

## **Macro Storm Water Study**

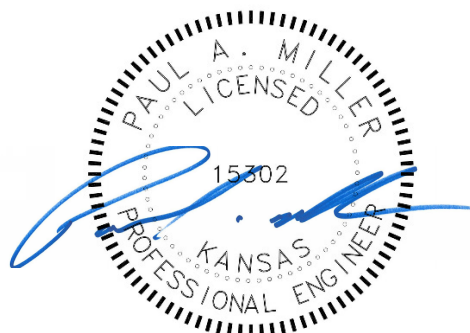
for:

### **Lot 1 – Lee’s Summit Town Centre**

Lee’s Summit, MO 64064

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**10/1/2021**

October 1st, 2021



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- Existing Conditions Output
- Proposed Conditions Output
- Detention Basin Output
- Volume Runoff Output

## General Information

Lot 1 of the Lee's Summit Town Centre development is located at the northeast corner of Town Centre Blvd. and Independence Ave. in Lee's Summit, MO. The site contains 11.61 acres of undeveloped grass pasture.

The site is located in the Northwest 1/4, Sec. 29-Twp. 48N. - Range. 31W. The development will contain a large storage facility and two separate pad sites. Refer to Appendix A for the site plan.

There are two different soil types represented on the project site, 10136-Sibley-Urban Land Complex and 30080-Greenton Silty Clay Loam, with 10136-Sibley-Urban Land Complex occupying the largest area at 9.50 acres. The hydrological soil group for 10136 is rated as C and the area is classified as Grass/Prairie land with 2 to 5 percent slopes. 30080- Greenton Silty Clay Loam represents 2.11 acres in the southwest corner of the site. The hydrological soil group for 30080 is rated as C/D and the area is classified as Grass/Prairie land with 5 to 9 percent slopes.

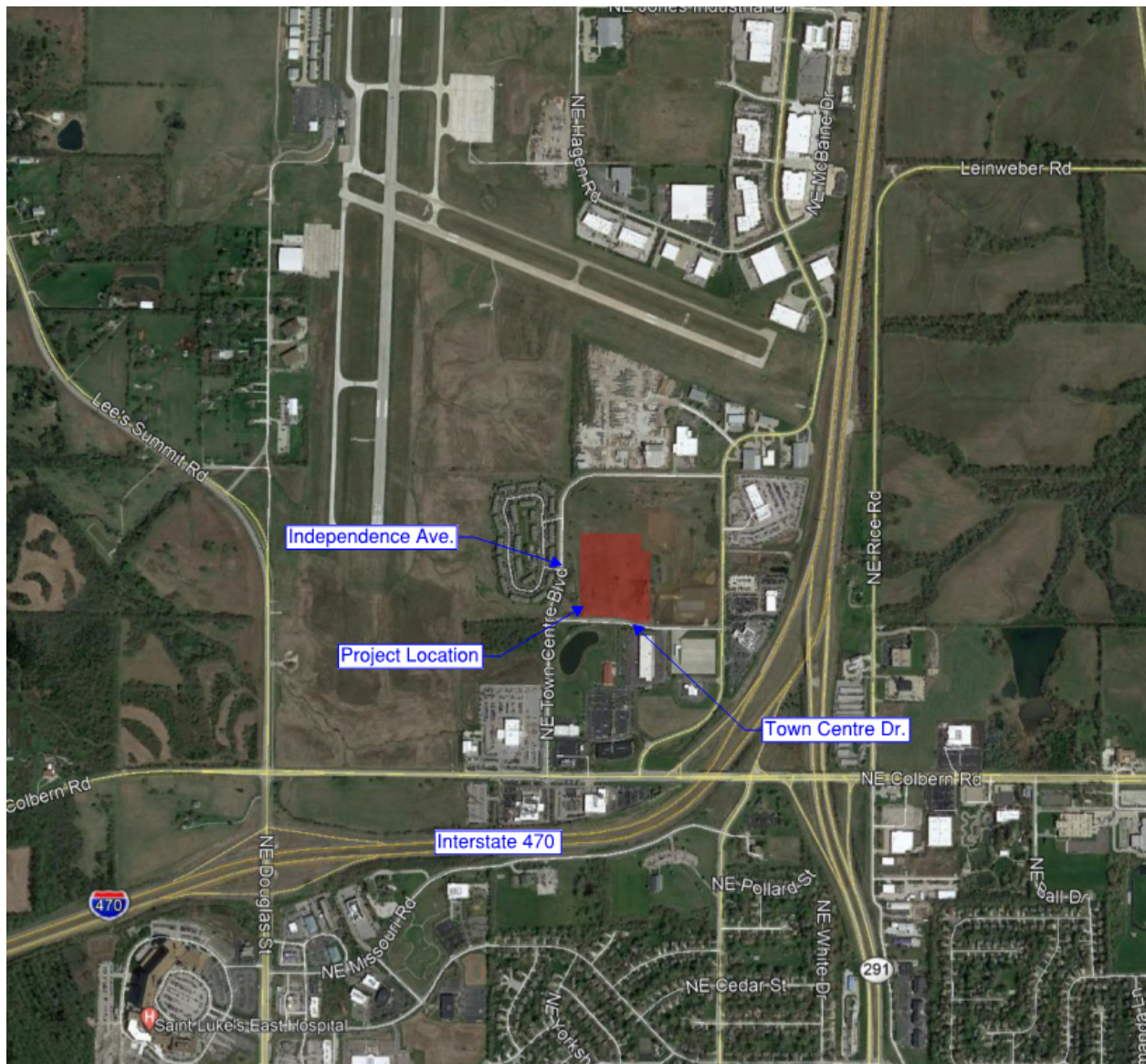


Figure 1. - Location Map (no scale)

## Methodology

Existing and proposed conditions were modeled and analyzed using Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2021 (Hydraflow). Hydrograph routing within Hydraflow used the Rational Method with depths of 2.9" 5.3", 6.1", and 7.5" for the 100% (1-Yr), 10% (10-Yr), 4% (25-Yr), and 1% (100-Yr) storm events, respectively. This method is also used in SCS TR-55. Convolution is known as linear superpositioning, and means that each ordinate of the rainfall hyetograph is multiplied by each ordinate of the unit hydrograph, thus creating a series of hydrographs. These hydrographs are then summed to form the final runoff hydrograph. Rainfall frequencies were determined by using TECHNICAL PAPER NO.40, RAINFALL FREQUENCY ATLAS OF THE UNITED STATES, by the U.S. Department of Commerce, Weather Bureau. The October 2012 American Public Works Association BMP Manual was used for this storm study.

## Existing Condition Analysis

The project site is located in the southwest corner of the Lee's Summit Town Centre development at the northeast corner of Town Centre Blvd. and Independence Ave. in Lee's Summit, MO. Lee's Summit Town Centre is located northwest of the Highway 291 and Interstate 470 interchange. The existing undeveloped site is 11.61 acres, with the entirety of the property being pervious.

Runoff from the site currently generally flows from the north to south and into a pond located on the east side of the property. A portion of the property in the southwest corner drains from east to west and down the sloped, moderately-wooded area into curb inlets located on Town Centre Dr. The site was analyzed as a greenfield site with a rational "c" value of 0.30.

Soils encountered on the site are 10136-Sibley-Urban land complex, 2 to 5 percent slopes, and 30080-Greenton Silty Clay Loam, 5 to 9 percent slopes. The Hydrologic Soil Groups of the encountered soils are C and C/D respectively (see Appendix A, Hydrologic Soil Group).

The site lies entirely outside of the 100-year floodplain as depicted on the FEMA Flood Insurance Rate Map (FIRM) Map Panel No. 0430G, Map Number 29095C0430G Dated January 20, 2017, Note: This area is shown as being completely within zone X. The Flood Insurance Rate Map is included in Appendix A.

The Existing Drainage Area Map, provided in Appendix A, depicts the existing drainage patterns for the site. Area A on this map currently sheet flows off the property to the west and eventually discharges into curb inlets near the intersection of Town Centre Dr. and Independence Ave. Area B sheet flows across the site and discharges to the property to the east and an existing pond that is located on the east side of the property. Runoff in the existing pond is eventually discharged to the neighboring property as well.

The detention basin on the newly developed property to the east was sized to handle and detain the runoff from the existing pre-developed site. The proposed site currently drains to a swale located just north of the neighboring property to the east, and then into the detention basin to the east..

The existing site results in the following conditions:

Table 1 – Existing Site Runoff Hydraflow Results			
Storm Event	Area A (cfs)	Area B (cfs)	Total Site Runoff (cfs)
1-Yr	1.41	11.69	13.10
10-Yr	2.50	20.76	23.26
100-Yr	3.77	31.27	35.04



## Proposed Condition Analysis

The proposed development consists of the construction of a large storage complex and two separate buildings with their own parking lots. The improvements will increase impervious area on-site by approximately 8.41 acres. The remaining 3.20 acres will have native vegetation that is either preserved or reestablished after land disturbance activities have been completed. The post development composite curve numbers (CN) for the project site have been developed based on soil types and proposed conditions. A CN value of 93 was used for the proposed development. Curve numbers are also provided in Appendix B.

Table 2 below shows the increase in peak discharge rates for the 1, 10, and 100-year storm events due to the increase in impervious area.

Table 2 – Proposed Site Runoff Hydraflow Results – Without Detention	
Storm Event	Post-Development Peak Flow (cfs)
1-Yr	28.36
10-Yr	50.33
100-Yr	75.82

In order to mitigate the increase in peak runoff rates from the site due to the increase in impervious area created by the proposed development, a private storm network is proposed to direct runoff to the proposed detention basin located on the east side of the property. The Proposed Drainage Area Map, provided in Appendix A, depicts the proposed drainage patterns for the site. Areas 1 through 5 shown on the Proposed Drainage Area Map, will discharge into the proposed on-site detention basin. Area 6 will follow the existing drainage pattern of the site, flowing to the southwest corner of the site and eventually discharging into the existing public storm system on Town Centre Dr. Area 7 will flow offsite to the neighboring property to east, following the existing drainage pattern of the site.

Discharge from the detention basin will be controlled by a 30" diameter outlet pipe spanning from the detention basin to the existing drainage swale just north of the neighboring property to the east. Discharge from the outlet pipe will be less than the existing pre-developed peak runoff rates. The runoff from the on-site detention basin will continue to the east in the existing drainage swale and eventually discharge into the detention basin on the neighboring property. This detention basin has been sized to handle the runoff for the peak storm events from the proposed site in its existing, pre-developed conditions.

Approximately 98.8% (11.47 acres) of the site will undergo water quality via an onsite BMP. The proposed BMPs include the following: inlet filter baskets to extended dry detention in a BMP train, extended dry detention only, and preservation/establishment of native vegetation. Approximately 1.2% of the site shall go untreated and be allowed to flow offsite to the existing public storm sewer system along Town Centre Dr. to the south of the property.

8.76 acres of the site shall be pre-treated by inlet filter baskets before being discharged into the proposed on-site detention basin. 0.97 acres (Area 1-1 on the Proposed Drainage Area Map) will be discharged directly to the detention basin without any pre-treatment. 1.74 acres of the site will have native vegetation preserved or reestablished after land disturbance activities have been completed, with runoff being discharged off-site. The remain 0.14 acres, which is the proposed eastern entrance to the site will be untreated and discharged off-site

Table 3 below shows the general conditions of the proposed stormwater detention basin.

<b>Table 3 – Proposed Detention Basin Hydraflow Results</b>		
Storm Event (yr)		Detention Basin 1
1-Yr	Discharge (cfs)	8.29
	Max. Elevation (ft)	1001.35
	Total Storage (cf)	17,344
10-Yr	Discharge (cfs)	14.48
	Max. Elevation (ft)	1002.23
	Total Storage (cf)	29,922
100-Yr	Discharge (cfs)	26.14
	Max. Elevation (ft)	1003.10
	Total Storage (cf)	43,433

Table 4 below shows the total post-developed peak discharge rates from the site with the proposed storm network and detention basin.

<b>Table 4 – Proposed Site Runoff Hydraflow Results – With Detention</b>			
Storm Event	Discharge from Detention Basin 1 - <b>Areas 1 - 5</b> (cfs)	Runoff to Offsite Public Storm System – <b>Areas 6 &amp; 7</b> (cfs)	Total Post-Development Runoff – With Detention
1-Yr	8.29	1.88	9.00
10-Yr	14.48	3.33	15.92
100-Yr	26.14	5.02	28.23

Note: "Total Peak Qs will be less than the simple sum of the areas due to a difference in time to peak discharge. See Appendix C for Hydraflow results."

Table 5 below displays the peak runoff rates for the existing pre-developed and post-developed conditions of the site.

<b>Table 5 – Proposed Total Site Runoff Hydraflow Results</b>			
Storm Event (yr)	Total Pre-Development Runoff (cfs)	Total Post-Development Runoff – With Detention (cfs)	Net Reduction in Post-Developed Site Discharge (cfs)
1-Yr	13.10	9.00	4.10

10-Yr	23.26	15.92	7.34
100-Yr	35.04	28.23	6.81

Note: "Total Peak Qs will be less than the simple sum of the areas due to a difference in time to peak discharge. See Appendix C for Hydraflow results."

## Storm Water Quality

The Mid-America Regional Council, Manual of Best Management Practices for Stormwater Quality, October 2012 requires the site to be designed to capture and treat the additional impervious runoff during the 90% mean annual storm (1.37"/24 hr) created by site improvements. The impervious area for the site has increased by 8.41 acres, requiring a value rating of 6.7. To address this requirement, a majority of the runoff from the site will be pre-treated through inlet filter baskets prior to being discharged into the extended dry detention basin. BMP worksheets 1A and 2 are included in Appendix B of this report. The combination of BMP trains, the extended dry detention basin, and the establishment/preservation of native vegetation will meet the required level of service for BMP's.

## Summary

Lot 1 of the Lee's Summit Town Centre development is located at the northeast corner of Town Centre Blvd. and Independence Ave. in Lee's Summit, MO. The existing undeveloped site is 11.61 acres, with the entirety of the property being pervious. Runoff from the site currently generally flows from the north to south and into a pond located on the east side of the property. A portion of the property in the southwest corner drains from east to west and down the sloped areas into curb inlets located on Town Centre Dr.

The on-site increase in stormwater runoff will be directed to an on-site extended dry detention basin located on the east side of the property. The detention basin and the outlet pipe will reduce overall post-developed stormwater runoff to below pre-developed conditions. 1.88 acres of the proposed site will discharge off-site to either the existing public storm sewer system or the existing detention basin on the newly-developed property to the east.

## Conclusions and Recommendations

It has been concluded that an extended dry detention basin will be added to Lot 1 of the Lee's Summit Town Centre Development to reduce site runoff. A new private storm sewer system will be added to convey the runoff into the on-site detention basin and eventually into the existing drainage swale north of the neighboring property to the east.

With the increase of impervious area and the addition of the on-site detention basin, this project will reduce runoff to the downstream system. Stormwater pretreatment BMP's for the site will be provided through the extended dry detention basin, as well as pre-treatment through inlet filter baskets. These treatment systems, along with the native vegetation to be established on the east, west, and south sides of the project will enhance the water quality LOS from the site's existing conditions. No further reduction of storm water runoff or additional BMP's should be required for this project site. This project will cause no adverse impact to the downstream structures/system.

## Appendix A



Local Benchmarks:

BM-1: (Sanitary Sewer Manhole, Center of Lid)

Elevation: 1006.88'

N: 1013449.78

E: 2826933.88

BM-2: (Storm Sewer Curb Inlet, Center of Lid)

Elevation: 994.34'

N: 1013518.71

E: 2826136.03

Floodplain Note:

The site lies entirely with "Zone X", areas determined to be outside the 0.2% annual chance floodplain as depicted on the FEMA Flood Insurance Rate Map (FIRM) no. 29095C0430G, Revision Date: January 20, 2017.

Fire Protection Notes:

- Plans and specifications, in accordance with NFPA 24, for the private fire line shall be submitted for review and approval prior to installation.
- Underground fire line installation including thrust blocks shall be inspected prior to being backfilled.
- Hydrostatic testing and flushes shall be completed with the fire department as a witness

Utility Legend

existing  
proposed

Linetypes

sanm	sanitary main
sans	sanitary service
stm	storm sewer (existing)
stm	storm sewer (solid wall, proposed)
stm	storm sewer (perforated, proposed)
wtrm	water main
wtrf	water service (fire)
wtrd	water service (domestic)
wtri	water service (irrigation)
gasm	natural gas main
gass	natural gas service schematic
elpu	underground primary electric
elsu	underground secondary electric
elpo	overhead electric
datu	underground cable/phone/data
datu	underground cable/phone/data service
fence-chainlink	fence-chainlink
fence-wood	fence-wood
fence-barbed wire	fence-barbed wire
treeline	treeline

Symbols

S	sanitary manhole
co	service cleanout
fmv	force main release valve
□	rectangular structure
○	circular structure
γ	fire hydrant
wv	water valve
M	water meter
BFP	backflow preventer
g	natural gas meter
T	service transformer (pad mount)
S	primary switch gear
☆	light pole
C	cable/phone/data junction box
○	street light
○	pedestrian street light
⊗	electric pole
→	guy wire
D	end section

Property Legend

right of way  
property lines  
easements  
setbacks

Grading Legend

existing minor contour  
existing major contour  
proposed minor contour  
proposed major contour

Construction Legend

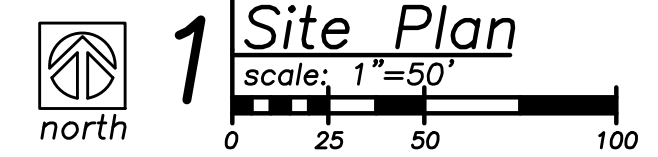
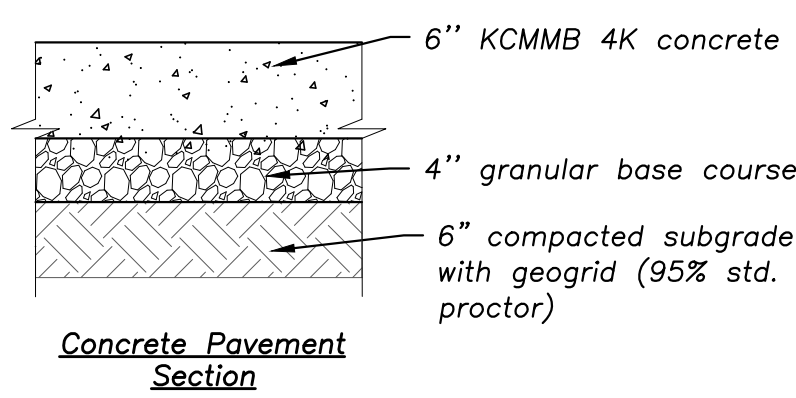
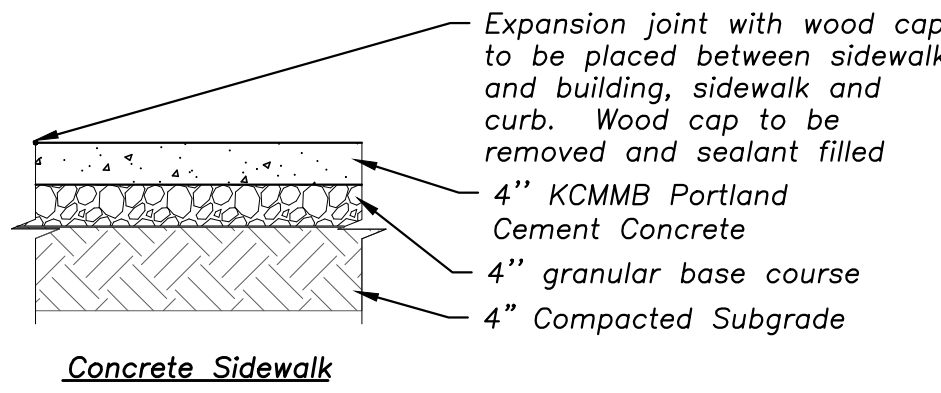
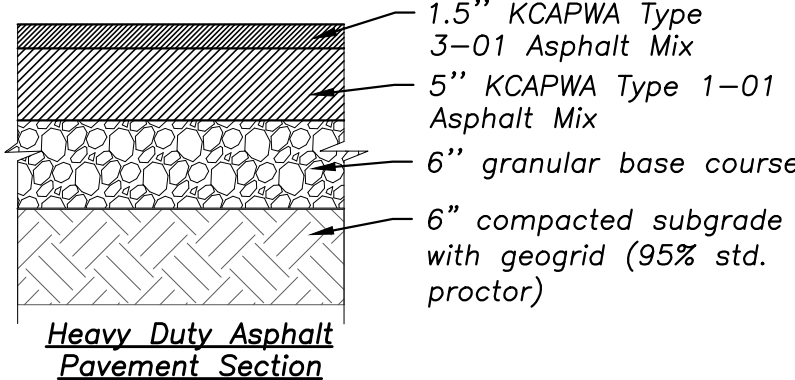
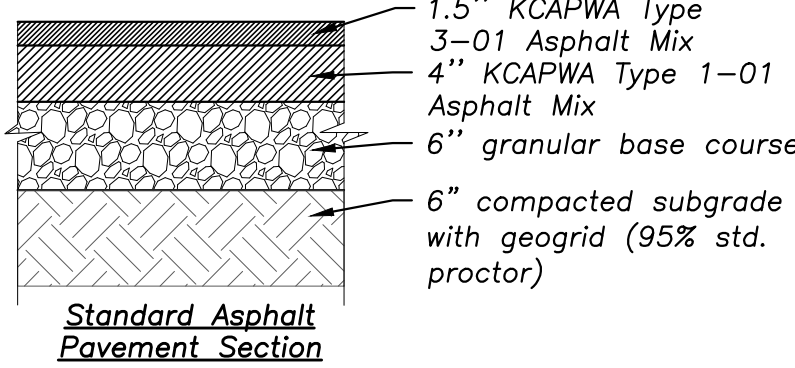
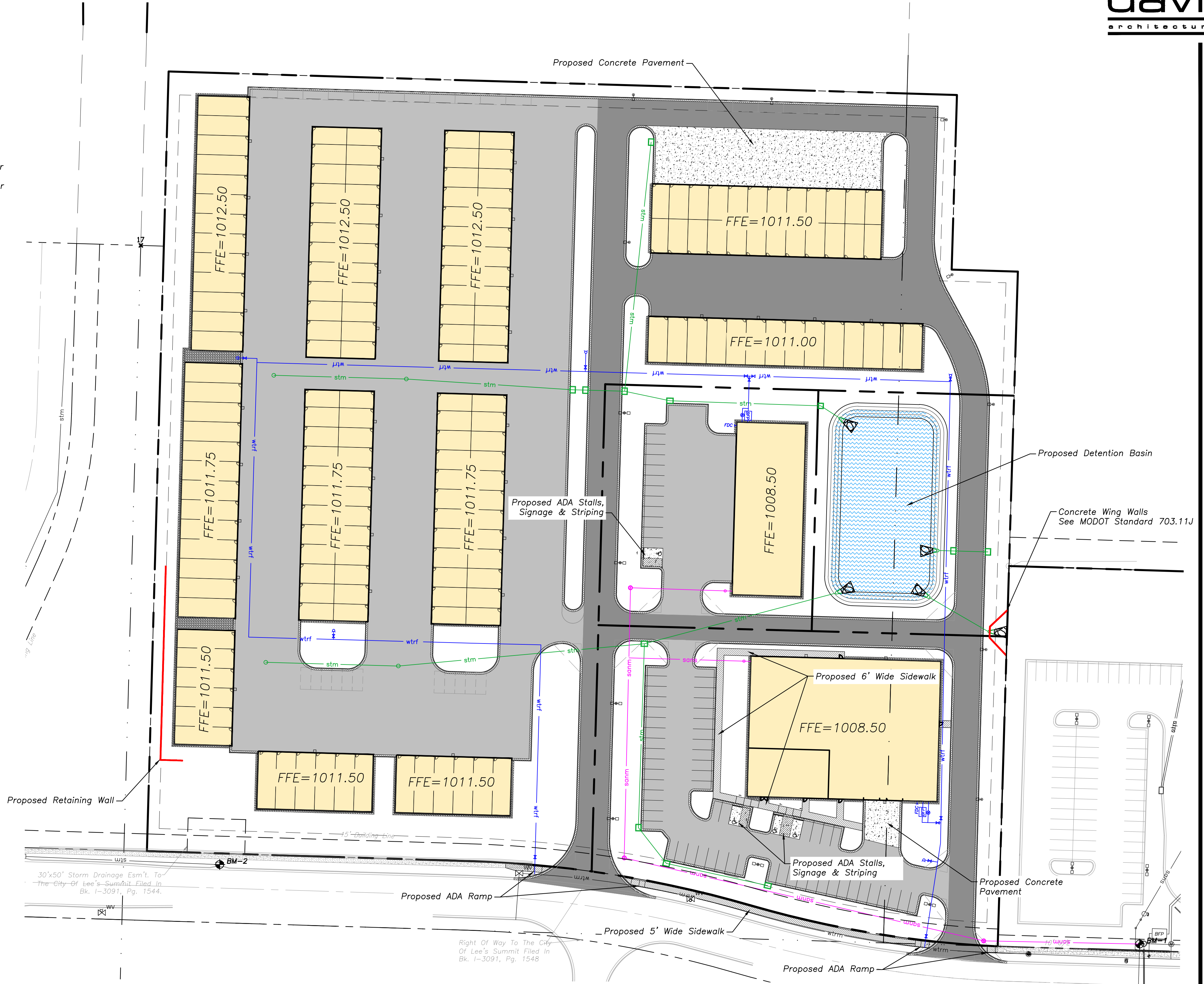
concrete pavement
standard asphalt
heavy duty asphalt
concrete sidewalk
standard curb & gutter
standard dry curb & gutter
temporary asphalt curb
retaining wall
detention basin

Utility Legend

sanm	existing sanitary main
wtrm	existing water main
stm	existing storm sewer
gasm	existing gas main
elpu	existing underground electric
elpo	existing overhead electric
datu	existing underground data
sanm	proposed sanitary main
sans	proposed sanitary service
wtrm	proposed water main
wtrf	proposed fire line
wtrd	proposed water service
stm	proposed storm sewer
gasm	proposed gas main
gass	proposed gas service
elpu	proposed underground primary electric
elsu	proposed underground secondary electric
elpo	proposed overhead electric
datu	proposed underground data

Americans with Disabilities Act (ADA) Notes:

- The running and cross slopes for all sidewalks, accessible paths, ramps, designated parking stalls, etc., shall be in compliance with latest Federal ADA guidelines, in addition to any accessibility standards adopted by the governing municipality. Prior to installation/construction, if any discrepancies are found within the plans, the Engineer shall be notified.
- All ADA parking areas shall have NO slopes greater than 2% in any direction.



a new development for  
**Town Centre Lot 1**  
520 NE Town Centre Drive  
Lee's Summit, Missouri

date  
10.01.2021  
drawn by  
JMP  
checked by  
PAM  
revisions

sheet number

**C1.2**

drawing type  
Re-Zoning/PDP

project number  
20231




Soil Map—Jackson County, Missouri




## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### 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: Jackson County, Missouri

Survey Area Data: Version 22, May 29, 2020

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

Date(s) aerial images were photographed: Sep 6, 2019—Nov 16, 2019

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10136	Sibley-Urban land complex, 2 to 5 percent slopes	8.3	81.8%
30080	Greenton silty clay loam, 5 to 9 percent slopes	1.9	18.2%
<b>Totals for Area of Interest</b>		<b>10.2</b>	<b>100.0%</b>

## Jackson County, Missouri

### 10136—Sibley-Urban land complex, 2 to 5 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2ql0j

*Elevation:* 720 to 1,080 feet

*Mean annual precipitation:* 33 to 41 inches

*Mean annual air temperature:* 50 to 55 degrees F

*Frost-free period:* 177 to 220 days

*Farmland classification:* All areas are prime farmland

#### Map Unit Composition

*Sibley and similar soils:* 60 percent

*Urban land:* 35 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Sibley

##### Setting

*Landform:* Interfluves

*Landform position (two-dimensional):* Summit

*Landform position (three-dimensional):* Interfluve

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loess

##### Typical profile

*A - 0 to 17 inches:* silt loam

*Bt - 17 to 65 inches:* silty clay loam

*C - 65 to 80 inches:* silt loam

##### Properties and qualities

*Slope:* 2 to 5 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high (0.20 to 0.57 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water supply, 0 to 60 inches:* High (about 12.0 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* C

*Ecological site:* R107BY002MO - Deep Loess Upland Prairie  
Amorpha canescens/Schizachyrium scoparium-Sporobolus  
heterolepis Leadplant/Little Bluestem-Prairie Dropseed  
*Other vegetative classification:* Grass/Prairie (Herbaceous  
Vegetation)  
*Hydric soil rating:* No

### **Description of Urban Land**

#### **Setting**

*Landform:* Interfluves  
*Landform position (two-dimensional):* Summit  
*Landform position (three-dimensional):* Interfluve  
*Across-slope shape:* Convex

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 8  
*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Jackson County, Missouri  
Survey Area Data: Version 22, May 29, 2020



## Jackson County, Missouri

### 30080—Greenton silty clay loam, 5 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2xjd9

*Elevation:* 640 to 1,120 feet

*Mean annual precipitation:* 35 to 41 inches

*Mean annual air temperature:* 50 to 57 degrees F

*Frost-free period:* 177 to 209 days

*Farmland classification:* Prime farmland if drained

#### Map Unit Composition

*Greenton and similar soils:* 90 percent

*Minor components:* 10 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Greenton

##### Setting

*Landform:* Hillslopes

*Landform position (two-dimensional):* Shoulder

*Landform position (three-dimensional):* Interfluve

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loess over residuum weathered from limestone and shale

##### Typical profile

*Ap - 0 to 12 inches:* silty clay loam

*Bt - 12 to 28 inches:* silty clay

*2Bt - 28 to 30 inches:* silty clay

*2C - 30 to 79 inches:* silty clay

##### Properties and qualities

*Slope:* 5 to 9 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* About 12 to 30 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 10 percent

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water supply, 0 to 60 inches:* High (about 9.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated): 3e*  
*Hydrologic Soil Group: C/D*  
*Ecological site: R109XY002MO - Loess Upland Prairie*  
*Hydric soil rating: No*

### **Minor Components**

#### **Sampsel**

*Percent of map unit: 10 percent*  
*Landform: Hillslopes*  
*Landform position (two-dimensional): Footslope*  
*Landform position (three-dimensional): Side slope*  
*Down-slope shape: Convex*  
*Across-slope shape: Convex*  
*Ecological site: R109XY002MO - Loess Upland Prairie*  
*Hydric soil rating: Yes*

## **Data Source Information**

Soil Survey Area: Jackson County, Missouri  
Survey Area Data: Version 22, May 29, 2020



NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Missouri State Plane West Zone (FIPS zone 2403). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NGS12  
National Geodetic Survey  
SSM-C-3, #2022  
1315 East-West Highway  
Silver Spring, Maryland 20910-3262  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

**Base map** information shown on this FIRM was derived from the U.S. D.A. Farm Service National Agriculture Imagery Program (NAIP) dated 2014. Produced at scale of 1:24,000.

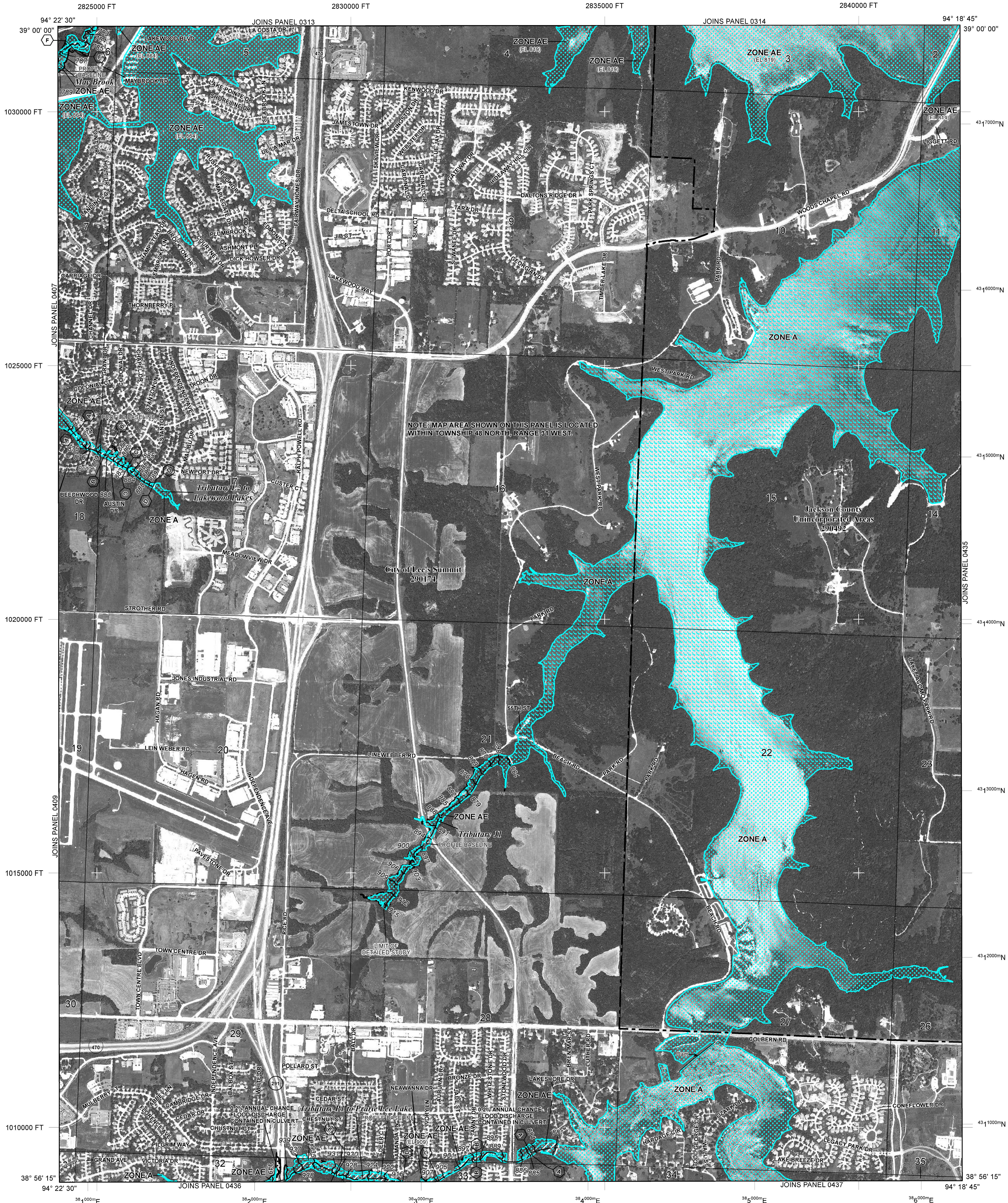
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations** and **floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.



**LEGEND**

**SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**  
The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.  
**ZONE AE** Base Flood Elevations determined.  
**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.  
**ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.  
**ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently dismantled. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.  
**ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.  
**ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.  
**ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**  
**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot (usually areas of ponding); no Base Flood Elevations determined, but possible.  
**OTHER AREAS**  
**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.  
**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**  
**OTHERWISE PROTECTED AREAS (OPAs)**  
CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

**1% Annual Chance Floodplain Boundary**  
**0.2% Annual Chance Floodplain Boundary**  
**Floodway boundary**  
**Zone D boundary**  
**CBRS and OPA boundary**  
**Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.**  
**Base Flood Elevation line and value; elevation in feet\***  
**Base Flood Elevation value where uniform within zone; elevation in feet\***

\*Referenced to the North American Vertical Datum of 1988

**Cross section line**  
**Transect line**  
**Culvert**  
**Bridge**  
**Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere**  
**5000-foot ticks: Missouri State Plane West Zone (FIPS Zone 2403), Transverse Mercator projection**  
**Bench mark (see explanation in Notes to Users section of this FIRM panel)**  
**River Mile**

**MAP REPOSITORIES**  
Refer to Map Repositories list on Map Index  
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
September 29, 2008  
**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
January 20, 2017 - to change Special Flood Hazard Areas

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.  
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 1000'**  
**FEET**  
**METERS**

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0430G**

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**JACKSON COUNTY, MISSOURI AND INCORPORATED AREAS**

**PANEL 430 OF 625**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**  
**COMMUNITY** JACKSON COUNTY  
LEE'S SUMMIT, CITY OF

**NUMBER** 290492  
290174

**PANEL** 0430  
0430

**SUFFIX** G  
G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
**29095C0430G**  
**MAP REVISED**  
**JANUARY 20, 2017**  
**Federal Emergency Management Agency**



Local Benchmarks:

BM-1: (Sanitary Sewer Manhole, Center of Lid)  
Elevation: 1006.88'  
N: 1013449.78  
E: 2826933.88

BM-2: (Storm Sewer Curb Inlet, Center of Lid)  
Elevation: 994.34'  
N: 1013518.71  
E: 2826136.03

Drainage Legend

drainage area

Property Legend

right of way  
property lines  
easements  
setbacks

Grading Legend

existing minor contour  
existing major contour  
proposed minor contour  
proposed major contour

Utility Legend

existing  
proposed

Linetypes

sanm sanitary main  
sans sanitary service  
storm sewer (existing)  
storm sewer (solid wall, proposed)  
stm storm sewer (solid wall, proposed)  
storm sewer (perforated, proposed)  
wtrm water main  
wtrf water service (fire)  
wtrd water service (domestic)  
wtri water service (irrigation)  
gasm natural gas main  
goss natural gas service schematic  
elpu underground primary electric  
elsu underground secondary electric  
elpo overhead electric  
datu underground cable/phone/data  
datasu underground cable/phone/data service  
fence-chainlink  
fence-wood  
fence-barbed wire  
treeline

Symbols

sanitary manhole  
service cleanout  
force main release valve  
rectangular structure  
circular structure  
fire hydrant  
water valve  
water meter  
backflow preventer  
natural gas meter  
service transformer (pad mount)  
primary switch gear  
light pole  
cable/phone/data junction box  
street light  
pedestrian street light  
electric pole  
guy wire  
end section



Pre-Construction Impervious Area Calculations

	Square Feet	Acres
Area of Site	505,732	11.61
Impervious Area	0	0
Pervious Area	505,732	11.61
Q: 10 year	23.26 cfs	
100 year	35.04 cfs	

1 Existing Drainage Area Map  
scale: 1"=80'



a new development for

Town Centre Lot 1

520 NE Town Centre Drive

Lee's Summit, Missouri

date  
10.01.2021

drawn by  
JMP  
checked by  
PAM  
revisions

sheet number

C3.1

drawing type  
PDP/Re-Zoning  
project number  
20231



a new development for

Town Centre Lot 1

520 NE Town Centre Drive

Lee's Summit, Missouri

date  
10.01.2021

drawn by  
JMP  
checked by  
PAM  
revisions

sheet number

C3.2

drawing type  
Re-Zoning/PDP  
project number  
20231

Local Benchmarks:

BM-1: (Sanitary Sewer Manhole, Center of Lid)  
Elevation: 1006.88'  
N: 1013449.78  
E: 2826933.88

BM-2: (Storm Sewer Curb Inlet, Center of Lid)  
Elevation: 994.34'  
N: 1013518.71  
E: 2826136.03

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drainage area

Property Legend

right of way  
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setbacks

Grading Legend

existing minor contour  
existing major contour  
proposed minor contour  
proposed major contour

Utility Legend

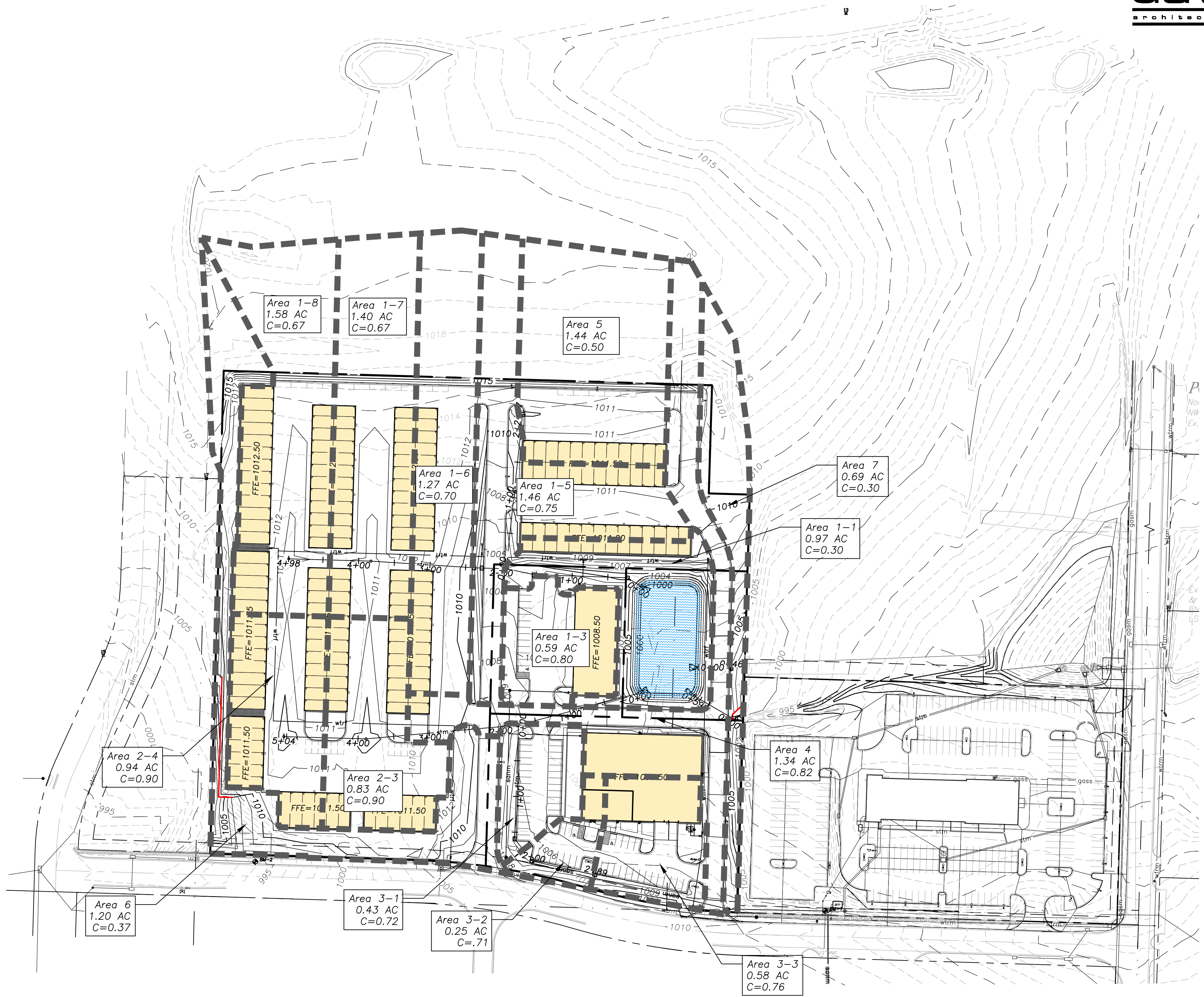
existing  
proposed

Linetypes

sanm sanitary main  
sans sanitary service  
ssm storm sewer (existing)  
ssms storm sewer (solid wall, proposed)  
stms storm sewer (solid wall, proposed)  
stms storm sewer (perforated, proposed)  
wtrm water main  
wtrf water service (fire)  
wtrd water service (domestic)  
wtri water service (irrigation)  
gasm natural gas main  
gass natural gas service schematic  
elpu underground primary electric  
elsu underground secondary electric  
elpo overhead electric  
datu underground cable/phone/data  
datasu underground cable/phone/data service  
fence-chainlink  
fence-wood  
fence-barbed wire  
treeline

Symbols

sanitary manhole  
service cleanout  
force main release valve  
rectangular structure  
circular structure  
fire hydrant  
water valve  
water meter  
backflow preventer  
natural gas meter  
service transformer (pad mount)  
primary switch gear  
light pole  
cable/phone/data junction box  
street light  
pedestrian street light  
electric pole  
guy wire  
end section



Post-Construction Impervious Area Calculations

	Square Feet	Acres
Area of Site	505,723	11.61
Impervious Area	366,377	8.41
Pervious Area	139,346	3.20

Q: 10 year 15.92 cfs  
100 year 28.23 cfs



1

Proposed Drainage Area Map

1:80\_XREF

0 40 80 160





Local Benchmarks:

BM-1: (Sanitary Sewer Manhole, Center of Lid)  
Elevation: 1006.88'  
N: 1013449.78  
E: 2826933.88

BM-2: (Storm Sewer Curb Inlet, Center of Lid)  
Elevation: 994.34'  
N: 1013518.71  
E: 2826136.03

Grading Legend

existing minor contour  
existing major contour  
proposed minor contour  
proposed major contour

Utility Legend

existing  
proposed

Linetypes

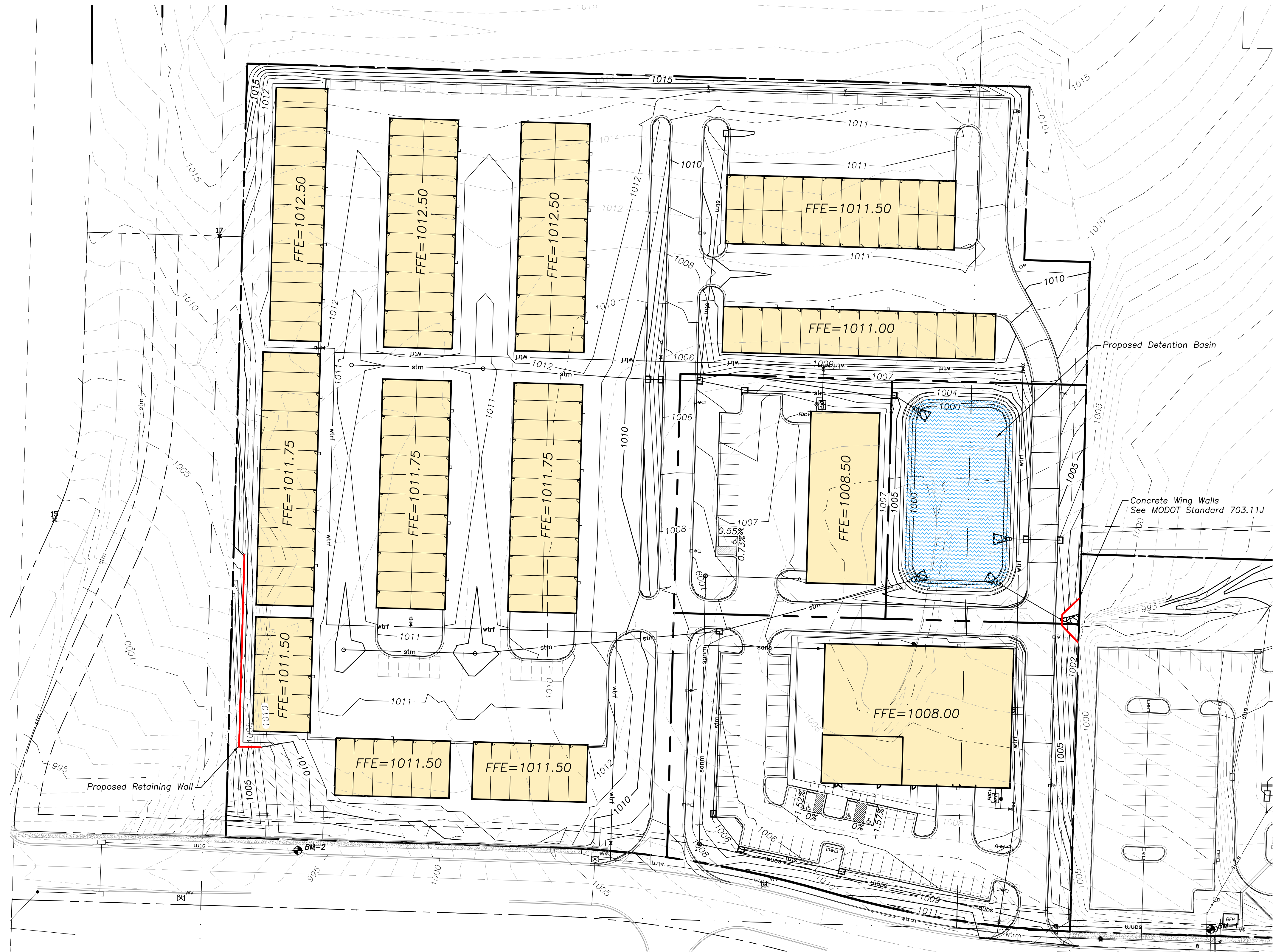
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stm storm sewer (existing)  
stm storm sewer (solid wall, proposed)  
stm storm sewer (solid wall, proposed)  
stm storm sewer (perforated, proposed)  
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wtrf water service (fire)  
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Property Legend

right of way  
property lines  
easements  
setbacks

Symbols

sanitary manhole  
service cleanout  
force main release valve  
rectangular structure  
circular structure  
fire hydrant  
water valve  
water meter  
backflow preventer  
natural gas meter  
service transformer (pad mount)  
primary switch gear  
light pole  
cable/phone/data junction box  
street light  
pedestrian street light  
electric pole  
guy wire  
end section



1 Grading Plan  
scale: 1" = 50'  
0 25 50 100  
north



a new development for

# Town Centre Lot 1

520 NE Town Centre Drive  
Lee's Summit, Missouri

date  
10.01.2021  
drawn by  
JMP  
checked by  
PAM  
revisions

sheet number

# C2.1

drawing type  
Re-Zoning/PDP  
project number  
20231



## Appendix B

**WORKSHEET 1A: REQUIRED LEVEL OF SERVICE - UNDEVELOPED SITE**

Project: Lot 4 - Kansas Commerce Center  
 Location: Lenexa, Kansas

By: JMP  
 Checked: PAM  
 Date: 10/1/2021

**1. Runoff Curve Area****A. Predevelopment CN**

Cover Description	Soil HSG	CN from Table 1	Area (ac.)	Product of CN x Area
Pervious Area	C/D	80	11.61	928.80
Impervious Area	D	98	0	0.00
				0.00
				0
Totals:			11.61	928.8

Area-Weighted CN = total product/total area =

**80.00**

**B. Postdevelopment CN**

Cover Description	Soil HSG <sup>1</sup>	CN from Table 1	Area (ac.)	Product of CN x Area
Pervious Area	C-D	80	3.2	256.00
Impervious Area	D	98	8.41	824.18
				0.00
				0
Totals:			11.61	1080.18

<sup>1</sup> Postdevelopment CN is one HSG higher for all cover types except preserved vegetation, absent documentation showing how postdevelopment soil structure will be preserved.

Area-Weighted CN = total product/total area =

**93.04**

**C. Level of Service (LS) Calculation**

		Change in CN	LS
		17+	8
Predevelopment CN:	80.00	7 to 16	7
		4 to 6	6
Postdevelopment CN:	93.04	1 to 3	5
		0	4
Difference:	13.04	-7 to -1	3
		-8 to -17	2
LS Required (see new scale adopted by KCAPWA BMP Manual Addendum #1 Accepted November 10, 2016)	6.7	-18 to -21	1
		-22 -	0

## WORKSHEET 2: DEVELOP MITIGATION PACKAGE(S) THAT MEET THE REQUIRED LS

Project: Lot 4 - Kansas Commerce Center  
Location: Lenexa, Kansas

By:  
Checked:  
Date:

### 1. Required LS (from Table 1 or 1A or Worksheet 1 of 1A, as appropriate):

**6.7**

Note: Various BMP's may alter CN of proposed development, and LS; recalculate both if applicable

### 2. Proposed BMP Option Package

Cover/BMP Description	Treatment Area	VR from Table 5 or 6	Product of VR x Area
Extended Dry Detention Basin	0.97	4	3.88
BMP Train - Flexstorm Inlet Filters to Extended Dry Detention	8.76	7	61.32
Native Vegetation Preserved or Established	1.74	9.25	16.095
Drainage Offsite (Bypass Infiltration)	0.14	0	0
			0
			0
			0
<b>TOTAL<sup>1</sup>:</b>	<b>11.61</b>	<b>TOTAL:</b>	<b>81.295</b>
	<b>Weighted VR:</b>		<b>7.0021533</b>

<sup>1</sup> VR Calculated for Final BMP only in Treatment Train

<sup>2</sup> Total treatment area cannot exceed 100 percent of the actual site area

\* Blank in redevelopment

Meets required LS (yes/no)?

YES

(If No, or if additional opt  
are being tested, proceed

### 3. Proposed BMP Option Package No. 2

Cover/BMP Description	Treatment Area	VR from Table 4.4 or 4.6 <sup>1</sup>	Product of VR x Area
			0
			0
			0
			0
			0
			0
			0
<b>TOTAL<sup>1</sup>:</b>	<b>0</b>	<b>TOTAL:</b>	<b>0</b>
	<b>*Weighted VR:</b>		<b>0</b>

<sup>1</sup> VR Calculated for Final BMP only in Treatment Train

<sup>2</sup> Total treatment area cannot exceed 100 percent of the actual site area

\* Blank in redevelopment

Meets required LS (yes/no)?

NO

(If No, or if additional opt  
being tested, move to ne:

## Appendix C



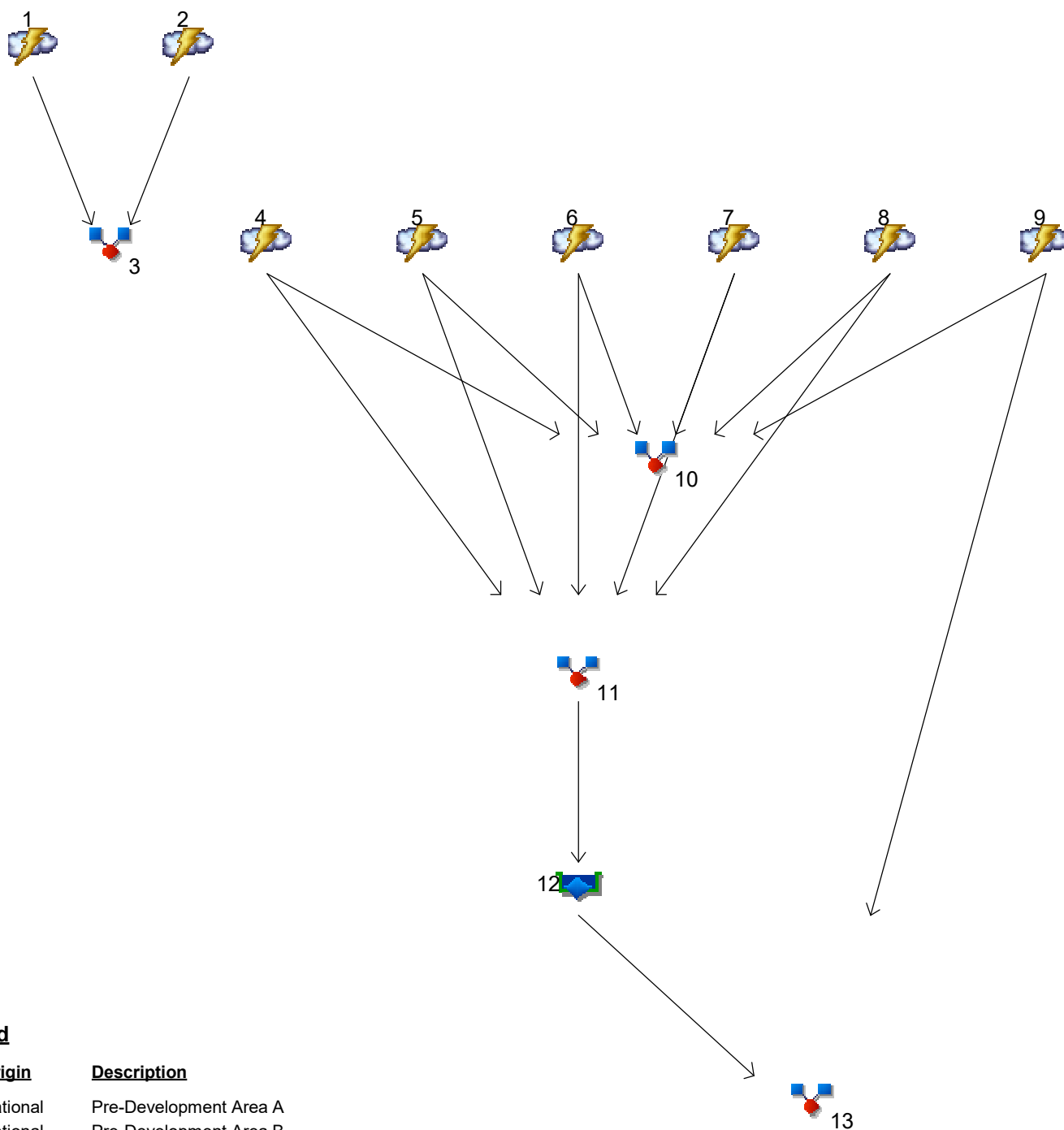
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<b>Hydrograph Return Period Recap.....</b>	<b>2</b>
<b>1 - Year</b>	
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<b>Hydrograph Reports.....</b>	<b>4</b>
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Hydrograph No. 2, Rational, Pre-Development Area B.....	5
Hydrograph No. 3, Combine, Total Pre-Development Runoff.....	6
Hydrograph No. 4, Rational, Post-Development Area 1.....	7
Hydrograph No. 5, Rational, Post-Development Area 2.....	8
Hydrograph No. 6, Rational, Post-Development Area 3.....	9
Hydrograph No. 7, Rational, Post-Development Area 4.....	10
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<b>100 - Year</b>	
<b>Summary Report.....</b>	<b>33</b>
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Hydrograph No. 13, Combine, Total Post-Development Flow w/ Detention.....	46
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# Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



## Legend

Hyd.	Origin	Description
1	Rational	Pre-Development Area A
2	Rational	Pre-Development Area B
3	Combine	Total Pre-Development Runoff
4	Rational	Post-Development Area 1
5	Rational	Post-Development Area 2
6	Rational	Post-Development Area 3
7	Rational	Post-Development Area 4
8	Rational	Post-Development Area 5
9	Rational	Post-Development Areas 6 & 7
10	Combine	Total Post-Development Runoff - No Detention
11	Combine	Post-Development Runoff to Detention
12	Reservoir	Detention Basin 1
13	Combine	Total Post-Development Flow w/ Detention

# Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	-----	1.410	1.793	-----	2.205	2.503	2.982	3.234	3.771	Pre-Development Area A
2	Rational	-----	11.69	14.87	-----	18.28	20.76	24.73	26.82	31.27	Pre-Development Area B
3	Combine	1, 2	13.10	16.66	-----	20.49	23.26	27.71	30.05	35.04	Total Pre-Development Runoff
4	Rational	-----	13.80	17.54	-----	21.57	24.49	29.18	31.64	36.89	Post-Development Area 1
5	Rational	-----	4.652	5.913	-----	7.272	8.256	9.835	10.67	12.44	Post-Development Area 2
6	Rational	-----	2.723	3.461	-----	4.256	4.832	5.757	6.244	7.279	Post-Development Area 3
7	Rational	-----	3.208	4.079	-----	5.016	5.695	6.784	7.358	8.578	Post-Development Area 4
8	Rational	-----	2.102	2.673	-----	3.287	3.731	4.445	4.821	5.621	Post- Development Area 5
9	Rational	-----	1.876	2.385	-----	2.933	3.330	3.967	4.303	5.017	Post-Development Areas 6 & 7
10	Combine	4, 5, 6, 7, 8, 9	28.36	36.05	-----	44.34	50.33	59.96	65.04	75.82	Total Post-Development Runoff - No
11	Combine	4, 5, 6, 7, 8, 11	26.48	33.67	-----	41.40	47.00	56.00	60.73	70.81	Post-Development Runoff to Detentio
12	Reservoir	11	8.294	10.79	-----	13.21	14.48	17.60	20.83	26.14	Detention Basin 1
13	Combine	9, 12	9.001	11.72	-----	14.39	15.92	18.94	22.44	28.23	Total Post-Development Flow w/ Dete
Proj. file: 20231 - Hydraflow.gpw										Wednesday, 09 / 29 / 2021	

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	1.410	1	15	1,269	-----	-----	-----	Pre-Development Area A
2	Rational	11.69	1	15	10,525	-----	-----	-----	Pre-Development Area B
3	Combine	13.10	1	15	11,794	1, 2	-----	-----	Total Pre-Development Runoff
4	Rational	13.80	1	15	12,419	-----	-----	-----	Post-Development Area 1
5	Rational	4.652	1	15	4,186	-----	-----	-----	Post-Development Area 2
6	Rational	2.723	1	15	2,450	-----	-----	-----	Post-Development Area 3
7	Rational	3.208	1	15	2,888	-----	-----	-----	Post-Development Area 4
8	Rational	2.102	1	15	1,892	-----	-----	-----	Post- Development Area 5
9	Rational	1.876	1	15	1,689	-----	-----	-----	Post-Development Areas 6 & 7
10	Combine	28.36	1	15	25,524	4, 5, 6, 7, 8, 9	-----	-----	Total Post-Development Runoff - No
11	Combine	26.48	1	15	23,835	4, 5, 6, 7, 8, 11	-----	-----	Post-Development Runoff to Detentio
12	Reservoir	8.294	1	25	23,818	11	1001.35	17,344	Detention Basin 1
13	Combine	9.001	1	23	25,506	9, 12	-----	-----	Total Post-Development Flow w/ Dete
20231 - Hydraflow.gpw					Return Period: 1 Year			Wednesday, 09 / 29 / 2021	



# Hydrograph Report

## Hyd. No. 1

### Pre-Development Area A

Hydrograph type	= Rational	Peak discharge	= 1.410 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 1,269 cuft
Drainage area	= 1.610 ac	Runoff coeff.	= 0.3
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 2

### Pre-Development Area B

Hydrograph type	= Rational	Peak discharge	= 11.69 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 10,525 cuft
Drainage area	= 13.350 ac	Runoff coeff.	= 0.3
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

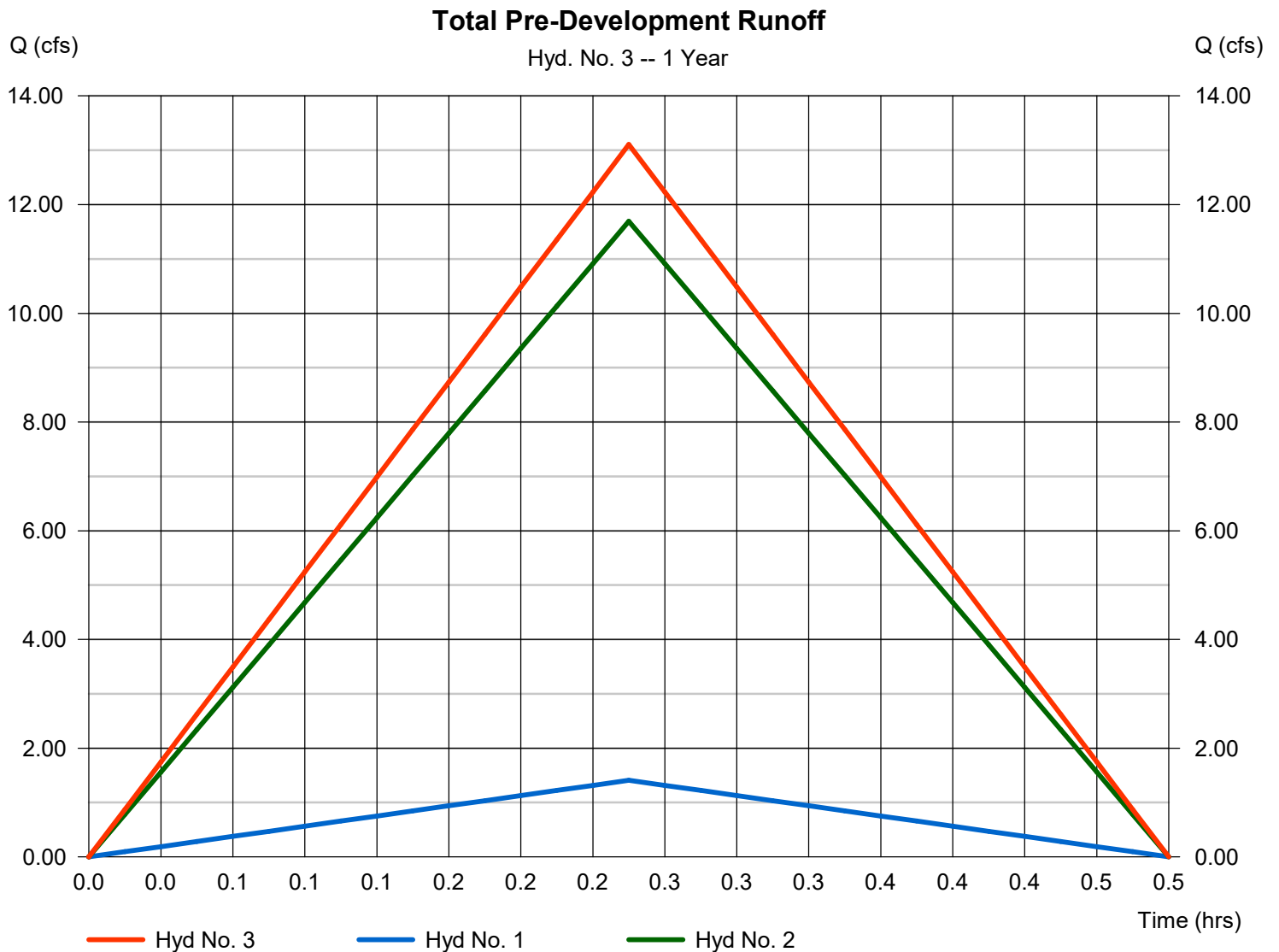
Wednesday, 09 / 29 / 2021

## Hyd. No. 3

### Total Pre-Development Runoff

Hydrograph type = Combine  
 Storm frequency = 1 yrs  
 Time interval = 1 min  
 Inflow hyds. = 1, 2

Peak discharge = 13.10 cfs  
 Time to peak = 0.25 hrs  
 Hyd. volume = 11,794 cuft  
 Contrib. drain. area = 14.960 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 4

### Post-Development Area 1

Hydrograph type	= Rational	Peak discharge	= 13.80 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 12,419 cuft
Drainage area	= 7.270 ac	Runoff coeff.	= 0.65
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1

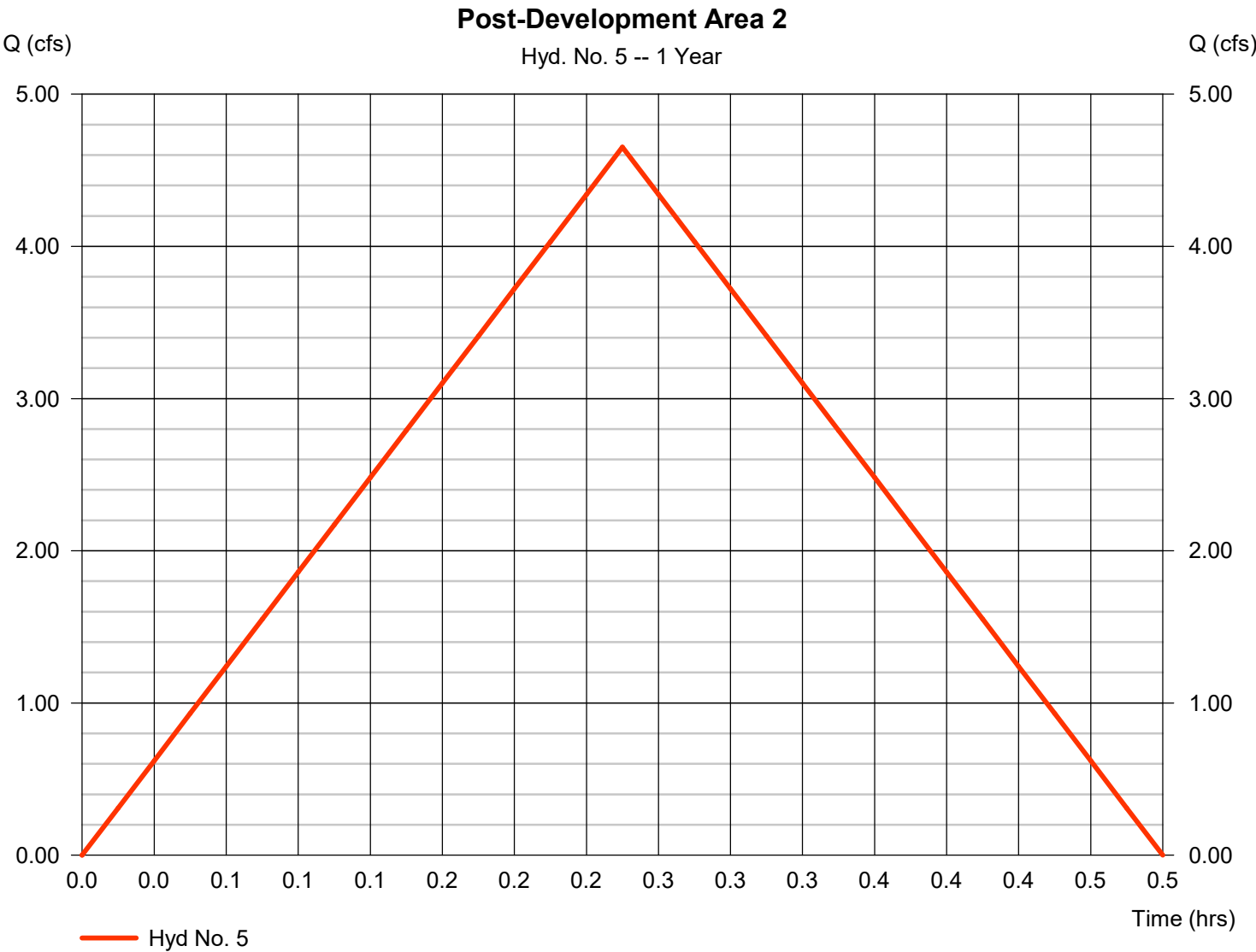


# Hydrograph Report

## Hyd. No. 5

### Post-Development Area 2

Hydrograph type	= Rational	Peak discharge	= 4.652 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 4,186 cuft
Drainage area	= 1.770 ac	Runoff coeff.	= 0.9
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1

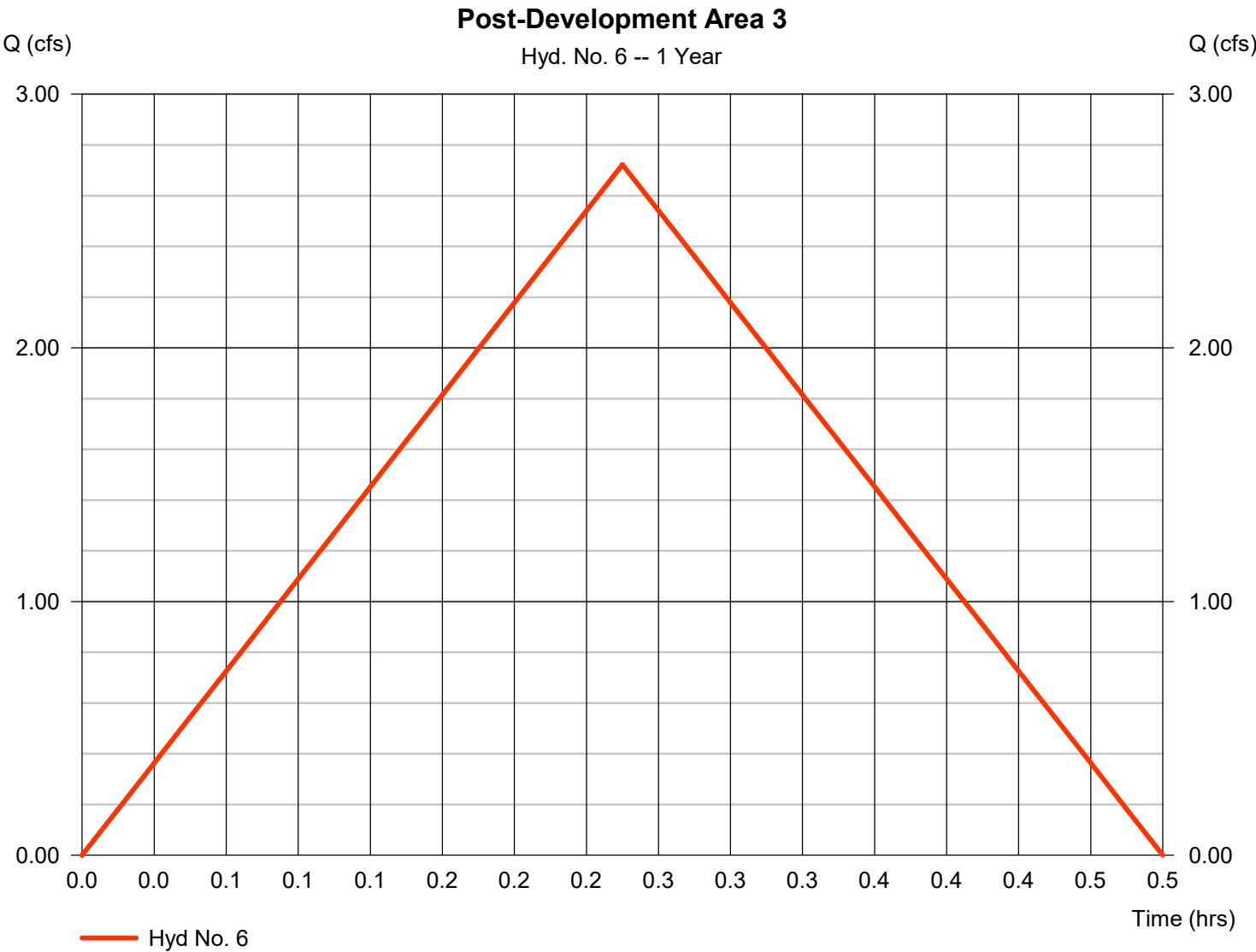


# Hydrograph Report

## Hyd. No. 6

### Post-Development Area 3

Hydrograph type	= Rational	Peak discharge	= 2.723 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 2,450 cuft
Drainage area	= 1.260 ac	Runoff coeff.	= 0.74
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

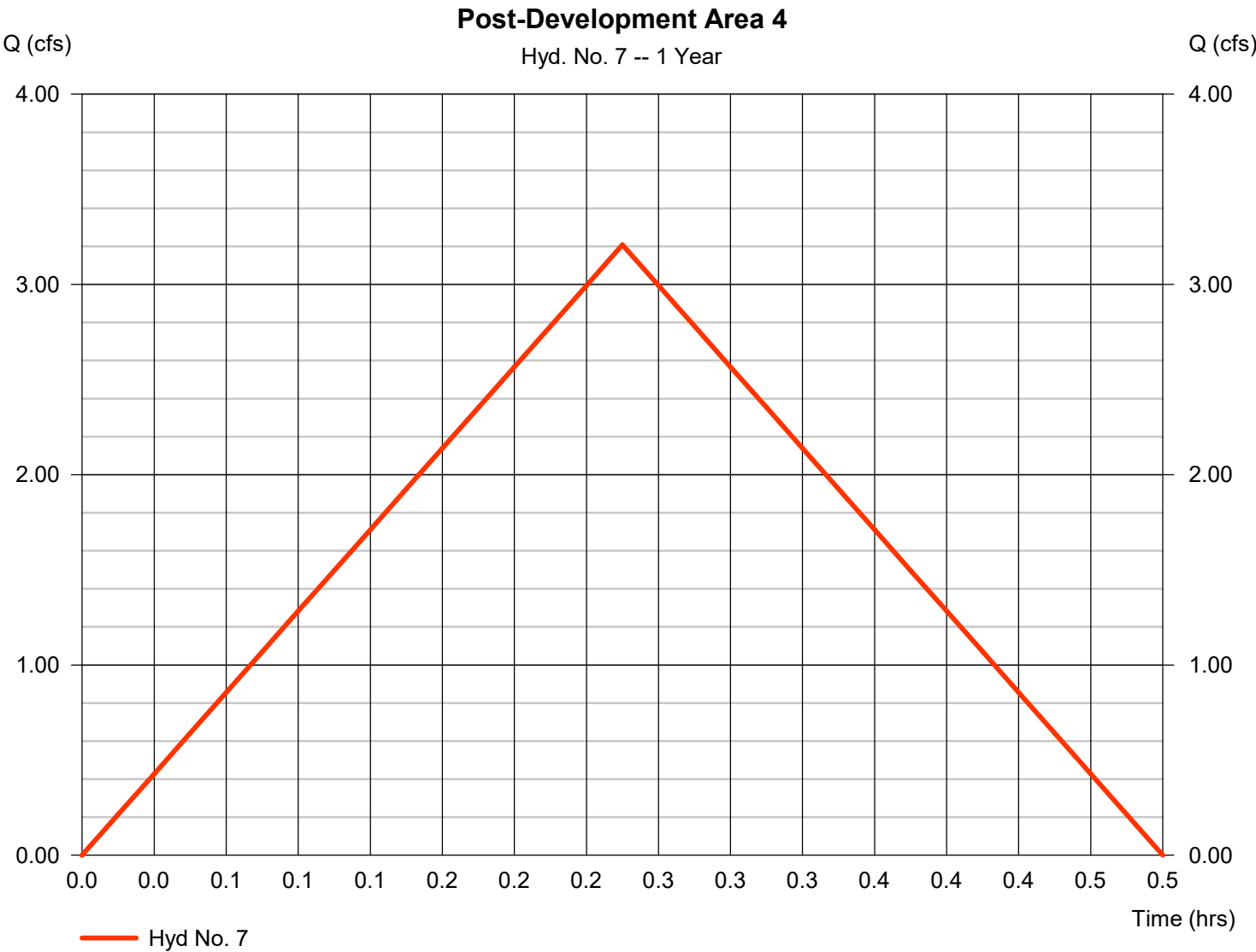
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 7

Post-Development Area 4

Hydrograph type	= Rational	Peak discharge	= 3.208 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 2,888 cuft
Drainage area	= 1.340 ac	Runoff coeff.	= 0.82
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 8

Post- Development Area 5

Hydrograph type	= Rational	Peak discharge	= 2.102 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 1,892 cuft
Drainage area	= 1.440 ac	Runoff coeff.	= 0.5
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

## Hyd. No. 9

Post-Development Areas 6 & 7

Hydrograph type	= Rational	Peak discharge	= 1.876 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 1,689 cuft
Drainage area	= 1.890 ac	Runoff coeff.	= 0.34
Intensity	= 2.920 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

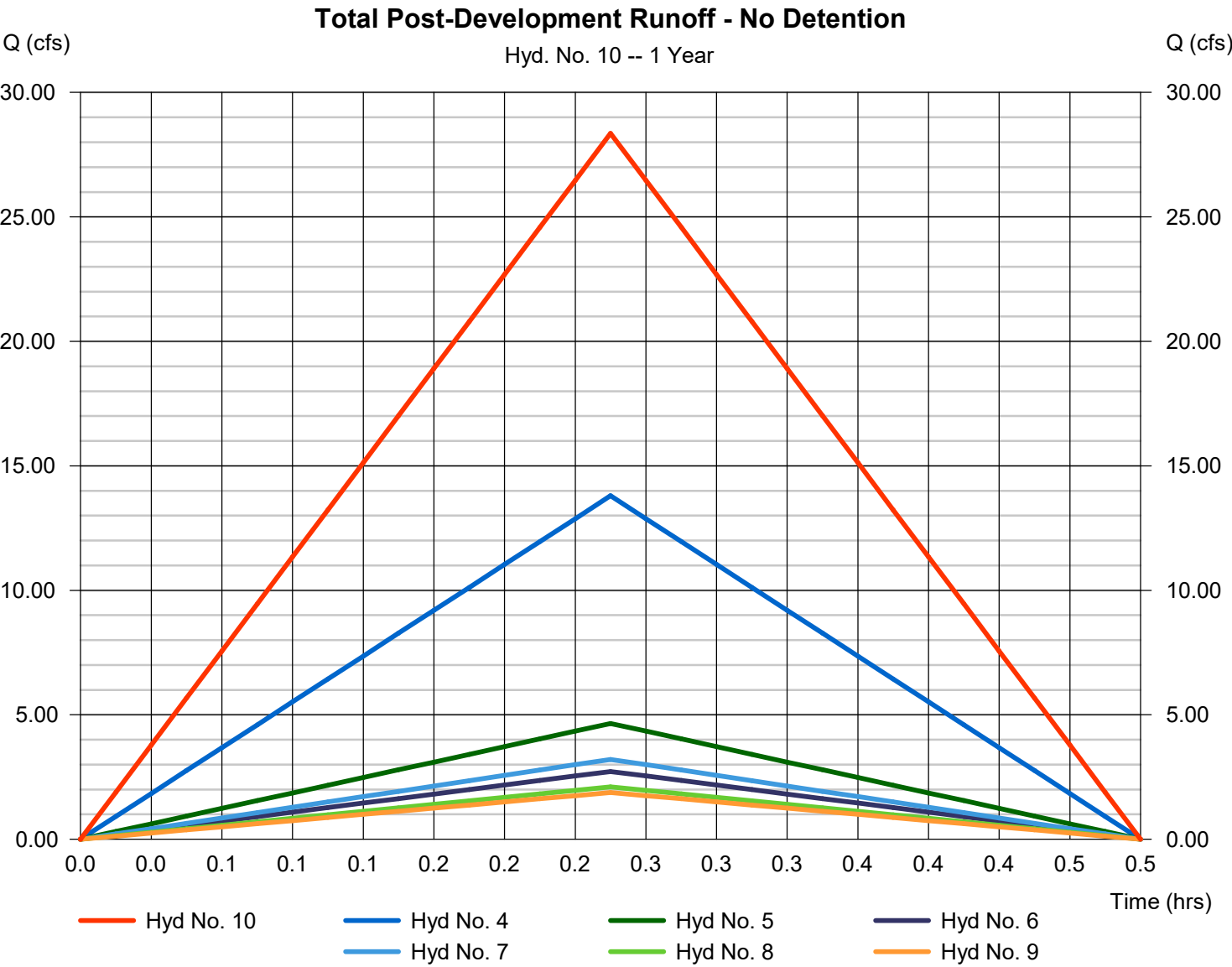
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 10

Total Post-Development Runoff - No Detention

Hydrograph type	= Combine	Peak discharge	= 28.36 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 25,524 cuft
Inflow hyds.	= 4, 5, 6, 7, 8, 9	Contrib. drain. area	= 14.970 ac

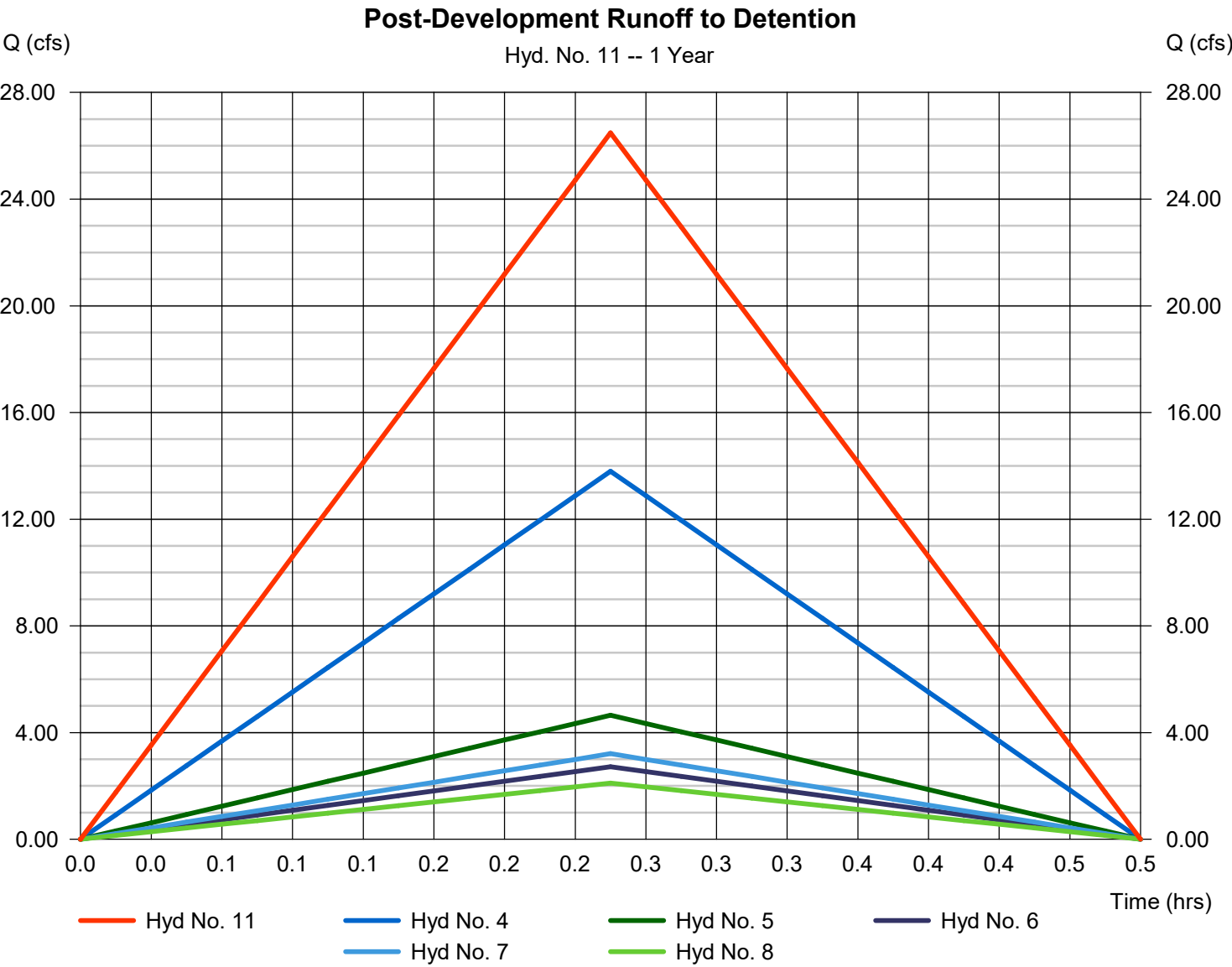


# Hydrograph Report

## Hyd. No. 11

### Post-Development Runoff to Detention

Hydrograph type	= Combine	Peak discharge	= 26.48 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 23,835 cuft
Inflow hyds.	= 4, 5, 6, 7, 8	Contrib. drain. area	= 13.080 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

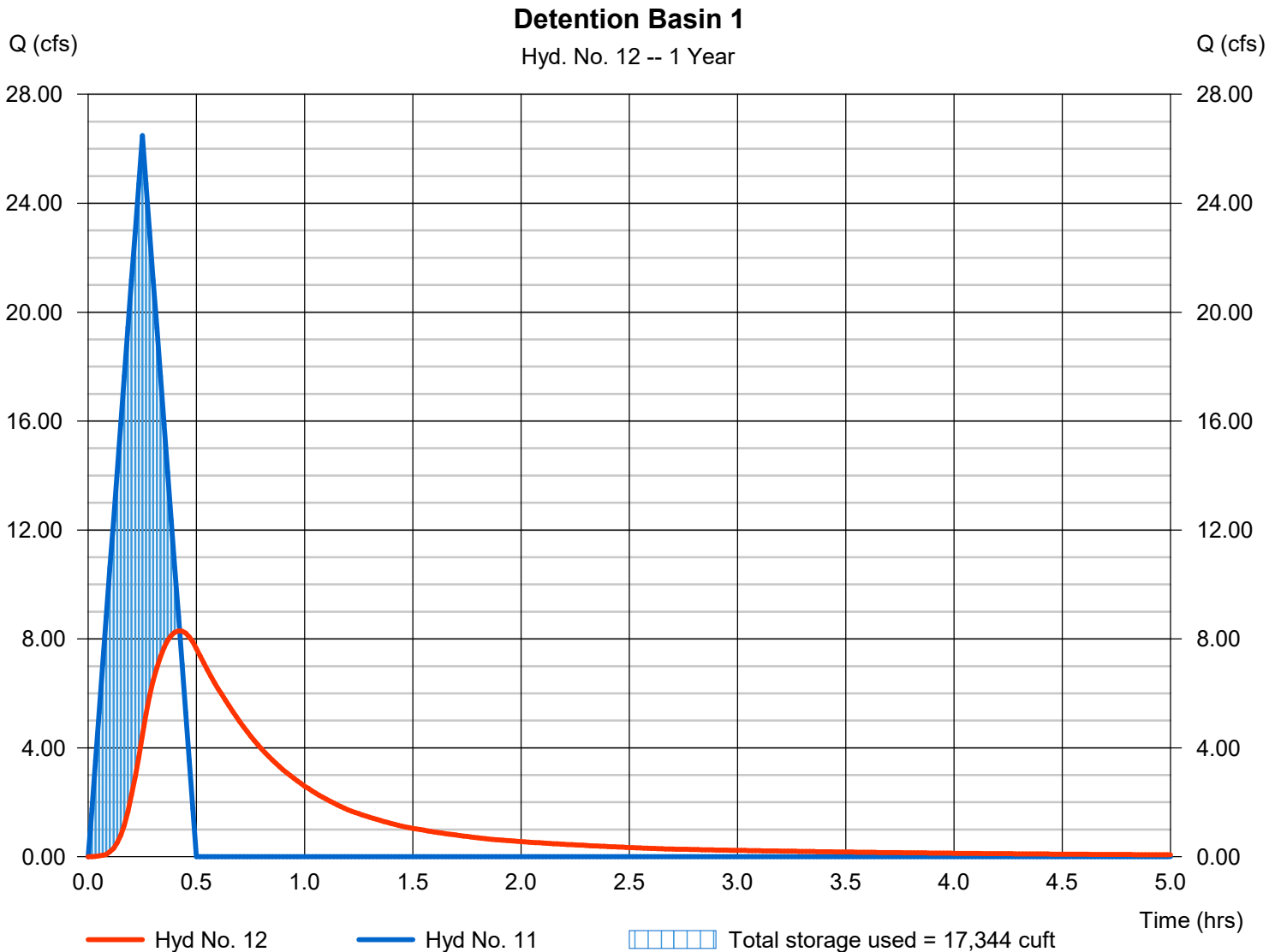
Wednesday, 09 / 29 / 2021

## Hyd. No. 12

### Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 8.294 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.42 hrs
Time interval	= 1 min	Hyd. volume	= 23,818 cuft
Inflow hyd. No.	= 11 - Post-Development Runoff	Max. Elevation	= 1001.35 ft
Reservoir name	= Detention Basin	Max. Storage	= 17,344 cuft

Storage Indication method used.



# Pond Report

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Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Pond No. 1 - Detention Basin

### Pond Data

**Contours** -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1000.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1000.00	11,836	0	0
1.00	1001.00	13,183	12,502	12,502
2.00	1002.00	14,586	13,877	26,379
3.00	1003.00	16,045	15,308	41,688
4.00	1004.00	17,561	16,796	58,483

### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 30.00	Inactive	Inactive	Inactive
Span (in)	= 30.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 1000.00	0.00	0.00	0.00
Length (ft)	= 58.57	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)	Inactive	Inactive	Inactive	Inactive
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	1000.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.10	1,250	1000.10	0.07 ic	---	---	---	---	---	---	---	---	---	0.071
0.20	2,500	1000.20	0.28 ic	---	---	---	---	---	---	---	---	---	0.282
0.30	3,751	1000.30	0.62 ic	---	---	---	---	---	---	---	---	---	0.624
0.40	5,001	1000.40	1.09 ic	---	---	---	---	---	---	---	---	---	1.092
0.50	6,251	1000.50	1.69 ic	---	---	---	---	---	---	---	---	---	1.687
0.60	7,501	1000.60	2.39 ic	---	---	---	---	---	---	---	---	---	2.390
0.70	8,752	1000.70	3.12 oc	---	---	---	---	---	---	---	---	---	3.116
0.80	10,002	1000.80	3.86 oc	---	---	---	---	---	---	---	---	---	3.860
0.90	11,252	1000.90	4.63 oc	---	---	---	---	---	---	---	---	---	4.634
1.00	12,502	1001.00	5.42 oc	---	---	---	---	---	---	---	---	---	5.423
1.10	13,890	1001.10	6.24 oc	---	---	---	---	---	---	---	---	---	6.242
1.20	15,278	1001.20	7.06 oc	---	---	---	---	---	---	---	---	---	7.063
1.30	16,665	1001.30	7.89 oc	---	---	---	---	---	---	---	---	---	7.892
1.40	18,053	1001.40	8.71 oc	---	---	---	---	---	---	---	---	---	8.714
1.50	19,441	1001.50	9.54 oc	---	---	---	---	---	---	---	---	---	9.536
1.60	20,829	1001.60	10.33 oc	---	---	---	---	---	---	---	---	---	10.33
1.70	22,216	1001.70	11.11 oc	---	---	---	---	---	---	---	---	---	11.11
1.80	23,604	1001.80	11.85 oc	---	---	---	---	---	---	---	---	---	11.85
1.90	24,992	1001.90	12.57 oc	---	---	---	---	---	---	---	---	---	12.57
2.00	26,379	1002.00	13.22 oc	---	---	---	---	---	---	---	---	---	13.22
2.10	27,910	1002.10	13.83 oc	---	---	---	---	---	---	---	---	---	13.83
2.20	29,441	1002.20	14.34 oc	---	---	---	---	---	---	---	---	---	14.34
2.30	30,972	1002.30	14.76 oc	---	---	---	---	---	---	---	---	---	14.76
2.40	32,503	1002.40	15.04 oc	---	---	---	---	---	---	---	---	---	15.04
2.50	34,033	1002.50	14.95 oc	---	---	---	---	---	---	---	---	---	14.95
2.60	35,564	1002.60	17.30 oc	---	---	---	---	---	---	---	---	---	17.30
2.70	37,095	1002.70	19.37 oc	---	---	---	---	---	---	---	---	---	19.37
2.80	38,626	1002.80	21.25 oc	---	---	---	---	---	---	---	---	---	21.25
2.90	40,157	1002.90	22.97 oc	---	---	---	---	---	---	---	---	---	22.97
3.00	41,688	1003.00	24.58 oc	---	---	---	---	---	---	---	---	---	24.58
3.10	43,367	1003.10	26.08 oc	---	---	---	---	---	---	---	---	---	26.08
3.20	45,047	1003.20	27.50 oc	---	---	---	---	---	---	---	---	---	27.50
3.30	46,726	1003.30	28.85 oc	---	---	---	---	---	---	---	---	---	28.85
3.40	48,406	1003.40	30.14 oc	---	---	---	---	---	---	---	---	---	30.14
3.50	50,085	1003.50	31.38 oc	---	---	---	---	---	---	---	---	---	31.38
3.60	51,765	1003.60	32.57 oc	---	---	---	---	---	---	---	---	---	32.57
3.70	53,445	1003.70	33.72 oc	---	---	---	---	---	---	---	---	---	33.72

Continues on next page...

Detention Basin

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
3.80	55,124	1003.80	34.83 oc	---	---	---	---	---	---	---	---	---	34.83
3.90	56,804	1003.90	35.91 oc	---	---	---	---	---	---	---	---	---	35.91
4.00	58,483	1004.00	36.96 oc	---	---	---	---	---	---	---	---	---	36.96

...End



# Hydrograph Report

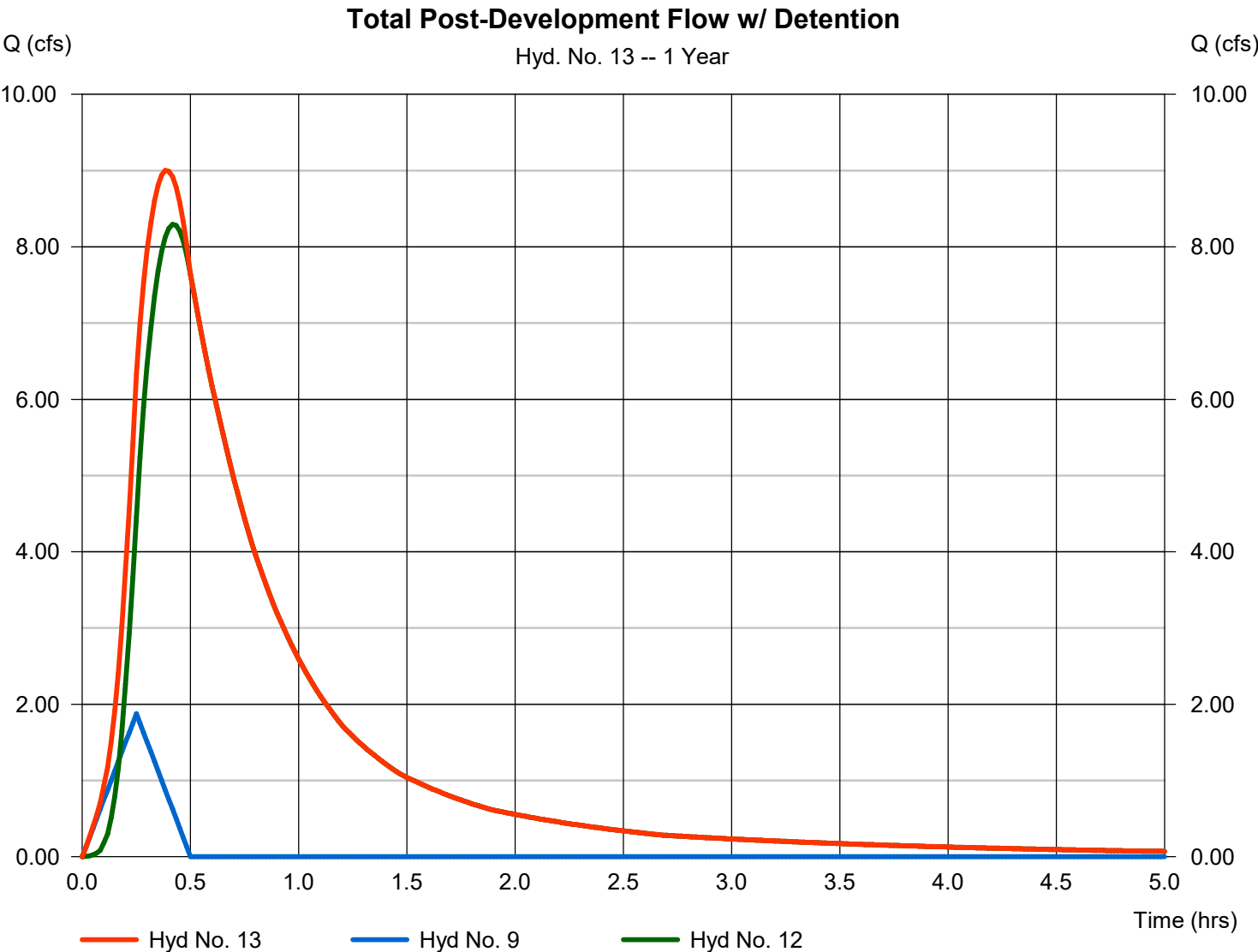
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 13

Total Post-Development Flow w/ Detention

Hydrograph type	= Combine	Peak discharge	= 9.001 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.38 hrs
Time interval	= 1 min	Hyd. volume	= 25,506 cuft
Inflow hyds.	= 9, 12	Contrib. drain. area	= 1.890 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	2.503	1	15	2,253	-----	-----	-----	Pre-Development Area A
2	Rational	20.76	1	15	18,681	-----	-----	-----	Pre-Development Area B
3	Combine	23.26	1	15	20,934	1, 2	-----	-----	Total Pre-Development Runoff
4	Rational	24.49	1	15	22,041	-----	-----	-----	Post-Development Area 1
5	Rational	8.256	1	15	7,430	-----	-----	-----	Post-Development Area 2
6	Rational	4.832	1	15	4,349	-----	-----	-----	Post-Development Area 3
7	Rational	5.695	1	15	5,125	-----	-----	-----	Post-Development Area 4
8	Rational	3.731	1	15	3,358	-----	-----	-----	Post- Development Area 5
9	Rational	3.330	1	15	2,997	-----	-----	-----	Post-Development Areas 6 & 7
10	Combine	50.33	1	15	45,301	4, 5, 6, 7, 8, 9	-----	-----	Total Post-Development Runoff - No
11	Combine	47.00	1	15	42,304	4, 5, 6, 7, 8, 9	-----	-----	Post-Development Runoff to Detentio
12	Reservoir	14.48	1	25	42,287	11	1002.23	29,922	Detention Basin 1
13	Combine	15.92	1	22	45,284	9, 12	-----	-----	Total Post-Development Flow w/ Dete
20231 - Hydraflow.gpw					Return Period: 10 Year			Wednesday, 09 / 29 / 2021	

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 1

Pre-Development Area A

Hydrograph type	= Rational	Peak discharge	= 2.503 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 2,253 cuft
Drainage area	= 1.610 ac	Runoff coeff.	= 0.3
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 2

Pre-Development Area B

Hydrograph type	= Rational	Peak discharge	= 20.76 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 18,681 cuft
Drainage area	= 13.350 ac	Runoff coeff.	= 0.3
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

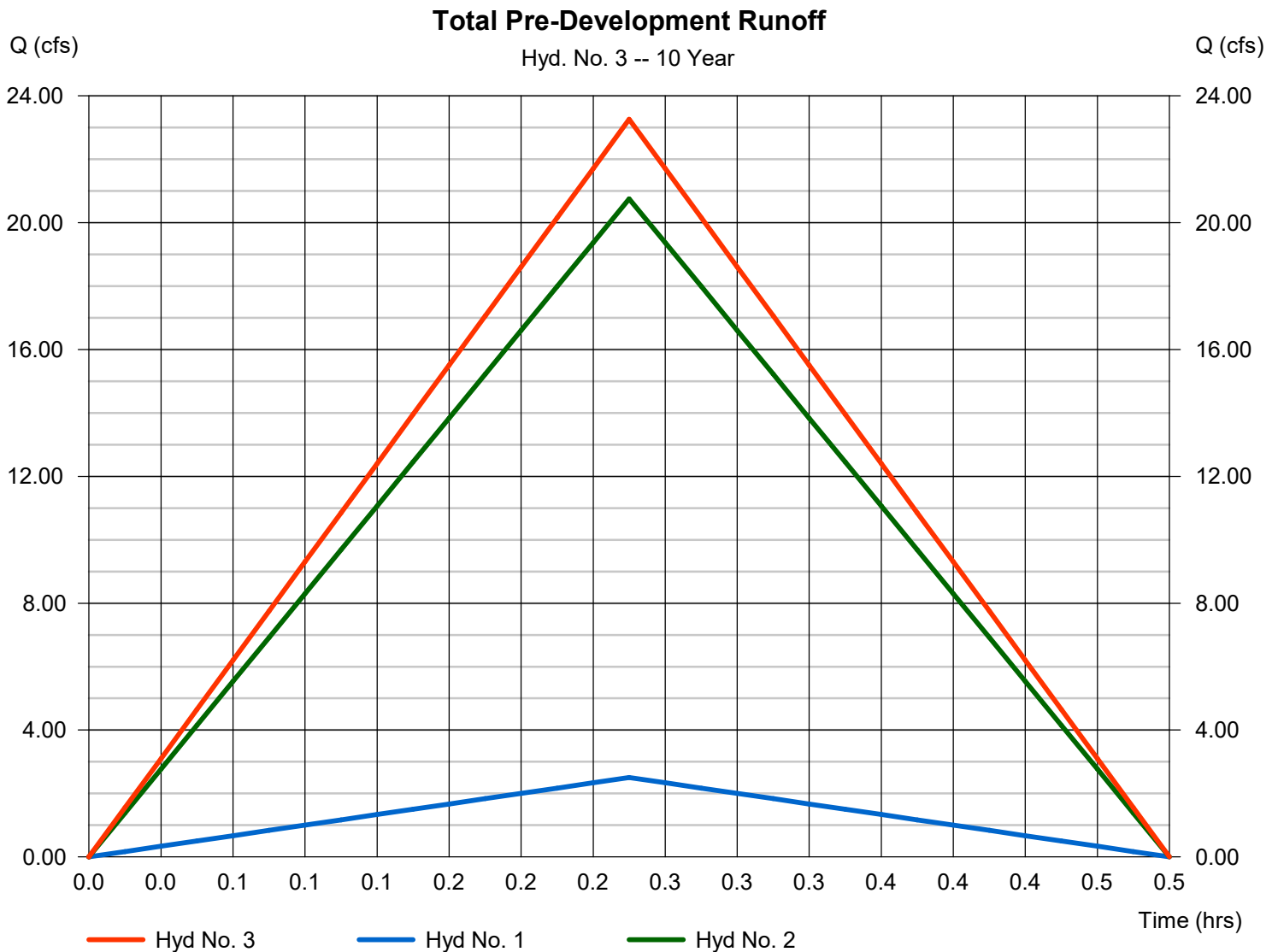
Wednesday, 09 / 29 / 2021

## Hyd. No. 3

### Total Pre-Development Runoff

Hydrograph type = Combine  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Inflow hyds. = 1, 2

Peak discharge = 23.26 cfs  
 Time to peak = 0.25 hrs  
 Hyd. volume = 20,934 cuft  
 Contrib. drain. area = 14.960 ac



# Hydrograph Report

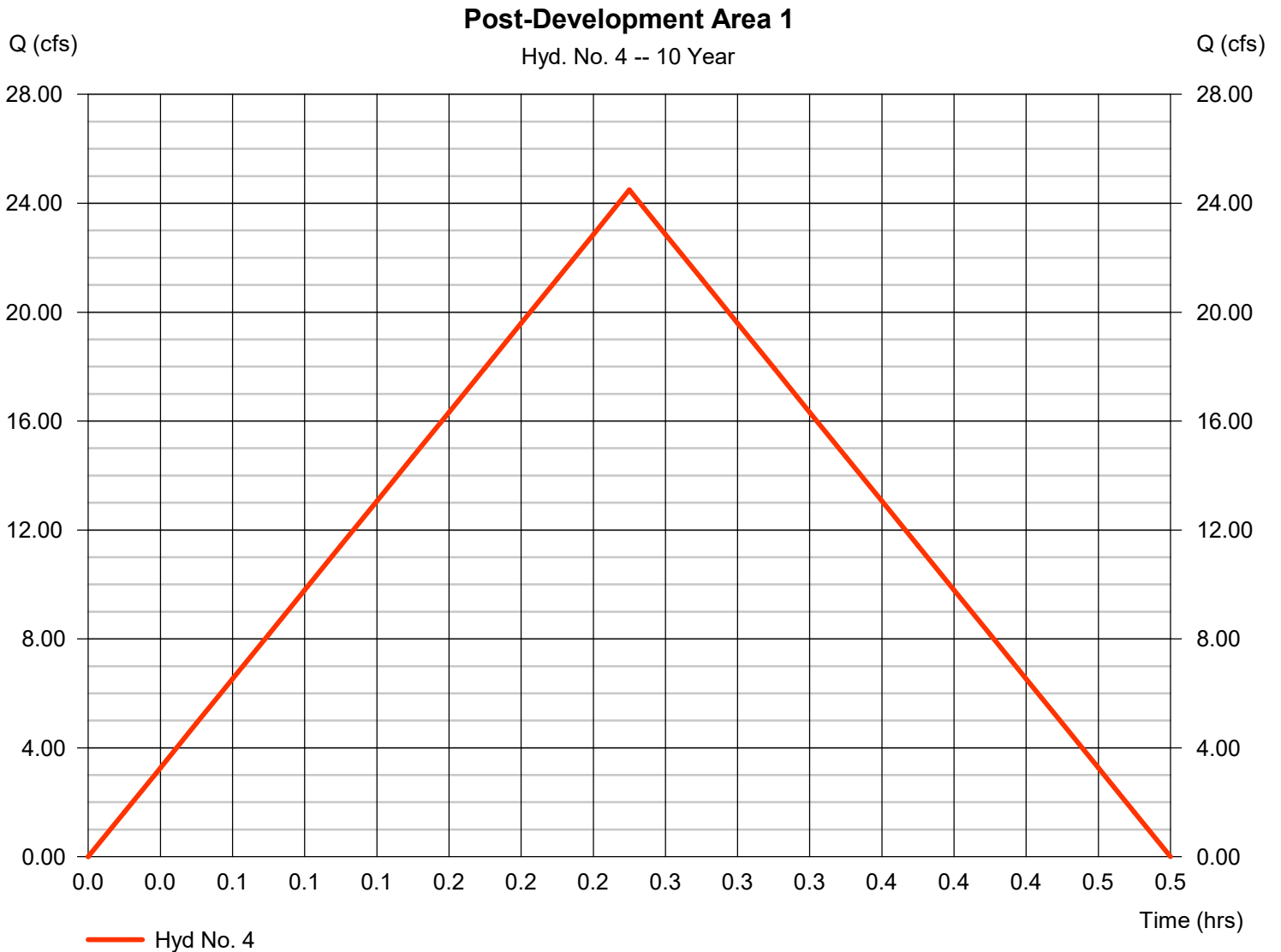
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 4

### Post-Development Area 1

Hydrograph type	= Rational	Peak discharge	= 24.49 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 22,041 cuft
Drainage area	= 7.270 ac	Runoff coeff.	= 0.65
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 5

### Post-Development Area 2

Hydrograph type	= Rational	Peak discharge	= 8.256 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 7,430 cuft
Drainage area	= 1.770 ac	Runoff coeff.	= 0.9
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1





# Hydrograph Report

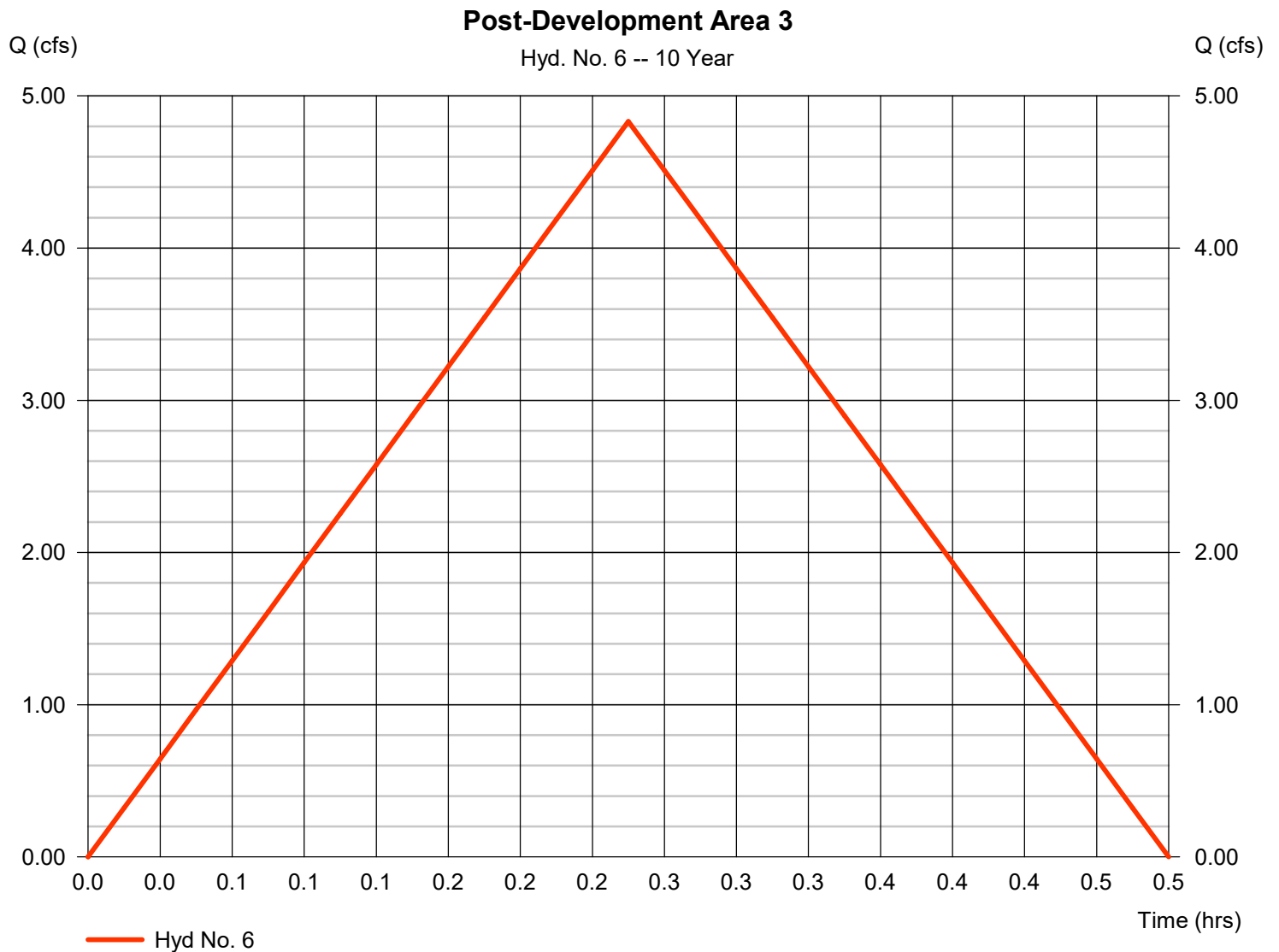
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 6

### Post-Development Area 3

Hydrograph type	= Rational	Peak discharge	= 4.832 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 4,349 cuft
Drainage area	= 1.260 ac	Runoff coeff.	= 0.74
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 7

### Post-Development Area 4

Hydrograph type	= Rational	Peak discharge	= 5.695 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 5,125 cuft
Drainage area	= 1.340 ac	Runoff coeff.	= 0.82
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 8

Post- Development Area 5

Hydrograph type	= Rational	Peak discharge	= 3.731 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 3,358 cuft
Drainage area	= 1.440 ac	Runoff coeff.	= 0.5
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

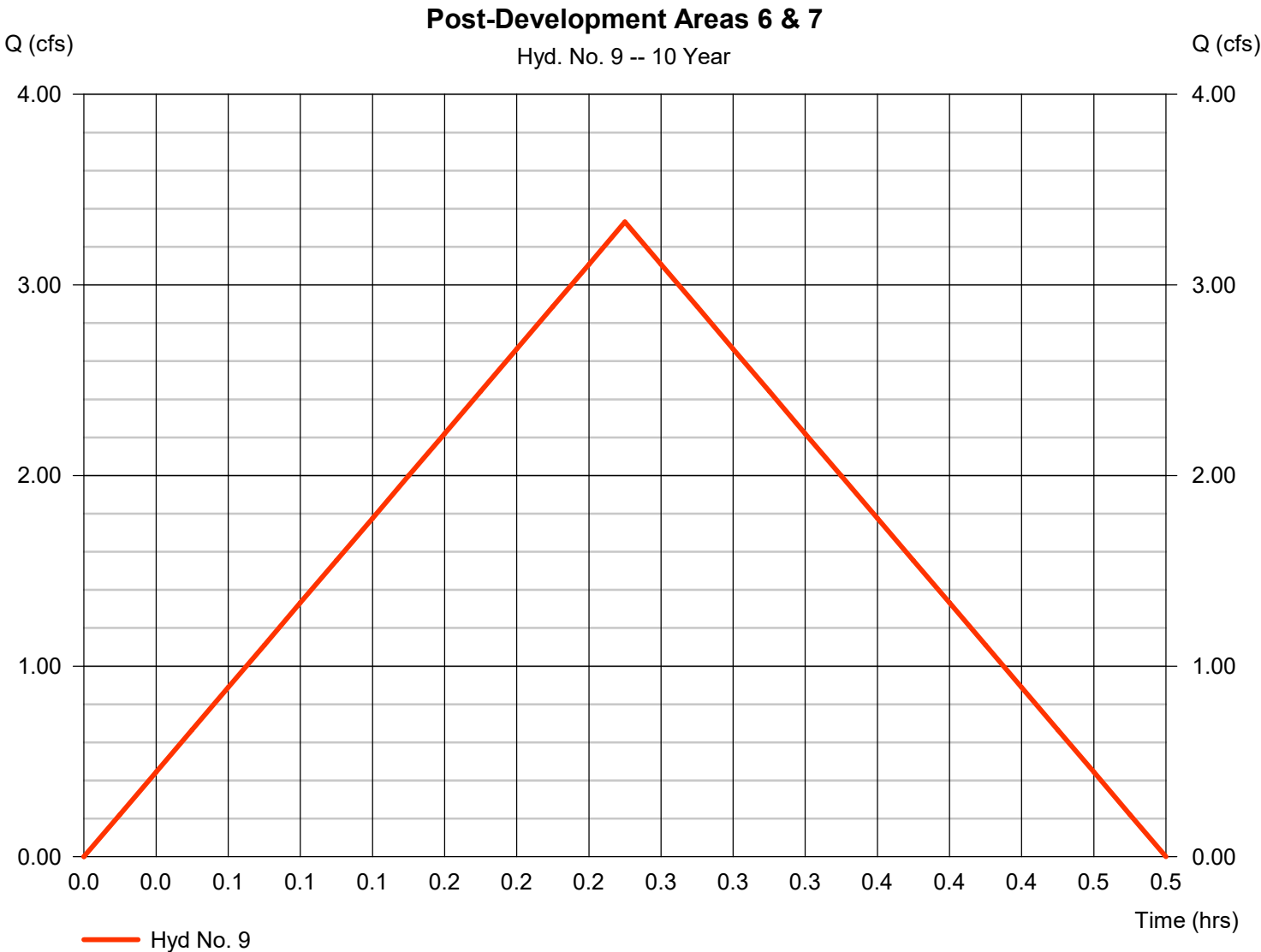
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 9

Post-Development Areas 6 & 7

Hydrograph type	= Rational	Peak discharge	= 3.330 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 2,997 cuft
Drainage area	= 1.890 ac	Runoff coeff.	= 0.34
Intensity	= 5.183 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

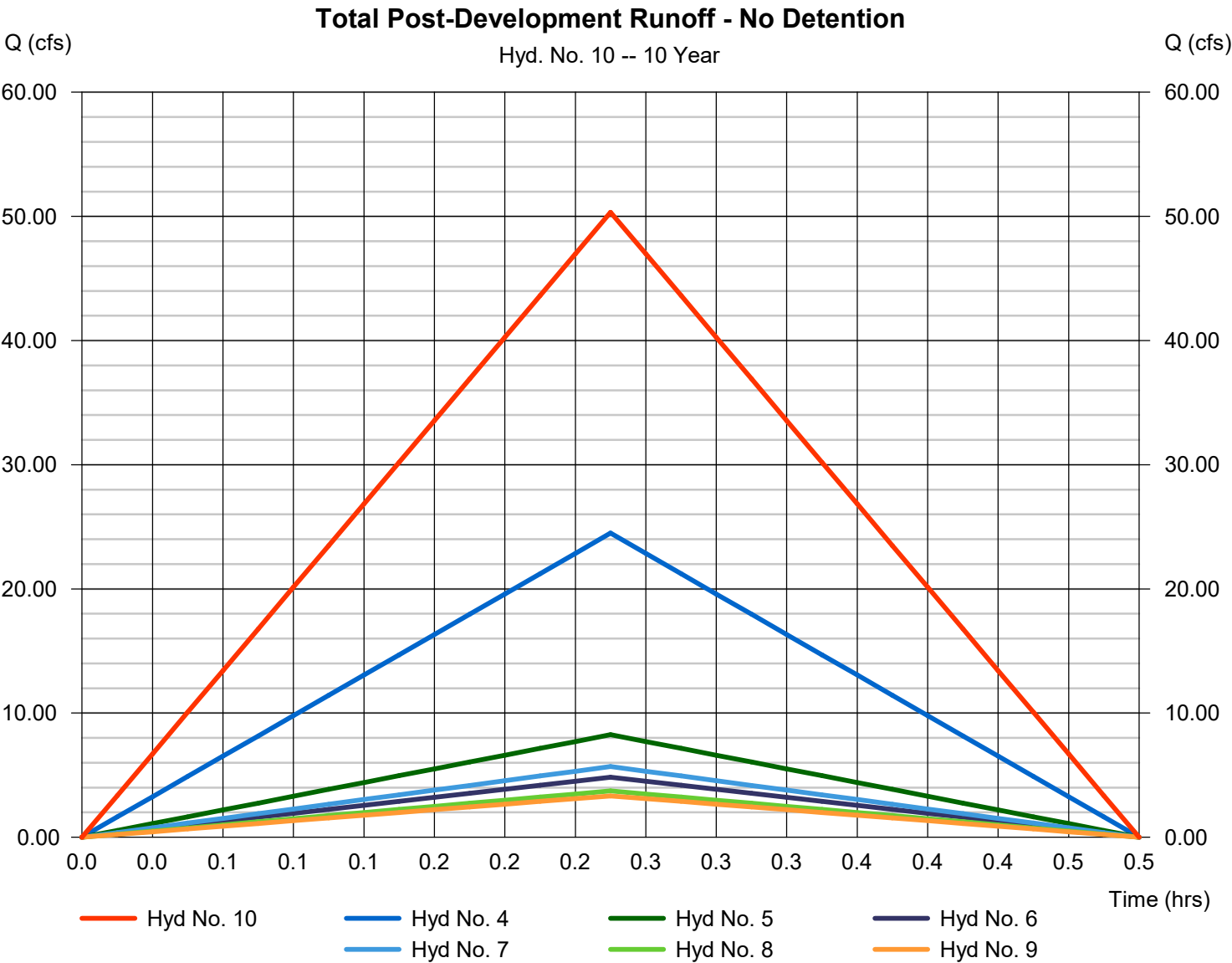
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 10

Total Post-Development Runoff - No Detention

Hydrograph type	= Combine	Peak discharge	= 50.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 45,301 cuft
Inflow hyds.	= 4, 5, 6, 7, 8, 9	Contrib. drain. area	= 14.970 ac

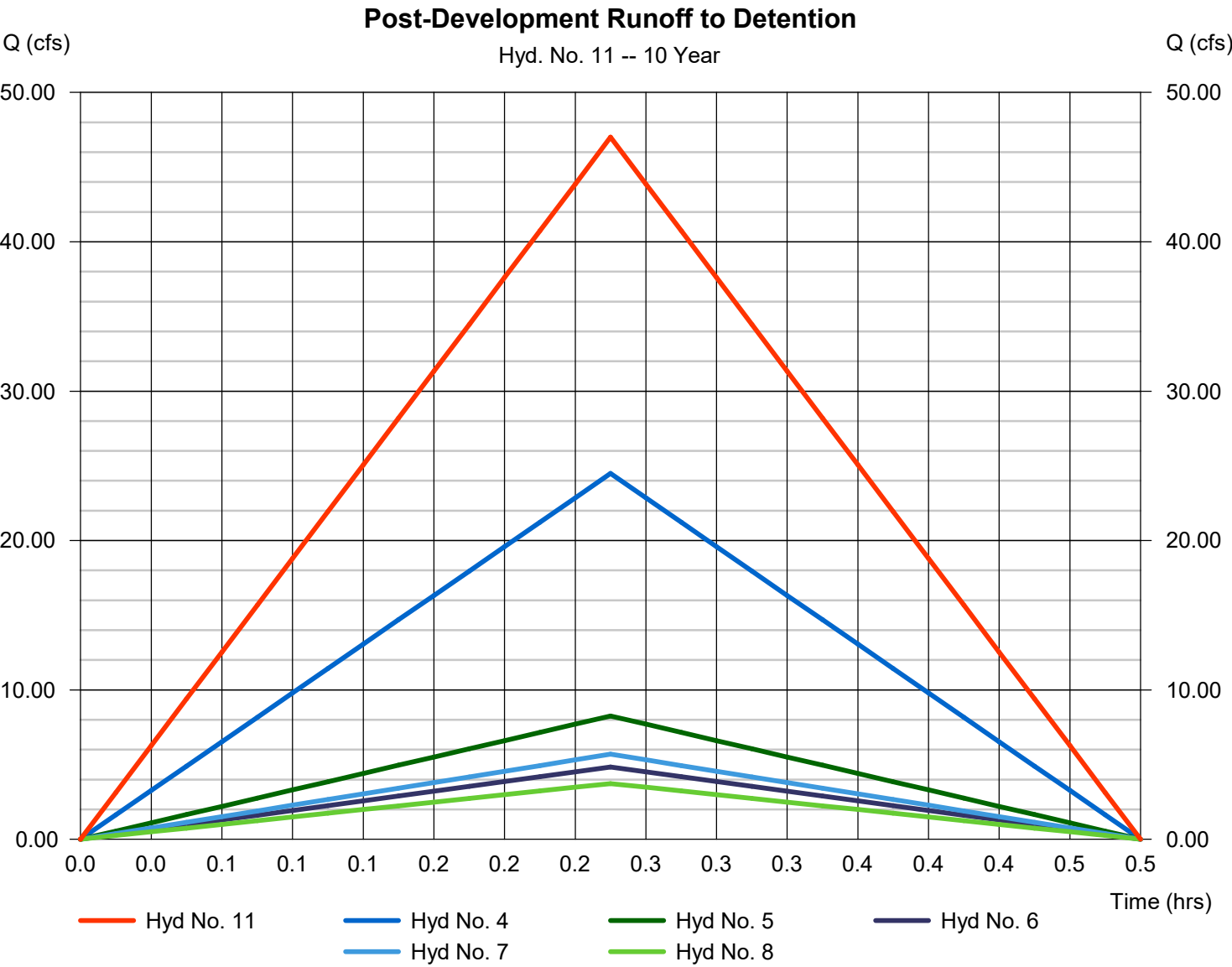


# Hydrograph Report

## Hyd. No. 11

### Post-Development Runoff to Detention

Hydrograph type	= Combine	Peak discharge	= 47.00 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 42,304 cuft
Inflow hyds.	= 4, 5, 6, 7, 8	Contrib. drain. area	= 13.080 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

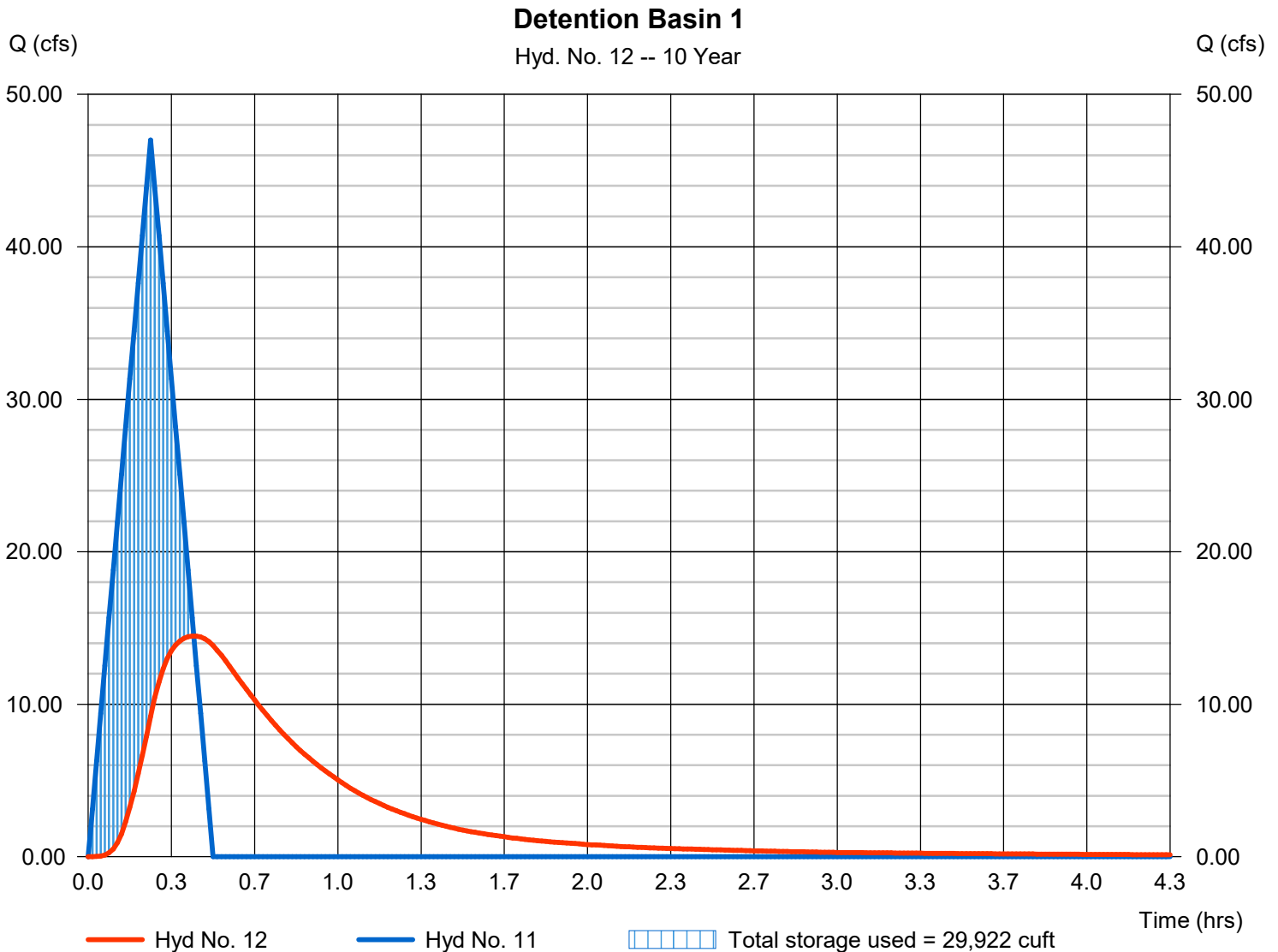
Wednesday, 09 / 29 / 2021

## Hyd. No. 12

### Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 14.48 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.42 hrs
Time interval	= 1 min	Hyd. volume	= 42,287 cuft
Inflow hyd. No.	= 11 - Post-Development Runoff	Max. Elevation	= 1002.23 ft
Reservoir name	= Detention Basin	Max. Storage	= 29,922 cuft

Storage Indication method used.





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

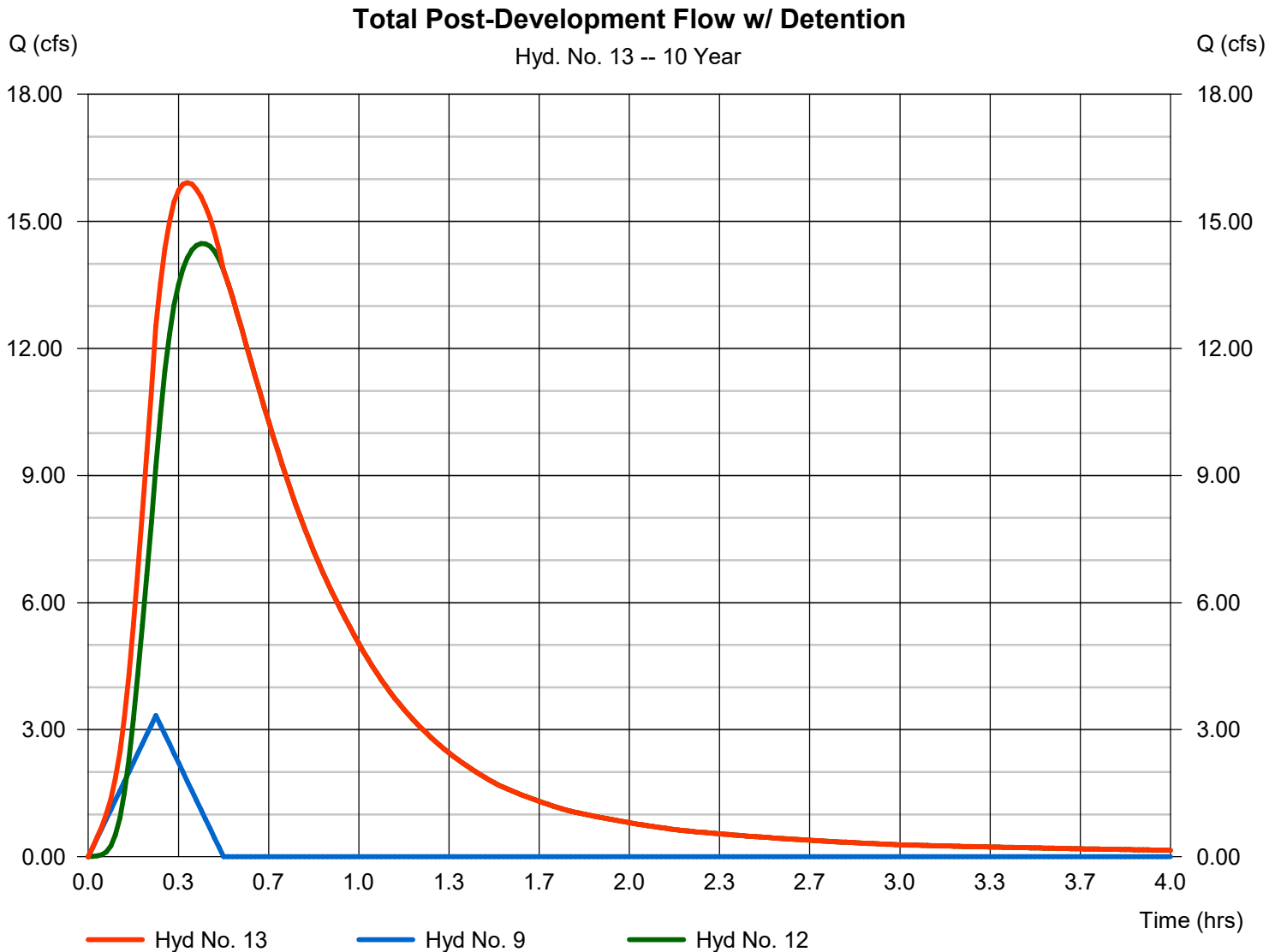
Wednesday, 09 / 29 / 2021

## Hyd. No. 13

### Total Post-Development Flow w/ Detention

Hydrograph type = Combine  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Inflow hyds. = 9, 12

Peak discharge = 15.92 cfs  
 Time to peak = 0.37 hrs  
 Hyd. volume = 45,284 cuft  
 Contrib. drain. area = 1.890 ac



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	3.771	1	15	3,394	-----	-----	-----	Pre-Development Area A
2	Rational	31.27	1	15	28,140	-----	-----	-----	Pre-Development Area B
3	Combine	35.04	1	15	31,534	1, 2	-----	-----	Total Pre-Development Runoff
4	Rational	36.89	1	15	33,203	-----	-----	-----	Post-Development Area 1
5	Rational	12.44	1	15	11,193	-----	-----	-----	Post-Development Area 2
6	Rational	7.279	1	15	6,551	-----	-----	-----	Post-Development Area 3
7	Rational	8.578	1	15	7,721	-----	-----	-----	Post-Development Area 4
8	Rational	5.621	1	15	5,059	-----	-----	-----	Post- Development Area 5
9	Rational	5.017	1	15	4,515	-----	-----	-----	Post-Development Areas 6 & 7
10	Combine	75.82	1	15	68,242	4, 5, 6, 7, 8, 9	-----	-----	Total Post-Development Runoff - No
11	Combine	70.81	1	15	63,727	4, 5, 6, 7, 8, 11	-----	-----	Post-Development Runoff to Detentio
12	Reservoir	26.14	1	24	63,709	11	1003.10	43,433	Detention Basin 1
13	Combine	28.23	1	23	68,224	9, 12	-----	-----	Total Post-Development Flow w/ Dete
20231 - Hydraflow.gpw					Return Period: 100 Year			Wednesday, 09 / 29 / 2021	

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 1

### Pre-Development Area A

Hydrograph type	= Rational	Peak discharge	= 3.771 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 3,394 cuft
Drainage area	= 1.610 ac	Runoff coeff.	= 0.3
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 2

Pre-Development Area B

Hydrograph type	= Rational	Peak discharge	= 31.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 28,140 cuft
Drainage area	= 13.350 ac	Runoff coeff.	= 0.3
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

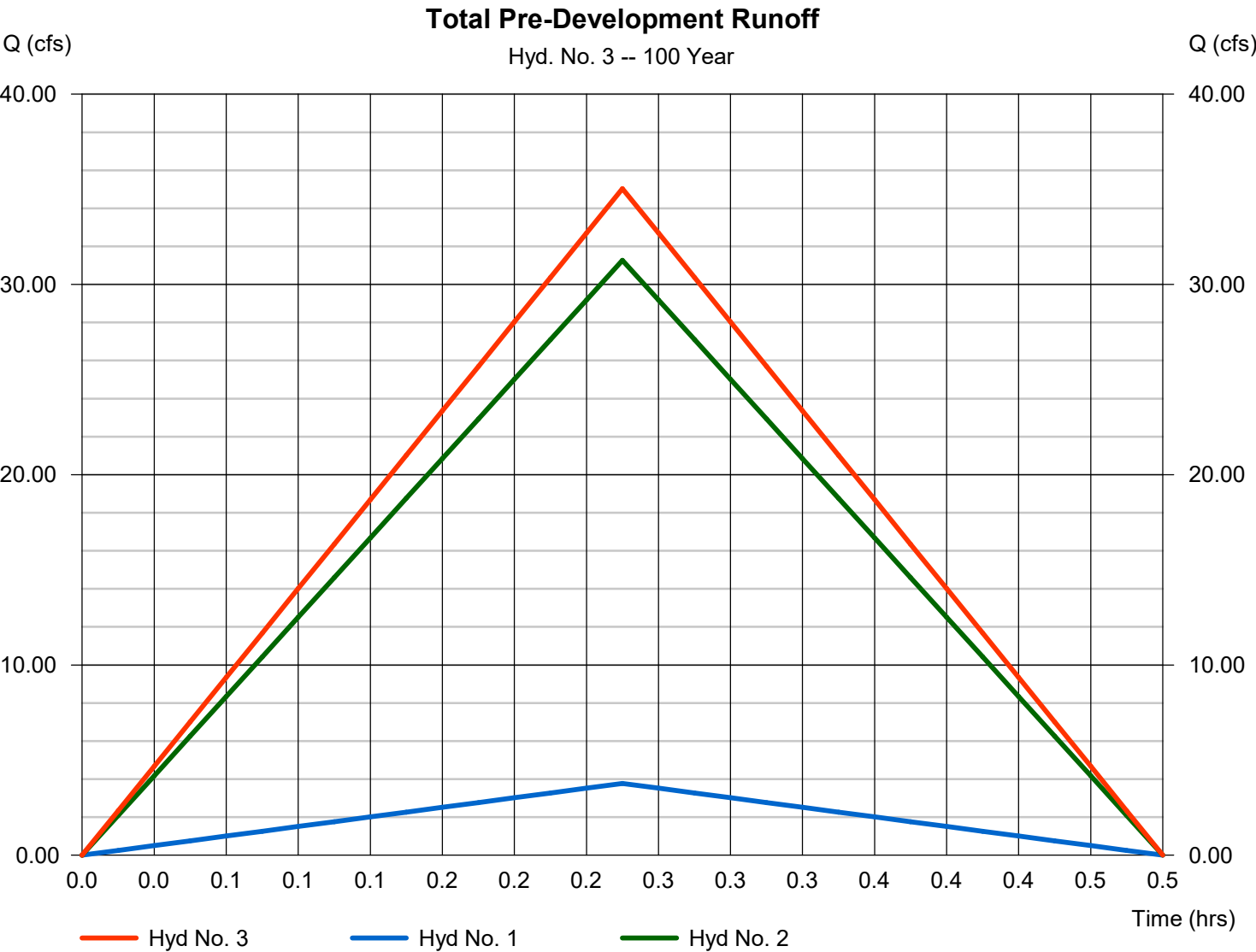
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 3

### Total Pre-Development Runoff

Hydrograph type	= Combine	Peak discharge	= 35.04 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 31,534 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 14.960 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 4

### Post-Development Area 1

Hydrograph type	= Rational	Peak discharge	= 36.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 33,203 cuft
Drainage area	= 7.270 ac	Runoff coeff.	= 0.65
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

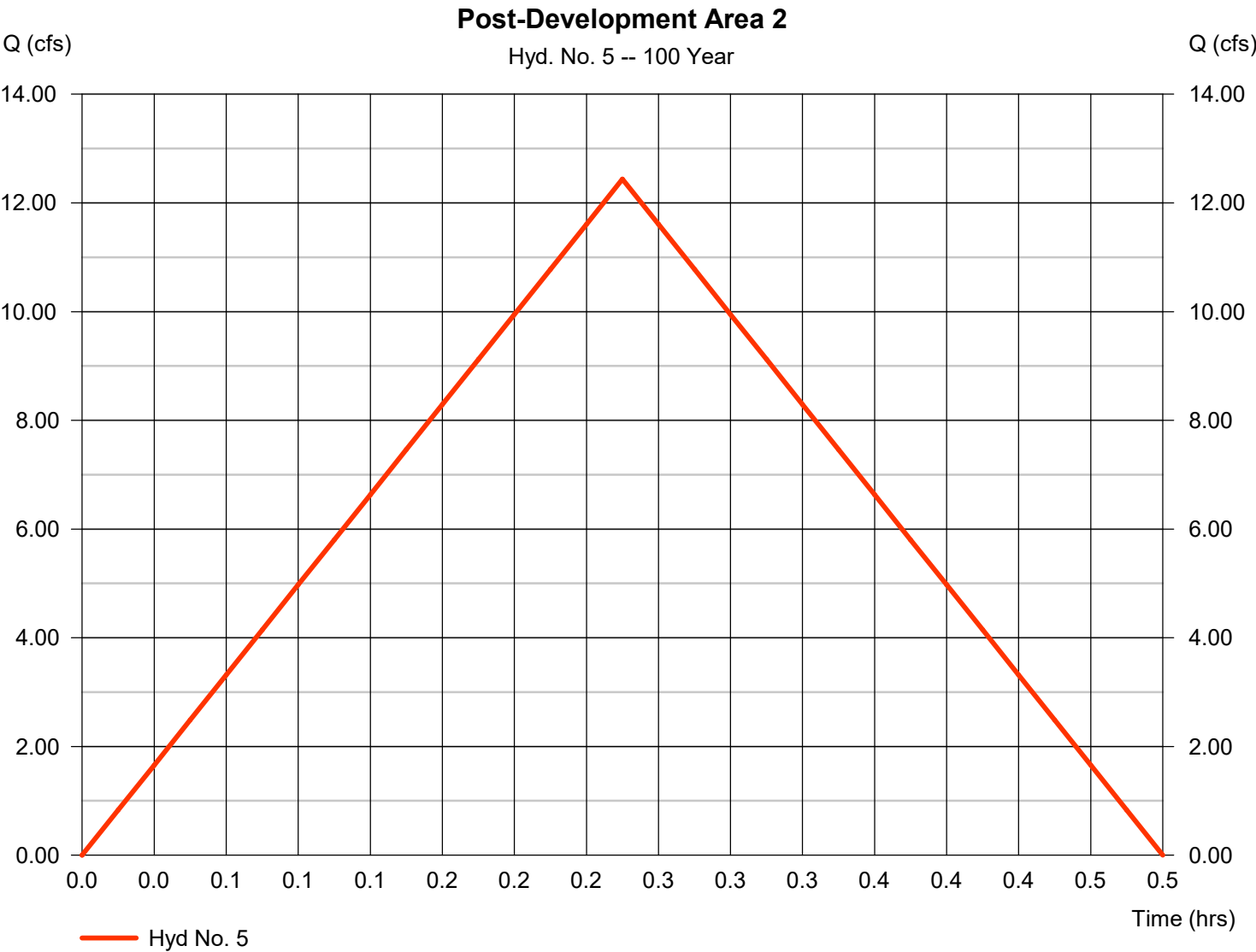
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 5

### Post-Development Area 2

Hydrograph type	= Rational	Peak discharge	= 12.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 11,193 cuft
Drainage area	= 1.770 ac	Runoff coeff.	= 0.9
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1





# Hydrograph Report

## Hyd. No. 6

### Post-Development Area 3

Hydrograph type	= Rational	Peak discharge	= 7.279 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 6,551 cuft
Drainage area	= 1.260 ac	Runoff coeff.	= 0.74
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

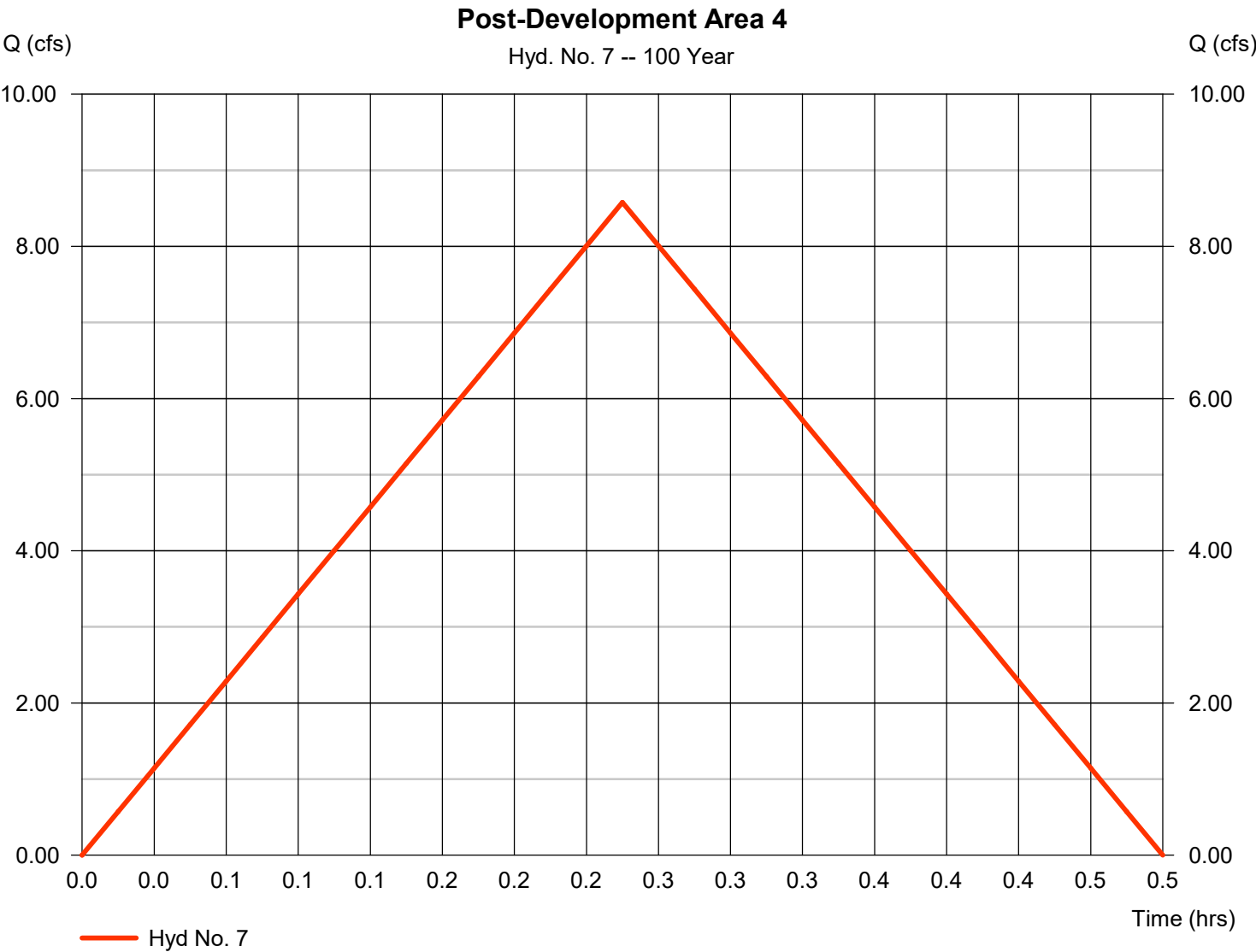
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 7

Post-Development Area 4

Hydrograph type	= Rational	Peak discharge	= 8.578 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 7,721 cuft
Drainage area	= 1.340 ac	Runoff coeff.	= 0.82
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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## Hyd. No. 8

Post- Development Area 5

Hydrograph type	= Rational	Peak discharge	= 5.621 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 5,059 cuft
Drainage area	= 1.440 ac	Runoff coeff.	= 0.5
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



# Hydrograph Report

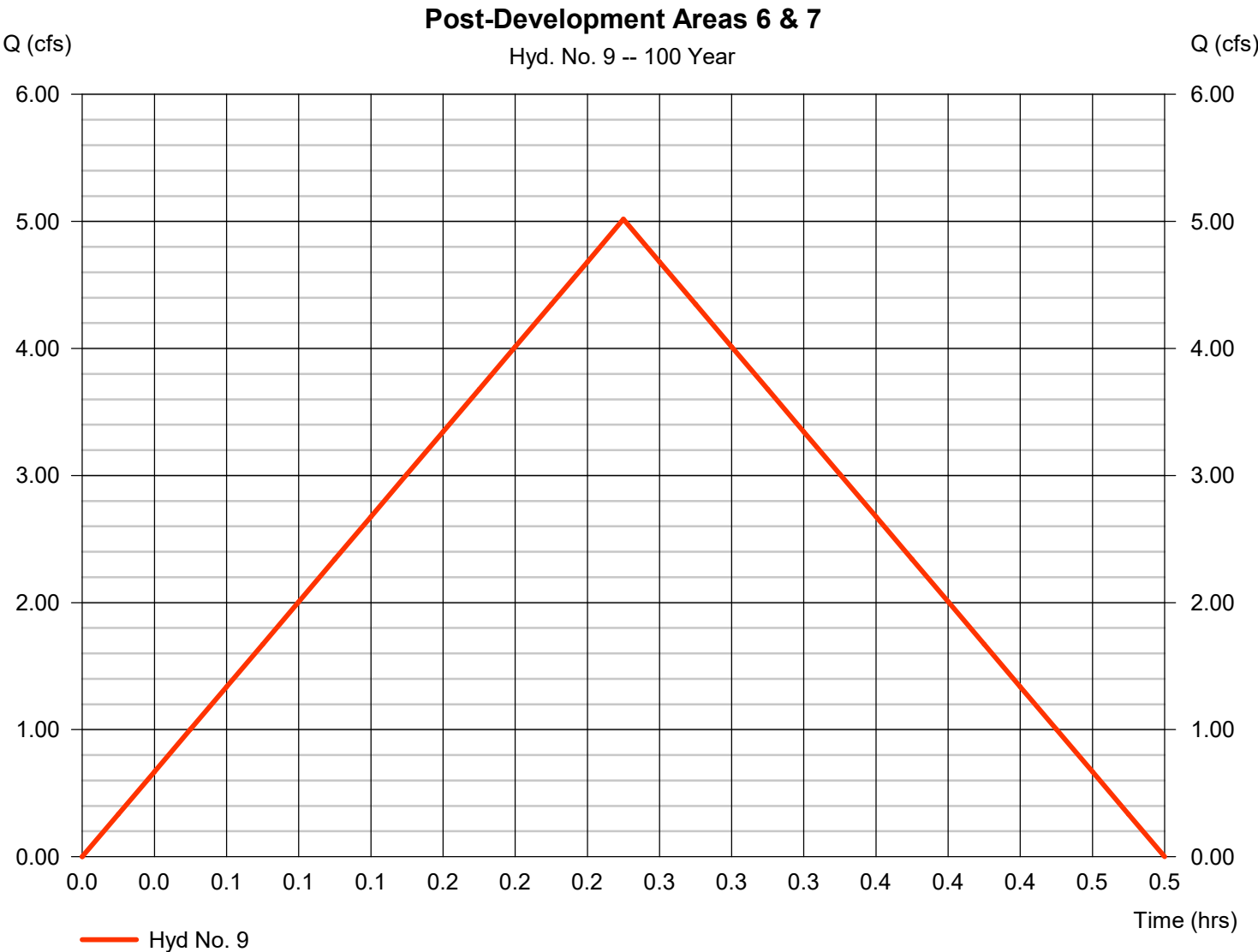
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 9

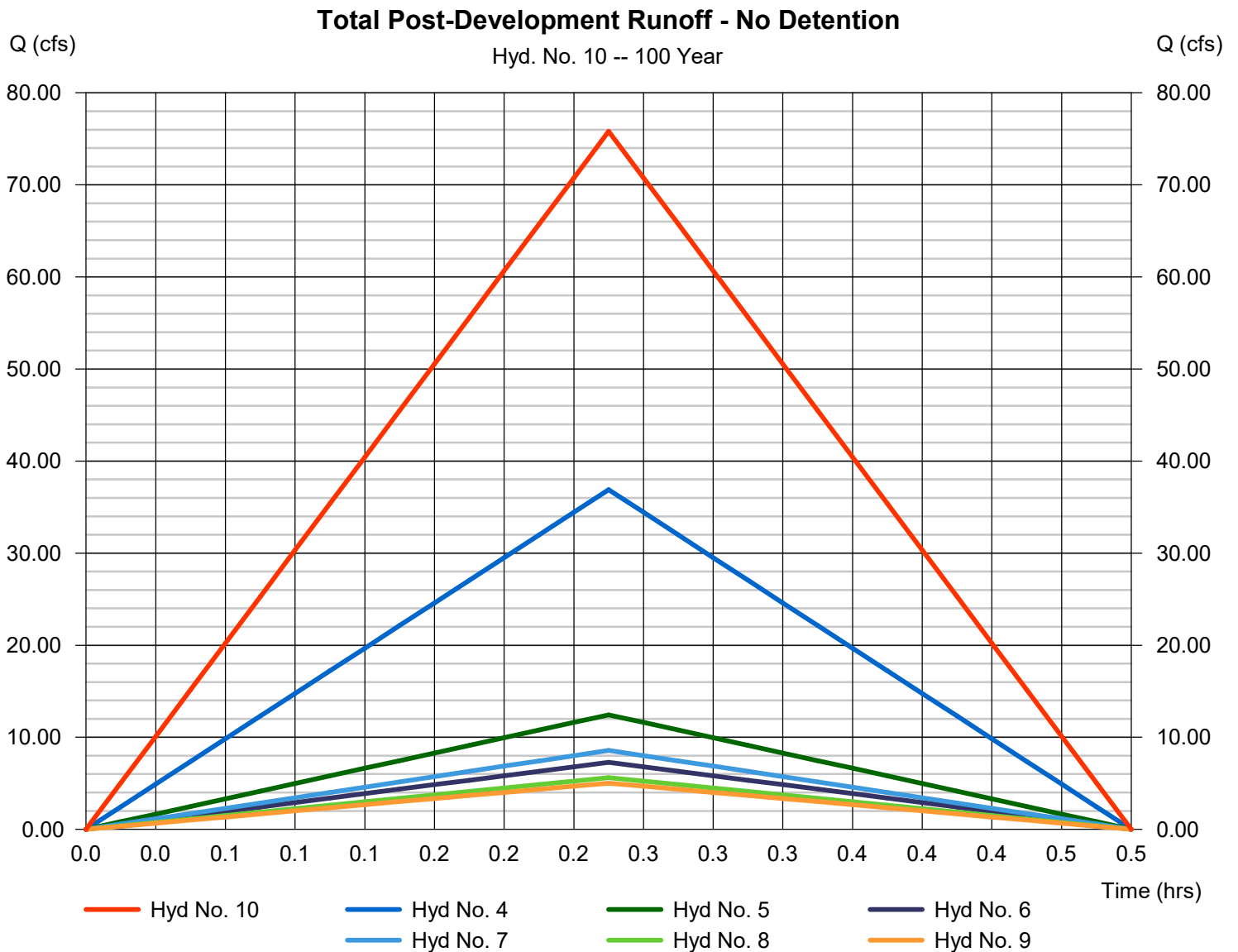
Post-Development Areas 6 & 7

Hydrograph type	= Rational	Peak discharge	= 5.017 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 4,515 cuft
Drainage area	= 1.890 ac	Runoff coeff.	= 0.34
Intensity	= 7.807 in/hr	Tc by User	= 15.00 min
IDF Curve	= Lenexa KS.IDF	Asc/Rec limb fact	= 1/1



### Total Post-Development Runoff - No Detention

Peak discharge = 75.82 cfs  
Time to peak = 0.25 hrs  
Hyd. volume = 68,242 cuft  
Contrib. drain. area = 14.970 ac



# Hydrograph Report

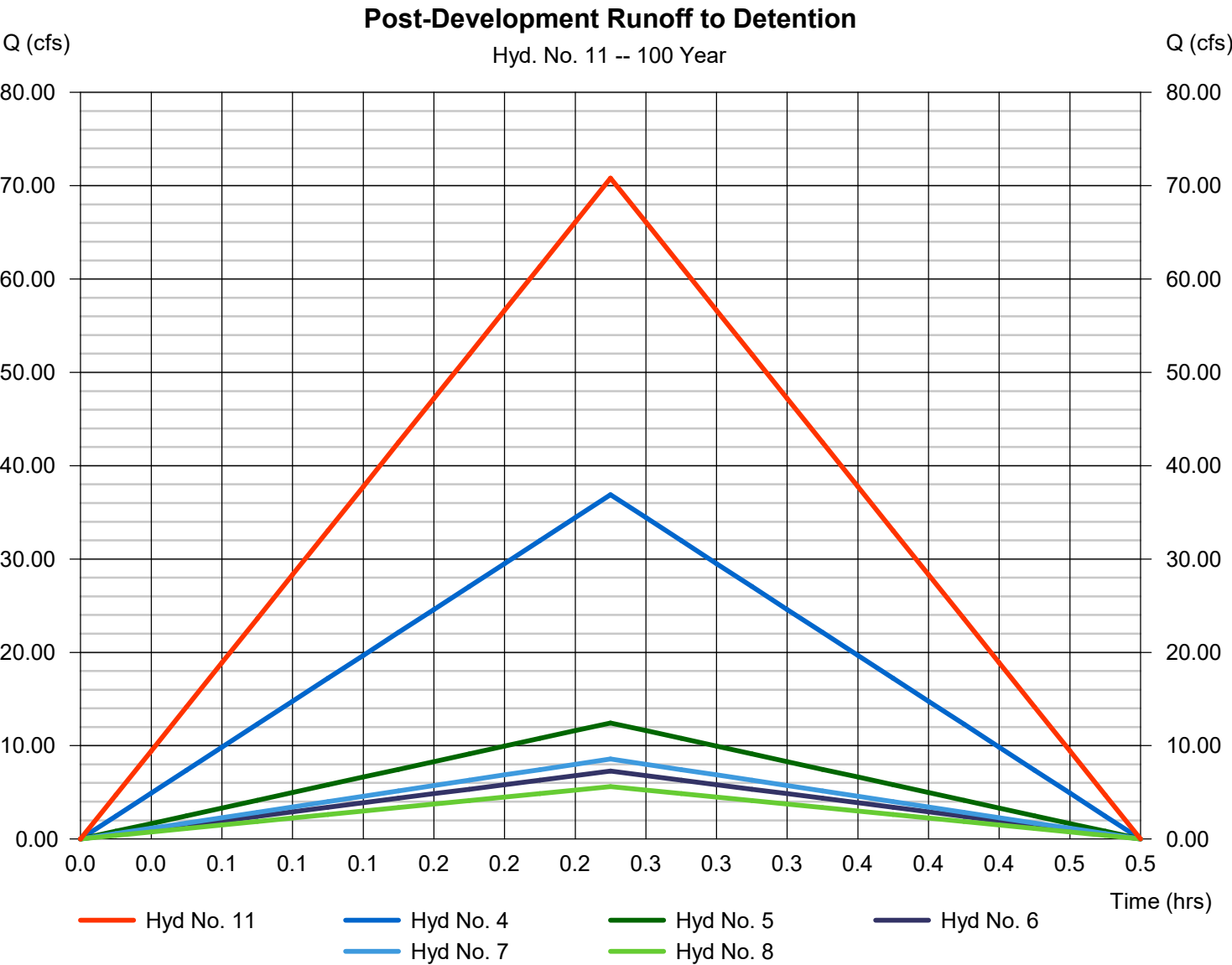
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

## Hyd. No. 11

### Post-Development Runoff to Detention

Hydrograph type	= Combine	Peak discharge	= 70.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.25 hrs
Time interval	= 1 min	Hyd. volume	= 63,727 cuft
Inflow hyds.	= 4, 5, 6, 7, 8	Contrib. drain. area	= 13.080 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

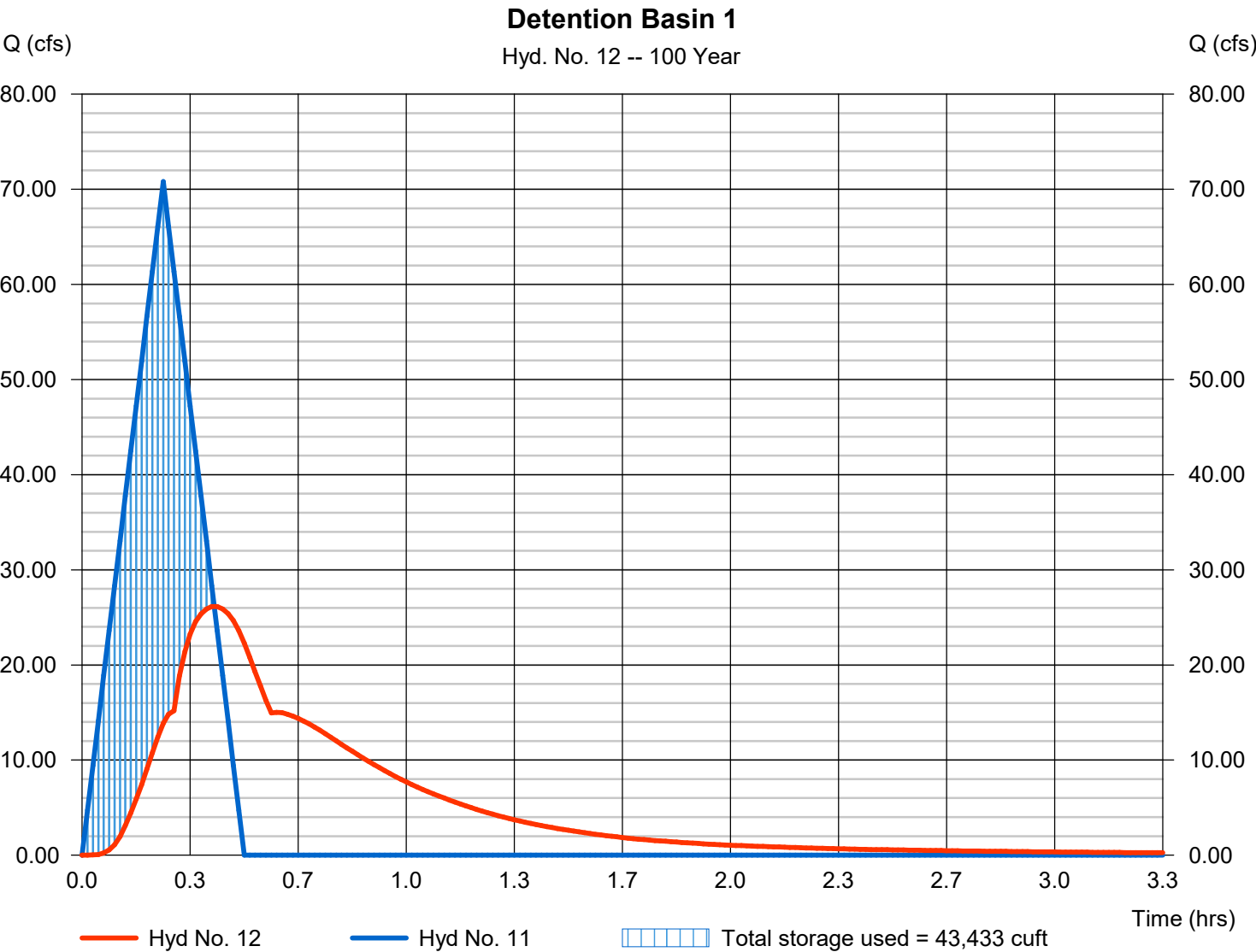
Wednesday, 09 / 29 / 2021

## Hyd. No. 12

### Detention Basin 1

Hydrograph type	= Reservoir	Peak discharge	= 26.14 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.40 hrs
Time interval	= 1 min	Hyd. volume	= 63,709 cuft
Inflow hyd. No.	= 11 - Post-Development Runoff	Max. Elevation	= 1003.10 ft
Reservoir name	= Detention Basin	Max. Storage	= 43,433 cuft

Storage Indication method used.





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

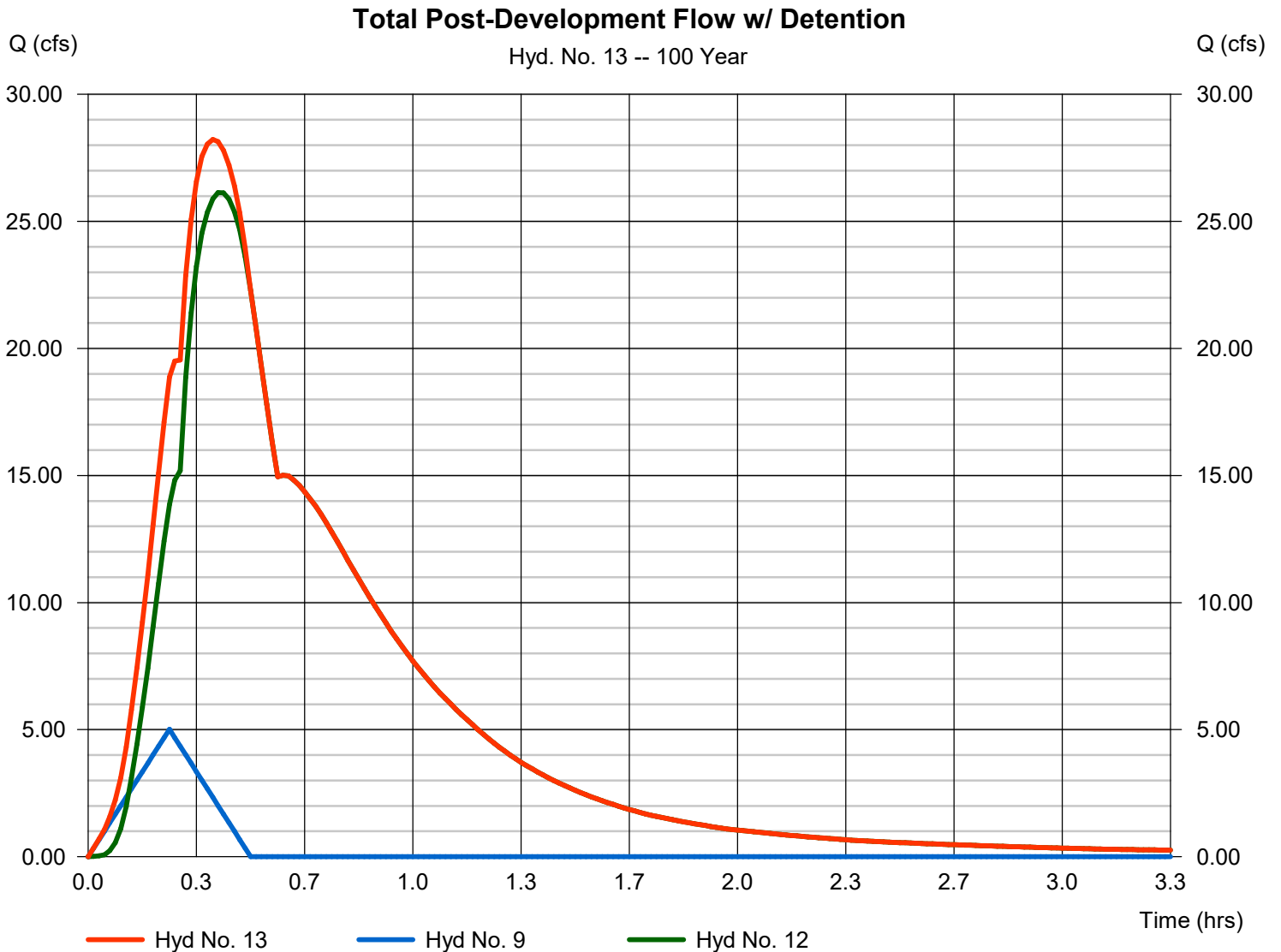
Wednesday, 09 / 29 / 2021

## Hyd. No. 13

### Total Post-Development Flow w/ Detention

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Inflow hyds. = 9, 12

Peak discharge = 28.23 cfs  
 Time to peak = 0.38 hrs  
 Hyd. volume = 68,224 cuft  
 Contrib. drain. area = 1.890 ac



# Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Wednesday, 09 / 29 / 2021

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	2.9200	0.1000	0.0000	-----
2	110.7137	16.5000	0.9842	-----
3	0.0000	0.0000	0.0000	-----
5	168.3971	19.5000	1.0189	-----
10	183.3473	19.2000	1.0096	-----
25	103.5313	15.9000	0.8218	-----
50	235.4014	19.9000	1.0020	-----
100	83.7894	6.1000	0.7783	-----

File name: Lenexa KS.IDF

$$\text{Intensity} = B / (T_c + D)^E$$

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
2	5.41	4.40	3.71	3.21	2.83	2.53	2.29	2.09	1.92	1.78	1.66	1.55
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.47	5.35	4.56	3.98	3.52	3.16	2.86	2.62	2.41	2.24	2.08	1.95
10	7.35	6.08	5.18	4.52	4.00	3.59	3.26	2.98	2.74	2.54	2.37	2.22
25	8.51	7.14	6.17	5.46	4.90	4.46	4.10	3.79	3.54	3.31	3.12	2.95
50	9.39	7.82	6.70	5.86	5.20	4.68	4.25	3.90	3.60	3.34	3.12	2.92
100	12.87	9.64	7.81	6.62	5.77	5.14	4.65	4.25	3.92	3.65	3.41	3.21

Tc = time in minutes. Values may exceed 60.

Precip. file name: P:\DAE Civil\Hydraflow Storm Sewer\SCS 24-hr Rainfall.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.85	3.50	0.00	4.50	5.30	6.10	6.90	7.50
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	2.90	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10