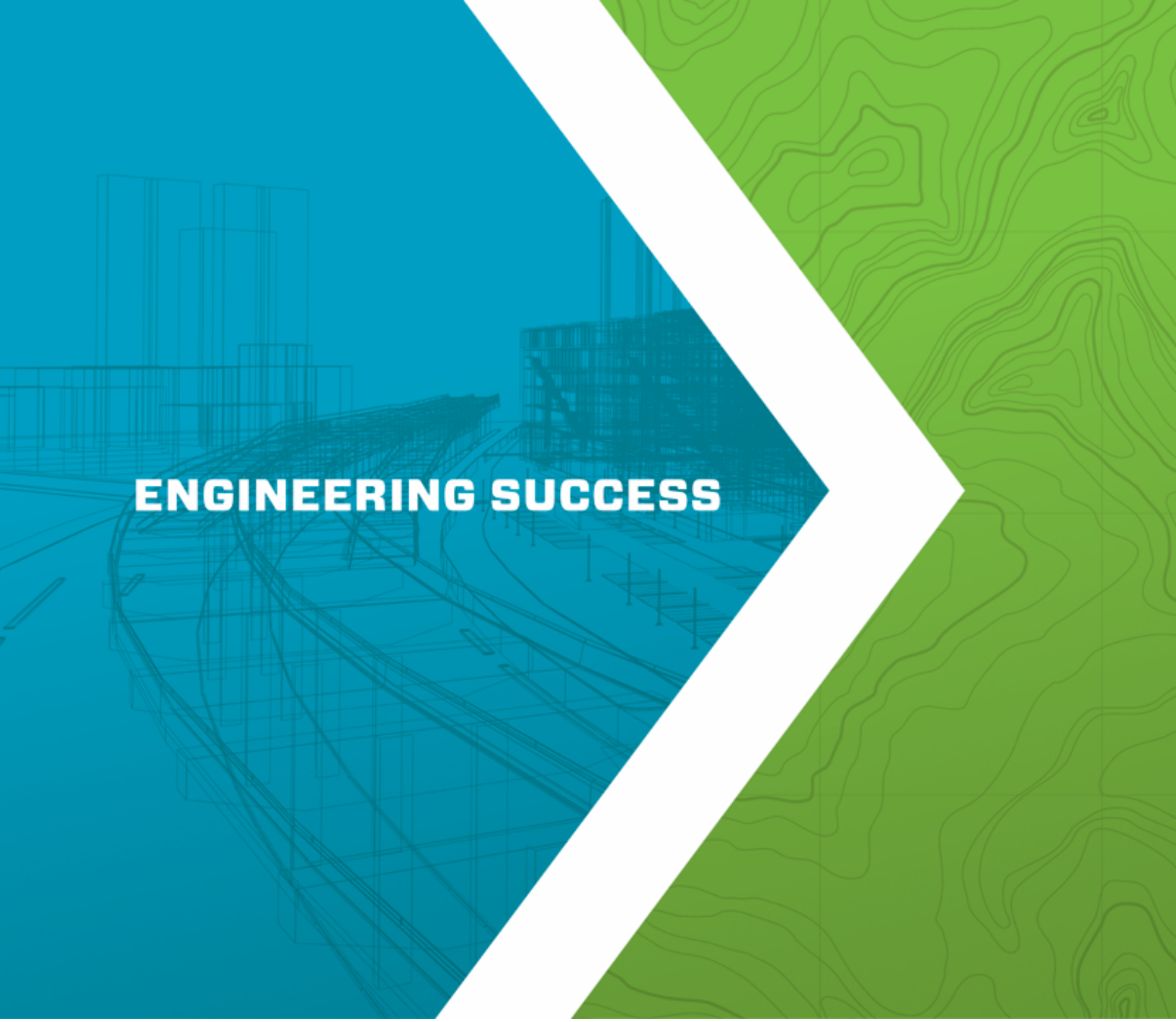


DRAINAGE STUDY
FOR

Monument Industrial, Lots 1 and 2
Monument, El Paso County, Colorado

411 N. Webb Rd.
Wichita, KS 67206
316.684.9600

PROJECT NUMBER: 2001010383
DATE: January 2021

Table of Contents

General Information

Purpose

This report evaluates the management of drainage and stormwater runoff for the site of Monument Industrial in the Town of Monument, Colorado. This report reviews existing drainage conditions and evaluates proposed drainage conditions as a result of the proposed improvements to the site and its conformance with Town requirements for managing stormwater runoff. The area of development was included within the Preliminary Santa Fe Park Drainage Report dated May 2020 by Rockwell Consulting, Inc. This report is required to document proposed flow rates from the site for the Town.

Location

The Monument Industrial site is approximately 11.0 acres and is located on Lots 1 and 2. The site is located west of I-25, east of Old Denver Highway, and north of West Baptist Road in Section 26, Township 11 South, Range 67 West. The site is shown on the USGS Quadrangle Exhibit, Appendix A and the Aerial Exhibit, Appendix B.

Development

The project site will be developed to include a proposed warehouse facility, parking lot, and detention facility. The current site is undeveloped pasture land. The site plan is included as Appendix C.

Datum

The site survey uses NAVD 88 datum.

History

The area of the site was included in the Preliminary Santa Fe Park Drainage Report dated May 2020 by Rockwell Consulting, Inc. This report documented historic and developed drainage areas for the Santa Fe Park Preliminary PD, including the area of Monument Industrial site development.

Soils

The drainage areas on site are comprised of the following soil types according to the Natural Resources Conservation Service (NRCS) Soil Survey, Appendix D:

- Pring Coarse Sandy Loam, 3 to 8 percent slopes, HSG “B”

The Hydraulic Soil Group (HSG) for selection of runoff curve numbers (CN) is HSG “B”.

Flood Insurance Rate Map (FIRM)

The site is shown on FEMA FIRM Panels 08041C0286G, Town of Monument, effective December 7th, 2018, Appendix E. The site is located in Zone X, areas of minimal flood hazard outside of the 1% annual chance flooding.

Drainage Patterns

Hydrologic Methods

The existing and proposed drainage areas were modeled using Hydraflow Hydrographs by AutoCAD, Appendix F. The SCS Method was used in calculations with rainfall depths determined from the NOAA Atlas 14 Monument, Colorado, as shown in Table 1. Time of Concentration was calculated using the TR-55 Method in Hydraflow Hydrographs, Appendix F. The El Paso County Drainage Criteria Manual and City of Colorado Springs Drainage Criteria Manuals have been referenced in this drainage report. The drainage report will meet requirements outlined in Chapter 17.45 of the Monument Town Code.

Table 1. Rainfall Depths (inches) for 24- Hour Design Storm

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Monument, CO	2.09	2.68	3.22	4.03	4.71	5.45

Drainage Conditions

Existing Conditions

Under existing conditions, the Monument Industrial project site is approximately 11 acres and is located in Historic Drainage Basin F, as documented in the Preliminary Santa Fe Park Drainage Report by Rockwell Consulting, Inc. In this report, the on-site and off-site area has been analyzed in greater detail in order to document existing flow rates for all design storms from the specific site area and analyzed using SCS Method for all design storms.

Historic Drainage Basin F is 13.56 acres and includes the 11 acres of site area. The remaining 2.56 acres is located offsite, north of the Monument Industrial site location. The area drains from north to south as it sheet flows to the south. These flows are directed into Historic OS-4 towards the existing roadway drainage swale on the north side of Baptist Road. The Historic Drainage Plan for Santa Fe Park has been included as Appendix G for reference. Table 2 describes existing drainage area conditions for all design storms.

Table 2. Existing Drainage Area (DA) Conditions

	Area (acres)	Tc (min)	CN	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
Offsite Drainage Area	2.56	5.0	84	2.9	4.5	6.1	8.6	10.8	13.1
Existing Site	11.0	10.0	73	5.4	11.1	17.1	27.0	35.9	46.0

Proposed Conditions

The proposed site is located on the developed drainage basin 17 and 18 from the Preliminary Santa Fe Park Drainage Report by Rockwell Consulting, Inc. It was determined during preliminary site design that detention would be required for the site due to development scheduling. The regional detention facility for Santa Fe Park Preliminary PD has not been constructed yet and has been planned on a longer development time frame. Therefore, the site requires an individual detention facility and will not utilize the Regional Detention Facility, as had been detailed in the previous report.

The regional water quality/ detention pond was planned at the southwestern corner of the Santa Fe Park development. Flows from the pond were planned to the released into the exiting drainage way along the north side of Baptist Road. The Regional Detention Pond is to provide a total of 10.876 acre-feet of Full Spectrum Detention volume. The Developed Drainage Plan for Santa Fe Park has been included as Appendix H for reference. The proposed drainage and utility plan for the Monument Industrial site has been included as Appendix I. Table 3 describes proposed drainage area conditions for all design storms.

Developed Drainage Basins 17 and 18 are approximately 15.0 acres combined. The site development utilizes approximately 11.0 acres of this drainage basin with the remaining 4.0 acres included in the offsite area to the proposed dry detention facility.

The proposed dry detention facility will be constructed to detain the proposed development. The dry detention facility will outfall to the south, bypassing the regional detention facility located at the southwest corner of the Santa Fe Park Preliminary PD development, approximately 500’ southwest of the Monument Industrial development. The proposed dry detention facility has a dry bottom elevation of 6,844’ and will drain through an 18” SWS outfall, Table 4. The outfall will drain to the south to the roadside ditch, as it does under existing conditions. The dry detention facility has a 100-year pond water surface elevation of 6,850’.

The top of berm is approximately 6,851' to provide a minimum of 1' of freeboard as required by the City of Colorado Springs Drainage Criteria Manual, Volume 1. The release rates from the proposed detention facility have decreased flow rates from the site to be less than pre-development runoff for the 2-year to 100-year design storms. The existing and proposed flow rates have been compared in Table 5.

A conveyance system for Basin OS-3 has been detailed in the Preliminary Santa Fe Park Drainage Report. A proposed 36" RCP stormwater system will route the offsite I-25 drainage area through the site. The system has been sized for the planned release rates of this area and will be conveyed around the Monument Industrial site as it bypasses undetained through the site to the existing Baptist Road swale.

Table 3. Proposed Drainage Area (DA) Conditions

	Area (acres)	Tc (min)	CN	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
Offsite Drainage Area	4.0	5.0	84.0	4.1	6.4	8.6	12.0	14.9	18.1
Proposed Site	11.0	5.0	92.0	24.2	33.5	42.1	54.9	65.6	77.1

Table 4. Dry Detention Facility

	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
Flow In (cfs)	28.2	39.9	50.7	66.9	80.5	95.3
Flow Out (cfs)	8.7	11.7	13.8	16.4	17.9	19.4
Storage Vol. (ac-ft)	0.5	0.7	0.9	1.2	1.5	1.8
Water Sur. Elev. (ft)	6846.2	6846.9	6847.5	6848.5	6849.2	6850.0
Outlet Structure	18" SWS at 6844'					

Table 5. Flow Rate to the South

	2-Yr cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
Existing	9.0	16.7	24.5	37.2	48.4	61.0
Proposed	8.7	11.7	13.8	16.4	17.9	19.4
Decrease	3.0%	30%	44%	56%	63%	68%

Utilities

Water

A proposed water line will connect to a future water line located along Terrazzo Drive. The proposed water line will connect and extend to service the proposed building.

Sanitary Sewer

A sanitary sewer line will be extended along La Campana Drive to service the proposed building.

Stormwater Sewer

Proposed stormwater sewer lines will convey runoff from the proposed site improvements to the dry detention facility. The detention facility will detain runoff from the site to the existing SWS system. The Preliminary Santa Fe Park Drainage Report by Rockwell Consulting, Inc. outlined a 36" RCP bypass line to convey I-2 stormwater from offsite to the existing Baptist Road drainage ditch.

Storm Water Quality

The dry detention facility will act as a Storage-Based BMP to greatly reduce runoff from the site. The Hydraulic Soil Group in this area is HSG "B", allowing a permeable soil for the dry detention facility.

The Stormwater Quality for the pond will adhere to the City of Colorado Springs Drainage Criteria Manual Volume 2. Chapter 3, Section 2.1 relays that the "maximum capture volume required is approximately 0.5 inches over the area of the watershed." Therefore, for the 15.0-acre Monument Industrial watershed area, approximately 0.6 ac-ft of detention is required. The proposed dry detention facility will provide adequate detention for the watershed.

Permitting

U.S. Army Corps of Engineers

There is no blue line stream located on the site, therefore permitting through the U.S. Army Corps of Engineers will not be required.

Federal Emergency Management Agency (FEMA)

There are no FEMA floodplains on the site; therefore permitting through FEMA will not be required.

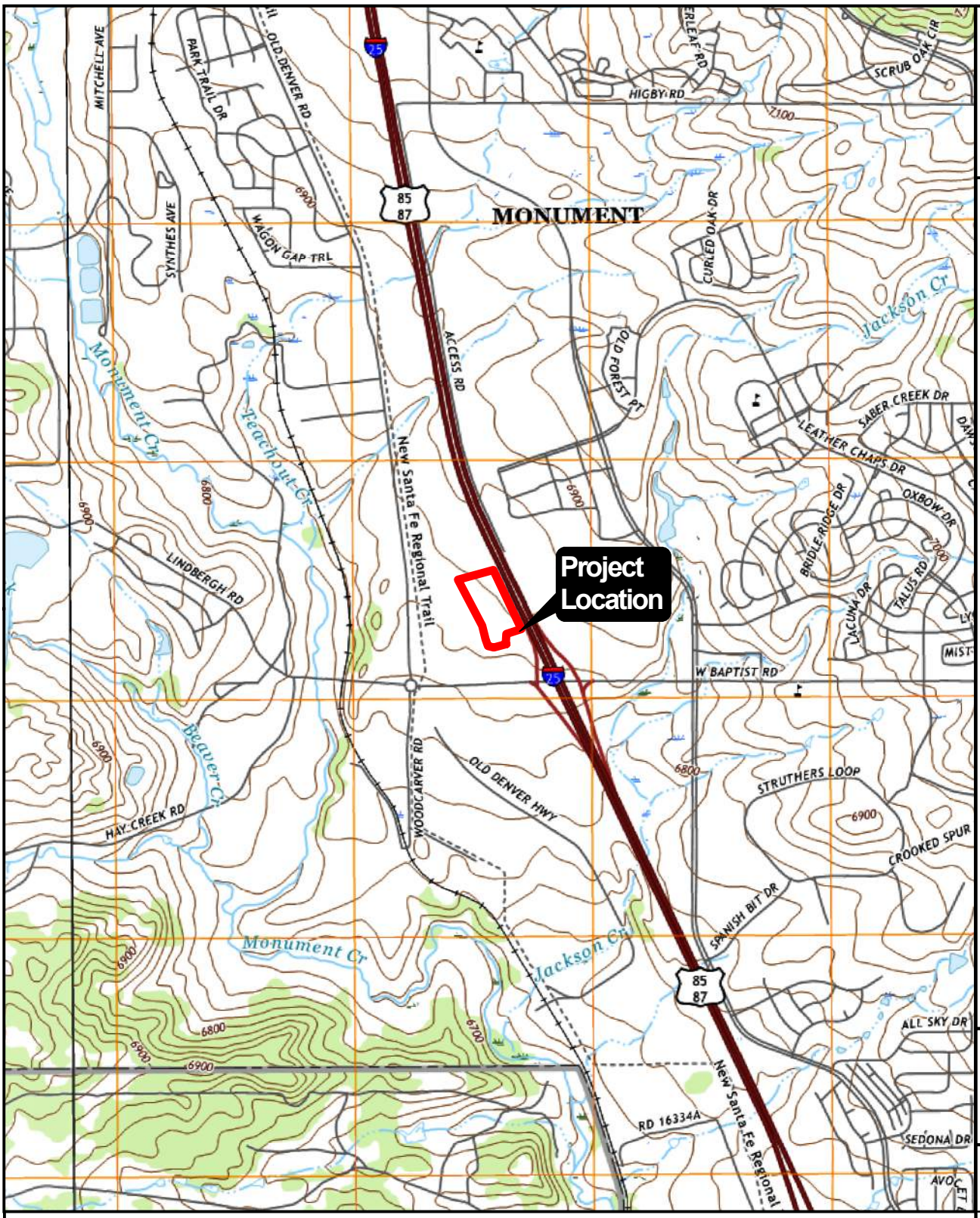
Colorado Department of Public Health and Environment (CDPHE)

Since the site disturbs more than 1.0 acre, a Notice of Intent (NOI) and Storm Water Management Plan (SWMP) will be required.

Summary

The Monument Industrial site is located in the Town of Monument, El Paso County, Colorado. The proposed development includes a warehouse, parking lot, and dry detention facility. This area was analyzed in the Preliminary Santa Fe Park Drainage Report, dated May 2020 by Rockwell Consulting, Inc. It was determined during preliminary site design that detention would be required for the site due to the timing of the construction of the regional detention. The site requires an individual detention facility and will not utilize the Southwest Extended Detention Facility, as had been detailed in the previous report. The proposed dry detention facility has a storage volume of 1.8 ac-ft in the 100-year design storm and will decrease runoff to be less than pre-developed conditions in all design storms.

Appendix A – USGS Quadrangle



MKEC

Wichita, KS 316.684.9600

USGS QUAD EXHIBIT
MONUMENT WAREHOUSE
MONUMENT, EL PASO COUNTY, COLORADO

SEC: 26
TWP: T11S
RNG: R67W

PROJECT NO.	2001010383
DATE	Jan 2021
SCALE	1"=2000'

DESIGNED	DRAWN	CHECKED
LES	LES	KLA

NO.	REVISION	DATE

SHEET NO.

1 OF 1

N

1 0.5 0 1 Miles

1,000 500 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 Feet

1 0.5 0 1 Kilometers

Path: J:\Projects\2020\2001010383_Triview Monument CO\05 Civil\GIS\USGS Quad Exhibit.mxd - Date: 1/6/2021

Appendix B – Aerial Photograph

SEC: 26
TWP: T11S
RNG: R67W

1 "=400 ' / 1:4800

0 100 200 400

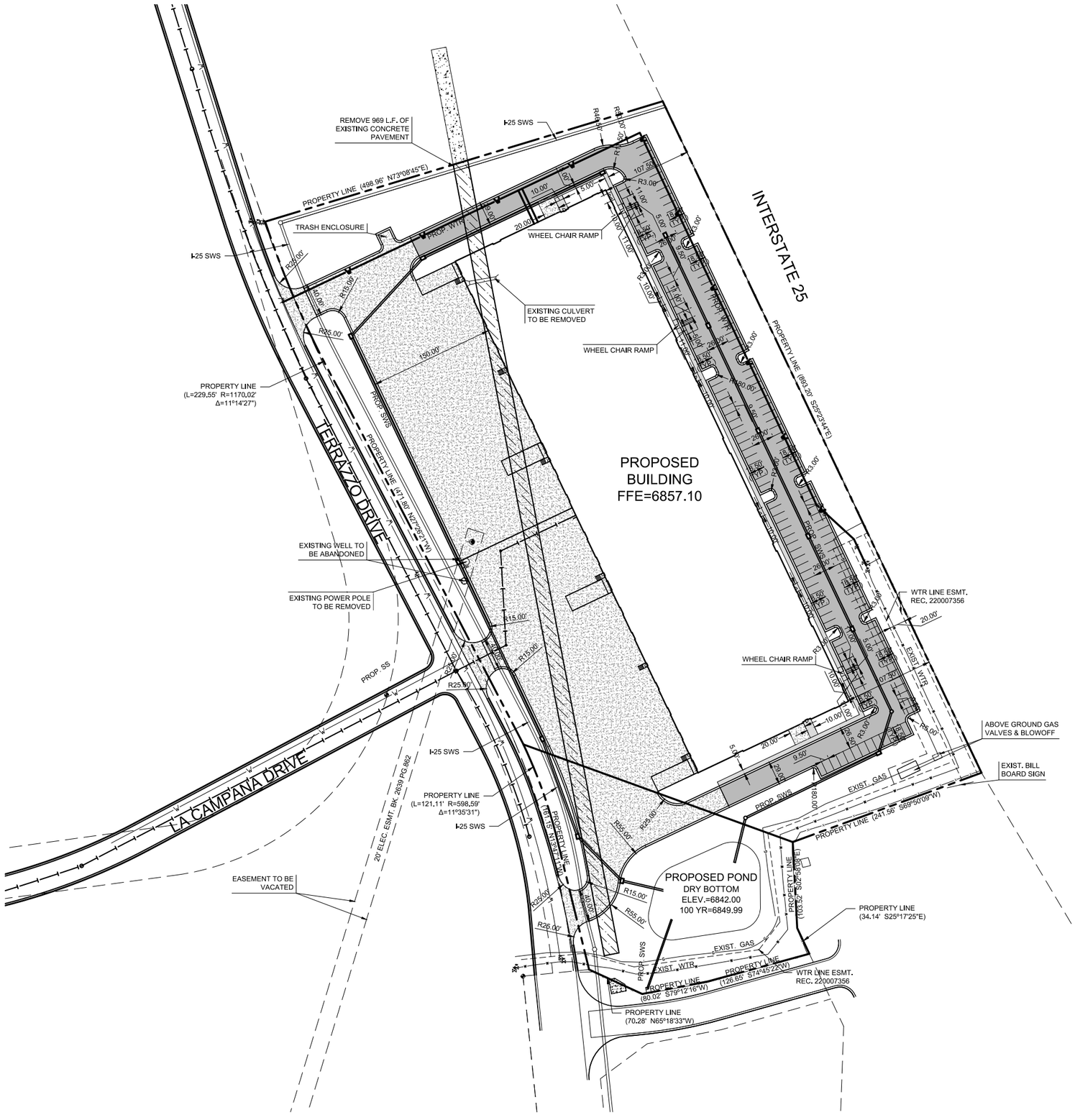
MKEC
Wichita, KS · 316.684.9600

AERIAL EXHIBIT
MONUMENT WAREHOUSE
MONUMENT, EL PASO COUNTY, COLORADO

PROJECT NO. 2001010383	DATE: January 2021		SHEET NO.
DRAWN BY: LES	DESIGNED BY: LES	APPROVED BY: KLA	1 OF 1

Path: J:\Projects\2020\2001010383_Triview Monument CO\05 Civil\GIS\Aerial Exhibit.mxd - Date: 1/6/2021

Appendix C – Site Plan



LEGEND

EXISTING SANITARY SEWER	5.5" ASPHALTIC PAVEMENT
EXISTING WATER LINE	6" CONCRETE PAVEMENT
EXISTING STORM SEWER	4" CONCRETE SIDEWALK
EXISTING UNDERGROUND ELECTRIC	13 PARKING STALL COUNT
EXISTING OVERHEAD ELECTRIC	PROPOSED SLEEVE
EXISTING GAS LINE	

N

SCALE: 1"=60'

0 60 120

MKEC
Wichita, KS - 316-684-9600

C20.000.00

CONCEPT DESIGN

MONUMENT WAREHOUSE

ADDRESS UNKNOWN
MONUMENT, COLORADO

ADAMS ARCHITECTS
700 Massachusetts St.
Suite 202
Lawrence, Kansas 66044
(785) 218-3980
www.adamsarchs.com

APPROVED BY:

Name: --- Date: --.--.--
Name: --- Date: --.--.--
Name: --- Date: --.--.--

UNLESS A PROFESSIONAL SEAL WITH SIGNATURE AND DATE IS AFFIXED, THIS DOCUMENT IS PRELIMINARY AND IS NOT INTENDED FOR CONSTRUCTION.

REVISIONS

No.	Description	Date
A	CONCEPT	01-08-21

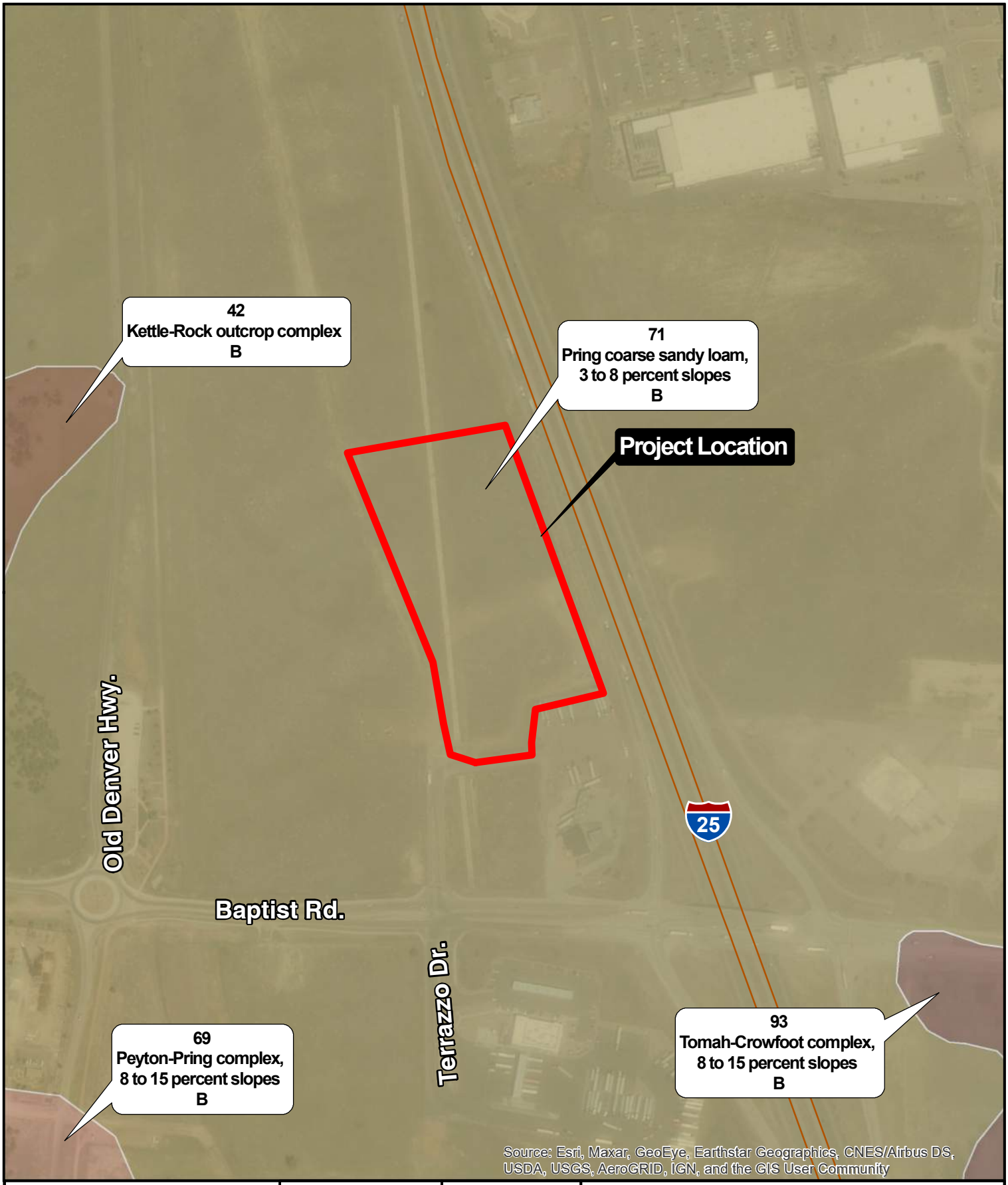
Rel. Date: 01-08-21

SITE PLAN

2

DATE PRINTED:Tuesday, December 20, 2005
LAST SAVED:Thursday, December 20, 2018
PRINTED BY:Adams Architects pc

Appendix D – Soil Survey



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RNG: R67W

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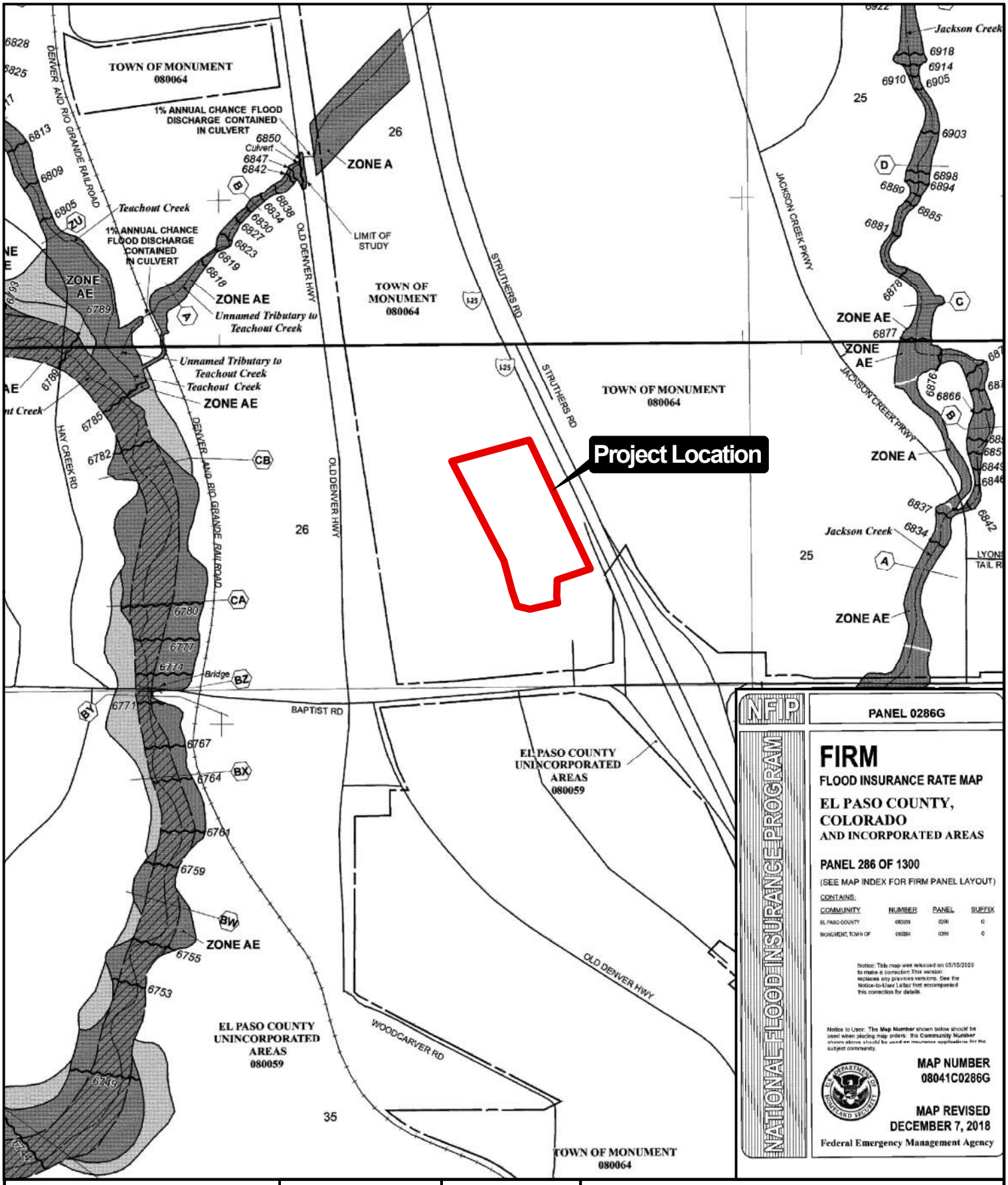
NRCS SOIL SURVEY EXHIBIT
MONUMENT WAREHOUSE
MONUMENT, EL PASO COUNTY, COLORADO

PROJECT NO. 2001010383	DATE: January 2021		SHEET NO.
DRAWN BY: LES	DESIGNED BY: LES	APPROVED BY: KLA	1 OF 1

Path: J:\Projects\2020\2001010383_Triview Monument CO\05 Civil\GIS\NRCS Soil Survey Exhibit.mxd - Date: 1/6/2021

Appendix E – FEMA FIRM



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RNG: R67W

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0 200 400 800

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Wichita, KS • 316.684.9600

FEMA FIRM EXHIBIT
MONUMENT WAREHOUSE
MONUMENT, EL PASO COUNTY, COLORADO

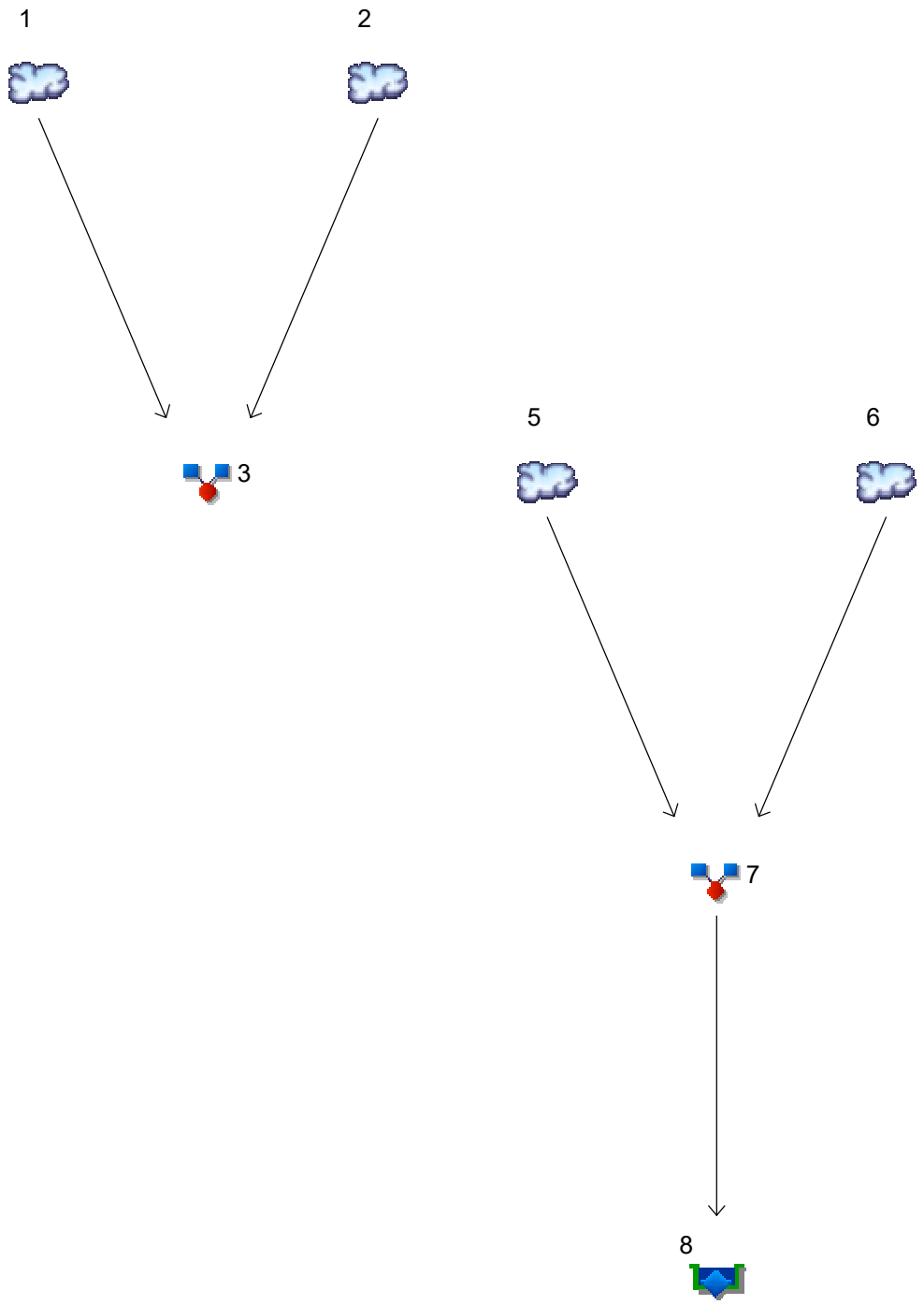
PROJECT NO. 2001010383	DATE: January 2021		SHEET NO.
DRAWN BY: LES	DESIGNED BY: LES	APPROVED BY: KLA	1 OF 1

Path: J:\Projects\2020\2001010383_Triview Monument CO\05 Civil\GIS\FEMA FIRM Exhibit.mxd - Date: 1/7/2021

Appendix F – Hydraflow Hydrograph Outputs

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3



Legend

Hyd.	Origin	Description
1	SCS Runoff	Offsite
2	SCS Runoff	Exist
3	Combine	Exist from site
5	SCS Runoff	Prop Offsite
6	SCS Runoff	Prop
7	Combine	Prop to Det
8	Reservoir	Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	2.992	2	722	0.181	------	------	------	Offsite
2	SCS Runoff	6.057	2	720	0.360	------	------	------	Exist
3	Combine	9.032	2	720	0.541	1, 2	------	------	Exist from site
5	SCS Runoff	4.125	2	718	0.189	------	------	------	Prop Offsite
6	SCS Runoff	24.16	2	716	1.139	------	------	------	Prop
7	Combine	28.21	2	716	1.329	5, 6	------	------	Prop to Det
8	Reservoir	8.673	2	724	1.328	7	6846.15	0.487	Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	4.705	2	720	0.281	------	------	------	Offsite
2	SCS Runoff	11.99	2	720	0.653	------	------	------	Exist
3	Combine	16.69	2	720	0.934	1, 2	------	------	Exist from site
5	SCS Runoff	6.363	2	718	0.295	------	------	------	Prop Offsite
6	SCS Runoff	33.52	2	716	1.606	------	------	------	Prop
7	Combine	39.88	2	716	1.901	5, 6	------	------	Prop to Det
8	Reservoir	11.72	2	724	1.901	7	6846.90	0.691	Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	6.379	2	720	0.380	------	------	------	Offsite
2	SCS Runoff	18.14	2	720	0.963	------	------	------	Exist
3	Combine	24.52	2	720	1.343	1, 2	------	------	Exist from site
5	SCS Runoff	8.575	2	716	0.398	------	------	------	Prop Offsite
6	SCS Runoff	42.09	2	716	2.044	------	------	------	Prop
7	Combine	50.67	2	716	2.443	5, 6	------	------	Prop to Det
8	Reservoir	13.82	2	724	2.442	7	6847.54	0.889	Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	8.977	2	720	0.536	------	------	------	Offsite
2	SCS Runoff	28.22	2	720	1.483	------	------	------	Exist
3	Combine	37.20	2	720	2.019	1, 2	------	------	Exist from site
5	SCS Runoff	12.00	2	716	0.562	------	------	------	Prop Offsite
6	SCS Runoff	54.89	2	716	2.713	------	------	------	Prop
7	Combine	66.90	2	716	3.275	5, 6	------	------	Prop to Det
8	Reservoir	16.38	2	724	3.274	7	6848.47	1.20	Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	11.20	2	720	0.672	------	------	------	Offsite
2	SCS Runoff	37.22	2	720	1.957	------	------	------	Exist
3	Combine	48.42	2	720	2.629	1, 2	------	------	Exist from site
5	SCS Runoff	14.93	2	716	0.705	------	------	------	Prop Offsite
6	SCS Runoff	65.57	2	716	3.280	------	------	------	Prop
7	Combine	80.50	2	716	3.985	5, 6	------	------	Prop to Det
8	Reservoir	17.94	2	724	3.984	7	6849.21	1.47	Pond

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph Description
1	SCS Runoff	13.64	2	720	0.823	------	------	------	Offsite
2	SCS Runoff	47.62	2	718	2.501	------	------	------	Exist
3	Combine	61.01	2	720	3.324	1, 2	------	------	Exist from site
5	SCS Runoff	18.13	2	716	0.864	------	------	------	Prop Offsite
6	SCS Runoff	77.12	2	716	3.902	------	------	------	Prop
7	Combine	95.25	2	716	4.766	5, 6	------	------	Prop to Det
8	Reservoir	19.43	2	726	4.765	7	6849.98	1.78	Pond

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 1

Offsite

Hydrograph type	= SCS Runoff	Peak discharge	= 13.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 0.823 acft
Drainage area	= 2.600 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
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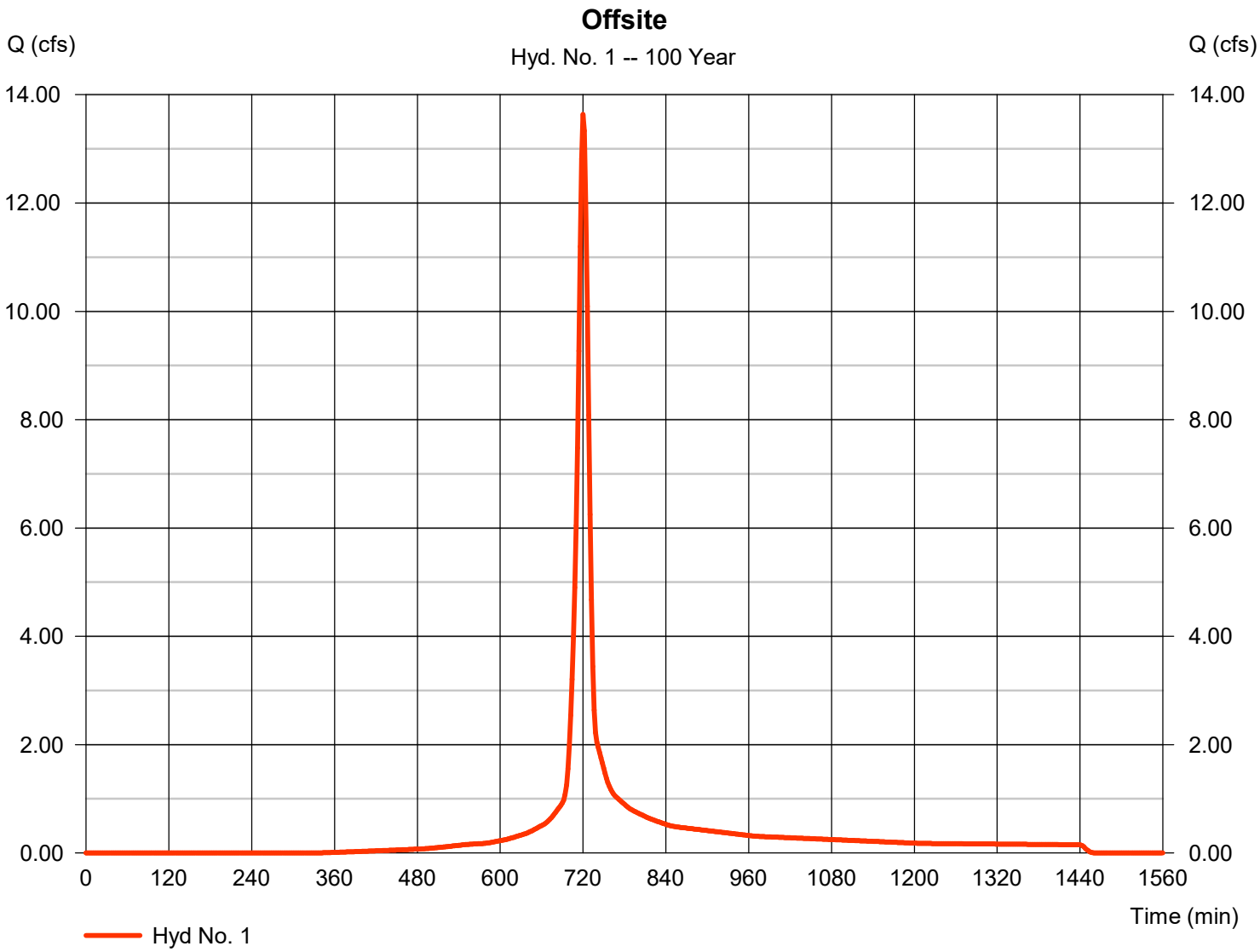
Total precip.	= 5.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 2

Exist

Hydrograph type	= SCS Runoff	Peak discharge	= 47.62 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2.501 acft
Drainage area	= 11.000 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
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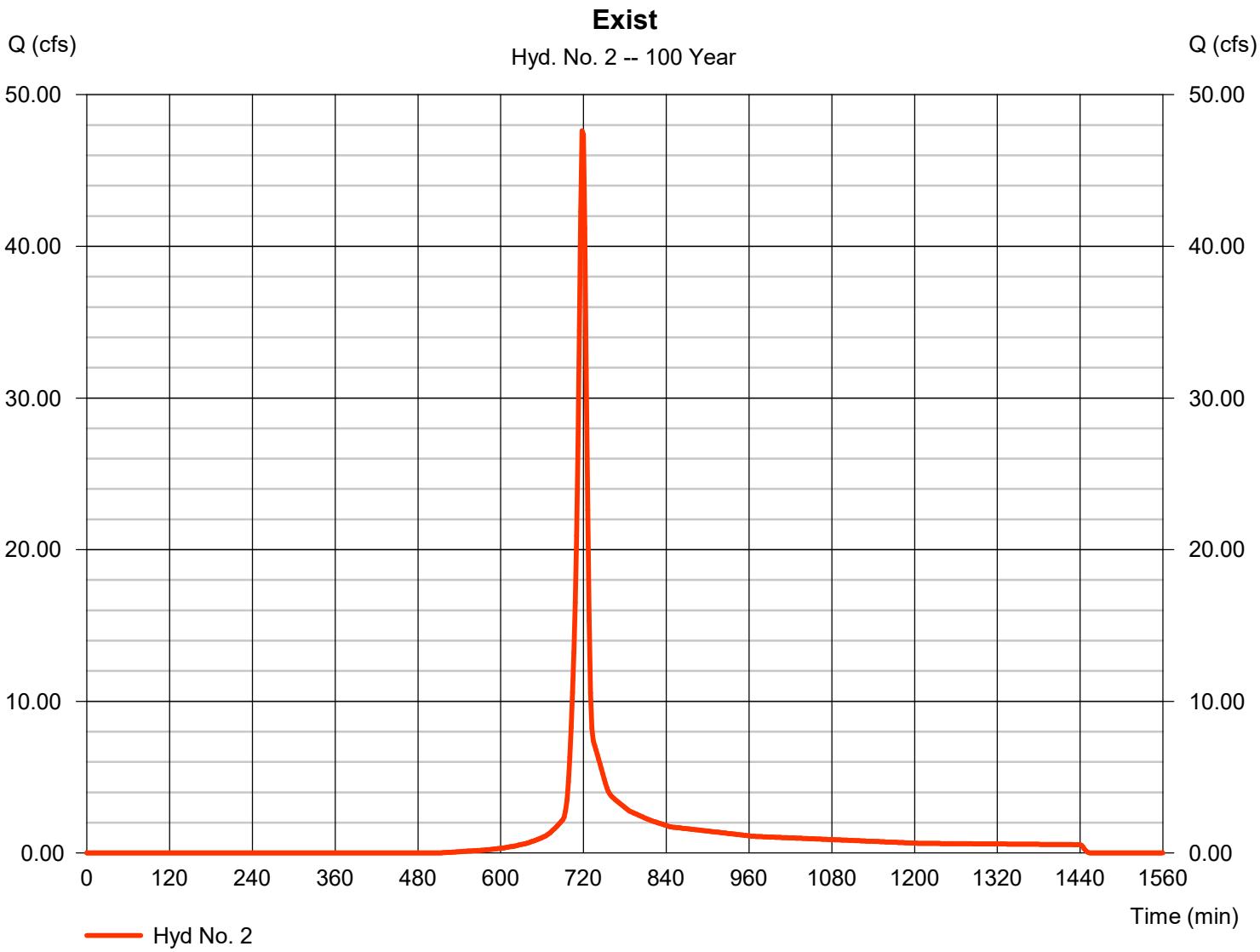
Storm duration	= 24 hrs	Shape factor	= 484



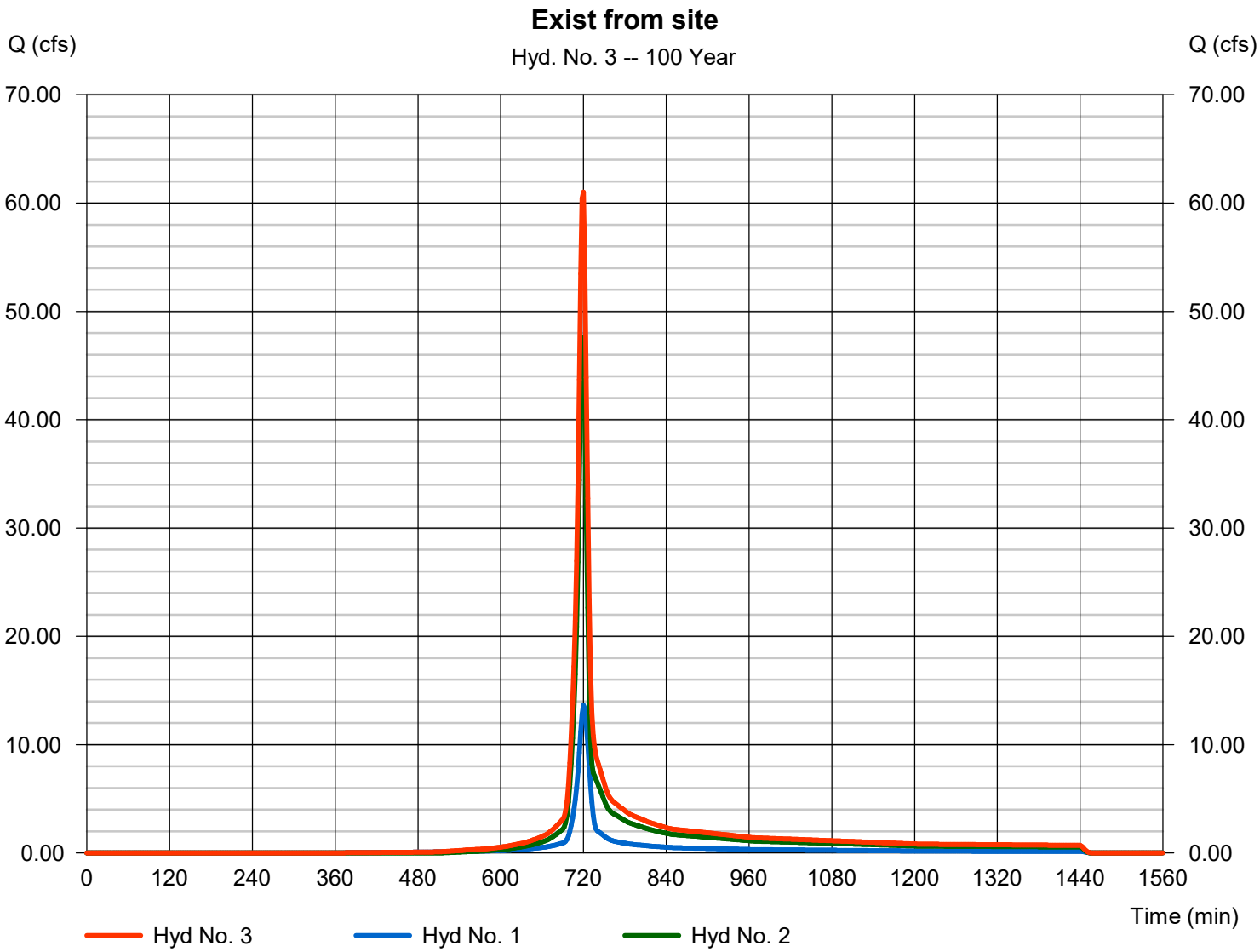
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 3

Exist from site

Hydrograph type	= Combine	Peak discharge	= 61.01 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 3.324 acft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 13.600 ac



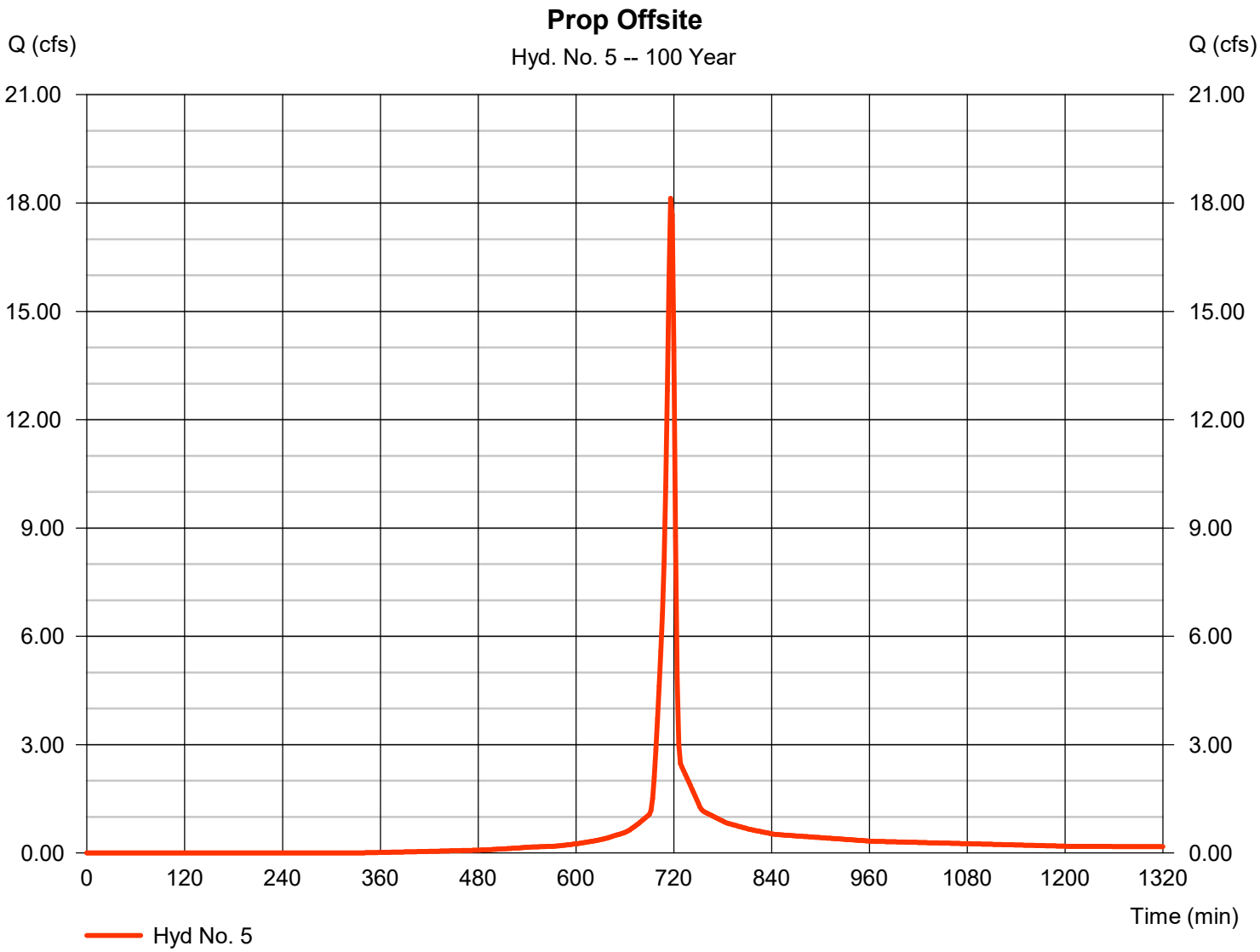
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 5

Prop Offsite

Hydrograph type	= SCS Runoff	Peak discharge	= 18.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 0.864 acft
Drainage area	= 3.000 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



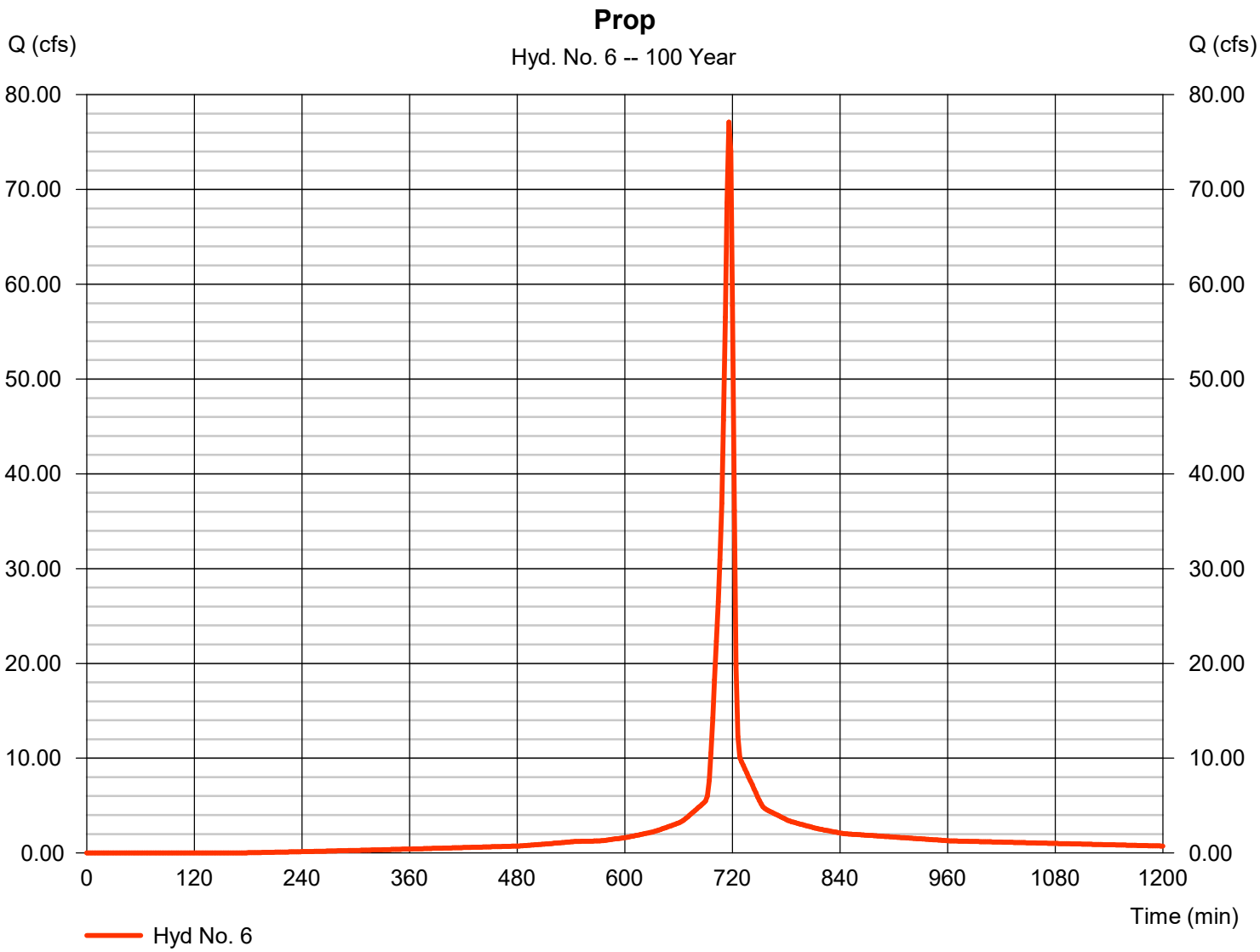
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 6

Prop

Hydrograph type	= SCS Runoff	Peak discharge	= 77.12 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 3.902 acft
Drainage area	= 11.000 ac	Curve number	= 92.1
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



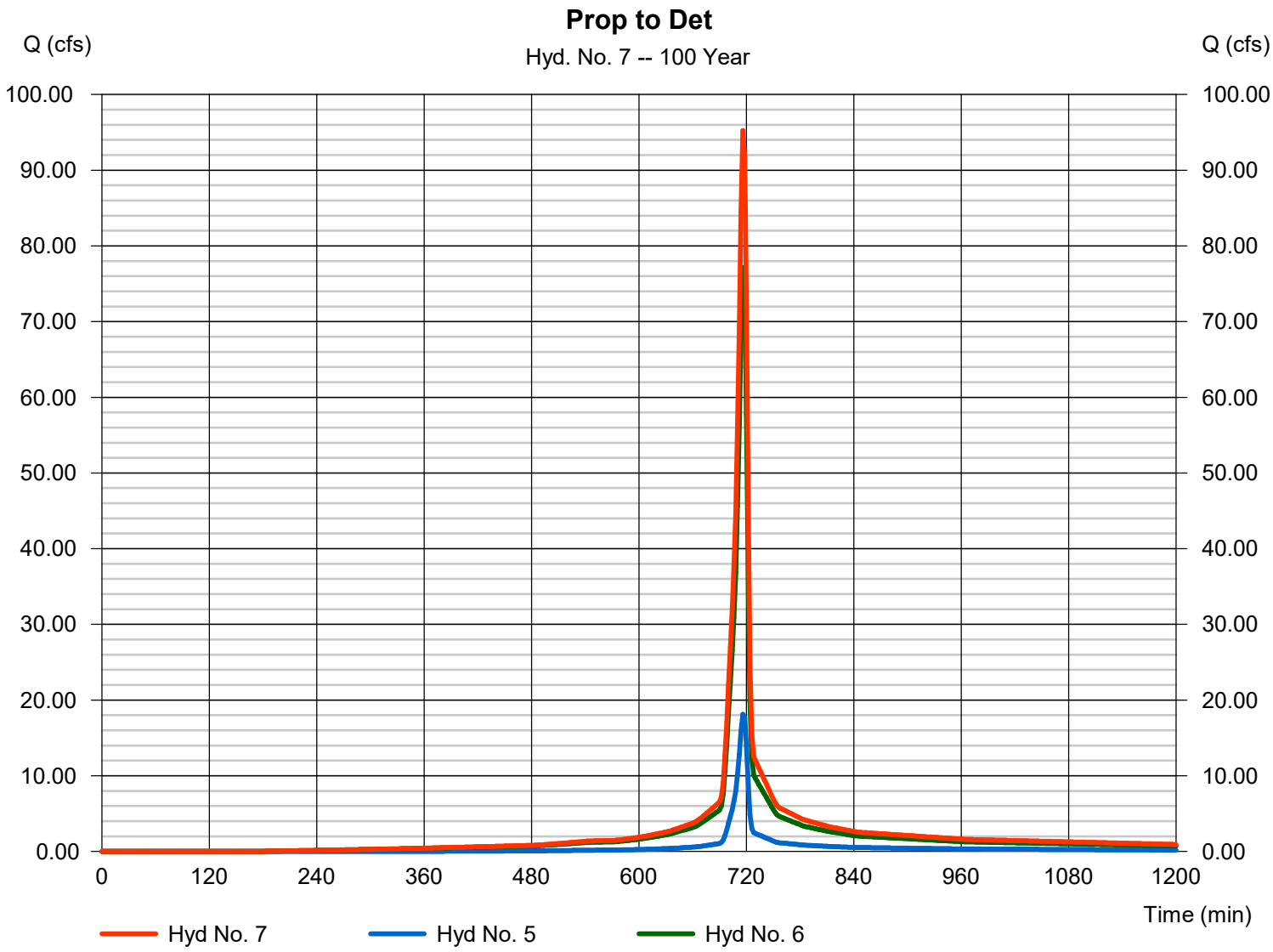
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 7

Prop to Det

Hydrograph type	= Combine	Peak discharge	= 95.25 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 4.766 acft
Inflow hyds.	= 5, 6	Contrib. drain. area	= 14.000 ac



Hydrograph Report

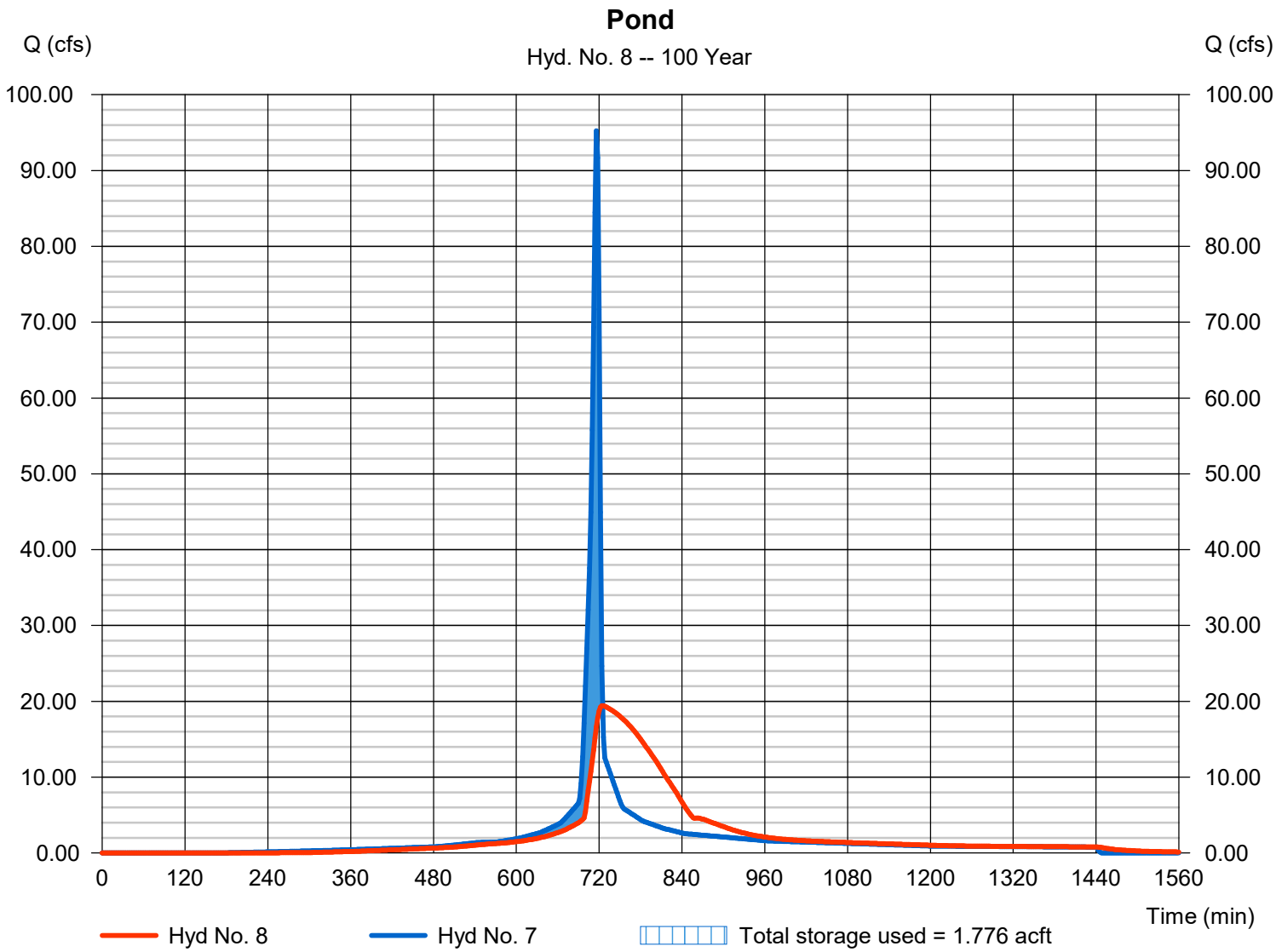
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Hyd. No. 8

Pond

Hydrograph type	= Reservoir	Peak discharge	= 19.43 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 4.765 acft
Inflow hyd. No.	= 7 - Prop to Det	Max. Elevation	= 6849.98 ft
Reservoir name	= Pond	Max. Storage	= 1.776 acft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3 Tuesday, 01 / 5 / 2021

Pond No. 1 - Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 6844.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	6844.00	8,256	0.000	0.000
1.00	6845.00	9,687	0.206	0.206
2.00	6846.00	11,219	0.240	0.445
3.00	6847.00	12,851	0.276	0.721
4.00	6848.00	14,584	0.315	1.036
5.00	6849.00	16,417	0.356	1.392
6.00	6850.00	18,351	0.399	1.791
7.00	6851.00	20,000	0.440	2.231

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	18.00	0.00	0.00	0.00
Span (in)	=	18.00	0.00	0.00	0.00
No. Barrels	=	1	0	0	0
Invert El. (ft)	=	6844.00	0.00	0.00	0.00
Length (ft)	=	50.00	0.00	0.00	0.00
Slope (%)	=	0.50	0.00	0.00	n/a
N-Value	=	.013	.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)	=	50.00	0.00	0.00	0.00
Crest El. (ft)	=	6851.00	0.00	0.00	0.00
Weir Coeff.	=	2.60	3.33	3.33	3.33
Weir Type	=	Broad	---	---	---
Multi-Stage	=	No	No	No	No

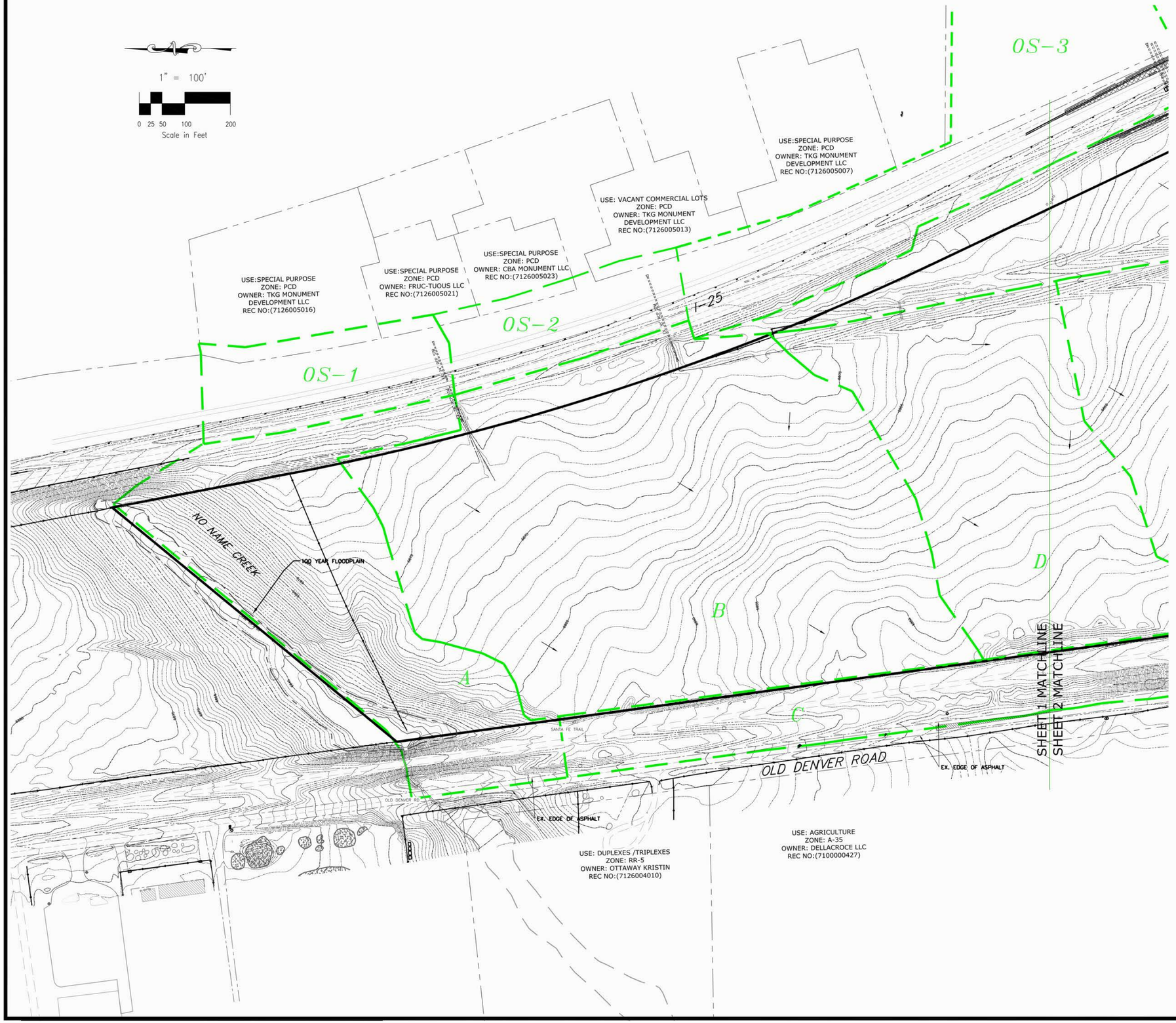
Exfil.(in/hr)	=	0.000 (by Wet area)
TW Elev. (ft)	=	0.00

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 acft	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	0.000	6844.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
1.00	0.206	6845.00	3.36 oc	---	---	---	0.00	---	---	---	---	---	3.360
2.00	0.445	6846.00	7.92 oc	---	---	---	0.00	---	---	---	---	---	7.921
3.00	0.721	6847.00	12.10 oc	---	---	---	0.00	---	---	---	---	---	12.10
4.00	1.036	6848.00	15.17 oc	---	---	---	0.00	---	---	---	---	---	15.17
5.00	1.392	6849.00	17.54 ic	---	---	---	0.00	---	---	---	---	---	17.54
6.00	1.791	6850.00	19.49 ic	---	---	---	0.00	---	---	---	---	---	19.49
7.00	2.231	6851.00	21.27 ic	---	---	---	0.00	---	---	---	---	---	21.27

Appendix G – Historic Drainage Plan- Santa Fe Park



VICINITY MAP

LEGEND

- EXISTING 1' CONTOUR
- 6450 EXISTING 5' CONTOUR
- EXISTING BASINS
- A HISTORIC BASINS
- HDP#1 HISTORIC DESIGN POINT
- DIRECTION OF FLOW
- PROPOSED BOUNDARY

HISTORIC DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A	6.80	1.6	11.5
B	18.44	3.2	23.7
C	13.30	2.5	13.1
D	8.81	1.6	11.9
E	21.02	3.4	25.1
F	13.56	2.1	15.3
G	10.34	2.0	14.4
H	1.51	2.3	5.9
OS-1	2.44	2.0	7.0
OS-2	2.15	1.9	6.2
OS-3	66.00	14.7	86.4
OS-4	11.55	16.7	37.9

HISTORIC DRAINAGE DESIGN POINTS

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
HDP#1	66.16	10.1	62.6
HDP#1A	76.89	11.4	72.4
HDP#2	91.11	24.3	112.5
HDP#3	102.96	25.7	108.1
HDP#4	169.12	34.2	169.0

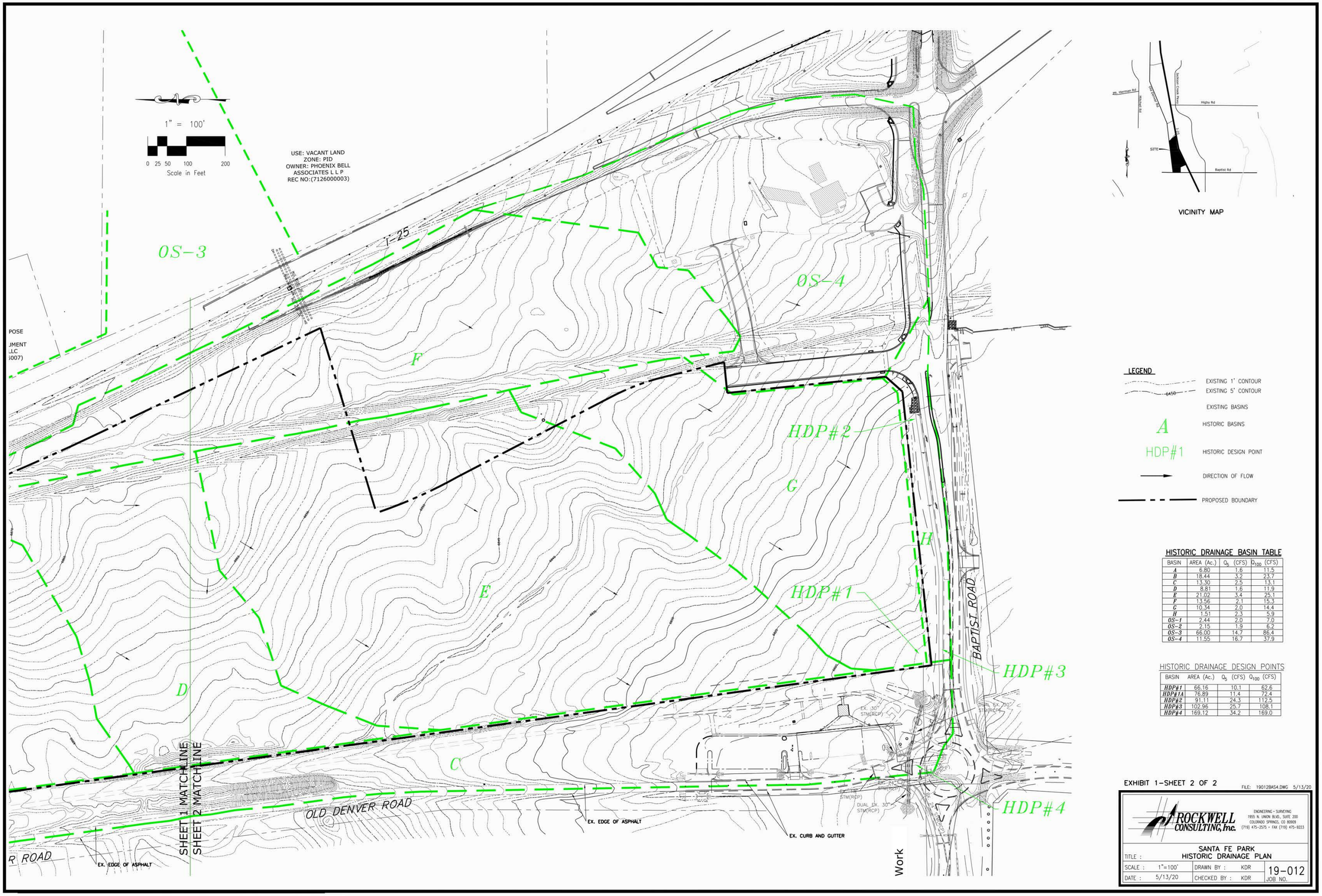
EXHIBIT 1–SHEET 1 OF 2

FILE: 19012BAS4.DWG 5/13/20

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-8223

TITLE : SANTA FE PARK
HISTORIC DRAINAGE PLAN

SCALE : 1"=100'
DATE : 5/13/20
DRAWN BY : KDR
CHECKED BY : KDR
19-012
JOB NO.



HISTORIC DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A	6.80	1.6	11.5
B	18.44	3.2	23.7
C	13.30	2.5	13.1
D	8.81	1.6	11.9
E	21.02	3.4	25.1
F	13.56	2.1	15.3
G	10.34	2.0	14.4
H	1.51	2.3	5.9
OS-1	2.44	2.0	7.0
OS-2	2.15	1.9	6.2
OS-3	66.00	14.7	86.4
OS-4	11.55	16.7	37.9

HISTORIC DRAINAGE DESIGN POINTS

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
HDP#1	66.16	10.1	62.6
HDP#1A	76.89	11.4	72.4
HDP#2	91.11	24.3	112.5
HDP#3	102.96	25.7	108.1
HDP#4	169.12	34.2	169.0

EXHIBIT 1-SHEET 2 OF 2

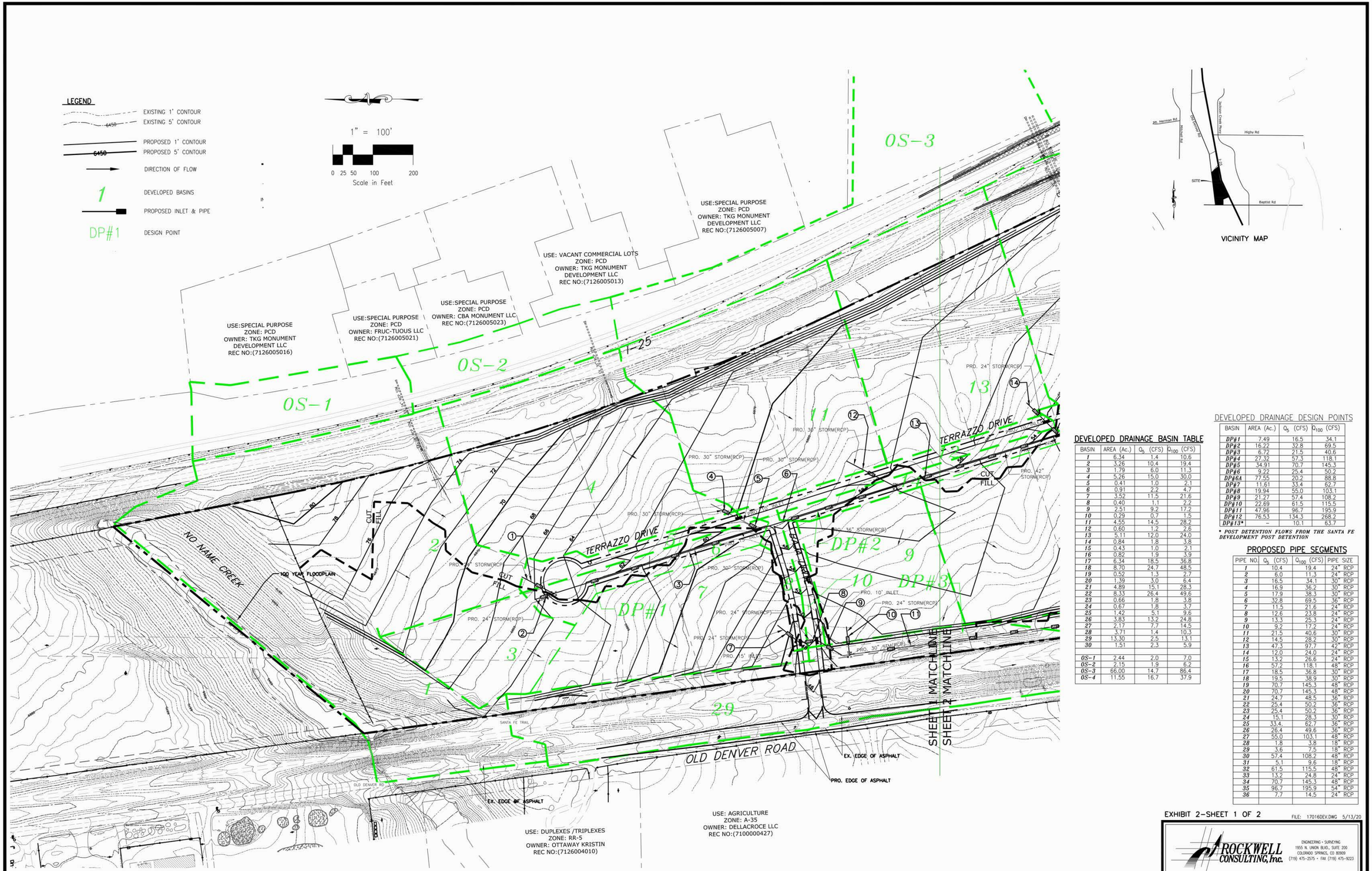
FILE: 19012BAS4.DWG 5/13/20

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

TITLE : SANTA FE PARK
HISTORIC DRAINAGE PLAN

SCALE : 1"=100'	DRAWN BY : KDR	19-012
DATE : 5/13/20	CHECKED BY : KDR	JOB NO.

Appendix H – Developed Drainage Plan- Santa Fe Park



VICINITY MAP

DEVELOPED DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
1	6.34	1.4	10.6
2	3.26	10.4	19.4
3	1.79	6.0	11.3
4	5.26	15.0	30.0
5	0.41	1.0	2.1
6	0.91	2.2	4.7
7	3.52	11.5	21.6
8	0.40	1.1	2.2
9	2.51	9.2	17.2
10	0.29	0.7	1.5
11	4.55	14.5	28.2
12	0.60	1.2	2.6
13	5.11	12.0	24.0
14	0.84	1.8	3.8
15	0.43	1.0	2.1
16	0.82	1.9	3.9
17	6.34	18.5	36.8
18	8.70	24.7	48.5
19	0.52	1.3	2.7
20	1.39	3.0	6.4
21	4.89	15.1	28.3
22	8.33	26.4	49.6
23	0.66	1.8	3.8
24	0.67	1.8	3.7
25	1.42	5.1	9.6
26	3.83	13.2	24.8
27	2.17	7.7	14.5
28	3.71	1.4	10.3
29	13.30	2.5	13.1
30	1.51	2.3	5.9
OS-1	2.44	2.0	7.0
OS-2	2.15	1.9	6.2
OS-3	66.00	14.7	86.4
OS-4	11.55	16.7	37.9

DEVELOPED DRAINAGE DESIGN POINTS

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
DP#1	7.49	16.5	34.1
DP#2	16.22	32.8	69.5
DP#3	6.72	21.5	40.6
DP#4	27.32	57.3	118.1
DP#5	34.91	70.7	145.3
DP#6	9.22	25.4	50.2
DP#6A	77.55	20.2	88.8
DP#7	11.61	33.4	62.7
DP#8	19.94	55.0	103.1
DP#9	21.27	57.4	108.2
DP#10	22.69	61.5	115.5
DP#11	47.96	96.7	195.9
DP#12	76.53	134.3	268.2
DP#13*	–	10.1	63.7

** POST DETENTION FLOWS FROM THE SANTA FE DEVELOPMENT POST DETENTION*

PROPOSED PIPE SEGMENTS

PIPE NO.	Q_5 (CFS)	Q_{100} (CFS)	PIPE SIZE
1	10.4	19.4	24" RCP
2	6.0	11.3	24" RCP
3	16.5	34.1	30" RCP
4	16.9	36.2	30" RCP
5	17.9	38.3	30" RCP
6	32.8	69.5	36" RCP
7	11.5	21.6	24" RCP
8	12.6	23.8	24" RCP
9	13.3	25.3	24" RCP
10	9.2	17.2	24" RCP
11	21.5	40.6	30" RCP
12	14.5	28.2	30" RCP
13	47.3	97.7	42" RCP
14	12.0	24.0	24" RCP
15	13.2	26.6	24" RCP
16	57.2	118.1	48" RCP
17	18.5	36.8	30" RCP
18	19.5	38.9	30" RCP
19	70.7	145.3	48" RCP
20	70.7	145.3	48" RCP
21	24.7	48.5	36" RCP
22	25.4	50.2	36" RCP
23	25.4	50.2	36" RCP
24	15.1	28.3	30" RCP
25	33.4	62.7	36" RCP
26	26.4	49.6	36" RCP
27	55.0	103.1	48" RCP
28	1.8	3.8	18" RCP
29	3.6	7.5	18" RCP
30	57.4	108.2	48" RCP
31	5.1	9.6	18" RCP
32	61.5	115.5	48" RCP
33	13.2	24.8	24" RCP
34	70.7	145.3	48" RCP
35	96.7	195.9	54" RCP
36	7.7	14.5	24" RCP

EXHIBIT 2–SHEET 1 OF 2

FILE: 17016DEV.DWG 5/13/20

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

TITLE : SANTA FE PARK
DEVELOPED DRAINAGE PLAN

SCALE :	1"=100'	DRAWN BY :	KDR
DATE :	5/13/20	CHECKED BY :	KDR

19–012
JOB NO.

LEGEND

- EXISTING 1' CONTOUR
- 6450 EXISTING 5' CONTOUR
- PROPOSED 1' CONTOUR
- 6450 PROPOSED 5' CONTOUR
- DIRECTION OF FLOW
- 1 DEVELOPED BASINS
- PROPOSED INLET & PIPE
- DP#1 DESIGN POINT
- FILL / CUT — CUT/FILL LINES

DEVELOPED DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
1	6.34	1.4	10.6
2	3.26	10.4	19.4
3	1.79	6.0	11.3
4	5.26	15.0	30.0
5	0.41	1.0	2.1
6	0.91	2.2	4.7
7	3.52	11.5	21.6
8	0.40	1.1	2.2
9	2.51	9.2	17.2
10	0.29	0.7	1.5
11	4.55	14.5	28.2
12	0.60	1.2	2.6
13	5.11	12.0	24.0
14	0.84	1.8	3.8
15	0.43	1.0	2.1
16	0.82	1.9	3.9
17	6.34	18.5	36.8
18	8.70	24.7	48.5
19	0.52	1.3	2.7
20	1.39	3.0	6.4
21	4.89	15.1	28.3
22	8.33	26.4	49.6
23	0.66	1.8	3.8
24	0.67	1.8	3.7
25	1.42	5.1	9.6
26	3.83	13.2	24.8
27	2.17	7.7	14.5
28	3.71	1.4	10.3
29	13.30	2.5	13.1
30	1.51	2.3	5.9
OS-1	2.44	2.0	7.0
OS-2	2.15	1.9	6.2
OS-3	66.00	14.7	86.4
OS-4	11.55	16.7	37.9

DEVELOPED DRAINAGE DESIGN POINTS

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
DP#1	7.49	16.5	34.1
DP#2	16.22	32.8	69.5
DP#3	6.72	21.5	40.6
DP#4	27.32	57.3	118.1
DP#5	34.91	70.7	145.3
DP#6	9.22	25.4	50.2
DP#6A	77.55	20.2	88.8
DP#7	11.61	33.4	62.7
DP#8	19.94	55.0	103.1
DP#9	21.27	57.4	108.2
DP#10	22.69	61.5	115.5
DP#11	47.96	96.7	195.9
DP#12	76.53	134.3	268.2
DP#13*	–	10.1	63.7

* POST DETENTION FLOWS FROM THE SANTA FE DEVELOPMENT POST DETENTION

PROPOSED PIPE SEGMENTS

PIPE NO.	Q_5 (CFS)	Q_{100} (CFS)	PIPE SIZE
1	10.4	19.4	24" RCP
2	6.0	11.3	24" RCP
3	16.5	34.1	30" RCP
4	16.9	36.2	30" RCP
5	17.9	38.3	30" RCP
6	32.8	69.5	36" RCP
7	11.5	21.6	24" RCP
8	12.6	23.8	24" RCP
9	13.3	25.3	24" RCP
10	9.2	17.2	24" RCP
11	21.5	40.6	30" RCP
12	14.5	28.2	30" RCP
13	47.3	97.7	42" RCP
14	12.0	24.0	24" RCP
15	13.2	26.6	24" RCP
16	57.2	118.1	48" RCP
17	18.5	36.8	30" RCP
18	19.5	38.9	30" RCP
19	70.7	145.3	48" RCP
20	70.7	145.3	48" RCP
21	24.7	48.5	36" RCP
22	25.4	50.2	36" RCP
23	25.4	50.2	36" RCP
24	15.1	28.3	30" RCP
25	33.4.	62.7	36" RCP
26	26.4	49.6	36" RCP
27	55.0	103.1	48" RCP
28	1.8	3.8	18" RCP
29	3.6	7.5	18" RCP
30	57.4	108.2	48" RCP
31	5.1	9.6	18" RCP
32	61.5	115.5	48" RCP
33	13.2	24.8	24" RCP
34	70.7	145.3	48" RCP
35	96.7	195.9	54" RCP
36	7.7	14.5	24" RCP
37	5.3	44.7	36" RCP

EXHIBIT 2–SHEET 2 OF 2

FILE: 17016DEV.DWG 5/13/20

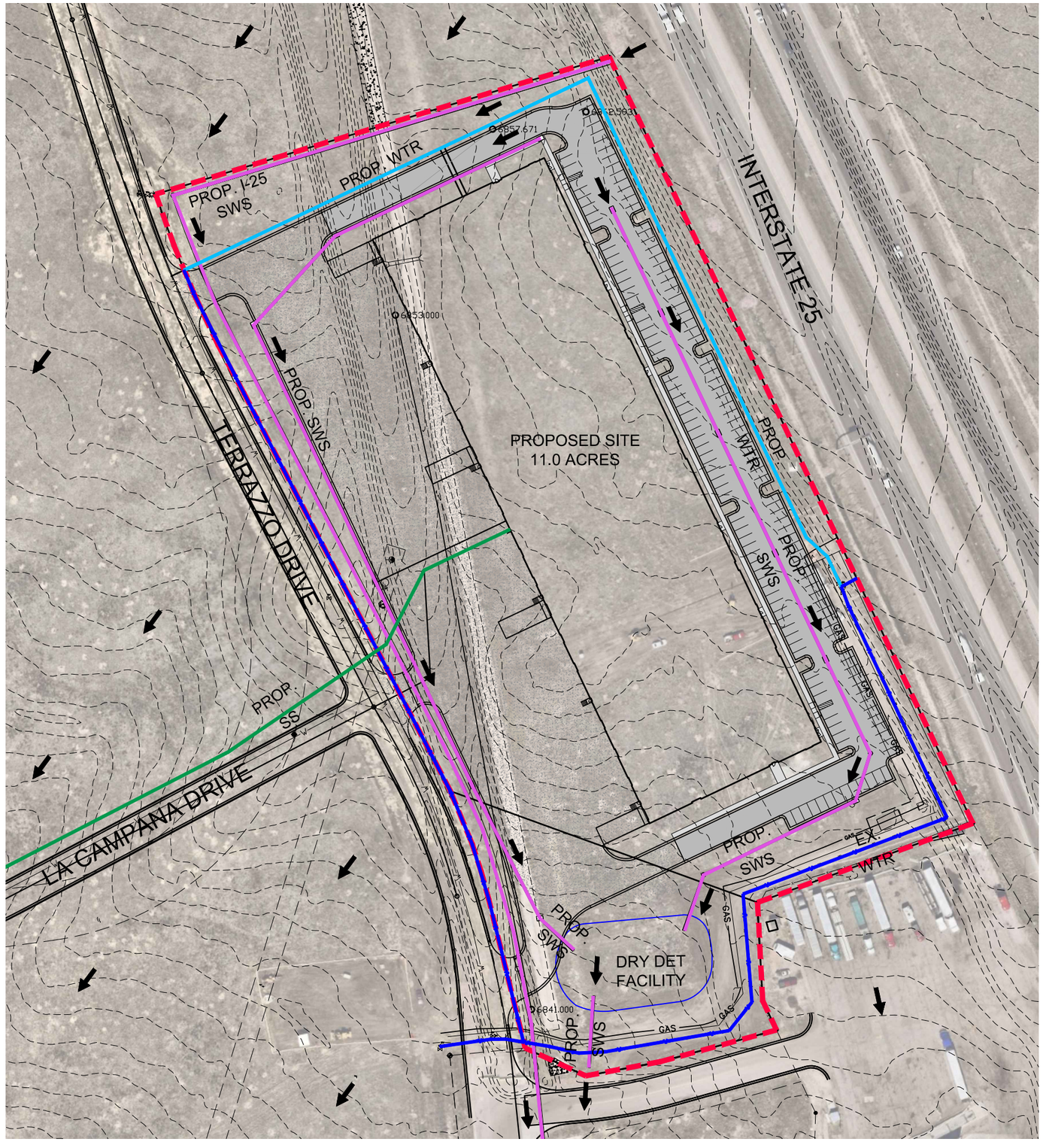
ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

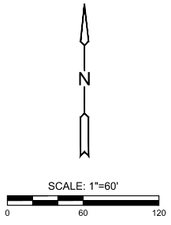
TITLE : SANTA FE PARK
DEVELOPED DRAINAGE PLAN

SCALE :	1"=100'	DRAWN BY :	KDR
DATE :	5/13/20	CHECKED BY :	KDR

19-012
JOB NO.

Appendix I – Proposed Drainage Plan- Monument Industrial





LEGEND

- FLOW ARROW
- EXIST. STORMWATER SEWER
- EXIST. WATERLINE
- EXIST. SANITARY SEWER
- PROP. STORMWATER SEWER
- PROP. WATERLINE
- PROP. SANITARY SEWER

MKEC
Wichita, KS • 316-684-9600

DRAINAGE AND UTILITY PLAN FOR

MONUMENT WAREHOUSE

MONUMENT, COLORADO

DUP

PROJECT NO.	2001010383
DATE	JAN 2021
SCALE	AS SHOWN

DESIGNED	DRAWN	CHECKED
ABW	ABW	KLA

NO.	REVISION	DATE
####	####	####
####	####	####
####	####	####
####	####	####
####	####	####

SHEET NO.

01 OF 01