No. 1 - Detention Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 6569.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	6569.00	800	0	0
1.00	6570.00	1,056	928	928
2.00	6571.00	1,344	1,200	2,128
3.00	6572.00	1,664	1,504	3,632
4.00	6573.00	2,016	1,840	5,472
5.00	6574.00	2,400	2,208	7,680
6.00	6575.00	2,816	2,608	10,288
7.00	6576.00	3,264	3,040	13,328
8.00	6577.00	3,744	3,504	16,832
9.00	6578.00	4,256	4,000	20,832
10.00	6579.00	4,800	4,528	25,360

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	Inactive	Inactive
Span (in)	= 29.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	1
Invert El. (ft)	= 6571.00	0.00	0.00	0.00
Length (ft)	= 395.00	0.00	0.00	0.00
Slope (%)	= 4.60	0.00	0.00	n/a
N-Value	= .024	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	6569.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.10	93	6569.10	0.00	---	---	---	---	---	---	---	---	---	0.000
0.20	186	6569.20	0.00	---	---	---	---	---	---	---	---	---	0.000
0.30	278	6569.30	0.00	---	---	---	---	---	---	---	---	---	0.000
0.40	371	6569.40	0.00	---	---	---	---	---	---	---	---	---	0.000
0.50	464	6569.50	0.00	---	---	---	---	---	---	---	---	---	0.000
0.60	557	6569.60	0.00	---	---	---	---	---	---	---	---	---	0.000
0.70	650	6569.70	0.00	---	---	---	---	---	---	---	---	---	0.000
0.80	742	6569.80	0.00	---	---	---	---	---	---	---	---	---	0.000
0.90	835	6569.90	0.00	---	---	---	---	---	---	---	---	---	0.000
1.00	928	6570.00	0.00	---	---	---	---	---	---	---	---	---	0.000
1.10	1,048	6570.10	0.00	---	---	---	---	---	---	---	---	---	0.000
1.20	1,168	6570.20	0.00	---	---	---	---	---	---	---	---	---	0.000
1.30	1,288	6570.30	0.00	---	---	---	---	---	---	---	---	---	0.000
1.40	1,408	6570.40	0.00	---	---	---	---	---	---	---	---	---	0.000
1.50	1,528	6570.50	0.00	---	---	---	---	---	---	---	---	---	0.000
1.60	1,648	6570.60	0.00	---	---	---	---	---	---	---	---	---	0.000
1.70	1,768	6570.70	0.00	---	---	---	---	---	---	---	---	---	0.000
1.80	1,888	6570.80	0.00	---	---	---	---	---	---	---	---	---	0.000
1.90	2,008	6570.90	0.00	---	---	---	---	---	---	---	---	---	0.000
2.00	2,128	6571.00	0.00	---	---	---	---	---	---	---	---	---	0.000
2.10	2,278	6571.10	0.26 ic	---	---	---	---	---	---	---	---	---	0.261
2.20	2,429	6571.20	0.74 ic	---	---	---	---	---	---	---	---	---	0.737
2.30	2,579	6571.30	1.35 ic	---	---	---	---	---	---	---	---	---	1.351
2.40	2,730	6571.40	2.08 ic	---	---	---	---	---	---	---	---	---	2.081
2.50	2,880	6571.50	2.91 ic	---	---	---	---	---	---	---	---	---	2.909
2.60	3,030	6571.60	3.83 ic	---	---	---	---	---	---	---	---	---	3.834
2.70	3,181	6571.70	4.83 ic	---	---	---	---	---	---	---	---	---	4.831
2.80	3,331	6571.80	5.90 ic	---	---	---	---	---	---	---	---	---	5.896
2.90	3,482	6571.90	7.04 ic	---	---	---	---	---	---	---	---	---	7.036
3.00	3,632	6572.00	8.23 ic	---	---	---	---	---	---	---	---	---	8.228
3.10	3,816	6572.10	9.49 ic	---	---	---	---	---	---	---	---	---	9.494

Continues on next page...

Detention Pond

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.20	4,000	6572.20	10.82 ic	---	---	---	---	---	---	---	---	---	10.82
3.30	4,184	6572.30	12.19 ic	---	---	---	---	---	---	---	---	---	12.19
3.40	4,368	6572.40	13.63 ic	---	---	---	---	---	---	---	---	---	13.63
3.50	4,552	6572.50	15.12 ic	---	---	---	---	---	---	---	---	---	15.12
3.60	4,736	6572.60	16.10 ic	---	---	---	---	---	---	---	---	---	16.10
3.70	4,920	6572.70	17.02 ic	---	---	---	---	---	---	---	---	---	17.02
3.80	5,104	6572.80	17.89 ic	---	---	---	---	---	---	---	---	---	17.89
3.90	5,288	6572.90	18.72 ic	---	---	---	---	---	---	---	---	---	18.72
4.00	5,472	6573.00	19.51 ic	---	---	---	---	---	---	---	---	---	19.51
4.10	5,693	6573.10	20.28 ic	---	---	---	---	---	---	---	---	---	20.28
4.20	5,914	6573.20	21.02 ic	---	---	---	---	---	---	---	---	---	21.02
4.30	6,134	6573.30	21.73 ic	---	---	---	---	---	---	---	---	---	21.73
4.40	6,355	6573.40	22.42 ic	---	---	---	---	---	---	---	---	---	22.42
4.50	6,576	6573.50	23.09 ic	---	---	---	---	---	---	---	---	---	23.09
4.60	6,797	6573.60	23.75 ic	---	---	---	---	---	---	---	---	---	23.75
4.70	7,018	6573.70	24.38 ic	---	---	---	---	---	---	---	---	---	24.38
4.80	7,238	6573.80	25.00 ic	---	---	---	---	---	---	---	---	---	25.00
4.90	7,459	6573.90	25.60 ic	---	---	---	---	---	---	---	---	---	25.60
5.00	7,680	6574.00	26.18 ic	---	---	---	---	---	---	---	---	---	26.18
5.10	7,941	6574.10	26.76 ic	---	---	---	---	---	---	---	---	---	26.76
5.20	8,202	6574.20	27.32 ic	---	---	---	---	---	---	---	---	---	27.32
5.30	8,462	6574.30	27.87 ic	---	---	---	---	---	---	---	---	---	27.87
5.40	8,723	6574.40	28.41 ic	---	---	---	---	---	---	---	---	---	28.41
5.50	8,984	6574.50	28.94 ic	---	---	---	---	---	---	---	---	---	28.94
5.60	9,245	6574.60	29.37 oc	---	---	---	---	---	---	---	---	---	29.37
5.70	9,506	6574.70	29.44 oc	---	---	---	---	---	---	---	---	---	29.44
5.80	9,766	6574.80	29.52 oc	---	---	---	---	---	---	---	---	---	29.52
5.90	10,027	6574.90	29.59 oc	---	---	---	---	---	---	---	---	---	29.59
6.00	10,288	6575.00	29.66 oc	---	---	---	---	---	---	---	---	---	29.66
6.10	10,592	6575.10	29.73 oc	---	---	---	---	---	---	---	---	---	29.73
6.20	10,896	6575.20	29.80 oc	---	---	---	---	---	---	---	---	---	29.80
6.30	11,200	6575.30	29.87 oc	---	---	---	---	---	---	---	---	---	29.87
6.40	11,504	6575.40	29.94 oc	---	---	---	---	---	---	---	---	---	29.94
6.50	11,808	6575.50	30.01 oc	---	---	---	---	---	---	---	---	---	30.01
6.60	12,112	6575.60	30.09 oc	---	---	---	---	---	---	---	---	---	30.09
6.70	12,416	6575.70	30.16 oc	---	---	---	---	---	---	---	---	---	30.16
6.80	12,720	6575.80	30.23 oc	---	---	---	---	---	---	---	---	---	30.23
6.90	13,024	6575.90	30.30 oc	---	---	---	---	---	---	---	---	---	30.30
7.00	13,328	6576.00	30.37 oc	---	---	---	---	---	---	---	---	---	30.37
7.10	13,678	6576.10	30.44 oc	---	---	---	---	---	---	---	---	---	30.44
7.20	14,029	6576.20	30.51 oc	---	---	---	---	---	---	---	---	---	30.51
7.30	14,379	6576.30	30.58 oc	---	---	---	---	---	---	---	---	---	30.58
7.40	14,730	6576.40	30.65 oc	---	---	---	---	---	---	---	---	---	30.65
7.50	15,080	6576.50	30.72 oc	---	---	---	---	---	---	---	---	---	30.72
7.60	15,430	6576.60	30.79 oc	---	---	---	---	---	---	---	---	---	30.79
7.70	15,781	6576.70	30.85 oc	---	---	---	---	---	---	---	---	---	30.85
7.80	16,131	6576.80	30.92 oc	---	---	---	---	---	---	---	---	---	30.92
7.90	16,482	6576.90	30.99 oc	---	---	---	---	---	---	---	---	---	30.99
8.00	16,832	6577.00	31.06 oc	---	---	---	---	---	---	---	---	---	31.06
8.10	17,232	6577.10	31.13 oc	---	---	---	---	---	---	---	---	---	31.13
8.20	17,632	6577.20	31.20 oc	---	---	---	---	---	---	---	---	---	31.20
8.30	18,032	6577.30	31.26 oc	---	---	---	---	---	---	---	---	---	31.26
8.40	18,432	6577.40	31.33 oc	---	---	---	---	---	---	---	---	---	31.33
8.50	18,832	6577.50	31.40 oc	---	---	---	---	---	---	---	---	---	31.40
8.60	19,232	6577.60	31.47 oc	---	---	---	---	---	---	---	---	---	31.47
8.70	19,632	6577.70	31.54 oc	---	---	---	---	---	---	---	---	---	31.54
8.80	20,032	6577.80	31.60 oc	---	---	---	---	---	---	---	---	---	31.60
8.90	20,432	6577.90	31.67 oc	---	---	---	---	---	---	---	---	---	31.67
9.00	20,832	6578.00	31.74 oc	---	---	---	---	---	---	---	---	---	31.74
9.10	21,285	6578.10	31.80 oc	---	---	---	---	---	---	---	---	---	31.80
9.20	21,738	6578.20	31.87 oc	---	---	---	---	---	---	---	---	---	31.87
9.30	22,190	6578.30	31.94 oc	---	---	---	---	---	---	---	---	---	31.94
9.40	22,643	6578.40	32.00 oc	---	---	---	---	---	---	---	---	---	32.00
9.50	23,096	6578.50	32.07 oc	---	---	---	---	---	---	---	---	---	32.07
9.60	23,549	6578.60	32.14 oc	---	---	---	---	---	---	---	---	---	32.14
9.70	24,002	6578.70	32.20 oc	---	---	---	---	---	---	---	---	---	32.20
9.80	24,454	6578.80	32.27 oc	---	---	---	---	---	---	---	---	---	32.27
9.90	24,907	6578.90	32.34 oc	---	---	---	---	---	---	---	---	---	32.34
10.00	25,360	6579.00	32.40 oc	---	---	---	---	---	---	---	---	---	32.40

...End

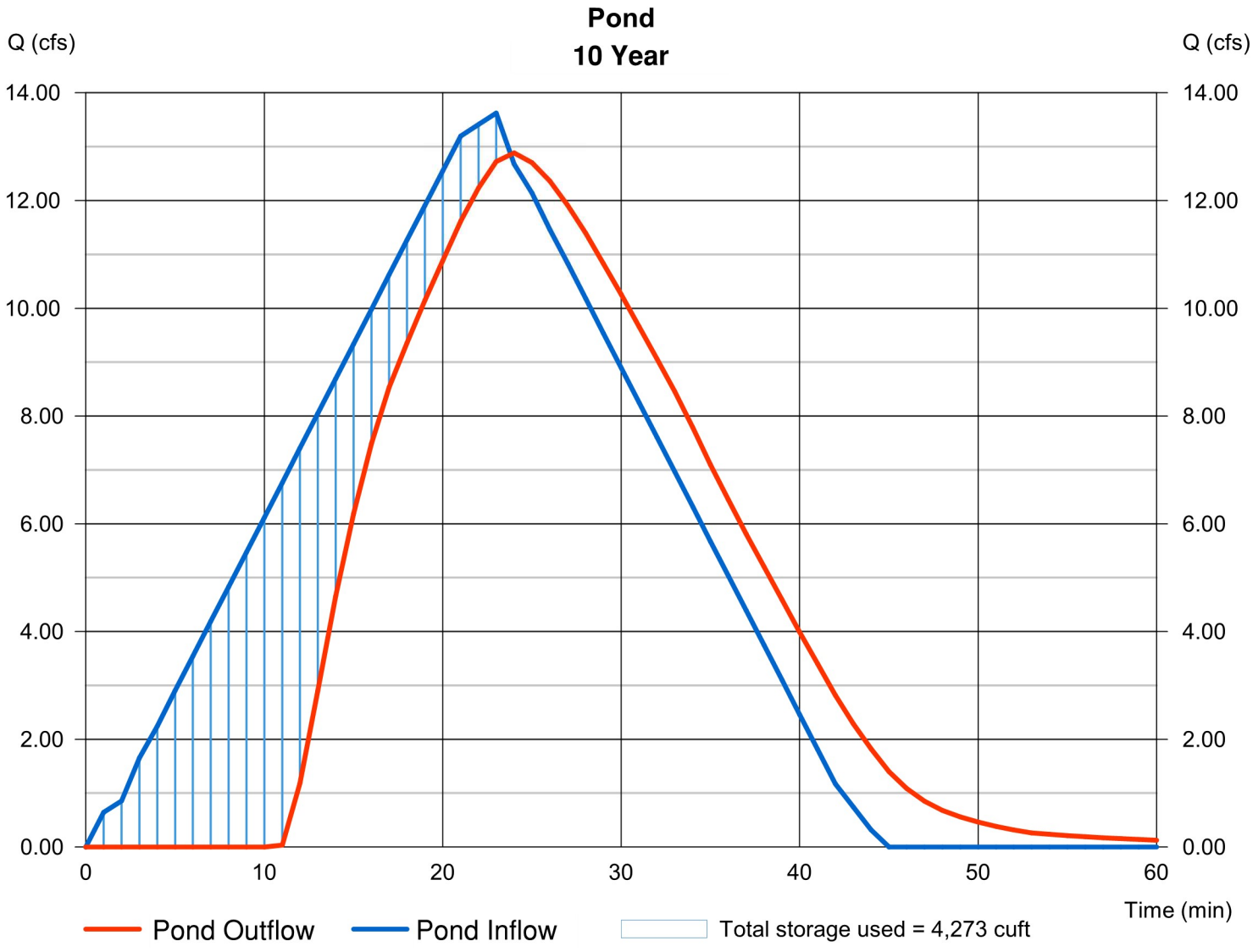
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

Pond Discharge

Hydrograph type	= Reservoir	Peak discharge	= 12.89 cfs
Storm frequency	= 10 yrs	Time to peak	= 24 min
Time interval	= 1 min	Hyd. volume	= 16,030 cuft
Inflow hyd. No.	= 4 - Pond Inlet	Max. Elevation	= 6572.35 ft
Reservoir name	= Detention Pond	Max. Storage	= 4,273 cuft

Storage Indication method used.



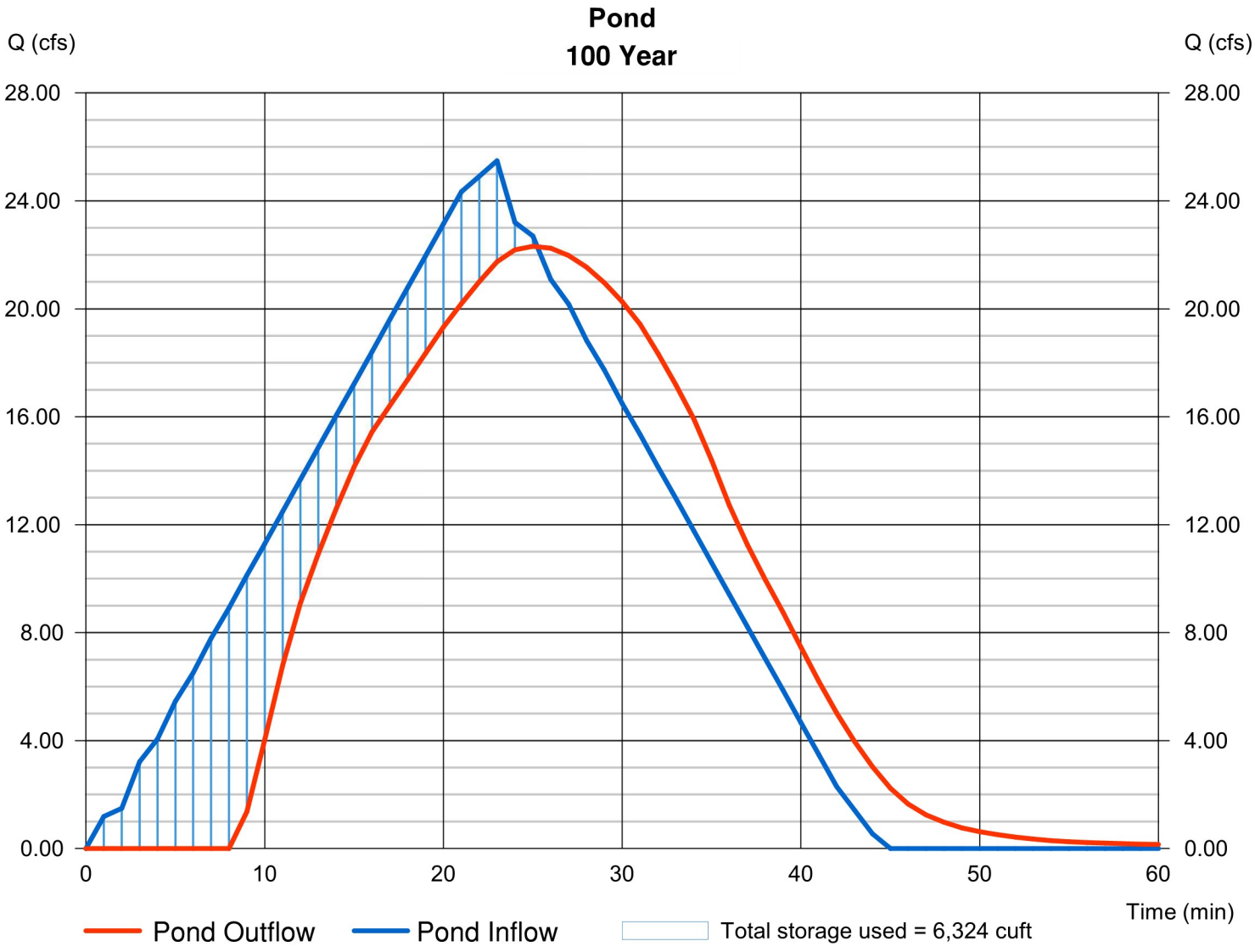
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Monday, 11 / 22 / 2021

Pond Discharge

Hydrograph type	= Reservoir	Peak discharge	= 22.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 31,537 cuft
Inflow hyd. No.	= 4 - Pond Inlet	Max. Elevation	= 6573.39 ft
Reservoir name	= Detention Pond	Max. Storage	= 6,324 cuft

Storage Indication method used.



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 22 2021

Ex. 18x29-inch Pond Discharge CMP

Invert Elev Dn (ft)	=	6552.80
Pipe Length (ft)	=	395.00
Slope (%)	=	4.61
Invert Elev Up (ft)	=	6571.00
Rise (in)	=	18.0
Shape	=	Elliptical
Span (in)	=	29.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Horizontal Ellipse Concrete
Culvert Entrance	=	Groove end projecting (H)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

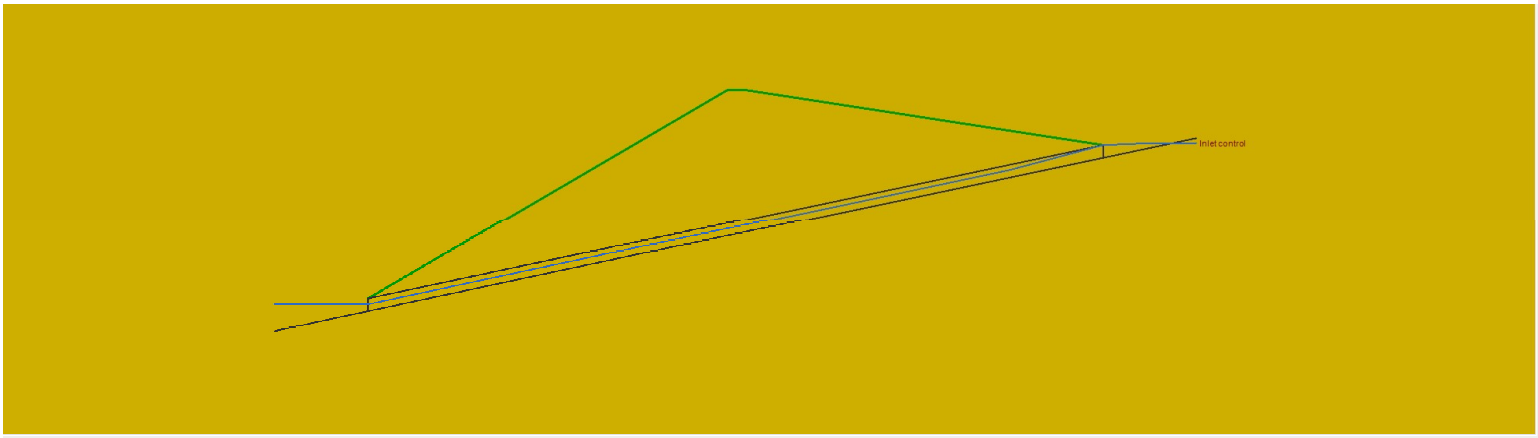
Top Elevation (ft)	=	6579.00
Top Width (ft)	=	8.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	13.00
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	12.90
Qpipe (cfs)	=	12.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.75
Veloc Up (ft/s)	=	7.02
HGL Dn (ft)	=	6553.61
HGL Up (ft)	=	6571.90
Hw Elev (ft)	=	6572.73
Hw/D (ft)	=	1.15
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 22 2021

Ex. 18x29-inch Pond Discharge CMP

Invert Elev Dn (ft)	=	6552.80
Pipe Length (ft)	=	395.00
Slope (%)	=	4.61
Invert Elev Up (ft)	=	6571.00
Rise (in)	=	18.0
Shape	=	Elliptical
Span (in)	=	29.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Horizontal Ellipse Concrete
Culvert Entrance	=	Groove end projecting (H)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

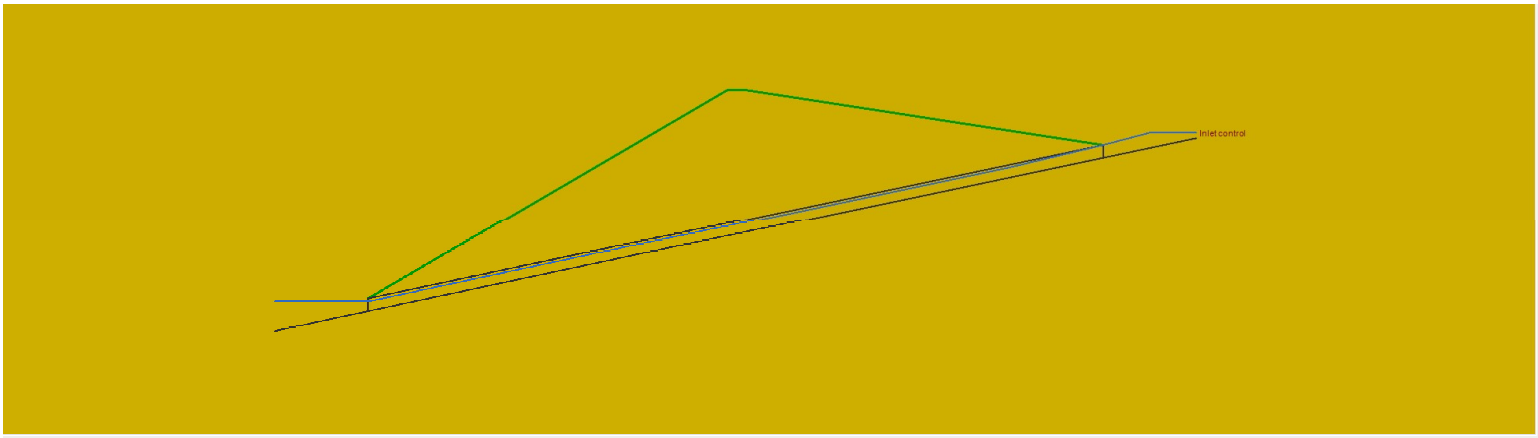
Top Elevation (ft)	=	6579.00
Top Width (ft)	=	8.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	22.00
Qmax (cfs)	=	24.00
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	22.30
Qpipe (cfs)	=	22.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.00
Veloc Up (ft/s)	=	9.00
HGL Dn (ft)	=	6553.94
HGL Up (ft)	=	6572.20
Hw Elev (ft)	=	6573.95
Hw/D (ft)	=	1.96
Flow Regime	=	Inlet Control



APPENDIX E – FINANCIAL ASSURANCE

2021 Financial Assurance Estimate Form
(with pre-plat construction)

Updated: 12/22/2020

PROJECT INFORMATION

GPAP Staging Area	1/5/2022	PPR2150
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	14,100	CY	$ 5.00	=	$ 70,500.00		$ 70,500.00
20,001-50,000; $100,000 min		CY	$ 3.50	=	$ -		$ -
50,001-200,000; $175,000 min		CY	$ 2.50	=	$ -		$ -
greater than 200,000; $500,000 min		CY	$ 2.00	=	$ -		$ -
* Permanent Seeding (inc. noxious weed mgmnt.)	1	AC	$ 828.00	=	$ 828.00		$ 828.00
* Mulching	0	AC	$ 777.00	=	$ -		$ -
* Permanent Erosion Control Blanket	0	SY	$ 6.00	=	$ -		$ -
* Permanent Pond/BMP Construction	0	CY	$ 21.00	=	$ -		$ -
* Permanent Pond/BMP (provide engineer's estimate)	0	EA		=	$ -		$ -
		EA		=	$ -		$ -
Safety Fence	0	LF	$ 3.00	=	$ -		$ -
Temporary Erosion Control Blanket	0	SY	$ 3.00	=	$ -		$ -
Vehicle Tracking Control	1	EA	$ 2,453.00	=	$ 2,453.00		$ 2,453.00
Silt Fence	0	LF	$ 2.60	=	$ -		$ -
Temporary Seeding	0	AC	$ 650.00	=	$ -		$ -
Temporary Mulch	0	AC	$ 777.00	=	$ -		$ -
Erosion Bales	0	EA	$ 26.00	=	$ -		$ -
Erosion Logs/Straw Waddle	10	LF	$ 5.00	=	$ 50.00		$ 50.00
Rock Check Dams	0	EA	$ 518.00	=	$ -		$ -
Inlet Protection	2	EA	$ 173.00	=	$ 346.00		$ 346.00
Sediment Basin	0	EA	$ 1,824.00	=	$ -		$ -
Concrete Washout Basin	1	EA	$ 932.00	=	$ 932.00		$ 932.00
				=	$ -		$ -
(insert items not listed but part of construction plans)				=	$ -		$ -
		MAINTENANCE (35% of Construction BMPs)		=	$ 1,323.35		$ 1,323.35
* Subject to defect warranty financial assurance. A minimum of 20% shall be retained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)		**Section 1 Subtotal**		=	$ 76,432.35		$ 76,432.35
SECTION 2 - PUBLIC IMPROVEMENTS *							
ROADWAY IMPROVEMENTS							
Construction Traffic Control	0	LS		=	$ -		$ -
Aggregate Base Course (135 lbs/cf)	0	Tons	$ 29.00	=	$ -		$ -
Aggregate Base Course (135 lbs/cf)	0	CY	$ 52.00		$ -		$ -
Asphalt Pavement (3" thick)	0	SY	$ 14.50		$ -		$ -
Asphalt Pavement (4" thick)	0	SY	$ 20.00		$ -		$ -
Asphalt Pavement (6" thick)	24,200	SY	$ 30.00		$ 726,000.00		$ 726,000.00
Asphalt Pavement (147 lbs/cf) _" thick	0	Tons	$ 91.00	=	$ -		$ -
Raised Median, Paved	0	SF	$ 8.30	=	$ -		$ -
Regulatory Sign/Advisory Sign	0	EA	$ 311.00	=	$ -		$ -
Guide/Street Name Sign	0	EA		=	$ -		$ -
Epoxy Pavement Marking	0	SF	$ 14.00	=	$ -		$ -
Thermoplastic Pavement Marking	0	SF	$ 24.00	=	$ -		$ -
Barricade - Type 3	0	EA	$ 207.00	=	$ -		$ -
Delineator - Type I	0	EA	$ 25.00	=	$ -		$ -
Curb and Gutter, Type A (6" Vertical)	0	LF	$ 31.00	=	$ -		$ -
Curb and Gutter, Type B (Median)	200	LF	$ 31.00	=	$ 6,200.00		$ 6,200.00
Curb and Gutter, Type C (Ramp)	20	LF	$ 31.00	=	$ 620.00		$ 620.00
4" Sidewalk (common areas only)	0	SY	$ 50.00	=	$ -		$ -
5" Sidewalk	0	SY	$ 62.00	=	$ -		$ -
6" Sidewalk	0	SY	$ 75.00	=	$ -		$ -
8" Sidewalk	0	SY	$ 99.00		$ -		$ -
Pedestrian Ramp	0	EA	$ 1,190.00	=	$ -		$ -
Cross Pan, local (8" thick, 6' wide to include return)	0	LF	$ 63.00	=	$ -		$ -
Cross Pan, collector (9" thick, 8' wide to include return)	0	LF	$ 95.00		$ -		$ -
Curb Chase	0	EA	$ 1,532.00	=	$ -		$ -
Guardrail Type 3 (W-Beam)	0	LF	$ 51.00	=	$ -		$ -
Guardrail Type 7 (Concrete)	0	LF	$ 75.00	=	$ -		$ -
Guardrail End Anchorage	0	EA	$ 2,172.00	=	$ -		$ -
Guardrail Impact Attenuator	0	EA	$ 3,899.00	=	$ -		$ -
Sound Barrier Fence (CMU block, 6' high)	0	LF	$ 81.00		$ -		$ -
Sound Barrier Fence (panels, 6' high)	700	LF	$ 83.00	=	$ 58,100.00		$ 58,100.00
Electrical Conduit, Size =	0	LF	$ 17.00	=	$ -		$ -
Traffic Signal, complete intersection	0	EA	$ 439,875	=	$ -		$ -

PROJECT INFORMATION

GPAP Staging Area	1/5/2022	PPR2150
Project Name	Date	PCD File No.

Description	Quantity	Units	Unit Cost		Total	% Complete	(with Pre-Plat Construction) Remaining
				=	$ -		$ -
(insert items not listed but part of construction plans)				=	$ -		$ -
STORM DRAIN IMPROVEMENTS							
Concrete Box Culvert (M Standard), Size (W x H)	0	LF		=	$ -		$ -
18" Reinforced Concrete Pipe	0	LF	$ 67.00	=	$ -		$ -
24" Reinforced Concrete Pipe	0	LF	$ 81.00	=	$ -		$ -
30" Reinforced Concrete Pipe	0	LF	$ 100.00	=	$ -		$ -
36" Reinforced Concrete Pipe	0	LF	$ 124.00	=	$ -		$ -
42" Reinforced Concrete Pipe	0	LF	$ 166.00	=	$ -		$ -
48" Reinforced Concrete Pipe	0	LF	$ 202.00	=	$ -		$ -
54" Reinforced Concrete Pipe	0	LF	$ 254.00	=	$ -		$ -
60" Reinforced Concrete Pipe	0	LF	$ 298.00	=	$ -		$ -
66" Reinforced Concrete Pipe	0	LF	$ 344.00	=	$ -		$ -
72" Reinforced Concrete Pipe	0	LF	$ 393.00	=	$ -		$ -
18" Corrugated Steel Pipe	0	LF	$ 87.00	=	$ -		$ -
24" Corrugated Steel Pipe	0	LF	$ 99.00	=	$ -		$ -
30" Corrugated Steel Pipe	0	LF	$ 126.00	=	$ -		$ -
36" Corrugated Steel Pipe	0	LF	$ 152.00	=	$ -		$ -
42" Corrugated Steel Pipe	0	LF	$ 174.00	=	$ -		$ -
48" Corrugated Steel Pipe	0	LF	$ 184.00	=	$ -		$ -
54" Corrugated Steel Pipe	0	LF	$ 269.00	=	$ -		$ -
60" Corrugated Steel Pipe	0	LF	$ 290.00	=	$ -		$ -
66" Corrugated Steel Pipe	0	LF	$ 352.00	=	$ -		$ -
72" Corrugated Steel Pipe	0	LF	$ 414.00	=	$ -		$ -
78" Corrugated Steel Pipe	0	LF	$ 476.00	=	$ -		$ -
84" Corrugated Steel Pipe	0	LF	$ 569.00	=	$ -		$ -
Flared End Section (FES) RCP Size = (unit cost = 6x pipe unit cost)	0	EA		=	$ -		$ -
Flared End Section (FES) CSP Size = (unit cost = 6x pipe unit cost)	0	EA		=	$ -		$ -
End Treatment- Headwall	0	EA		=	$ -		$ -
End Treatment- Wingwall	0	EA		=	$ -		$ -
End Treatment - Cutoff Wall	0	EA		=	$ -		$ -
Curb Inlet (Type R) L=5', Depth < 5'	0	EA	$ 5,736.00	=	$ -		$ -
Curb Inlet (Type R) L=5', 5' ≤ Depth < 10'	0	EA	$ 7,440.00	=	$ -		$ -
Curb Inlet (Type R) L =5', 10' ≤ Depth < 15'	0	EA	$ 8,637.00	=	$ -		$ -
Curb Inlet (Type R) L =10', Depth < 5'	0	EA	$ 7,894.00	=	$ -		$ -
Curb Inlet (Type R) L =10', 5' ≤ Depth < 10'	0	EA	$ 8,136.00	=	$ -		$ -
Curb Inlet (Type R) L =10', 10' ≤ Depth < 15'	0	EA	$ 10,185.00	=	$ -		$ -
Curb Inlet (Type R) L =15', Depth < 5'	0	EA	$ 10,265.00	=	$ -		$ -
Curb Inlet (Type R) L =15', 5' ≤ Depth < 10'	0	EA	$ 11,005.00	=	$ -		$ -
Curb Inlet (Type R) L =15', 10' ≤ Depth < 15'	0	EA	$ 12,034.00	=	$ -		$ -
Curb Inlet (Type R) L =20', Depth < 5'	0	EA	$ 10,940.00	=	$ -		$ -
Curb Inlet (Type R) L =20', 5' ≤ Depth < 10'	0	EA	$ 12,075.00	=	$ -		$ -
Grated Inlet (Type C), Depth < 5'	0	EA	$ 4,802.00	=	$ -		$ -
Grated Inlet (Type D), Depth < 5'	0	EA	$ 5,932.00	=	$ -		$ -
Storm Sewer Manhole, Box Base	0	EA	$ 12,034.00	=	$ -		$ -
Storm Sewer Manhole, Slab Base	0	EA	$ 6,619.00	=	$ -		$ -
Geotextile (Erosion Control)	0	SY	$ 6.20	=	$ -		$ -
Rip Rap, d50 size from 6" to 24"	0	Tons	$ 83.00	=	$ -		$ -
Rip Rap, Grouted	0	Tons	$ 98.00	=	$ -		$ -
Drainage Channel Construction, Size (W x H)	0	LF		=	$ -		$ -
Drainage Channel Lining, Concrete	0	CY	$ 590.00	=	$ -		$ -
Drainage Channel Lining, Rip Rap	0	CY	$ 116.00	=	$ -		$ -
Drainage Channel Lining, Grass	0	AC	$ 1,520.00	=	$ -		$ -
Drainage Channel Lining, Other Stabilization	0			=	$ -		$ -
				=	$ -		$ -
(insert items not listed but part of construction plans)				=	$ -		$ -
* Subject to de led warranty financial assurance A minimum of 20% shall be retained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)			**Section 2 Subtotal**	=	$ 790,920.00		$ 790,920.00

PROJECT INFORMATION		
GPAP Staging Area	1/5/2022	PPR2150
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							
None	0			=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
STORM DRAIN IMPROVEMENTS	(Exception Permanent Pond/BMP shall be itemized under Section 1)						
None	0			=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
				=	$ -		$ -
WATER SYSTEM IMPROVEMENTS							
Water Main Pipe (PVC), Size 8"	0	LF	$ 66.00	=	$ -		$ -
Water Main Pipe (Ductile Iron), Size 8"	0	LF	$ 78.00	=	$ -		$ -
Gate Valves, 8"	0	EA	$ 1,923.00	=	$ -		$ -
Fire Hydrant Assembly, w/ all valves	0	EA	$ 6,828.00	=	$ -		$ -
Water Service Line Installation, Inc. tap and valves	0	EA	$ 1,370.00	=	$ -		$ -
Fire Cistern Installation, complete	0	EA		=	$ -		$ -
				=	$ -		$ -
(insert items not listed but part of construction plans)				=	$ -		$ -
SANITARY SEWER IMPROVEMENTS							
Sewer Main Pipe (PVC), Size 8"	0	LF	$ 66.00	=	$ -		$ -
Sanitary Sewer Manhole, Depth < 15 feet	0	EA	$ 4,540.00	=	$ -		$ -
Sanitary Service Line Installation, complete	0	EA	$ 1,451.00	=	$ -		$ -
Sanitary Sewer Lift Station, complete	0	EA		=	$ -		$ -
				=	$ -		$ -
(insert items not listed but part of construction plans)				=	$ -		$ -
LANDSCAPING IMPROVEMENTS	(For subdivision specific condition of approval, or PUD)						
None	0	EA		=	$ -		$ -
		EA		=	$ -		$ -
		EA		=	$ -		$ -
		EA		=	$ -		$ -
		EA		=	$ -		$ -
** Section 3 is not subject to defect warranty requirements			**Section 3 Subtotal**	=	$ -		$ -

PROJECT INFORMATION

GPAP Staging Area	1/5/2022	PPR2150
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		=	$ -		$ -

Total Construction Financial Assurance $ 867,352.35
(Sum of all section subtotals plus as-builts and pond/BMP certification)

Total Remaining Construction Financial Assurance (with Pre-Plat Construction) $ 867,352.35
(Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)

Total Defect Warranty Financial Assurance $ 172,449.60
(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.

COLORADO LICENSED
SEBASTIAN-COLEMAN
PROFESSIONAL ENGINEER

Richard Sebastian-Coleman, Engineer, P.E. Seal Required

Clint Barden, Owner / Applicant — Date 1/11/2022

Approved by El Paso County Engineer / ECM Administrator — Date

APPENDIX F – DRAINAGE FIGURES

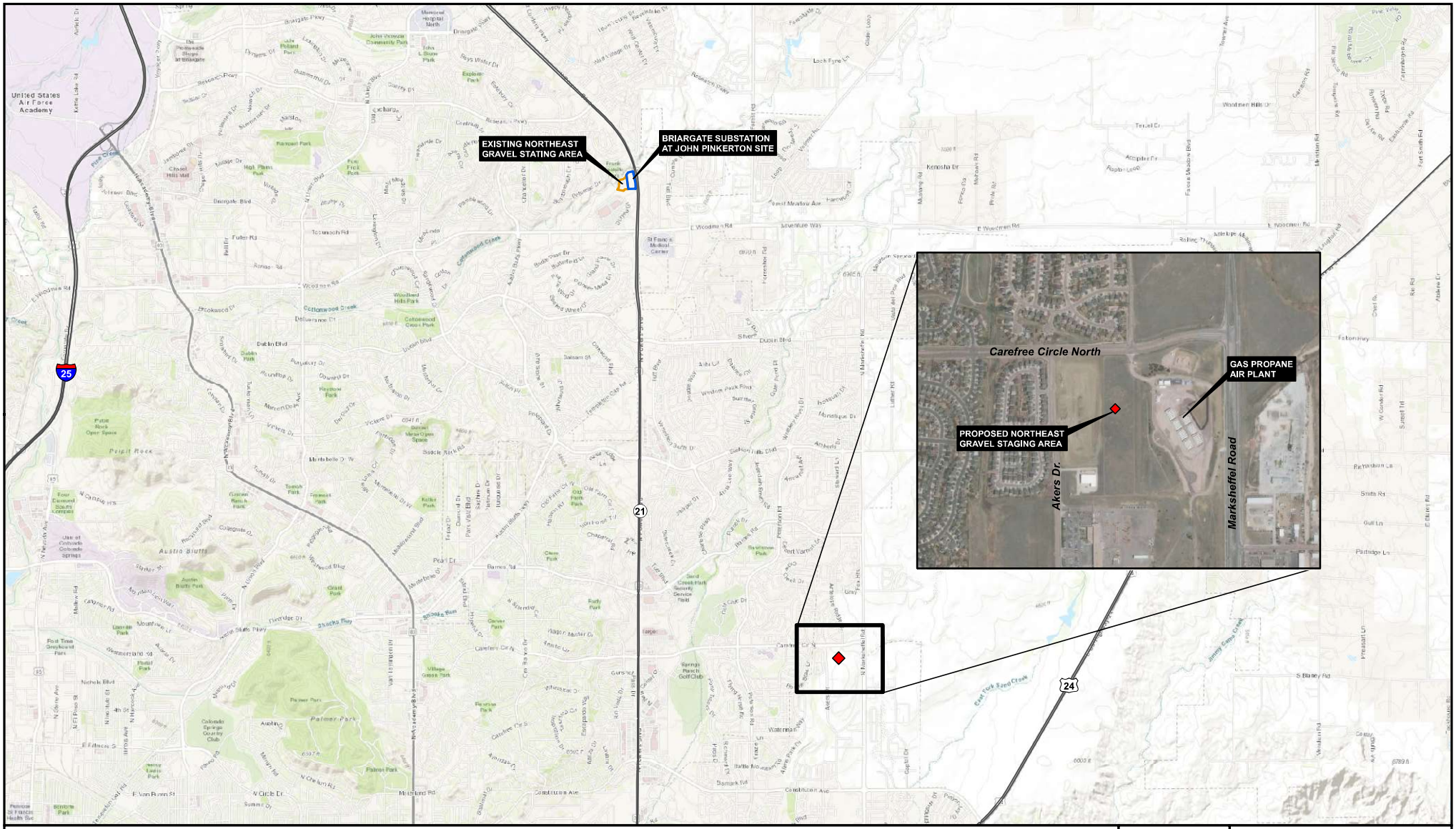


FIGURE 1

BURNS McDONNELL

GRAVEL STAGING AREA RELOCATION

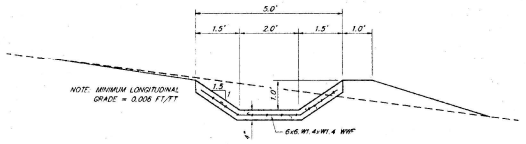
BRIARGATE SUBSTATION

COLORADO SPRINGS UTILITIES
COLORADO SPRINGS, CO

Issued: 8/24/2021

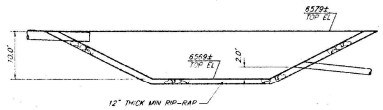
Path: I:\ESP\Projects\CSU\Figures\MXD\Briargate\FIG_00_Briargate_StorageYard_Relocation.mxd sjensley 8/24/2021

FIGURE 2

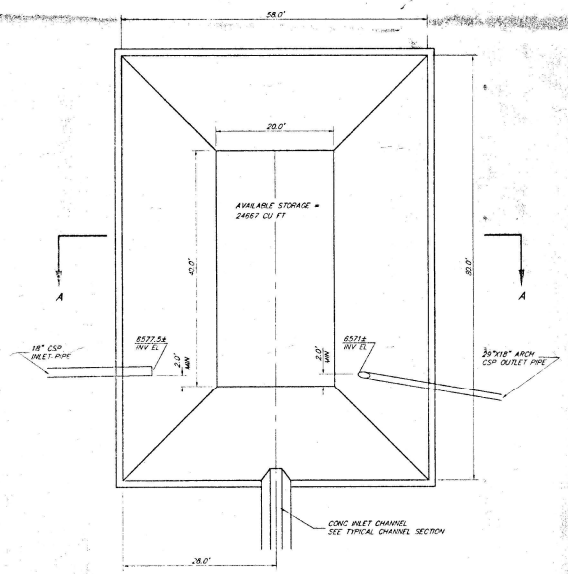


TYPICAL CHANNEL SECTION

SCALE 1" = 2'

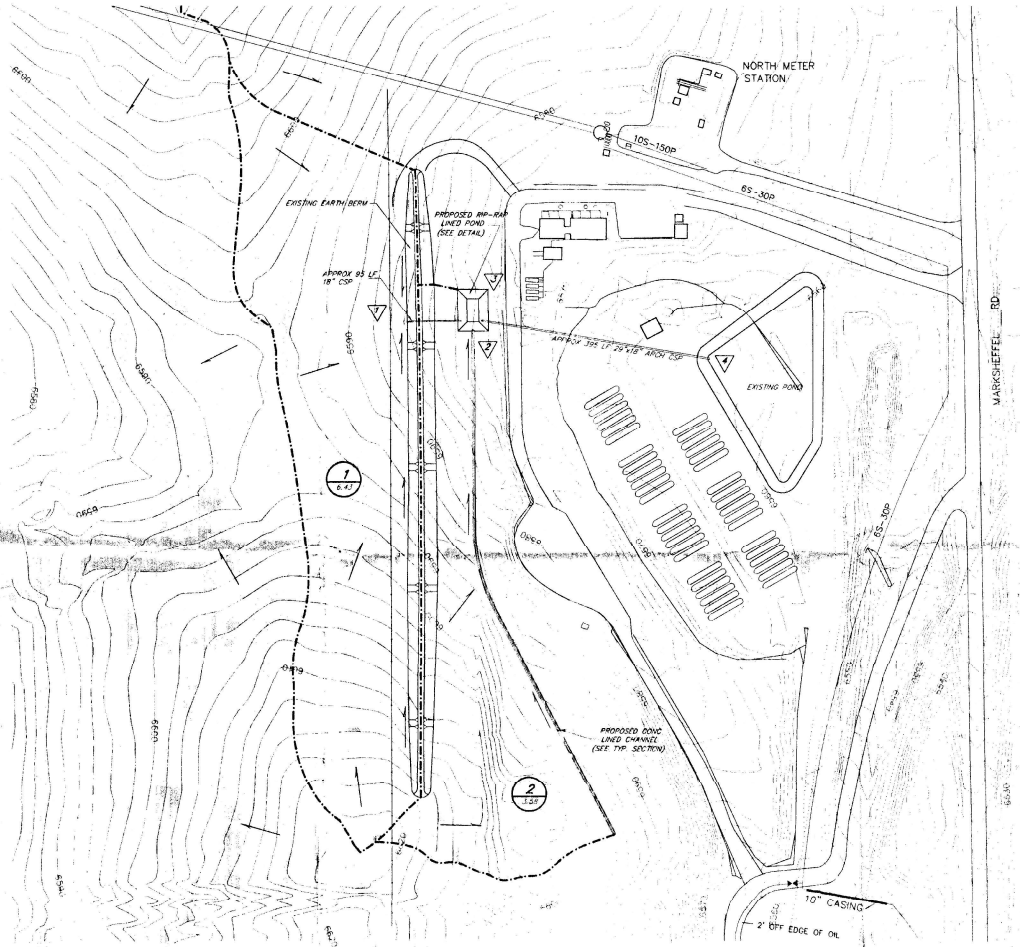


SECTION A-A



DETENSION POND DETAIL

SCALE 1" = 10'



SCALE

100' 50' 0 50' 100' 200'

75' 25'

1"=100' 1:1200

SITE HYDROLOGY DATA

DESIGN POINT	INCL. BASINS	AREA (Ac)	Q_5 (cfs)	Q_{100} (cfs)	NOTE
1	1	6.43	4.4	10.7	PEAK DISCHARGE WEST OF BERM INTO 2-12" PIPES & ENTERING POND
2	2	3.58	2.6	6.4	PEAK DISCHARGE IN CHANNEL FROM BASIN 1 ENTERING POND
3	1, 2	10.01	--	16.3	TOTAL PEAK DISCHARGE INTO POND (TOTAL INFLOW)
4	1, 2	10.01	--	13.2	TOTAL PEAK DISCHARGE FROM 29"x18" ARCH CSP OUTLET PIPE (TOTAL OUTFLOW)

LEGEND

- DRAINAGE BASIN BOUNDARY LINE
- E (6.43) — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- 53 LF 18" RCP — PROPOSED STORM DRAIN PIPE
- 1 — DESIGN POINT DESIGNATION
- FLOW DIRECTION ARROW

NOTE: THE EXISTING TOPOGRAPHY SHOWN ON THIS MAP IS FROM THE COLORADO SPRINGS UTILITIES' FACILITY INFORMATION MANAGEMENT SYSTEMS (FIMS) PROVIDED BY THE GAS DEPARTMENT.

PROJECT: COLORADO SPRINGS UTILITIES - GAS DEPT.

TITLE: DRAINAGE IMPROVEMENTS PLAN - PROP. FEAK. PLANT

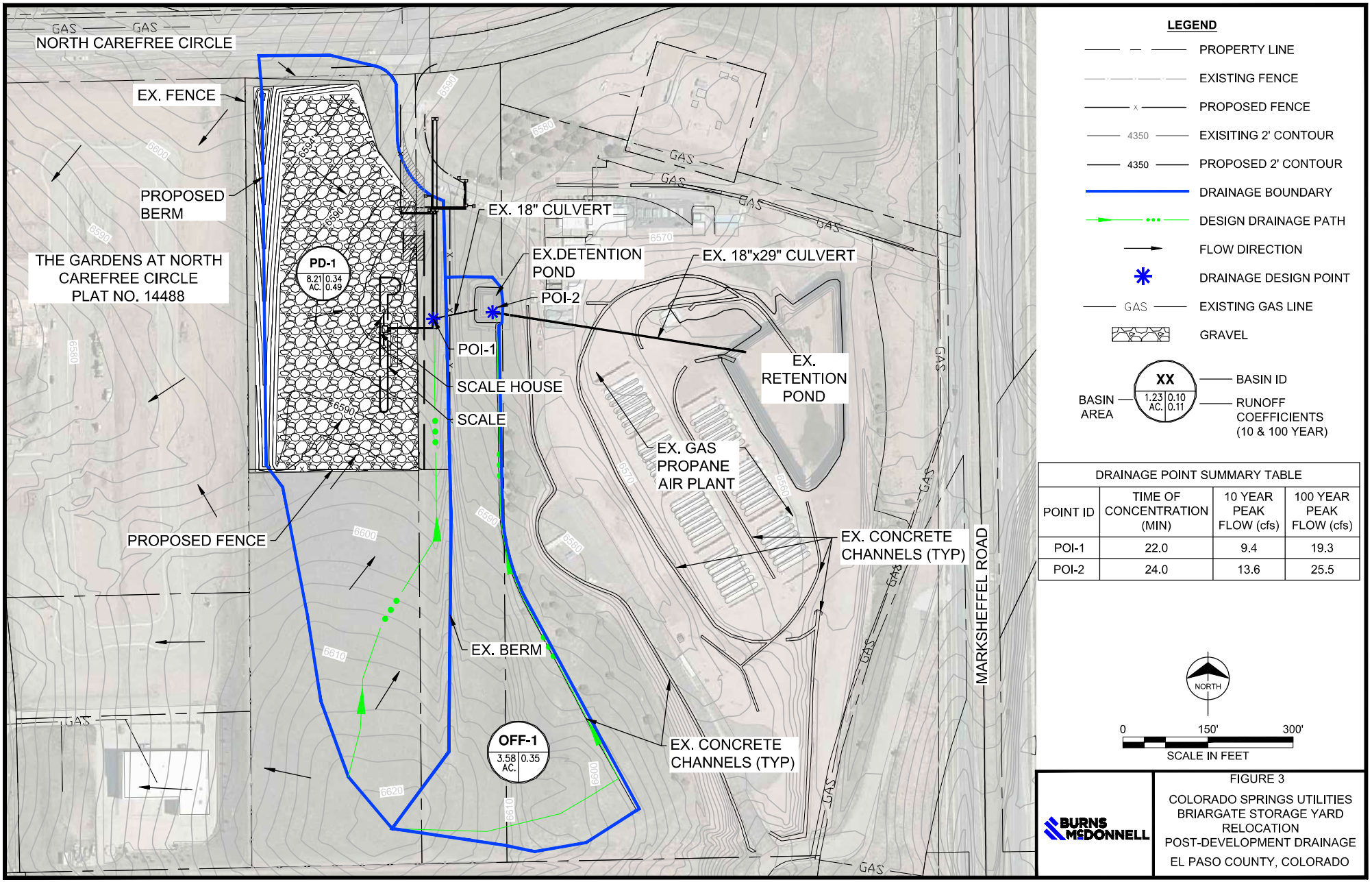
MONUMENT VALLEY ENGINEERS INC.

ENGINEERS • SURVEYORS

PROJ. NO.
DRAWN:
ENGINEER:
CHECKED:
SCALE:
DATE:
REVISIONS:
NO. DATE:

SHEET OF

DRAWING



LEGEND

- PROPERTY LINE
- EXISTING FENCE
- PROPOSED FENCE
- 4350 EXISITING 2' CONTOUR
- 4350 PROPOSED 2' CONTOUR
- DRAINAGE BOUNDARY
- DESIGN DRAINAGE PATH
- FLOW DIRECTION
- DRAINAGE DESIGN POINT
- GAS EXISTING GAS LINE
- GRAVEL

BASIN AREA — XX (1.23 AC. | 0.10 | 0.11) — BASIN ID; RUNOFF COEFFICIENTS (10 & 100 YEAR)

DRAINAGE POINT SUMMARY TABLE			
POINT ID	TIME OF CONCENTRATION (MIN)	10 YEAR PEAK FLOW (cfs)	100 YEAR PEAK FLOW (cfs)
POI-1	22.0	9.4	19.3
POI-2	24.0	13.6	25.5

NORTH

0 150' 300'

SCALE IN FEET

BURNS McDONNELL

FIGURE 3

COLORADO SPRINGS UTILITIES
BRIARGATE STORAGE YARD RELOCATION
POST-DEVELOPMENT DRAINAGE
EL PASO COUNTY, COLORADO

CREATE AMAZING.

Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
O 816-333-9400
F 816-333-3690
www.burnsmcd.com

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone 719-520-6300
Fax 719-520-6695
www.elpasoco.com

EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

FINAL DRAINAGE REPORT (FDR) CHECKLIST

Revised: July 2019

		Applicant	PCD
1	**Final Drainage Report**		
	The final drainage report finalizes concepts and presents the design details for the drainage facilities. Any changes to the preliminary design concepts presented in a preliminary drainage plan due to review comments by the County are incorporated into the final drainage plan. A final drainage report is generally required to accompany any site development plan, final plat or major development that utilized a preliminary drainage report, or which does not qualify for a letter report. A determination of whether a final drainage report is required shall be made by the ECM Administrator in conformance with the requirements of the ECM. When specific improvements are required, the construction drawings and specifications shall be submitted for review with the final drainage plan, and any improvements included in the construction financial assurance required by the ECM.		
	The purpose of the Final Drainage Report is to finalize concepts and to present the design details for the draiage facilities presented in the PDR. Also, any change to the preliminary design concepts which were incorporated due to review comments by the County, must be presented. The FDR shall contain all componenets of the PDR checklist plus additional necessay information relating to the design of specific facilities associated with the development.		
a	**Report Contents**		
1	Table of contents, pages numbered	X	
2	Existing/Historic and Developed Conditions Plans at the end of the report	X	
b	**General Location**		
1	City and County, and local streets within and adjacent to the subdivision.	Sect 1.1	
2	Township, Range, section, 1/4 section.	Sect 1.1	
3	Major drainage ways and existing facilities.	Sect 1.2.2	
4	Names of surrounding platted developments.	Sect 1.1	
c	**Description of Property**		
1	Area in acres.	Sect 1.2.1	
2	Ground cover, (type of trees, shrubs, vegitation).	Sect 1.2.1	
3	General topography	Sect 1.2.2	
4	General soil conditions.	Sect 1.2.3	
5	Major drainageways	Sect 2.1	
6	Irrigation facilities	N/A	
7	Utilities and other encumbrances	Sect 1.2.1	
d	**Major Basin Descriptions**		
1	Reference should be made to major drainageway planning studies; Such as Drainage Basin Planning Studies; Flood Hazard delineation reports, and flood insurance studies or maps if available.	Sect 2.1	
2	A flood plain statement shall be provided indicating whether any portion of the development is in a designated floodplain as delineated on the curret FEMA mapping.	Sect 2.1	
3	Major basin drainage characteristics.	Sect 2.1	
4	Identification of all nearby irrigation facilities and other obstructions which could influence or be influenced by local drainage.	N/A	
e	**Sub-Basin Descriptions**		
1	Discussion of historic drainage patterns of the property in question	Sect 2.2	
2	Discussion of offsite drainage flow patterns and their impact on the development.	Sect 2.2	
f	**Drainage Design Criteria**		
1	Reference all criteria, master plans, and technical information used for report preparation and design; any deviation from such material must be discussed and justified.	Sect 3.1	
2	Discussion of previous drainage studies (i.e. PDR, drainage basin planning studies, master plans, flood insurance studies) for the site in question that influence or are influenced by the drainage design and how the studies affect drainage design for the site	Sect 2.1	

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone 719-520-6300
Fax 719-520-6695
www.elpasoco.com

EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

FINAL DRAINAGE REPORT (FDR) CHECKLIST

	Revised: July 2019	Applicant	PCD
g	**Four Step Process**		
1	Runoff reduction proposed.	Sect 3.4.1	
2	Stabilization of drainage ways proposed/discussed.	Sect 3.4.2	
3	Proposed Stormwater Quality Capture Volume (WQCV) proposed.	Sect 3.4.3	
4	Identify Best Management Practices (BMP's) to be used to control industrial and commercial pollutants.	Sect 3.4.4	
h	**Hydrologic Criteria**		
1	Identify design rainfall.	Sect 3.2	
2	Identify runoff calculation method.	Sect 3.2	
3	Identify design storm recurrence intervals	Sect 3.2	
4	Identify detention discharge and storage calculation method.	Sect 3.3	
5	Note ECM Apendix I Full Spectrum Detention (FSD) requirement.	N/A	
i	**Drainage Facility Design - General Concept**		
1	Discussion of compliance with offsite runoff considerations.	N/A	
2	Discussion of anticipated and proposed drainage patterns.	Sect 4.1	
3	Discussion of the content of tables, charts, figures, plates or drawings presented in the report.	X	
j	**Drainage Facility Design - Specific Details**		
1	Presentation of existing and proposed hydrologic conditions including approximate flow rates entering and exiting the subdivision with all necessary calculation	Sect 4.2	
2	Presentation of approach to accommodate drainage impacts on existing or proposed improvements and facilities	Sect 4.3	
3	Presentation of proposed facilities with respect to alignment, material and structure type.	N/A	
4	Discussion of drainage impact of site constraints such as streets, utilities existing and proposed structures.	Sect 4.4	
5	Environmental features and issues shall be presented if applicable.	N/A	
6	Discussion of maintenance access and aspects of the preliminary design.	N/A	
7	Discussion and analysis of existing and proposed downstream drainage facilities and their ability to convey developed runoff from the proposed development.	Sect 4.4	
8	Presentation of detention storage and outlet design (including reservoir routings) when applicable. Note the Engineering Critreia Manual Apendix I which requires Full Spectrum Detention.	App C&D	
9	Presentations of all hydrologic and hydraulic calculations including hydraulic grade line computations as appropriate. Recommended use of Urban Drainage and Flood Control District (UDFCD) spreadsheets and calculations to properly meet this requirement.	App C&D	
10	Presentation of an accurate, complete current estimate of cost of proposed facilties.	Sect 4.4.2	
11	Presentation of all drainage fees bridge fees for the property in question as applicable.	Sect 4.4.3	
k	**Other Government agency requirements**		
1	Federal Emergency Management Agency (FEMA)	N/A	
2	Army Corps of Engineers (COE)	N/A	
3	Colorado State Engineer	N/A	
4	Colorado Water Conservation Board (CWCB)	N/A	
5	Others	N/A	
l	**Drawing Contents, two maps/plans are required, existing conditions & the proposed plans.**		
1	General Location Map: A map shall be provided in sufficient detail to identify drainage flows entering and leaving the development and general drainage patterns. The map should be at a scale of 1"=50' to 1"=2000'. The map shall identify any major construction (i.e. development, irrigation ditches, existing detention facilities, culverts, storm sewers, etc.) that shall influence or be influenced by the subdivision.	App F	
2	Drainage Plan: Map(s) of the proposed development at a scale of 1"=20' to 1"=200' shall be included to identify existing and proposed conditions on or adjacent to the site in question.	App F	

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone 719-520-6300
Fax 719-520-6695
www.elpasoco.com

EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

FINAL DRAINAGE REPORT (FDR) CHECKLIST

	Revised: July 2019	Applicant	PCD
i	Existing and proposed contours at 2 feet maximum intervals. For subdivisions involving rural lots greater than 1.0 acre, the maximum interval may be 5 feet where approved. In terrain greater than 10% the intervals should be 10 foot intervals.	App F	
ii	Property lines and existing or proposed easements with purposes noted.	App F	
iii	All Streets	App F	
iv	Existing drainage facilities and structures, including irrigation ditches roadside ditches, drainageways, gutters and culverts, all indicating flow direction. All pertinent information such as material, size, shape, slope and locations shall also be included.	App F	
v	Overall drainage area boundary and drainage sub-area boundaries relating to the subdivision.	App F	
vi	Proposed type of street sections (i.e., vertical or ramp curb and gutters roadside ditch, gutter flow and/or cross pans).	N/A	
vii	Proposed storm sewers and open drainageways, including inlets, manholes, culverts, and other appurtenances.	N/A	
viii	Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.	App F	
ix	Routing and summary of initial and major flow rates at various design points for all storm runoff associated with the property.	App F	
x	Path (s) chosen for computation of time of concentration.	App F	
xi	Details of and design computations for detention storage facilities including outlet.	App F	
xii	Location and elevations of all defined 100-year flood plains affecting the property.	N/A	
xiii	Location of all existing and proposed utilities affected by or affecting the drainage design.	App F	

4. Applicant Comments:

If the applicant has failed to provide any of the required items they must provide justification in the comment section below indicating why the requirement is unnesessary.

1			
2			
3			