

DRAINAGE PLAN
DULING INDUSTRIAL 3RD
ADDITION
TO
WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY



29 APRIL 2013



DRAINAGE PLAN DULING INDUSTRIAL 3RD ADDITON

FINAL REPORT

Prepared by Baughman Company, P.A.
29 April 2013

By Trevor R. Kurth, P.E., CFM
N. Brent Wooten, P.E., L.S.



REPORT CONTENTS

City of Wichita Checklist

Project Narrative

- Existing Conditions
- Proposed Conditions
- Offsite Conditions

Hydrologic Analysis

- Forward
- Drainage Methods & Standards
- Site Characteristics
- Hydrologic Analysis
- Detention Facilities
- Downstream Drainage Capacity

Floodplain Submittal

- Source of Floodplain Information

Federal, State, & Local Permitting

- US Army Corps of Engineers
- Kansas Dept of Agriculture – DWR Permitting
- FEMA
- Kansas Dept of Transportation
- Sedgwick County ROW

Exhibits

- Exhibit 1: Site Location Map
- Exhibit 2: Aerial Photo Exhibit with Lidar Topography
- Exhibit 3: Plat -- Half Scale
- Exhibit 4: Drainage Plan – Half Scale
- Exhibit 5: Floodplain Location (FIRM)

Appendices: Supporting Calculations

- Appendix A: USGS Soils Survey
- Appendix B: HydraFlow Hydrographs

Plan Sheets

- Drainage Plan 1: 100 Scale

PROJECT NARRATIVE

EXISTING CONDITIONS

The site is located along West Street just south of Macarthur Road in Wichita, Kansas. A portion of the site, the frontage to West Street, is currently platted as Limited Industrial. The site is currently partially developed and is a heavy equipment rental exchange as well as a construction company yard. The site is mainly gravel parking with various out-buildings which will remain.

The site has a detention pond located in the rear half of the property. The pond does not appear to have an apparent outlet and appears to drain overland to the east and then south. The site accepts offsite runoff from the north adjacent open space farmland.

The site lies within a FEMA SFHA Zone X. The drainage patterns as defined above can be seen on the Aerial (Exhibit 2).

PROPOSED CONDITIONS

The property is being platted and re-platted as two lots and a reserve. At this time, there are no plans to redevelop or develop the property. A plat was needed to 'clean up' the boundaries as well as secure zoning on the rear unplatted property. Therefore, the existing conditions for this plat are the same as the developed conditions.

For a half-scale copy of the Plat, see Exhibit 3.

OFFSITE CONDITIONS

There appears to be approximately 25.5 acres entering the site from the north adjacent property. The north property is generally flat with what appears to be less than a 0.2% slope. Since the property is farmed there does not appear to be a distinct flow path when it encroaches the subject property. The onsite topography suggests that this offsite flow will enter the pond shortly after encroaching the site. Just adjacent and downstream of the site is a platted limited industrial site with a low lying pond area. This area accepts all the offsite runoff from the site before discharging further south. Based on aerial photography, all of this basins runoff flows through a series of ponds and defined channel sections at a minimum 1 mile downstream.

The overall site location and hydrogeodatabase can be seen with the site location plotted as Exhibit 1.

HYDROLOGIC ANALYSIS

FORWARD

At this time, we do not expect any further development or disturbance on the site. Therefore the existing conditions and proposed conditions are assumed to be the same as the site is currently developed. The following methods and standards are used for both existing and proposed cover conditions.

DRAINAGE METHODS & STANDARDS

The following methods and standards, although not a complete list, were used in calculating the existing conditions runoff values.

- STORM SERIES
 - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 100-yr Storm Events Modeled
 - 2-yr Rainfall Depth = 3.5 in
 - 10-yr Rainfall Depth = 5.3 in
 - 100-yr Rainfall Depth = 7.9 in

- FLOW DATA
 - Areas per LIDAR data, USGS Quadrangle Sheet, Aerial Photos, and Site Visits
 - SCS Hydrograph Method used for Existing Flows (CN = 0.70, Soil Type C/D, Disturbed cover)
 - Time of Concentration: Lag Method (minimum 15 min)

SITE CHARACTERISTICS

The majority of the site is currently zoned and platted as limited industrial. The front half of the site is currently developed with buildings, drives, and concrete pads. This portion is used for a rental exchange business as well as equipment storage for a construction company. The rear portion of the lot is poorly covered with the pit pond. The pond does not appear to have an outlet structure and appears to currently overflow to the east and then south onto the adjacent property. The site is relatively flat with the majority draining to the east and into the pond. The frontage area, where the current development is, sheet flows to the West Street ROW ditch section.

The existing site characteristics can be seen from the aerial exhibit (Exhibit 2).

HYDROLOGIC ANALYSIS

The site was analyzed for pre-development conditions using the SCS Hydrograph Method for the entire storm series. A CN of 86 was used based on partially developed and disturbed area in Types C and D Soils. The site's soils are likely packed from construction equipment thus this CN was applied to the entire site and not just the frontage area. A Tc was calculated using a hydrologic run length of 800', basin slope of 0.3%. The Tc was approximately 40 minutes.

DETENTION FACILITIES

There is currently one existing detention pond on the site located near the center of the property. The pond does not appear to have a true static elevation or defined outfall section. The pond is relatively low, and based on past aerial

photography and owner comments, the pond is rarely 'full' to the top bank despite having no defined outfall.

➤ Pond

The pond is located at the center of the property and currently accepts runoff from this site as well as offsite from the north. The pond is relatively 'low' at this time, and appears to have adequate storage for detention values for this site, if needed. The pond was modeled with the current static as the pool elevation and a 20' broadcrested overflow weir and the primary outlet. The pond will have 100-year WSE at approximate elevation 1282.9, the weir section is at elevation 1282.0. If any development were to occur on this property we would expect a more defined weir section to be constructed to define the runoff to the south and into the offsite drainage easement and directly into the offsite pond to the south.

DOWNSTREAM DRAINAGE CAPACITY

At this time, we are not aware of any downstream restrictions or issues immediately downstream of this site. There is an offsite pond to the south which accepts this sites and ponds runoff. There is also an easement located directly downstream to accept this ponds outflow.

FLOODPLAIN SUBMITTAL

SOURCE OF FLOODPLAIN INFORMATION

The site lies within a FEMA Zone X - Shaded. The location of the property, on FEMA FIRM Panel 485E of 700 for Sedgwick County, Kansas, effective February 2, 2007, is attached as Exhibit 5.

FEDERAL, STATE, & LOCAL PERMITTING

US ARMY CORPS OF ENGINEERS

There does not appear to be any jurisdictional waters of the US on this site.

KANSAS DEPT OF AGRICULTURE – DWR PERMITTING

There does not appear to be any DWR permitting needed on the proposed site at this time.

FEMA

There is no mapped A or AE floodplain located upon the proposed site. Therefore, no FEMA permitting is expected at this time.

KANSAS DEPT OF TRANSPORTATION

There is no KDOT ROW located along the property.

SEDGWICK COUNTY PERMITTING

There does not appear to be any Sedgwick County permitting needed at this time.

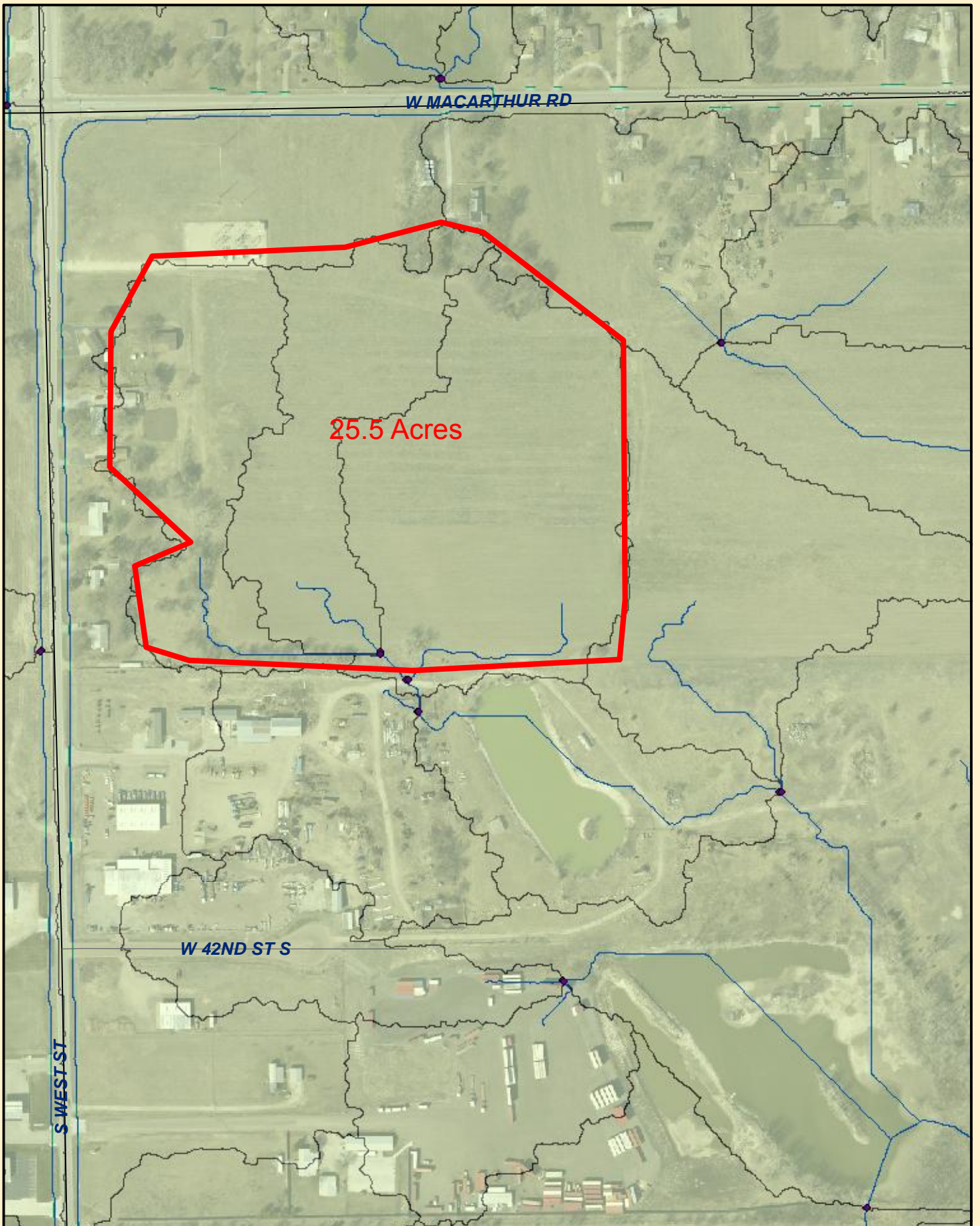
EXHIBIT 1: Site Location Map

EXHIBIT 2: Aerial Photo Exhibit with Lidar Topography

EXHIBIT 3: Plat – Half Scale

EXHIBIT 4: Drainage Plan – Half Scale

EXHIBIT 5: Floodplain Location (FIRM)



W MACARTHUR RD

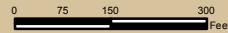
25.5 Acres

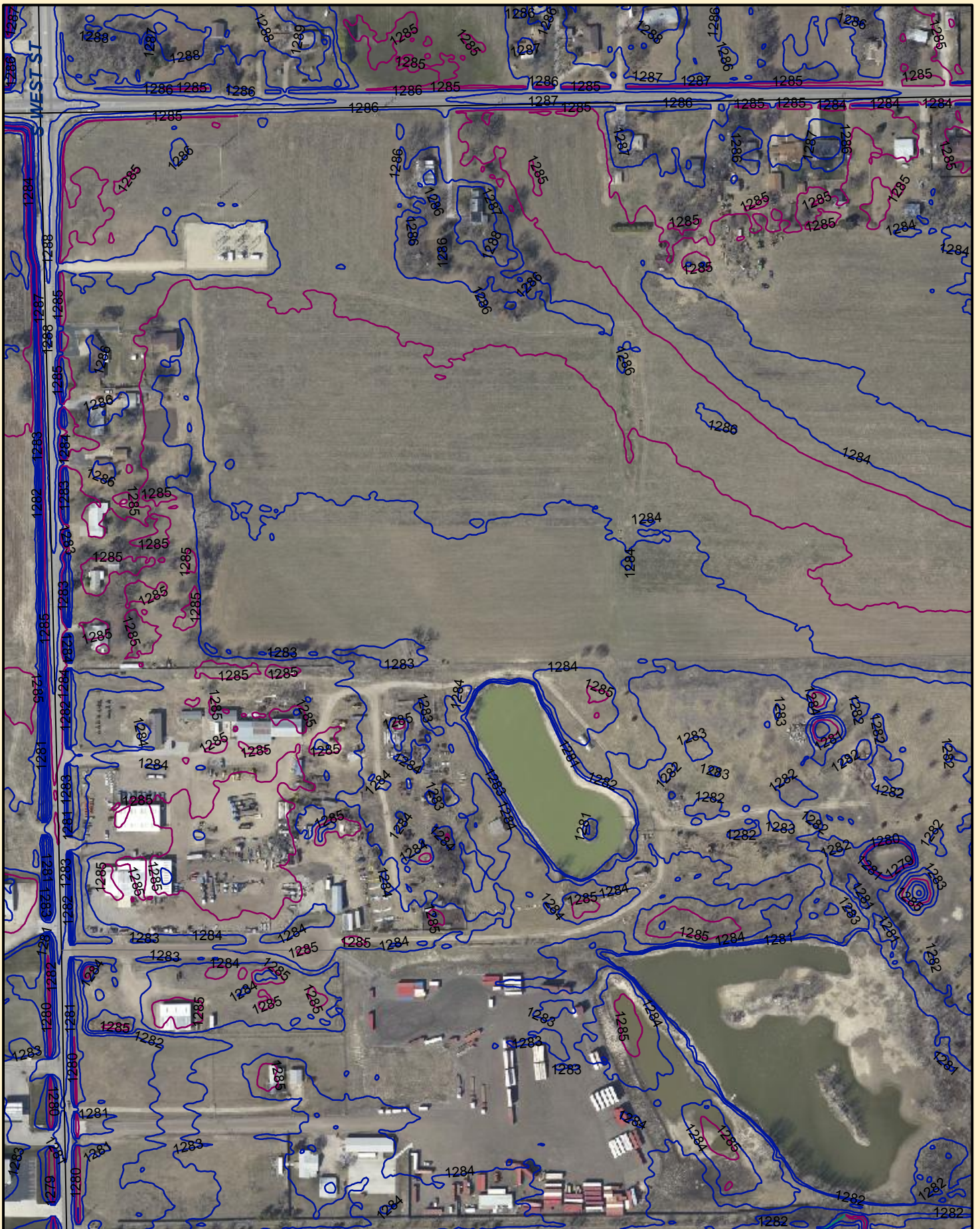
W 42ND ST S

S WEST ST

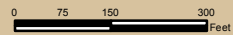


DULING INDUSTRIAL 3rd



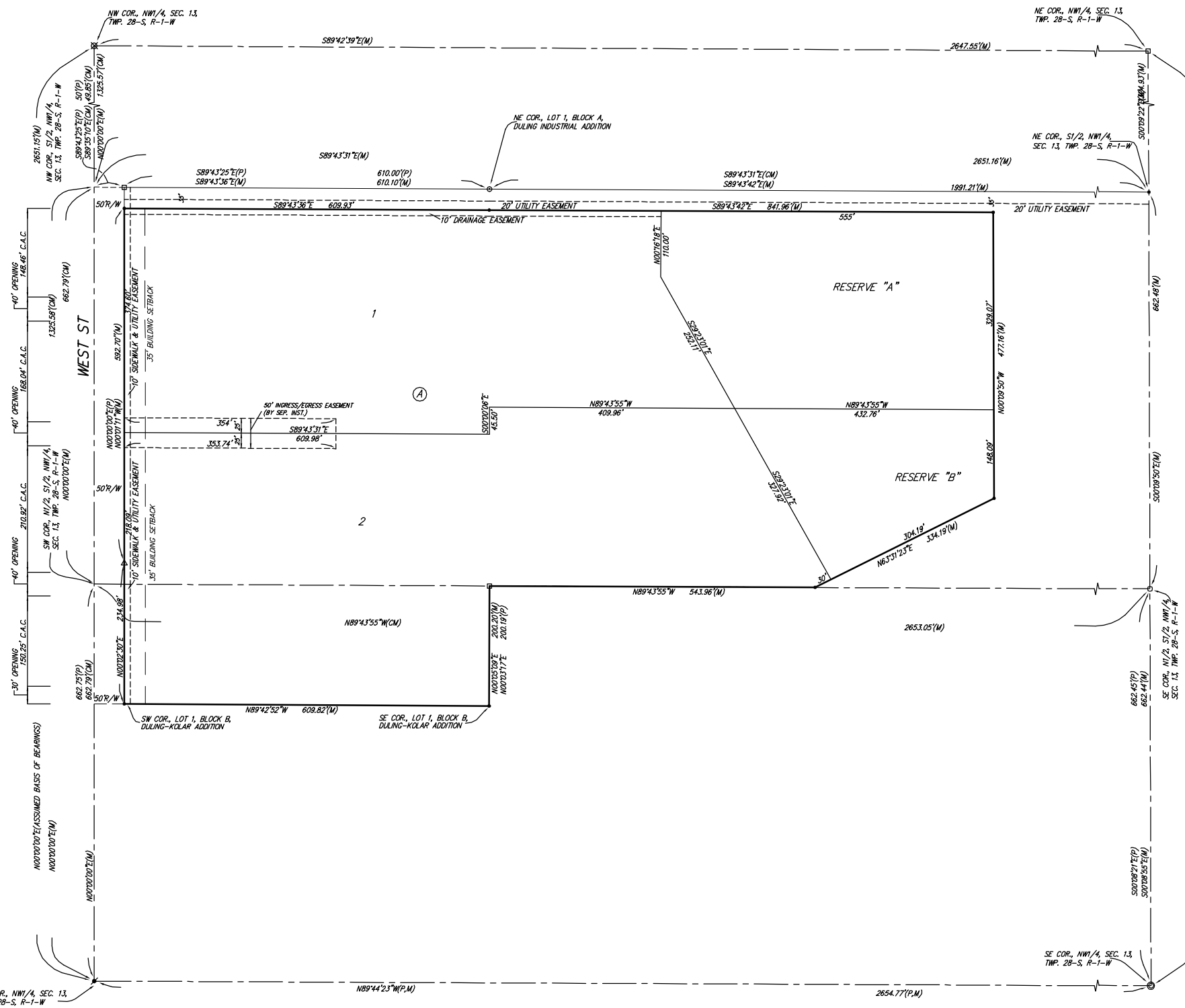


DULING INDUSTRIAL 3rd



DULING INDUSTRIAL 3RD ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS



State of Kansas) SS
 Sedgwick County) We, Baughman Company, P.A., Surveyors in
 aforesaid county and state do hereby certify that we have surveyed and
 platted "DULING INDUSTRIAL 3RD ADDITION", Wichita, Sedgwick County,
 Kansas and that the accompanying plat is a true and correct exhibit of
 the property surveyed, described as being a replat of Lot 1, Block A,
 Duling Industrial Addition, Sedgwick County, Kansas, except the north
 35.00 feet of said Lot 1, together with all of Lot 1, Block A and Lot 1,
 Block B, together with all of 42nd St. S., all as platted or dedicated in
 Duling-Kolar Addition to Sedgwick County, Kansas, together with that part
 of the North Half of the South Half of the Northwest Quarter of Section
 13, Township 28 South, Range 1 West of the Sixth Principal Meridian,
 Sedgwick County, Kansas described as follows: Commencing at the
 southeast corner of the North Half of the South Half of said Northwest
 Quarter, said southeast corner also being the northeast corner of Lot 1,
 Block A, Lange Addition, Wichita, Sedgwick County, Kansas; thence
 N89°43'56"W along the south line of the North Half of the South Half of
 said Northwest Quarter, and along the north line of said Lot 1, 1449.08
 feet for a point of beginning; thence N63°31'23"E, 334.19 feet; thence
 N00°09'50"W parallel with the east line of the North Half of the South
 Half of said Northwest Quarter, 512.16 feet to a point on the north line
 of the North Half of the South Half of said Northwest Quarter, said point
 being 1149.51 feet westerly of the northeast corner of the North Half of
 the South Half of said Northwest Quarter; thence N89°43'42"W along the
 north line of the North Half of the South Half of said Northwest Quarter,
 841.70 feet to the northeast corner of Lot 1, Block A, in said Duling
 Industrial Addition; thence S00°00'00"E along the east line of Lot 1, Block
 A, in said Duling Industrial Addition, along the east line of Lot 1, Block A,
 Duling-Kolar Addition to Sedgwick County, Kansas, and along the east line
 of 42nd Street South as dedicated in said Duling-Kolar Addition, 662.69
 feet to the intersection with the centerline of said 42nd Street South,
 said intersection being a point on the south line of the North Half of the
 South Half of said Northwest Quarter, said intersection also being the
 northwest corner of 42nd Street South as dedicated in said Lange
 Addition; thence S89°43'56"E along the north line of 42nd Street South as
 dedicated in said Lange Addition, along the north line of Lot 1, Block A,
 in said Lange Addition, and along the south line of the North Half of the
 South Half of said Northwest Quarter, 544.02 feet to the point of
 beginning, EXCEPT the north 35.00 feet of the above described tract.

Existing public easements and dedications
 being vacated by virtue of K.S.A. 12-512b, as amended.
 Baughman Company, P.A.

Michael G. Canrey, Surveyor

Know all men by these presents that we,
 the undersigned, have caused the land in the surveyors certificate to be
 platted into Lots and Block, to be known as "DULING INDUSTRIAL 3RD
 ADDITION", Wichita, Sedgwick County, Kansas. The utility easements are
 hereby granted as indicated for the construction and maintenance of all
 public utilities. The drainage easement is hereby granted as indicated for
 drainage purposes. The sidewalk and utility easement is hereby granted
 as indicated for construction and maintenance of a public sidewalk and for
 the construction and maintenance of all public utilities. Reserves "A" and
 "B" are hereby reserved for open space, lakes, landscaping, outdoor
 equipment and miscellaneous storage, and drainage purposes. Reserve "A"
 shall be owned and maintained by the owner of Lot 1, Block A. Reserve
 "B" shall be owned and maintained by the owner of Lot 2, Block A.
 Access controls shall be as depicted on the face of the plat and are
 hereby granted to the City of Wichita, Kansas. The permitted opening
 locations shall be as determined by the City Engineer of the City of
 Wichita, Kansas. The Minimum Building Pad Elevations for the lowest
 opening to the structures shall be as indicated on the face of the plat.

Duling Family Investments, LLC
 a Kansas limited liability company

Robert J. Duling, Manager
 John T. Duling, Manager
 Raymond E. Duling Revocable Trust

Robert J. Duling, Co-Trustee
 John T. Duling, Co-Trustee

State of Kansas) SS
 Sedgwick County) The foregoing instrument acknowledged before
 me, this day of 2013, by Robert J. Duling and John T.
 Duling, Managers of the Duling Family Investments, LLC, a Kansas limited
 liability company, on behalf of the limited liability company.

This plat of "DULING INDUSTRIAL 3RD
 ADDITION", Wichita, Sedgwick County, Kansas has been submitted to and
 approved by the Wichita-Sedgwick County Metropolitan Area Planning
 Commission, Wichita, Kansas.
 Dated this day of 2013.
 Wichita-Sedgwick County Metropolitan Area Planning Commission

David Dennis, Chair
 John L. Schlegel, Secretary

This plat approved and all dedications
 shown hereon accepted by the City Council of the City of Wichita,
 Kansas, this day of 2013.

Carl Brewer, Mayor
 Karen Sublett, City Clerk

Reviewed in accordance with K.S.A. 58-2005
 on this day of 2013.

Tricia L. Robella, L.S. #1246
 Deputy County Surveyor
 Sedgwick County, Kansas

Entered on transfer record this day
 of 2013.

Kelly B. Arnold, County Clerk

State of Kansas) SS
 Sedgwick County) This is to certify that this plat has been
 filed for record in the office of the Register of Deeds, this day
 of 2013 at o'clock M, and is duly recorded.

Bill Meek, Register of Deeds

Tonya Buckingham, Deputy

State of Kansas) SS
 Sedgwick County) The foregoing instrument acknowledged before
 me, this day of 2013, by Robert J. Duling and John T.
 Duling, Co-Trustees of the Raymond E. Duling Revocable Trust, on behalf
 of the Trust.

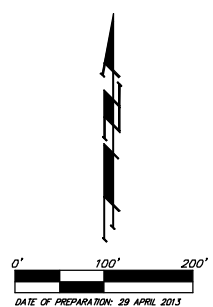
Notary Public

My App't. Exp. _____

DULING INDUSTRIAL 3RD ADDITION

29 APRIL 2013
 Baughman Company, P.A.
 315 E 18th St., Wichita, KS 67211 P 316-262-3271 F 316-262-0149
 BENCHMARKING | SURVEYING | PLANNING | LANDSCAPE ARCHITECTURE

NOTE:
 A drainage plan has been developed for this subdivision and is on file with
 the City of Wichita, Kansas. Drainage intent shall remain as depicted or as
 modified with the approval of the City Engineer of the City of Wichita,
 Kansas. No obstructions which impede the flow of this drainage plan shall
 be allowed.



- = #4 REBAR W/ "BAUGHMAN" (SET)
 - = 3/4" IRON PIPE (FOUND)
 - = 1/2" IRON PIPE (FOUND)
 - △ = 3/4" IRON PIPE W/ "WIDEHRING" CAP (FOUND)
 - ⊙ = #4 REBAR W/ "MKEC" (FOUND)
 - ▲ = #5 REBAR (FOUND)
 - ⊗ = 1-1/4" IRON PIPE IN THIMBLE (FOUND)
- (M) = MEASURED
 (P) = PLATTED
 (C) = CALCULATED
 (CM) = CALCULATED PER MEASURED INFO.
 (CP) = CALCULATED PER PLATTED INFO.
 (CD) = CALCULATED PER DESCRIBED INFO.

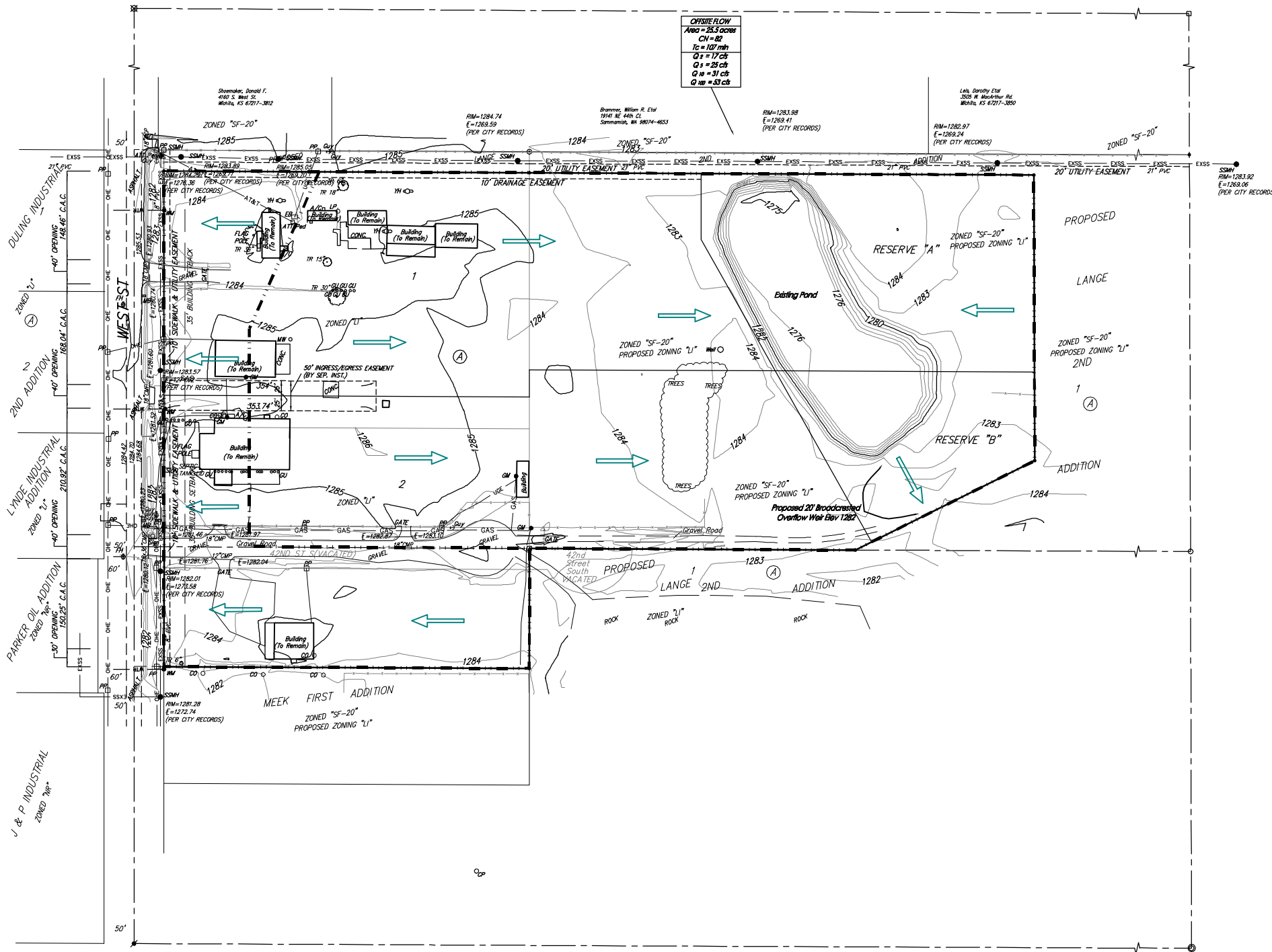
MINIMUM BUILDING PAD ELEVATIONS FOR LOWEST OPENING TO THE STRUCTURES		
LOT	BLOCK	ELEVATION
1,2	A	1283.0

BENCHMARK:
 COW BENCHMARK, DISC. NW CORNER LIFT STATION
 53' NE OF W 1/4 COR SEC 13 T-28-S R1W
 ELEVATION = 1282.52 NGVD88

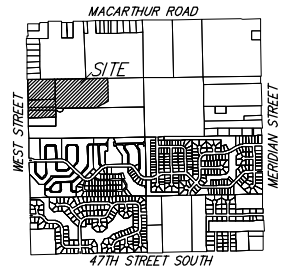
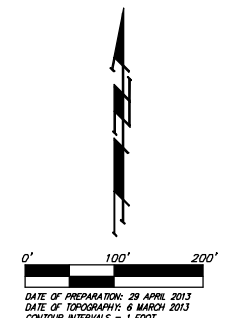
DRAINAGE PLAN

DULING INDUSTRIAL 3RD ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS



OFFSITE FLOW
 Area = 25.3 acres
 CN = 86
 Tc = 107 min
 Q 2 = 17 cfs
 Q 5 = 26 cfs
 Q 10 = 31 cfs
 Q 100 = 53 cfs



VICINITY MAP
 SEC. 13, T28S, R1W

STAGE	INFLOW	OUTFLOW	ELEVATION
5 yr	53 cfs	1.1 cfs	1282.1
10 yr	63 cfs	4.3 cfs	1282.2
100 yr	109 cfs	30 cfs	1282.9

ELEVATION	AREA (acres)
1276	61100
1277	64700
1278	68000
1279	71000
1280	74500
1281	78000
1282	81000
1283	85000

EAST SITE FLOW
 Area = 18 acres
 CN = 86
 Tc = 40 min
 Q 2 = 28 cfs
 Q 5 = 40 cfs
 Q 10 = 49 cfs
 Q 100 = 81 cfs

WEST SITE FLOW
 Area = 5.5 acres
 CN = 86
 Tc = 15 min
 Q 2 = 13 cfs
 Q 5 = 21 cfs
 Q 10 = 25 cfs
 Q 100 = 41 cfs

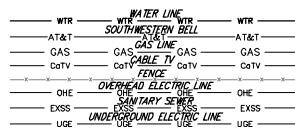
This property is currently partially developed and used primarily for equipment storage. The onsite pond has no apparent outlet or static pool elevation.

No development or land disturbance is expected with this plat at this time. Upon site development in the future, an updated drainage plan will need to be provided based on proposed conditions.

Upon development of the west portion of the site - which drains to West Street - may need to provide additional onsite detention if adding more than 1 acre of additional impervious area. Additionally, if West Street is improved in the future this site may need to add SWS at the time of site development also.

LOT	BLOCK	ELEVATION
1,2	A	1283.0

- = #4 REBAR W/ "BAUGHMAN" (SET)
 - = 3/4" IRON PIPE (FOUND)
 - = 1/2" IRON PIPE (FOUND)
 - △ = 3/4" IRON PIPE W/ "MOHRING" CAP (FOUND)
 - = #4 REBAR W/ "MKEC" (FOUND)
 - = #5 REBAR (FOUND)
 - ⊗ = 1-1/4" IRON PIPE IN THIMBLE (FOUND)
- (M) = MEASURED
 (P) = PLATTED
 (C) = CALCULATED
 (CM) = CALCULATED PER MEASURED INFO.
 (CP) = CALCULATED PER PLATTED INFO.
 (CD) = CALCULATED PER DESCRIBED INFO.



- CO ○ = Cleanout
- OP ○ = Cable TV Pedestal
- EB □ = Electric Box
- FH ⊕ = Fire Hydrant
- GM ● = Gas Meter
- GU ⊕ = Guard Post (Ballard)
- Guy ⊕ = Guy Anchor
- GV ● = Gas Valve
- LP ○ = Light Pole
- MB = Mail Box
- PP □ = Power Pole
- Sign ⊕ = Sign
- SSM ⊕ = Sanitary Sewer Manhole
- ATT Pad □ = ATT Pedestal
- TR ○ = Tree
- WWO ○ = Cased Well
- WM ⊕ = Water Meter
- WV ● = Water Valve
- TRM □ = Transformer
- YH ⊕ = Yard Hydrant (Spigot)

NOTES: There is no FEMA SFHA located on this property as of this date per FEMA FIRM Panel 485 of 700, for Wichita, Sedgwick County, Kansas; effective February 2, 2007.

DULING INDUSTRIAL 3RD ADDITION

Baughman Company, P.A.
 315 Elk St. Wichita, KS 67211 P. 316-262-7271 F. 316-262-0149
 ENGINEERING | SURVEYING | PLANNING | LANDSCAPE ARCHITECTURE

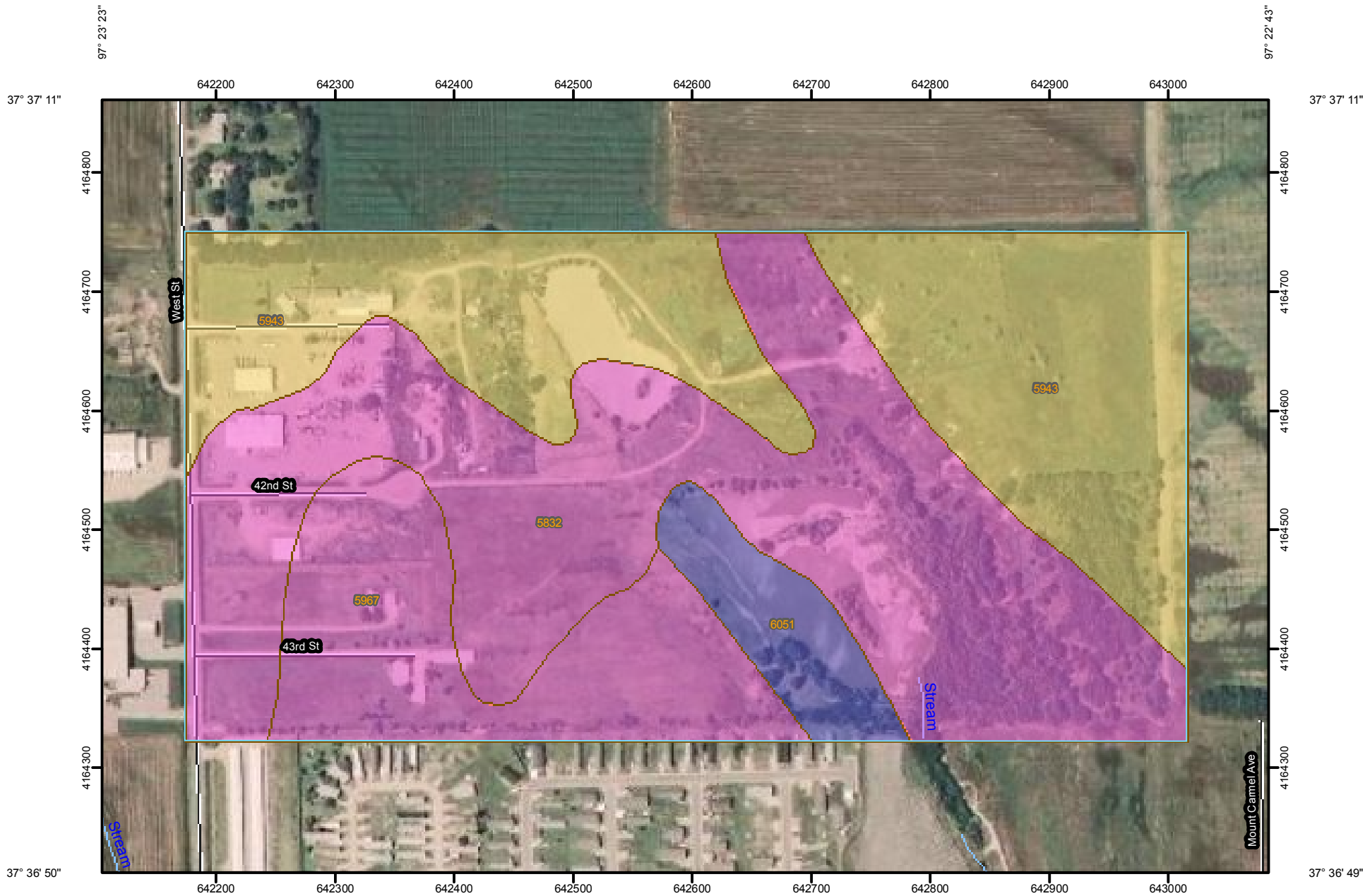
SUPPORTING CALCULATIONS

APPENDIX A: USGS Soils Survey

APPENDIX B: HydraFlow Hydrographs
- Site Flow & Pond Routing

USGS Soils Survey

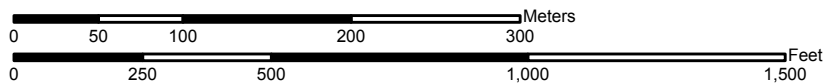
Hydrologic Soil Group—Sedgwick County, Kansas



97° 23' 23"




Map Scale: 1:4,650 if printed on A size (8.5" x 11") sheet.



97° 22' 43"

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Units

Soil Ratings

 A

 A/D


 B

 B/D

 C

 C/D


 D

 Not rated or not available

Political Features

 Cities

Water Features

 Streams and Canals


Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

MAP INFORMATION

Map Scale: 1:4,650 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: UTM Zone 14N NAD83

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

Soil Survey Area: Sedgwick County, Kansas
Survey Area Data: Version 8, Sep 20, 2012

Date(s) aerial images were photographed: 6/20/2006

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Sedgwick County, Kansas (KS173)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5832	Punkin-Taver complex, 0 to 1 percent slopes	D	38.3	43.1%
5943	Saltcreek and Naron fine sandy loams, 0 to 1 percent slopes	C	32.1	36.1%
5967	Tabler silty clay loam, 0 to 1 percent slopes	D	13.9	15.6%
6051	Elandco silt loam, frequently flooded	B	4.6	5.2%
Totals for Area of Interest			89.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

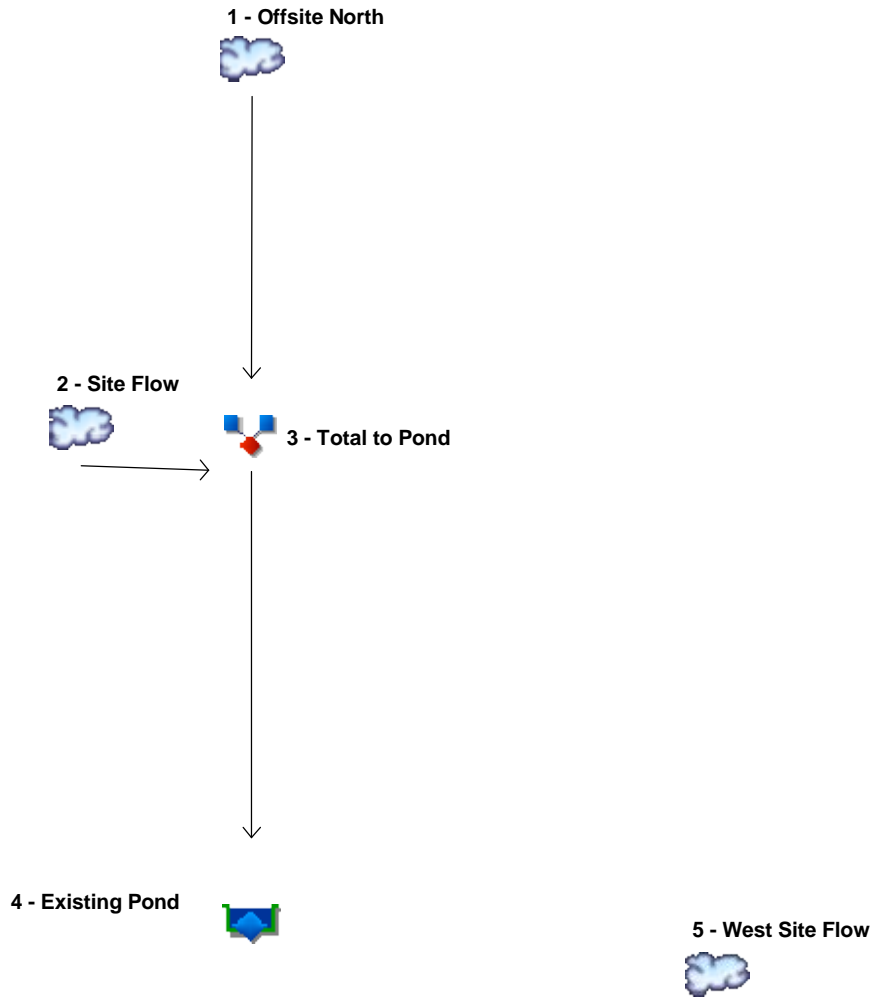
The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

HydraFlow Hydrographs

Site Flow & Pond Routing

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8



Legend

Hyd.	Origin	Description
1	SCS Runoff	Offsite North
2	SCS Runoff	Site Flow
3	Combine	Total to Pond
4	Reservoir	Existing Pond
5	SCS Runoff	West Site Flow

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	-----	11.07	16.49	1.290	24.67	30.57	38.27	45.17	52.97	Offsite North
2	SCS Runoff	-----	20.05	28.29	3.543	40.41	48.98	60.03	69.84	80.86	Site Flow
3	Combine	1, 2	25.13	36.23	3.979	52.73	64.52	79.81	93.47	108.87	Total to Pond
4	Reservoir	3	0.000	0.000	0.000	1.130	4.267	15.15	30.23	45.85	Existing Pond
5	SCS Runoff	-----	10.37	14.54	1.939	20.62	24.91	30.43	35.33	40.82	West Site Flow
Proj. file: Duling Site.gpw									Wednesday, May 1, 2013		

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	11.07	2	778	112,807	-----	-----	-----	Offsite North	
2	SCS Runoff	20.05	2	738	97,520	-----	-----	-----	Site Flow	
3	Combine	25.13	2	738	210,328	1, 2	-----	-----	Total to Pond	
4	Reservoir	0.000	2	n/a	0	3	1279.16	210,328	Existing Pond	
5	SCS Runoff	10.37	2	722	29,053	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 1 Year			Wednesday, May 1, 2013		

Hydrograph Report

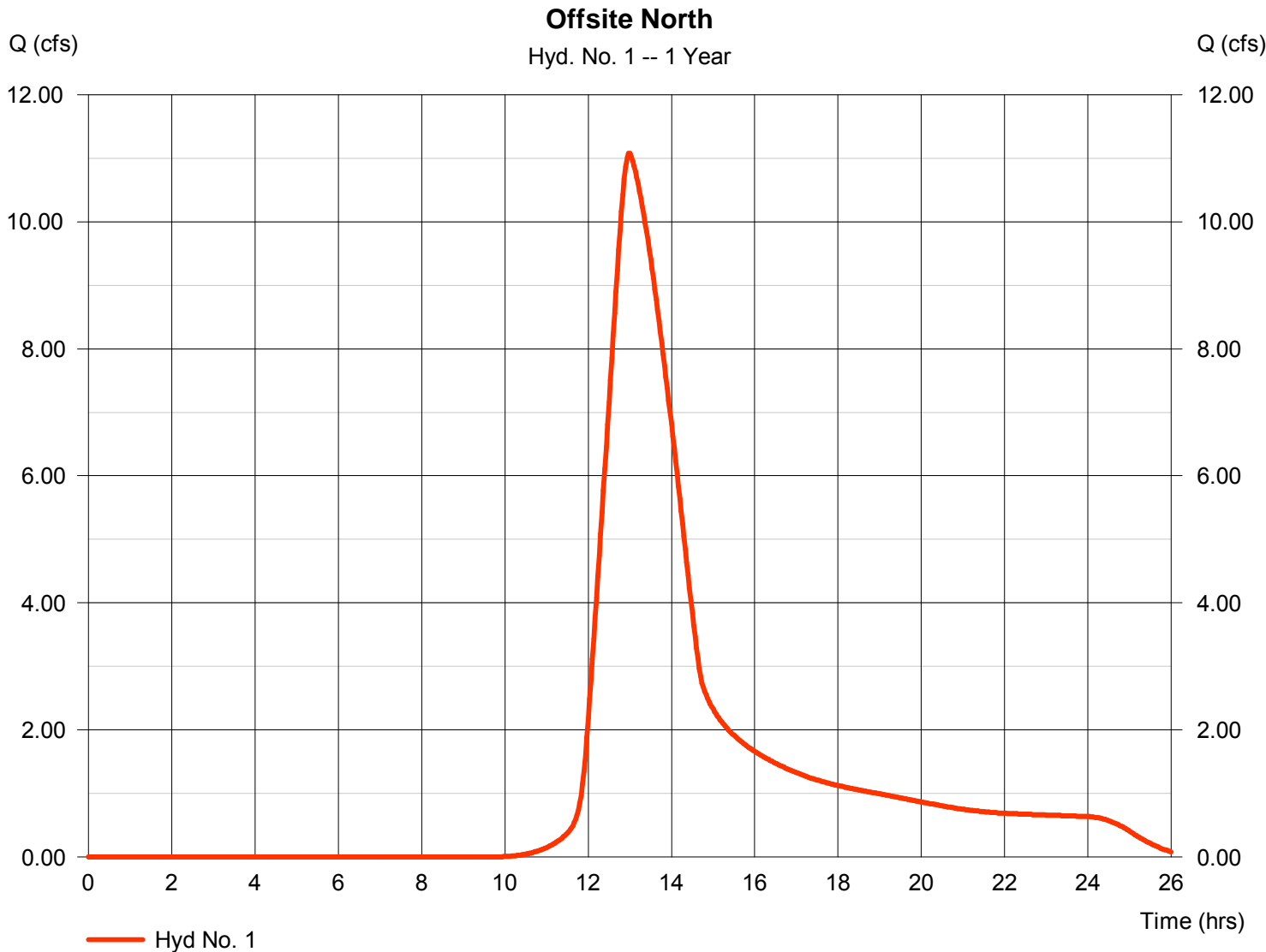
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 11.07 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 112,807 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

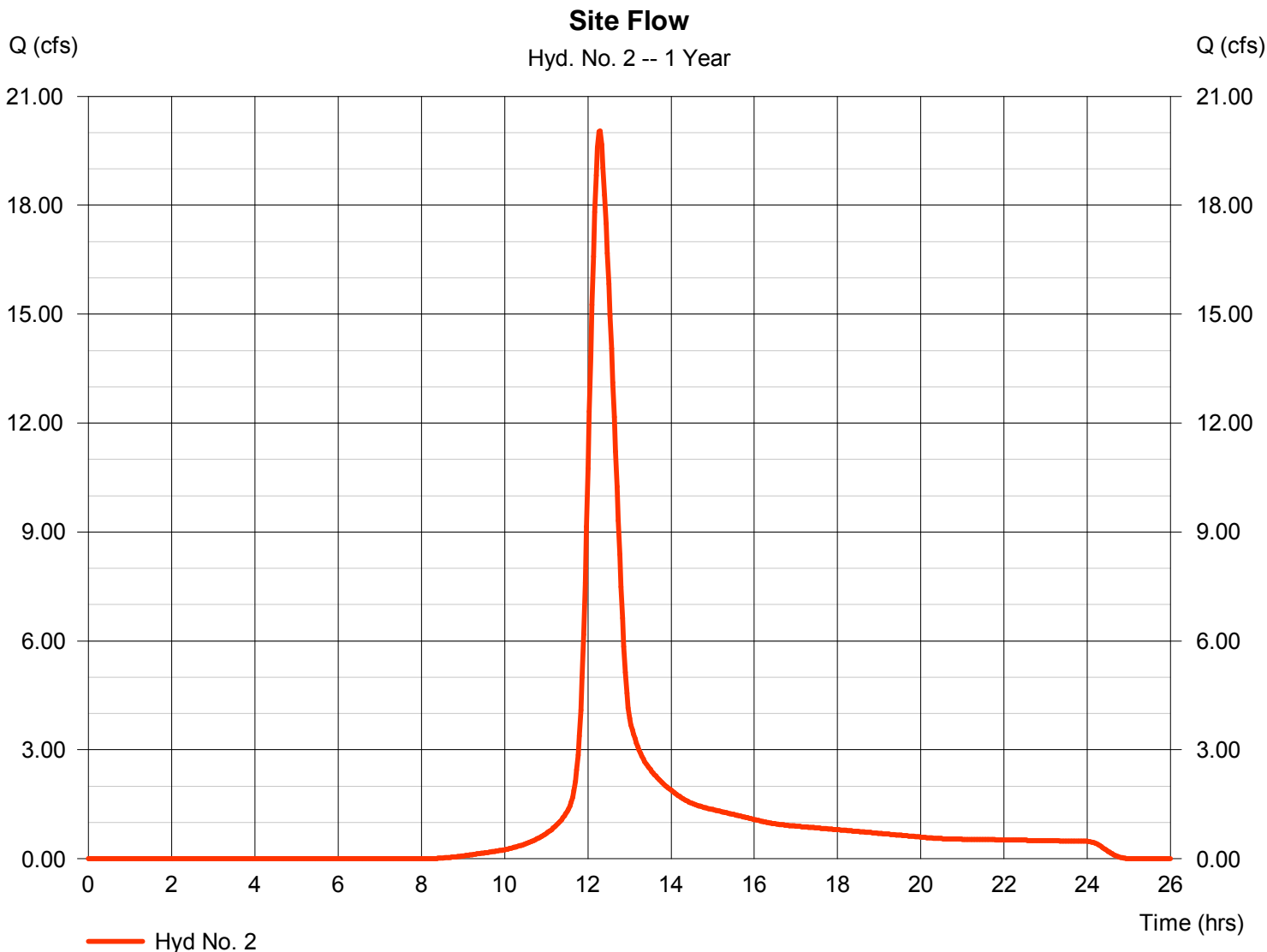
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 20.05 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 97,520 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

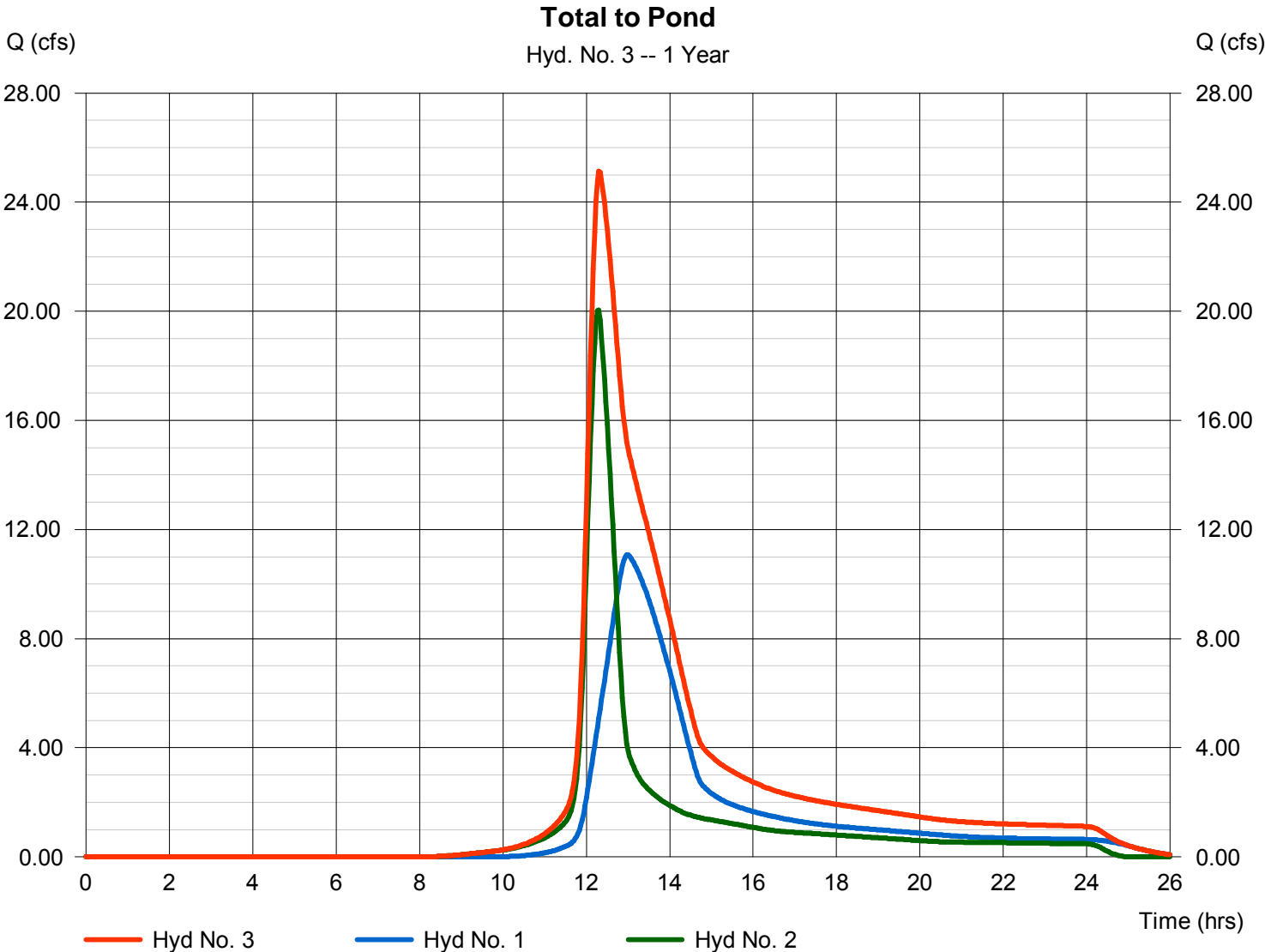
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

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

Peak discharge = 25.13 cfs
Time to peak = 12.30 hrs
Hyd. volume = 210,328 cuft
Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

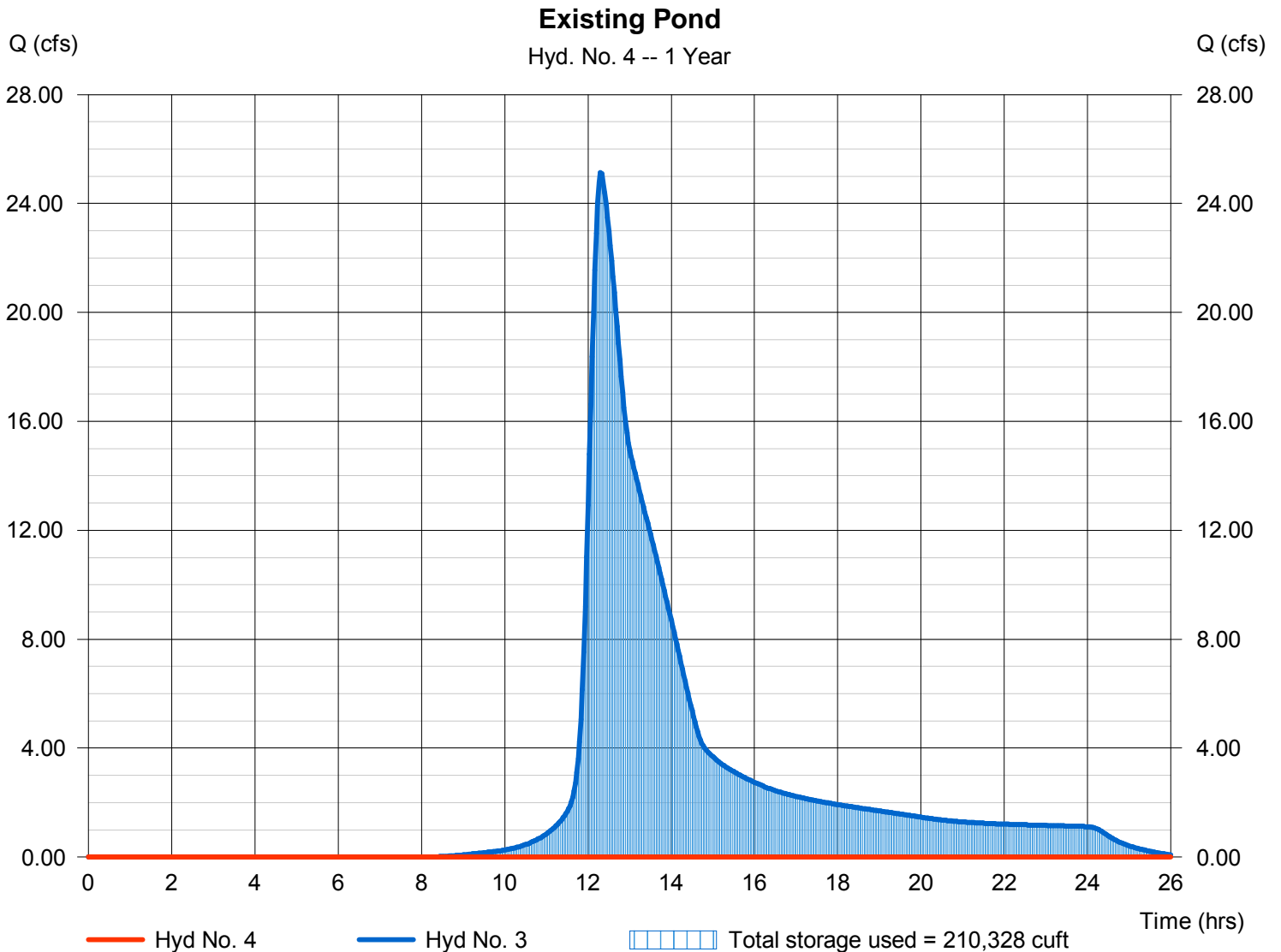
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1279.16 ft
Reservoir name	= Existing Pond	Max. Storage	= 210,328 cuft

Storage Indication method used.



Pond No. 1 - Existing Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 1276.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1276.00	61,100	0	0
1.00	1277.00	64,700	62,885	62,885
2.00	1278.00	68,000	66,336	129,222
3.00	1279.00	71,000	69,488	198,709
4.00	1280.00	74,500	72,736	271,445
5.00	1281.00	78,000	76,236	347,681
6.00	1282.00	81,000	79,487	427,168
7.00	1283.00	85,000	82,984	510,152
8.00	1284.00	87,000	85,989	596,141

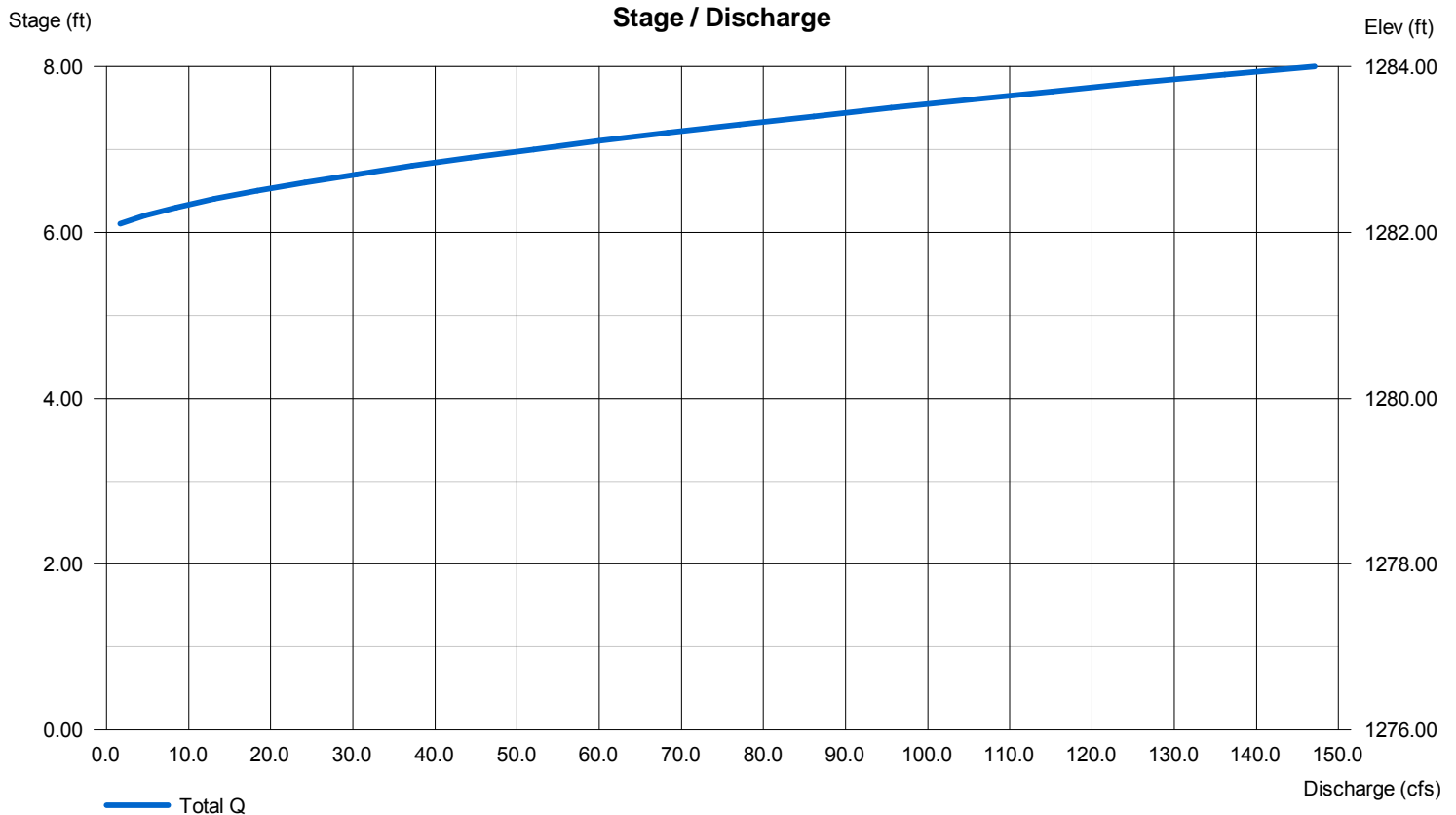
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	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)	= 20.00	0.00	0.00	0.00
Crest El. (ft)	= 1282.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by 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).



Hydrograph Report

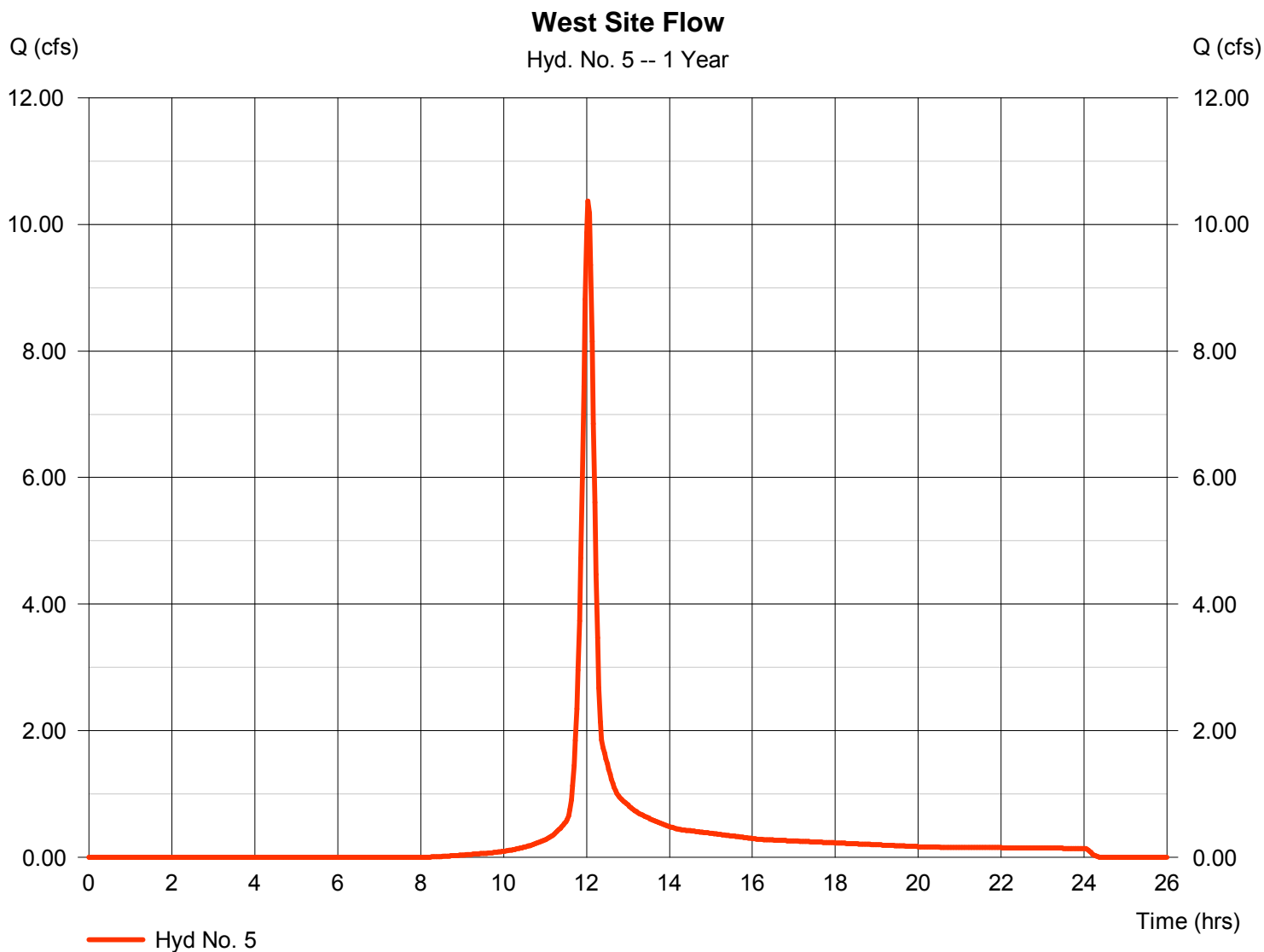
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 10.37 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 29,053 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	16.49	2	778	164,363	-----	-----	-----	Offsite North	
2	SCS Runoff	28.29	2	736	137,106	-----	-----	-----	Site Flow	
3	Combine	36.23	2	738	301,469	1, 2	-----	-----	Total to Pond	
4	Reservoir	0.000	2	n/a	0	3	1280.39	301,469	Existing Pond	
5	SCS Runoff	14.54	2	722	40,846	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 2 Year			Wednesday, May 1, 2013		

Hydrograph Report

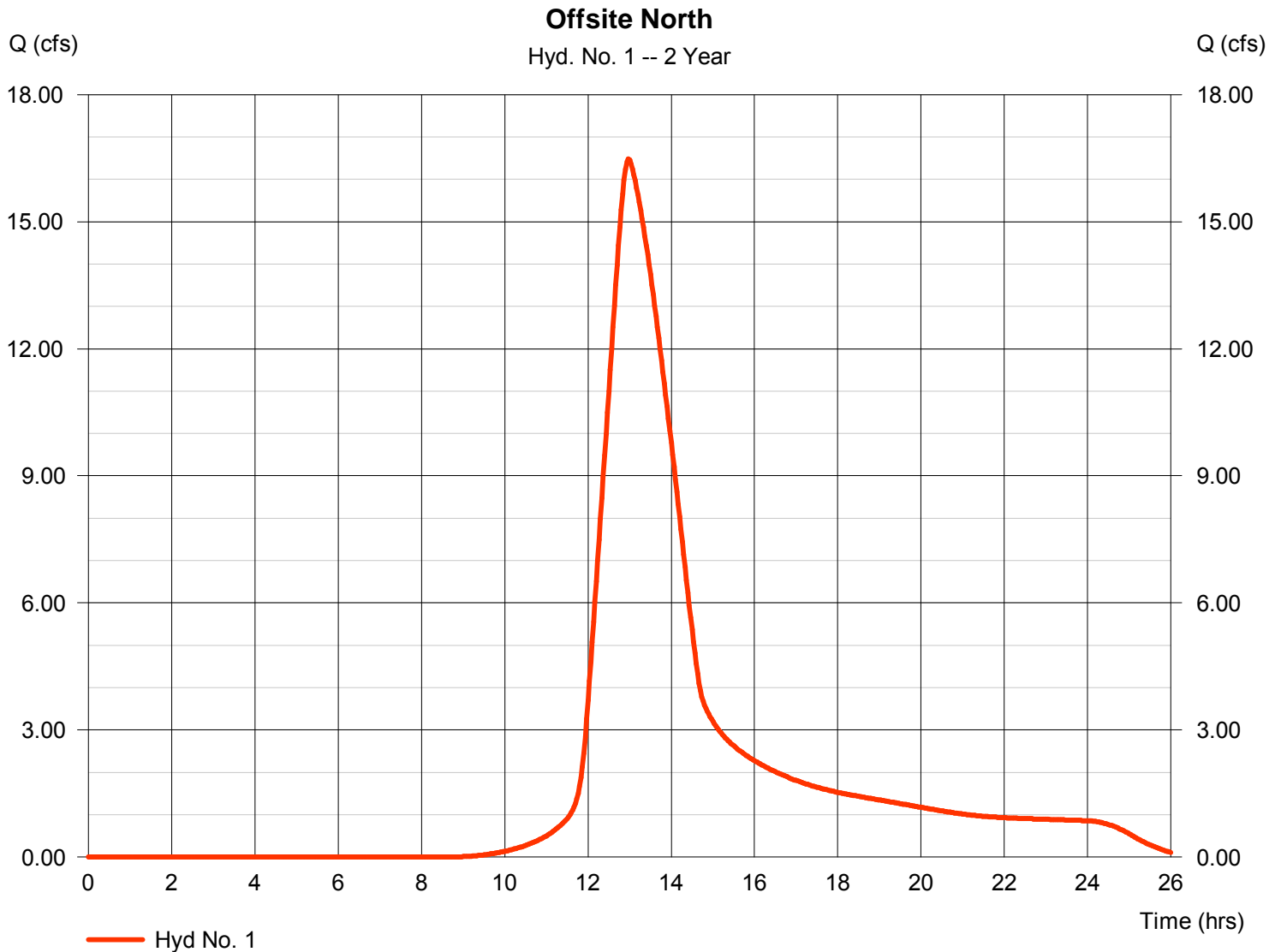
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 16.49 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 164,363 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

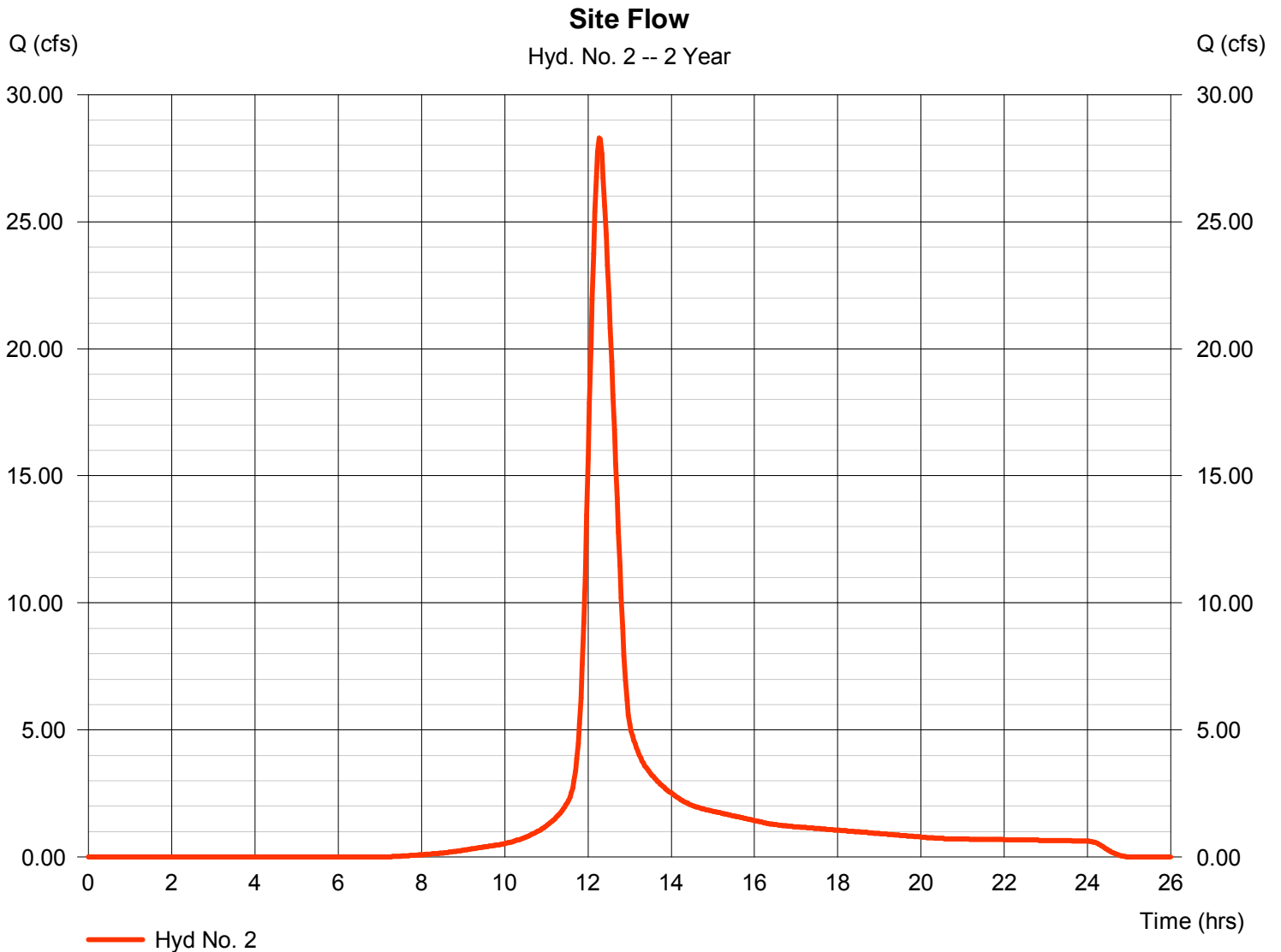
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 28.29 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 137,106 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

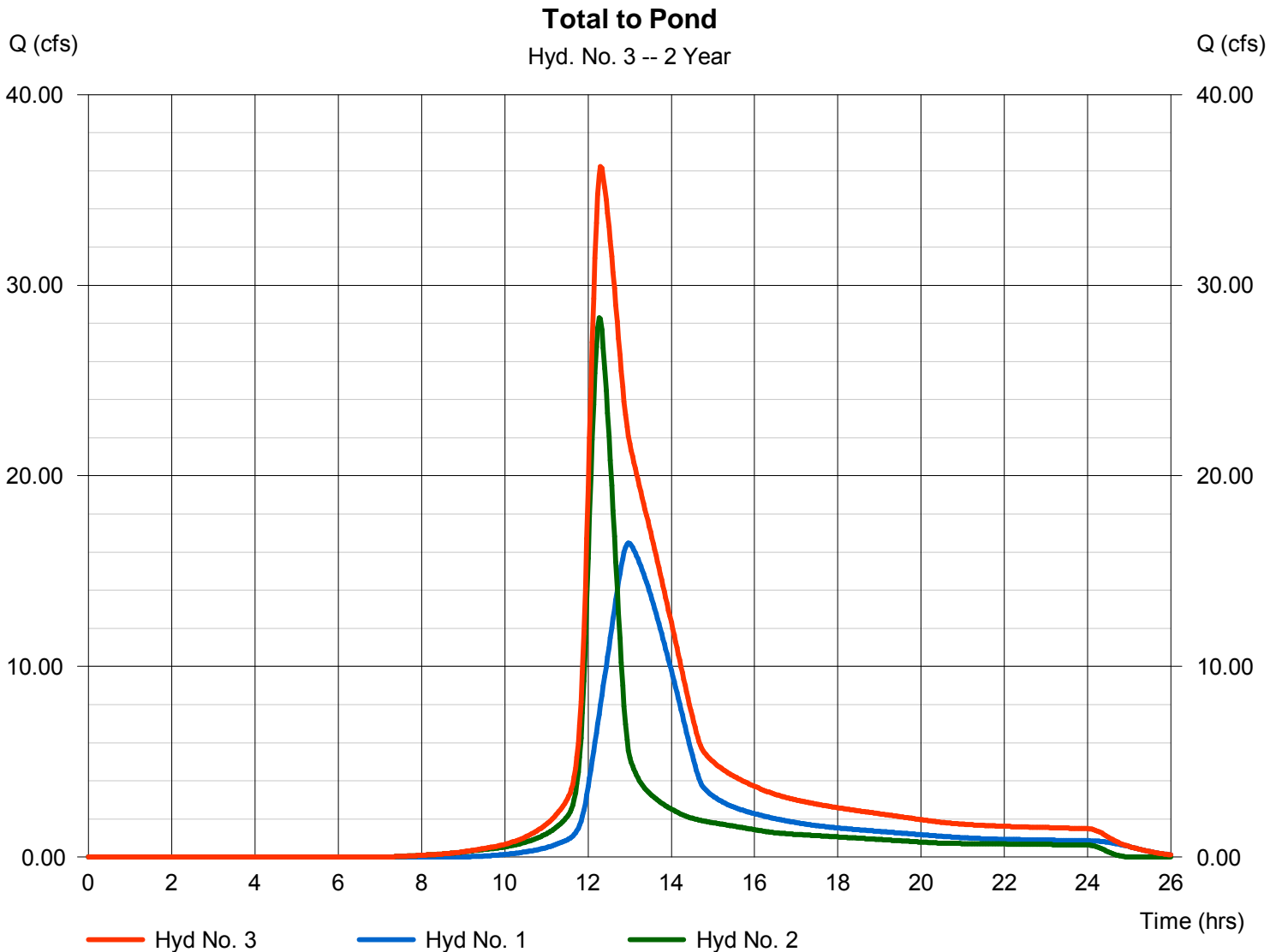
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

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

Peak discharge = 36.23 cfs
 Time to peak = 12.30 hrs
 Hyd. volume = 301,469 cuft
 Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

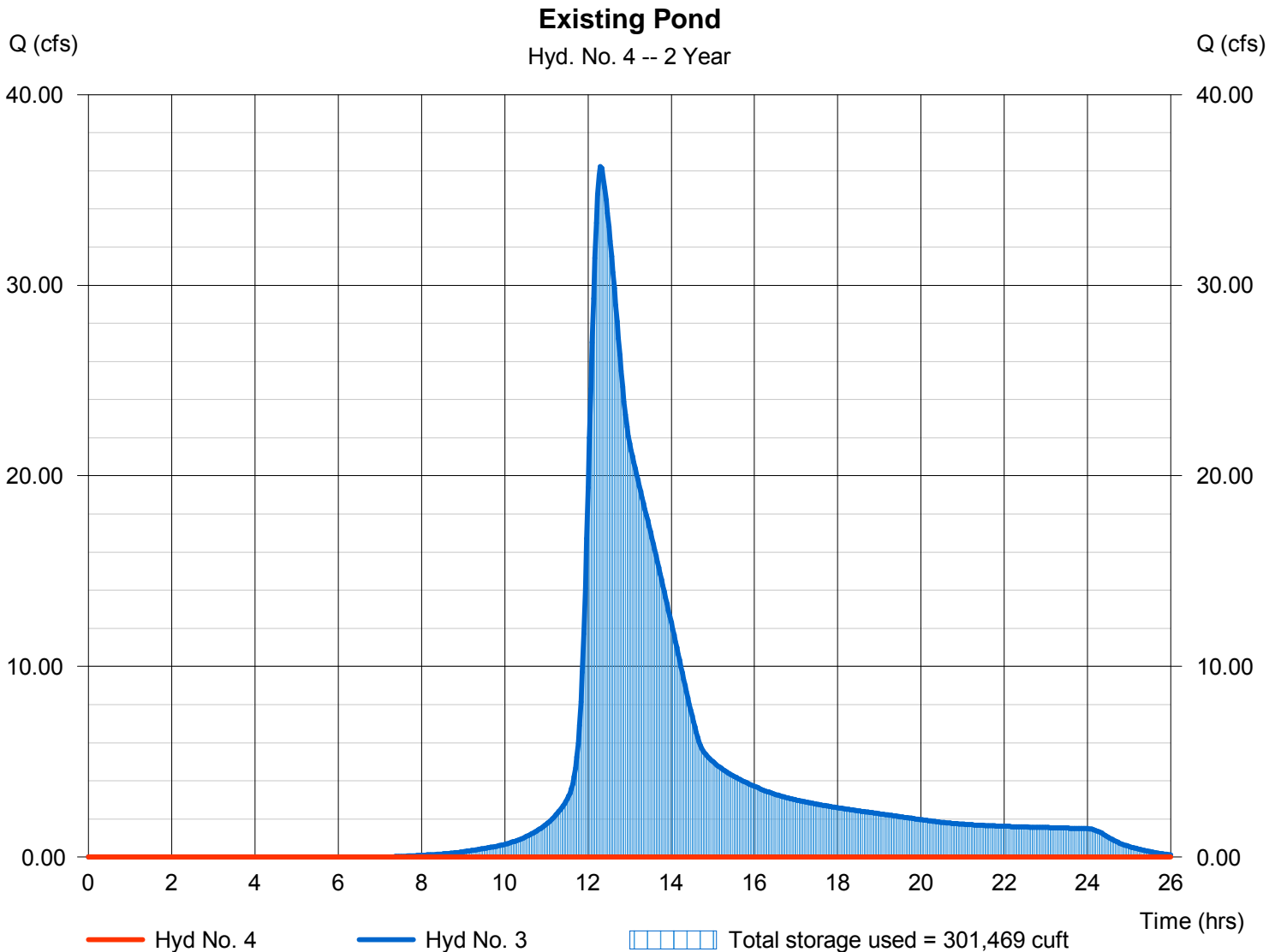
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1280.39 ft
Reservoir name	= Existing Pond	Max. Storage	= 301,469 cuft

Storage Indication method used.



Hydrograph Report

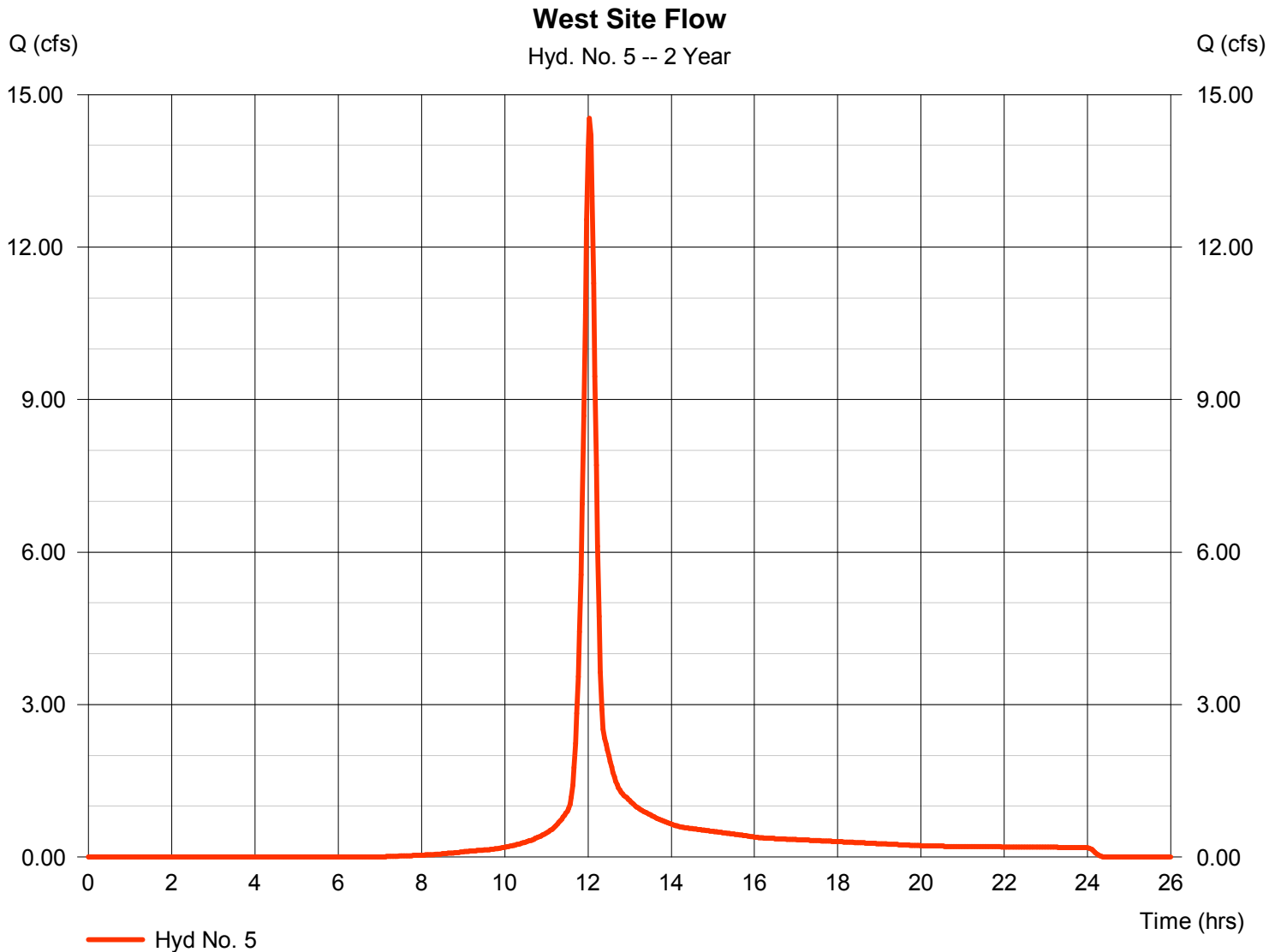
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 14.54 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 40,846 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	1.290	2	792	18,057	-----	-----	-----	Offsite North	
2	SCS Runoff	3.543	2	738	19,965	-----	-----	-----	Site Flow	
3	Combine	3.979	2	740	38,022	1, 2	-----	-----	Total to Pond	
4	Reservoir	0.000	2	n/a	0	3	1276.60	38,022	Existing Pond	
5	SCS Runoff	1.939	2	724	5,948	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 3 Year			Wednesday, May 1, 2013		

Hydrograph Report

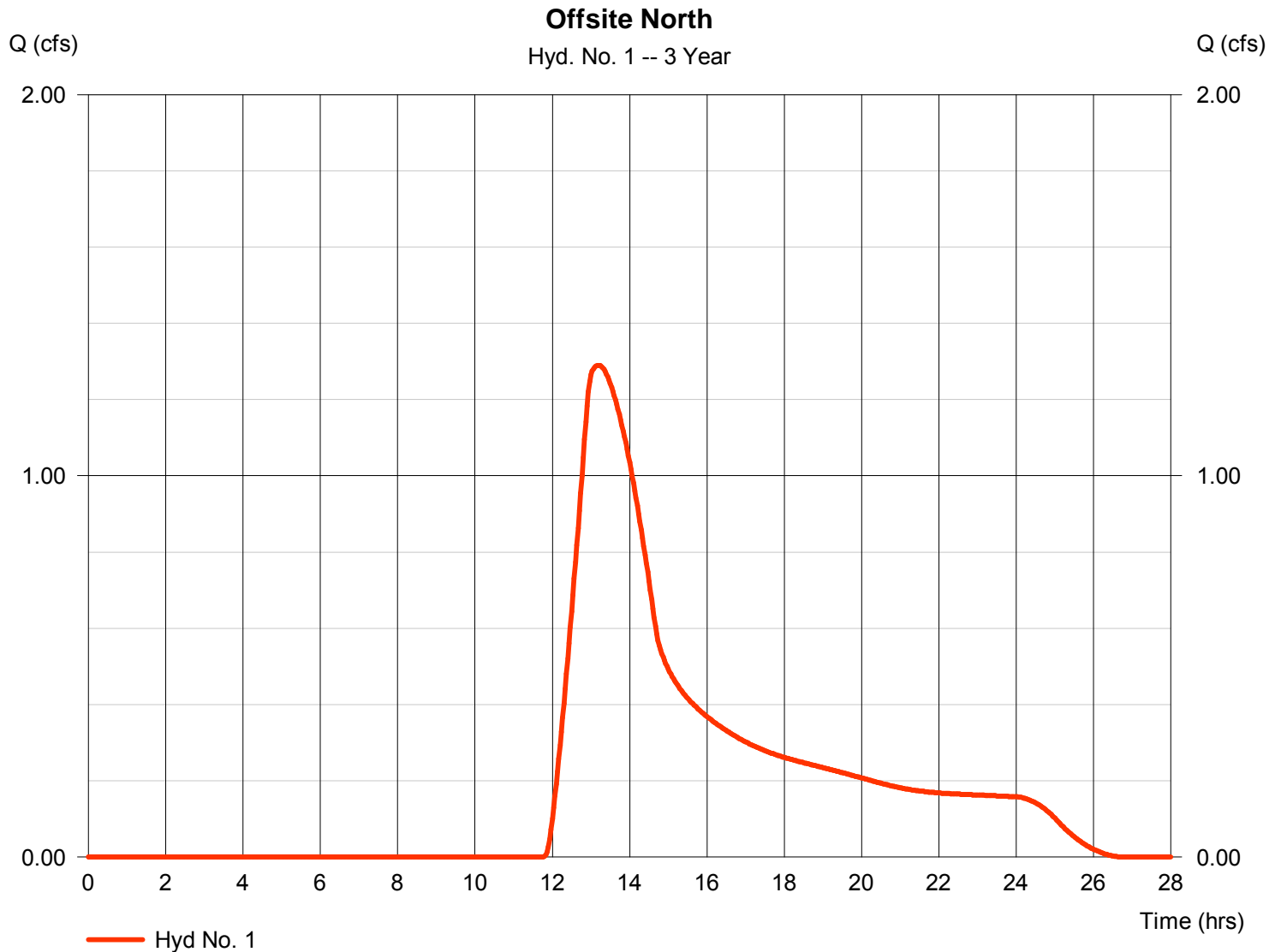
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 1.290 cfs
Storm frequency	= 3 yrs	Time to peak	= 13.20 hrs
Time interval	= 2 min	Hyd. volume	= 18,057 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

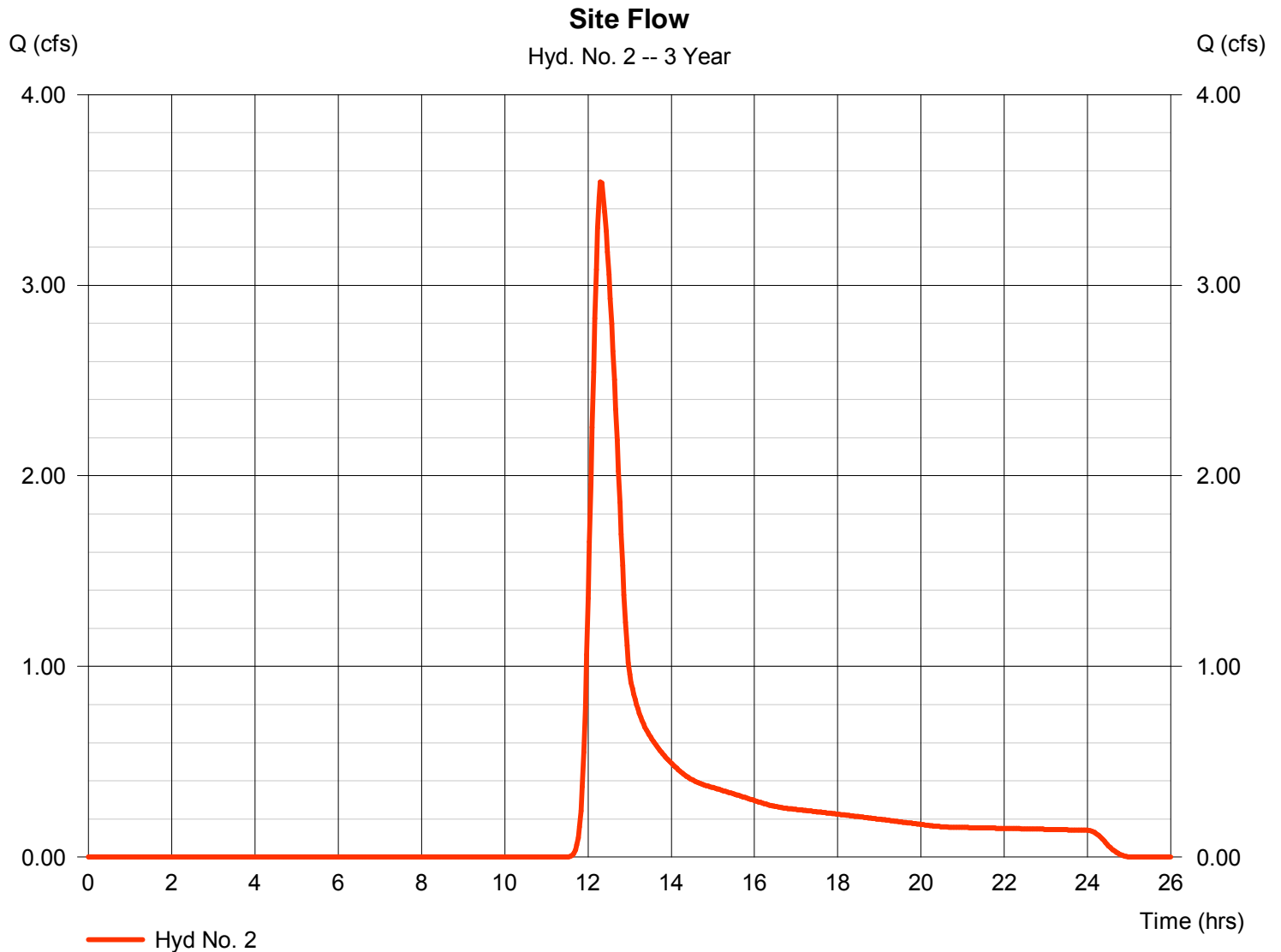
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 3.543 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 19,965 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

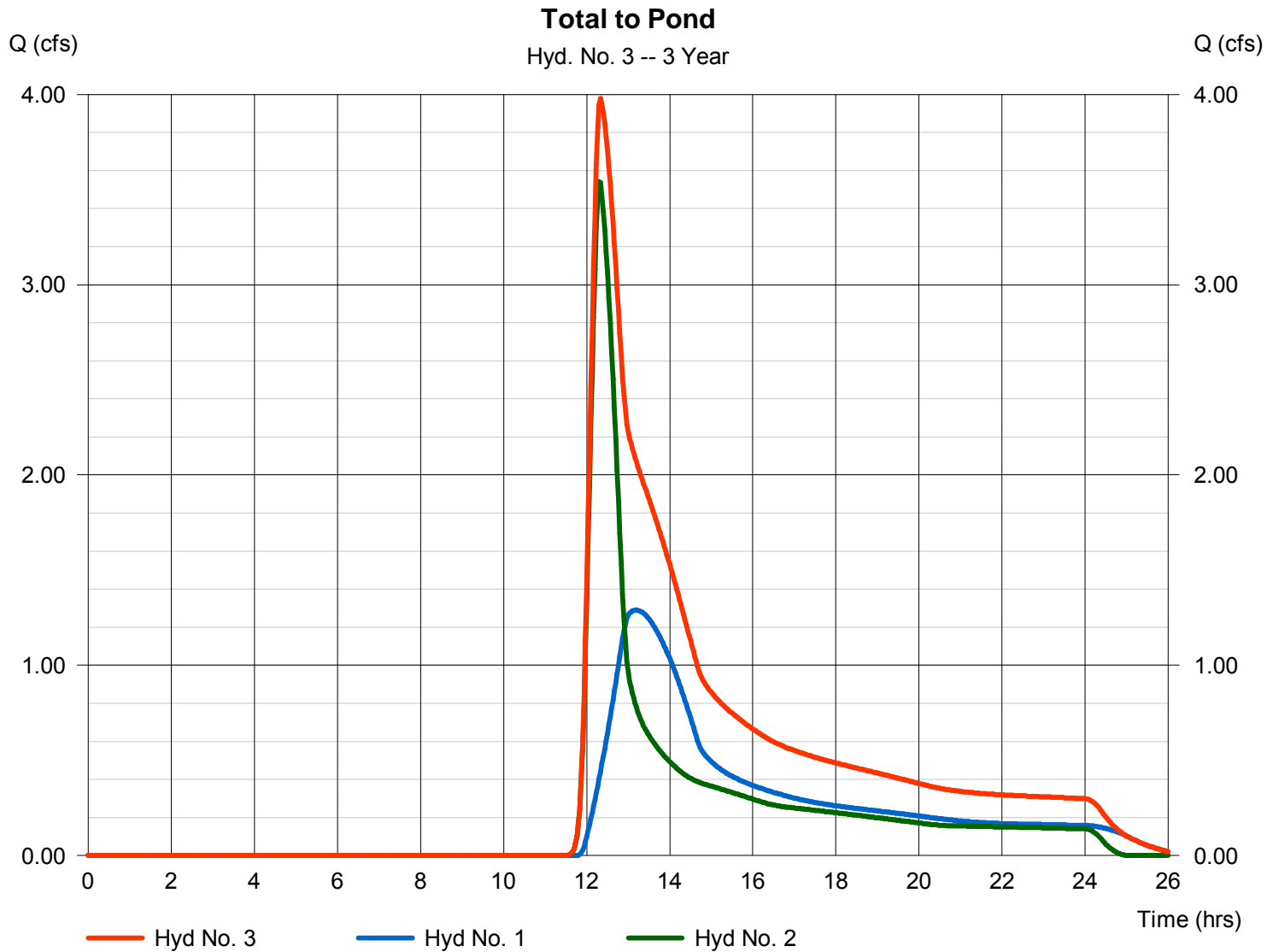
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

Hydrograph type	= Combine	Peak discharge	= 3.979 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 38,022 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

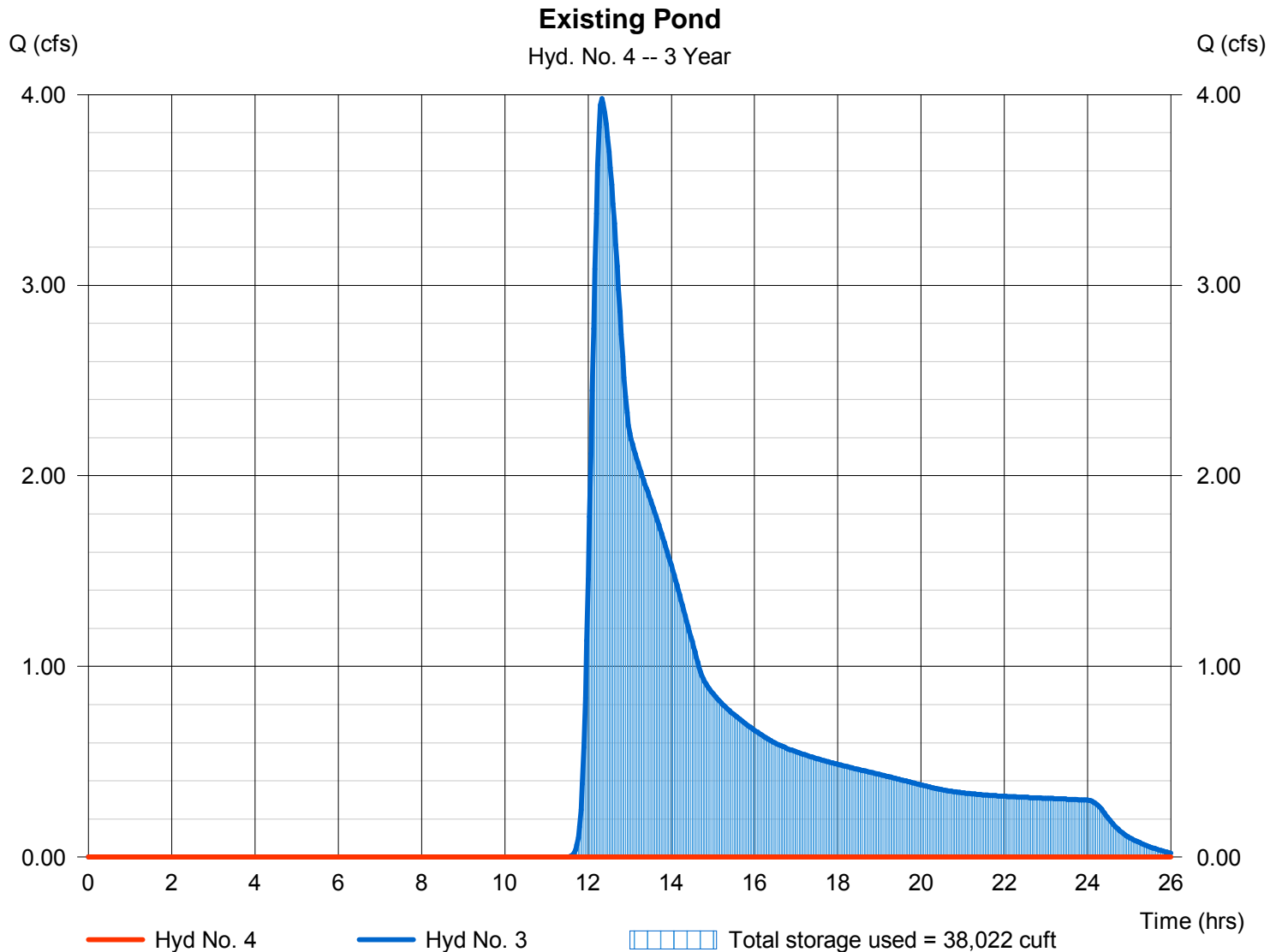
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 3 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1276.60 ft
Reservoir name	= Existing Pond	Max. Storage	= 38,022 cuft

Storage Indication method used.



Hydrograph Report

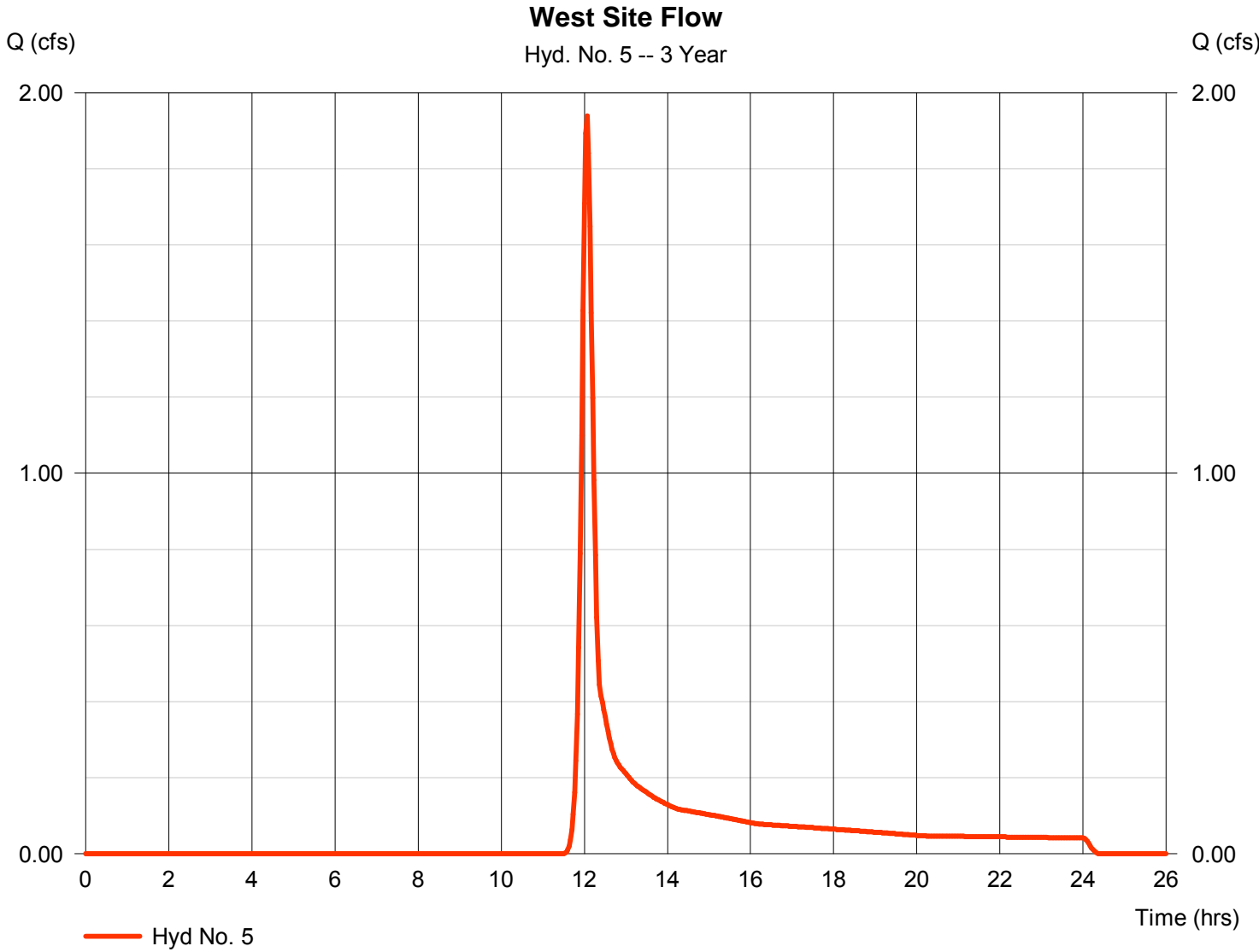
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 1.939 cfs
Storm frequency	= 3 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 5,948 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

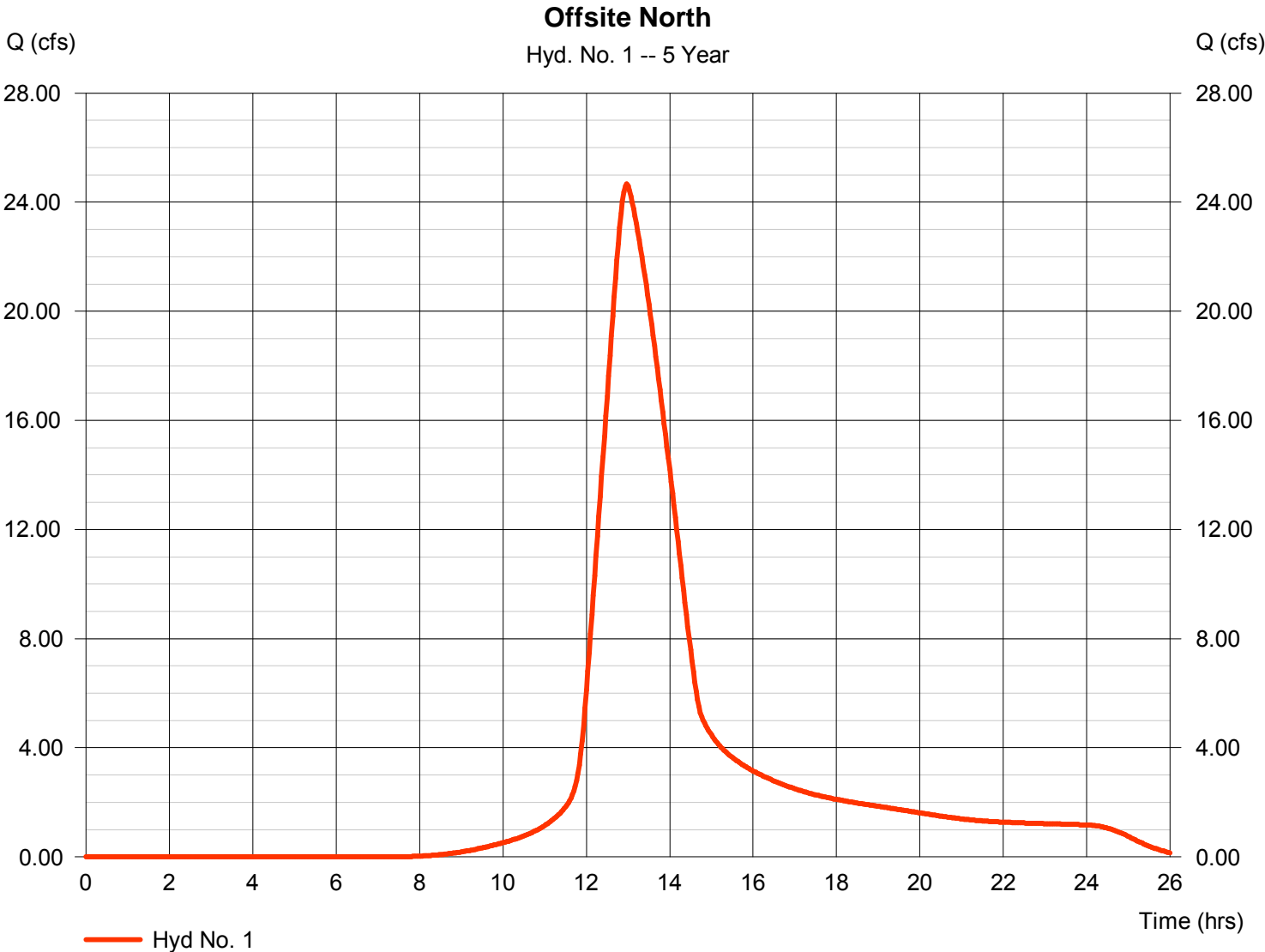
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	24.67	2	778	243,055	-----	-----	-----	Offsite North	
2	SCS Runoff	40.41	2	736	196,232	-----	-----	-----	Site Flow	
3	Combine	52.73	2	738	439,286	1, 2	-----	-----	Total to Pond	
4	Reservoir	1.130	2	1480	12,113	3	1282.07	432,872	Existing Pond	
5	SCS Runoff	20.62	2	722	58,461	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 5 Year			Wednesday, May 1, 2013		

Hydrograph Report

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 24.67 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 243,055 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

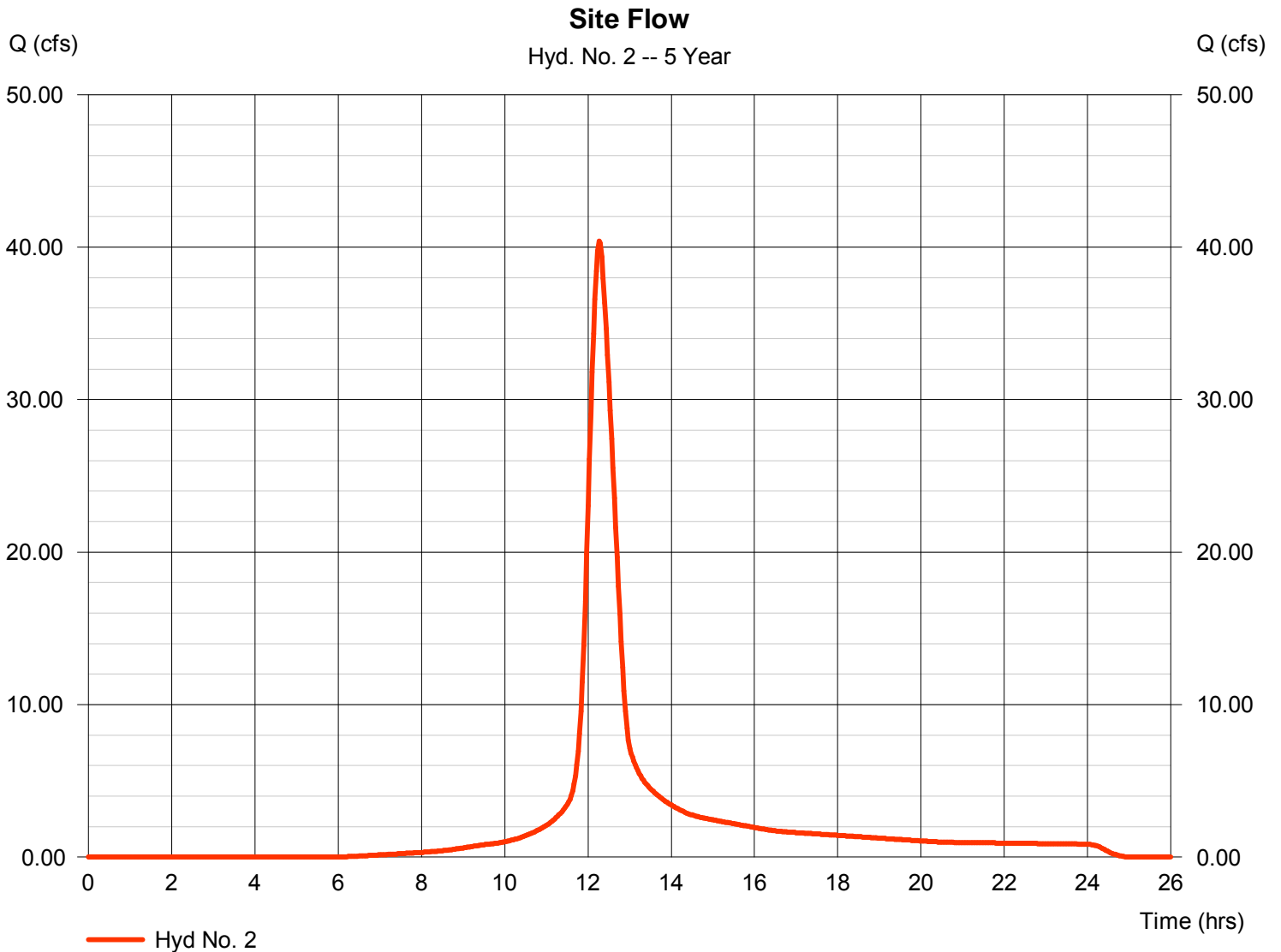
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 40.41 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 196,232 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

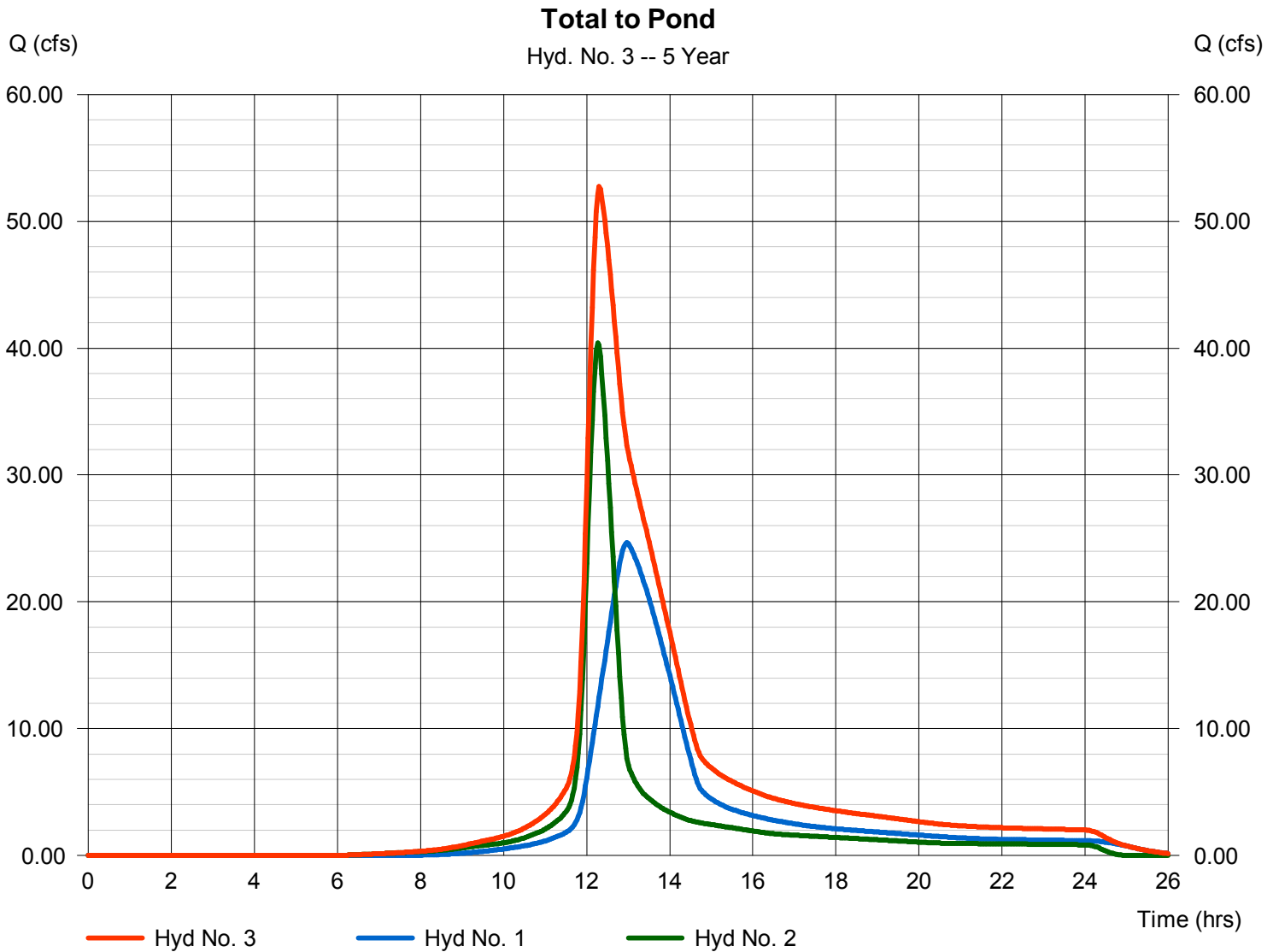
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

Hydrograph type = Combine
Storm frequency = 5 yrs
Time interval = 2 min
Inflow hyds. = 1, 2

Peak discharge = 52.73 cfs
Time to peak = 12.30 hrs
Hyd. volume = 439,286 cuft
Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

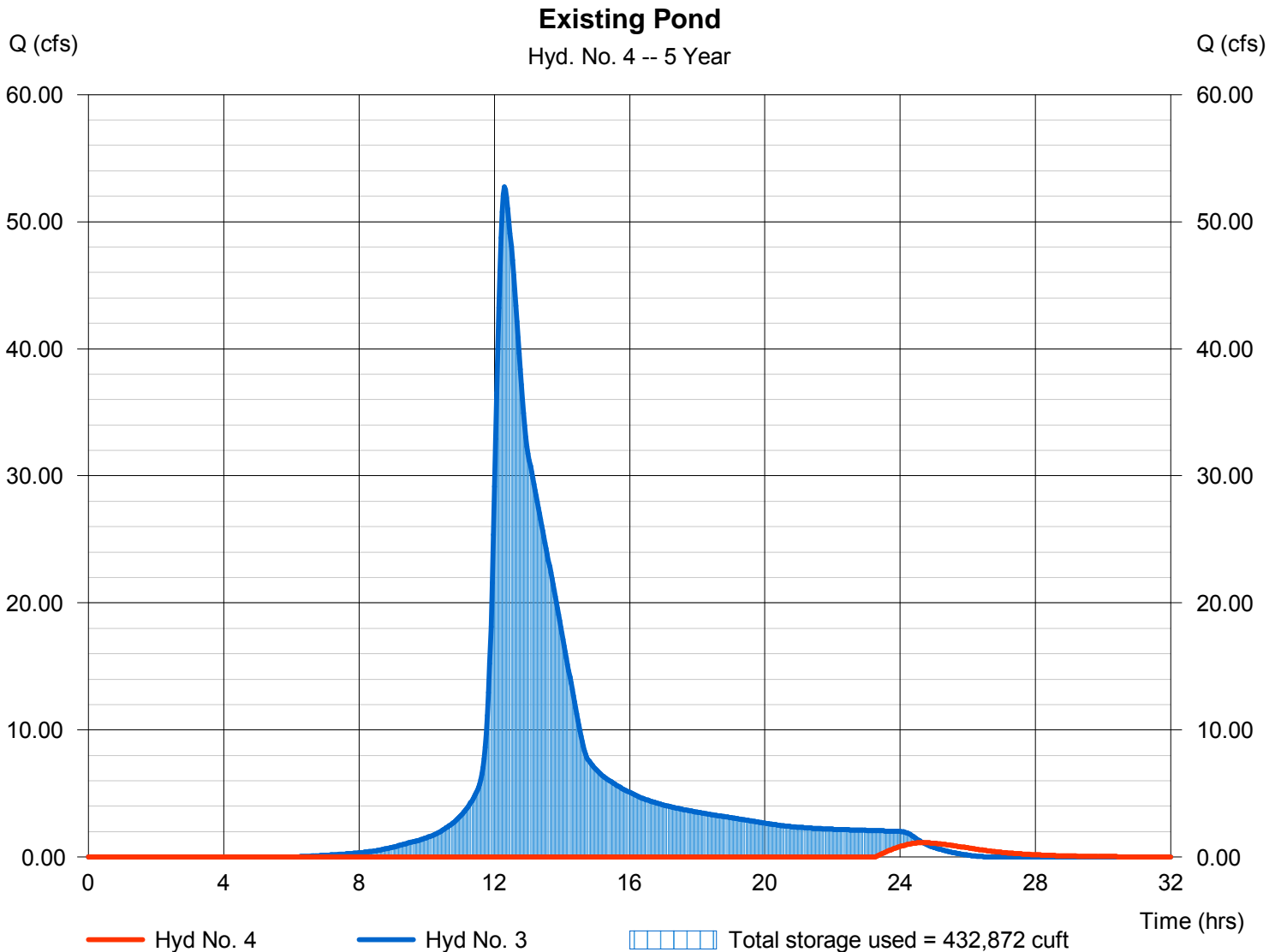
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 1.130 cfs
Storm frequency	= 5 yrs	Time to peak	= 24.67 hrs
Time interval	= 2 min	Hyd. volume	= 12,113 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1282.07 ft
Reservoir name	= Existing Pond	Max. Storage	= 432,872 cuft

Storage Indication method used.



Hydrograph Report

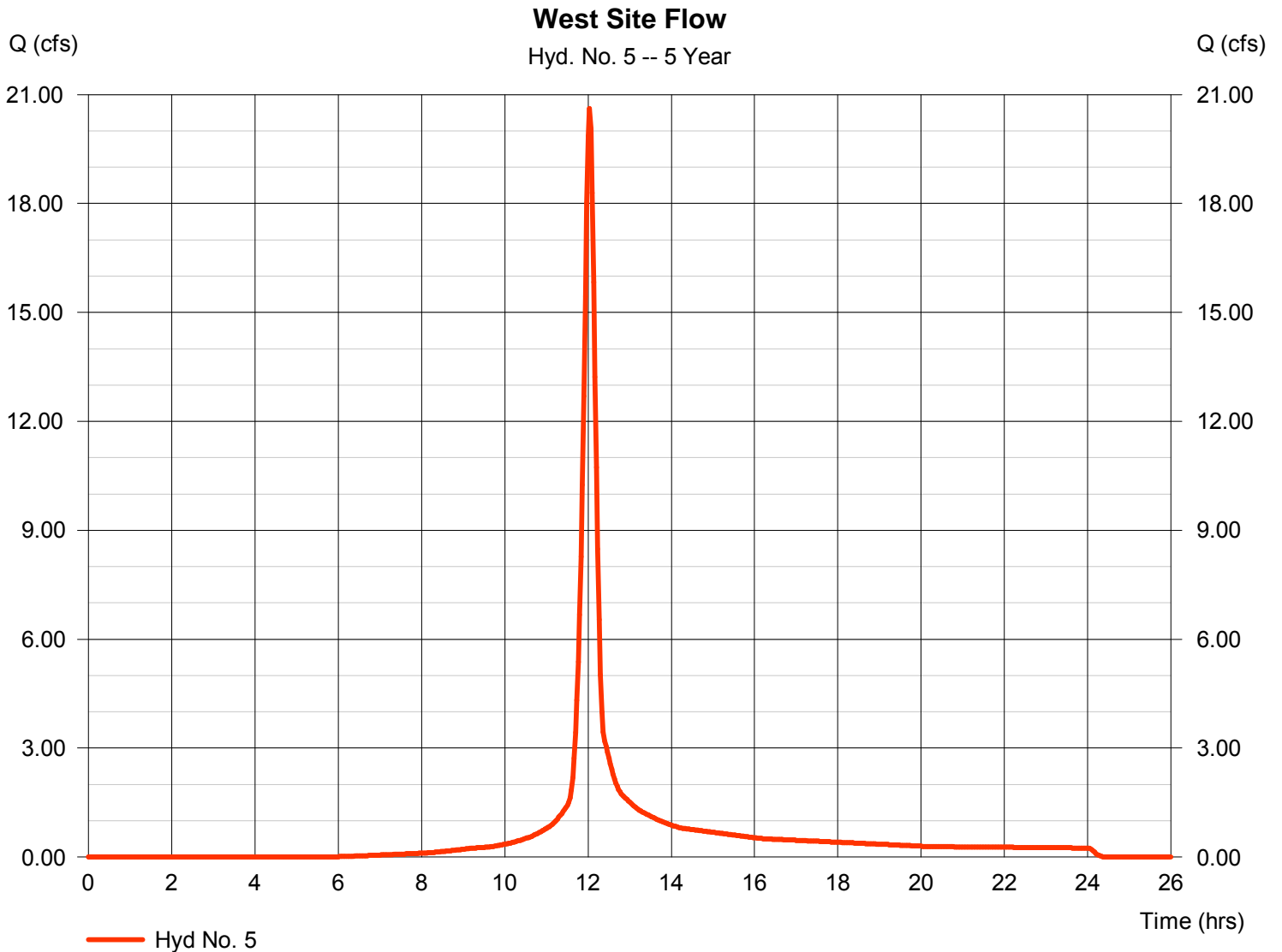
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 20.62 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 58,461 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 4.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	30.57	2	778	300,451	-----	-----	-----	Offsite North	
2	SCS Runoff	48.98	2	736	238,757	-----	-----	-----	Site Flow	
3	Combine	64.52	2	738	539,208	1, 2	-----	-----	Total to Pond	
4	Reservoir	4.267	2	1072	112,034	3	1282.19	442,711	Existing Pond	
5	SCS Runoff	24.91	2	722	71,130	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 10 Year			Wednesday, May 1, 2013		

Hydrograph Report

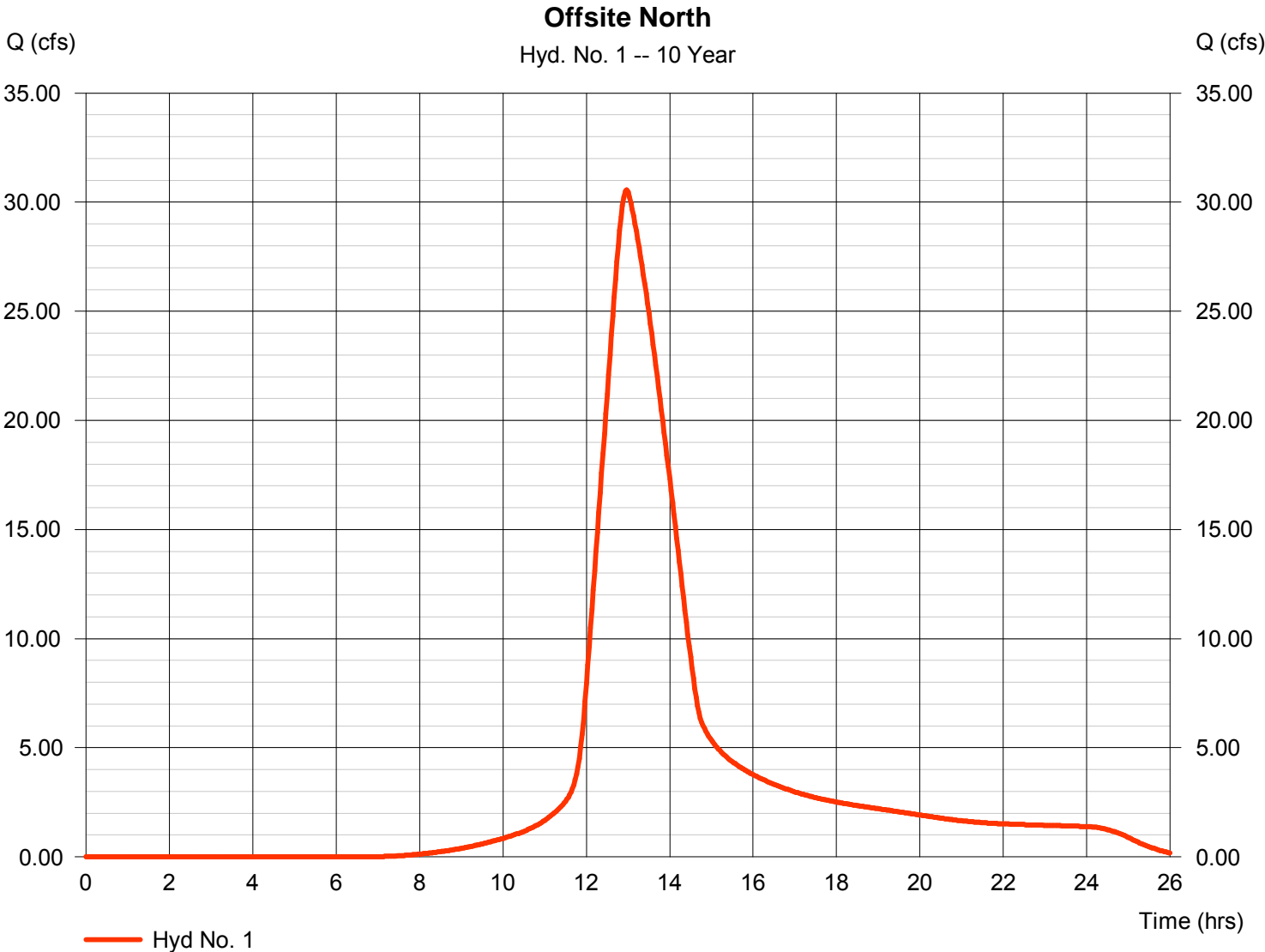
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 30.57 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 300,451 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

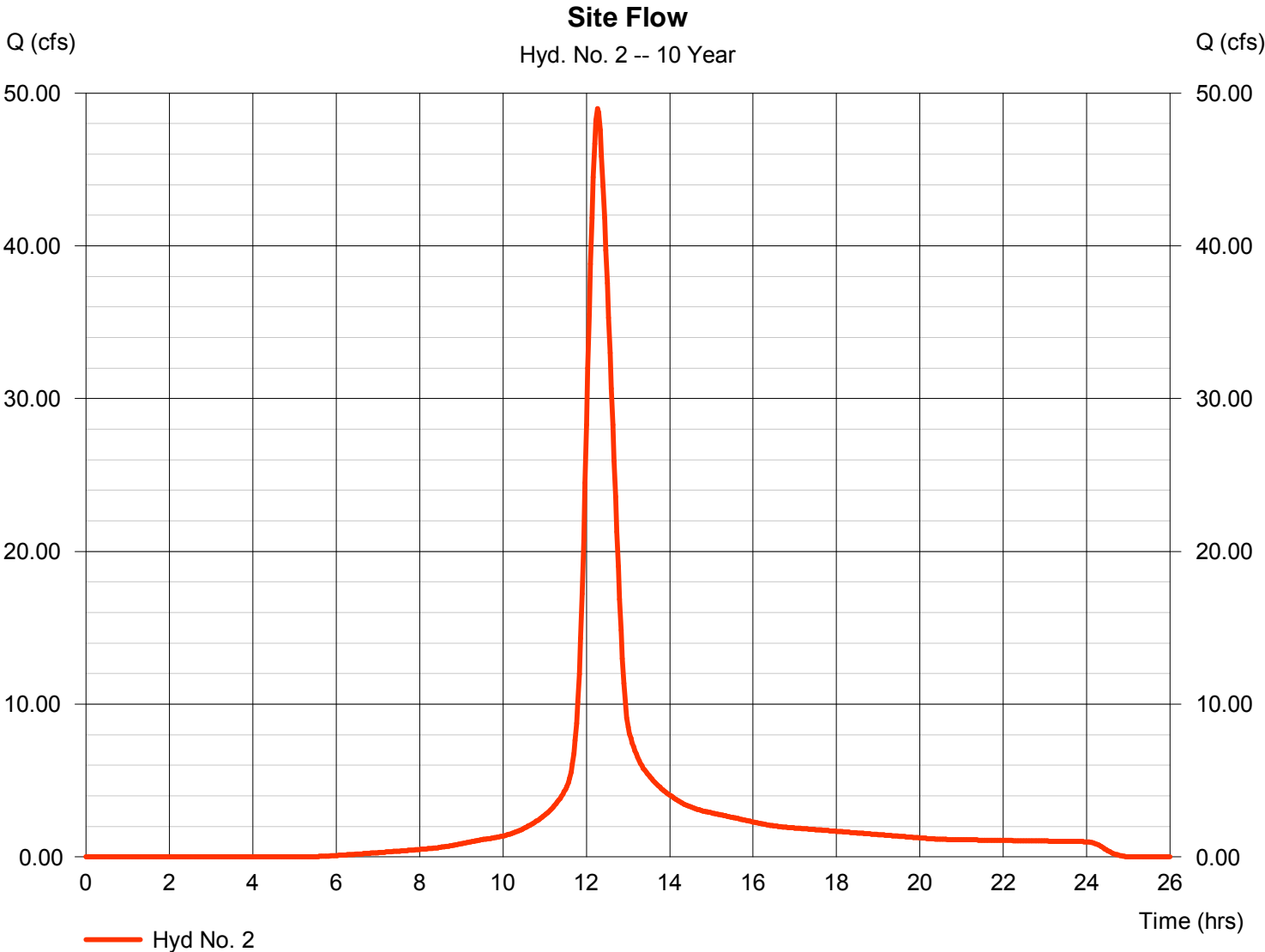
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 48.98 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 238,757 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

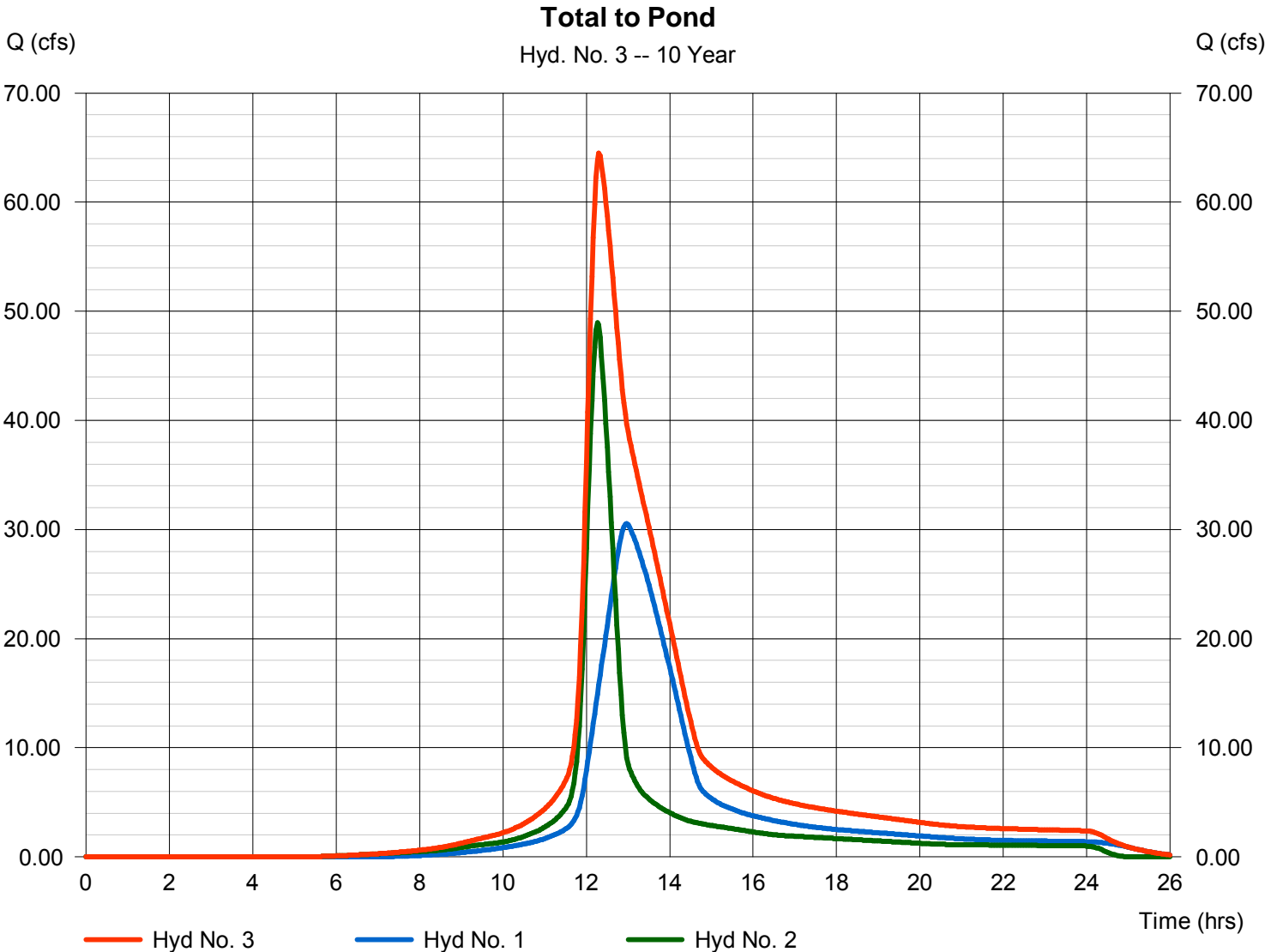
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

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

Peak discharge = 64.52 cfs
Time to peak = 12.30 hrs
Hyd. volume = 539,208 cuft
Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

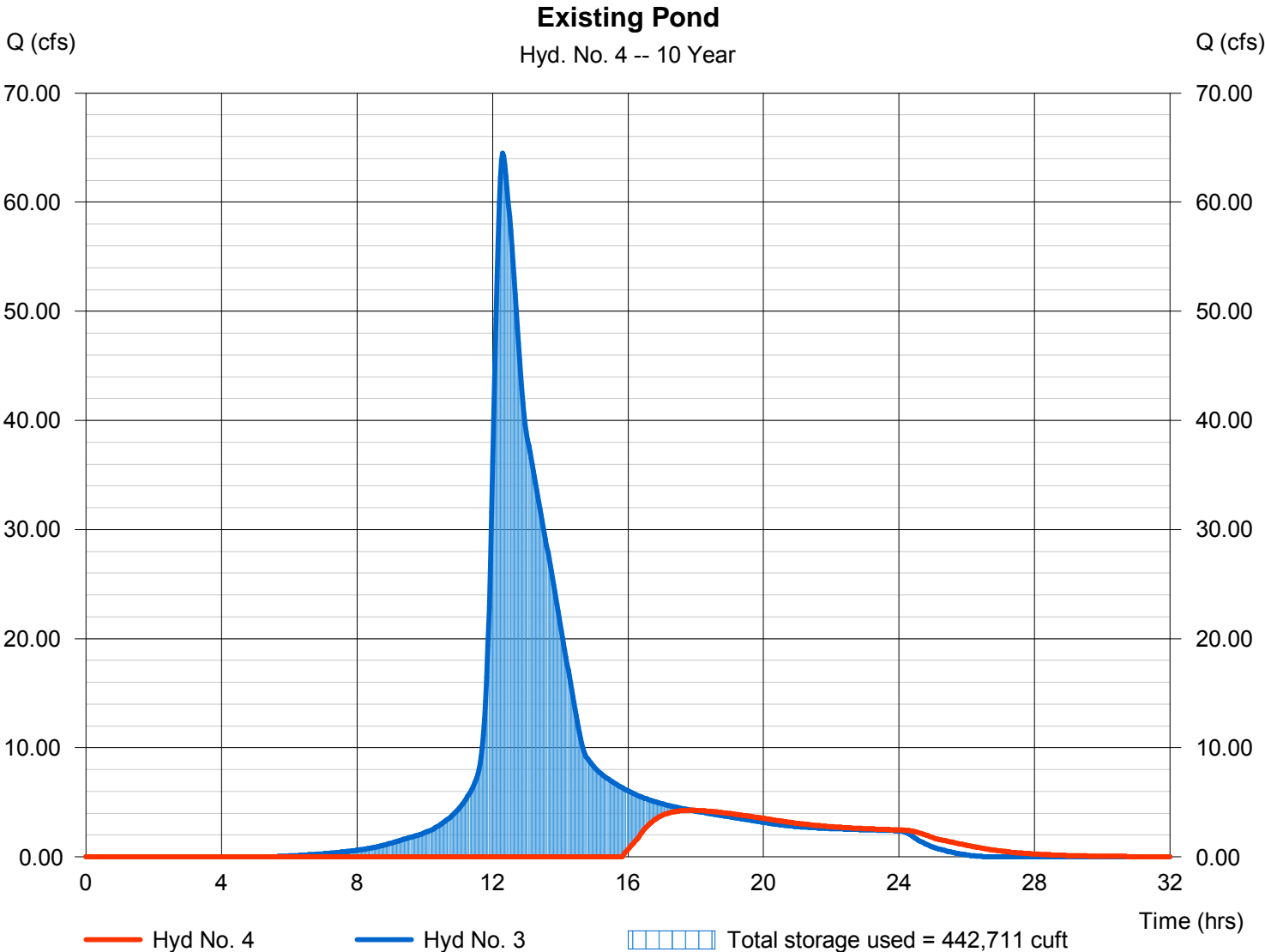
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 4.267 cfs
Storm frequency	= 10 yrs	Time to peak	= 17.87 hrs
Time interval	= 2 min	Hyd. volume	= 112,034 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1282.19 ft
Reservoir name	= Existing Pond	Max. Storage	= 442,711 cuft

Storage Indication method used.



Hydrograph Report

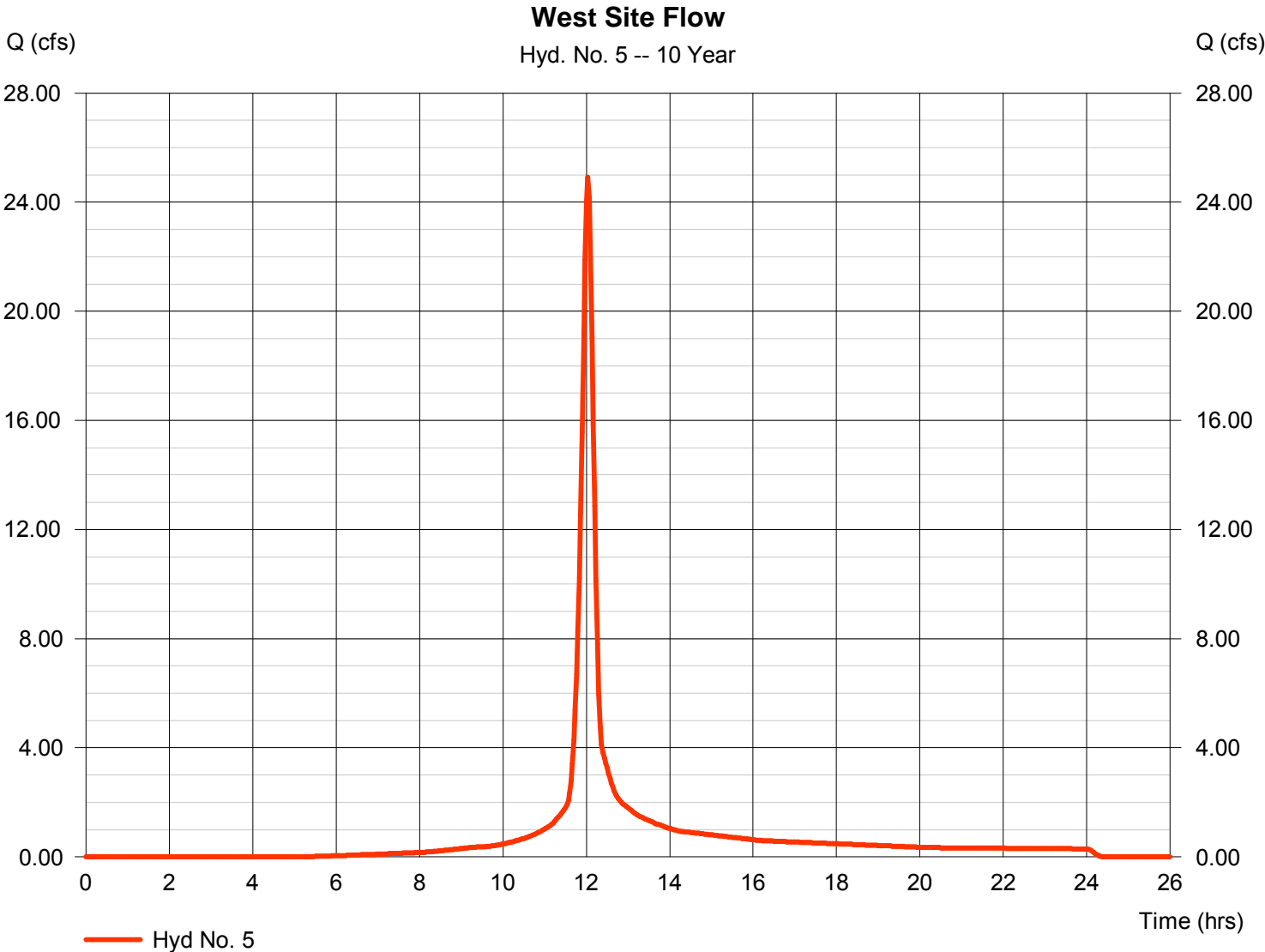
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 24.91 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 71,130 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	38.27	2	778	376,117	-----	-----	-----	Offsite North	
2	SCS Runoff	60.03	2	736	294,325	-----	-----	-----	Site Flow	
3	Combine	79.81	2	738	670,442	1, 2	-----	-----	Total to Pond	
4	Reservoir	15.15	2	870	243,269	3	1282.44	463,535	Existing Pond	
5	SCS Runoff	30.43	2	722	87,684	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 25 Year			Wednesday, May 1, 2013		

Hydrograph Report

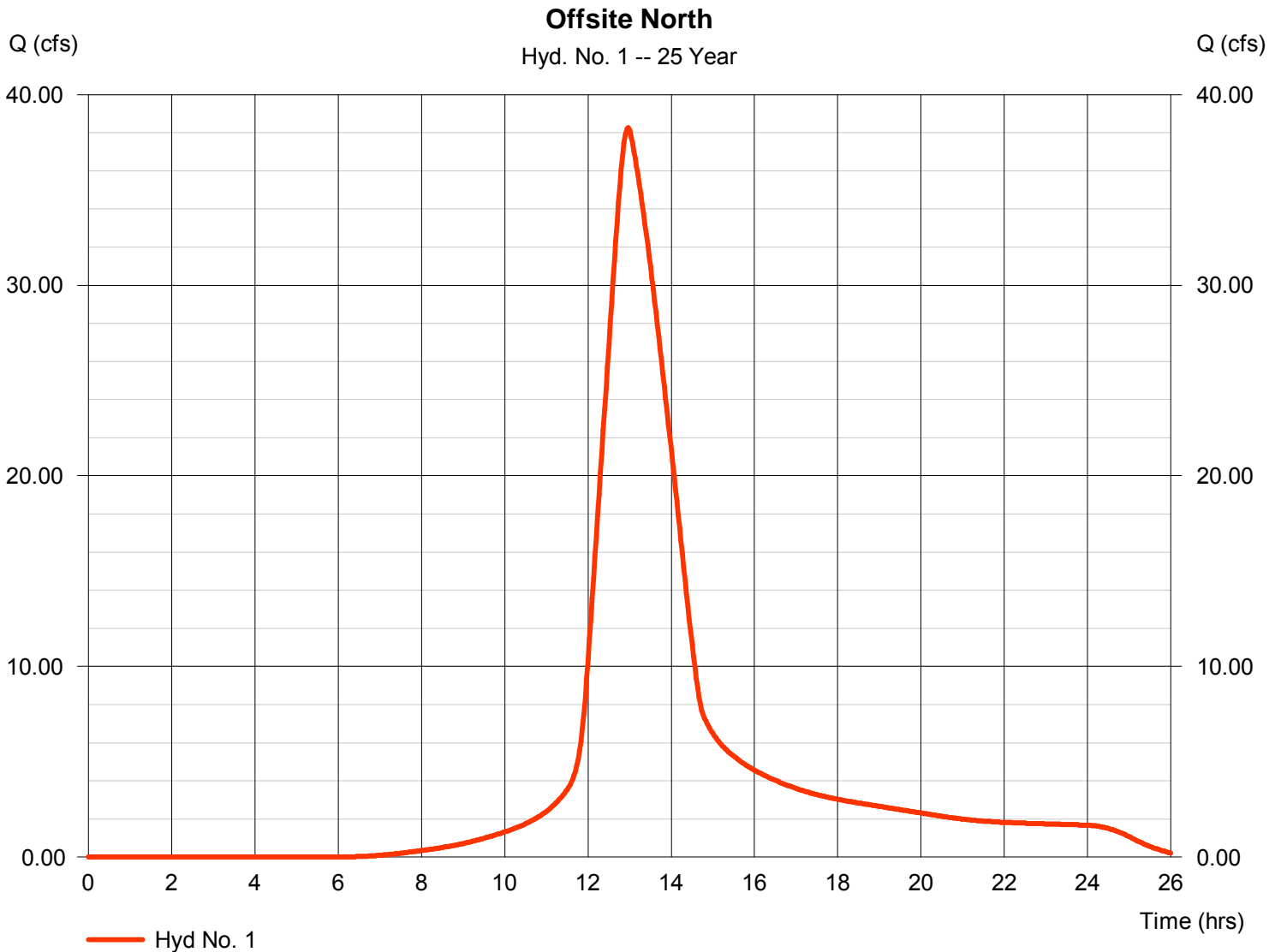
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 38.27 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 376,117 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

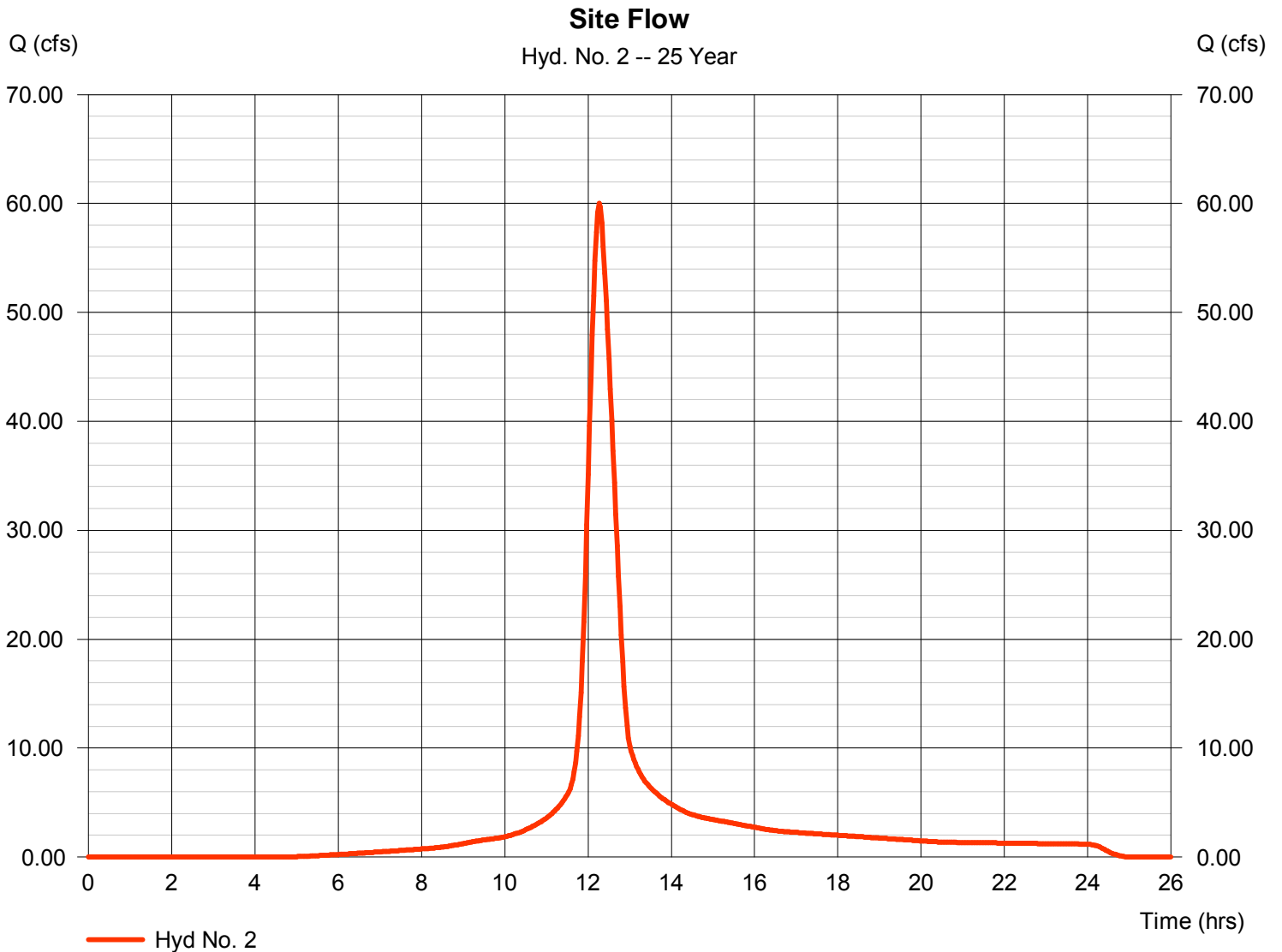
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 60.03 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 294,325 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

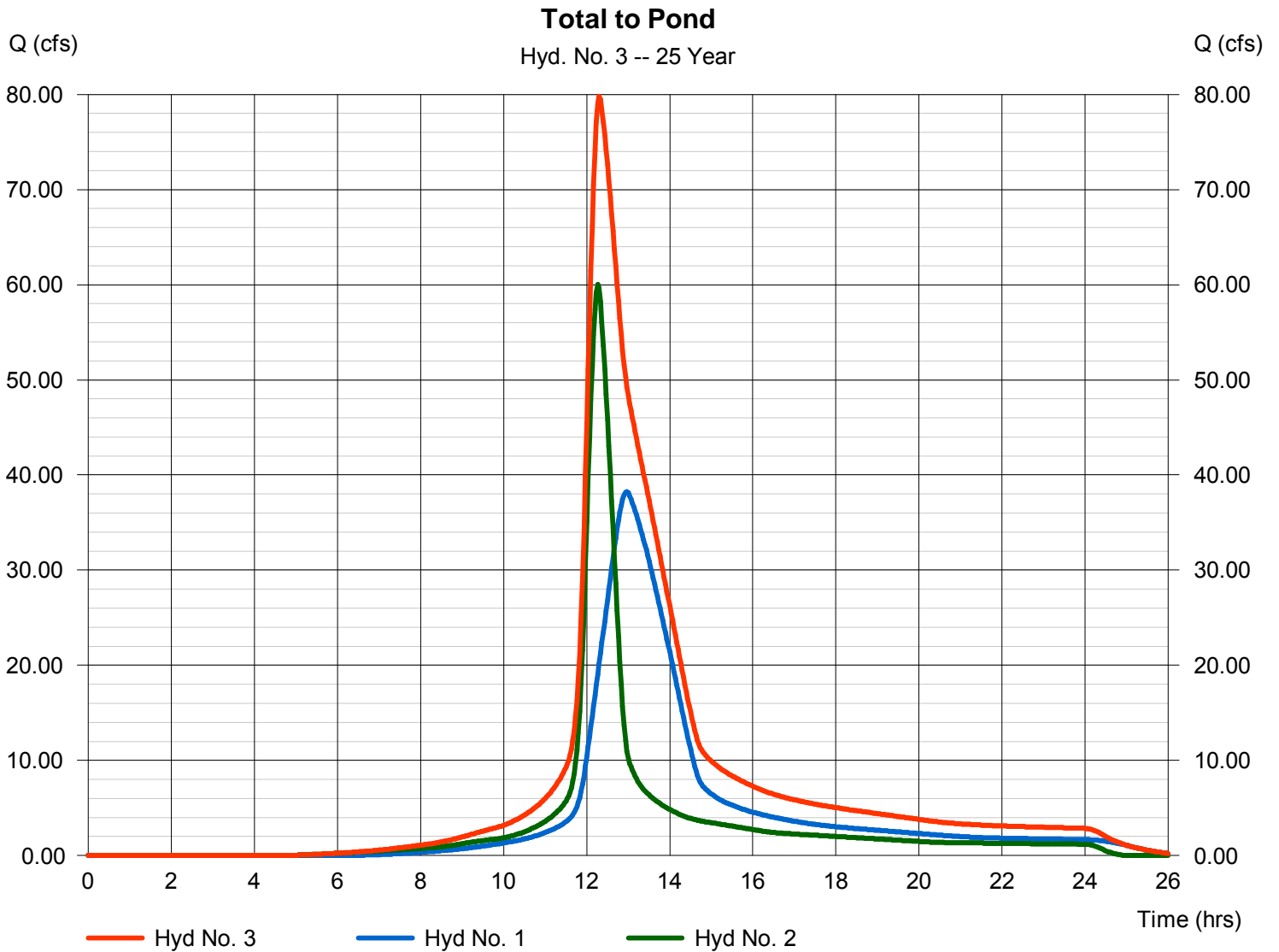
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

Hydrograph type = Combine
 Storm frequency = 25 yrs
 Time interval = 2 min
 Inflow hyds. = 1, 2

Peak discharge = 79.81 cfs
 Time to peak = 12.30 hrs
 Hyd. volume = 670,442 cuft
 Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

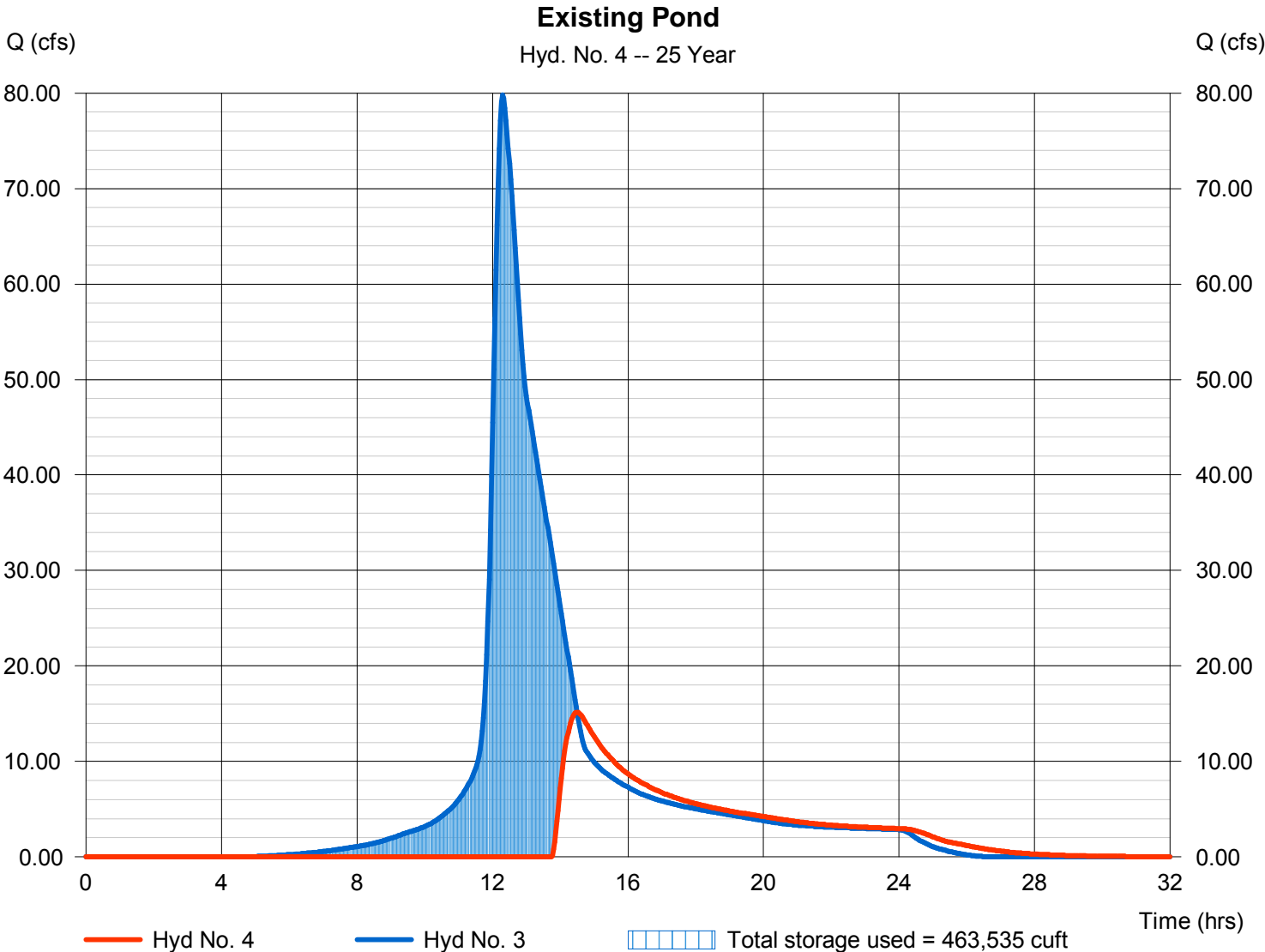
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 15.15 cfs
Storm frequency	= 25 yrs	Time to peak	= 14.50 hrs
Time interval	= 2 min	Hyd. volume	= 243,269 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1282.44 ft
Reservoir name	= Existing Pond	Max. Storage	= 463,535 cuft

Storage Indication method used.



Hydrograph Report

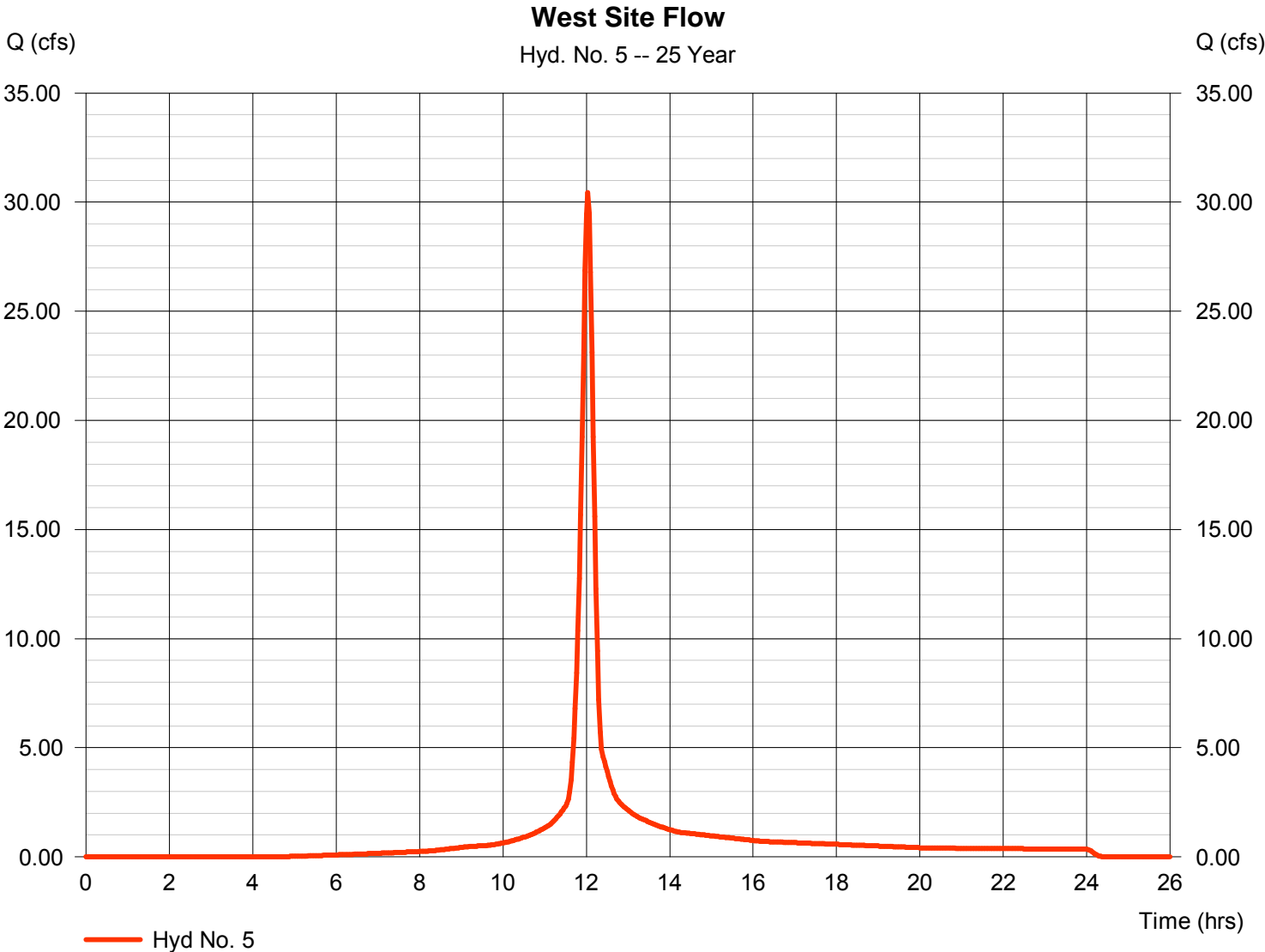
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 30.43 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 87,684 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	45.17	2	778	444,653	-----	-----	-----	Offsite North
2	SCS Runoff	69.84	2	736	344,315	-----	-----	-----	Site Flow
3	Combine	93.47	2	738	788,969	1, 2	-----	-----	Total to Pond
4	Reservoir	30.23	2	840	361,795	3	1282.70	484,973	Existing Pond
5	SCS Runoff	35.33	2	722	102,577	-----	-----	-----	West Site Flow
Duling Site.gpw					Return Period: 50 Year			Wednesday, May 1, 2013	

Hydrograph Report

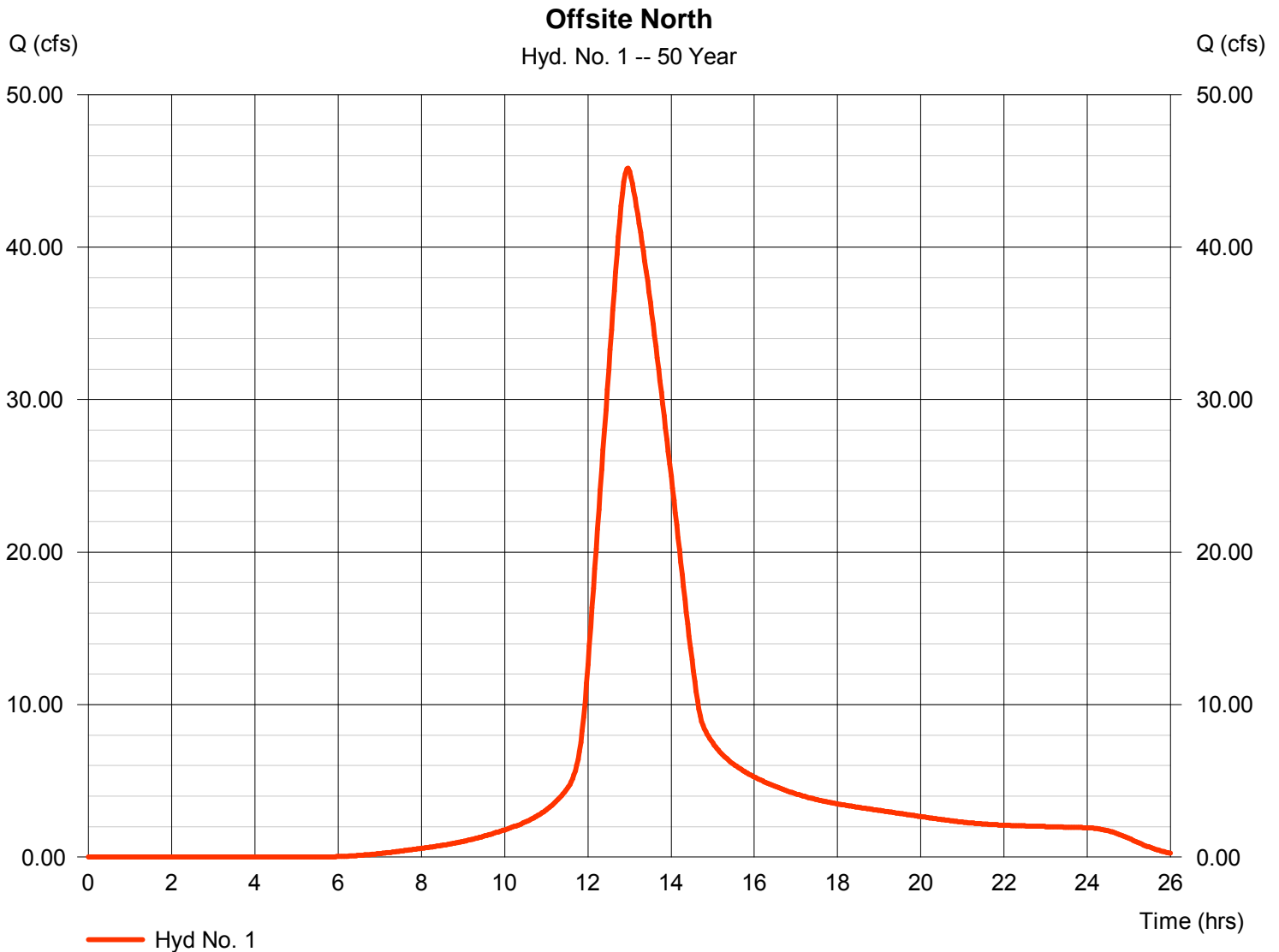
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 45.17 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 444,653 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

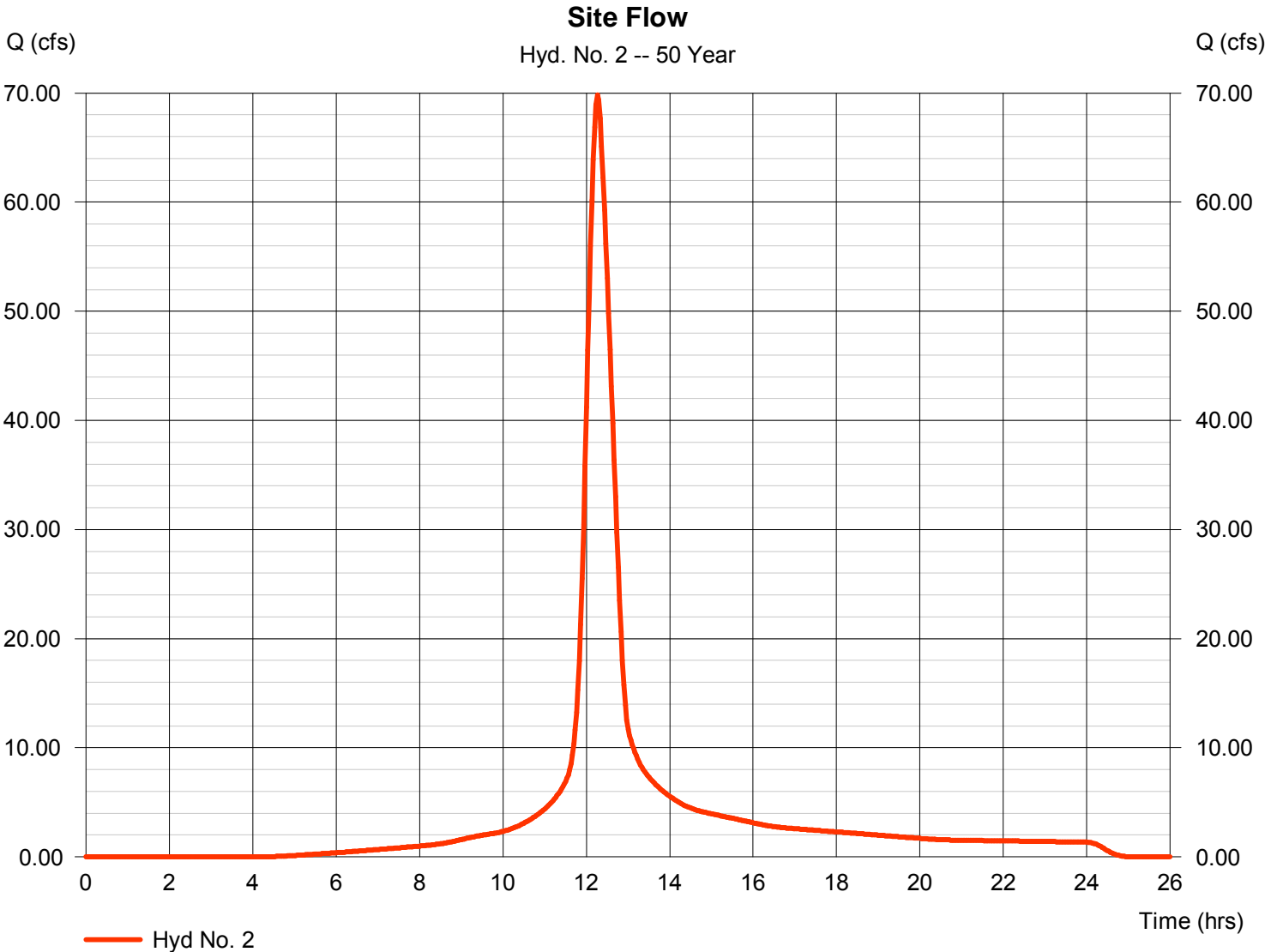
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 69.84 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 344,315 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

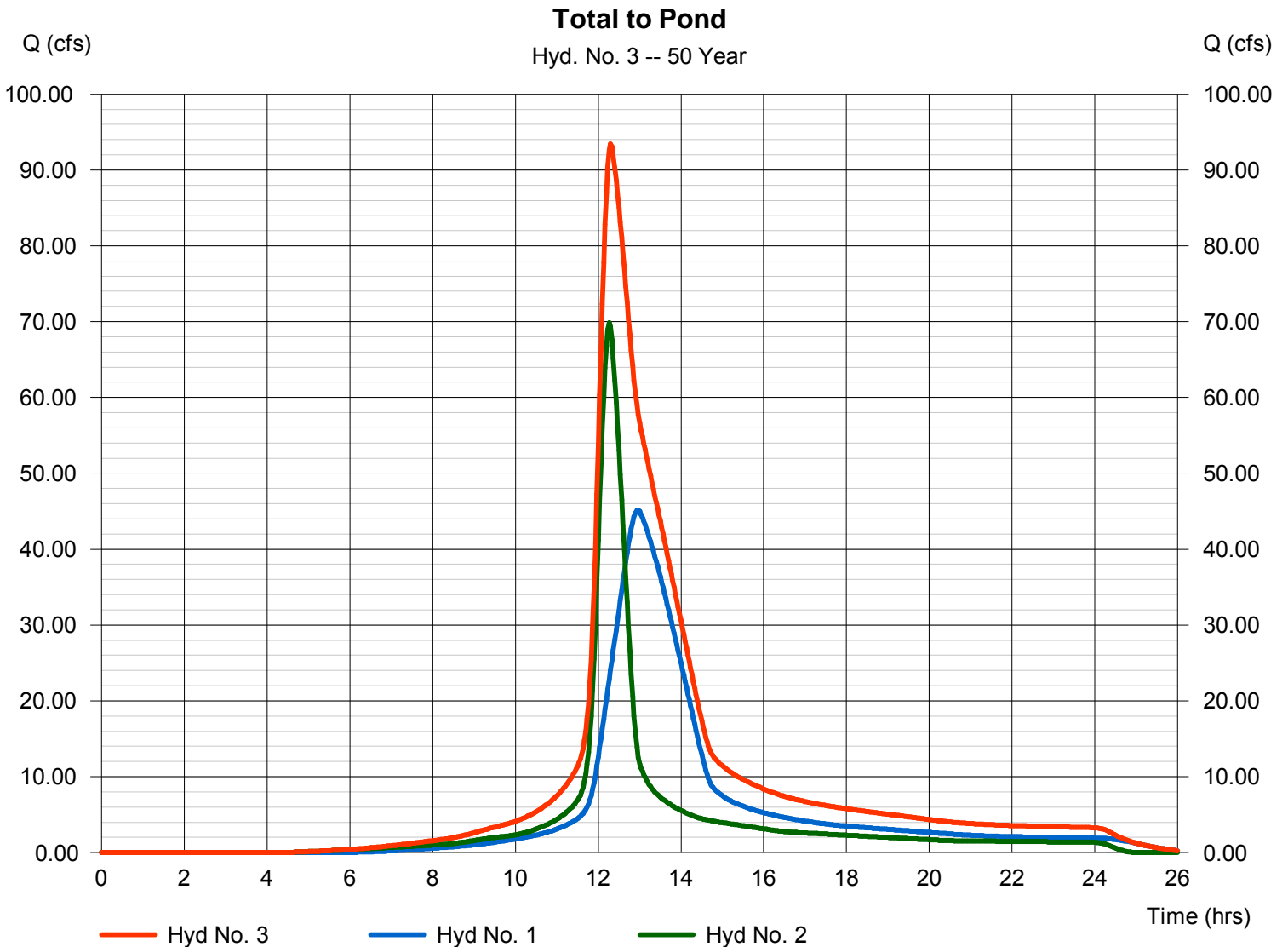
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

Hydrograph type = Combine
 Storm frequency = 50 yrs
 Time interval = 2 min
 Inflow hyds. = 1, 2

Peak discharge = 93.47 cfs
 Time to peak = 12.30 hrs
 Hyd. volume = 788,969 cuft
 Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

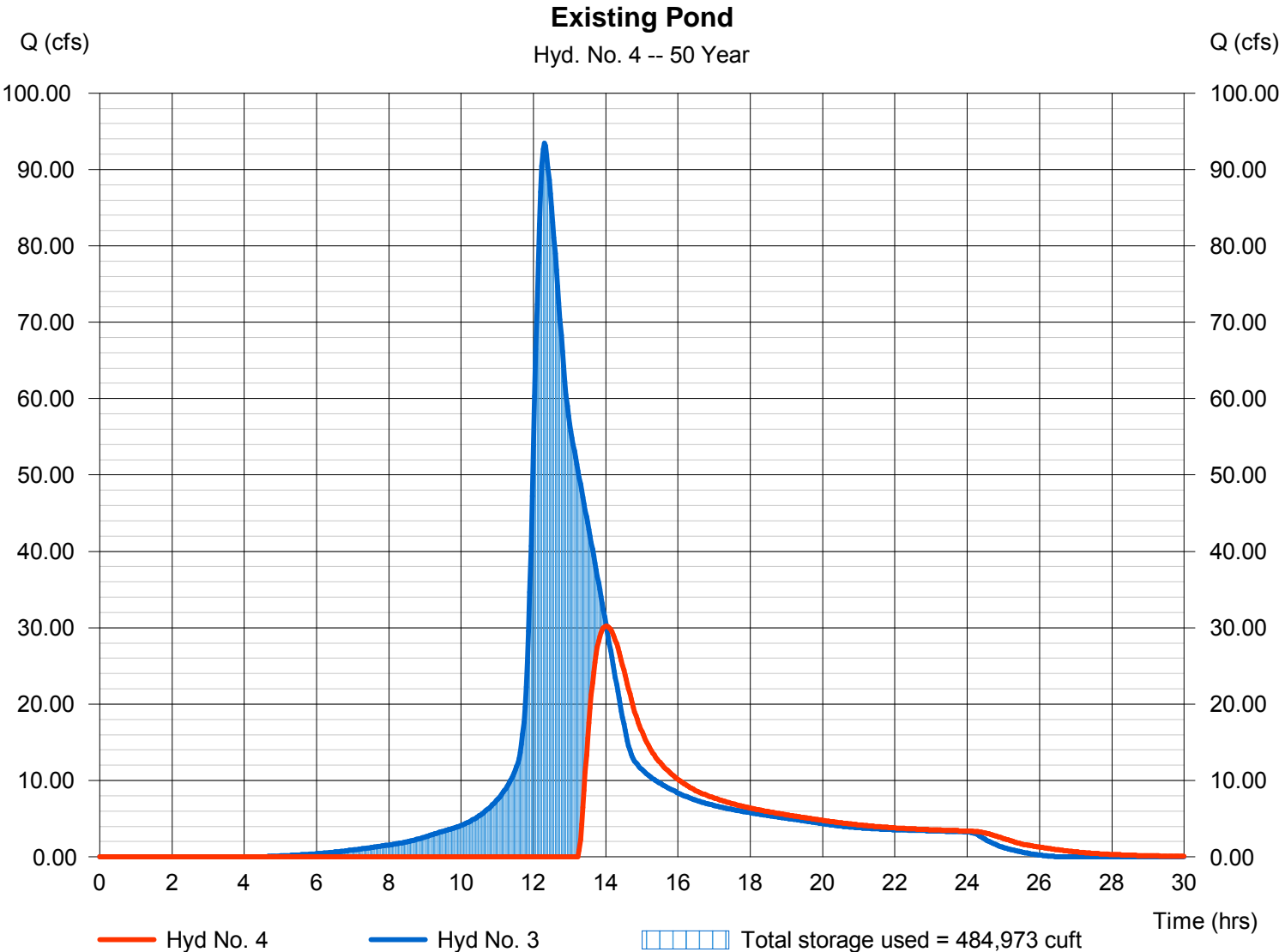
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 30.23 cfs
Storm frequency	= 50 yrs	Time to peak	= 14.00 hrs
Time interval	= 2 min	Hyd. volume	= 361,795 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1282.70 ft
Reservoir name	= Existing Pond	Max. Storage	= 484,973 cuft

Storage Indication method used.



Hydrograph Report

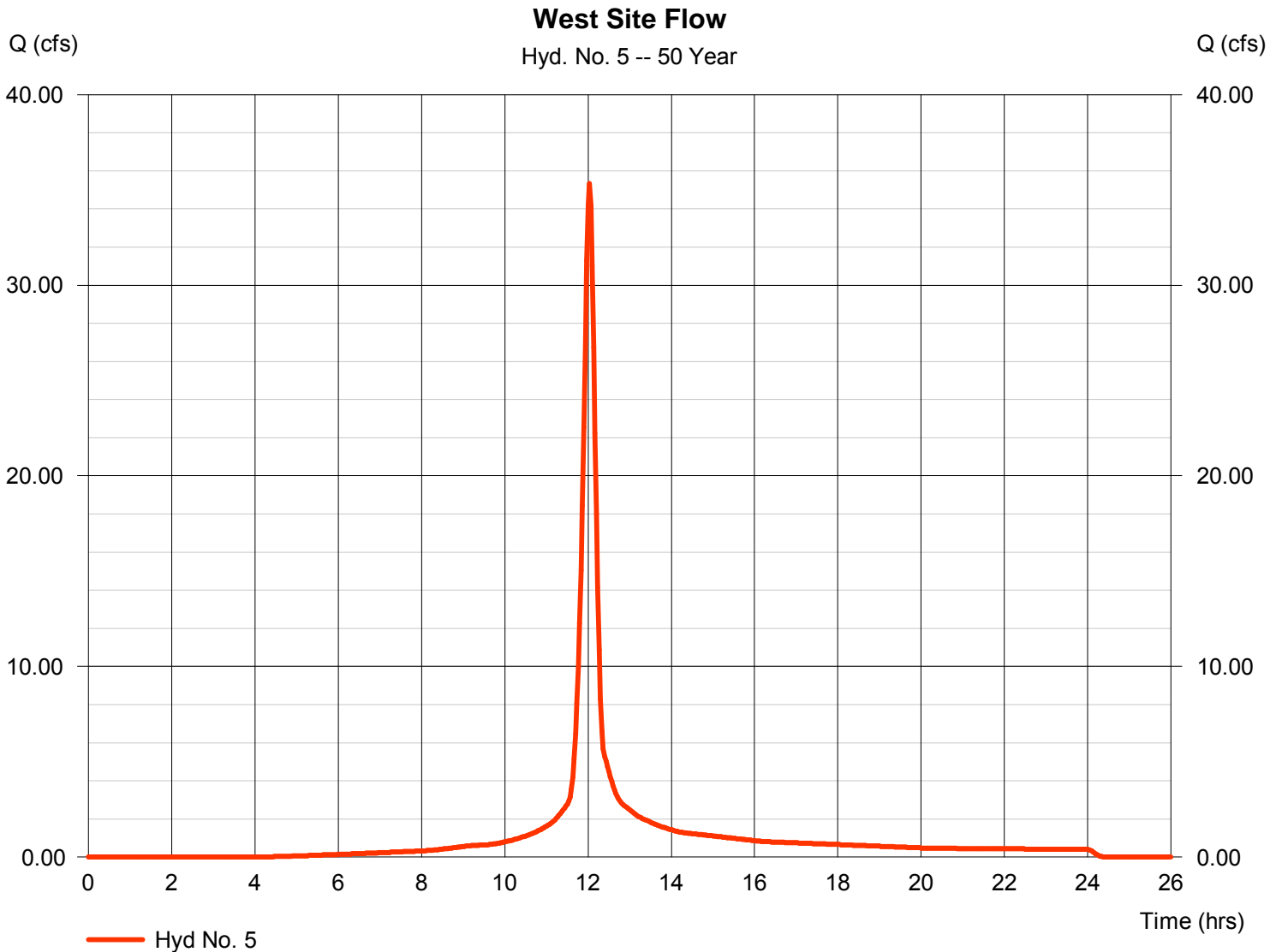
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 35.33 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 102,577 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 6.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

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	SCS Runoff	52.97	2	778	522,802	-----	-----	-----	Offsite North	
2	SCS Runoff	80.86	2	736	401,034	-----	-----	-----	Site Flow	
3	Combine	108.87	2	738	923,836	1, 2	-----	-----	Total to Pond	
4	Reservoir	45.85	2	820	496,662	3	1282.92	503,454	Existing Pond	
5	SCS Runoff	40.82	2	722	119,475	-----	-----	-----	West Site Flow	
Duling Site.gpw					Return Period: 100 Year			Wednesday, May 1, 2013		

Hydrograph Report

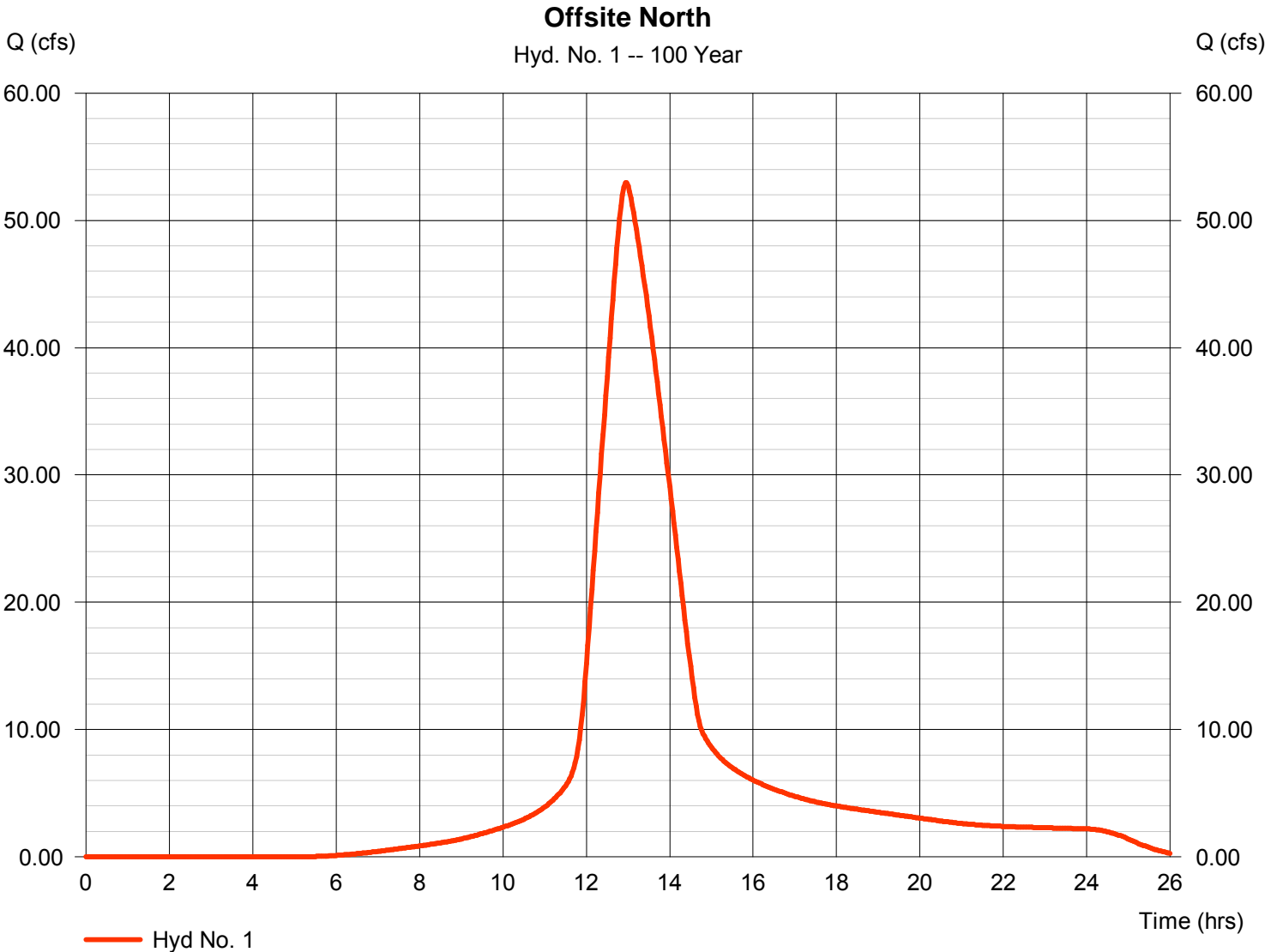
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 1

Offsite North

Hydrograph type	= SCS Runoff	Peak discharge	= 52.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.97 hrs
Time interval	= 2 min	Hyd. volume	= 522,802 cuft
Drainage area	= 25.500 ac	Curve number	= 82
Basin Slope	= 0.2 %	Hydraulic length	= 1500 ft
Tc method	= LAG	Time of conc. (Tc)	= 106.68 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

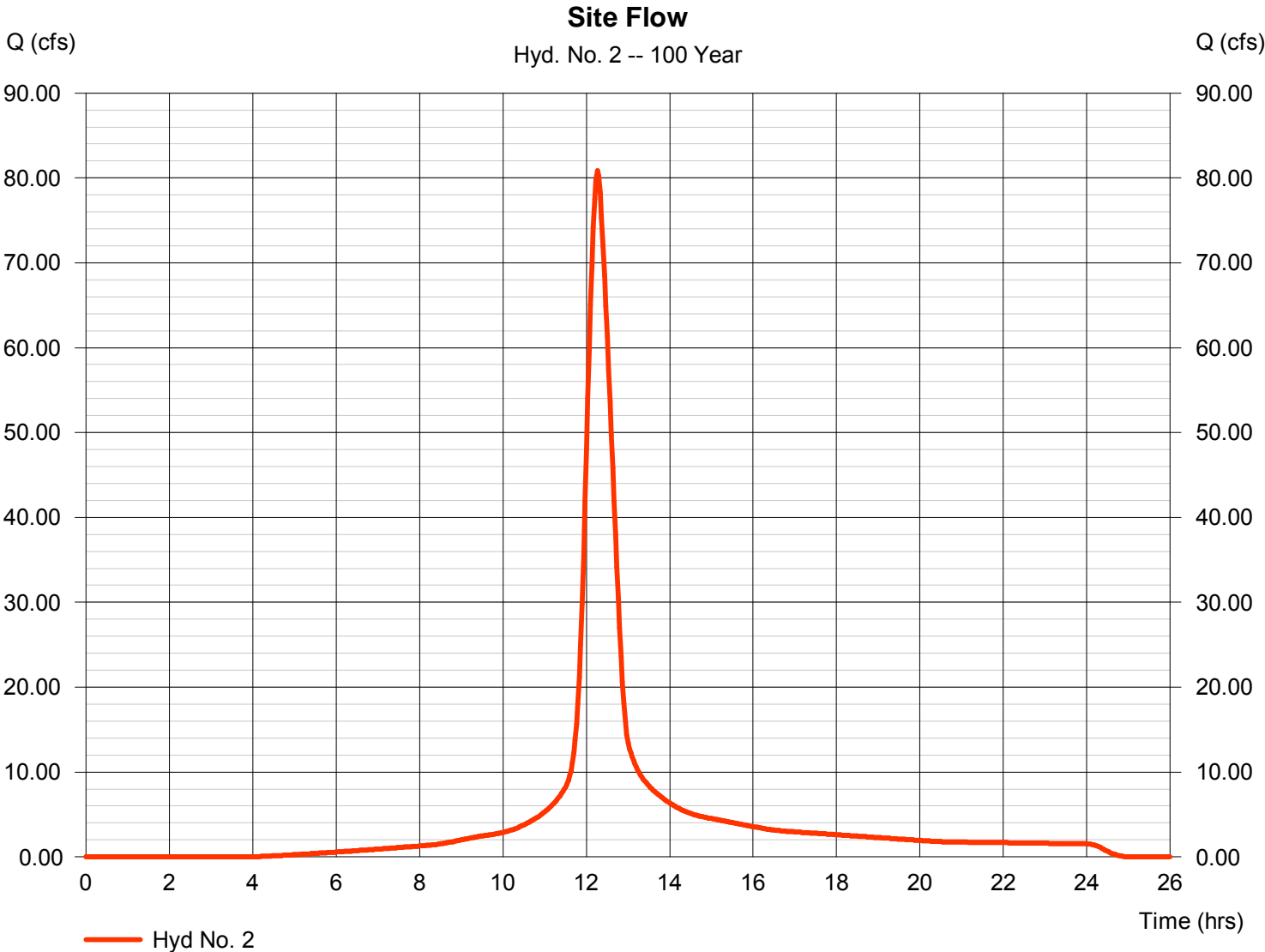
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 2

Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 80.86 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 401,034 cuft
Drainage area	= 18.000 ac	Curve number	= 86
Basin Slope	= 0.3 %	Hydraulic length	= 800 ft
Tc method	= LAG	Time of conc. (Tc)	= 39.79 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

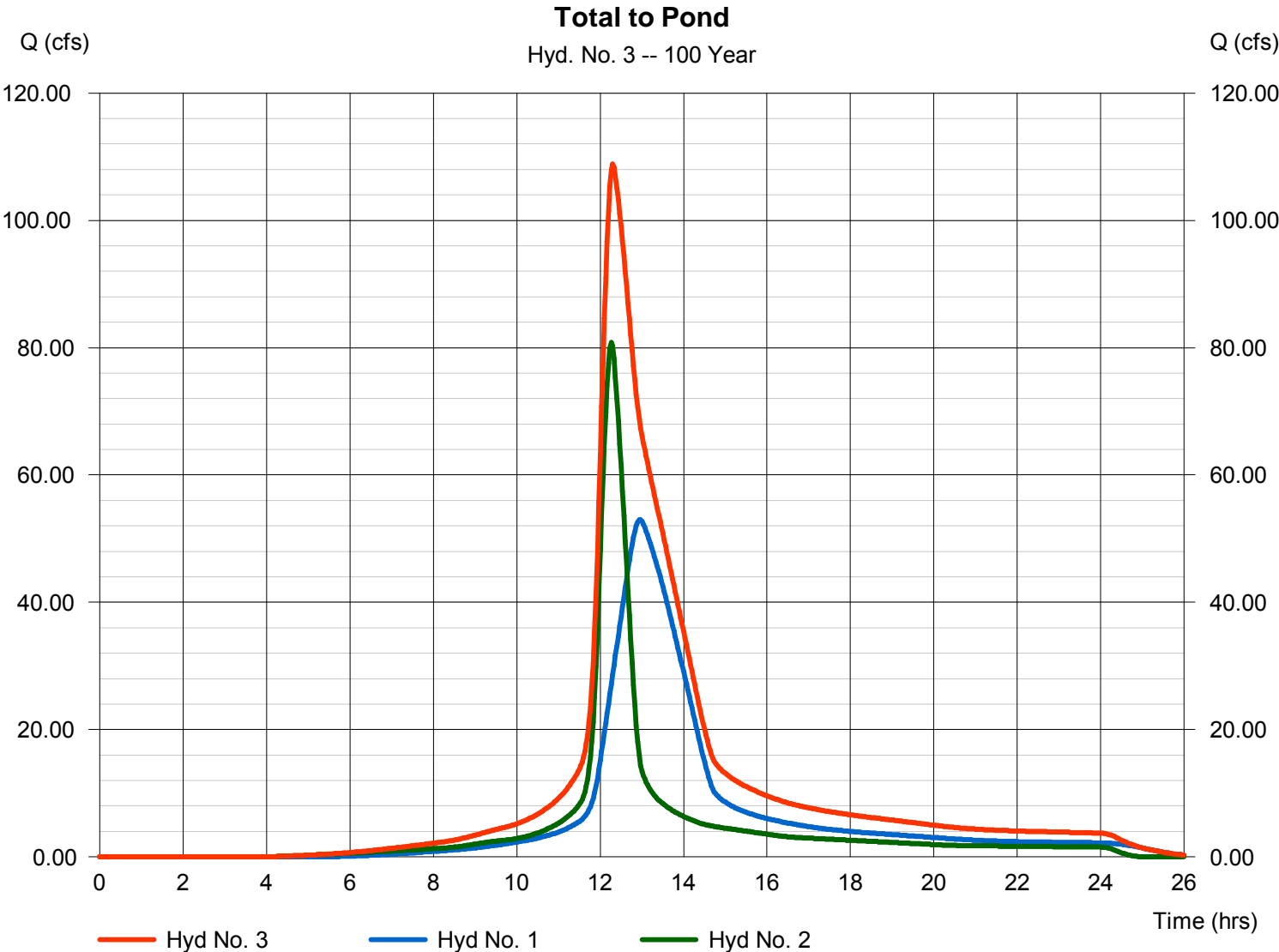
Wednesday, May 1, 2013

Hyd. No. 3

Total to Pond

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 1, 2

Peak discharge = 108.87 cfs
Time to peak = 12.30 hrs
Hyd. volume = 923,836 cuft
Contrib. drain. area = 43.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

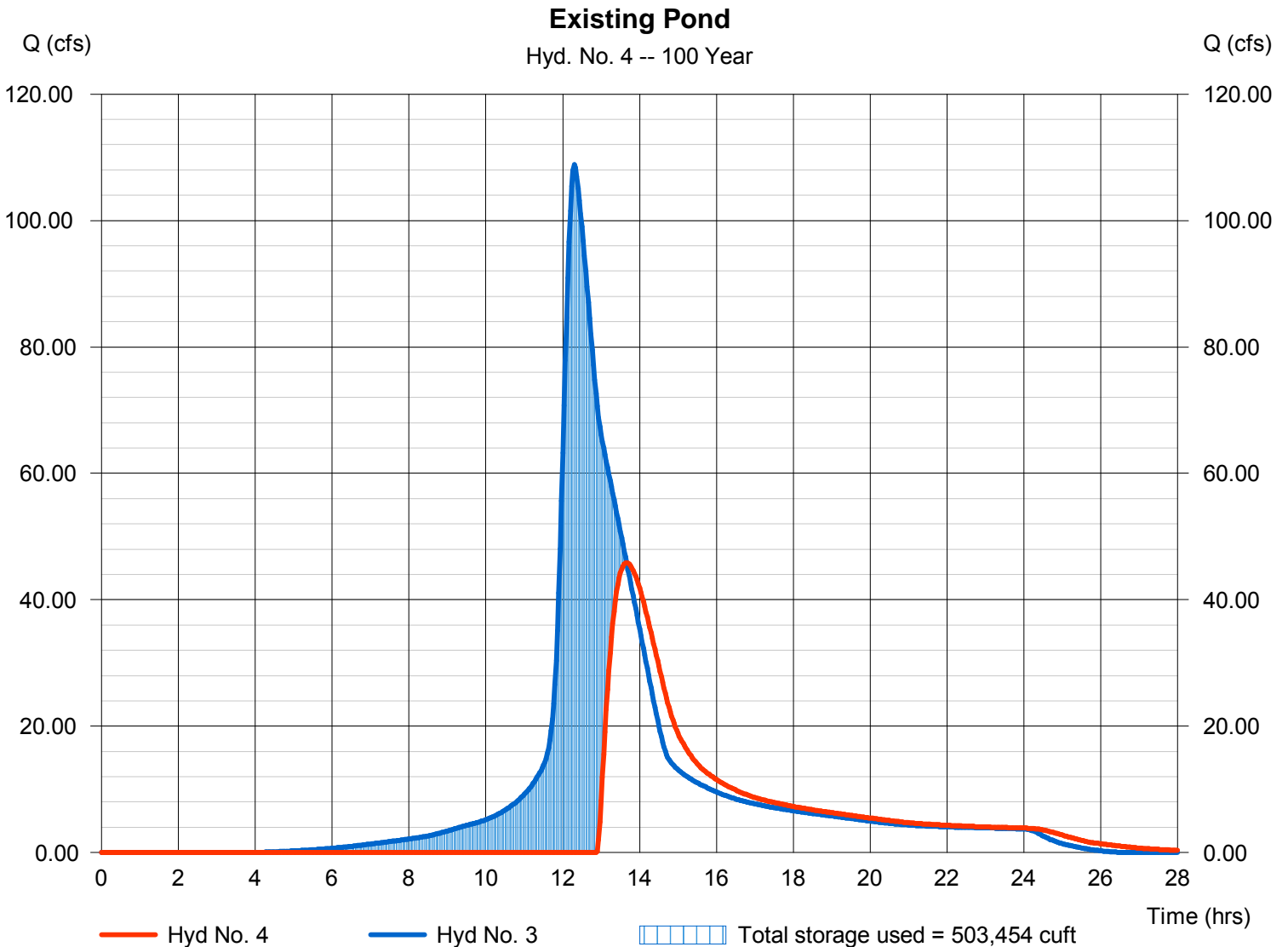
Wednesday, May 1, 2013

Hyd. No. 4

Existing Pond

Hydrograph type	= Reservoir	Peak discharge	= 45.85 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.67 hrs
Time interval	= 2 min	Hyd. volume	= 496,662 cuft
Inflow hyd. No.	= 3 - Total to Pond	Max. Elevation	= 1282.92 ft
Reservoir name	= Existing Pond	Max. Storage	= 503,454 cuft

Storage Indication method used.



Hydrograph Report

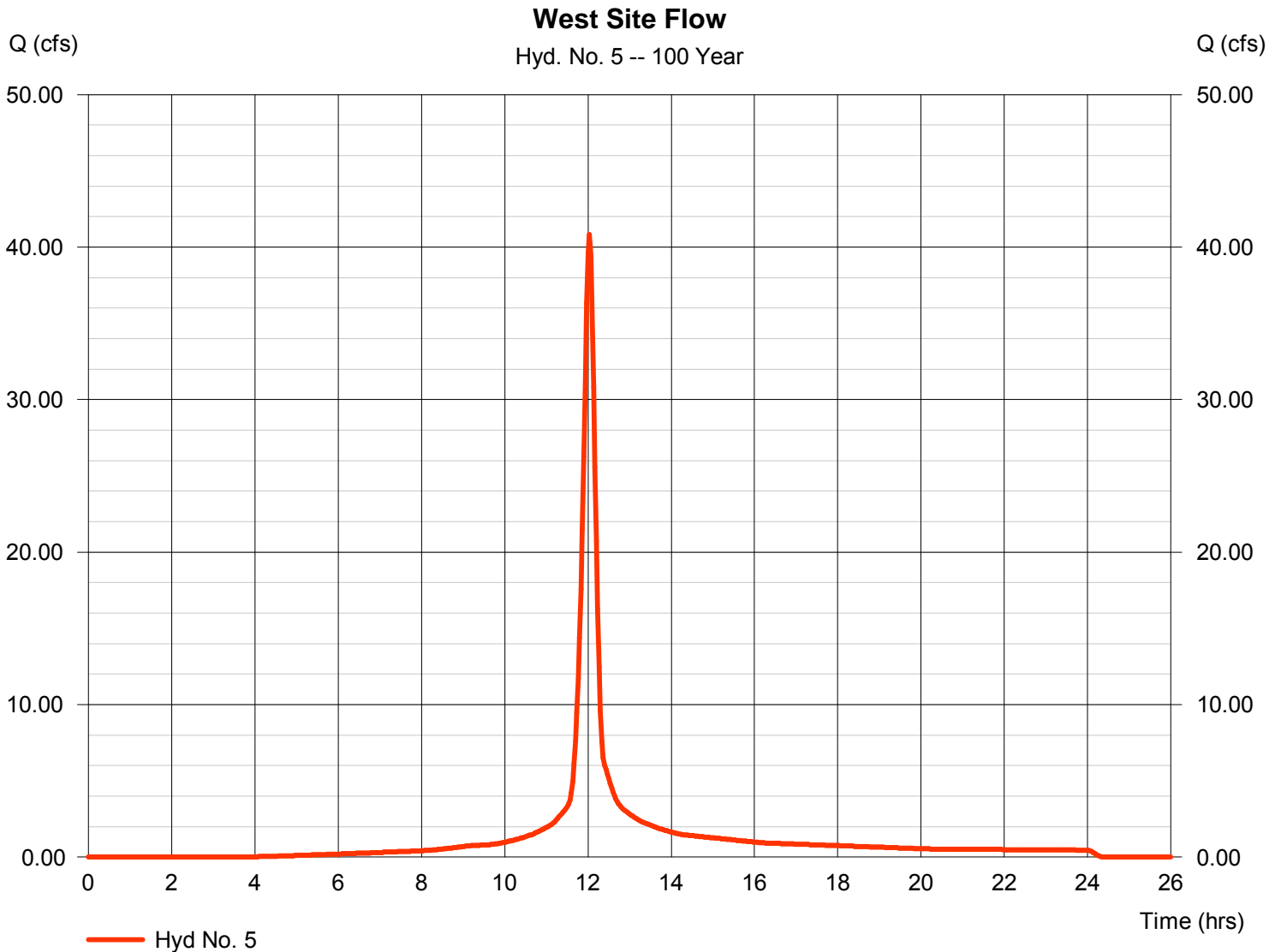
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Hyd. No. 5

West Site Flow

Hydrograph type	= SCS Runoff	Peak discharge	= 40.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 119,475 cuft
Drainage area	= 5.500 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 7.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2011 by Autodesk, Inc. v8

Wednesday, May 1, 2013

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	27.8967	9.8000	0.7047	-----
2	76.3137	14.3000	0.8844	-----
3	1.2000	0.1000	0.0000	-----
5	52.6224	11.2000	0.7497	-----
10	55.1841	11.1000	0.7229	-----
25	60.7012	11.1000	0.7068	-----
50	66.9222	11.3000	0.7004	-----
100	62.2794	10.1000	0.6624	-----

File name: wich_IDF.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	4.18	3.40	2.90	2.55	2.29	2.08	1.91	1.78	1.66	1.56	1.48	1.40
2	5.57	4.54	3.85	3.35	2.97	2.67	2.43	2.23	2.06	1.92	1.80	1.69
3	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
5	6.52	5.33	4.55	3.99	3.57	3.24	2.97	2.75	2.57	2.41	2.27	2.15
10	7.40	6.09	5.22	4.60	4.13	3.76	3.46	3.21	3.00	2.82	2.67	2.53
25	8.51	7.03	6.05	5.35	4.81	4.39	4.05	3.76	3.52	3.32	3.14	2.98
50	9.47	7.86	6.78	6.00	5.41	4.94	4.56	4.24	3.98	3.75	3.55	3.37
100	10.31	8.53	7.37	6.53	5.90	5.40	5.00	4.66	4.37	4.13	3.92	3.73

T_c = time in minutes. Values may exceed 60.

Precip. file name: wich_24hr.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	2.80	3.50	1.20	4.50	5.20	6.10	6.90	7.80
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	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

Watershed Model Schematic	1
Hydrograph Return Period Recap	2
1 - Year	
Summary Report.....	3
Hydrograph Reports.....	4
Hydrograph No. 1, SCS Runoff, Offsite North.....	4
Hydrograph No. 2, SCS Runoff, Site Flow.....	5
Hydrograph No. 3, Combine, Total to Pond.....	6
Hydrograph No. 4, Reservoir, Existing Pond.....	7
Pond Report - Existing Pond.....	8
Hydrograph No. 5, SCS Runoff, West Site Flow.....	9
2 - Year	
Summary Report.....	10
Hydrograph Reports.....	11
Hydrograph No. 1, SCS Runoff, Offsite North.....	11
Hydrograph No. 2, SCS Runoff, Site Flow.....	12
Hydrograph No. 3, Combine, Total to Pond.....	13
Hydrograph No. 4, Reservoir, Existing Pond.....	14
Hydrograph No. 5, SCS Runoff, West Site Flow.....	15
3 - Year	
Summary Report.....	16
Hydrograph Reports.....	17
Hydrograph No. 1, SCS Runoff, Offsite North.....	17
Hydrograph No. 2, SCS Runoff, Site Flow.....	18
Hydrograph No. 3, Combine, Total to Pond.....	19
Hydrograph No. 4, Reservoir, Existing Pond.....	20
Hydrograph No. 5, SCS Runoff, West Site Flow.....	21
5 - Year	
Summary Report.....	22
Hydrograph Reports.....	23
Hydrograph No. 1, SCS Runoff, Offsite North.....	23
Hydrograph No. 2, SCS Runoff, Site Flow.....	24
Hydrograph No. 3, Combine, Total to Pond.....	25
Hydrograph No. 4, Reservoir, Existing Pond.....	26
Hydrograph No. 5, SCS Runoff, West Site Flow.....	27
10 - Year	
Summary Report.....	28
Hydrograph Reports.....	29
Hydrograph No. 1, SCS Runoff, Offsite North.....	29
Hydrograph No. 2, SCS Runoff, Site Flow.....	30
Hydrograph No. 3, Combine, Total to Pond.....	31
Hydrograph No. 4, Reservoir, Existing Pond.....	32

Hydrograph No. 5, SCS Runoff, West Site Flow.....	33
25 - Year	
Summary Report.....	34
Hydrograph Reports.....	35
Hydrograph No. 1, SCS Runoff, Offsite North.....	35
Hydrograph No. 2, SCS Runoff, Site Flow.....	36
Hydrograph No. 3, Combine, Total to Pond.....	37
Hydrograph No. 4, Reservoir, Existing Pond.....	38
Hydrograph No. 5, SCS Runoff, West Site Flow.....	39
50 - Year	
Summary Report.....	40
Hydrograph Reports.....	41
Hydrograph No. 1, SCS Runoff, Offsite North.....	41
Hydrograph No. 2, SCS Runoff, Site Flow.....	42
Hydrograph No. 3, Combine, Total to Pond.....	43
Hydrograph No. 4, Reservoir, Existing Pond.....	44
Hydrograph No. 5, SCS Runoff, West Site Flow.....	45
100 - Year	
Summary Report.....	46
Hydrograph Reports.....	47
Hydrograph No. 1, SCS Runoff, Offsite North.....	47
Hydrograph No. 2, SCS Runoff, Site Flow.....	48
Hydrograph No. 3, Combine, Total to Pond.....	49
Hydrograph No. 4, Reservoir, Existing Pond.....	50
Hydrograph No. 5, SCS Runoff, West Site Flow.....	51
IDF Report.....	52

Drainage Plan
1:100 Scale