EarthRes
ENGINEERING AND SCIENCE

PENNSYLVANIA
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Pipersville, PA 18947
215.766.1211

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June 14, 2018

Mr. Joseph S. Blyler, Jr., P.E.
Mining Engineer
PA Department of Environmental Protection
Pottsville District Mining Office
5 West Laurel Boulevard
Pottsville, PA 17901-2454

RE: Hanson Aggregates Pennsylvania LLC – Rock Hill Quarry
Permit Update – E&S Plan Certification
SMP No. 7974SM1
East Rockhill Township, Bucks County
EarthRes Project No. 061003.052

Dear Mr. Blyler:

On behalf of Hanson Aggregates Pennsylvania LLC (Hanson), EarthRes Group, Inc. (EarthRes) is hereby submitting confirmation/certification of the installation of the E&S Controls for the Rock Hill Quarry located in East Rockhill Township, Bucks County. Included with this document are the following items:

- E&S Photo Log and Notes;
- Pond Certification for Basins 1 and 2;
- Supplemental As-Built Calculations; and
- E&S Site Plan As-Built.

Should you have any questions or require additional information, please contact me at (215) 766-1211.

Sincerely,
EarthRes Group, Inc.

Michael D. Fling, P.E.
Project Manager

Enclosures: As stated

Cc: Andrew Gutshall, Hanson
Charlie Elwell, R.E. Pierson

E&S CONTROL FEATURES

PHOTO LOG & NOTES

Hanson Aggregates Pennsylvania LLC - Rock Hill Quarry
E&S Cert - Photo Log and Notes

Photo #	Control Device	Installed	Notes
1	Sediment Trap 1	Yes	Sediment Trap 1 was installed as designed.
2	Sediment Trap 2	Yes	Sediment Trap 2 was installed as designed.
3	Sediment Trap 3	Yes	Sediment Trap 3 was installed as designed. Sediment Trap 3 was added to the E&S Plan during construction to provide additional treatment of the drainage area upslope of Sediment Trap 1. Design calculations and details are included with the Cert.
4	Diversion Berm 1	Yes	Diversion Berm 1 was installed as designed.
5	Diversion Berm 2	Yes	Diversion Berm 2 was installed as designed.
6	Diversion Berm 3	Yes	Diversion Berm 3 was installed as designed.
7	Clarifying Pond	Yes	Clarifying pond was installed with additional riprap lining along the slope sides.
8	Seep Interceptor Pipe	Yes	Interceptor pipe was installed based on field conditions. Perforated pipe was added to the rock-lined/geotextile wrapped trench for collection of additional shallow groundwater flow. The interceptor pipe outlets to the Clarifying Pond. An additional length of interceptor pipe shall be installed following grading efforts around the proposed plant to provide for additional collection and diversion of shallow groundwater flow.
9	Channel 1	Yes	Channel 1 was extended further northwest an additional 80 feet to meet the invert of an existing culvert (Culvert 6) that was uncovered during construction.
10	Channel 2 Section 1	Yes	Channel 2 Section 1 was realigned to meet the invert of the existing culvert (Culvert 6) uncovered during construction. A filter berm was installed on the northwestern end of the channel.
11	Channel 2 Section 2	Yes	Channel 2 Section 2 was installed as designed.
12	Channel 3	Yes	Channel 3 was installed as designed.
13	Channel 4	Yes	Channel 4 was installed as designed.
14	Channel 5	Yes	Channel 5 was extended, eliminating Culvert 7 and directly connecting into Culvert 4.
15	Channel 6	Yes	Channel 6 was installed as designed.
16	Sediment Basin 1	Yes	Sediment Basin 1 was reshaped in order to increase the width of the site access driveway without compromising on basin design volume.
17	Sediment Basin 2	Yes	Sediment Basin 2 was reshaped along the northern corner to account for the extension of rail spur uncovered during construction without compromising on basin design volume.
18	Perimeter Berm	Yes	Perimeter berm (precast concrete blocks) was installed as designed.
19	Culvert 1	Yes	Culvert 1 was installed as designed.
20	Culvert 2	Yes	Culvert 2 was installed as designed.
21	Culvert 3	Yes	Culvert 3 was existing and remains.
22	Culvert 4	Yes	Culvert 4 was existing and the outlet was cut to fit site conditions upon installation of Sediment Basin 2.
23	Culvert 5	Yes	Culvert 5 is an existing feature with no proposed changes.
24	Culvert 6	Yes	Culvert 6 is an existing feature with no proposed changes.
25	Culvert 7	No	Culvert 7 was eliminated and Channel 5 was extended through the area.
26	Culvert 8	Yes	Culvert 8 was installed as designed.
N/A	Quarry Impoundment Dewatering System	Yes	The dewatering system was installed per Figure 1 detail.

1) Sediment Trap 1

2) Sediment Trap 2

3) Sediment Trap 3

4) Diversion Berm 1

5) Diversion Berm 2

6) Diversion Berm 3

7) Clarifying Pond

8) Interceptor Pipe

9) Channel 1

10) Channel 2 Section 1

11) Channel 2 Section 2

12) Channel 3

13) Channel 4

14) Channel 5

15) Channel 6

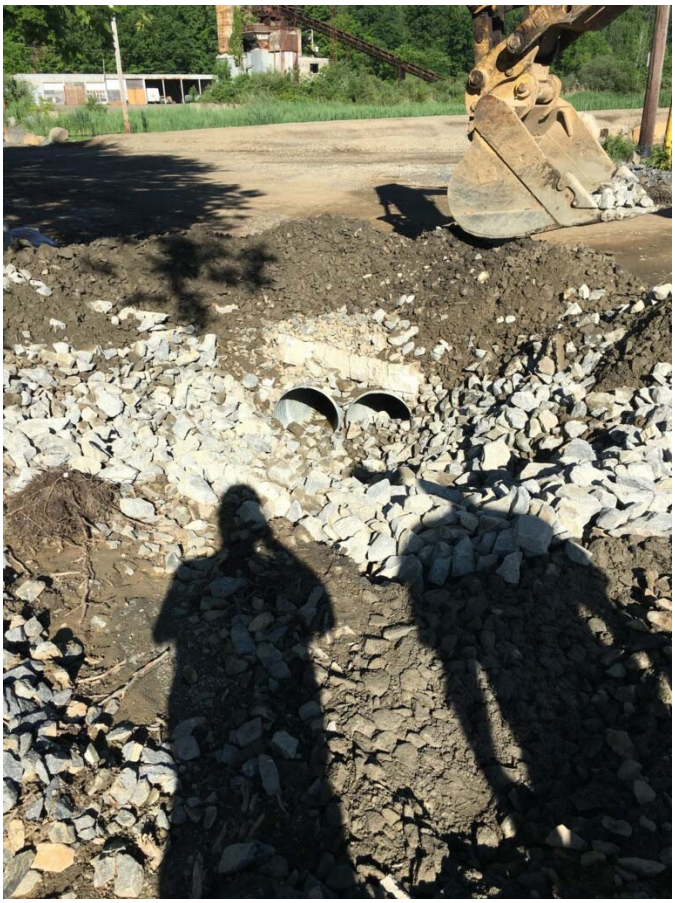
16) Sediment Basin 1

17) Sediment Basin 2

18) Perimeter Berm

19) Culvert 1

20) Culvert 2



21) Culvert 3

22) Culvert 4

23) Culvert 5

24) Culvert 6

25) Culvert 7

N/A, culvert was not installed.

26) Culvert 8

POND CERTIFICATION

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Mining Programs

POND CERTIFICATION

Permittee HANSON AGGREGATES PENNSYLVANIA LLC
Permit No. SMP NO. 7974SM1
Pond SEDIMENT BASIN 1
Township EAST ROCKHILL TOWNSHIP
County BUCKS COUNTY
Engineer/Land Surveyor MICHAEL D. FLING, P.E.
Date 05/31/2018

Instructions: Complete first page and submit with permit application. Use both pages to certify completed impoundment.

Sedimentation ponds and other impoundments must be constructed in accordance with the approved permit before any disturbance of the area to be drained into the pond. Impoundment requiring a Chapter 105 permit or is equal to or greater than 20 acre-feet storage capacity must be inspected during construction under the supervision of, and certified to the Department upon completion of construction by a registered professional engineer. If impoundment does not require a Chapter 105 permit or is less than 20 acre-feet storage capacity, it must be inspected during construction, and certified by a registered professional engineer or a registered professional land surveyor.

Any enlargement, reduction in size, reconstruction, or other modification, that may affect the stability or operation must be approved by the Department. Pond must be certified and approved prior to the start of any other mining activities.

Unless otherwise specified in your permit, use this form for the sedimentation pond and other impoundment certification. Submit 1 original and 2 copies to the appropriate District Mining Office. All information must be provided, otherwise it will be returned for completion.

U.S.G.S. Quadrangle: QUAKERTOWN Location (point of discharge): Latitude 40° 24′ 13.6″ ; Longitude 76° 18′ 11.4″ or
Location from ***Bottom Right*** corner of U.S.G.S. Quadrangle: N/A inches North; N/A inches West
HYDROLOGY: Drainage Area 14.51 ACRES acres Design Storm 10-YEAR Average Watershed Slope N/A
Land Use MINING SUPPORT Soil Type N/A Curve Number 89 Peak Discharge 61.12

		Permit Application	***As Constructed***
Embankment	Top Width (Minimum)	10 FT	13 FT
	Outside Slope (Maximum) (_H: _ V)	3:1	3:1
	Inside Slope (Maximum)	2:1	2:1
	Top Elevation	537 MSL	537 MSL
	Bottom Elevation	528 MSL	526 MSL
	Upstream Toe Elevation	530 MSL	529.81 MSL
	Downstream Toe Elevation	529.5 MSL	528.72 MSL
	Type of Cover	GRASS	GRASS
	Incised Slope (if any)	N/A	N/A
	Inside Slope (Maximum) (_H: _V)	N/A	N/A
	Top Elevation	N/A	N/A
	Bottom Elevation	N/A	N/A
Principal Spillway	Type	BARREL/RISER	BARREL/RISER
	Conduit Diameter (if barrel/riser give both)	18" / 24"	18" / 24"
	Inlet Elevation	530 MSL	529.81 MSL
	Outlet Protection	R-4	R-4
	Spillway Capacity	20.36 CFS	21.47 CFS
Dewatering Device	Type/Size	PERFORATIONS / 1"	PERFORATIONS / 1"
	Inlet Elevation	530 MSL	530.35 MSL
	Discharge Regulation (ie., self draining or valved)	SELF DRAINING	SELF DRAINING
	Discharge Capacity (cubic feet/second)	0.19 CFS	0.28 CFS
	Time to Dewater Full Pond	6.99 DAYS	6.65 DAYS
Emergency Spillway	Type	BROAD CRESTED WEIR	BROAD CRESTED WEIR
	Width	15'	32.5'
	Depth (with 2 feet of freeboard)	2.5'	2.61'
	Length	21.6'	26.4'
	Sideslopes	2:1	2:1
	Crest Elevation	534.50 MSL	534.39 MSL
	Slope	3:1	3:1
	Type of Lining/Protection	R-3	R-3
	Spillway Capacity (provide design calculations)	177.88 CFS	411.12 CFS
Storage Capacity	Length @ Bottom	184.5'	188.5'
	Width @ Bottom	83.1'	81.2'
	Length @ Crest of Emergency Spillway	220.8'	249.5'
	Width @ Crest of Emergency Spillway	110.7'	132.9'
	Volume @ Crest of Emergency Spillway	116,409 CUFT	147,997 CUFT

Permittee HANSON AGGREGATES PENNSYLVANIA LLC
Permit No. SMP NO. 7974SM1
Pond SEDIMENT BASIN 1
Township EAST ROCKHILL TOWNSHIP
County BUCKS COUNTY

TO BE COMPLETED AFTER CONSTRUCTION

1. Has the facility been constructed at the location shown in the approved permit? ☒ Yes ☐ No
2. Is the emergency spillway constructed at the location shown in the approved plan? ☒ Yes ☐ No
3. Is the principal spillway constructed at the location shown in the approved plan? ☒ Yes ☐ No
4. Are the collection channel inlets constructed with adequate inlet protection and at the location shown in the approved plan? ☒ Yes ☐ No
5. Identify any conditions or deficiencies in the facility that need to be corrected. N/A

Construction Inspection

Stage of Construction (specify stage e.g. layout, impoundment/embankment construction, spillway/piping installation)	Date of Inspection	Inspected By
FINAL AS-BUILT	05/16/2018	EARTHRES

Supervising Professional Engineer/Registered Professional Land Surveyor MICHAEL D. FLING

Address 6912 OLD EASTON ROAD

PIPERSVILLE, PA 18947

Telephone Number 215-766-1211

I certify in accordance with 25 Pa Code Section 77.531 that the above-mentioned structure is complete and has been constructed.

6/14/18
Signature of Registered Professional Engineer/Registered Professional Land Surveyor Date

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL MICHAEL D. FLING ENGINEER PE080620A

PE080620 09/30/2019
Registration Number and Expiration Date

6/14/18
Signature of Permittee or Responsible Official Date

VICE PRESIDENT
Title

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Mining Programs

POND CERTIFICATION

Permittee HANSON AGGREGATES PENNSYLVANIA LLC
Permit No. SMP NO. 7974SM1
Pond SEDIMENT BASIN 2
Township EAST ROCKHILL TOWNSHIP
County BUCKS COUNTY
Engineer/Land Surveyor MICHAEL D. FLING, P.E.
Date 05/31/2018

Instructions: Complete first page and submit with permit application. Use both pages to certify completed impoundment.

Sedimentation ponds and other impoundments must be constructed in accordance with the approved permit before any disturbance of the area to be drained into the pond. Impoundment requiring a Chapter 105 permit or is equal to or greater than 20 acre-feet storage capacity must be inspected during construction under the supervision of, and certified to the Department upon completion of construction by a registered professional engineer. If impoundment does not require a Chapter 105 permit or is less than 20 acre-feet storage capacity, it must be inspected during construction, and certified by a registered professional engineer or a registered professional land surveyor.

Any enlargement, reduction in size, reconstruction, or other modification, that may affect the stability or operation must be approved by the Department. Pond must be certified and approved prior to the start of any other mining activities.

Unless otherwise specified in your permit, use this form for the sedimentation pond and other impoundment certification. Submit 1 original and 2 copies to the appropriate District Mining Office. All information must be provided, otherwise it will be returned for completion.

U.S.G.S. Quadrangle: QUAKERTOWN Location (point of discharge): Latitude 40° 24′ 17.7″ ; Longitude 75° 18′ 15.4″ or
Location from ***Bottom Right*** corner of U.S.G.S. Quadrangle: N/A inches North; N/A inches West
HYDROLOGY: Drainage Area 20.34 ACRES acres Design Storm 10-YEAR Average Watershed Slope N/A
Land Use MINING SUPPORT Soil Type N/A Curve Number 89 Peak Discharge 115.39 CFS

		Permit Application	***As Constructed***
Embankment	Top Width (Minimum)	10 FT	15 FT
	Outside Slope (Maximum) (_H: _ V)	3:1	3:1
	Inside Slope (Maximum)	2:1	2:1
	Top Elevation	534 MSL	533 MSL
	Bottom Elevation	526 MSL	525 MSL
	Upstream Toe Elevation	527.21 MSL	526.84 MSL
	Downstream Toe Elevation	526.75 MSL	526.67 MSL
	Type of Cover	GRASS	GRASS
	Incised Slope (if any)	N/A	N/A
	Inside Slope (Maximum) (_H: _V)	N/A	N/A
	Top Elevation	N/A	N/A
	Bottom Elevation	N/A	N/A
Principal Spillway	Type	BARREL/RISER	BARREL/RISER
	Conduit Diameter (if barrel/riser give both)	18" / 24"	18" / 24"
	Inlet Elevation	527.21 MSL	526.84 MSL
	Outlet Protection	R-4	R-4
	Spillway Capacity	20.93 MSL	19.87 MSL
Dewatering Device	Type/Size	PERFORATIONS / 1"	PERFORATIONS / 1"
	Inlet Elevation	527.21 MSL	526.76 MSL
	Discharge Regulation (ie., self draining or valved)	SELF DRAINING	SELF DRAINING
	Discharge Capacity (cubic feet/second)	0.72 CFS	0.39 CFS
	Time to Dewater Full Pond	5.37 DAYS	6.63 DAYS
Emergency Spillway	Type	BROAD CRESTED WEIR	BROAD CRESTED WEIR
	Width	15'	21.1'
	Depth (with 2 feet of freeboard)	3.33'	2.80'
	Length	26.6'	30.2'
	Sideslopes	2:1	2:1
	Crest Elevation	530.67 MSL	530.20 MSL
	Slope	3:1	3:1
	Type of Lining/Protection	R-3	R-3
	Spillway Capacity (provide design calculations)	273.45 CFS	296.58 CFS
Storage Capacity	Length @ Bottom	357.3'	358.1'
	Width @ Bottom	90.2'	91.6'
	Length @ Crest of Emergency Spillway	374.0'	377.0'
	Width @ Crest of Emergency Spillway	106.9'	108.5'
	Volume @ Crest of Emergency Spillway	150,185 CUFT	165,320 CUFT

Permittee HANSON AGGREGATES PENNSYLVANIA LLC
Permit No. SMP NO. 7974SM1
Pond SEDIMENT BASIN 2
Township EAST ROCKHILL TOWNSHIP
County BUCKS COUNTY

TO BE COMPLETED AFTER CONSTRUCTION

1. Has the facility been constructed at the location shown in the approved permit? ☒ Yes ☐ No
2. Is the emergency spillway constructed at the location shown in the approved plan? ☒ Yes ☐ No
3. Is the principal spillway constructed at the location shown in the approved plan? ☒ Yes ☐ No
4. Are the collection channel inlets constructed with adequate inlet protection and at the location shown in the approved plan? ☒ Yes ☐ No
5. Identify any conditions or deficiencies in the facility that need to be corrected. N/A

Construction Inspection

Stage of Construction (specify stage e.g. layout, impoundment/embankment construction, spillway/piping installation)	Date of Inspection	Inspected By
FINAL AS-BUILT	05/16/2018	EARTHRES

Supervising Professional Engineer/Registered Professional Land Surveyor MICHAEL D. FLING

Address 6912 OLD EASTON ROAD

PIPERSVILLE, PA 18947

Telephone Number 215-766-1211

I certify in accordance with 25 Pa Code Section 77.531 that the above-mentioned structure[illegible] had been constructed.

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL MICHAEL D. FLING ENGINEER PE080620

6/14/18
Signature of Registered Professional Engineer/Registered Professional Land Surveyor Date

PE080620 09/30/2019
Registration Number and Expiration Date

6/14/18
Signature of Permittee or Responsible Official Date

VICE PRESIDENT
Title

SUPPLEMENTAL AS-BUILT CALCULATIONS

EarthRes
ENGINEERING AND SCIENCE

SEDIMENT BASIN 1

CALCULATIONS

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 1

Sedimentation Basin Storage Volume Check

Elevation ft.	Plan Area sf	Average Area sf	Elevation Difference ft.	Incremental Volume cf	Incremental Volume acre-ft	Cummulative Volume cf	Cummulative Volume acre-ft
526	10179						
527	14,141.00	12,106	1	12,106	0.278	12,106	0.278
528	17,418.00	15,751	1	15,751	0.362	27,857	0.640
529	19,073.00	18,239	1	18,239	0.419	46,096	1.058
530	20,299.00	19,683	1	19,683	0.452	65,779	1.510
531	21,541.00	20,917	1	20,917	0.480	86,696	1.990
532	22,800.00	22,168	1	22,168	0.509	108,863	2.499
533	24,077.00	23,436	1	23,436	0.538	132,299	3.037
534	25,371.00	24,721	1	24,721	0.568	157,020	3.605
535	26,694.00	26,030	1	26,030	0.598	183,050	4.202
536	28,037.00	27,363	1	27,363	0.628	210,413	4.830

Design:

Sediment Storage Volume =	73,100	CF
Sediment Storage Volume Elevation =	530.35	ft.
Settling Storage Volume =	147,997	CF
Settling Storage Volume Elevation =	533.64	ft.

Requirements:

Sediment Storage Volume (2,000 CF/disturbed area acres) =	29,020	CF
Settling Storage Volume (5,000 CF/drainage area acres) =	72,550	CF
Drainage Area (acres) =	14.51	acres

Average area calculated as follows: [A+B+sqrt(A*B)]/3

By: JTK
Date: 6/7/2018
Chk'd: MDF
Date: 6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 1

PRINCIPAL SPILLWAY DISCHARGE CAPACITY

WATER SURFACE ELEV (FT)	RISER						TOTAL SPILLWAY CAPACITY (CFS) (5)
	ORIFICE FLOW		WEIR FLOW		PIPE FLOW		
	HEAD H (FT)	FLOW (1) Q (CFS)	HEAD H (FT)	FLOW (2) Q (CFS)	PIPE HEAD H (FT)	FLOW (3) Q (CFS)	
533.64	0.00	0.00	0.00	0.00	4.17	15.98	0.00
533.75	0.11	5.02	0.11	0.71	4.28	16.19	0.71
534.00	0.36	9.08	0.36	4.21	4.53	16.65	4.21
534.25	0.61	11.81	0.61	9.28	4.78	17.10	9.28
534.39	0.75	13.10	0.75	12.65	4.92	17.35	12.65
534.50	0.86	14.03	0.86	15.53	5.03	17.55	14.03
534.75	1.11	15.94	1.11	22.78	5.28	17.98	15.94
535.00	1.36	17.64	1.36	30.89	5.53	18.40	17.64
535.25	1.61	19.19	1.61	39.79	5.78	18.81	18.81
535.50	1.86	20.63	1.86	49.41	6.03	19.21	19.21
535.75	2.11	21.97	2.11	59.70	6.28	19.61	19.61
536.00	2.36	23.24	2.36	70.62	6.53	19.99	19.99
536.25	2.61	24.44	2.61	82.13	6.78	20.37	20.37
536.50	2.86	25.58	2.86	94.21	7.03	20.74	20.74
536.75	3.11	26.68	3.11	106.83	7.28	21.11	21.11
537.00	3.36	27.73	3.36	119.96	7.53	21.47	21.47

Notes:

(1) Orifice flow through top of riser, Q = Ca(2gh)^0.5

where: C = orifice coefficient = 0.60

a = cross-sec. area of inlet, sq. ft., = 3.14

where: riser diameter, inches = 24.00

g = acceleration of gravity = 32.2 ft/sec^2

H = head on top of riser (See table)

Note: Q = total flow through all submerged orifices.

(2) Weir flow, Q = CLH^1.5

where: C = weir coefficient = 3.10

L = weir length, ft = 6.28

where: riser diameter, inches = 24.00

H = head over weir, ft (See table)

(3) Pipe flow, Q = cA[(2gH)/(1+Km+(Kp)L)]^0.5

where: A = cross-sec area of barrel, sq ft, = 1.77

g = acceleration of gravity, 32.2 ft/sec^2

H = head above centerline of outlet of pipe, where 529.47

elev. of outlet of pipe = 528.72

Km = coeff. of minor losses = 1.00

Kp = pipe friction coefficient; 0.0155

Kp = (5087n^2)/d^(4/3)

where:

n = Manning's roughness coefficient = 0.012

d = inside diameter of barrel, inches 18.00

L = pipe length, ft, = 82.80

c = number of pipes = 1.00

By: JTK

Date: 6/7/2018

Chk'd: MDF

Date: 6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 1

Sedimentation Basin Dewatering Time

Water Surface Elevation (ft.)	Storage Volume (cu. ft.)	Incremental Storage Volume (cu. ft.)	Discharge (cfs)	Average Discharge (cfs)	Time (hrs)	Accumulated Time (hrs)
533.64	147,997		0.28			
		15,698		0.26	16.62	
533.00	132,299		0.25			16.62
		23,436		0.22	29.85	
532.00	108,863		0.19			46.47
		22,168		0.15	41.74	
531.00	86,696		0.11			88.21
		13,596		0.05	71.35	
530.35	73,100		0.00			159.56

Dewatering Time = 6.65 days

By: JTK
Date: 6/7/2018
Chk'd: MDF
Date: 6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 1

EMERGENCY SPILLWAY DISCHARGE CAPACITY

WEIR FLOW		
WATER SURFACE ELEV (FT)	HEAD H (FT)	FLOW (1) Q (CFS)
534.39	0.00	0.00
534.50	0.11	3.56
534.75	0.36	21.06
535.00	0.61	46.45
535.25	0.86	77.76
535.50	1.11	114.02
535.75	1.36	154.64
536.00	1.61	199.18
536.25	1.86	247.33
536.50	2.11	298.83
536.75	2.36	353.49
537.00	2.61	411.12

Notes:

(1) Weir Flow, Q = CLH^1.5

where: C = weir coefficient = 3.00

L = bottom width of the spillway crest, ft. = 32.50

H = depth of flow above the spillway crest, ft. Variable

By: JTK

Date: 6/7/2018

Chk'd: MDF

Date: 6/7/2018

SEDIMENT BASIN 2

CALCULATIONS

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 2

Sedimentation Basin Storage Volume Check

Elevation ft.	Plan Area sf	Average Area sf	Elevation Difference ft.	Incremental Volume cf	Incremental Volume acre-ft	Cummulative Volume cf	Cummulative Volume acre-ft
525	13,264						
526	31,651	21,801	1	21,801	0.500	21,801	0.500
527	34,422	33,027	1	33,027	0.758	54,828	1.259
528	36,590	35,500	1	35,500	0.815	90,329	2.074
529	38,626	37,603	1	37,603	0.863	127,932	2.937
530	40,670	39,644	1	39,644	0.910	167,576	3.847
531	42,718	41,690	1	41,690	0.957	209,266	4.804
532	44,777	43,743	1	43,743	1.004	253,009	5.808
533	46,859	45,814	1	45,814	1.052	298,823	6.860

Design:

Sediment Storage Volume =	46,900	CF
Sediment Storage Volume Elevation =	526.76	ft.
Settling Storage Volume =	155,700	CF
Settling Storage Volume Elevation =	529.70	ft.

Requirements:

Sediment Storage Volume (2,000 CF/disturbed area acres) =	40,680	CF
Settling Storage Volume (5,000 CF/drainage area acres) =	101,700	CF
Drainage Area (acres) =	20.34	acres

Average area calculated as follows: [A+B+sqrt(A*B)]/3

By: JTK
Date: 6/7/2018
Chk'd: MDF
Date: 6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 2

PRINCIPAL SPILLWAY DISCHARGE CAPACITY

WATER SURFACE ELEV (FT)	RISER						TOTAL SPILLWAY CAPACITY (CFS) (5)
	ORIFICE FLOW		WEIR FLOW		PIPE FLOW		
	HEAD H (FT)	FLOW (1) Q (CFS)	HEAD H (FT)	FLOW (2) Q (CFS)	PIPE HEAD H (FT)	FLOW (3) Q (CFS)	
529.70	0.00	0.00	0.00	0.00	2.28	12.70	0.00
530.00	0.30	8.29	0.30	3.20	2.58	13.51	3.20
530.20	0.50	10.70	0.50	6.89	2.78	14.03	6.89
530.25	0.55	11.22	0.55	7.94	2.83	14.15	7.94
530.50	0.80	13.53	0.80	13.94	3.08	14.76	13.53
530.75	1.05	15.50	1.05	20.96	3.33	15.35	15.35
531.00	1.30	17.25	1.30	28.87	3.58	15.92	15.92
531.25	1.55	18.83	1.55	37.59	3.83	16.46	16.46
531.50	1.80	20.29	1.80	47.04	4.08	16.99	16.99
531.75	2.05	21.66	2.05	57.17	4.33	17.50	17.50
532.00	2.30	22.94	2.30	67.94	4.58	18.00	18.00
532.25	2.55	24.16	2.55	79.31	4.83	18.49	18.49
532.50	2.80	25.31	2.80	91.26	5.08	18.96	18.96
532.75	3.05	26.42	3.05	103.75	5.33	19.42	19.42
533.00	3.30	27.48	3.30	116.76	5.58	19.87	19.87

Notes:

(1) Orifice flow through top of riser, $Q = Ca(2gh)^{0.5}$

where: C = orifice coefficient = 0.60

a = cross-sec. area of inlet, sq. ft., = 3.14

where: riser diameter, inches = 24.00

g = acceleration of gravity = 32.2 ft/sec^2

H = head on top of riser (See table)

Note: Q = total flow through all submerged orifices.

(2) Weir flow, $Q = CLH^{1.5}$

where: C = weir coefficient = 3.10

L = weir length, ft = 6.28

where: riser diameter, inches = 24.00

H = head over weir, ft (See table)

(3) Pipe flow, $Q = cA[(2gH)/(1+Km+(Kp)L)]^{0.5}$

where: A = cross-sec area of barrel, sq ft, = 1.77

g = acceleration of gravity, 32.2 ft/sec^2

H = head above centerline of outlet of pipe, where 527.42

elev. of outlet of pipe = 526.67

Km = coeff. of minor losses = 1.00

Kp = pipe friction coefficient; 0.0155

Kp = (5087n^2)/d^(4/3)

where:

n = Manning's roughness coefficient = 0.012

d = inside diameter of barrel, inches 18.00

L = pipe length, ft, = 54.24

c = number of pipes = 1.00

By: JTK

Date: 6/7/2018

Chk'd: MDF

Date: 6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 2

Sedimentation Basin Dewatering Time

Water Surface Elevation (ft.)	Storage Volume (cu. ft.)	Incremental Storage Volume (cu. ft.)	Discharge (cfs)	Average Discharge (cfs)	Time (hrs)	Accumulated Time (hrs)
529.70	155,700		0.39			0
		27,768		0.36	21.16	
529.00	127,932		0.34			21.16
		37,603		0.29	36.58	
528.00	90,329		0.23			57.74
		35,500		0.17	58.55	
527.00	54,828		0.10			116.29
		7,928		0.05	42.80	
526.76	46,900		0.00			159.08

Dewatering Time = 6.63 days

By: JTK
Date: 6/7/2018
Chk'd: MDF
Date: 6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

SEDIMENTATION BASIN NO. 2

EMERGENCY SPILLWAY DISCHARGE CAPACITY

WEIR FLOW		
WATER SURFACE ELEV (FT)	HEAD H (FT)	FLOW (1) Q (CFS)
530.20	0.00	0.00
530.25	0.05	0.71
530.50	0.30	10.40
530.75	0.55	25.82
531.00	0.80	45.29
531.25	1.05	68.11
531.50	1.30	93.83
531.75	1.55	122.15
532.00	1.80	152.87
532.25	2.05	185.80
532.50	2.30	220.80
532.75	2.55	257.76
533.00	2.80	296.58

Notes:

(1) Weir Flow, $Q = CLH^{1.5}$

where: C = weir coefficient = 3.00

L = bottom width of the spillway crest, ft. = 21.10

H = depth of flow above the spillway crest, ft. Variable

By: JTK

Date: 6/7/2018

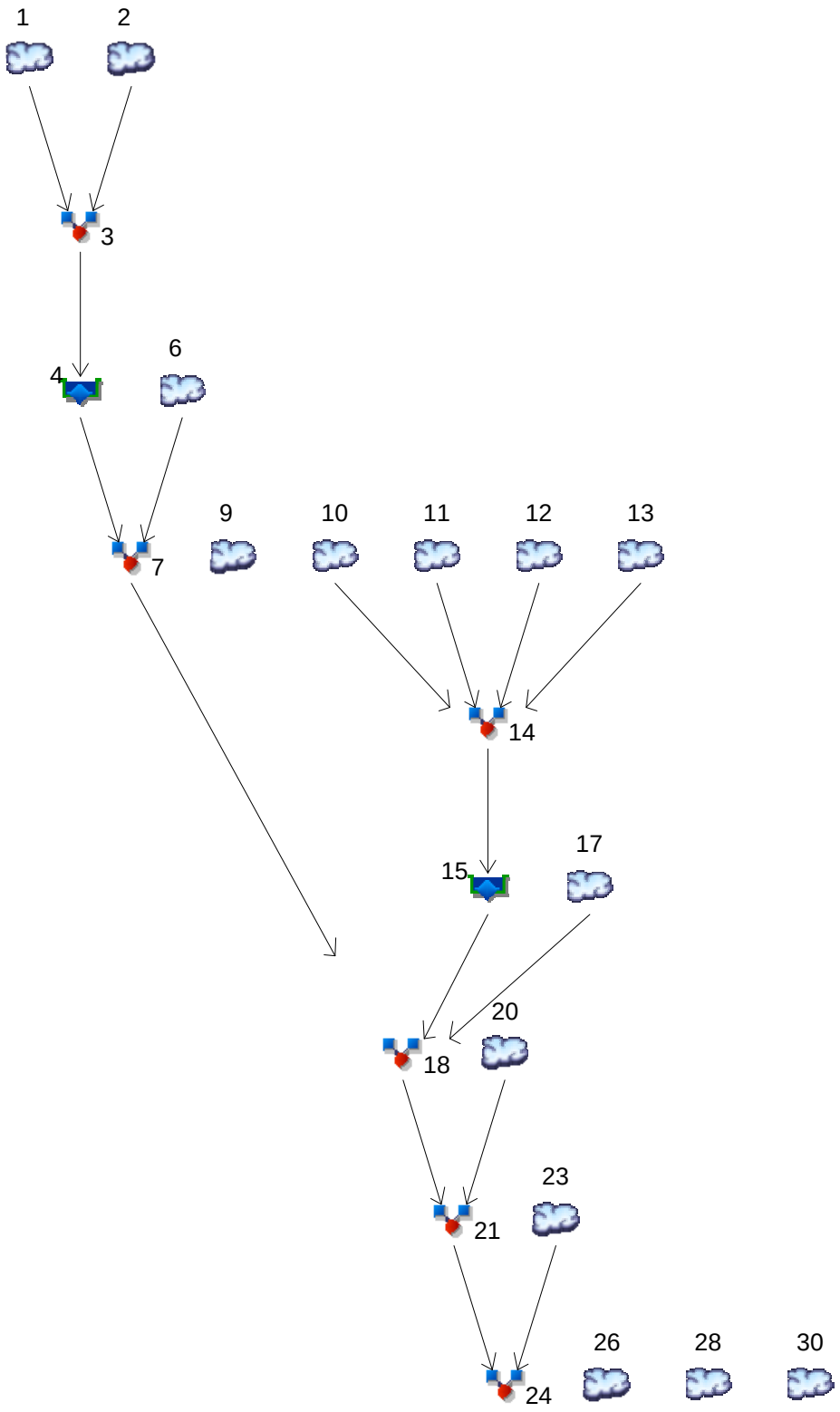
Chk'd: MDF

Date: 6/7/2018

HYDRAFLOW HYDROGRAPH OUTPUT

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12



Hydrograph Return Period Recap

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	SCS Runoff	------	-------	32.28	-------	-------	52.99	-------	-------	-------	Culvert 2 & Berm 1 DA
2	SCS Runoff	------	-------	7.932	-------	-------	12.93	-------	-------	-------	Basin 1 DA
3	Combine	1, 2	-------	37.16	-------	-------	61.12	-------	-------	-------	Basin 1 Inflow
4	Reservoir	3	-------	0.122	-------	-------	1.221	-------	-------	-------	Basin 1 Routing
6	SCS Runoff	------	-------	1.879	-------	-------	3.063	-------	-------	-------	Channel 1 DA
7	Combine	4, 6	-------	1.879	-------	-------	3.063	-------	-------	-------	Channel 1 & Culvert 6 Inflow
9	SCS Runoff	------	-------	3.444	-------	-------	5.616	-------	-------	-------	Channel 5 & Culvert 7 DA
10	SCS Runoff	------	-------	7.932	-------	-------	12.93	-------	-------	-------	Culvert 3 DA
11	SCS Runoff	------	-------	12.87	-------	-------	20.99	-------	-------	-------	Culvert 4 DA
12	SCS Runoff	------	-------	16.07	-------	-------	26.21	-------	-------	-------	Basin 2 DA
13	SCS Runoff	------	-------	33.89	-------	-------	55.25	-------	-------	-------	Upslope Pad Area
14	Combine	10, 11, 12, 13	-------	70.77	-------	-------	115.39	-------	-------	-------	Basin 2 Inflow
15	Reservoir	14	-------	0.134	-------	-------	4.196	-------	-------	-------	Basin 2 Routing
17	SCS Runoff	------	-------	3.618	-------	-------	5.900	-------	-------	-------	Channel 2 Section 1 DA
18	Combine	7, 15, 17	-------	5.513	-------	-------	9.028	-------	-------	-------	Channel 2 Section 1 & Culvert 8 Inflo
20	SCS Runoff	------	-------	2.832	-------	-------	4.618	-------	-------	-------	Channel 2 Section 2 DA
21	Combine	18, 20	-------	8.345	-------	-------	13.65	-------	-------	-------	Channel 2 Section 2 & Culvert 5 Inflo
23	SCS Runoff	------	-------	6.680	-------	-------	10.89	-------	-------	-------	Channel 3 DA
24	Combine	21, 23	-------	15.02	-------	-------	24.54	-------	-------	-------	Channel 3 Inflow
26	SCS Runoff	------	-------	17.08	-------	-------	27.85	-------	-------	-------	Berms 2 and 3 DA
28	SCS Runoff	------	-------	21.94	-------	-------	43.18	-------	-------	-------	Channel 4 DA
30	SCS Runoff	------	-------	4.940	-------	-------	8.056	-------	-------	-------	Berm 4 & Berm 5 DA

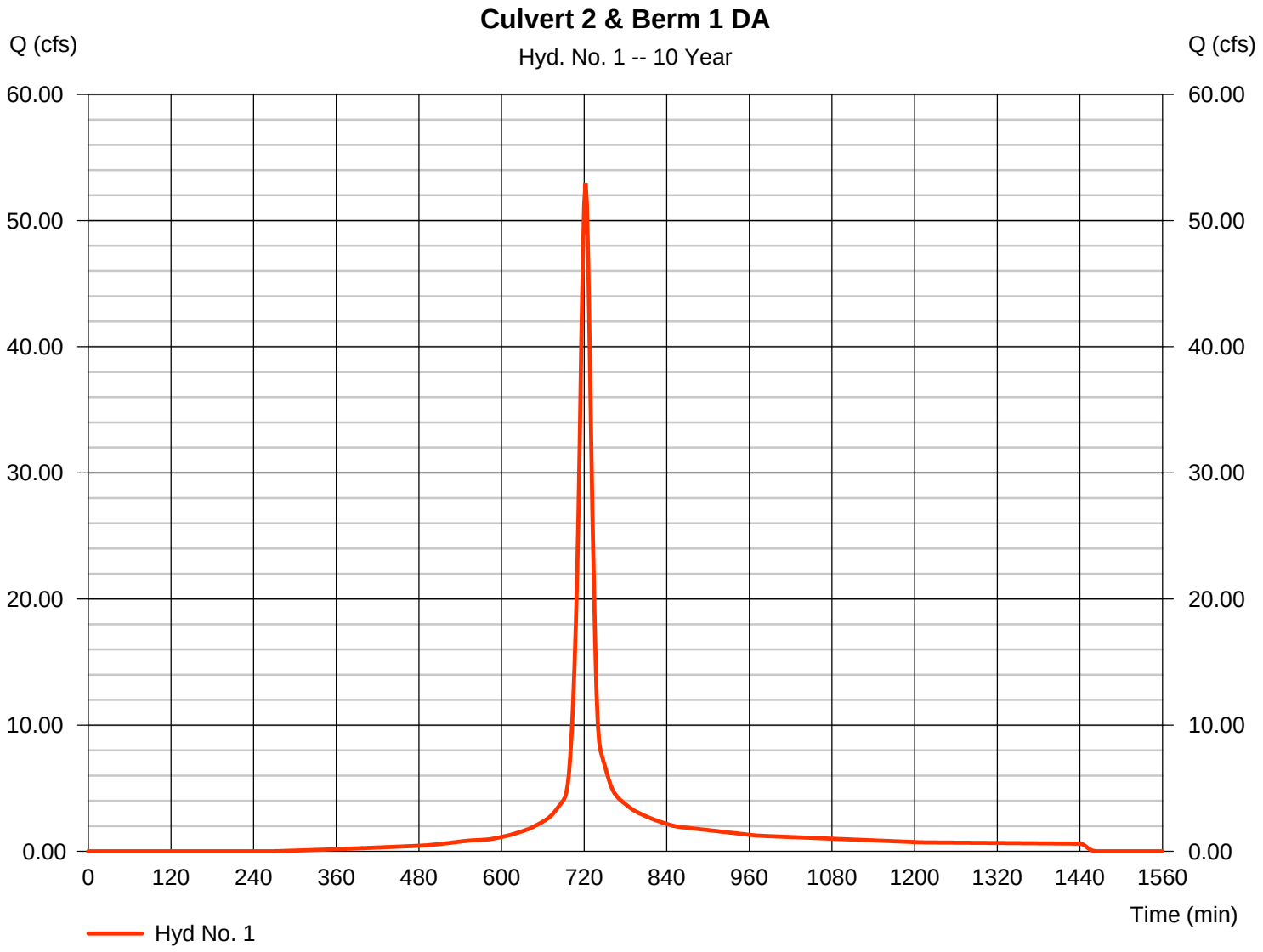
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 06 / 13 / 2018

Hyd. No. 1

Culvert 2 & Berm 1 DA

Hydrograph type	=	SCS Runoff	Peak discharge	=	52.99 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	152,928 cuft
Drainage area	=	12.230 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	4.75 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

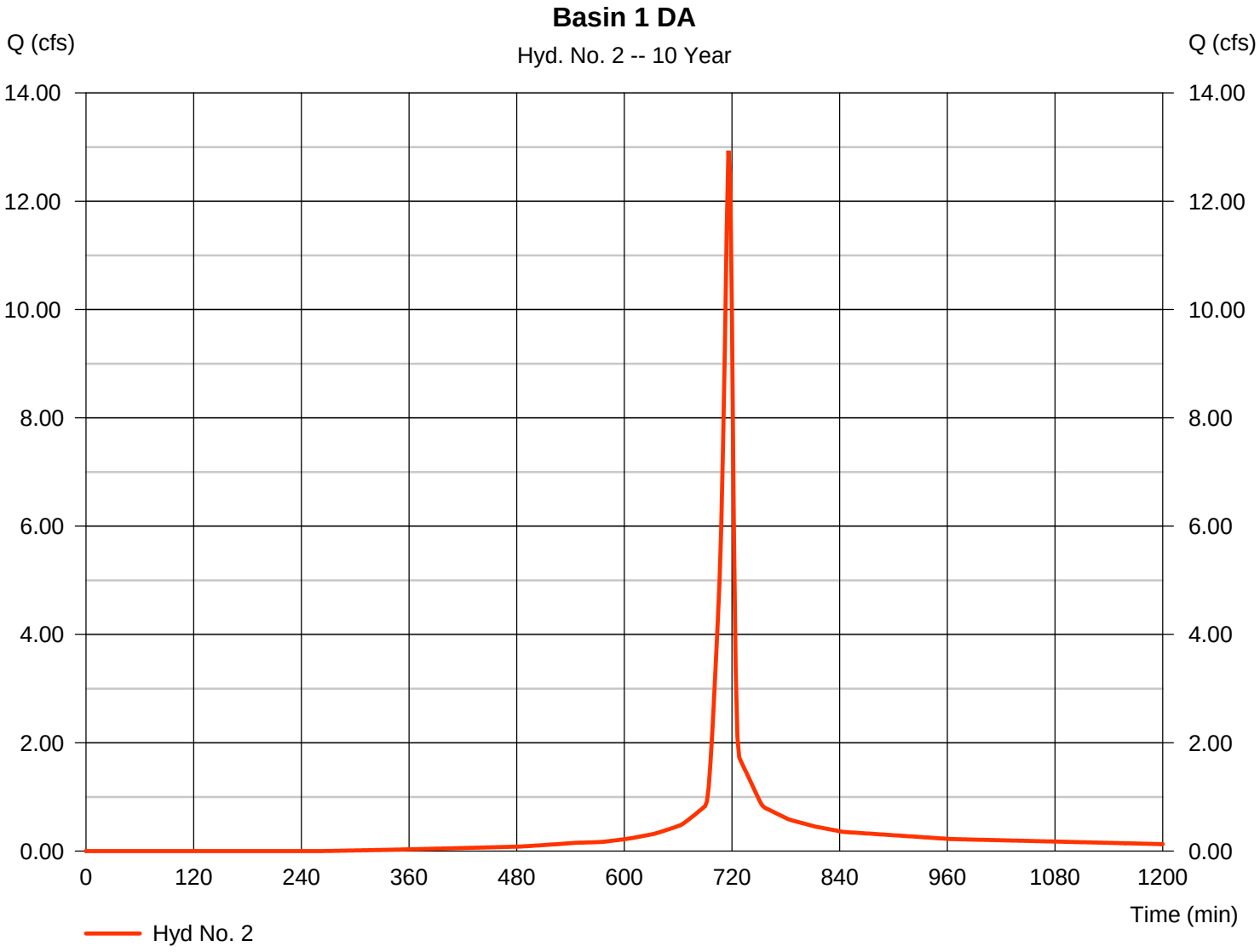


Hydrograph Report

Hyd. No. 2

Basin 1 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 12.93 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 27,413 cuft
Drainage area	= 2.280 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

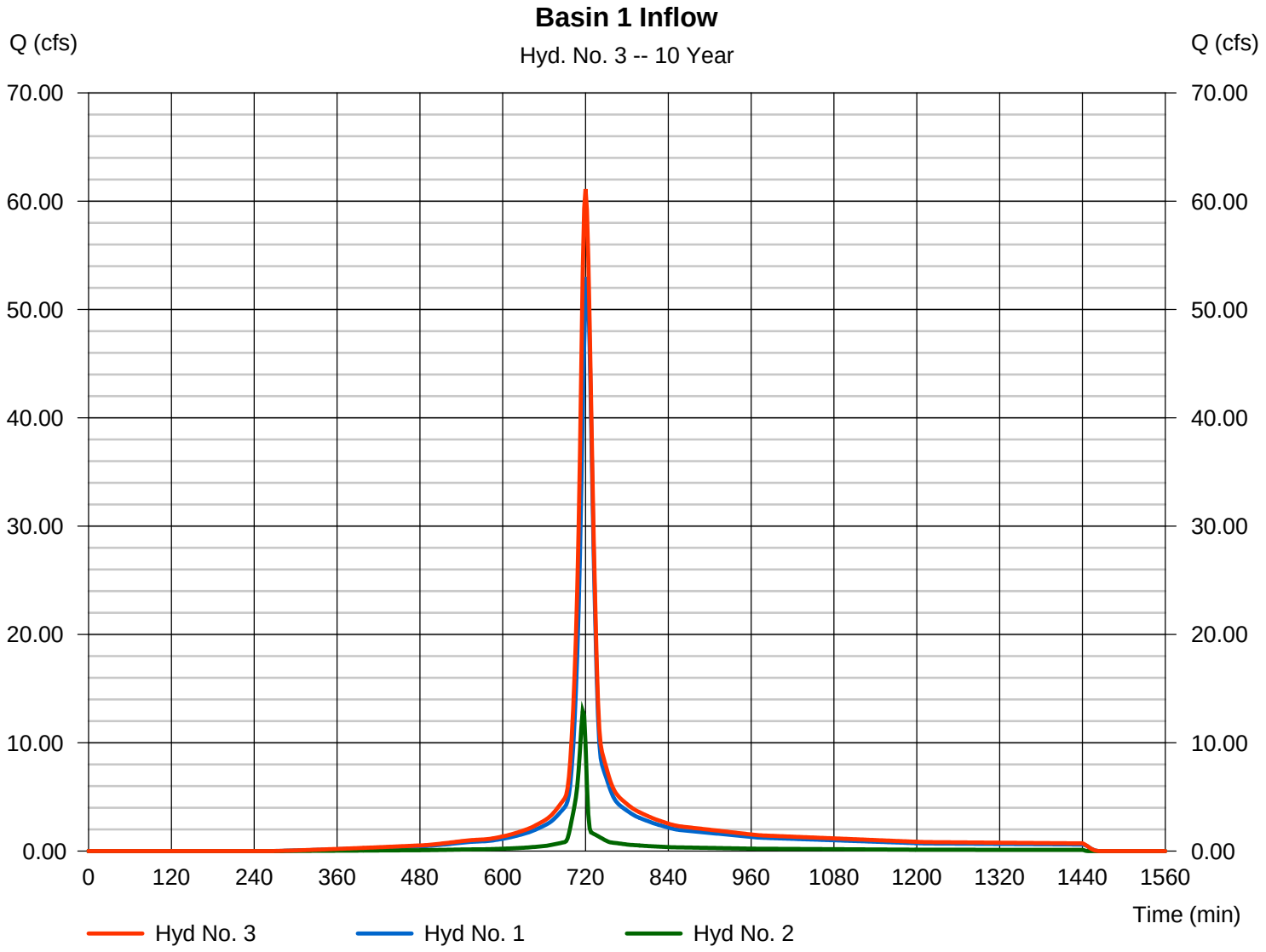


Hydrograph Report

Hyd. No. 3

Basin 1 Inflow

Hydrograph type	= Combine	Peak discharge	= 61.12 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 180,341 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 14.510 ac



Hydrograph Report

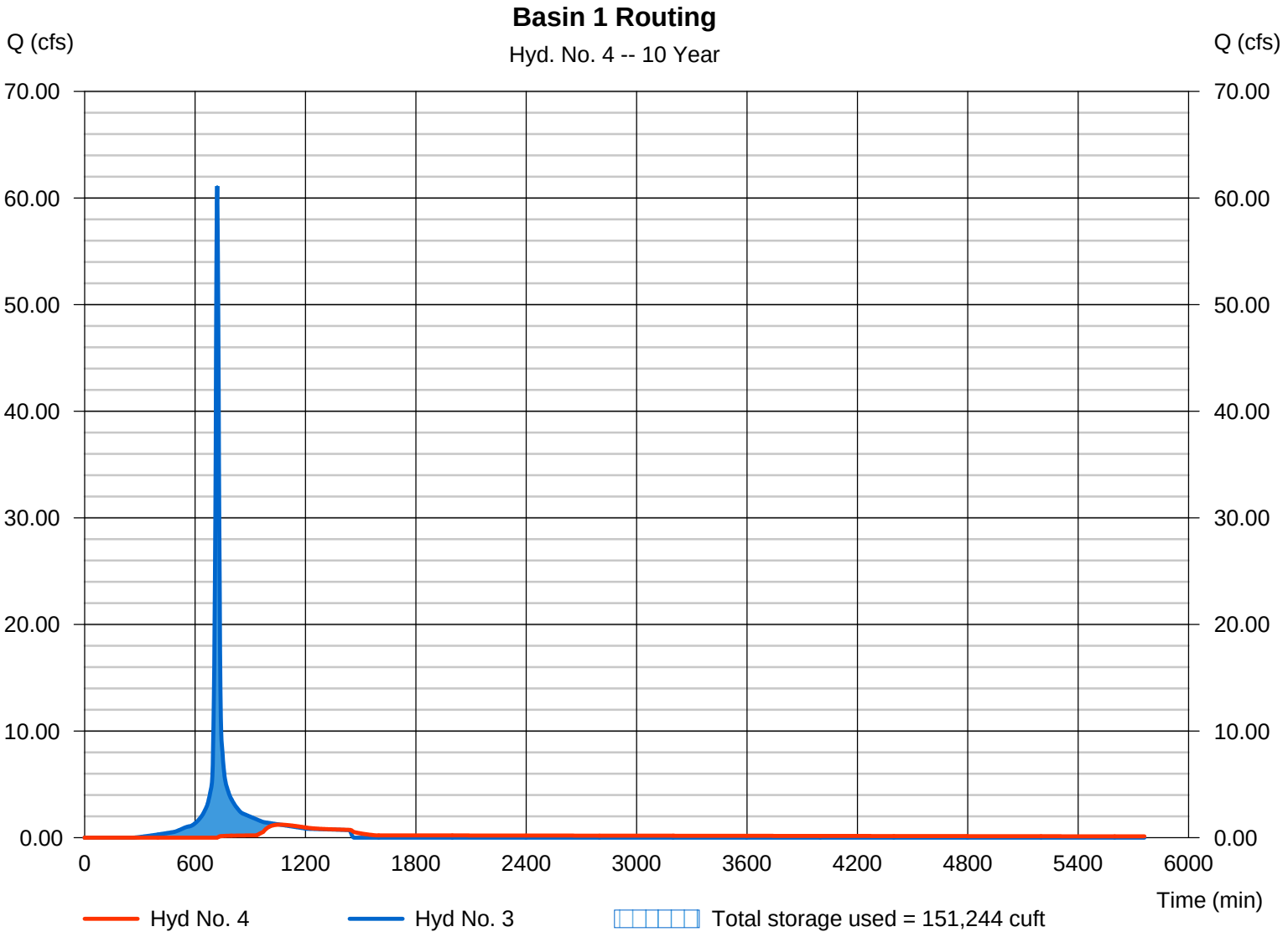
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 06 / 13 / 2018

Hyd. No. 4

Basin 1 Routing

Hydrograph type	=	Reservoir	Peak discharge	=	1.221 cfs
Storm frequency	=	10 yrs	Time to peak	=	1062 min
Time interval	=	2 min	Hyd. volume	=	76,213 cuft
Inflow hyd. No.	=	3 - Basin 1 Inflow	Max. Elevation	=	533.77 ft
Reservoir name	=	Sediment Basin 1	Max. Storage	=	151,244 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Sediment Basin 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 526.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	526.00	10,179	0	0
1.00	527.00	14,141	12,105	12,105
2.00	528.00	17,418	15,749	27,854
3.00	529.00	19,073	18,237	46,091
4.00	530.00	20,299	19,681	65,772
5.00	531.00	21,541	20,915	86,687
6.00	532.00	22,800	22,165	108,852
7.00	533.00	24,077	23,433	132,285
8.00	534.00	25,371	24,719	157,004
9.00	535.00	26,694	26,027	183,031
10.00	536.00	28,037	27,360	210,392
11.00	537.00	29,426	28,726	239,118

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.50	0.50	0.00
Span (in)	= 18.00	1.00	1.00	0.00
No. Barrels	= 1	7	1	0
Invert El. (ft)	= 529.81	530.35	531.39	0.00
Length (ft)	= 82.80	0.10	0.10	0.00
Slope (%)	= 1.32	0.10	0.10	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.28	30.00	0.00	0.00
Crest El. (ft)	= 533.64	534.39	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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	526.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	12,105	527.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.00	27,854	528.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
3.00	46,091	529.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
4.00	65,772	530.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
5.00	86,687	531.00	0.10 ic	0.09 ic	0.00	---	0.00	0.00	---	---	---	---	0.093
6.00	108,852	532.00	0.17 ic	0.15 ic	0.01 ic	---	0.00	0.00	---	---	---	---	0.162
7.00	132,285	533.00	0.22 ic	0.19 ic	0.02 ic	---	0.00	0.00	---	---	---	---	0.211
8.00	157,004	534.00	4.80 ic	0.21 ic	0.03 ic	---	4.52	0.00	---	---	---	---	4.750
9.00	183,031	535.00	17.56 ic	0.05 ic	0.01 ic	---	17.51 s	37.16	---	---	---	---	54.72
10.00	210,392	536.00	19.61 oc	0.03 ic	0.00 ic	---	19.57 s	159.34	---	---	---	---	178.94
11.00	239,118	537.00	21.30 oc	0.02 ic	0.00 ic	---	21.25 s	328.89	---	---	---	---	350.16

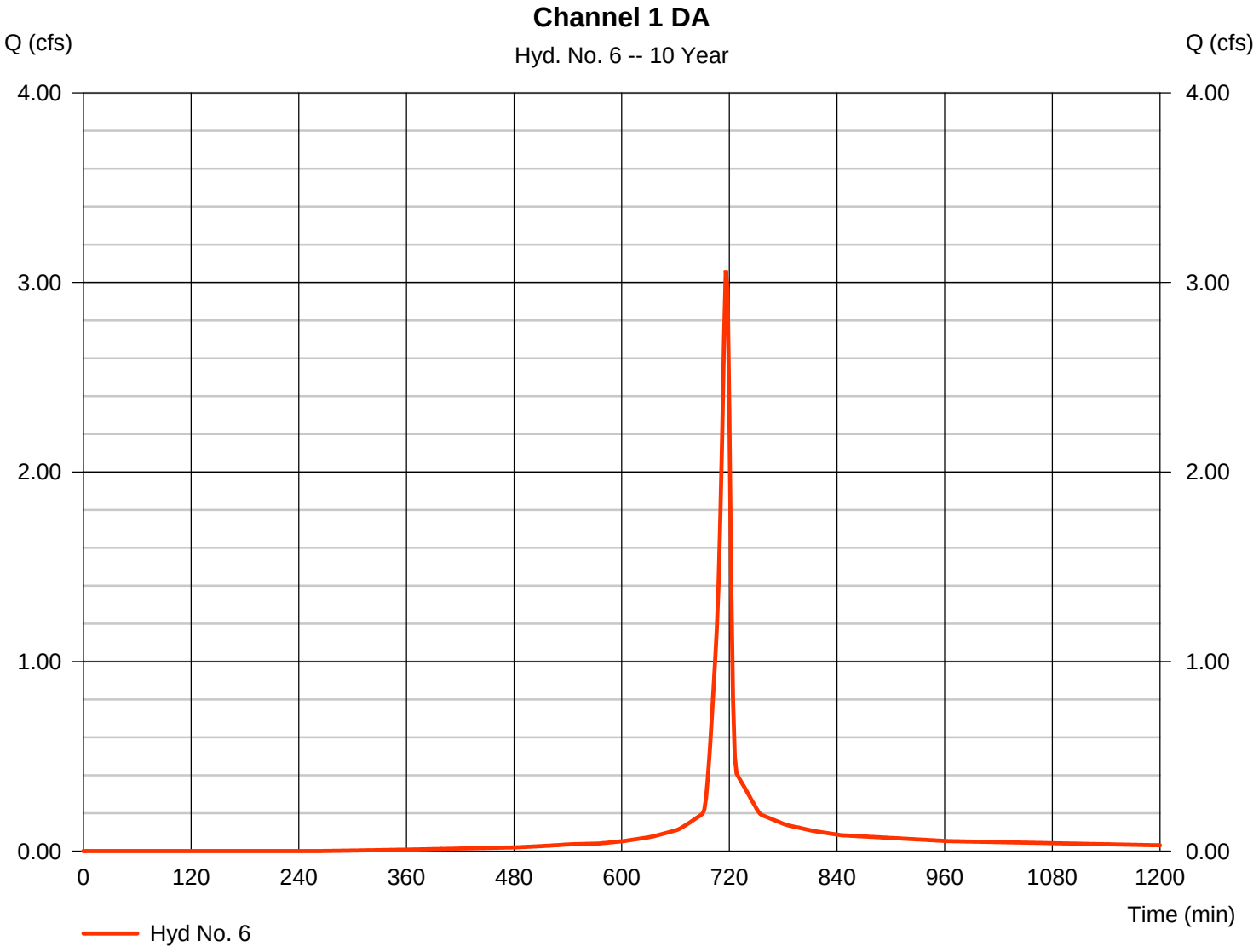
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 6

Channel 1 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 3.063 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 6,493 cuft
Drainage area	= 0.540 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

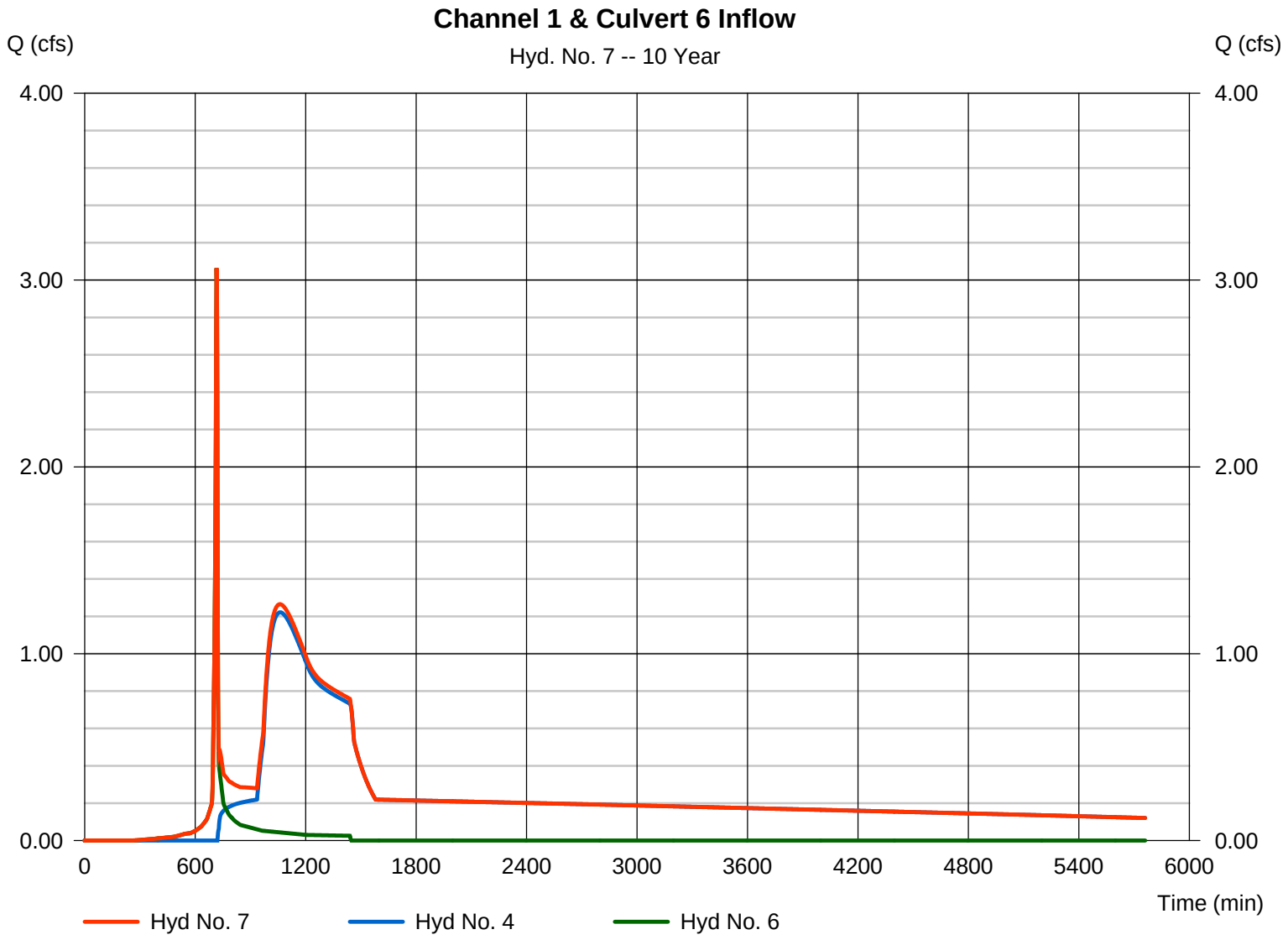


Hydrograph Report

Hyd. No. 7

Channel 1 & Culvert 6 Inflow

Hydrograph type	= Combine	Peak discharge	= 3.063 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 82,706 cuft
Inflow hyds.	= 4, 6	Contrib. drain. area	= 0.540 ac



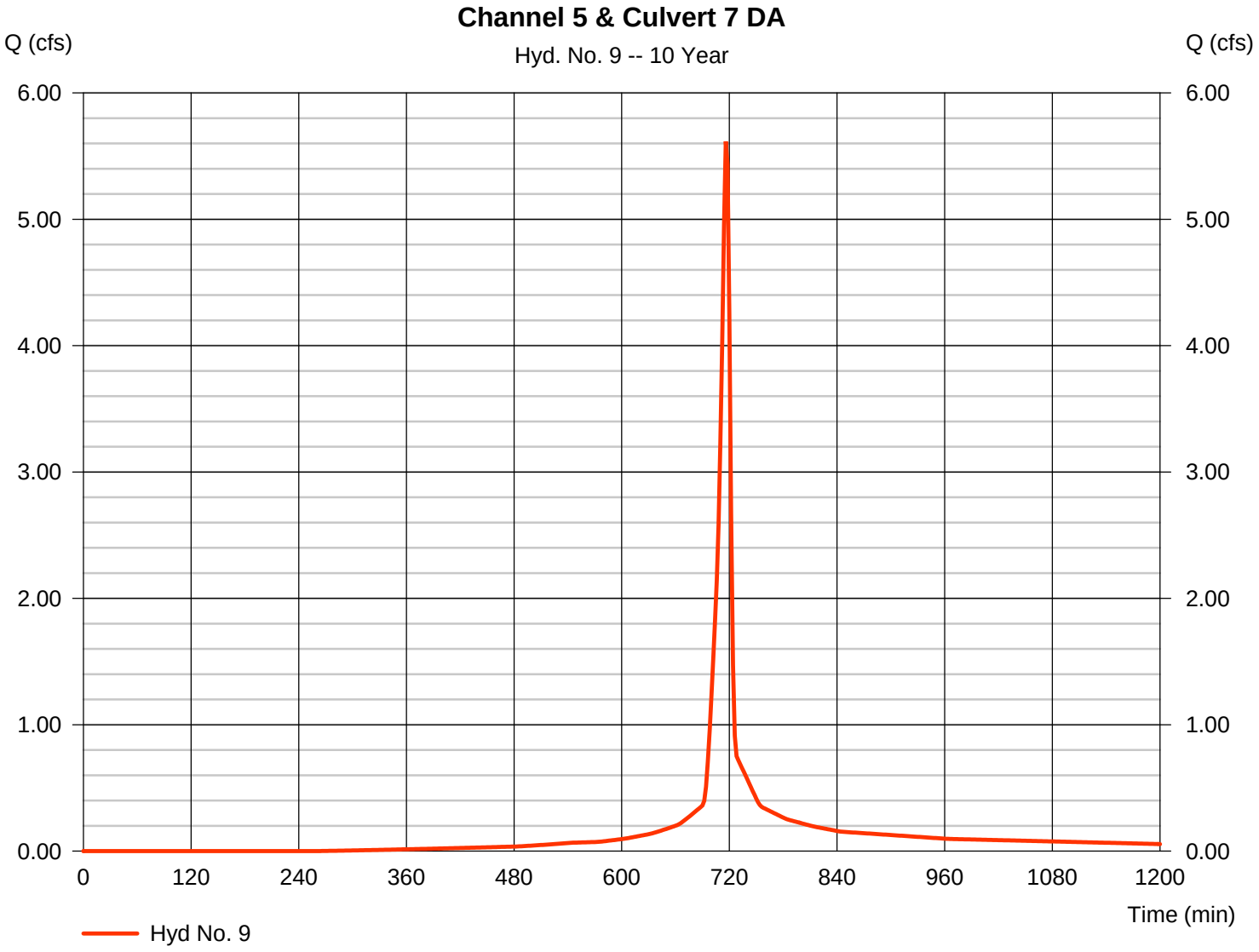
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 9

Channel 5 & Culvert 7 DA

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.616 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	11,903 cuft
Drainage area	=	0.990 ac	Curve number	=	89
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.75 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

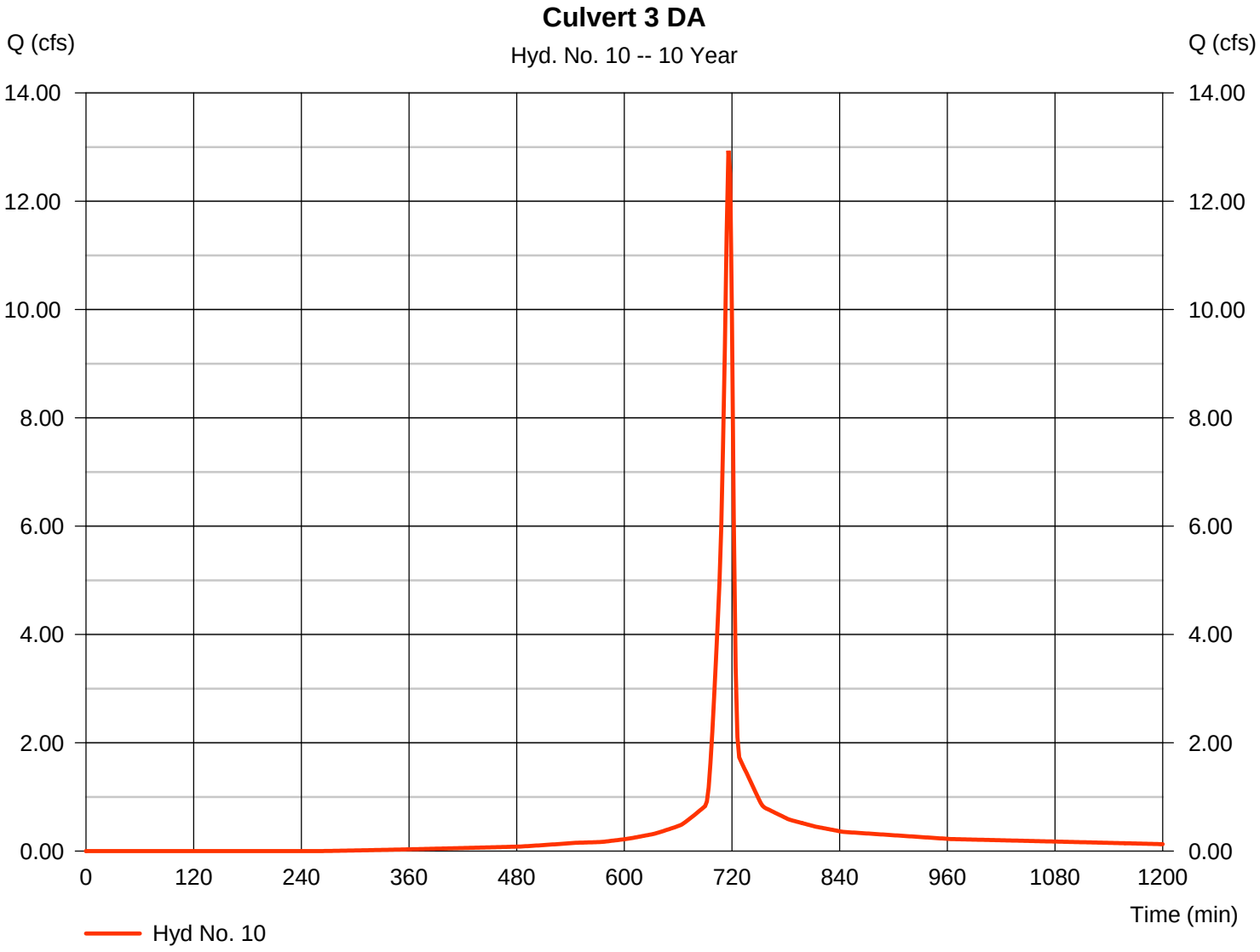


Hydrograph Report

Hyd. No. 10

Culvert 3 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 12.93 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 27,413 cuft
Drainage area	= 2.280 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

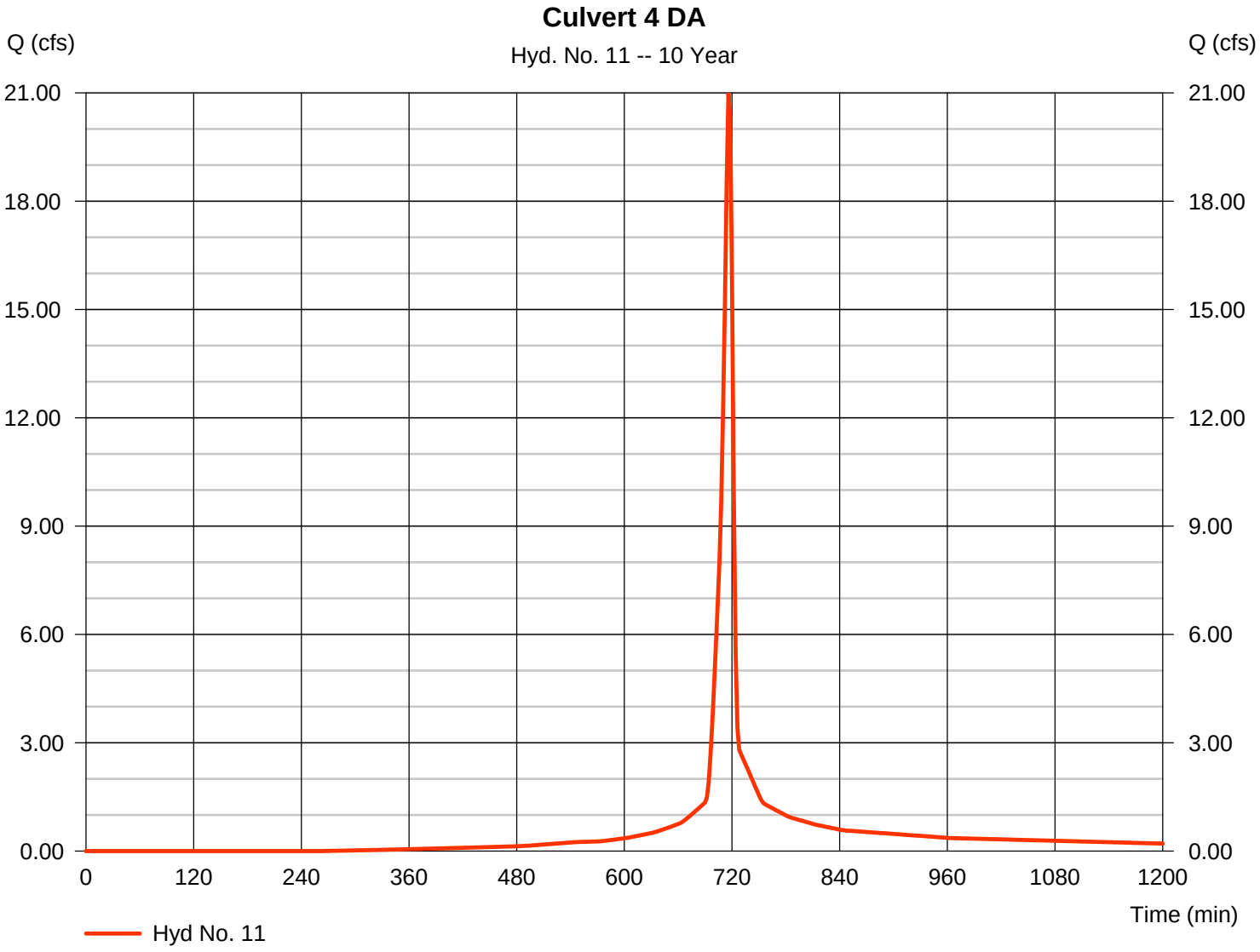


Hydrograph Report

Hyd. No. 11

Culvert 4 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 20.99 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 44,486 cuft
Drainage area	= 3.700 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



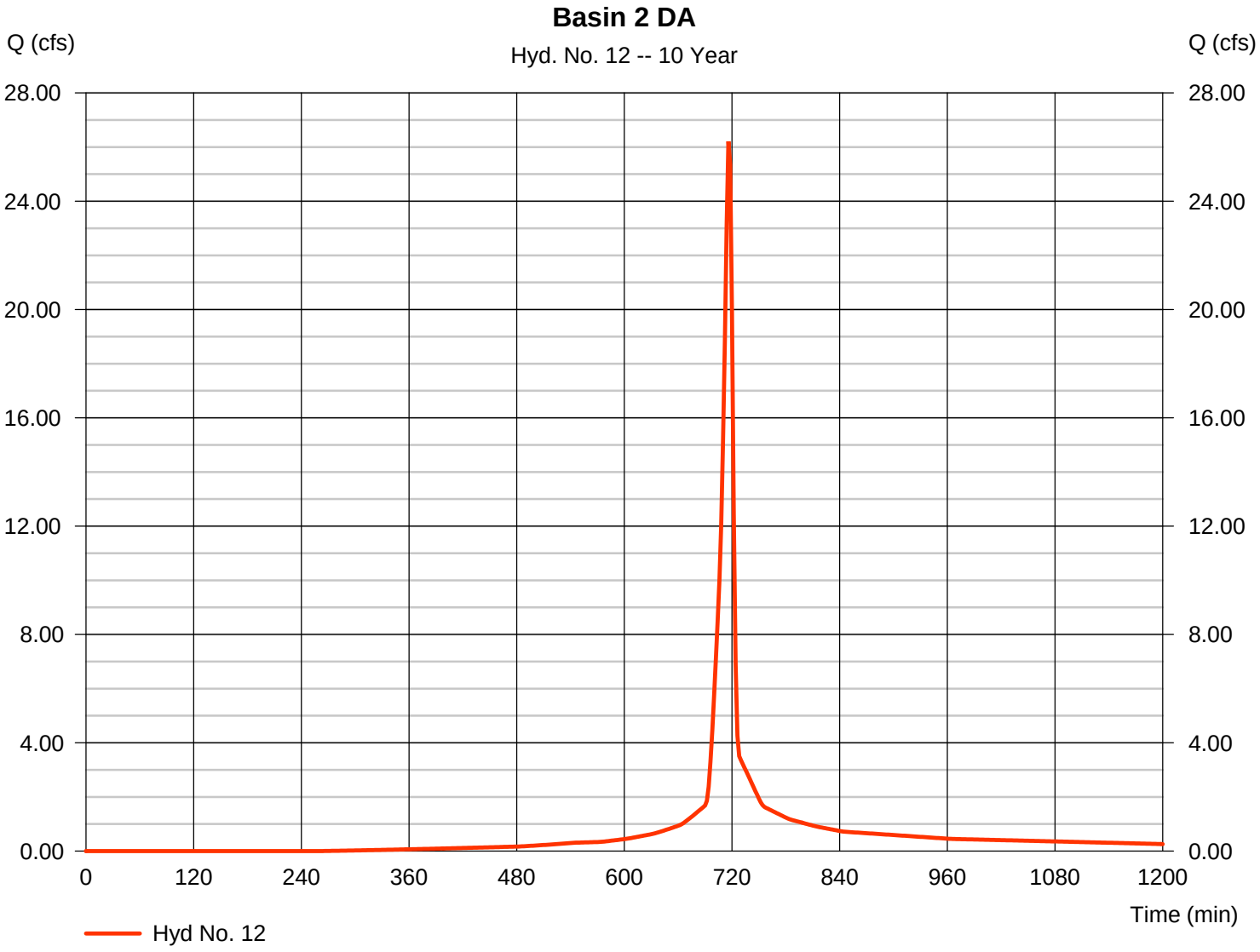
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 12

Basin 2 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 26.21 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 55,548 cuft
Drainage area	= 4.620 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

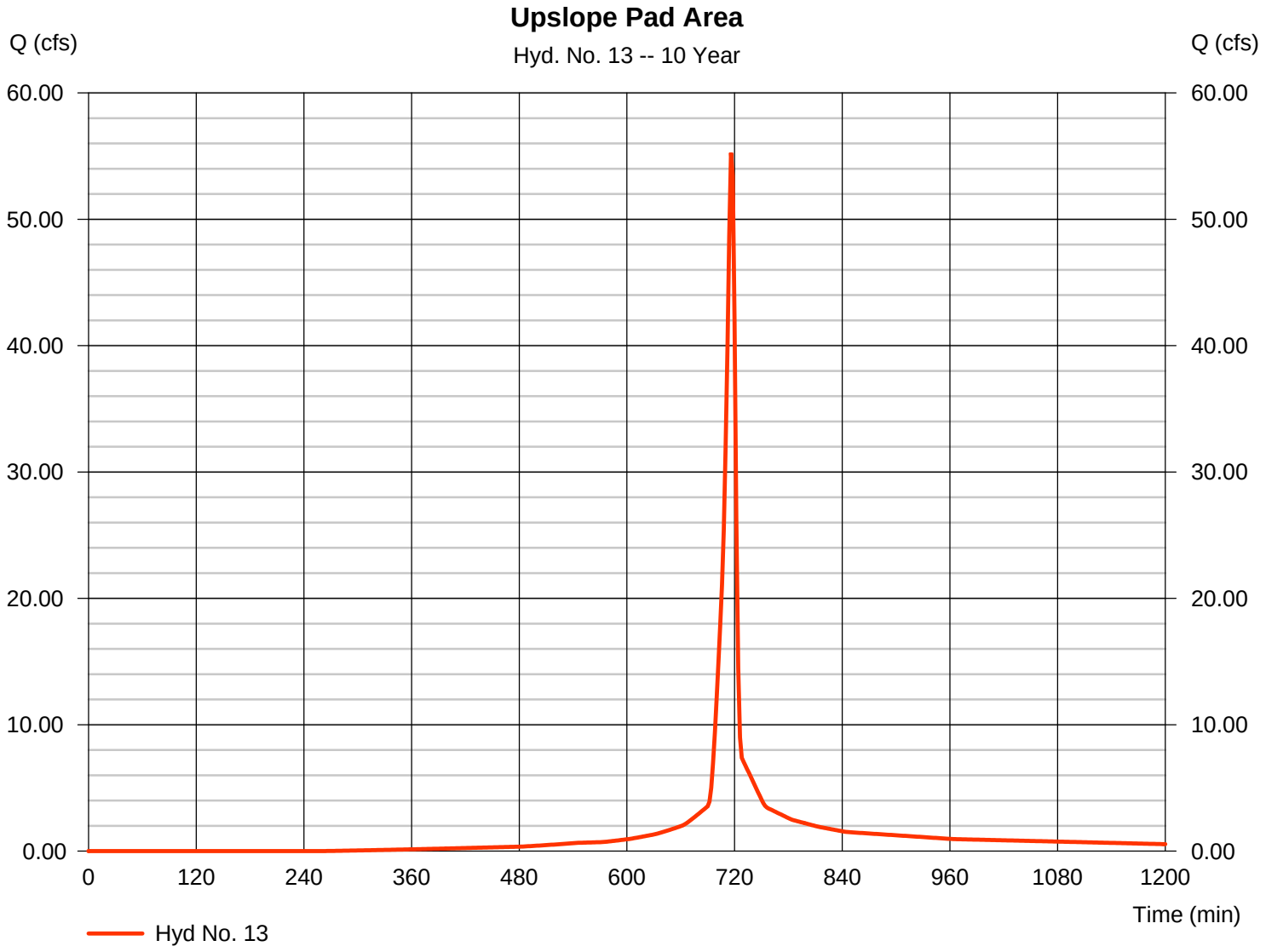


Hydrograph Report

Hyd. No. 13

Upslope Pad Area

Hydrograph type	= SCS Runoff	Peak discharge	= 55.25 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 117,108 cuft
Drainage area	= 9.740 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

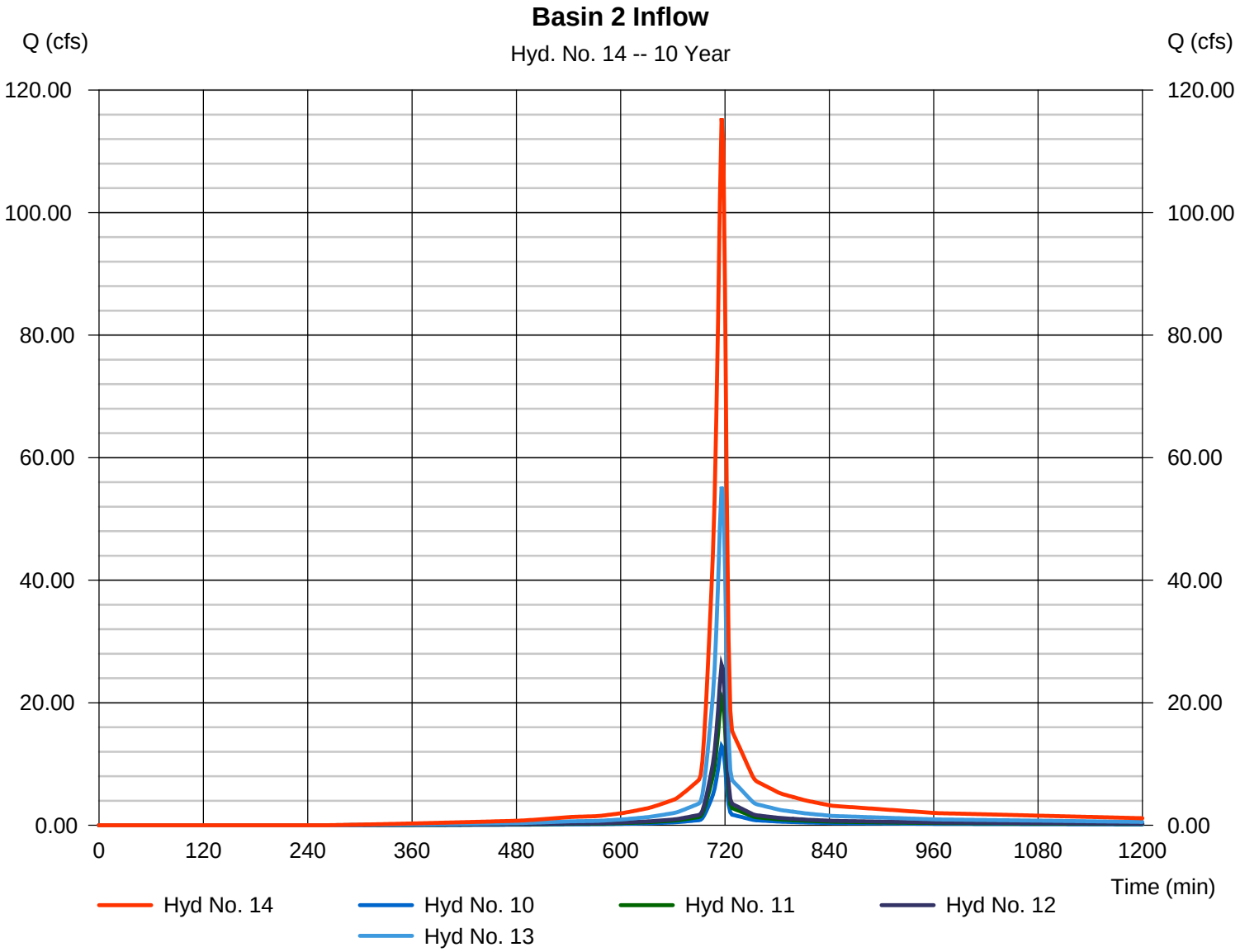


Hydrograph Report

Hyd. No. 14

Basin 2 Inflow

Hydrograph type	= Combine	Peak discharge	= 115.39 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 244,556 cuft
Inflow hyds.	= 10, 11, 12, 13	Contrib. drain. area	= 20.340 ac



Hydrograph Report

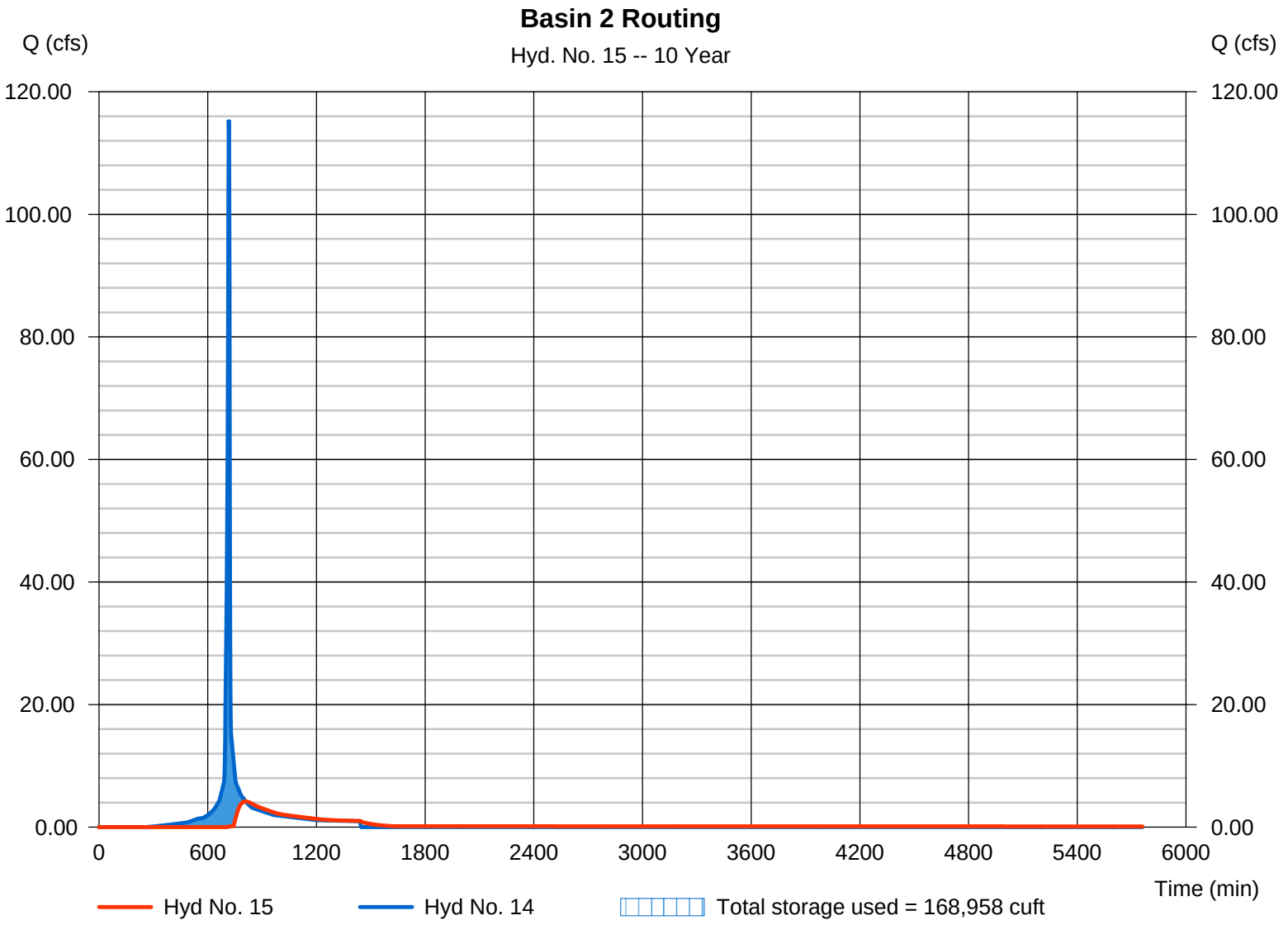
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 15

Basin 2 Routing

Hydrograph type	= Reservoir	Peak discharge	= 4.196 cfs
Storm frequency	= 10 yrs	Time to peak	= 808 min
Time interval	= 2 min	Hyd. volume	= 121,310 cuft
Inflow hyd. No.	= 14 - Basin 2 Inflow	Max. Elevation	= 530.03 ft
Reservoir name	= Sediment Basin 2	Max. Storage	= 168,958 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 06 / 13 / 2018

Pond No. 2 - Sediment Basin 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 525.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	525.00	13,264	0	0
1.00	526.00	31,651	21,799	21,799
2.00	527.00	34,422	33,023	54,823
3.00	528.00	36,590	35,497	90,319
4.00	529.00	38,626	37,599	127,919
5.00	530.00	40,670	39,639	167,558
6.00	531.00	42,718	41,686	209,244
7.00	532.00	44,777	43,739	252,983
8.00	533.00	46,859	45,809	298,792

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	1.00	1.00	0.00
Span (in)	= 18.00	1.00	1.00	0.00
No. Barrels	= 1	5	1	0
Invert El. (ft)	= 526.84	526.76	528.25	0.00
Length (ft)	= 54.24	0.10	0.10	0.00
Slope (%)	= 0.31	0.10	0.10	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.28	15.00	0.00	0.00
Crest El. (ft)	= 529.70	530.20	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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	525.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
1.00	21,799	526.00	0.00	0.00	0.00	---	0.00	0.00	---	---	---	---	0.000
2.00	54,823	527.00	0.04 oc	0.04 ic	0.00	---	0.00	0.00	---	---	---	---	0.037
3.00	90,319	528.00	0.13 oc	0.13 ic	0.00	---	0.00	0.00	---	---	---	---	0.131
4.00	127,919	529.00	0.22 oc	0.18 ic	0.02 ic	---	0.00	0.00	---	---	---	---	0.206
5.00	167,558	530.00	3.65 oc	0.18 ic	0.03 ic	---	3.44	0.00	---	---	---	---	3.648
6.00	209,244	531.00	14.80 oc	0.05 ic	0.01 ic	---	14.74 s	27.91	---	---	---	---	42.70
7.00	252,983	532.00	17.53 oc	0.03 ic	0.01 ic	---	17.49 s	94.18	---	---	---	---	111.70
8.00	298,792	533.00	19.75 oc	0.02 ic	0.00 ic	---	19.72 s	182.73	---	---	---	---	202.46

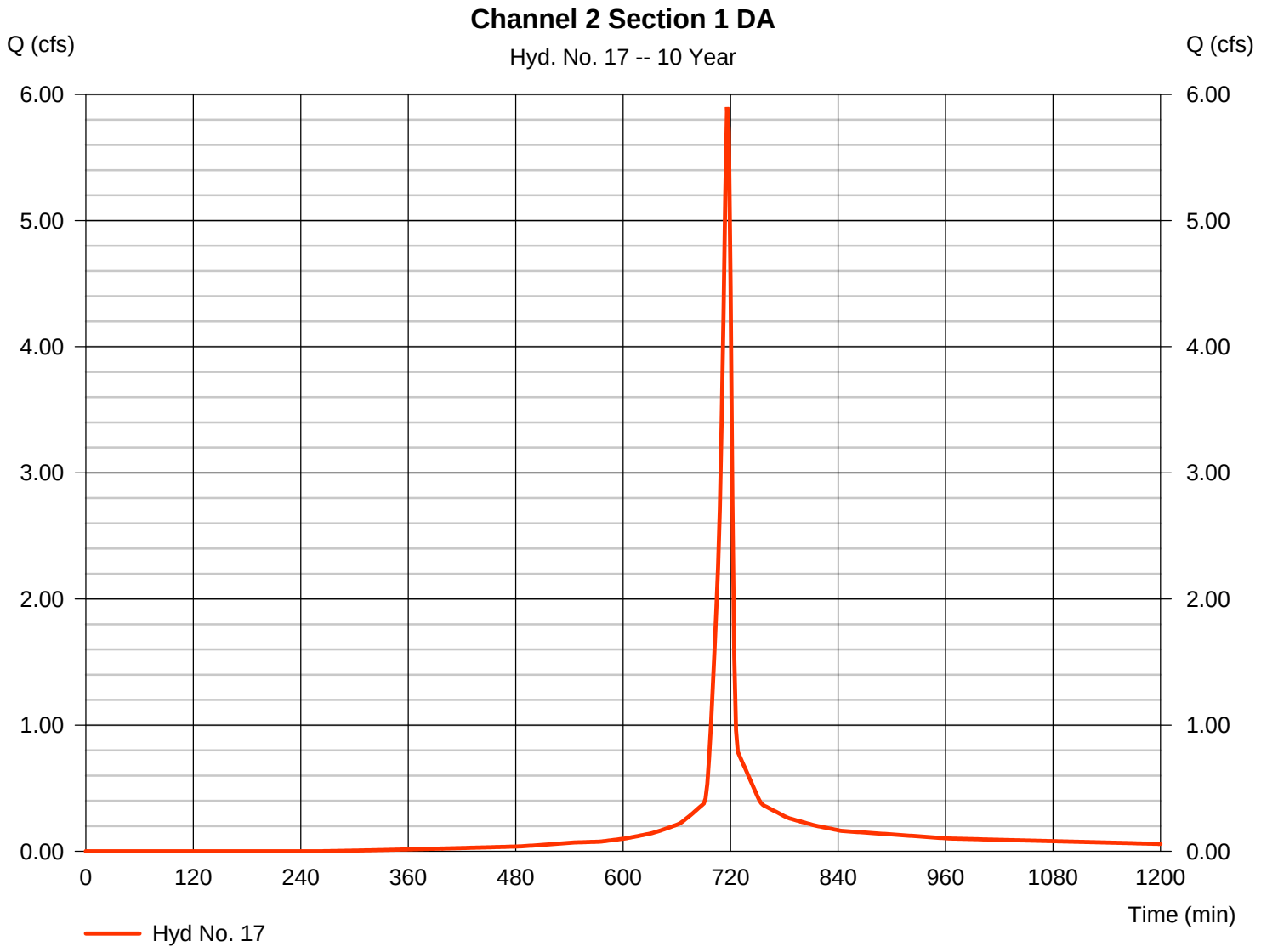
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 17

Channel 2 Section 1 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 5.900 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 12,504 cuft
Drainage area	= 1.040 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

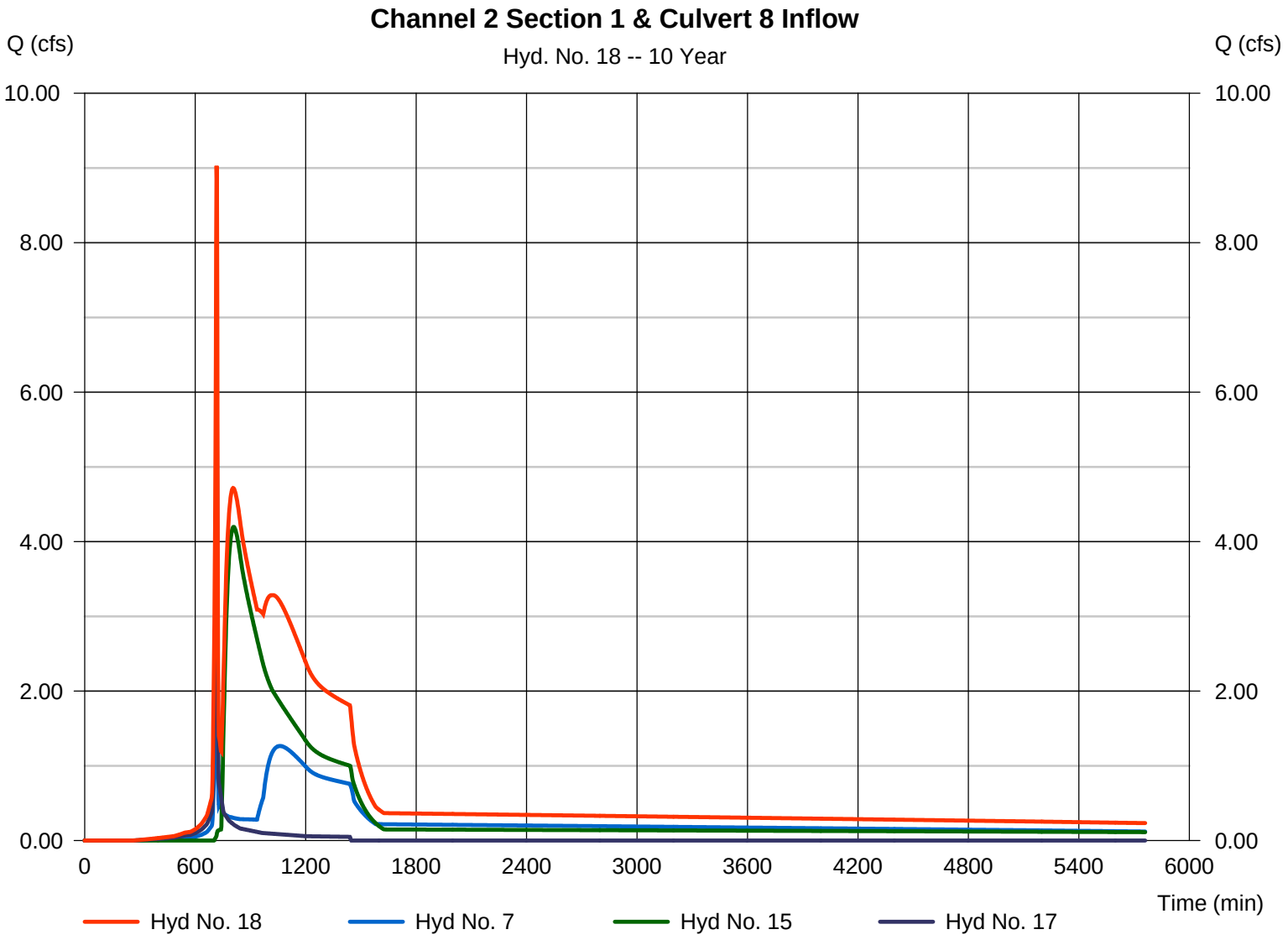


Hydrograph Report

Hyd. No. 18

Channel 2 Section 1 & Culvert 8 Inflow

Hydrograph type	= Combine	Peak discharge	= 9.028 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 216,520 cuft
Inflow hyds.	= 7, 15, 17	Contrib. drain. area	= 1.040 ac



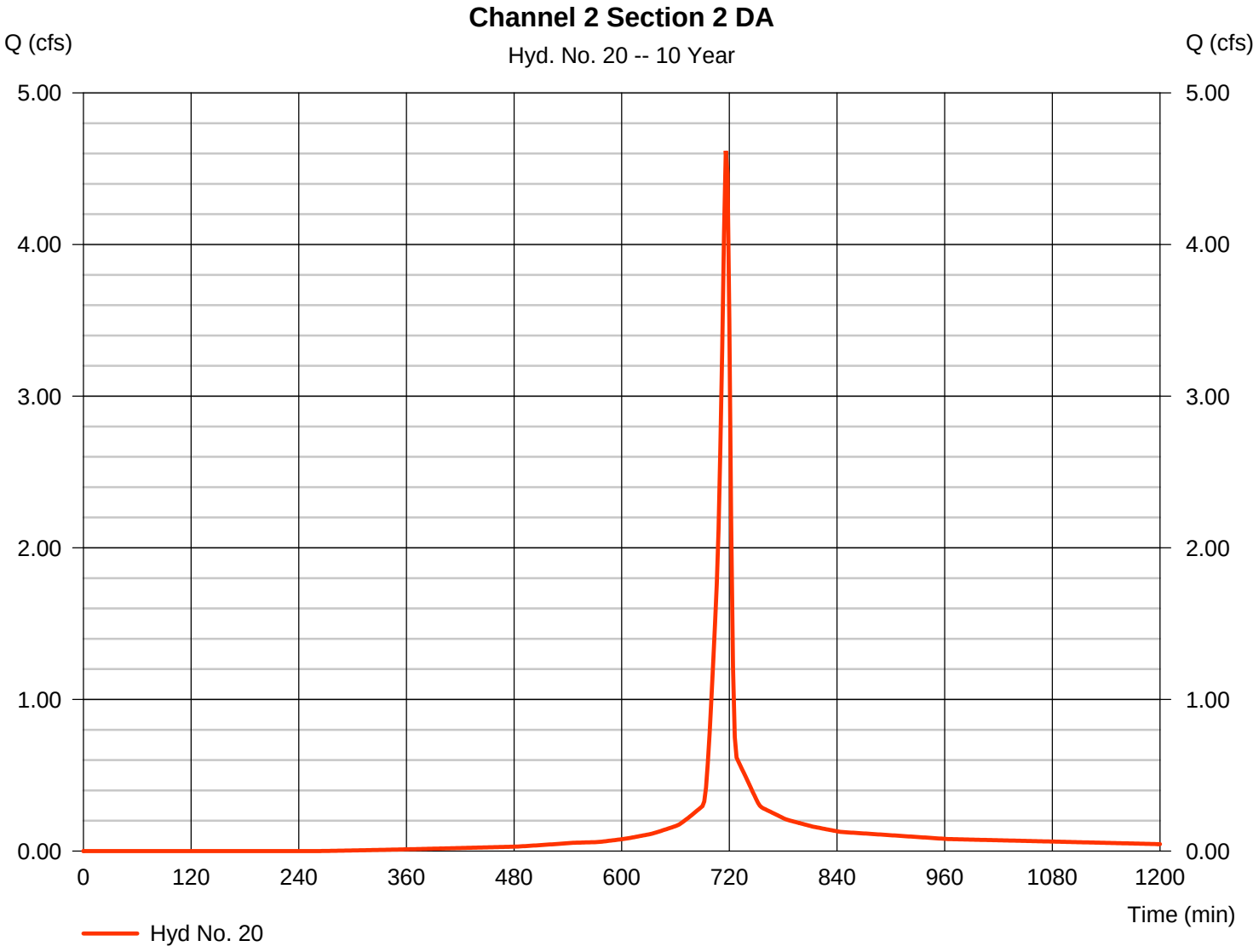
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 20

Channel 2 Section 2 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 4.618 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 9,787 cuft
Drainage area	= 0.814 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

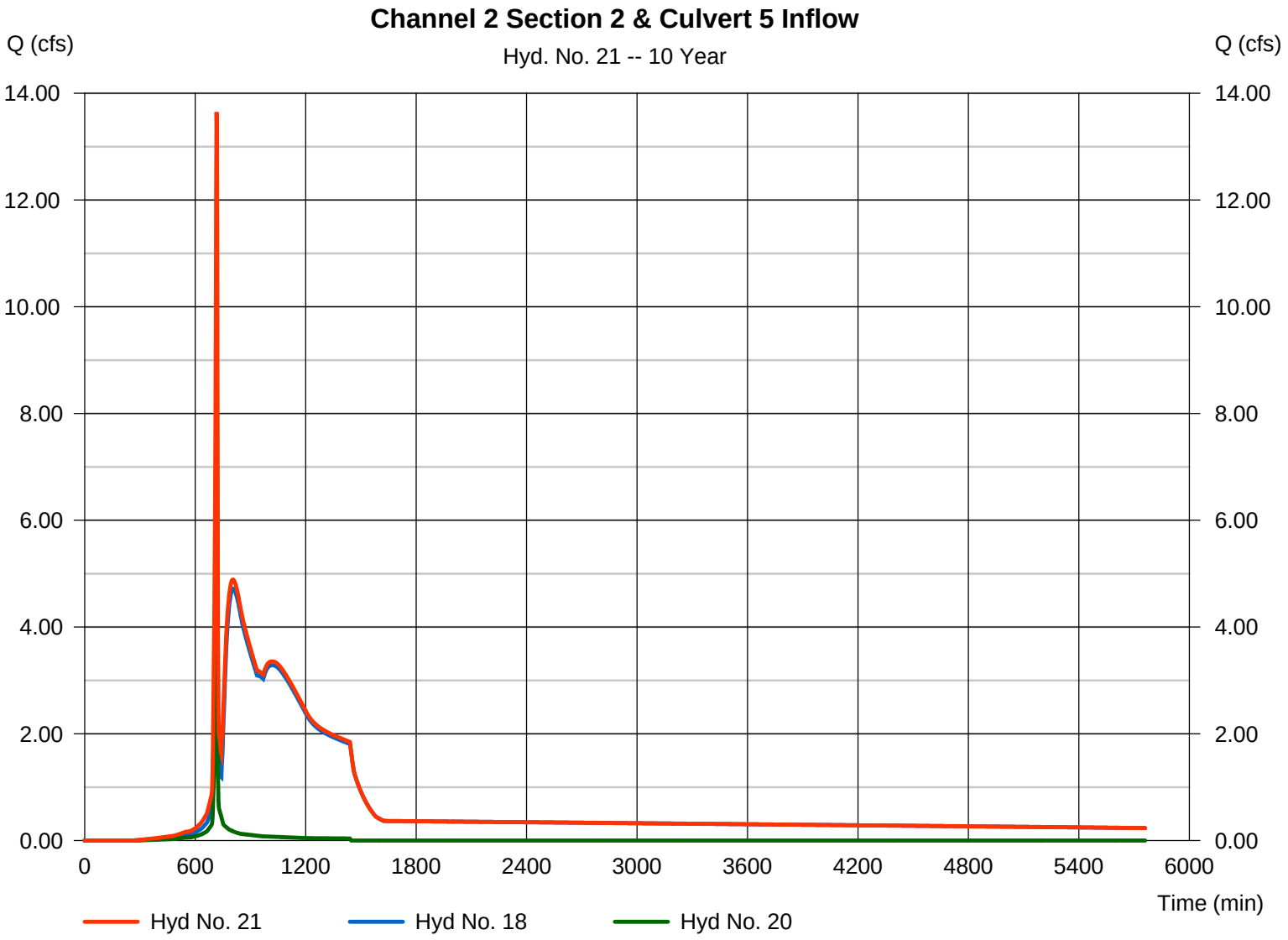


Hydrograph Report

Hyd. No. 21

Channel 2 Section 2 & Culvert 5 Inflow

Hydrograph type	= Combine	Peak discharge	= 13.65 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 226,307 cuft
Inflow hyds.	= 18, 20	Contrib. drain. area	= 0.814 ac



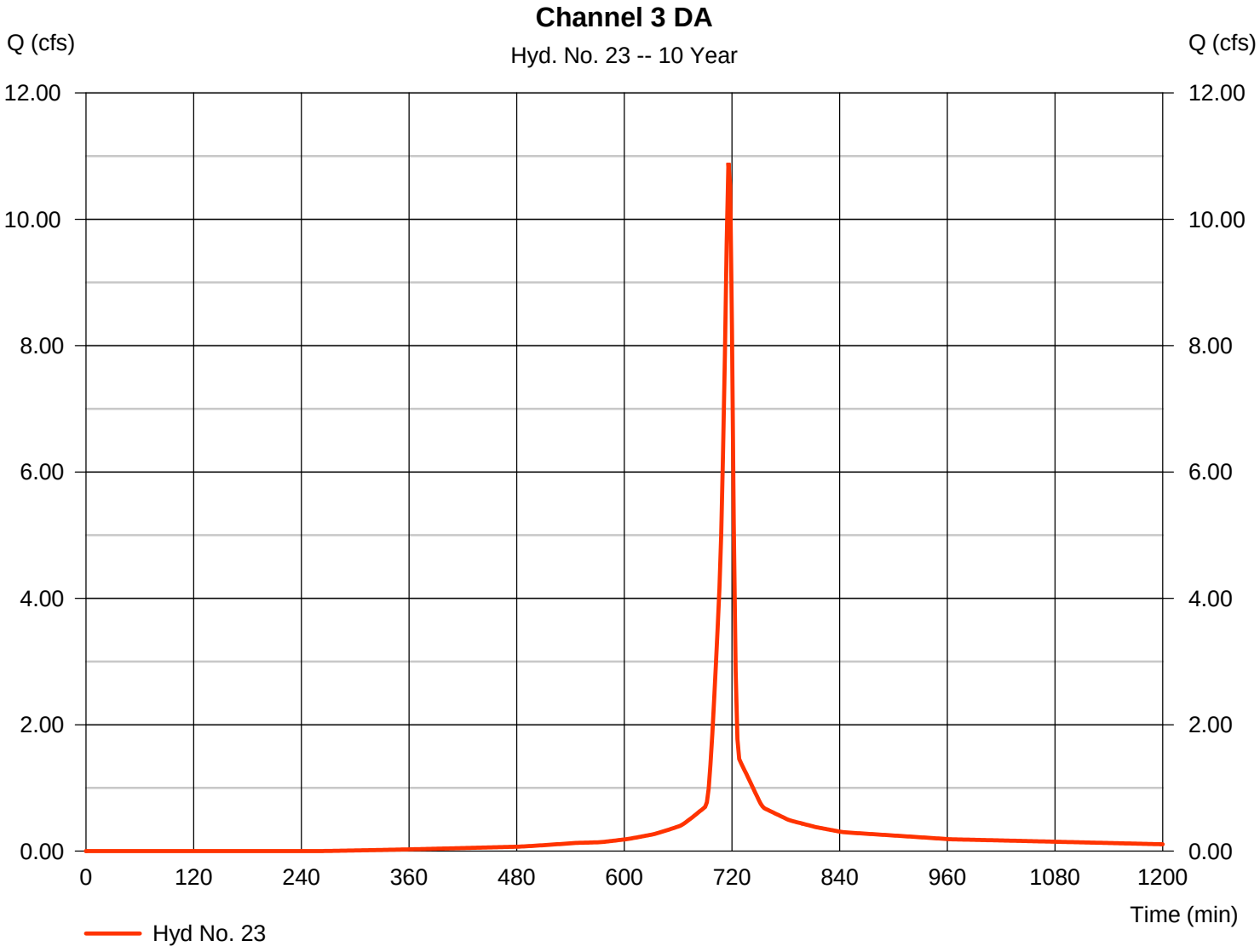
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 06 / 13 / 2018

Hyd. No. 23

Channel 3 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 10.89 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 23,085 cuft
Drainage area	= 1.920 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



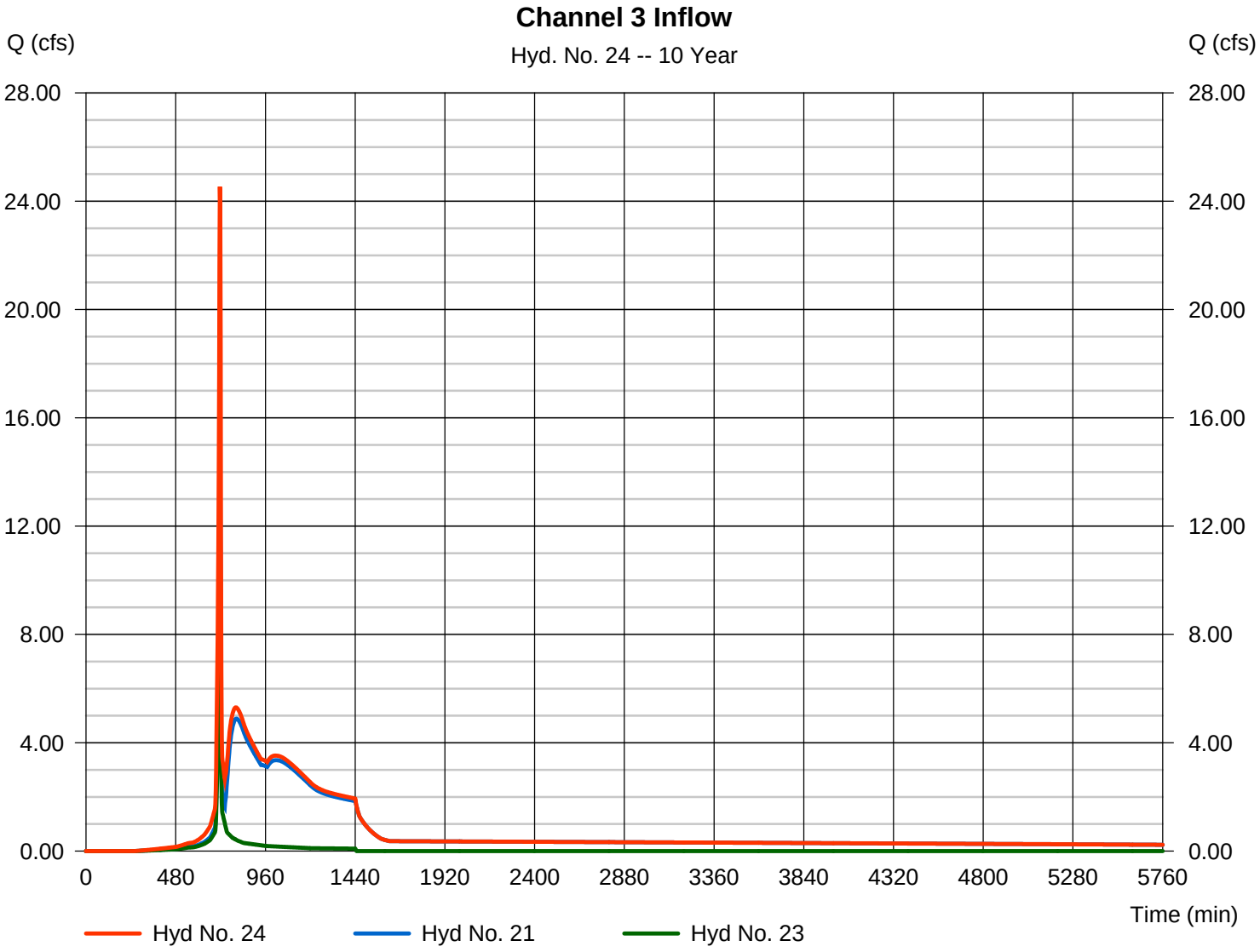
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 06 / 13 / 2018

Hyd. No. 24

Channel 3 Inflow

Hydrograph type	= Combine	Peak discharge	= 24.54 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 249,392 cuft
Inflow hyds.	= 21, 23	Contrib. drain. area	= 1.920 ac

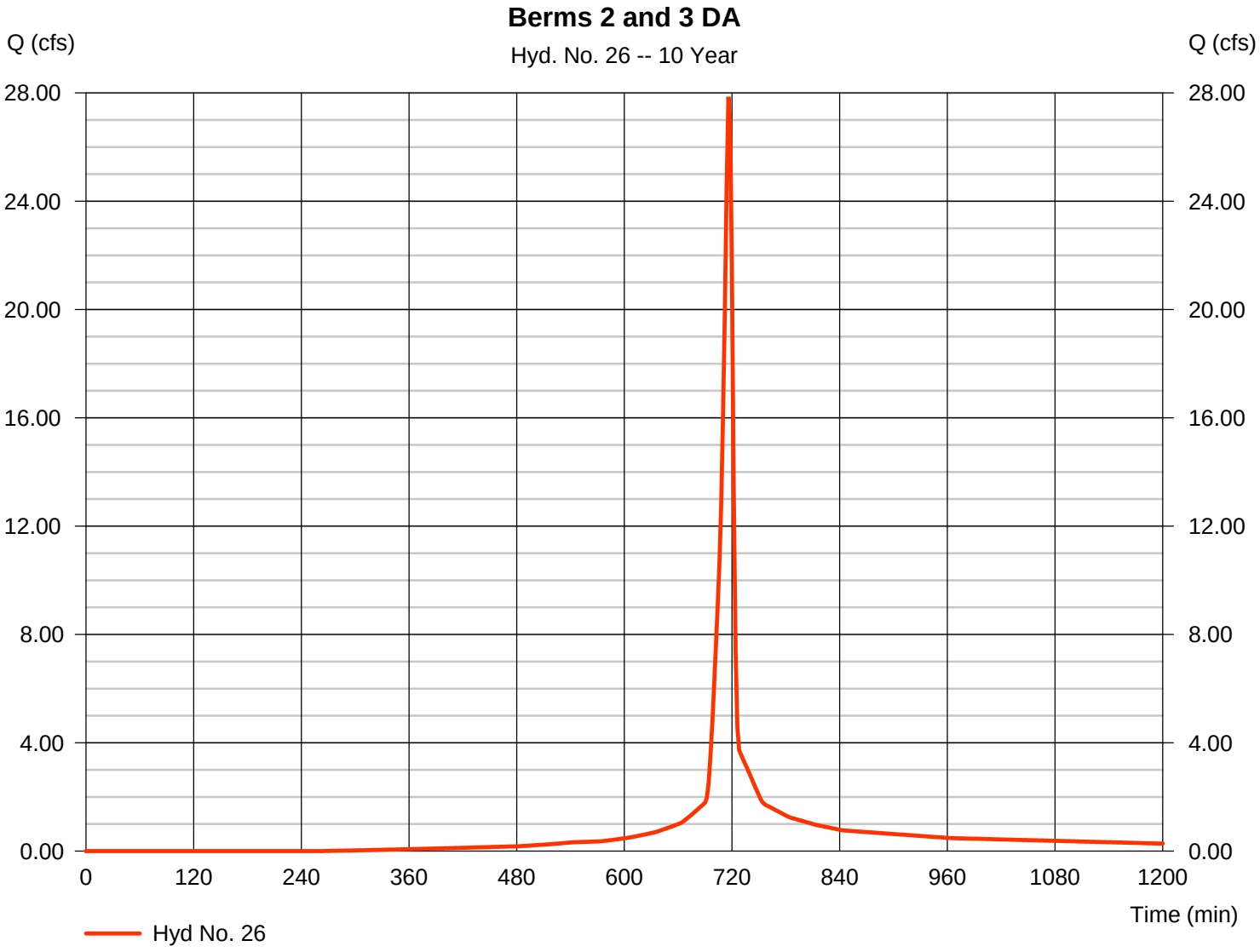


Hydrograph Report

Hyd. No. 26

Berms 2 and 3 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 27.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 59,035 cuft
Drainage area	= 4.910 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



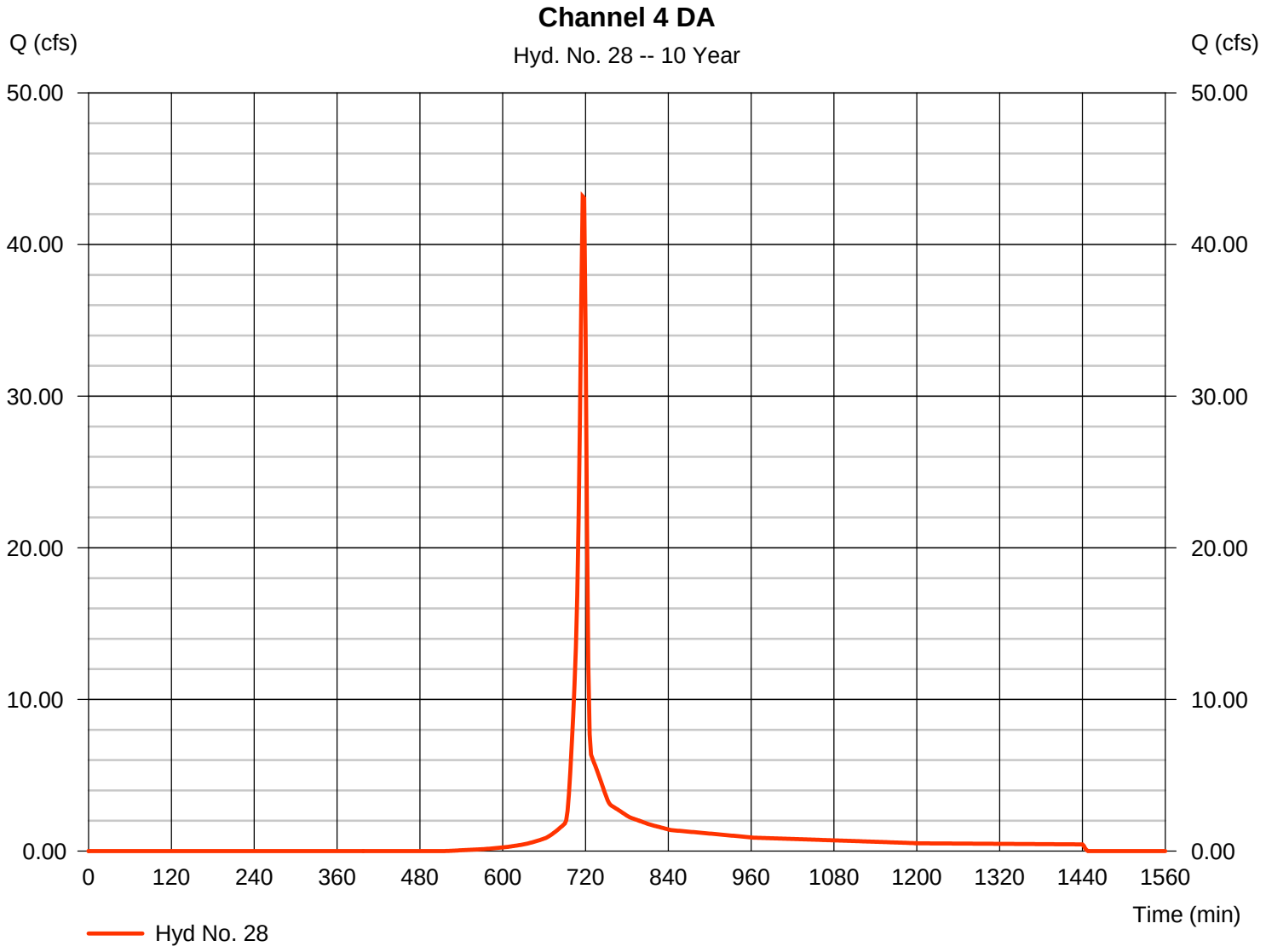
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 28

Channel 4 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 43.18 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 87,182 cuft
Drainage area	= 10.990 ac	Curve number	= 76
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



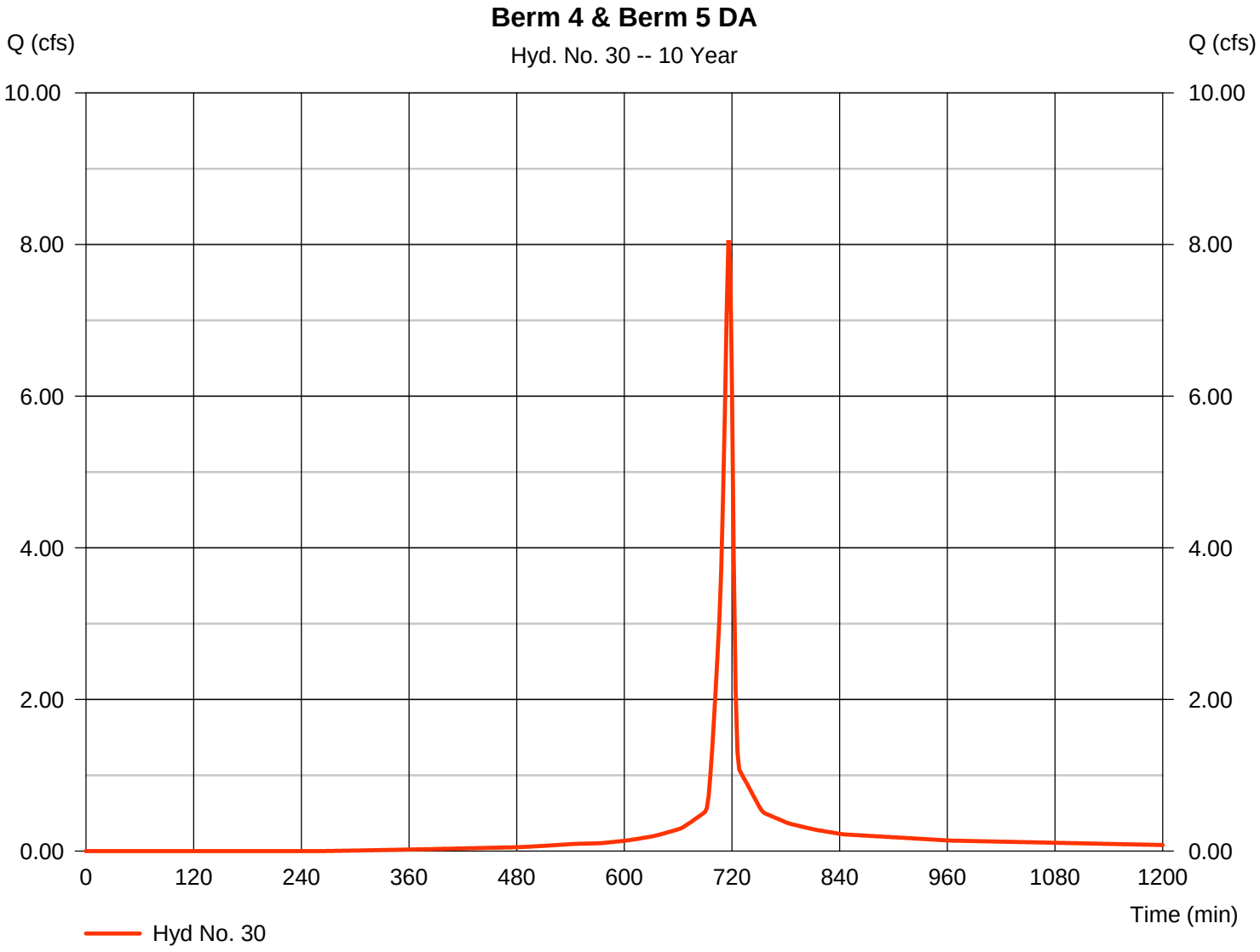
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 06 / 13 / 2018

Hyd. No. 30

Berm 4 & Berm 5 DA

Hydrograph type	= SCS Runoff	Peak discharge	= 8.056 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 17,073 cuft
Drainage area	= 1.420 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



CLARIFYING POND

CALCULATIONS

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HANSON AGGREGATES - ROCK HILL QUARRY

CLARIFYING POND

Storage Volume Check

Elevation ft.	Plan Area sf	Average Area sf	Elevation Difference ft.	Incremental Volume cf	Incremental Volume acre-ft	Cummulative Volume cf	Cummulative Volume acre-ft
526	2412						
527	3503	2,941	1	2,941	0.068	2,941	0.068
528	4632	4,054	1	4,054	0.093	6,995	0.161
529	5799	5,205	1	5,205	0.119	12,200	0.280
530	6980	6,380	1	6,380	0.146	18,580	0.427
531	8200	7,582	1	7,582	0.174	26,162	0.601
532	9432	8,809	1	8,809	0.202	34,971	0.803
533	10703	10,061	1	10,061	0.231	45,032	1.034
534	11986	11,338	1	11,338	0.260	56,370	1.294
535	13318	12,646	1	12,646	0.290	69,016	1.584
536	14650	13,979	1	13,979	0.321	82,994	1.905

Design:

Volume at Weir Crest =	52,290 CF
Volume with 1' freeboard =	69,016 CF
Volume at Weir Top =	82,994 CF
Minimum Design Volume =	48,168 CF

Average area calculated as follows: [A+B+sqrt(A*B)]/3

By:	JTK
Date:	6/7/2018
Chk'd:	MDF
Date:	6/7/2018

HANSON AGGREGATES - ROCK HILL QUARRY

CLARIFYING POND

WEIR DISCHARGE CAPACITY

WEIR FLOW		
WATER SURFACE ELEV (FT)	HEAD H (FT)	FLOW (1) Q (CFS)
533.64	0.00	0.00
533.75	0.11	0.02
534.00	0.36	0.32
534.25	0.61	1.18
534.50	0.86	2.77
534.75	1.11	5.23
535.00	1.36	8.69
535.25	1.61	13.24
535.50	1.86	18.98
535.75	2.11	26.00
536.00	2.36	34.39

Notes:

(1) Weir Flow, $Q = 4.28*C*\tan(\theta/2)*(h+k)^{(5/2)}$

where:

C = discharge coefficient =	0.5779
k = head correction factor, ft. =	0.0029
θ = notch angle	90.0
H = depth of flow above the spillway crest, ft. =	Variable

* $C = 0.607165052 - 0.000874466963*\theta + 6.10393334*10^{(-6)}*\theta^{(2)}$
* $k = 0.0144902648 - 0.00033955535*\theta + 3.29819003*10^{(-6)}*\theta^{(2)} - 1.06215442*10^{(-8)}*\theta^{(3)}$

By:	JTK
Date:	6/7/2018
Chk'd:	MDF
Date:	6/7/2018

CLARIFYING POND

DETENTION TIME

VOLUME OVERTURN				
POND INFLOW (GPM)	POND INFLOW (CFS)	POND DESIGN VOLUME SLUDGE FACTOR (CF)	POND DESIGN VOLUME NO FACTOR (CF)	POND DETENTION TIME (HRS)
500	1.11	69,016	51,892	12.94
1,000	2.23	69,016	51,892	6.47
2,000	4.46	69,016	51,892	3.23
3,000	6.68	69,016	51,892	2.16
4,488	10.00	69,016	51,892	1.44

Note: *Sludge Factor = 1.33 x Design Volume
**Design Inflow Rate = 1,000 gpm
***Minimum 6 hour detention time based on the design rate.
The long term average flow rate is anticipated to be lower than this rate, thus providing greater detention time.

By: JTK
Date: 6/7/2018
Chk'd: MDF
Date: 6/7/2018

SEDIMENT TRAP 3

Hanson Aggregates - Rock Hill Quarry

Sediment Trap 3

Design Notes

Required Storage Volume and Elevations		
Drainage Area, DA (acres)	Measured	3.72
Required Sediment Storage Volume (cf)	700 x DA	2,604
Required Settling Volume (cf)	1300 x DA	4,836
Required Total Volume (cf)	Sediment + Settling	7,440
Total Storage Volume Provided (cf)	Storage Volume Table	7,600
Elevation for Sediment Storage Volume (ft.)	Chosen	545.15
Total Volume Elevation (ft.)	Chosen	546.80
Top of Embankment Elevation		
Total Volume Elevation (ft.)	Primary Spillway Table	546.80
Freeboard (ft.)	Required	1.00
Top of Embankment Elevation (ft.)	Flow Elevation + Freeboard (min.)	549.00
Trap Dimensions		
Bottom Length (ft.)	Chosen	67.20
Bottom Width (ft.)	Chosen	16.60
Crest Length (ft.)	Chosen	81.76
Crest Width (ft.)	Chosen	29.37
Top Length (ft.)	Chosen	88.00
Top Width (ft.)	Chosen	34.84

Hanson Aggregates - Rock Hill Quarry

Sediment Trap 3

Storage Volume Check

Elevation ft.	Plan Area sf	Average Area sf	Elevation Difference ft.	Incremental Volume cf	Incremental Volume acre-ft	Cummulative Volume cf	Cummulative Volume acre-ft
544	2,072					0	0
545	2,508	2,286	1.0	2,286	0.052	2,286	0.052
546	2,975	2,738	1.0	2,738	0.063	5,025	0.115
547	3,473	3,221	1.0	3,221	0.074	8,246	0.189
548	4,002	3,734	1.0	3,734	0.086	11,980	0.275

Design:

Sediment Storage Volume =	2700.00	CF
Sediment Storage Volume Elevation =	545.15	ft.
Settling Storage Volume =	4900.00	CF
Settling Storage Volume Elevation =	546.80	ft.

Requirements:

Sediment Storage Volume (700 CF/disturbed area acres) =	2,604	CF
Settling Storage Volume (1,300 CF/drainage area acres) =	4,836	CF
Drainage Area (acres) =	3.72	acres

Average area calculated as follows: [A+B+sqrt(A*B)]/3

By:	JTK
Date:	6/5/2018
Chk'd:	MDF
Date:	6/5/2018

Hanson Aggregates - Rock Hill Quarry

Sediment Trap 3

EMERGENCY SPILLWAY DISCHARGE CAPACITY

WEIR FLOW		
WATER SURFACE ELEV (FT)	HEAD H (FT)	FLOW (1) Q (CFS)
546.80	0.00	0.00
547.00	0.20	8.05
547.25	0.45	27.17
547.50	0.70	52.71
547.75	0.95	83.34
548.00	1.20	118.31

Notes:

(1) Weir Flow, Q = CLH^1.5

where: C = weir coefficient = 3.00

L = bottom width of the spillway crest, ft. = 30.00

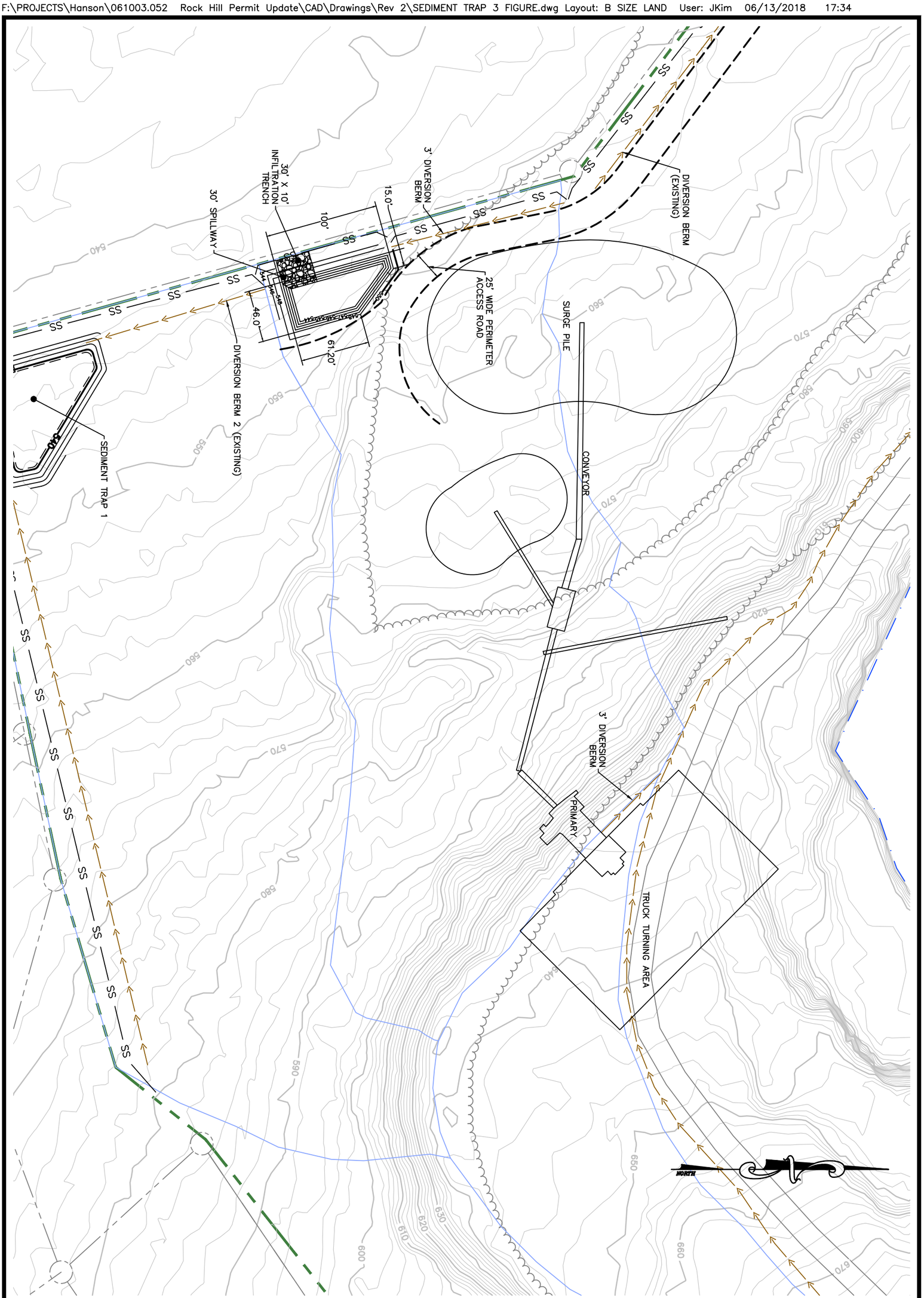
H = depth of flow above the spillway crest, ft.

By: JTK

Date: 6/5/2018

Chk'd: MDF

Date: 6/5/2018



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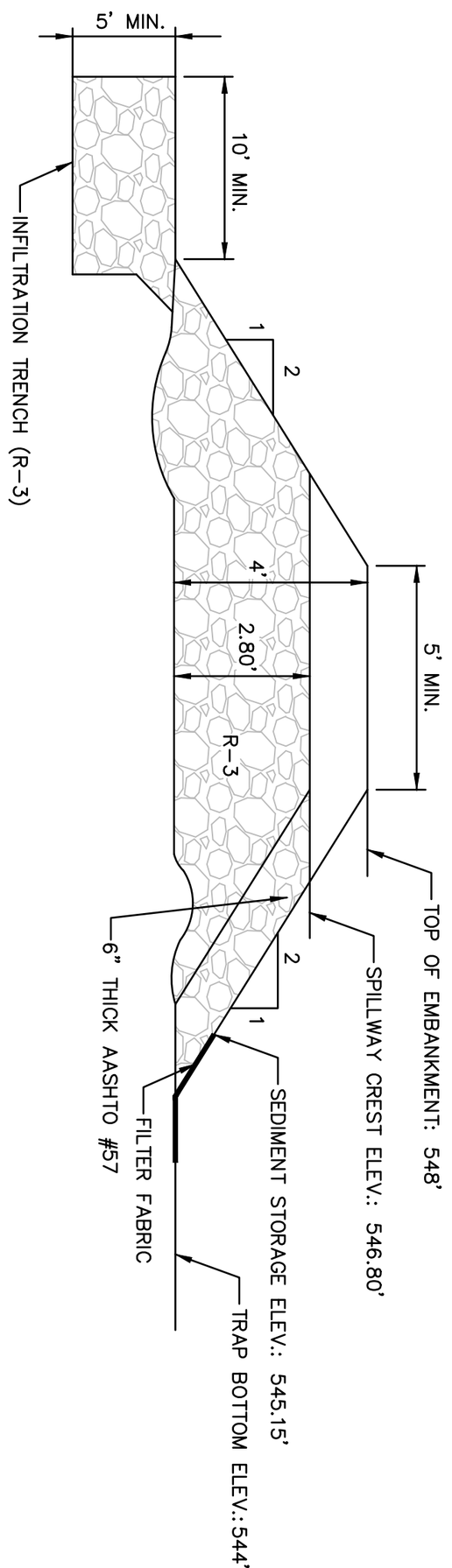
WV office 304.212.6866
toll free 800.264.4553

DRAWN BY:	CHECKED BY:
JTK	MDF
DATE:	PROJECT NO:
6/5/18	061003.052

DRAWING SCALE: 1" = 80'

FIGURE 1
SEDIMENT TRAP 3 PLAN

HANSON AGGREGATES PENNSYLVANIA LLC
ROCK HILL QUARRY



SECTION THROUGH SPILLWAY

NOT TO SCALE

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DRAWN BY: JTK	CHECKED BY: MDF
DATE: 6/5/18	PROJECT NO: 061003.052
DRAWING SCALE: NOT TO SCALE	

FIGURE 2
SEDIMENT TRAP 3 DETAIL

HANSON AGGREGATES PENNSYLVANIA LLC
ROCK HILL QUARRY

QUARRY IMPOUNDMENT DEWATERING SYSTEM DETAIL

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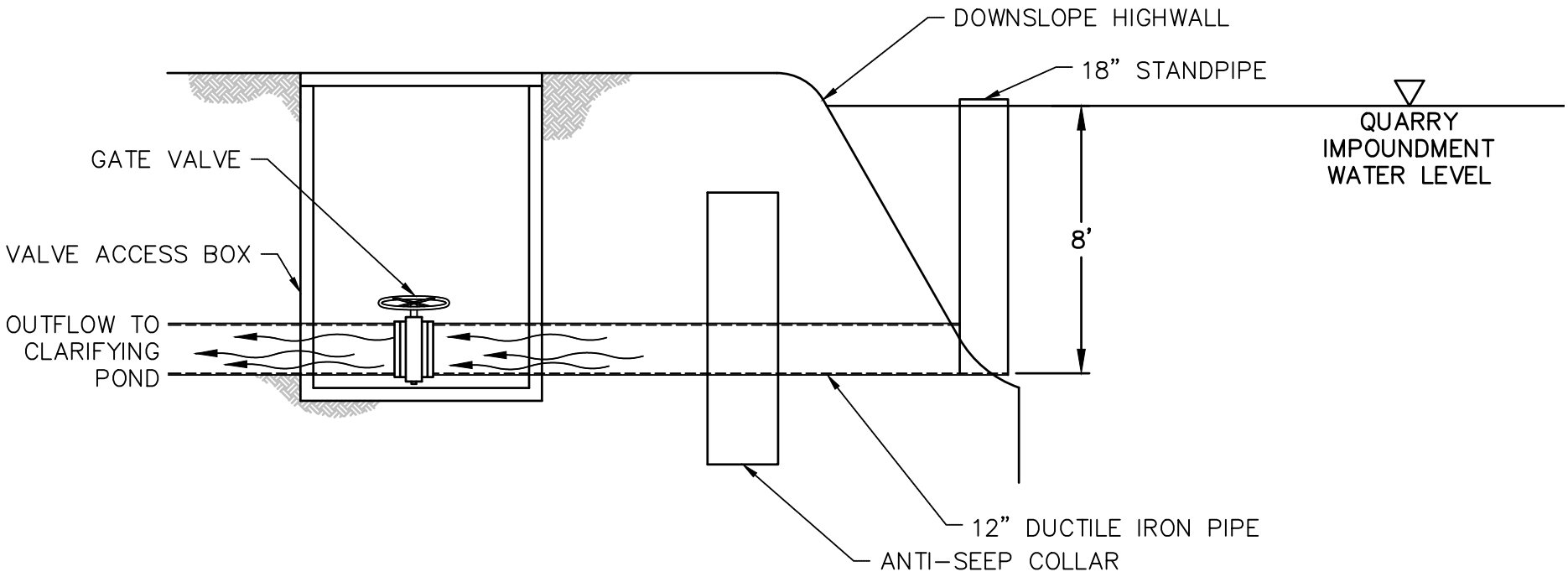

QUARRY IMPOUNDMENT DEWATERING SYSTEM

NOT TO SCALE

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Morgantown, WV 26508

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WV office 304.212.6866
toll free 800.264.4553

DRAWN BY:	CHECKED BY:
CBR	MDF
DATE: 05/30/2018	PROJECT NO: 061003.052
DRAWING SCALE: NOT TO SCALE	

FIGURE 1
QUARRY IMPOUNDMENT DEWATERING SYSTEM

HANSON AGGREGATES PENNSYLVANIA LLC
ROCKHILL QUARRY
EAST ROCKHILL TOWNSHIP, BUCKS COUNTY
PENNSYLVANIA

AS-BUILT SITE PLAN

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STABILIZED ENTRANCE
DIVERSION BERM 5
SEDIMENT TRAP 2
NPDES 001
CHANNEL 5
PERIMETER BERM
UPSLOPE DIVERSION SWALE, CHANNEL 4
CHANNEL 3
DIVERSION BERM 4
CULVERT 5
CULVERT 4
CHANNEL 2 SECTION 2
CULVERT 8
EMERGENCY SPILLWAY
PRIMARY SPILLWAY 24" RISER / 18" BARREL
SEDIMENT BASIN 2
QUARRY PIT (WATER ELEV. ~590' MSL)
FUTURE SEEP INTERCEPTOR (TO BE FIELD FIT AND INSTALLED AS NEEDED FOLLOWING DEMOLITION OF EXISTING FOUNDATIONS AND BASE GRADING FOR FUTURE PLANT)
CHANNEL 6
CULVERT 3
CHANNEL 2 SECTION 1
CULVERT 6
ANTI-SEEP COLLAR
VALVE BOX (MANUAL CONTROLLED DEWATERING)
PRIMARY SPILLWAY 24" RISER / 18" BARREL
EMERGENCY SPILLWAY
SEDIMENT BASIN 1
CULVERT 2
INLET BOX
8" STEEL PIPE (PRESUMED ORIGIN IS QUARRY PIT WATER IMPOUNDMENT)
DIVERSION
CHANNEL 1
DIVERSION BERM 1 SECTION 2
SOLID PERFORATED
INTERCEPTOR PIPE 1 SECTION 1
CULVERT 1
INTERCEPTOR PIPE 1 SECTION 2
DIVERSION
V-NOTCH OVERFLOW WEIR
CLARIFYING POND
DIVERSION BERM 1 SECTION 1
PROCESSING PLANT AND STOCKPILE AREA
STABILIZED ENTRANCE
SEDIMENT TRAP 3
DIVERSION BERM 2
DIVERSION BERM 3
SEDIMENT TRAP 1
NORTH

LEGEND

- EXISTING GRADE CONTOUR
- EXISTING SMP BOUNDARY
- EXISTING SURFACE WATER
- LIMIT OF EARTHRES SURVEY (1/2018)
- PROPERTY BOUNDARY
- EXISTING RAILROAD
- EXISTING TREELINE
- EXISTING PERIMETER BERM (PRECAST CONCRETE BLOCKS)
- EXISTING FILTER BERM
- EXISTING CHANNEL
- EXISTING DIVERSION BERM
- EXISTING COMPOST FILTER SOCK
- NPDES 001 NPDES DISCHARGE POINT

NOTES:
1. EXISTING GRADE TOPOGRAPHY COMPILED BY PAMAP PROGRAM, PA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY, DATED JUNE 2010.
2. TOPOGRAPHY AND SITE FEATURES IN WESTERN PERMIT AREA WERE SURVEYED BY EARTHRES GROUP, INC. PERSONNEL, JANUARY 2018.
3. BASEMAP FEATURES INCLUDING BUILDINGS, ROADS, UTILITIES, WATER FEATURES, AND TREELINES RETRACED FROM AERIAL PHOTOGRAPHY DATED 2015, PUBLISHED BY THE DELAWARE VALLEY REGIONAL PLANNING COMMISSION.
4. EXISTING PERMIT INFORMATION INCLUDING PERMIT BOUNDARY, MINING LIMIT, DEPTH OF MINING, AND PRE-ACT HIGHWALLS ARE REFERENCED TO THE PERMIT DRAWING "MINING PLAN, SHEET 3 OF 6" PREPARED BY SKELLY AND LOY, DATED MARCH 18, 1980.
5. HANSON PROPERTY BOUNDARY PROVIDED BY MAP TITLED "PLAT OF SURVEY OF LANDS OF GENERAL CRUSHED STONE", PREPARED BY ORANGEVILLE SURVEYING CONSULTANTS, INC., DATED MAY 7, 2001.
6. ADJACENT PARCEL BOUNDARIES ARE REFERENCED TO THE BUCKS COUNTY GIS RECORDS.
7. STREAM INFORMATION IS REFERENCED TO THE PA DEP eMAPPA ONLINE RECORDS.
8. AS-BUILT SURVEY CONDUCTED ON MAY 16, 2018 BY EARTHRES GROUP, INC. PERSONNEL.

GRAPHIC SCALE

100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

NO.	DATE	BY	REVISIONS

COMMONWEALTH OF PENNSYLVANIA
MICHAEL D. FLING
ENGINEER
PE080620
MICHAEL D. FLING, P.E.
LICENSE NO. PE080620

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E&S SITE PLAN AS-BUILT

HANSON AGGREGATES PENNSYLVANIA LLC
ROCK HILL QUARRY
EAST ROCKHILL TOWNSHIP, BUCKS COUNTY
PENNSYLVANIA

DRAWN BY: JTK
CHECKED BY: MDF
DATE: 6/7/18
PROJECT NO: 061003.052
DRAWING NUMBER: D-001
SHEET 1 OF 1

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