DRAINAGE PLAN

ASHTON CREEK COMMERCIAL PARK

TO

WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY

Baughman
ENGINEERING | SURVEYING | PLANNING
LANDSCAPE ARCHITECTURE

30 JUNE 2008

ENGINEERING | SURVEYING | PLANNING
LANDSCAPE ARCHITECTURE

DRAINAGE PLAN
ASHTON CREEK COMMERCIAL PARK

FINAL REPORT

Prepared by Baughman Company, P.A.
30 June 2008

By N. Brent Wooten, P.E.
Trevor R. Kurth, P.E.
Nicholas H. Jefferson, P.E.

REPORT CONTENTS

City of Wichita Subdivision Checklist

Project Narrative
Existing Conditions
Proposed Conditions
Offsite Conditions

Existing Conditions Runoff Calculations
Drainage Methods & Standards
Site Characteristics
Existing Conditions Hydrologic Analysis
Downstream Drainage Capacity

Post-Development Hydrologic Analysis
Drainage Methods & Standards
Detention Facilities
Detention Summary
Discharge Points Summary
Potential Upstream/Downstream Impacts

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 Topography
Exhibit 3: Plat – Half Scale
Exhibit 4: Drainage & Grading Plan – Half Scale
Exhibit 5: Floodplain Location (FIRM)

Appendices: Supporting Calculations
Appendix A: USGS Soils Survey
Appendix B: HydraFlow Hydrographs Routing
Appendix C: HydraFlow StormSewer
Appendix D: HydraFlow Express

Plan Sheets
Drainage Plan 1:100 Scale

EXISTING CONDITIONS

The site is located at the southwest corner of the intersection of 29th Street North and 119th Street West in Wichita, Sedgwick County, Kansas. The property is currently open space farmground. The site generally drains to the south and then to the southwest offsite and into the Cowskin Creek. There is offsite draining encroaching this property from the north and east. There is an apparent swale which runs from the north and to the south, located along the west property line. The majority of the site 'falls' to this swale. The site location is depicted on the USGS Quadrangle Sheet as Exhibit 1. The aerial photograph with existing topography can be seen as Exhibit 2.

There is no FEMA SFHA located on the property as of this report. The nearest FEMA Floodplain is located approximately 600' west of the northwest corner of this property.

PROPOSED CONDITIONS

The proposed Ashton Creek Commercial Park will consist of 10 commercial lots with utilities, drainage systems, and access requirements. This development will detain its developed runoff to at least existing conditions. This will be accomplished by locating a detention facility to the south of this plat (in an offsite Reserve) and directing runoff to via storm sewer as well as a channel section. As of this report, we do not exactly how the individual lots will develop. Therefore, the drainage and grading plans will direct the developed runoff to the nearest conveyance systems. At the time of development, we expect additional onsite storm sewer (or approved equivalent) to convey the runoff to the proposed (as shown) conveyance systems.

The proposed pond is expected to be a surface water pond and will discharge to the southwest at existing grade. This pond is sized only for this developed property as well as the offsite drainage that currently flows across this property. In the future, if the surrounding property is to develop into a residential community, the pond will need to be enlarged to accommodate the additional flow. Due to the anticipated future surrounding development, the pond will have a natural (rip-rap or riparian) 15' broadcrested weir overflow. We expect some minor regrading downstream of the pond outlet to ensure positive drainage to the southwest.

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

OFFSITE CONDITIONS

The site has a distinct drainage pattern along the west line which runs from the north to the south. There is drainage from the north 29th Street ROW which drains through this property in this area. There are 2 CMPs under 29th Street and 2 RCPs under 119th Street which convey approximately 60 acres (area per USGS Quad Sheet) of runoff from the north and onto this property. The intersection of 29th and 119th Streets has recently been improved, therefore the 2-18" RCPs are relatively new. The CMPs under 29th Street have been in place for many years and appear to be functioning. We expect 29th Street to be improved to the west, adjacent to this property, before this property fully develops. At that time, we expect these pipes to be removed and a curb and gutter section be utilized for the street drainage.

This site, as well as the adjacent south and west, drain to the south and west and into the Cowskin Creek. There is FEMA Floodplain located approximately 1100' to the southwest of the property.

EXISTING CONDITIONS RUNOFF CALCULATIONS

DRAINAGE METHODS & STANDARDS

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

- Ø STORM SERIES
  - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 100-yr Storm Events Modeled
  - 2-yr Rainfall Depth = 3.5 in
  - 5-yr Rainfall Depth = 4.5 in
  - 10-yr Rainfall Depth = 5.3 in
  - 25-yr Rainfall Depth = 6.1 in
  - 100-yr Rainfall Depth = 7.9 in

- Ø FLOW DATA
  - Existing Conditions modeled in HydraFlow Hydrographs
  - Areas per USGS Quadrangle Sheet, Aerial Photos, and Site Visits
  - HydraFlow Hydrograph software for existing offsite flows
  - Runoff Coefficient: CN = 80 (Type D Soils, Open Space – Good Condition)
  - Offsite Runoff Coefficient: CN = 74 (Type C Soils, Open Space – Good Condition)
  - Time of Concentration: Lag Method (15 min minimum)

SITE CHARACTERISTICS

The site is currently open space and is utilized as farmland for crop production. The site is mostly of Soil Type D with Types B and C apparent on the edges of the property. The site drains to the south and west and eventually into the Cowskin Creek. There is an offsite area encroaching the site from the north which drains along the west line and to the south.
The Aerial Exhibit can be seen as Exhibit 2.

EXISTING CONDITIONS HYDROLOGIC ANALYSIS

The site was analyzed for pre-development conditions using the hydrograph method for the 2, 5, 10, 25, and 100-year storm events. A curve number of 80 was used for existing onsite conditions assuming undeveloped agricultural land use (open space – good condition) with Types D soils. The offsite runoff from the north and east was modeled with a CN of 74. This was due to a Soil Type C. The time of concentration was calculated using the Lag Method with a minimum time of concentration of 15 minutes.

DOWNSTREAM DRAINAGE CAPACITY

The site drains to the south and west and into the Cowskin Creek. Directly downstream of this property is farmland. There is an apparent swale which conveys this sites and adjacent property's runoff. This property is not located in a FEMA SFHA. There is FEMA Floodplain and Floodway located to the west of this property along the Cowskin Creek. There does not appear to be any flooding affects from the Cowskin Creek on this particular property.

POST-DEVELOPMENT HYDROLOGIC ANALYSIS

DRAINAGE METHODS & STANDARDS

The following methods and standards, although not a complete list, were used in developing the drainage and grading plans.

- Ø STORM SERIES
  - 24-hour; 2-yr, 5-yr, 10-yr, 25-yr, 100-yr Storm Events Modeled
  - HydraFlow Hydrographs software for existing flows
  - SCS Curve Number; CN = 95 (Type D Soils, Commercial)
  - Time of Concentration; Lag method, minimum Tc = 15min

- Ø GRADING CONSTRAINTS
  - Match grades along site perimeter
  - Emergency Overflows for 24-hr, 100-yr Storm Event

- Ø POND ROUTING / GRADING
  - HydraFlow Hydrographs software utilized for pond routing

Storm Water Sewer

The stormsewer routing was done 3 separate ways. First, all flows – onsite and offsite – were routed assuming the 100-year rainfall and coincident time of concentrations. The stormsewer was then modeled assuming the offsite 100-year peak only and then the onsite 100-year peak storm only. The overall size was then determined to allow for the 100-year peak offsite flow. This was due to the onsite flow time of concentration being much quicker (15 minutes) compared to the offsite flow (101 minutes). There will also be emergency overflows to the proposed channel section as well as the pond. The systems routings can be found in Appendix C.

DETENTION FACILITIES

There is one (1) detention facility proposed for this plat. The proposed detention pond will be located just to the south offsite (located in a Reserve) of the proposed lots. This can be seen on the half-scale Drainage & Grading Plan as Exhibits 4. The pond is described in more detail below.

- Ø POND

  The proposed pond will be located just south of the property in an offsite Reserve. This pond will detain the developed runoff to less than existing conditions. The pond is expected to have a static water surface of a 1351.0 and a corresponding 100-year water surface elevation of a 1353.5. The pond will discharge to the south, offsite, via a 15 ' broadcrested weir at the static water surface elevation. The weir is expected to be rip rap lined. Residential development is expected to be platted around this area in the future. At that time, the pond will need to be enlarged and a more permanent structure should be installed. We expect minor regarding to the southwest, in the existing swale, to allow the pond to drain un-impeded to the Cowskin Creek.

DETENTION SUMMARY

Detention will be provided on the proposed site to limit the developed runoff to less than or equal to the existing conditions. The following tables represents the pond systems inflow and outflow for the 24-hour, 100-yr storm event.

POND

POND	INFLOW	OUTFLOW	100-yr WSE	OUTLET
Pond	250 cfs	153 cfs	1353.5	15" Weir

DISCHARGE POINTS SUMMARY

The site discharges to the south and eventually into the Cowskin Creek. There is an apparent swale which conveys runoff to the south and west. This swale, south to the Cowskin Creek, will continue to convey runoff to the south. We expect minor re-grading south of the pond to obtain positive drainage to the creek.

POTENTIAL UPSTREAM/DOWNSTREAM IMPACTS

There does not appear to be any negative impacts associated with the development of this property. The pond will detain to less than existing conditions and will discharge primarily to the same point at the same elevation. We anticipate future residential development around this pond. At that time, the pond will need to be re-modeled and increased in size with a more permanent outlet. There is no FEMA SFHA on this property. The FEMA Floodplain is located, at the nearest point, approximately 650' feet from this property at the northwest corner.

This property will accept all offsite runoff from the north and east and therefore is not expected to have any negative effect upstream. We expect 29th Street North to be improved and curb and gutter with storm sewer system be installed and work directly with this drainage plan.

SOURCE OF FLOODPLAIN INFORMATION

There is no FEMA SFHA located on this property as of this report. The location of the property, on FEMA FIRM Panel 330 of 700 for Sedgwick County, Kansas, effective date February 2, 2007 is attached as Exhibit 5.

FEDERAL, STATE, & LOCAL PERMITTING

US ARMY CORPS OF ENGINEERS
We do not expect any USACOE permitting at this time.

KANSAS DEPT OF AGRICULTURE – DWR PERMITTING
We do not expect any DWR permitting at this time.

FEMA
No FEMA SFHA exists on this property and we do not expect any FEMA permitting at this time.

KANSAS DEPT OF TRANSPORTATION
There does not appear to be any KDOT permitting needed on the proposed project.

SEDGWICK COUNTY ROW
There does not appear to be any discharge into the county ROW. No permit is expected at this time.

EXHIBIT 1: Site Location Map

EXHIBIT 2: Aerial Photo Exhibit with Topography

EXHIBIT 3: Plat – Half Scale

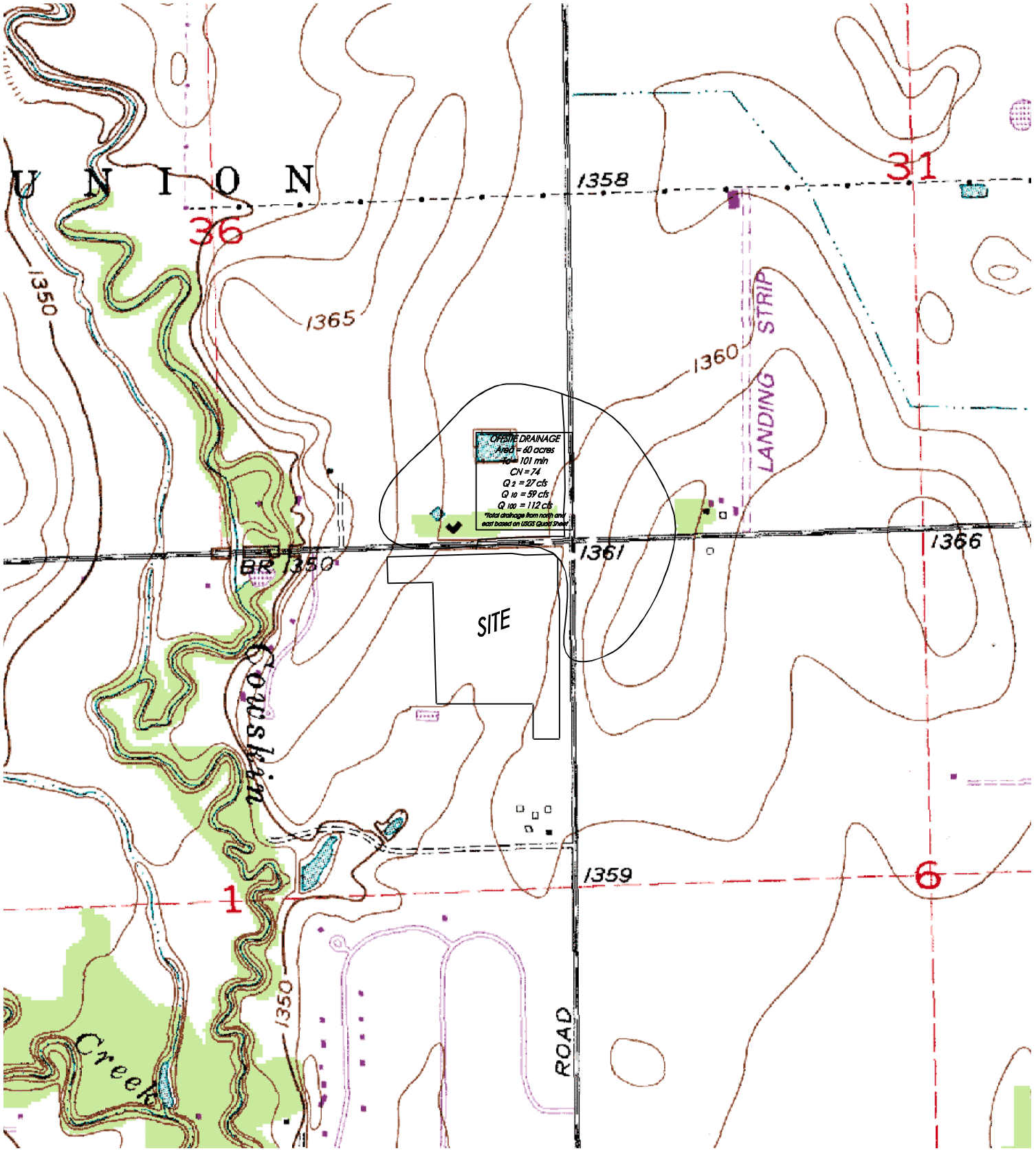
EXHIBIT 4: Drainage & Grading Plan – Half Scale

EXHIBIT 5: Floodplain Location (FIRM)

SITE LOCATION EXHIBIT

ASHTON CREEK COMMERCIAL ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS



0 500 1000

DATE OF PREPARATION: 30 JUNE 2008

EXHIBIT 1
ASHTON CREEK COMMERCIAL
30 JUNE 2008

Baughman Company, P.A.
315 Ellis St. Wichita, KS 67211 P 316.263.7271 F 316.263.0149
Baughman ENGINEERING | SURVEYING | PLANNING | LANDSCAPE ARCHITECTURE

AERIAL EXHIBIT

ASHTON CREEK COMMERCIAL ADDITION

WICHITA, SEDGWICK COUNTY, KANSAS

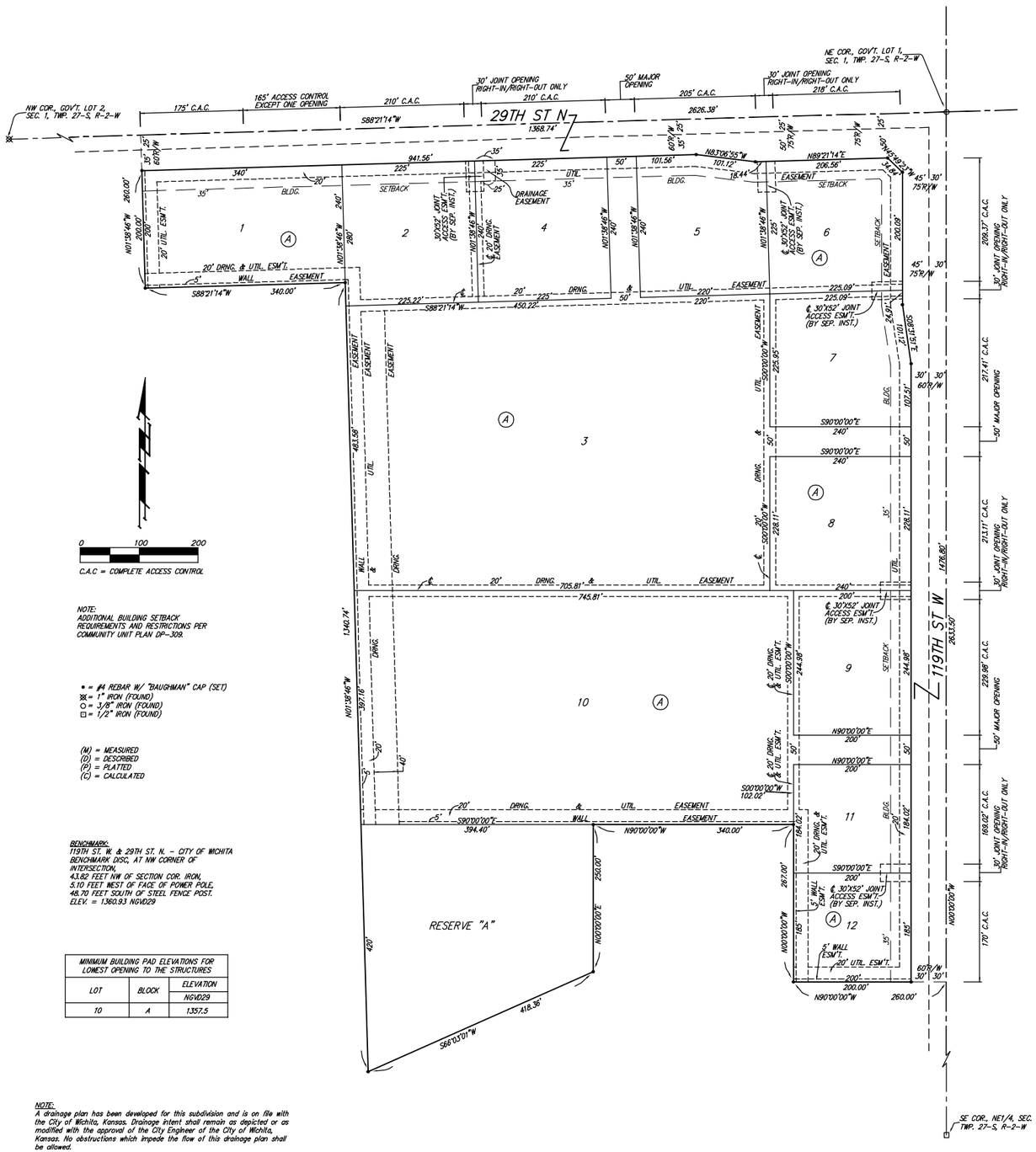
0 200 400

DATE OF PREPARATION: 30 JUNE 2008

EXHIBIT 3
ASHTON CREEK COMMERCIAL
30 JUNE 2008

Baughman Company, P.A.
315 Ellis St. Wichita, KS 67211 P 316.262.7271 F 316.262.0149
Baughman ENGINEERING | SURVEYING | PLANNING | LANDSCAPE ARCHITECTURE

ASHTON CREEK COMMERCIAL PARK
WICHITA, SEDGWICK COUNTY, KANSAS



0 100 200

C.A.C. = COMPLETE ACCESS CONTROL

NOTE:
ADDITIONAL BUILDING SETBACK REQUIREMENTS AND RESTRICTIONS PER COMMUNITY UNIT PLAN DP-309.

• = #4 REBAR W/ "BAUGHMAN" CAP (SET)
⊠ = 1" IRON (FOUND)
○ = 3/8" IRON (FOUND)
□ = 1/2" IRON (FOUND)

(M) = MEASURED
(D) = DESCRIBED
(P) = PLATTED
(C) = CALCULATED

BENCHMARK:
119TH ST. W. & 29TH ST. N. – CITY OF WICHITA BENCHMARK DISC, AT NW CORNER OF INTERSECTION,
43.82 FEET NW OF SECTION COR. IRON,
5.10 FEET WEST OF FACE OF POWER POLE,
48.70 FEET SOUTH OF STEEL FENCE POST.
ELEV. = 1360.93 NGVD29

MINIMUM BUILDING PAD ELEVATIONS FOR LOWEST OPENING TO THE STRUCTURES		
LOT	BLOCK	ELEVATION NGVD29
10	A	1357.5

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.

State of Kansas)
Sedgwick County) SS

We, Baughman Company, P.A., Surveyors in aforesaid county and state do hereby certify that we have surveyed and platted "ASHTON CREEK COMMERCIAL PARK", Wichita, Sedgwick County, Kansas and that the accompanying plat is a true and correct exhibit of the property surveyed, described as that part of Government Lots 1 and 2 and the S1/2 of the NE1/4 of Sec. 1, Twp. 27-S, R-2-W of the 6th P.M., Sedgwick County, Kansas described as follows: Beginning at the NE corner of said NE1/4; thence southerly along the east line of said NE1/4, 1476.80 feet; thence westerly perpendicular to the east line of said NE1/4, 260.00 feet; thence northerly parallel to the east line of said NE1/4, 267.00 feet; thence westerly perpendicular to the east line of said NE1/4, 340.00 feet; thence southerly parallel with the east line of said NE1/4, 250.00 feet; thence southwesterly, 418.36 feet to a point 1600.74 feet normally distant south of the north line of said NE1/4 and 982.34 feet normally distant west of the east line of said NE1/4; thence northerly perpendicular to the north line of said NE1/4, 1340.74 feet to a point 260.00 feet normally distant south of the north line of said NE1/4; thence westerly parallel with the north line of said NE1/4, 340.00 feet; thence northerly perpendicular to the north line of said NE1/4, 260.00 feet to a point on the north line of said NE1/4; thence easterly along the north line of said NE1/4, 1368.74 feet to the point of beginning, all being subject to road rights-of-way of record.

Existing public easements and dedications being vacated by virtue of K.S.A. 12-512(b).

Baughman Company, P.A.

_____, Surveyor
Michael G. Conrey

Know all men by these presents that we, the undersigned, have caused the land in the surveyors certificate to be platted into Lots, a Block, and Streets, to be known as "ASHTON CREEK COMMERCIAL PARK", Wichita, Sedgwick County, Kansas. The utility easements are hereby granted as indicated for the construction and maintenance of all public utilities. The drainage and utility easements are hereby granted as indicated for drainage purposes and for the construction and maintenance of all public utilities. The drainage easements are hereby granted as indicated for drainage purposes. The wall easements are hereby granted as indicated for the construction and maintenance of a private screening wall and utility main lines and service lines shall be allowed to cross these easements. Reserve "A" is hereby reserved for open space, landscaping, lakes, berms, and drainage purposes. Reserve "A" shall be owned and maintained by the lot owners association for the addition. The streets are hereby dedicated to and for the use of the public. 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.

C D Land Company, LLC

_____, Manager
Christopher Dugan

State of Kansas)
Sedgwick County) SS

The foregoing instrument acknowledged before me, this____day of_____, 2008, by Christopher Dugan, Manager of the C D Land Company, LLC, on behalf of the limited liability company.

_____, Notary Public

My App't. Exp. _____

This plat of "ASHTON CREEK COMMERCIAL PARK", 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_____, 2008.
Wichita-Sedgwick County Metropolitan Area Planning Commission

_____, Chair
M. S. Mitchell

_____, Secretary
John L. Schlegel

This plat approved and all dedications shown hereon accepted by the City Council of the City of Wichita, Kansas, this_____day of_____, 2008.

_____, Mayor
Carl Brewer

_____, City Clerk
Karen Sublett

Reviewed in accordance with K.S.A. 58-2005 on this_____day of_____, 2008.

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

Entered on transfer record this_____day of_____, 2008.

_____, County Clerk
Don Brace

State of Kansas)
Sedgwick County) SS

This is to certify that this plat has been filed for record in the office of the Register of Deeds, this_____day of_____, 2008 at_____o'clock__M; and is duly recorded.

_____, Register of Deeds
Bill Meek

_____, Deputy
Tonya Buckingham

ASHTON CREEK COMMERCIAL PARK

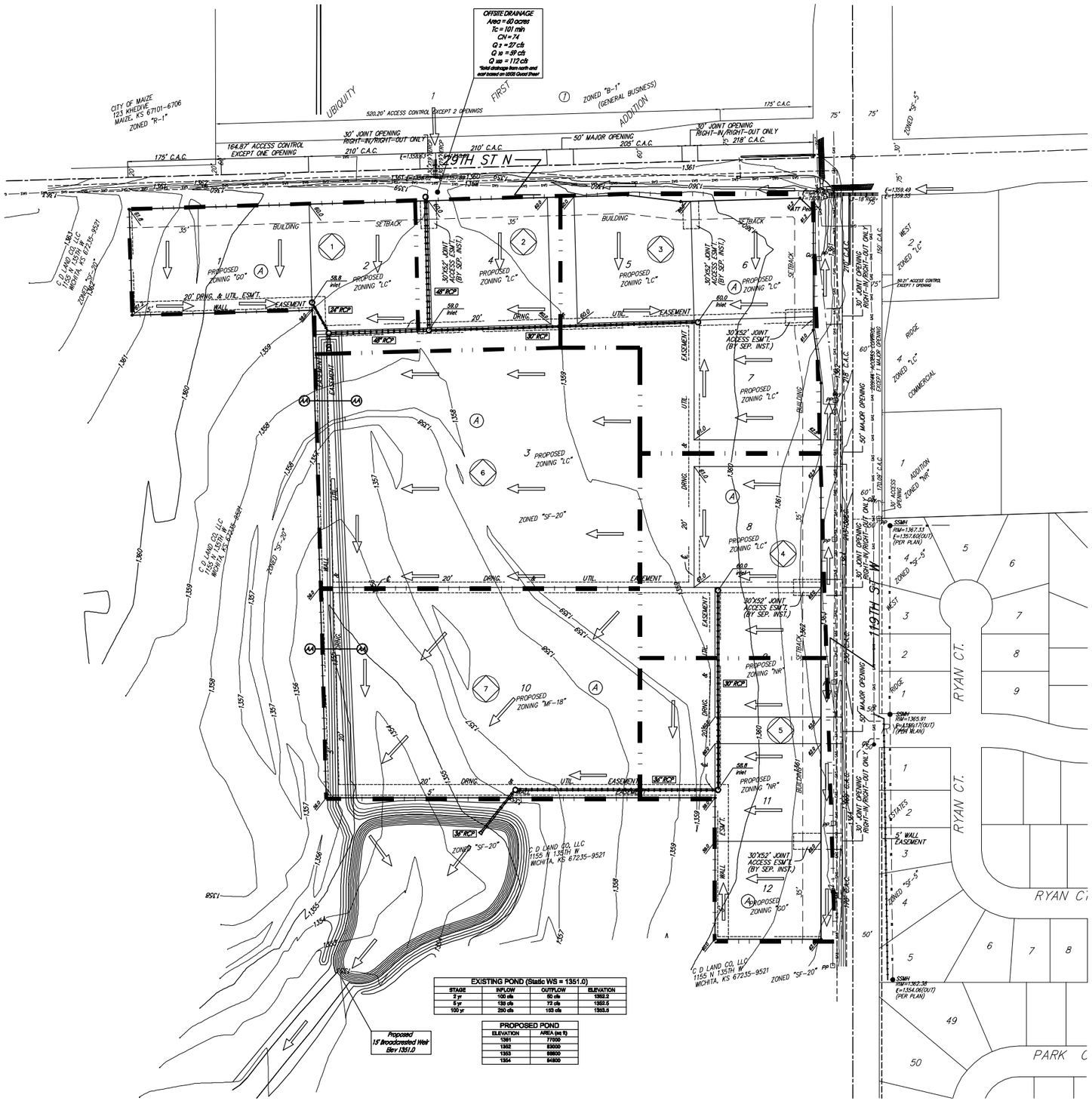
Baughman Company, P.A.
315 Ellis St. Wichita, KS 67211 P 316.262.7271 F 316.262.0149
Baughman ENGINEERING | SURVEYING | PLANNING | LANDSCAPE ARCHITECTURE

F:/PLAT/ASHTONCREEKCOMMERCIALPARK/DWG/ASHTONCREEKCOM-P.DWG-RKR

DRAINAGE & GRADING PLAN

ASHTON CREEK COMMERCIAL PARK

WICHITA, SEDGWICK COUNTY, KANSAS



EXISTING POND (Static WS = 1351.0)			
STAGE	INFLOW	OUTFLOW	ELEVATION
2 yr	100 cfs	50 cfs	1352.2
5 yr	130 cfs	72 cfs	1352.5
100 yr	280 cfs	153 cfs	1353.5

PROPOSED POND	
ELEVATION	AREA (sq ft)
1351	77000
1352	83000
1353	89800
1354	94800

0 100 200

DATE OF PREPARATION: 12 MAY 2008
DATE OF TOPOGRAPHIC: 7 APRIL 2008
CONTOUR INTERVALS = 1 FOOT

NOTE:
ADDITIONAL BUILDING SETBACK REQUIREMENTS AND RESTRICTIONS PER COMMUNITY UNIT PLAT DP-309.

- = #4 REBAR W/ "BAUGHMAN" CAP (SET)
- = #4 REBAR W/ "ITLS1" CAP (FOUND)
- = 1" IRON (FOUND)
- = 3/8" IRON (FOUND)
- = 1/2" IRON (FOUND)

(M) = MEASURED
(D) = DESCRIBED
(P) = PLATTED
(C) = CALCULATED

OWNER:
C D LAND CO, LLC
ATTN: CHRIS DUGAN
1155 N 135TH ST W
WICHITA, KS 67235-9521
PH: (316) 721-6575

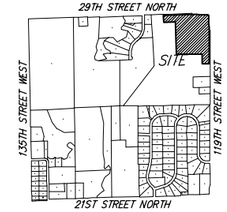
LEGAL DESCRIPTION:
THAT PART OF GOVERNMENT LOTS 1 AND 2 AND THE S ½ OF THE NE ¼ OF SEC. 1, TWP. 27-S, R-2-W OF THE 6TH P.M., SEDGWICK COUNTY, KANSAS DESCRIBED AS FOLLOWS: BEGINNING AT THE NE CORNER OF SAID NE ¼; THENCE SOUTHERLY ALONG THE EAST LINE OF SAID NE ¼, 1476.80 FEET; THENCE WESTERLY PERPENDICULAR TO THE EAST LINE OF SAID NE ¼, 260.00 FEET; THENCE NORTHERLY PARALLEL TO THE EAST LINE OF SAID NE ¼, 267.00 FEET; THENCE WESTERLY PERPENDICULAR TO THE EAST LINE OF SAID NE ¼, 734.40 FEET; THENCE NORTHERLY PERPENDICULAR TO THE NORTH LINE OF SAID NE ¼, 920.74 FEET TO A POINT 260.00 FEET NORMALLY DISTANT SOUTH OF THE NORTH LINE OF SAID NE ¼; THENCE WESTERLY PARALLEL WITH THE NORTH LINE OF SAID NE ¼, 340.00 FEET; THENCE NORTHERLY PERPENDICULAR TO THE NORTH LINE OF SAID NE ¼, 260.00 FEET TO A POINT ON THE NORTH LINE OF SAID NE ¼; THENCE EASTERLY ALONG THE NORTH LINE OF SAID NE ¼, 1368.74 FEET TO THE POINT OF BEGINNING, ALL BEING SUBJECT TO ROAD RIGHTS-OF-WAY OF RECORD.

BENCHMARK:
119TH ST. W. & 29TH ST. N. - CITY OF WICHITA BENCHMARK DISC, AT NW CORNER OF INTERSECTION.
43.82 FEET NW OF SECTION COR. IRON,
5.10 FEET WEST OF FACE OF POWER POLE,
48.70 FEET SOUTH OF STEEL FENCE POST.
ELEV. = 1360.93 NGVD29

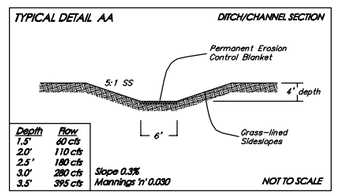
Developed	2yr	25yr	100yr
Intensity	3.8	6.06	7.36
Rational C	0.68	0.73	0.80

Basin ID	Area	Developed Flowrates		
		2-yr	25-yr	100-yr
	acres	cfs	cfs	cfs
1	3.0	7.8	13	18
2	1.6	4.1	7.1	9.4
3	4.5	12	20	26
4	3.0	7.8	13	18
5	3.5	9.0	15	21
6	6.6	17	29	39
7	5.5	14	24	32
TOTAL	27.7	72	123	163

- GAS — GAS — GAS — GAS — GAS — GAS — GAS — GAS — GAS — GAS — GAS — GAS — GAS —
- = Catch Basin
- CO = Cleanout
- CP = Cable TV Pedestal
- = Drop Inlet
- = Detecter Loop
- EB = Electric Box
- FH = Fire Hydrant
- GM = Gas Meter
- GP = Guy Pole
- GU = Guard Post(Bollard)
- Guy = Guy Anchor
- GV = Gas Valve
- HLP = High Line Pole
- ICV = Irrigation Control Valve - Valve Box
- LP = Light Pole
- MB = Mail Box
- MW = Monitoring Well
- P = Pine Tree
- PM = Pipeline Marker
- PP = Power Pole
- RWM = Right-of-Way Marker
- SD = Satellite Dish
- SH = Sprinkler Head
- Sign = Signal Pole
- Sign = Sign
- SP = Stand Pipe
- SSMH = Sanitary Sewer Manhole
- ATTMH = ATT Manhole
- ATT Ped = ATT Pedestal
- SWSMH = Stormwater Sewer Manhole
- T = Tree
- TB = Traffic Box
- TMH = Traffic Manhole
- TP = Telephone Pole
- WM = Cased Well
- WM = Water Meter
- WV = Water Valve
- WVT = Water Vault
- XFMR = Transformer
- YH = Yard Hydrant(Spigot)



VICINITY MAP
SEC. 1, T27S, R2W



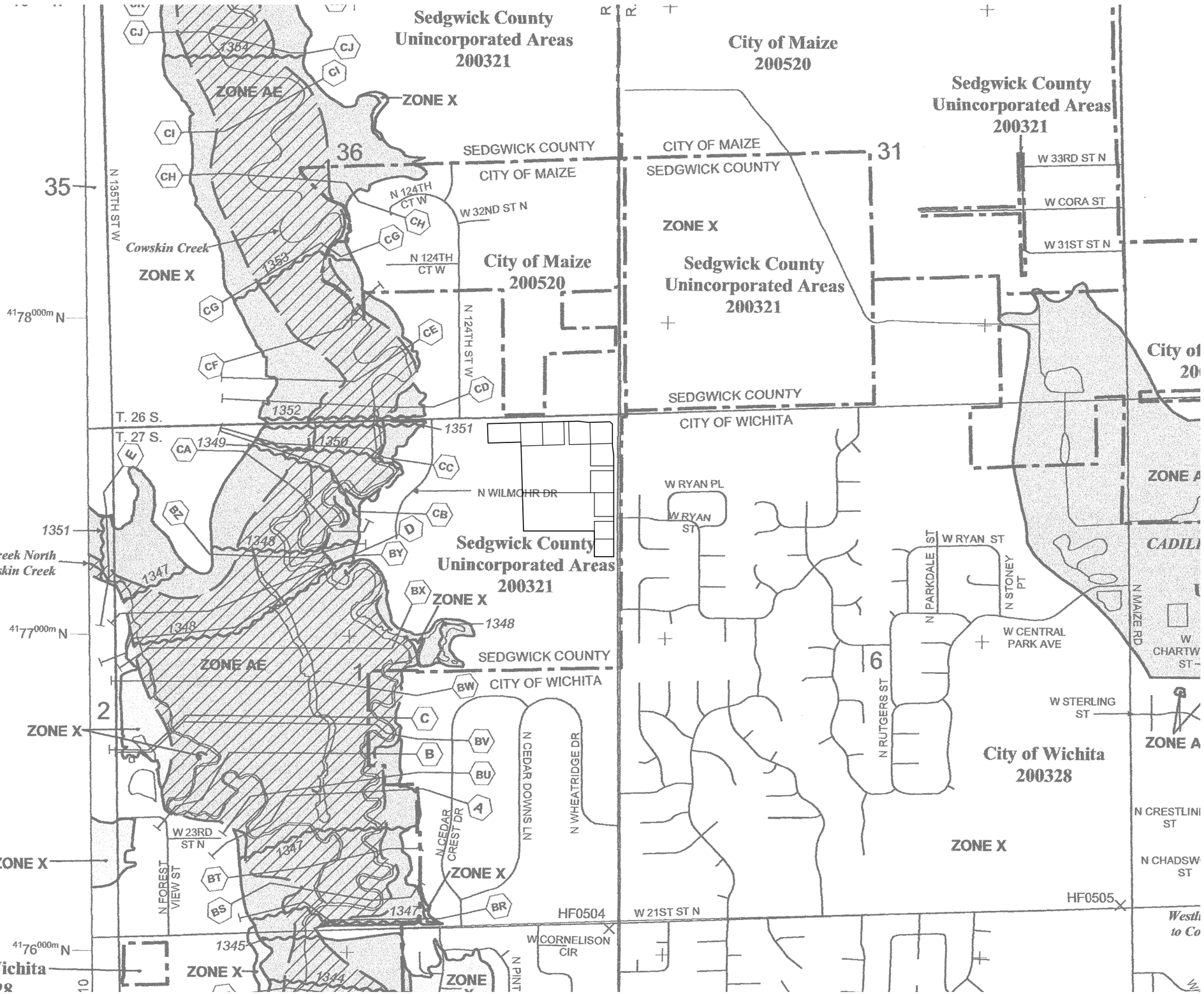
- Proposed SWS
- Proposed SWS Inlet
- Proposed Conveyence Direction

NOTE: No FEMA SFHA exists on this property as of June 30, 2008 per FEMA FIRM Panel 330 of 700 for Sedgwick County, Kansas, effective February 2, 2007.

DRAINAGE & GRADING PLAN
ASHTON CREEK COMMERCIAL PARK
30 JUNE 2008

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

F:\HYDRO\Projects\AshtonCreek\ASHTONCREEKCOM P_drain.dwg


Sedgwick County
Unincorporated Areas
200321
City of Maize
200520
Sedgwick County
Unincorporated Areas
200321
ZONE AE
ZONE X
SEDGWICK COUNTY
CITY OF MAIZE
CITY OF MAIZE
SEDGWICK COUNTY
W 33RD ST N
W CORA ST
W 31ST ST N
36
31
35
N 135TH ST W
N 124TH CT W
W 32ND ST N
Cowskin Creek
ZONE X
City of Maize
200520
N 124TH CT W
N 124TH ST W
Sedgwick County
Unincorporated Areas
200321
ZONE X
SEDGWICK COUNTY
CITY OF WICHITA
T. 26 S.
T. 27 S.
1354
1353
1352
1351
1350
1349
1348
1347
1345
1344
N WILMOHR DR
Sedgwick County
Unincorporated Areas
200321
Dry Creek North
of Cowskin Creek
ZONE AE
ZONE X
SEDGWICK COUNTY
CITY OF WICHITA
W RYAN PL
W RYAN ST
N PARKDALE ST
W RYAN ST
N STONEY PT
N MAIZE RD
W CENTRAL
PARK AVE
W STERLING
ST
N RUTGERS ST
City of Wichita
200328
ZONE X
N CRESTLINE
ST
N CHADSWICK
ST
HF0505
HF0504
W 21ST ST N
W CORNELISON
CIR
N CEDAR DOWNS LN
N WHEATRIDGE DR
N CEDAR CREST DR
N FOREST VIEW ST
W 23RD ST N
ZONE X
ZONE X
ZONE X
ZONE X
City of Wichita
200328
41°78'000m N
41°77'000m N
41°76'000m N
MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0330E
FIRM
FLOOD INSURANCE RATE MAP
SEDGWICK COUNTY, KANSAS
AND INCORPORATED AREAS
PANEL 330 OF 700
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
MAIZE, CITY OF 200520 0330 E
SEDGWICK COUNTY 200321 0330 E
WICHITA, CITY OF 200328 0330 E
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
20173C0330E
EFFECTIVE DATE
FEBRUARY 2, 2007
Federal Emergency Management Agency

APPENDIX A: USGS Soils Survey

APPENDIX B: HydraFlow Hydrographs Routing
- Existing & Proposed Conditions

APPENDIX C: HydraFlow StormSewer
- Coincedent 100-year Peak
- Offsite 100-year Peak
- Onsite 100-year Peak
- South System

APPENDIX D: HydraFlow Express
- Proposed Channel

USGS Soils Survey


633360
633450
633540
633630
633720
633810
633900
4177680
4177590
4177500
4177410
4177320
4177230
4177140
N 124TH ST W
W 29TH ST N
N 119TH ST W
6322
5967
5977
5976
N
Meters
0
50
100
200
300
Feet
0
200
400
800
1,200

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

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

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

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 4, Dec 29, 2007

Date(s) aerial images were photographed: 3/20/1996; 3/31/1996

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				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5967	Tabler silty clay loam, 0 to 1 percent slopes	D	32.6	50.0%
5976	Vanoss silt loam, 0 to 1 percent slopes	B	0.2	0.2%
5977	Vanoss silt loam, 1 to 3 percent slopes	B	17.8	27.4%
6322	Blanket silt loam, 0 to 1 percent slopes	C	14.6	22.4%
Totals for Area of Interest (AOI)			65.2	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.

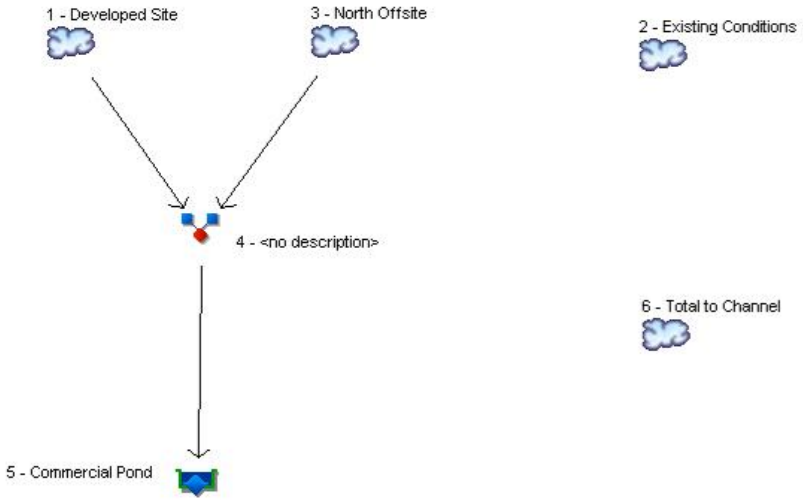
Tie-break Rule: Lower

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 Routing

Existing & Proposed Conditions

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Developed Site
2	SCS Runoff	Existing Conditions
3	SCS Runoff	North Offsite
4	Combine	<no description>
5	Reservoir	Commercial Pond
6	SCS Runoff	Total to Channel

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.02

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	-------	-------	97.32	-------	127.82	152.05	176.18	-------	230.20	Developed Site
2	SCS Runoff	-------	-------	57.60	-------	87.02	111.33	136.01	-------	192.07	Existing Conditions
3	SCS Runoff	-------	-------	20.84	-------	34.70	46.65	59.13	-------	88.35	North Offsite
4	Combine	1, 3	-------	100.20	-------	133.87	161.18	188.68	-------	251.00	<no description>
5	Reservoir	4	-------	50.34	-------	71.94	90.48	109.75	-------	153.02	Commercial Pond
6	SCS Runoff	-------	-------	97.32	-------	127.82	152.05	176.18	-------	230.20	Total to Channel

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.02

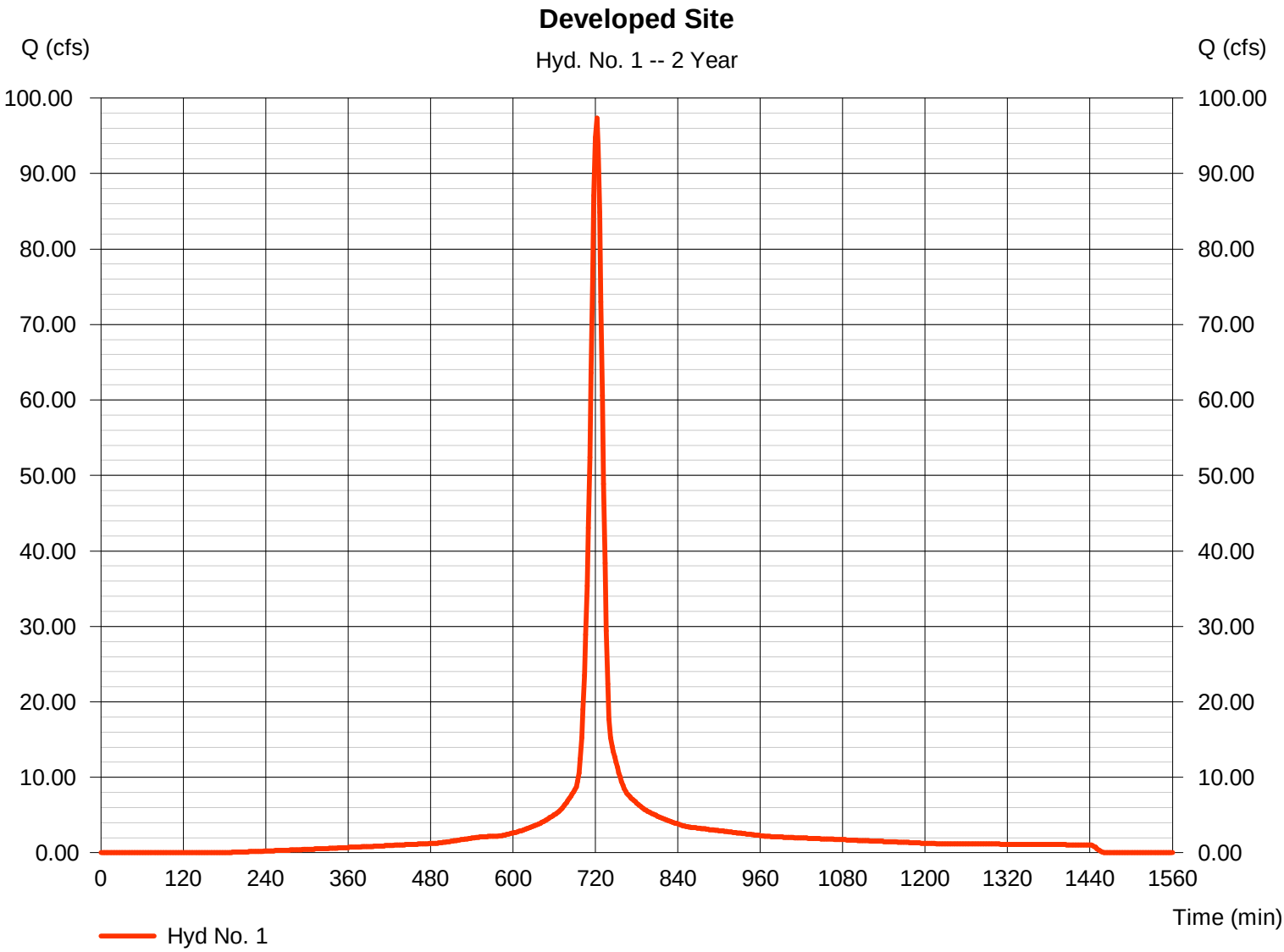
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	97.32	2	722	291,258	----	------	------	Developed Site
2	SCS Runoff	57.60	2	722	162,162	----	------	------	Existing Conditions
3	SCS Runoff	20.84	2	798	269,230	----	------	------	North Offsite
4	Combine	100.20	2	722	560,489	1, 3	------	------	<no description>
5	Reservoir	50.34	2	732	560,483	4	1352.19	95,877	Commercial Pond
6	SCS Runoff	97.32	2	722	291,258	----	------	------	Total to Channel

Hydrograph Report

Hyd. No. 1

Developed Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	97.32 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	291,258 cuft
Drainage area	=	28.000 ac	Curve number	=	95
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

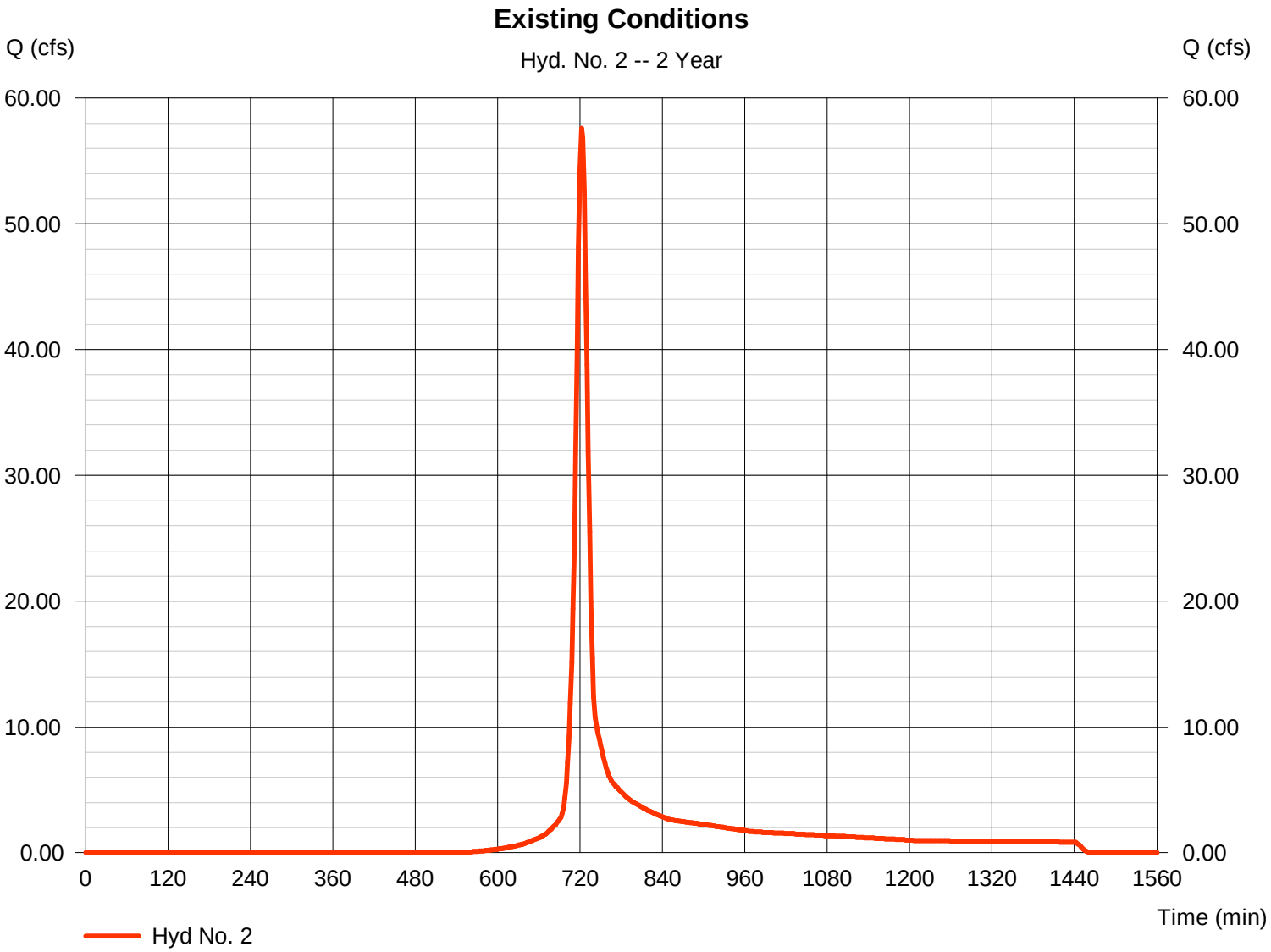


Hydrograph Report

Hyd. No. 2

Existing Conditions

Hydrograph type	=	SCS Runoff	Peak discharge	=	57.60 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	162,162 cuft
Drainage area	=	28.000 ac	Curve number	=	80
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

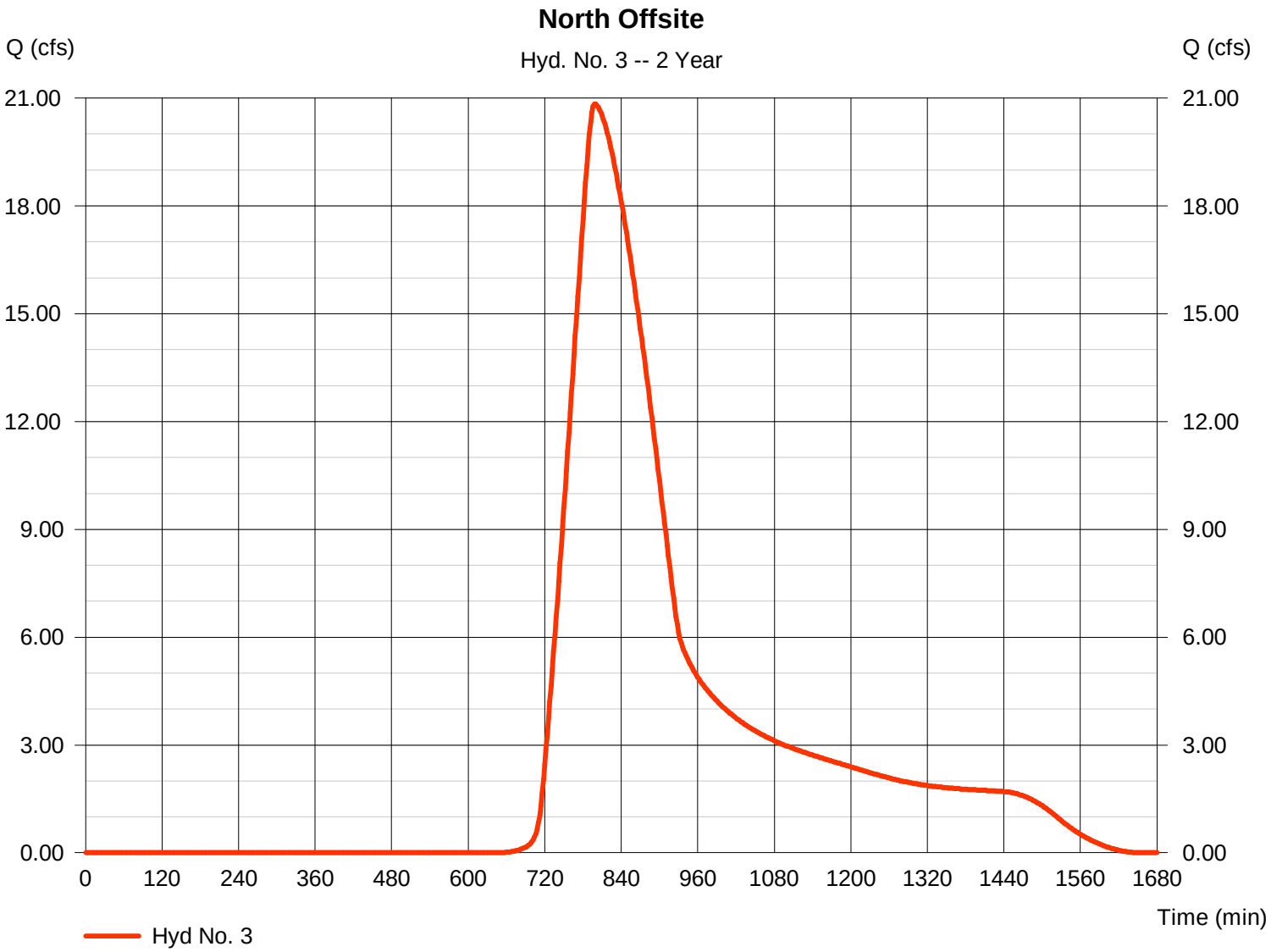


Hydrograph Report

Hyd. No. 3

North Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	20.84 cfs
Storm frequency	=	2 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	269,230 cuft
Drainage area	=	60.000 ac	Curve number	=	74
Basin Slope	=	0.2 %	Hydraulic length	=	1800 ft
Tc method	=	LAG	Time of conc. (Tc)	=	136.14 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

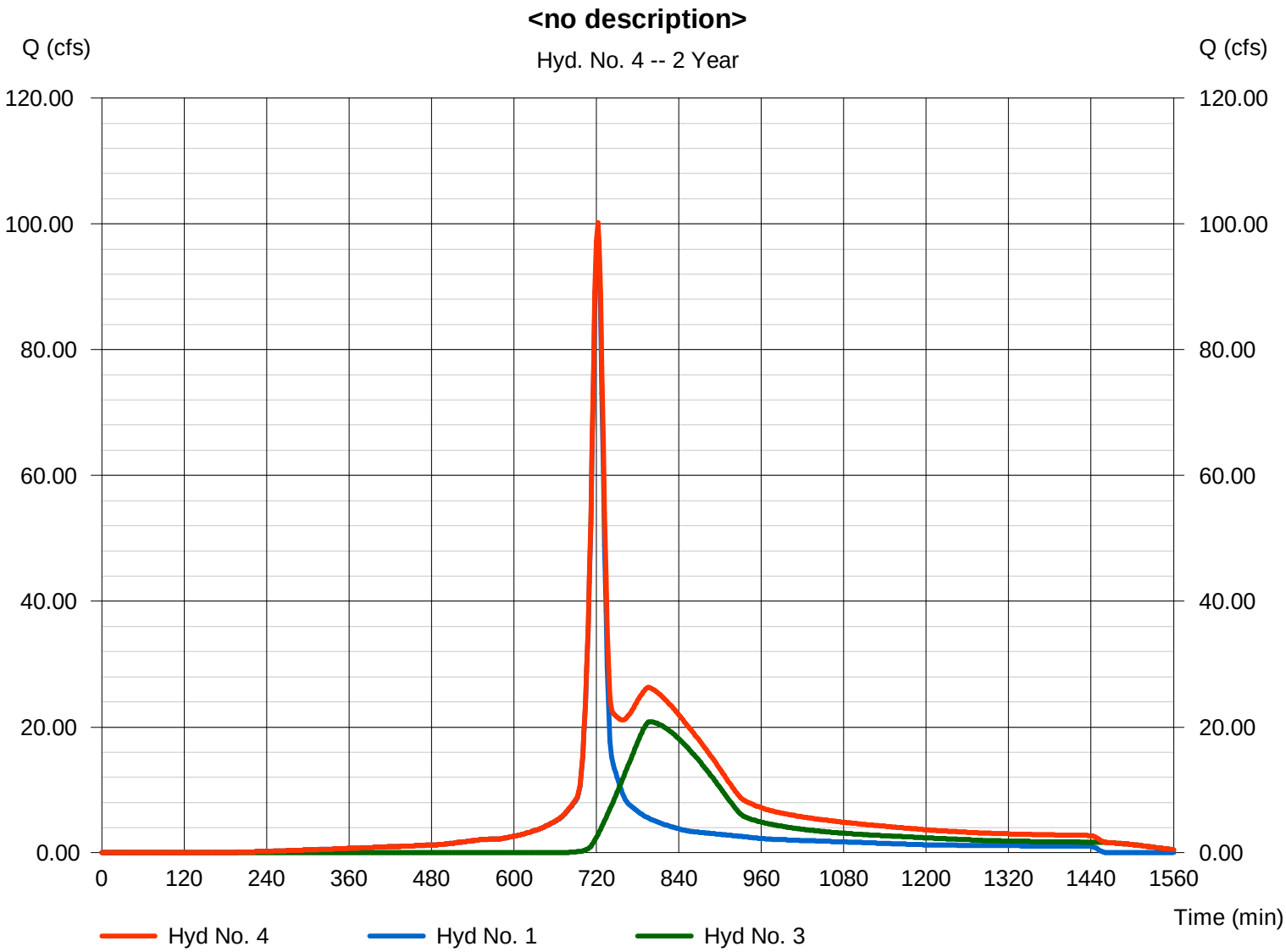


Hydrograph Report

Hyd. No. 4

<no description>

Hydrograph type	= Combine	Peak discharge	= 100.20 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 560,489 cuft
Inflow hyds.	= 1, 3	Contrib. drain. area	= 88.000 ac



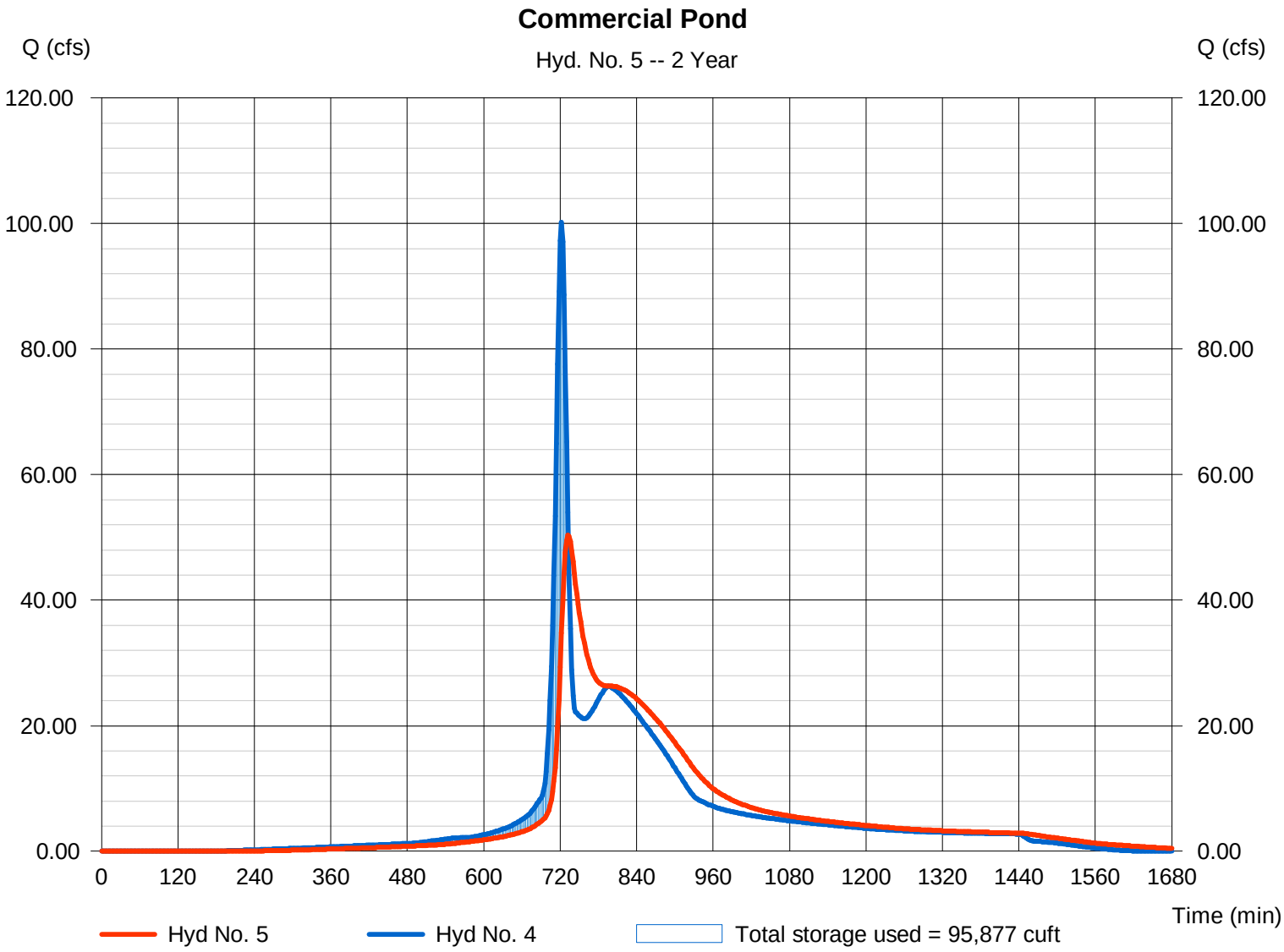
Hydrograph Report

Hyd. No. 5

Commercial Pond

Hydrograph type	=	Reservoir	Peak discharge	=	50.34 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	560,483 cuft
Inflow hyd. No.	=	4 - <no description>	Max. Elevation	=	1352.19 ft
Reservoir name	=	South Pond	Max. Storage	=	95,877 cuft

Storage Indication method used.



Pond No. 1 - South Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1351.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1351.00	77,000	0	0
1.00	1352.00	83,000	79,973	79,973
2.00	1353.00	88,800	85,875	165,848
3.00	1354.00	94,800	91,775	257,623

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

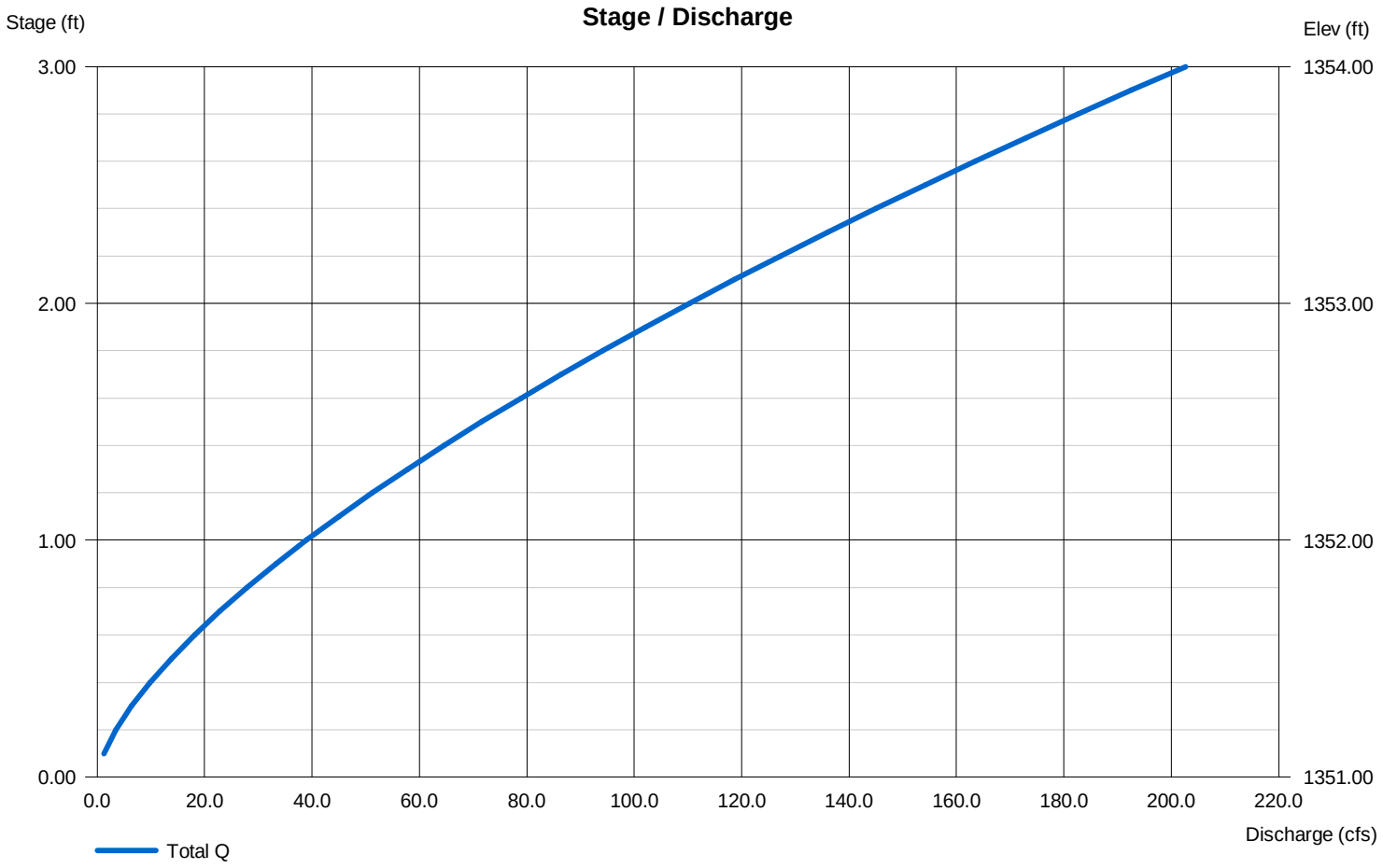
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 1351.00	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 and outlet control. Weir risers are checked for orifice conditions.

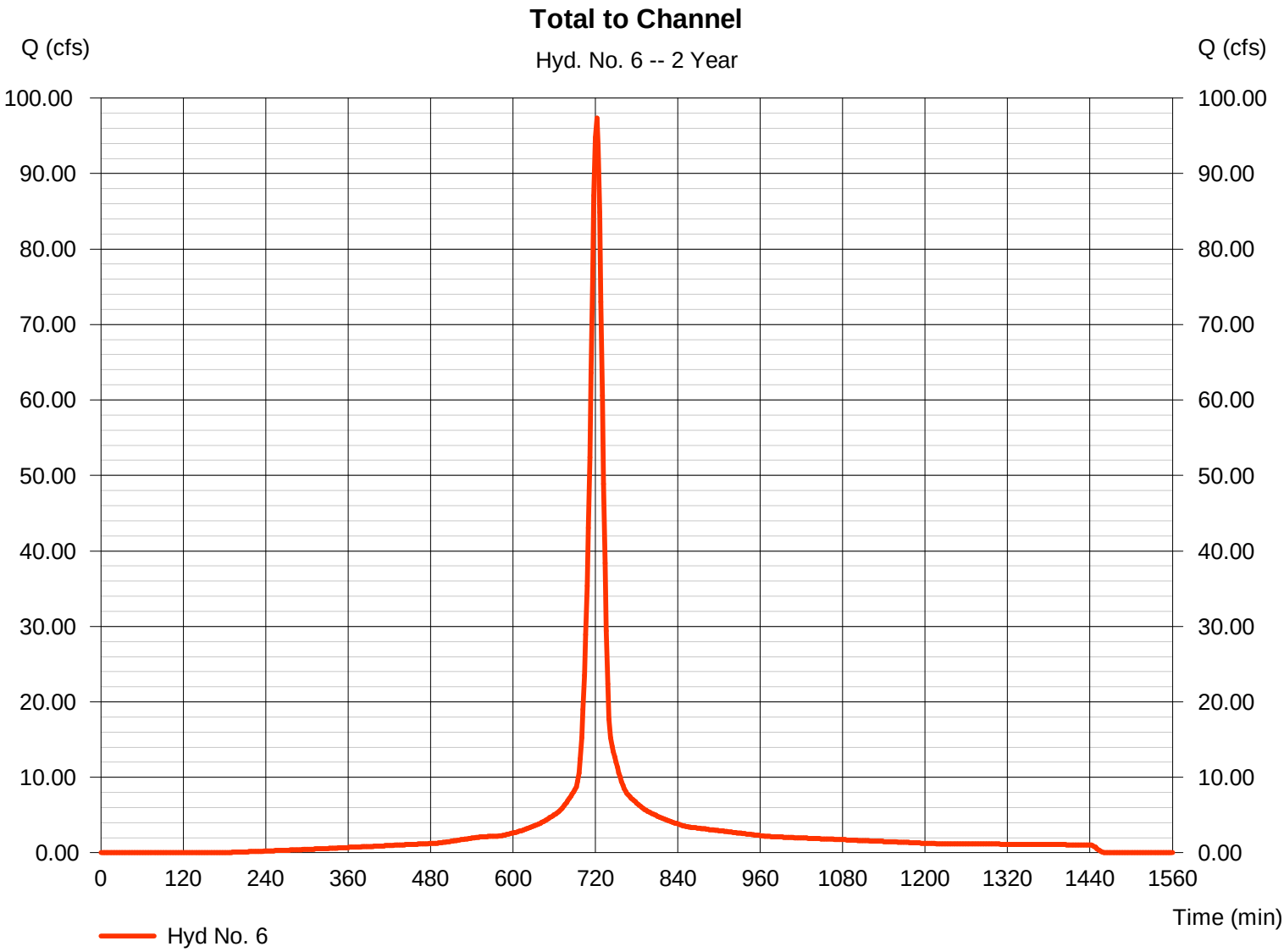


Hydrograph Report

Hyd. No. 6

Total to Channel

Hydrograph type	=	SCS Runoff	Peak discharge	=	97.32 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	291,258 cuft
Drainage area	=	28.000 ac	Curve number	=	95
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 by Intelisolve v9.02

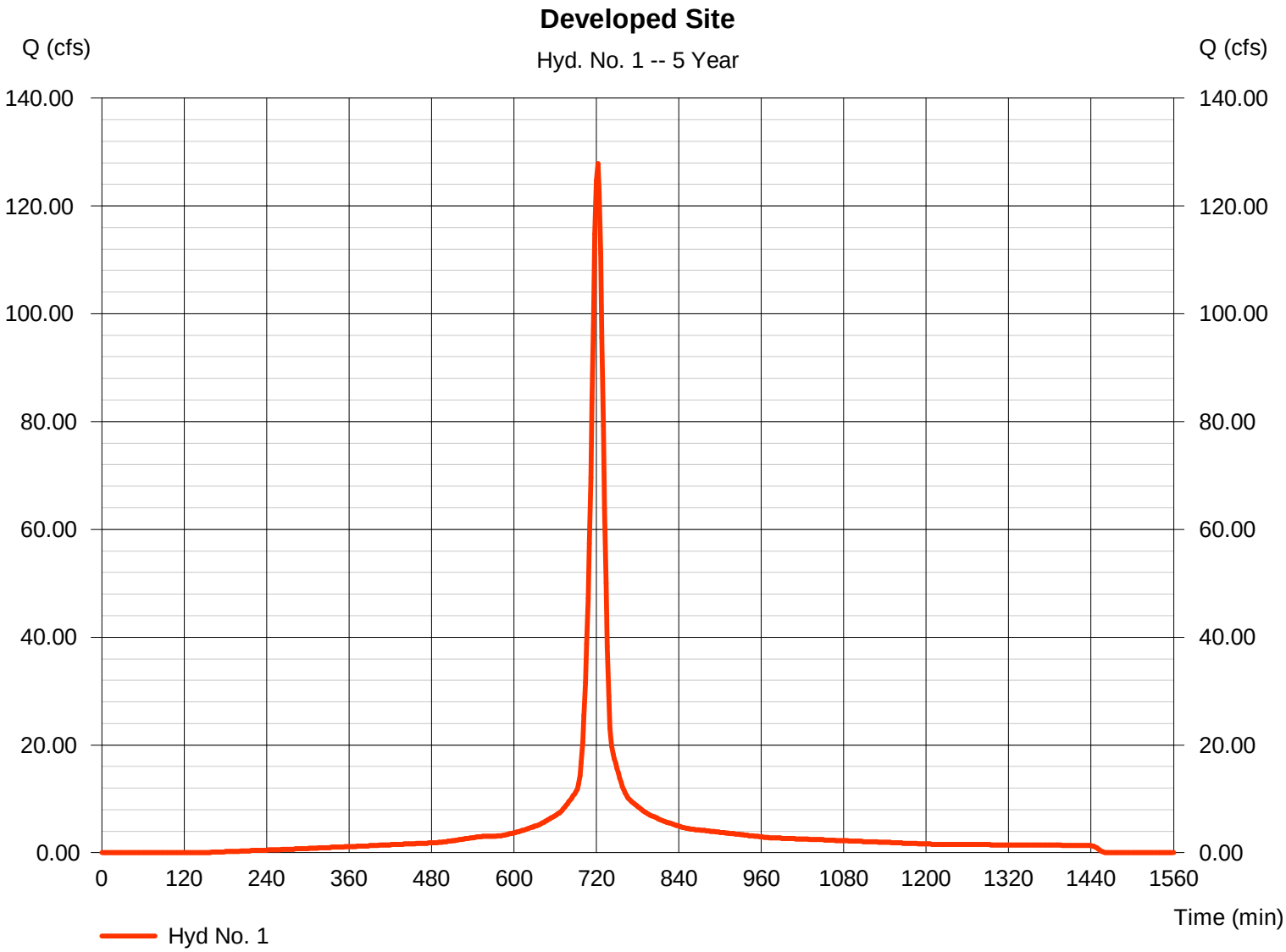
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	127.82	2	722	388,935	----	------	------	Developed Site
2	SCS Runoff	87.02	2	722	243,936	----	------	------	Existing Conditions
3	SCS Runoff	34.70	2	798	428,268	----	------	------	North Offsite
4	Combine	133.87	2	722	817,202	1, 3	------	------	<no description>
5	Reservoir	71.94	2	732	817,195	4	1352.51	123,262	Commercial Pond
6	SCS Runoff	127.82	2	722	388,935	----	------	------	Total to Channel

Hydrograph Report

Hyd. No. 1

Developed Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	127.82 cfs
Storm frequency	=	5 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	388,935 cuft
Drainage area	=	28.000 ac	Curve number	=	95
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

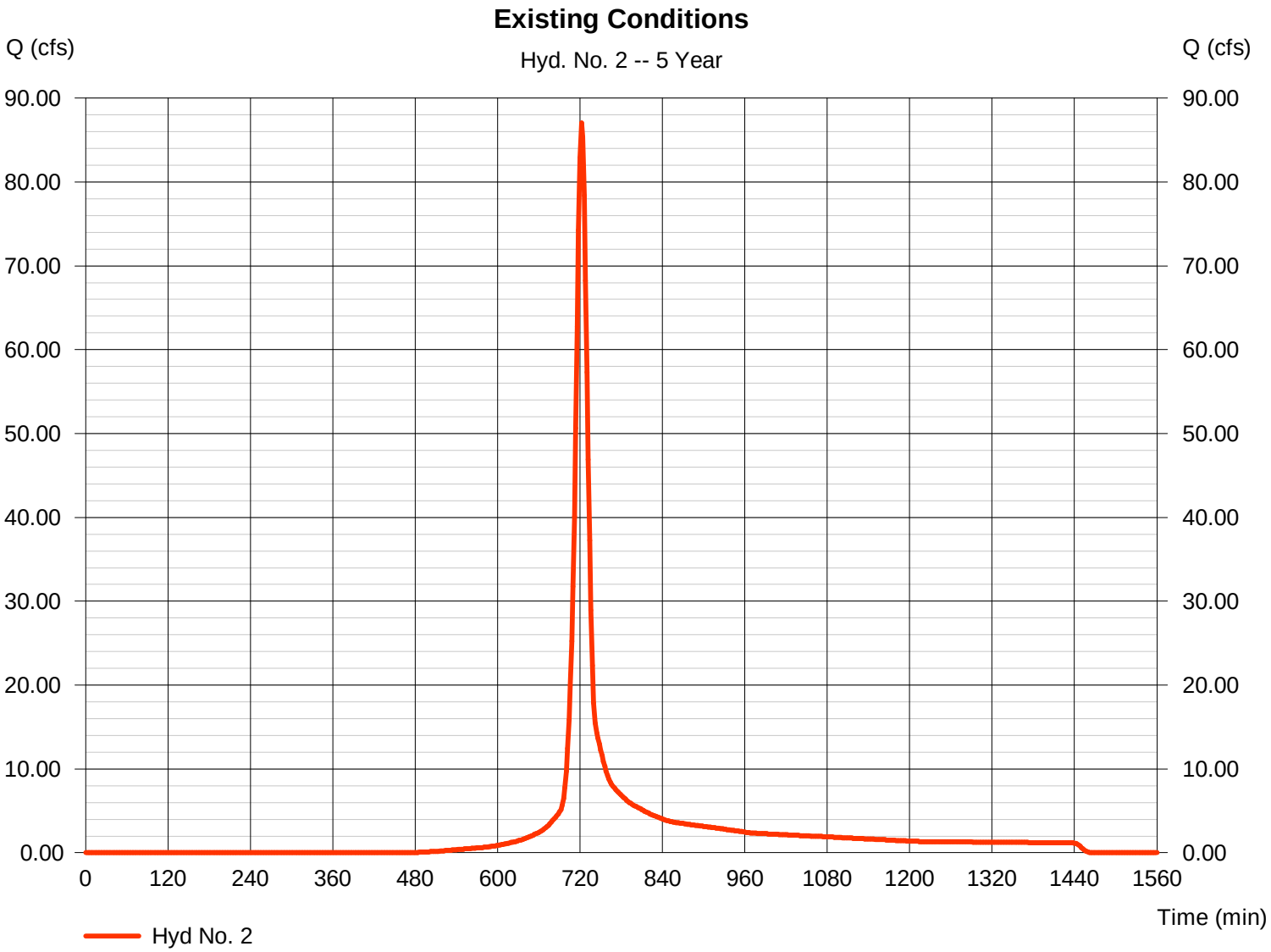


Hydrograph Report

Hyd. No. 2

Existing Conditions

Hydrograph type	=	SCS Runoff	Peak discharge	=	87.02 cfs
Storm frequency	=	5 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	243,936 cuft
Drainage area	=	28.000 ac	Curve number	=	80
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

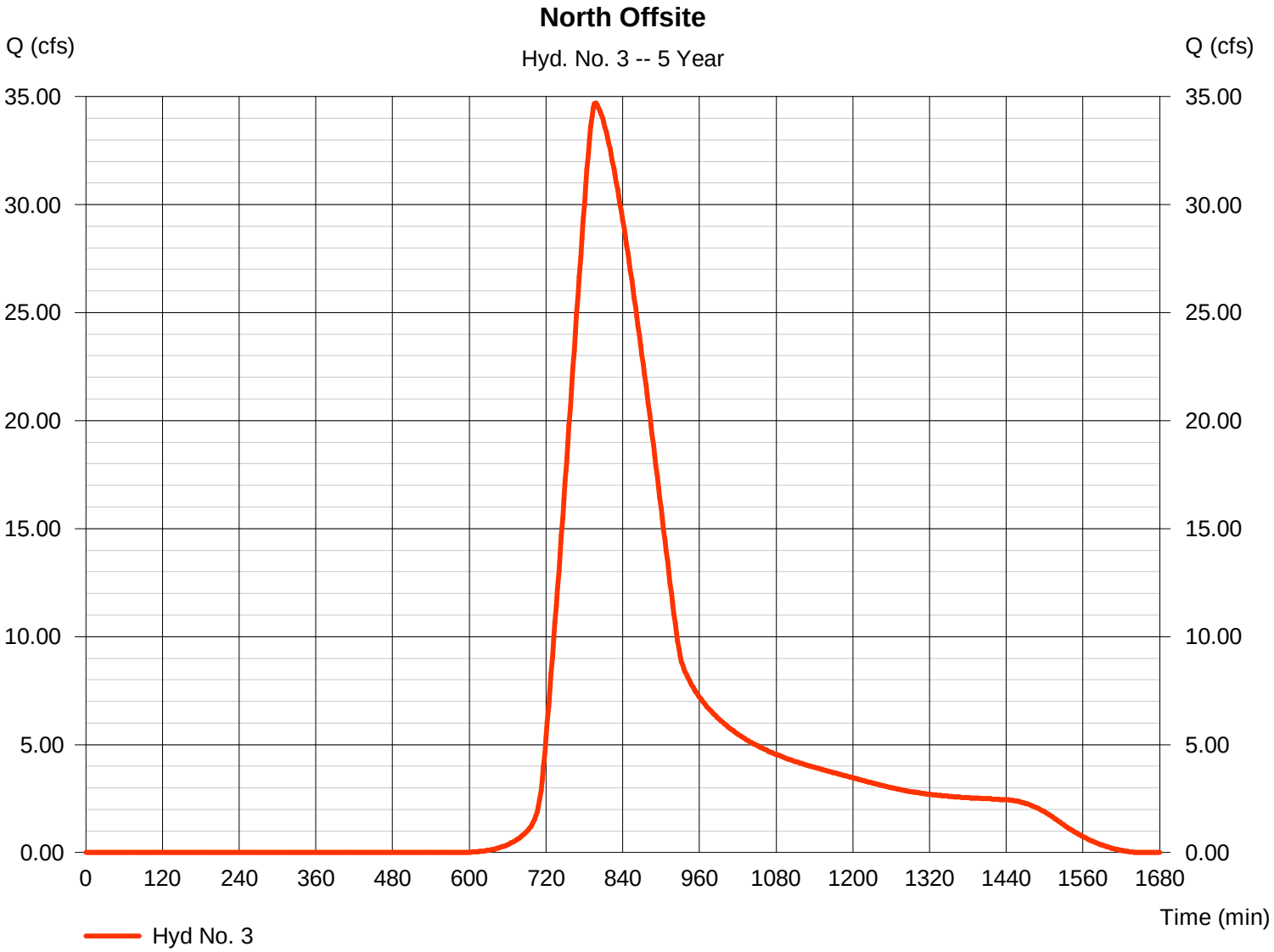


Hydrograph Report

Hyd. No. 3

North Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.70 cfs
Storm frequency	=	5 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	428,268 cuft
Drainage area	=	60.000 ac	Curve number	=	74
Basin Slope	=	0.2 %	Hydraulic length	=	1800 ft
Tc method	=	LAG	Time of conc. (Tc)	=	136.14 min
Total precip.	=	4.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

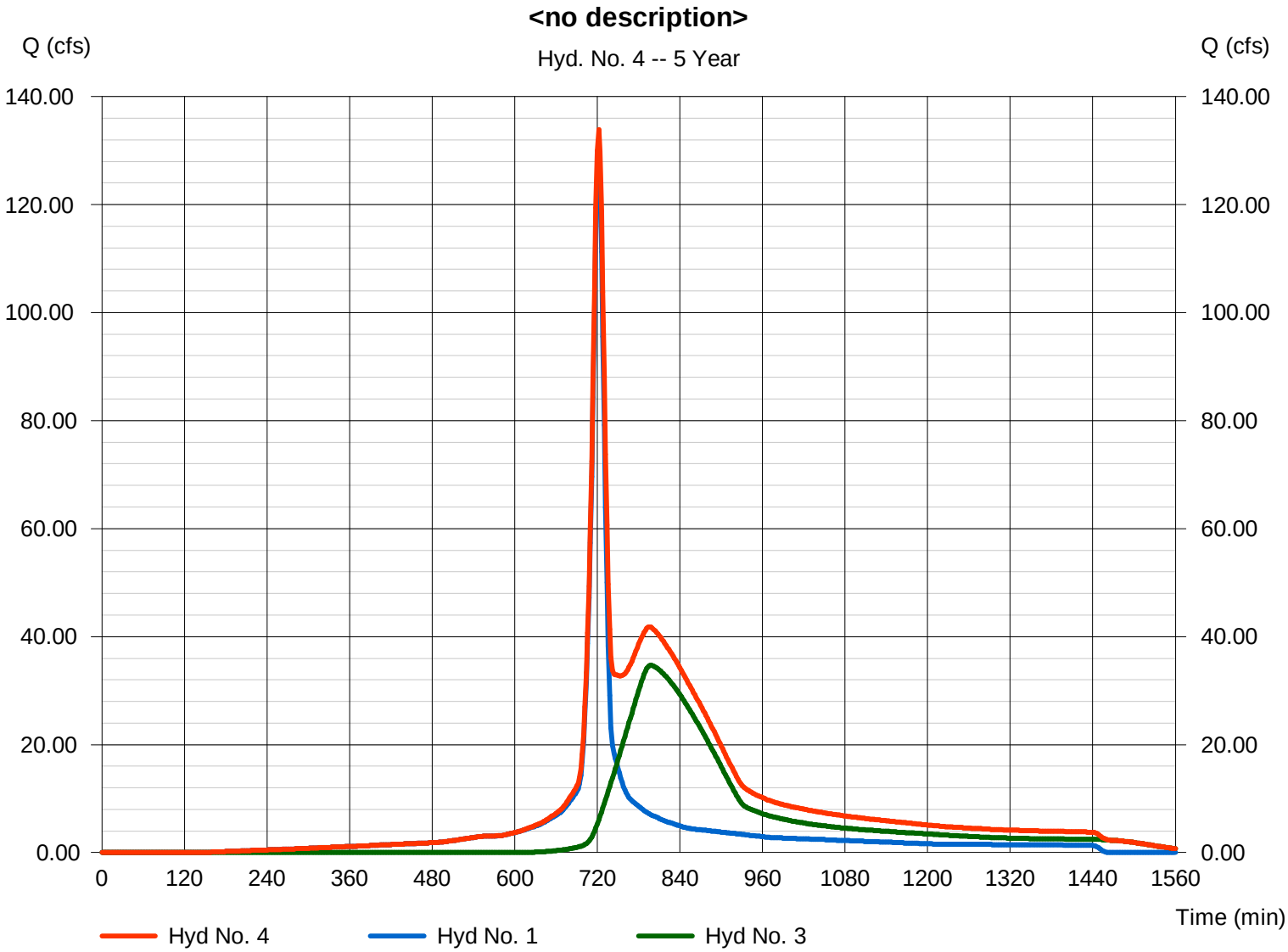


Hydrograph Report

Hyd. No. 4

<no description>

Hydrograph type	= Combine	Peak discharge	= 133.87 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 817,202 cuft
Inflow hyds.	= 1, 3	Contrib. drain. area	= 88.000 ac



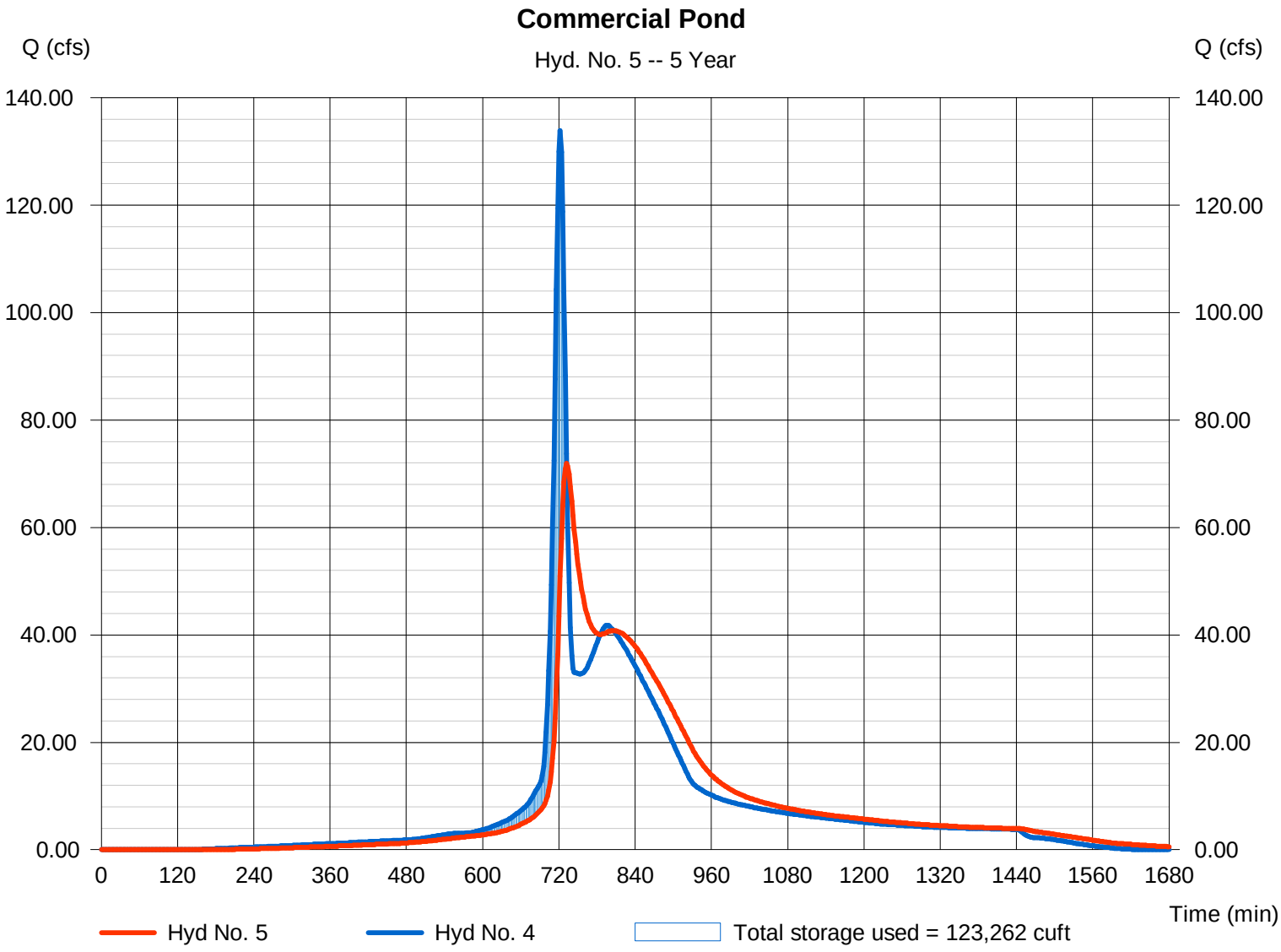
Hydrograph Report

Hyd. No. 5

Commercial Pond

Hydrograph type	=	Reservoir	Peak discharge	=	71.94 cfs
Storm frequency	=	5 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	817,195 cuft
Inflow hyd. No.	=	4 - <no description>	Max. Elevation	=	1352.51 ft
Reservoir name	=	South Pond	Max. Storage	=	123,262 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - South Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1351.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1351.00	77,000	0	0
1.00	1352.00	83,000	79,973	79,973
2.00	1353.00	88,800	85,875	165,848
3.00	1354.00	94,800	91,775	257,623

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

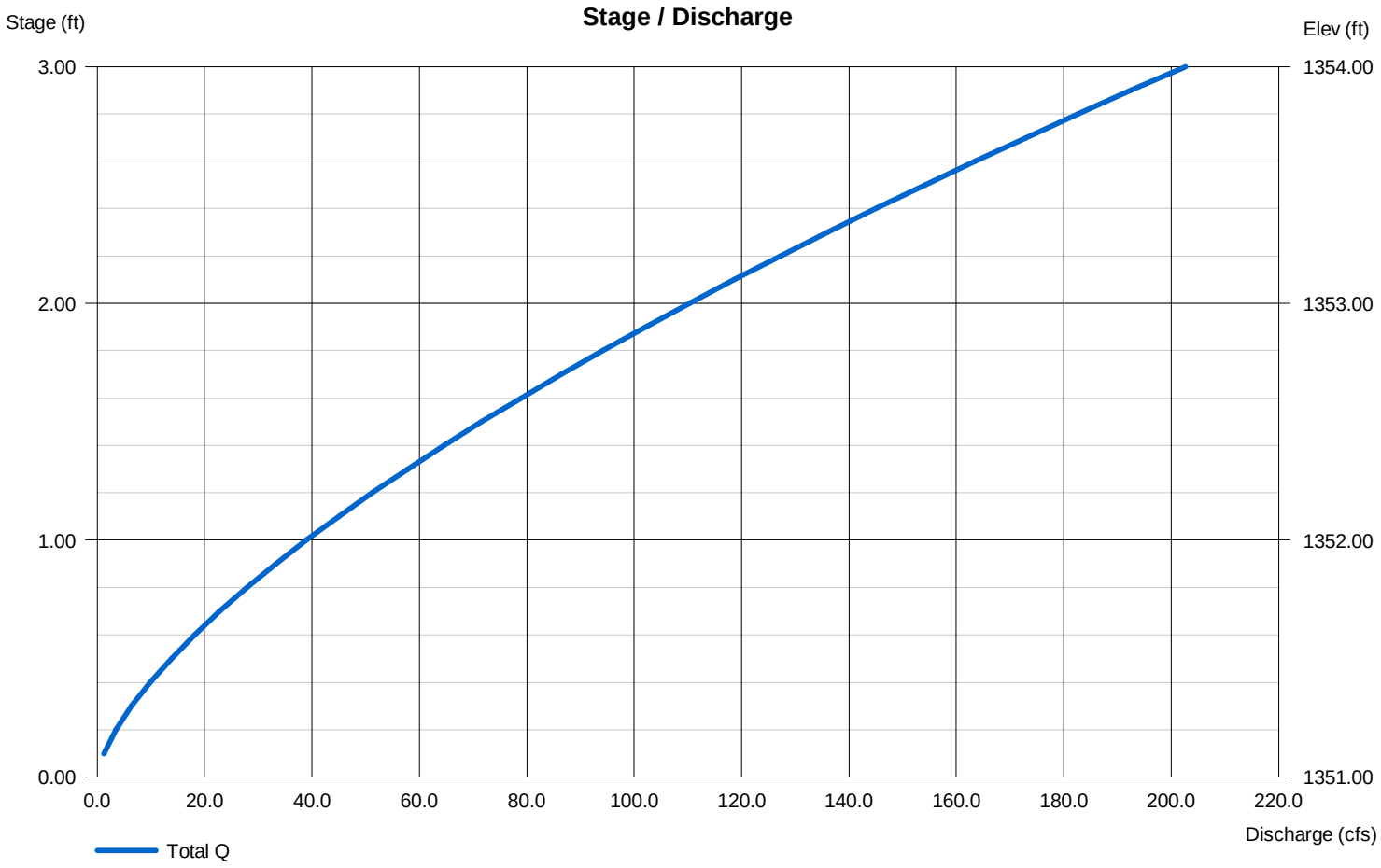
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 1351.00	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 and outlet control. Weir risers are checked for orifice conditions.

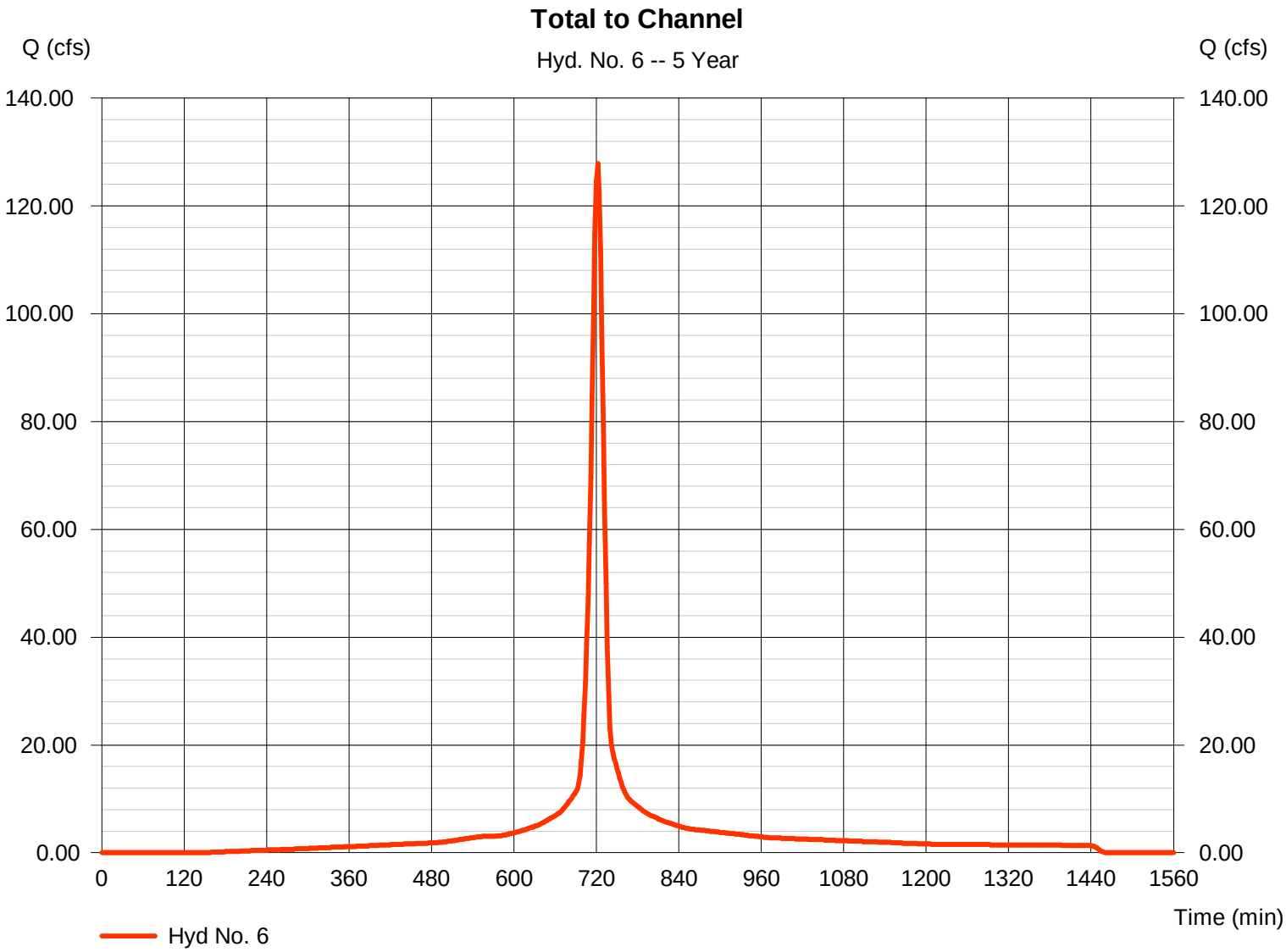


Hydrograph Report

Hyd. No. 6

Total to Channel

Hydrograph type	=	SCS Runoff	Peak discharge	=	127.82 cfs
Storm frequency	=	5 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	388,935 cuft
Drainage area	=	28.000 ac	Curve number	=	95
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 by Intelisolve v9.02

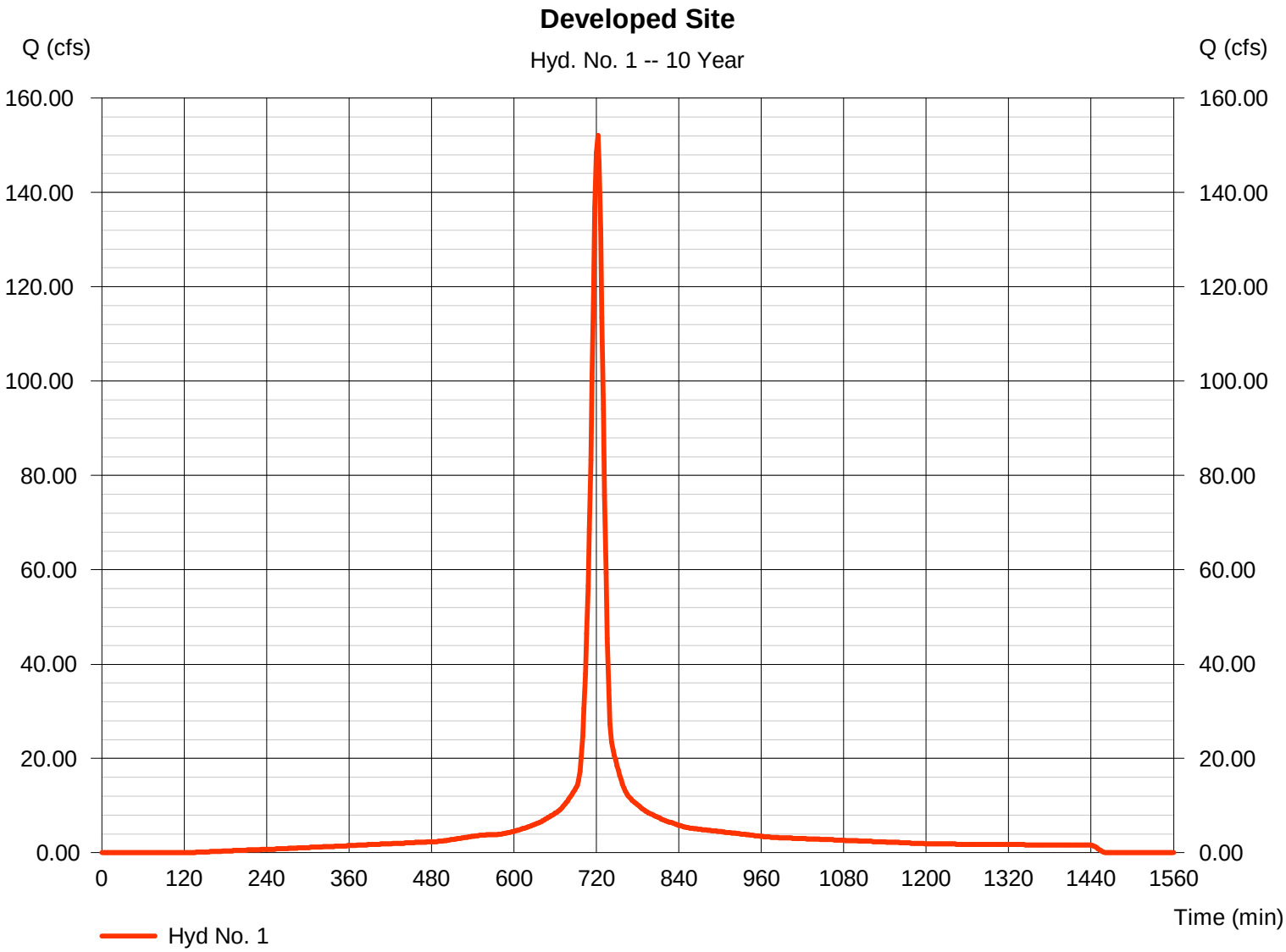
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	152.05	2	722	467,434	----	------	------	Developed Site
2	SCS Runoff	111.33	2	722	312,773	----	------	------	Existing Conditions
3	SCS Runoff	46.65	2	798	565,812	----	------	------	North Offsite
4	Combine	161.18	2	722	1,033,247	1, 3	------	------	<no description>
5	Reservoir	90.48	2	732	1,033,240	4	1352.75	144,584	Commercial Pond
6	SCS Runoff	152.05	2	722	467,434	----	------	------	Total to Channel

Hydrograph Report

Hyd. No. 1

Developed Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	152.05 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	467,434 cuft
Drainage area	=	28.000 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

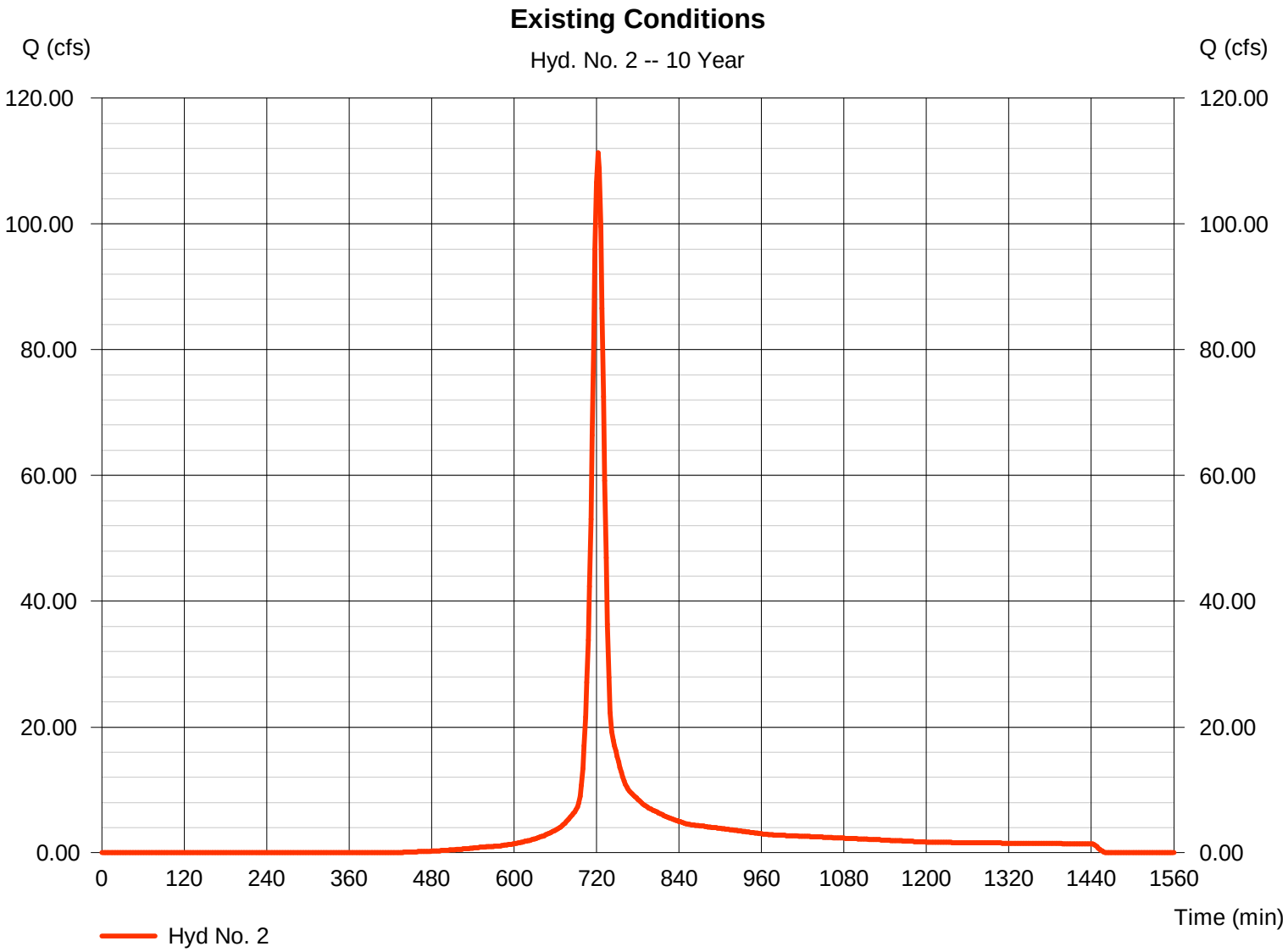


Hydrograph Report

Hyd. No. 2

Existing Conditions

Hydrograph type	=	SCS Runoff	Peak discharge	=	111.33 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	312,773 cuft
Drainage area	=	28.000 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

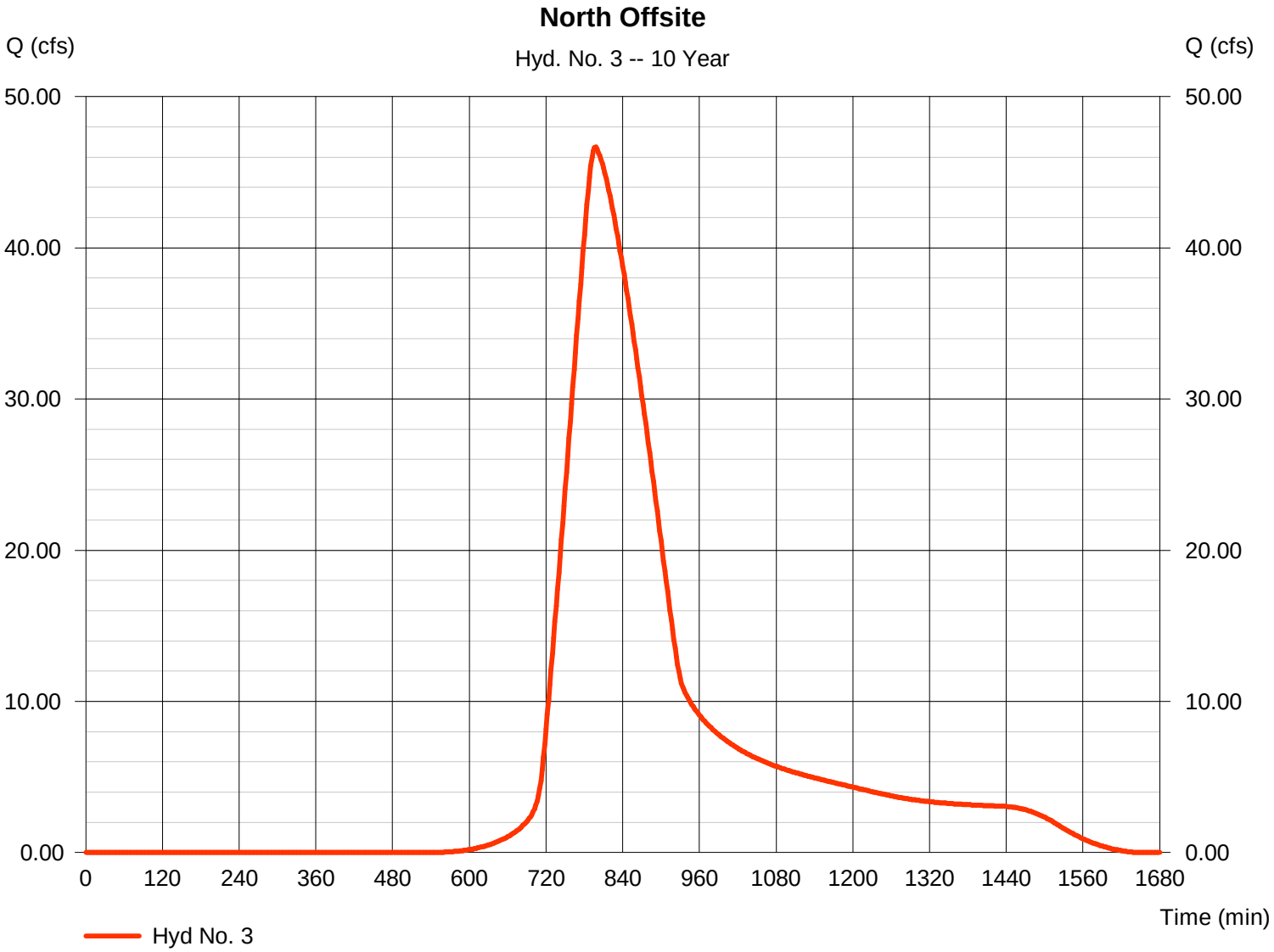


Hydrograph Report

Hyd. No. 3

North Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.65 cfs
Storm frequency	=	10 yrs	Time to peak	=	798 min
Time interval	=	2 min	Hyd. volume	=	565,812 cuft
Drainage area	=	60.000 ac	Curve number	=	74
Basin Slope	=	0.2 %	Hydraulic length	=	1800 ft
Tc method	=	LAG	Time of conc. (Tc)	=	136.14 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

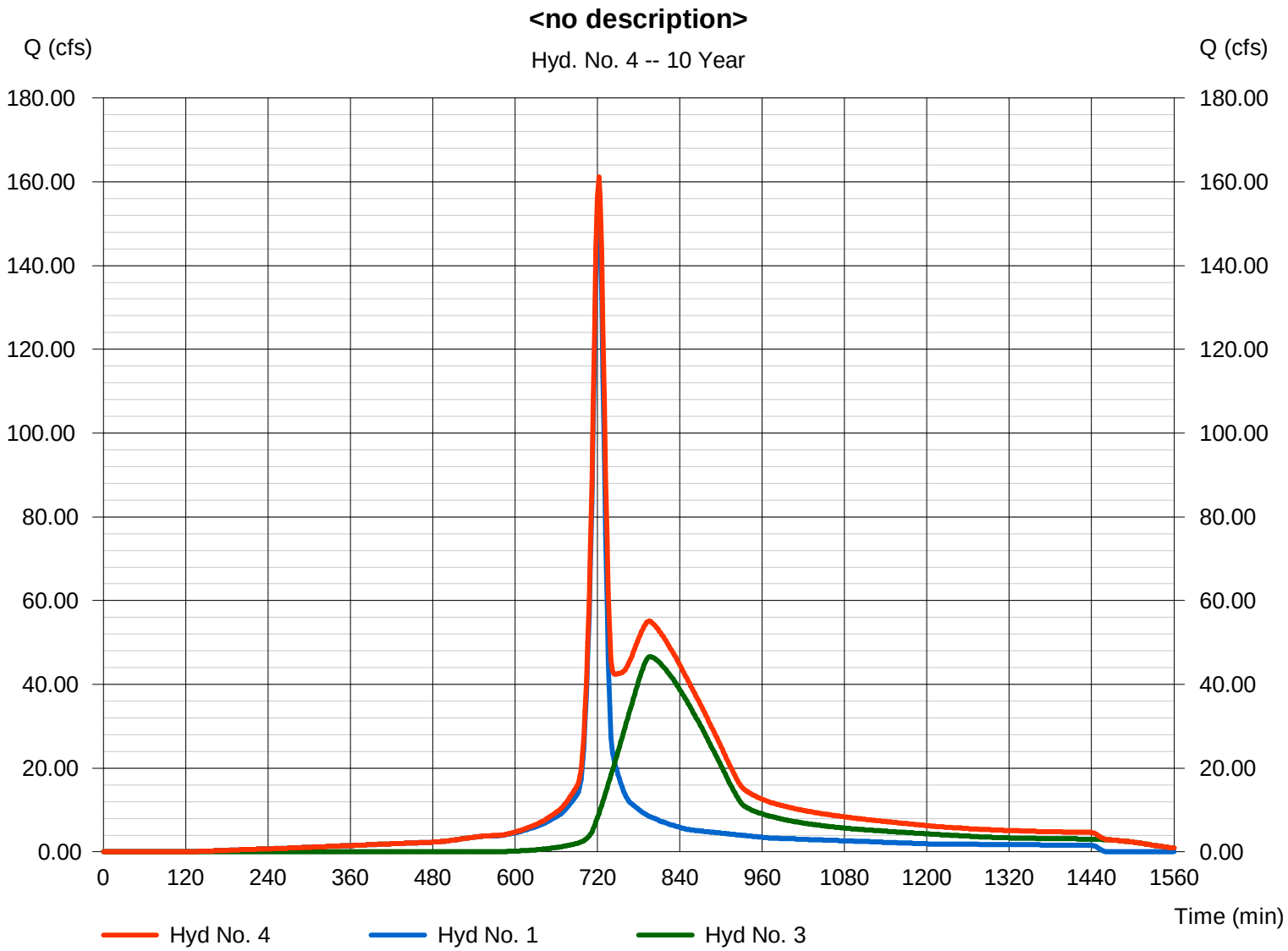


Hydrograph Report

Hyd. No. 4

<no description>

Hydrograph type	= Combine	Peak discharge	= 161.18 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,033,247 cuft
Inflow hyds.	= 1, 3	Contrib. drain. area	= 88.000 ac



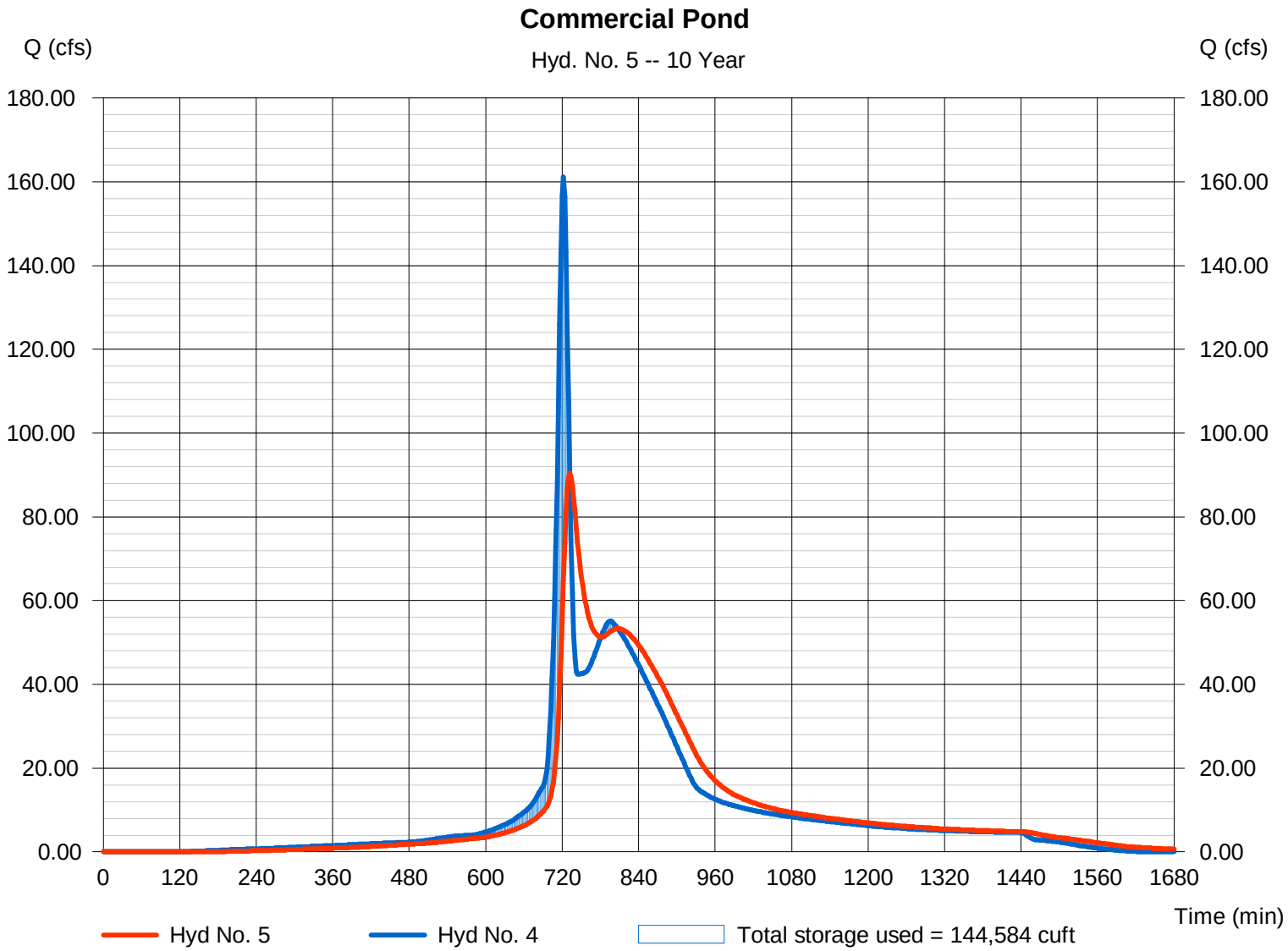
Hydrograph Report

Hyd. No. 5

Commercial Pond

Hydrograph type	=	Reservoir	Peak discharge	=	90.48 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	1,033,240 cuft
Inflow hyd. No.	=	4 - <no description>	Max. Elevation	=	1352.75 ft
Reservoir name	=	South Pond	Max. Storage	=	144,584 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - South Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1351.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1351.00	77,000	0	0
1.00	1352.00	83,000	79,973	79,973
2.00	1353.00	88,800	85,875	165,848
3.00	1354.00	94,800	91,775	257,623

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

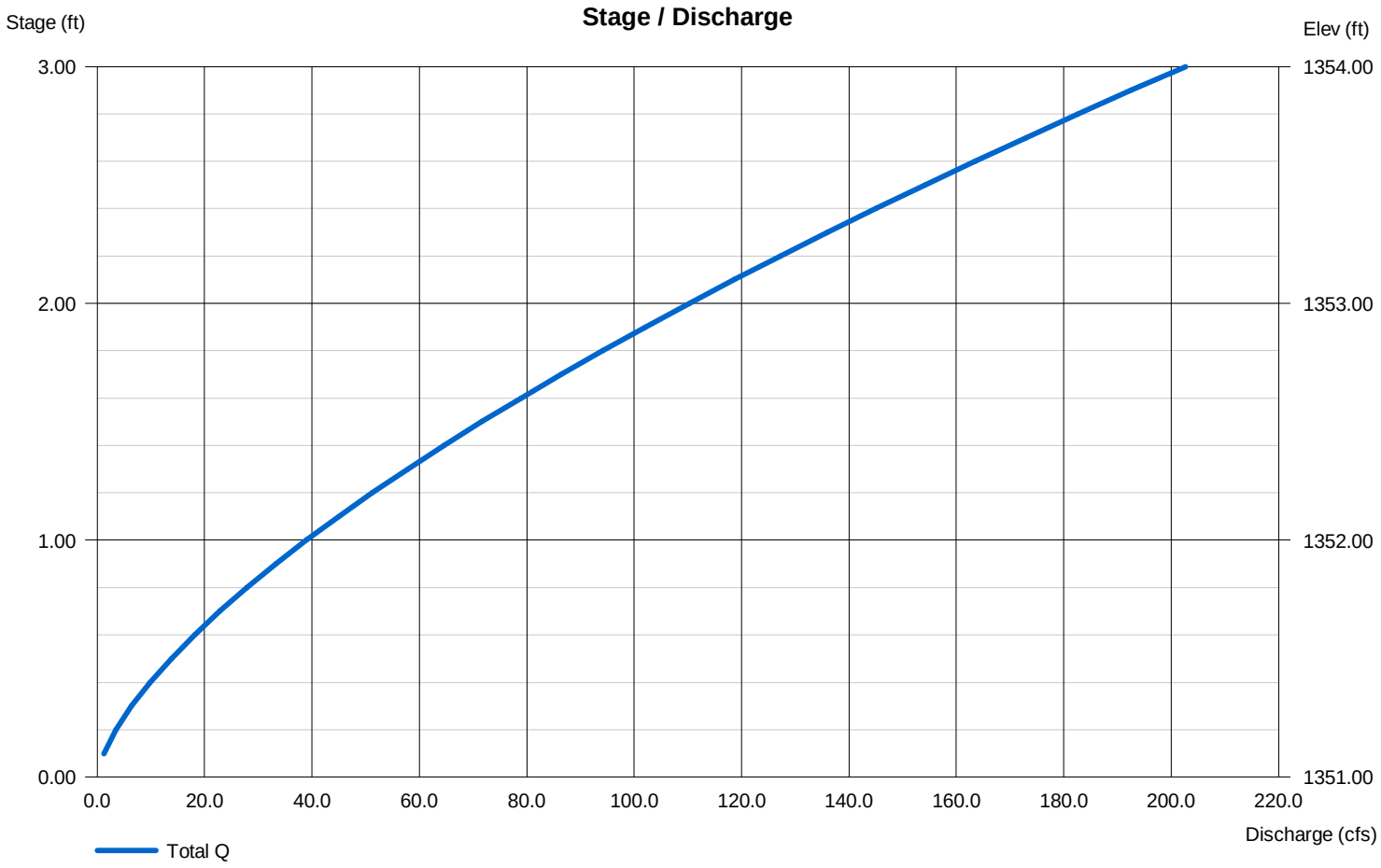
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 1351.00	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 and outlet control. Weir risers are checked for orifice conditions.

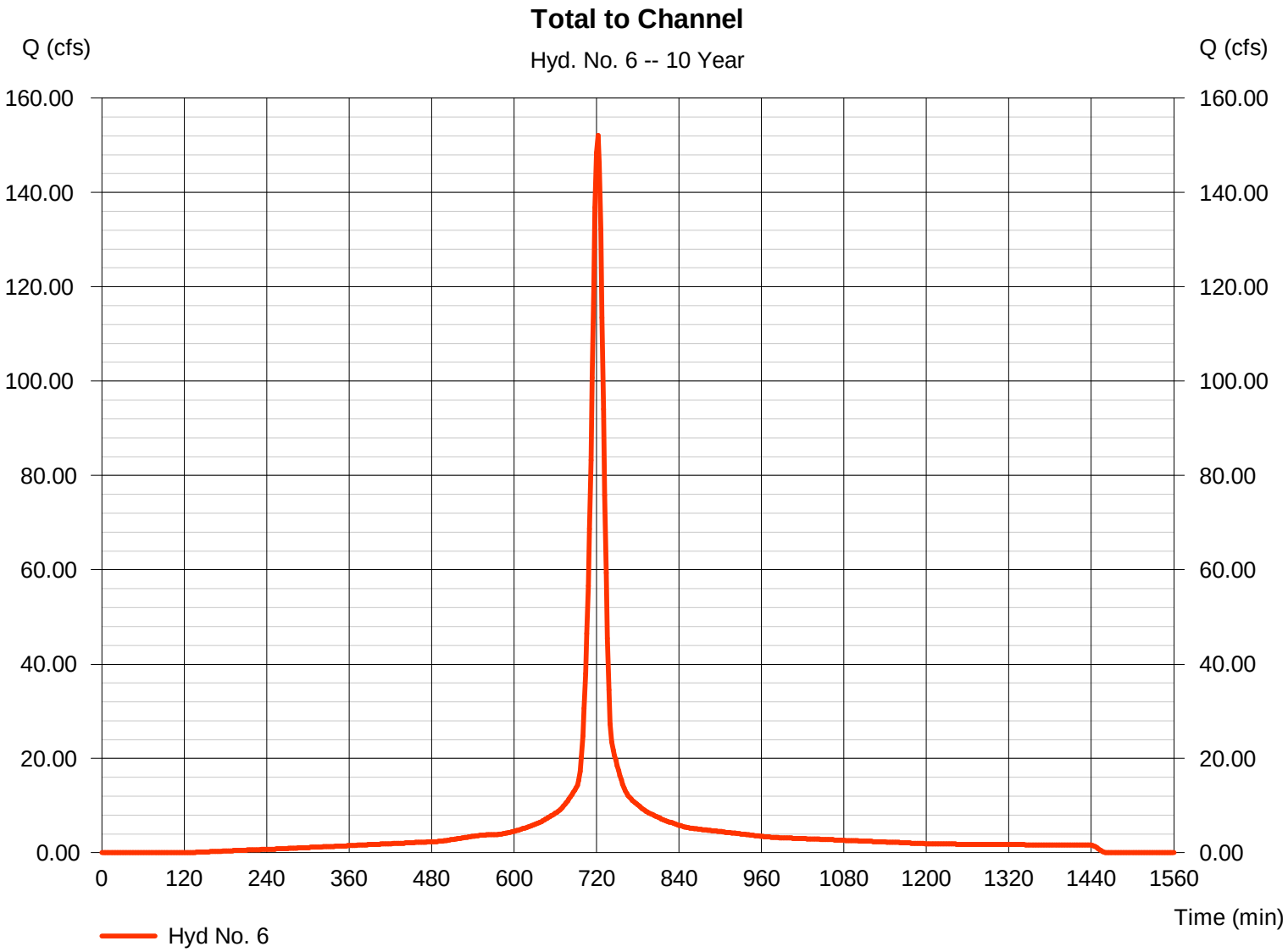


Hydrograph Report

Hyd. No. 6

Total to Channel

Hydrograph type	=	SCS Runoff	Peak discharge	=	152.05 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	467,434 cuft
Drainage area	=	28.000 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.02

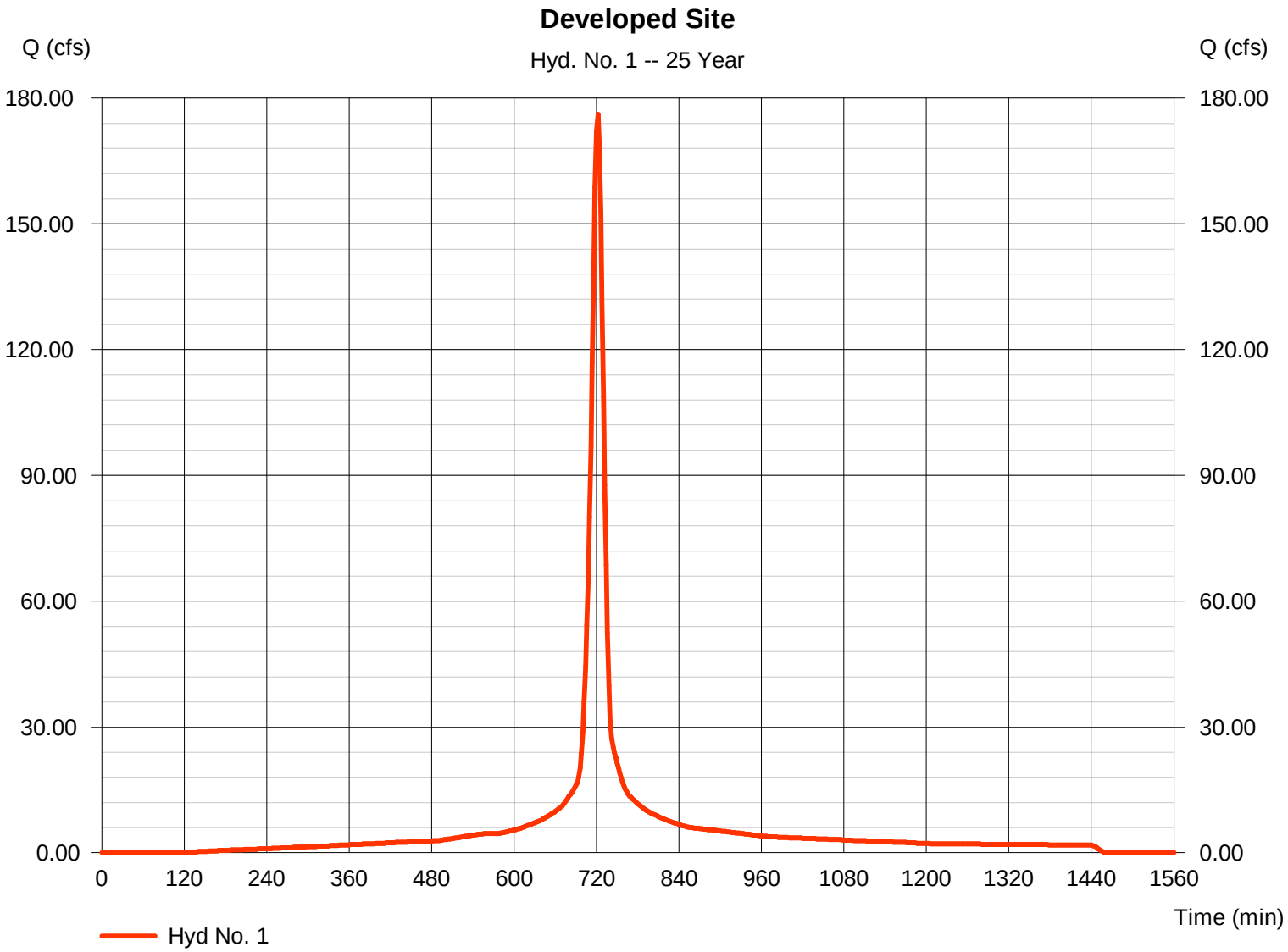
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	176.18	2	722	546,125	----	------	------	Developed Site
2	SCS Runoff	136.01	2	722	383,672	----	------	------	Existing Conditions
3	SCS Runoff	59.13	2	796	709,851	----	------	------	North Offsite
4	Combine	188.68	2	722	1,255,976	1, 3	------	------	<no description>
5	Reservoir	109.75	2	732	1,255,971	4	1353.00	165,266	Commercial Pond
6	SCS Runoff	176.18	2	722	546,125	----	------	------	Total to Channel

Hydrograph Report

Hyd. No. 1

Developed Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	176.18 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	546,125 cuft
Drainage area	=	28.000 ac	Curve number	=	95
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

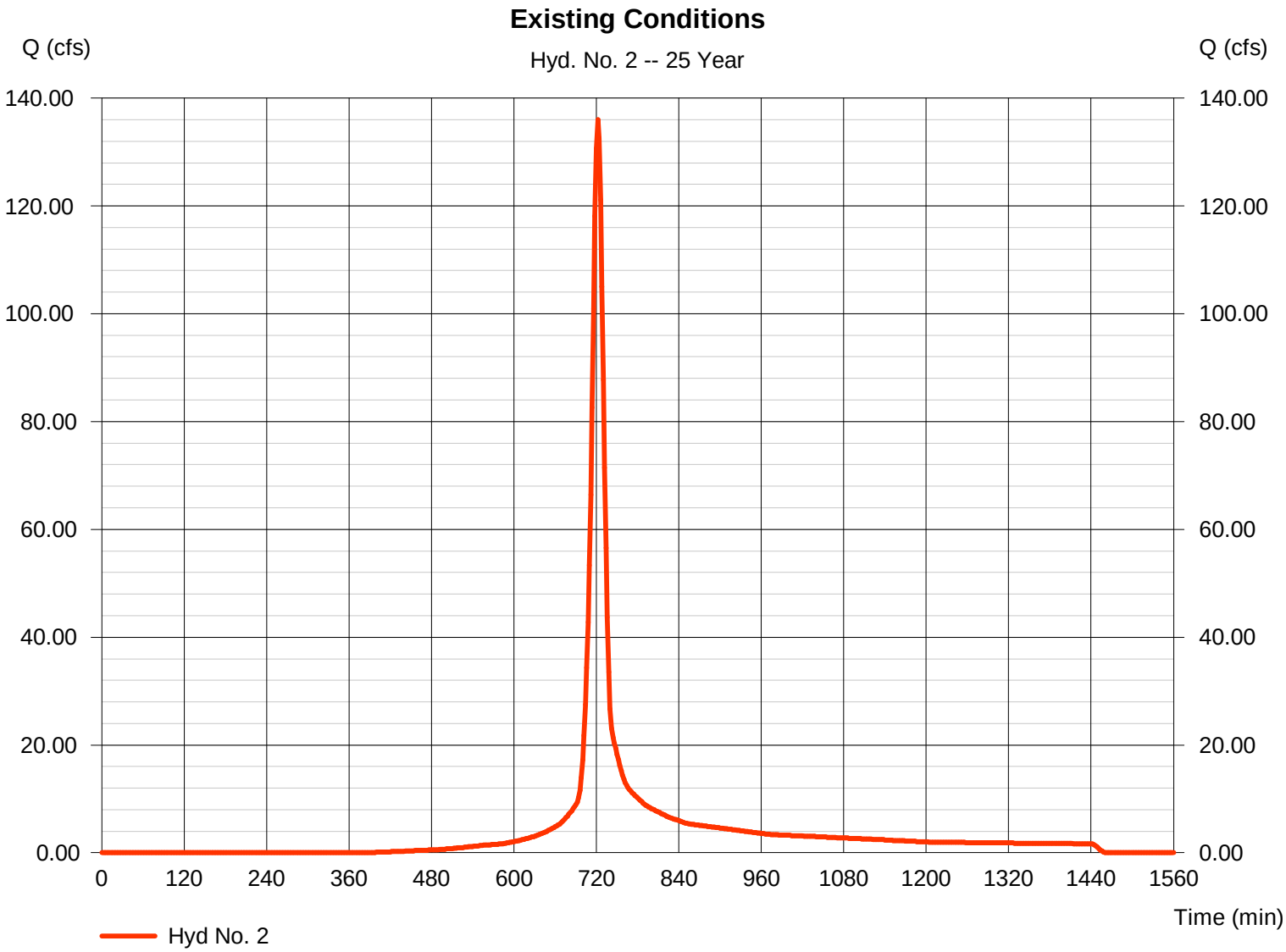


Hydrograph Report

Hyd. No. 2

Existing Conditions

Hydrograph type	=	SCS Runoff	Peak discharge	=	136.01 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	383,672 cuft
Drainage area	=	28.000 ac	Curve number	=	80
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

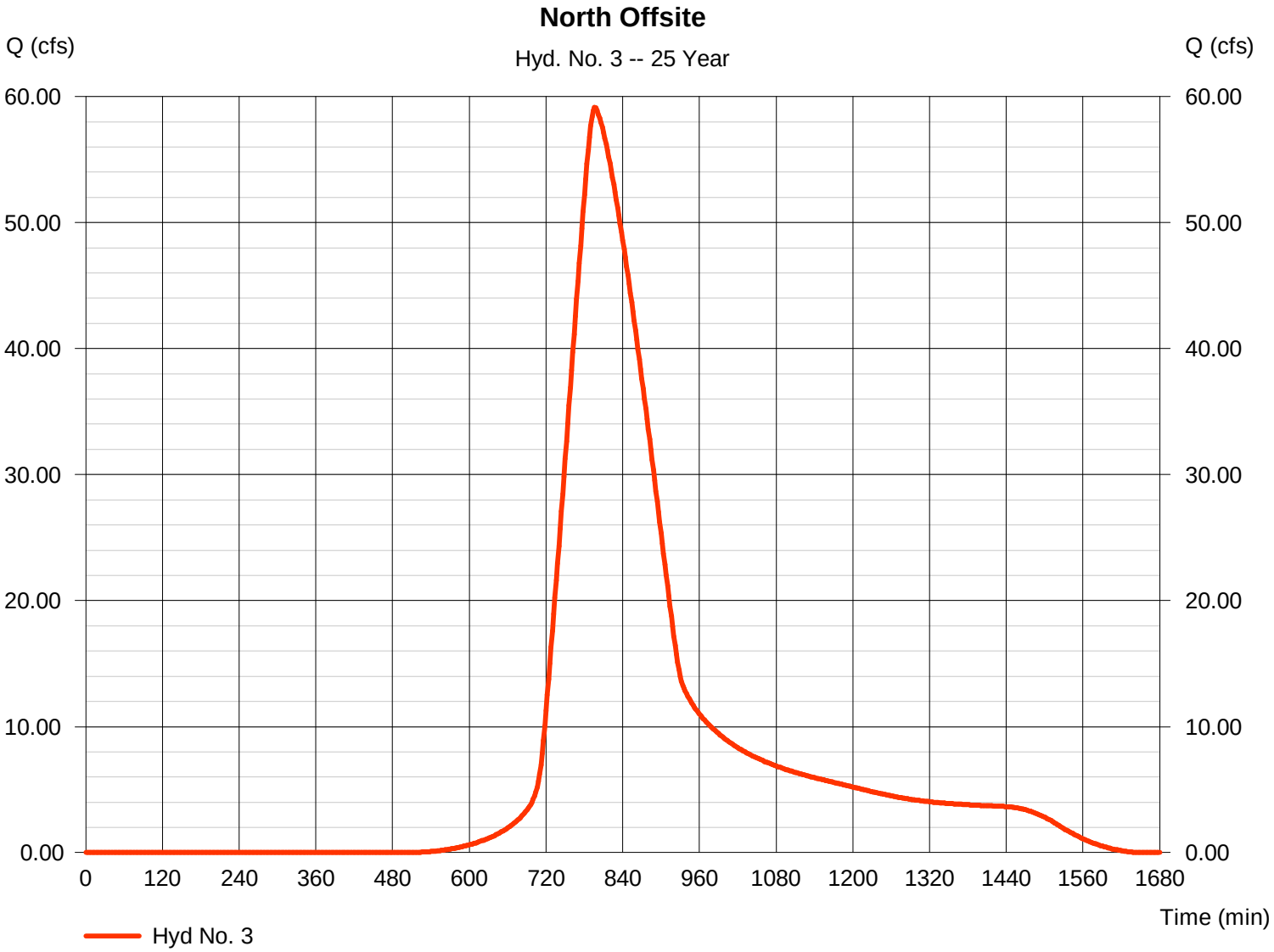


Hydrograph Report

Hyd. No. 3

North Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	59.13 cfs
Storm frequency	=	25 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	709,851 cuft
Drainage area	=	60.000 ac	Curve number	=	74
Basin Slope	=	0.2 %	Hydraulic length	=	1800 ft
Tc method	=	LAG	Time of conc. (Tc)	=	136.14 min
Total precip.	=	6.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

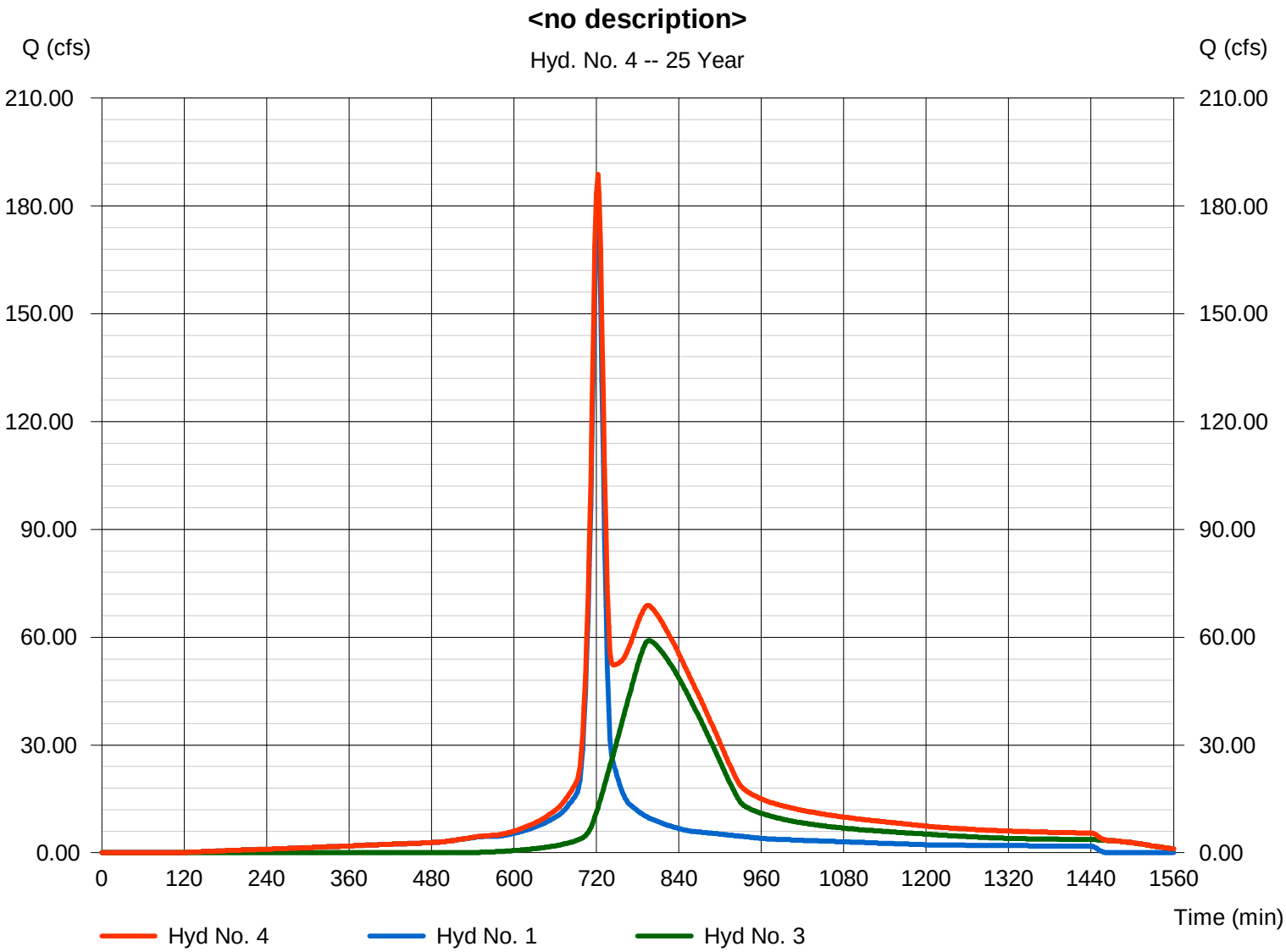


Hydrograph Report

Hyd. No. 4

<no description>

Hydrograph type	= Combine	Peak discharge	= 188.68 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 1,255,976 cuft
Inflow hyds.	= 1, 3	Contrib. drain. area	= 88.000 ac



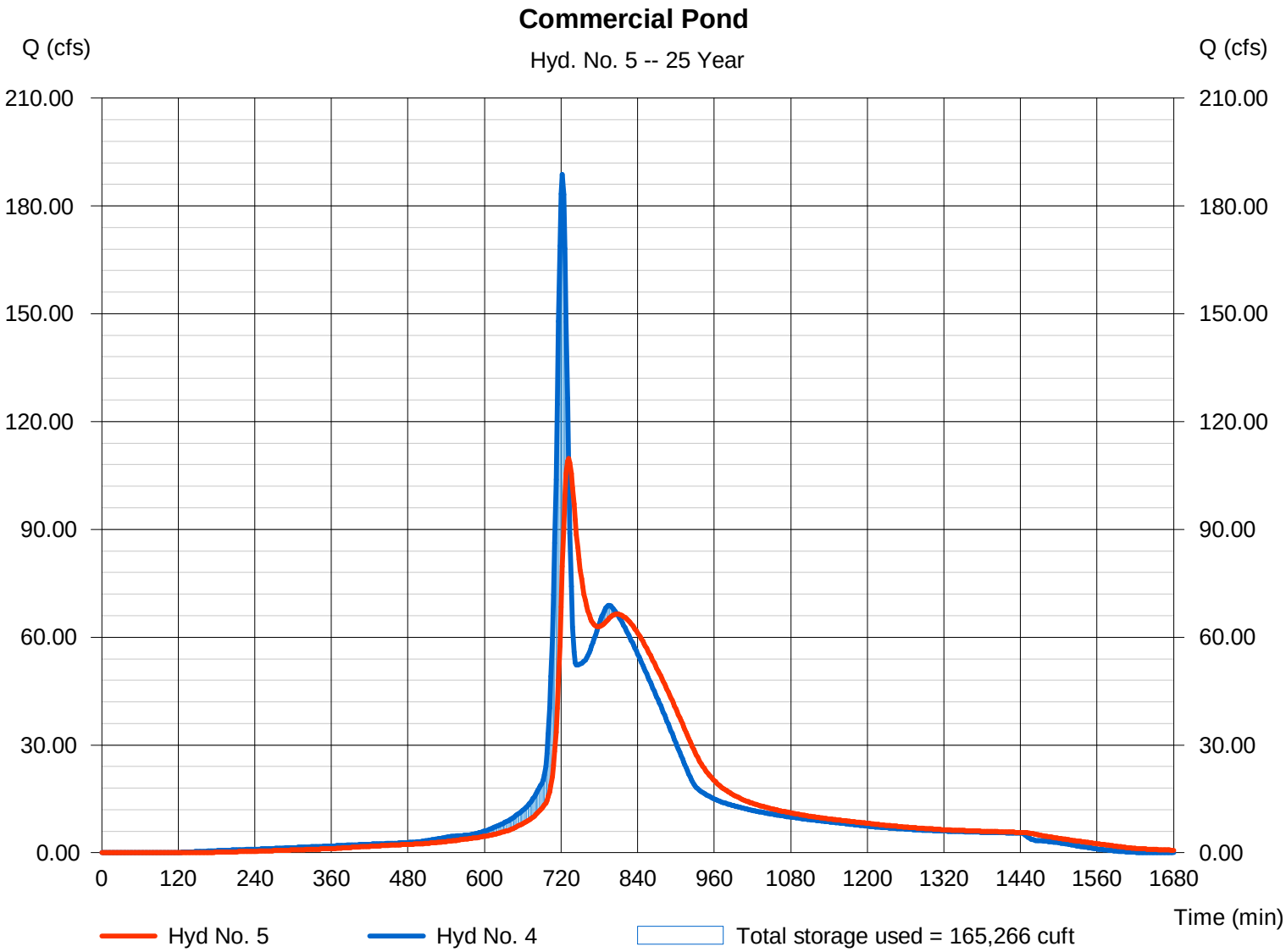
Hydrograph Report

Hyd. No. 5

Commercial Pond

Hydrograph type	=	Reservoir	Peak discharge	=	109.75 cfs
Storm frequency	=	25 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	1,255,971 cuft
Inflow hyd. No.	=	4 - <no description>	Max. Elevation	=	1353.00 ft
Reservoir name	=	South Pond	Max. Storage	=	165,266 cuft

Storage Indication method used.



Pond No. 1 - South Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1351.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1351.00	77,000	0	0
1.00	1352.00	83,000	79,973	79,973
2.00	1353.00	88,800	85,875	165,848
3.00	1354.00	94,800	91,775	257,623

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

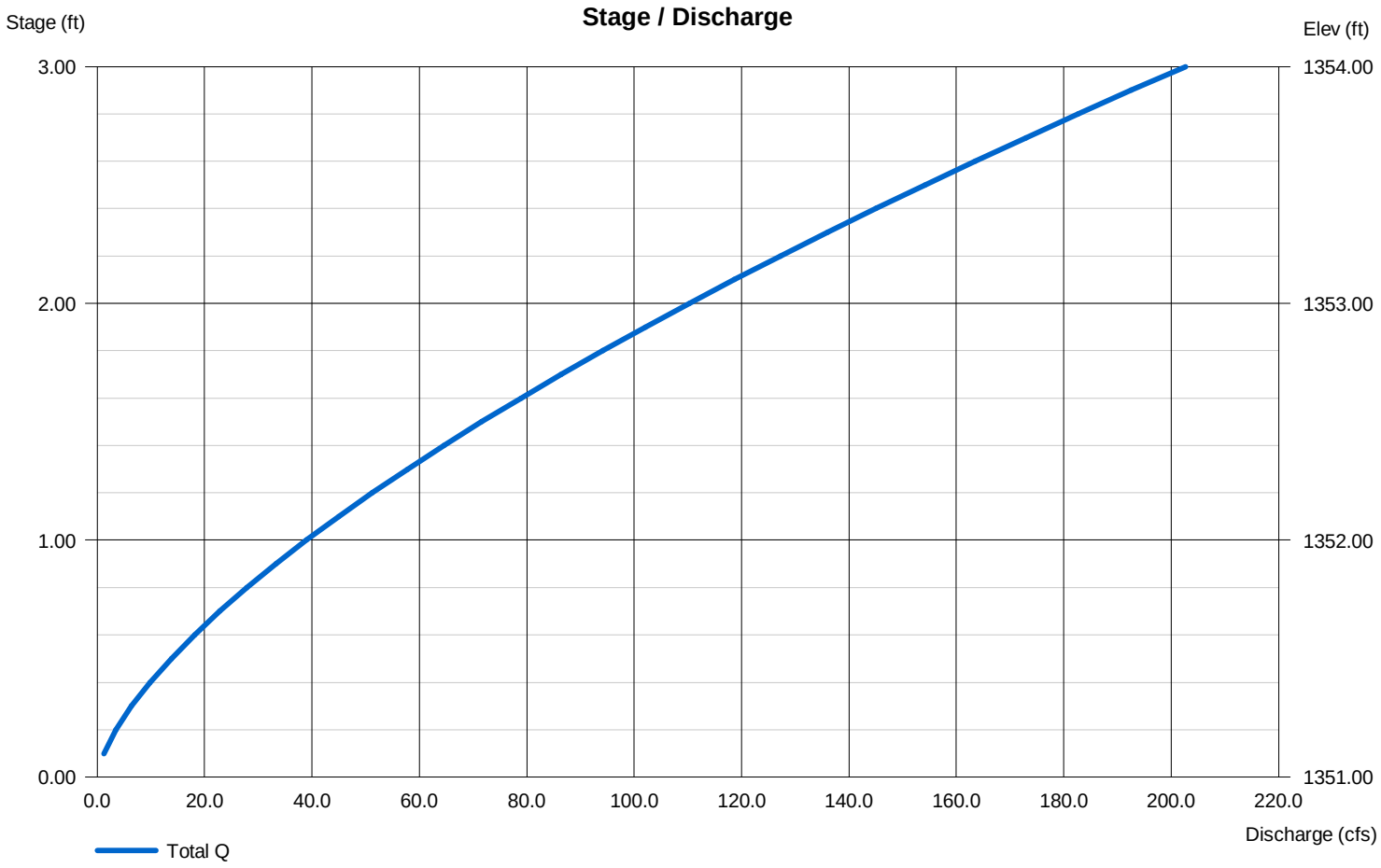
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 1351.00	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 and outlet control. Weir risers are checked for orifice conditions.

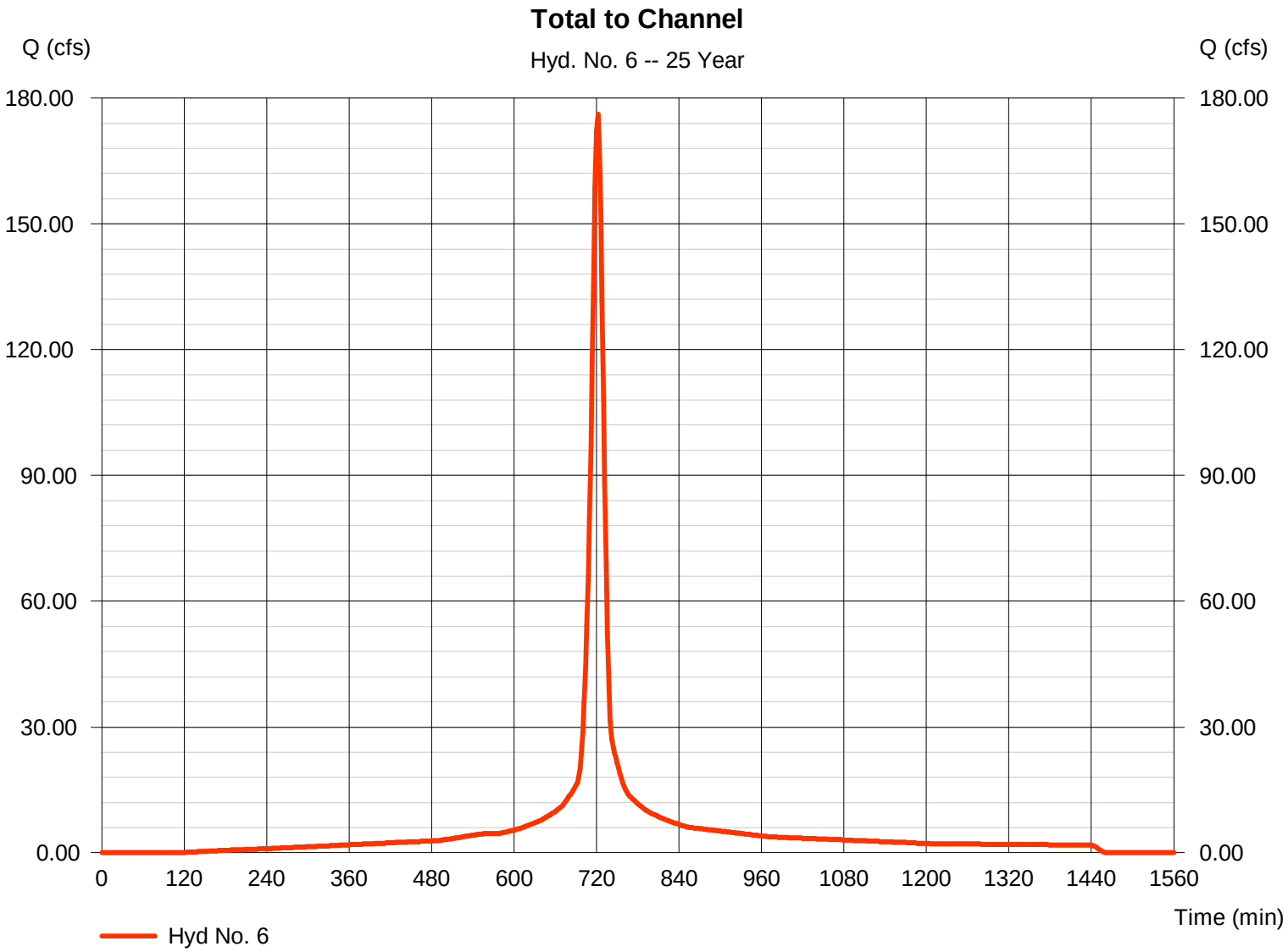


Hydrograph Report

Hyd. No. 6

Total to Channel

Hydrograph type	=	SCS Runoff	Peak discharge	=	176.18 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	546,125 cuft
Drainage area	=	28.000 ac	Curve number	=	95
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 by Intelisolve v9.02

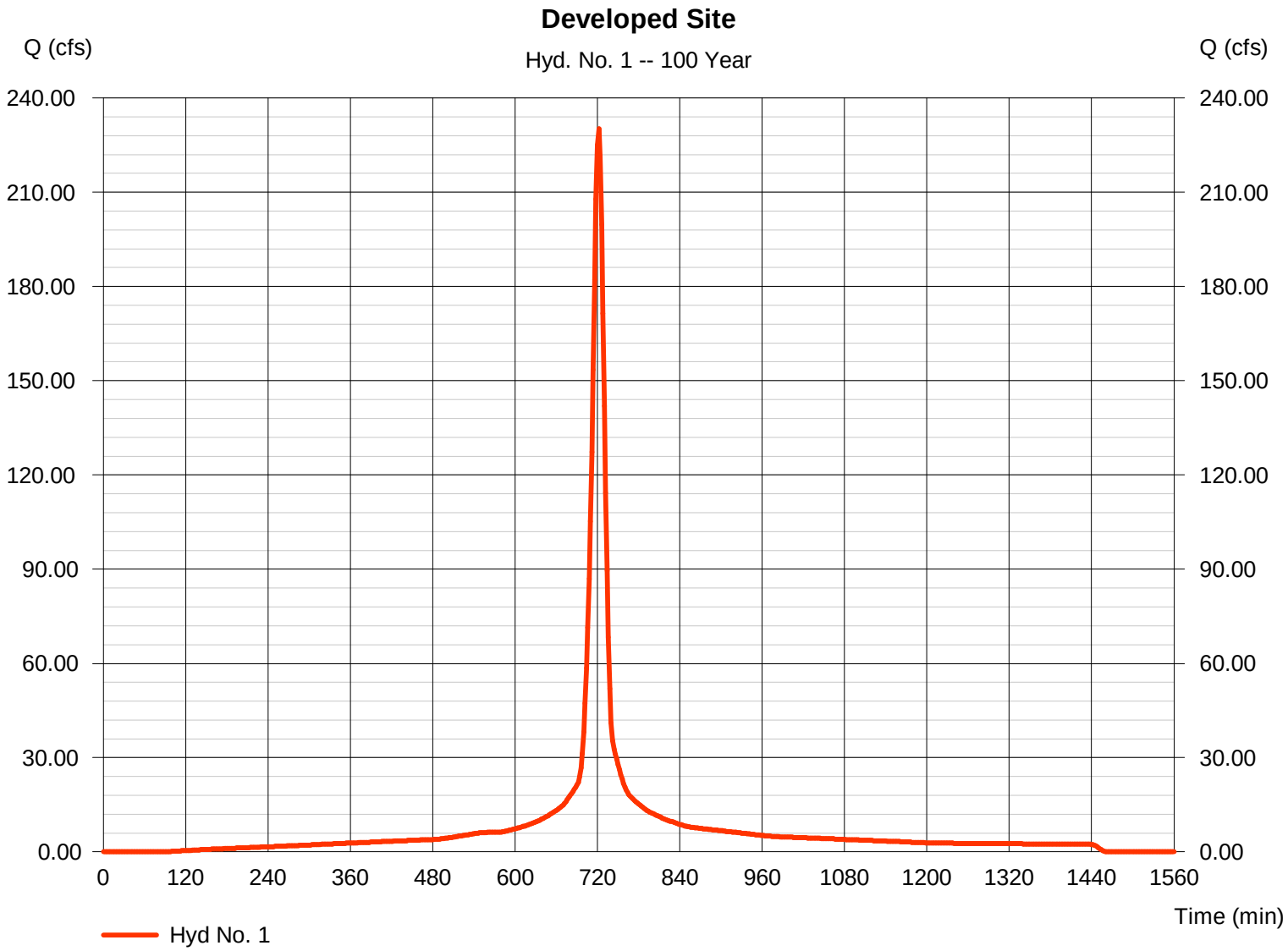
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	230.20	2	722	723,592	----	------	------	Developed Site
2	SCS Runoff	192.07	2	722	548,148	----	------	------	Existing Conditions
3	SCS Runoff	88.35	2	796	1,050,142	----	------	------	North Offsite
4	Combine	251.00	2	722	1,773,735	1, 3	------	------	<no description>
5	Reservoir	153.02	2	732	1,773,728	4	1353.49	210,600	Commercial Pond
6	SCS Runoff	230.20	2	722	723,592	----	------	------	Total to Channel

Hydrograph Report

Hyd. No. 1

Developed Site

Hydrograph type	=	SCS Runoff	Peak discharge	=	230.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	723,592 cuft
Drainage area	=	28.000 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

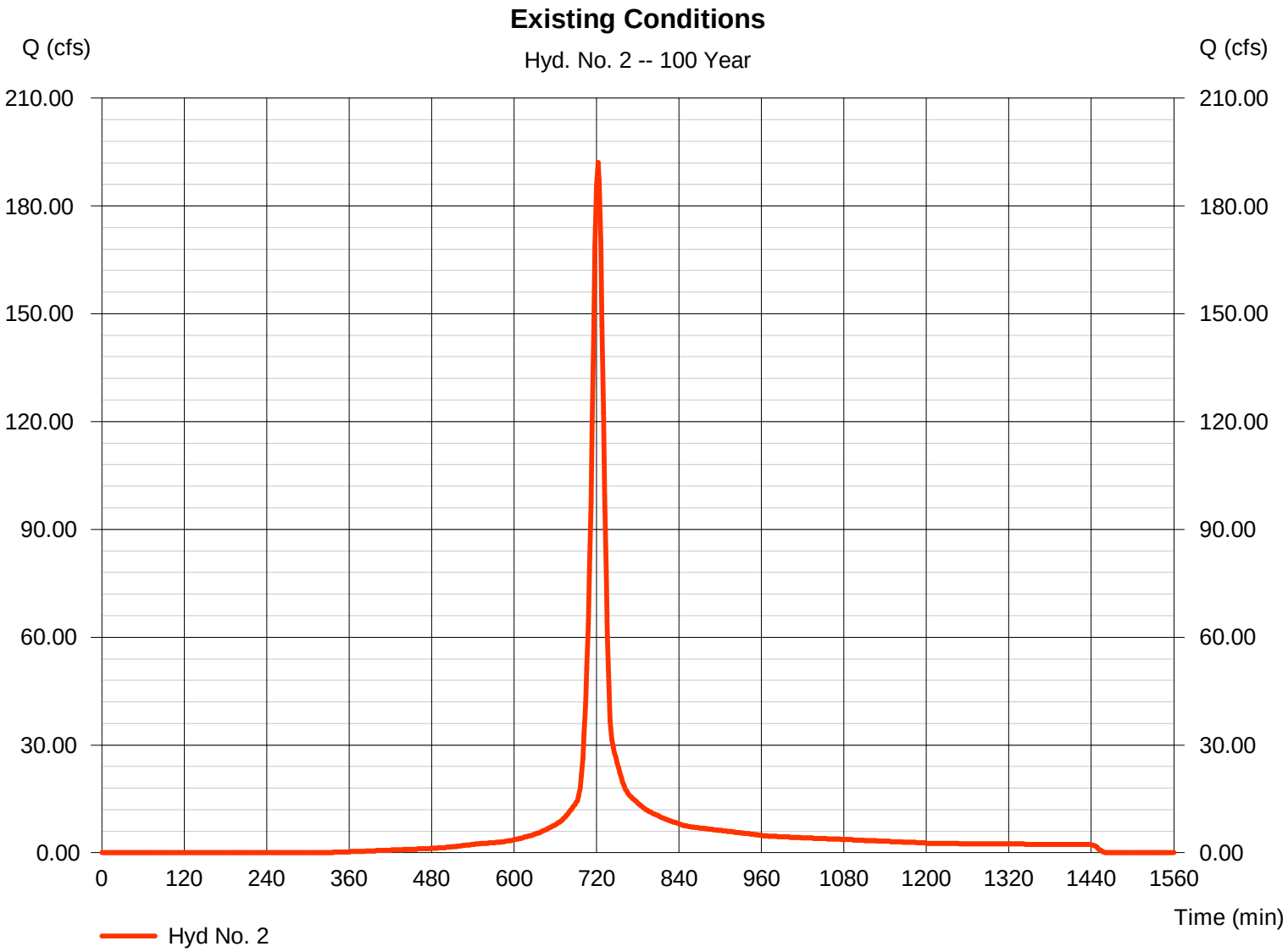


Hydrograph Report

Hyd. No. 2

Existing Conditions

Hydrograph type	=	SCS Runoff	Peak discharge	=	192.07 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	548,148 cuft
Drainage area	=	28.000 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

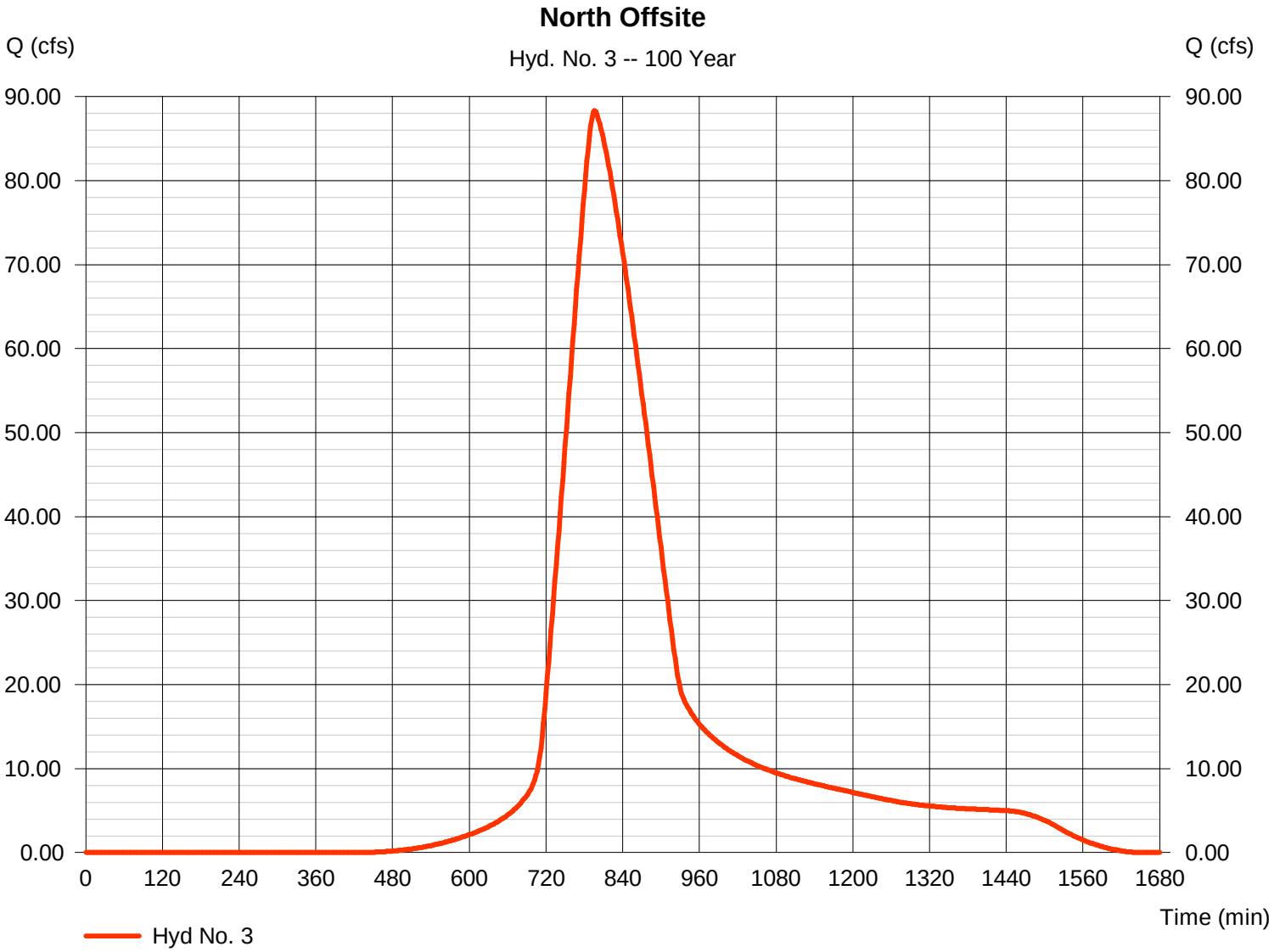


Hydrograph Report

Hyd. No. 3

North Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	88.35 cfs
Storm frequency	=	100 yrs	Time to peak	=	796 min
Time interval	=	2 min	Hyd. volume	=	1,050,142 cuft
Drainage area	=	60.000 ac	Curve number	=	74
Basin Slope	=	0.2 %	Hydraulic length	=	1800 ft
Tc method	=	LAG	Time of conc. (Tc)	=	136.14 min
Total precip.	=	7.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

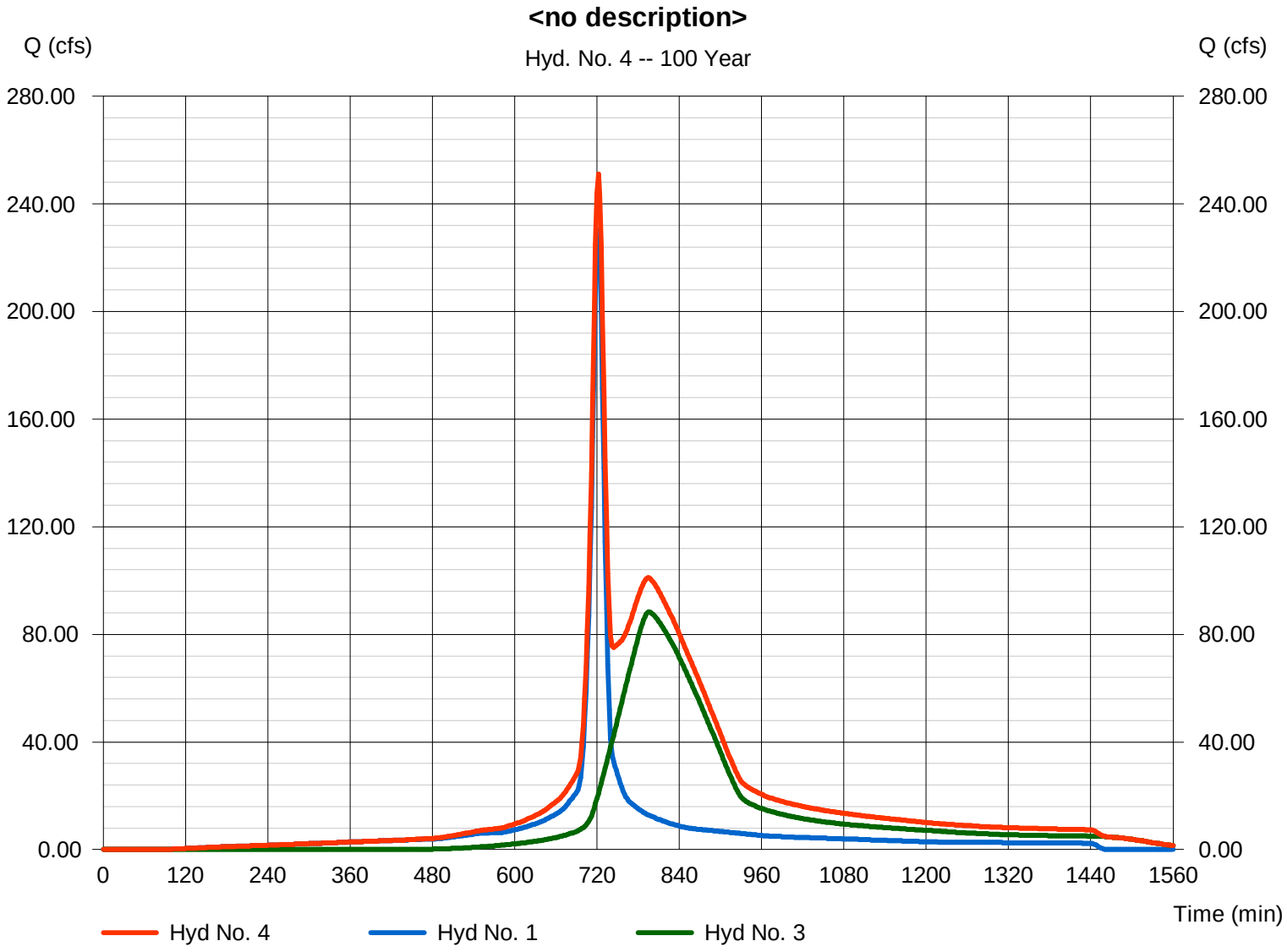


Hydrograph Report

Hyd. No. 4

<no description>

Hydrograph type	=	Combine	Peak discharge	=	251.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,773,735 cuft
Inflow hyds.	=	1, 3	Contrib. drain. area	=	88.000 ac



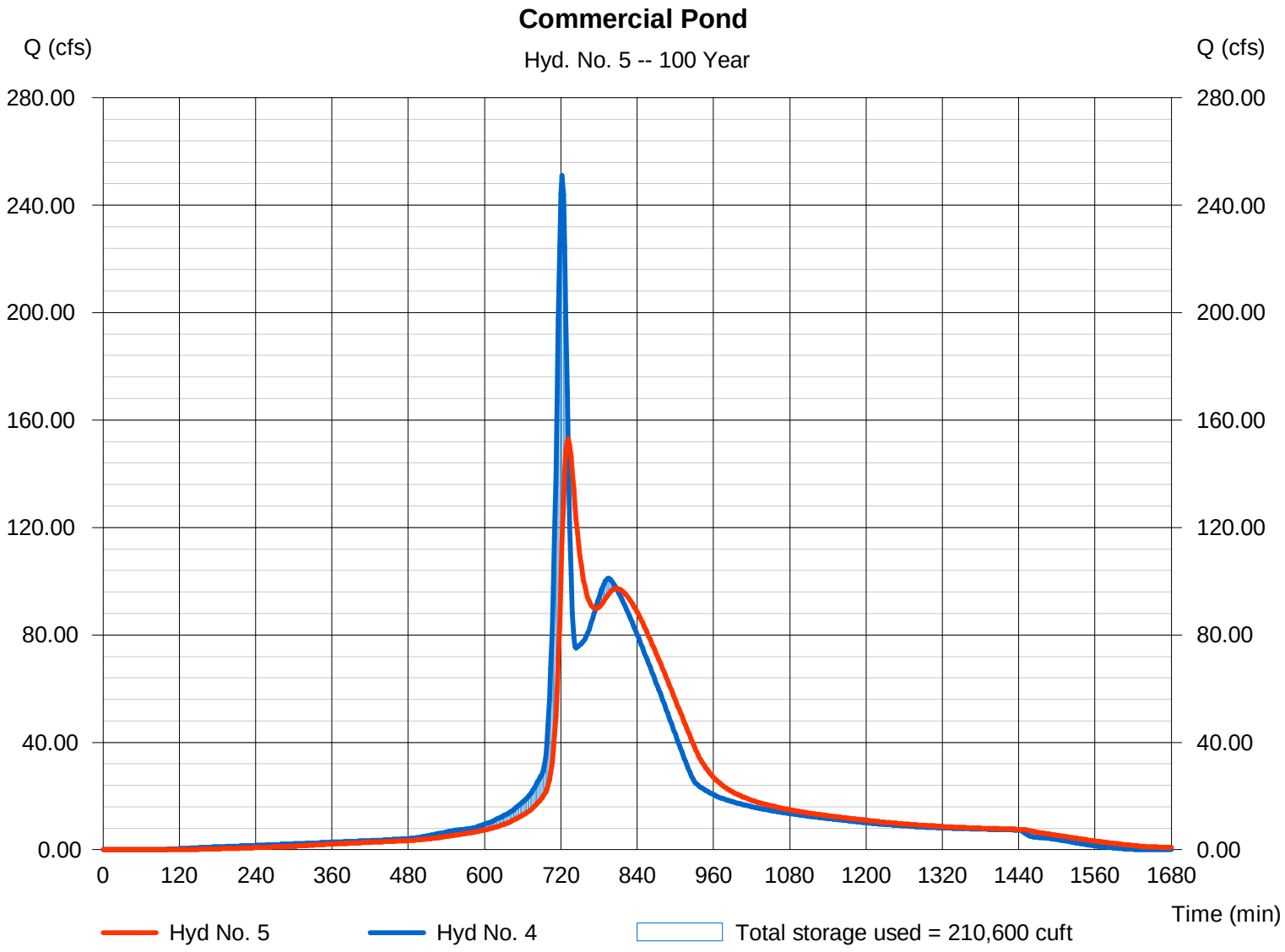
Hydrograph Report

Hyd. No. 5

Commercial Pond

Hydrograph type	=	Reservoir	Peak discharge	=	153.02 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	1,773,728 cuft
Inflow hyd. No.	=	4 - <no description>	Max. Elevation	=	1353.49 ft
Reservoir name	=	South Pond	Max. Storage	=	210,600 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - South Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1351.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1351.00	77,000	0	0
1.00	1352.00	83,000	79,973	79,973
2.00	1353.00	88,800	85,875	165,848
3.00	1354.00	94,800	91,775	257,623

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

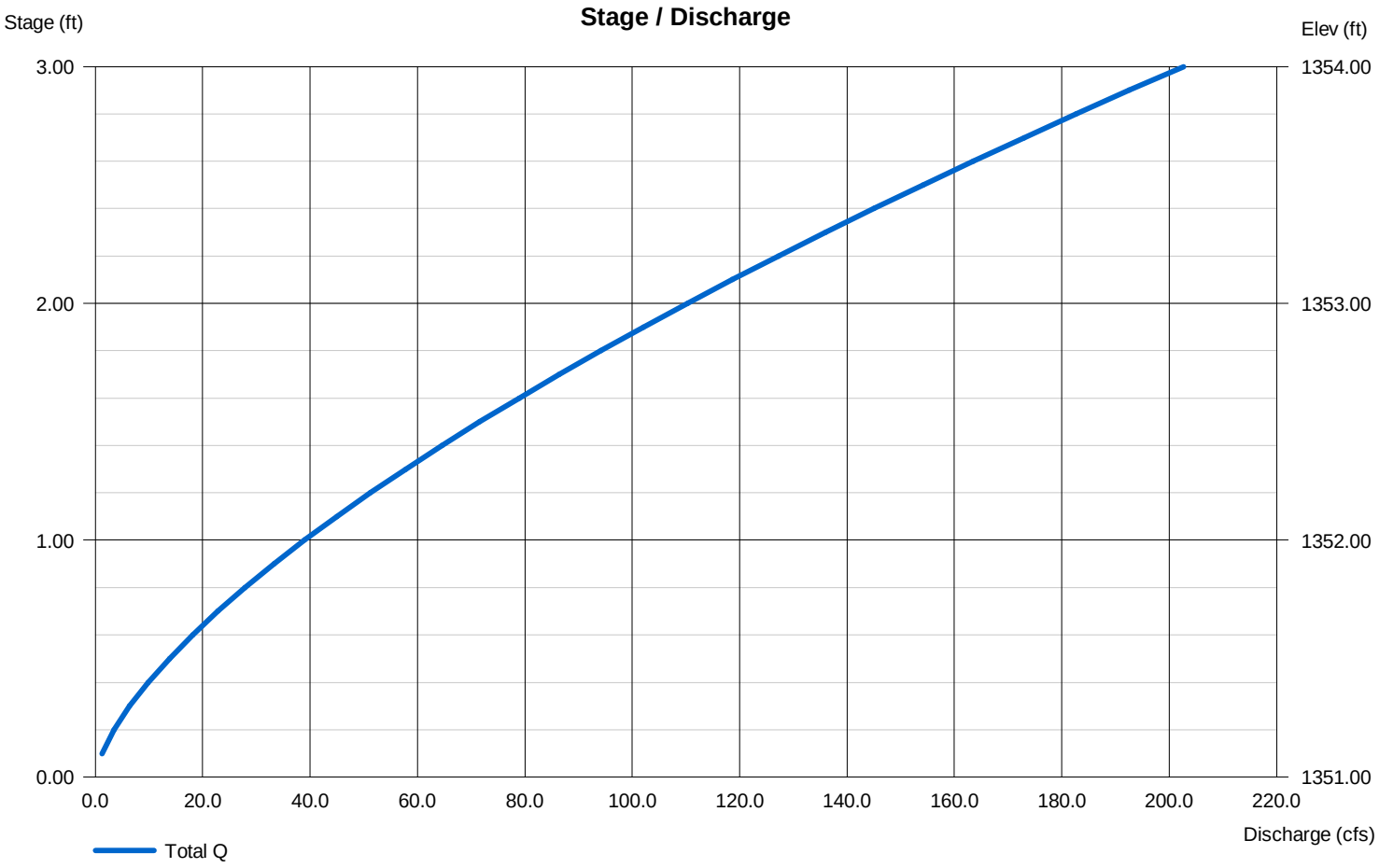
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 1351.00	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 and outlet control. Weir risers are checked for orifice conditions.

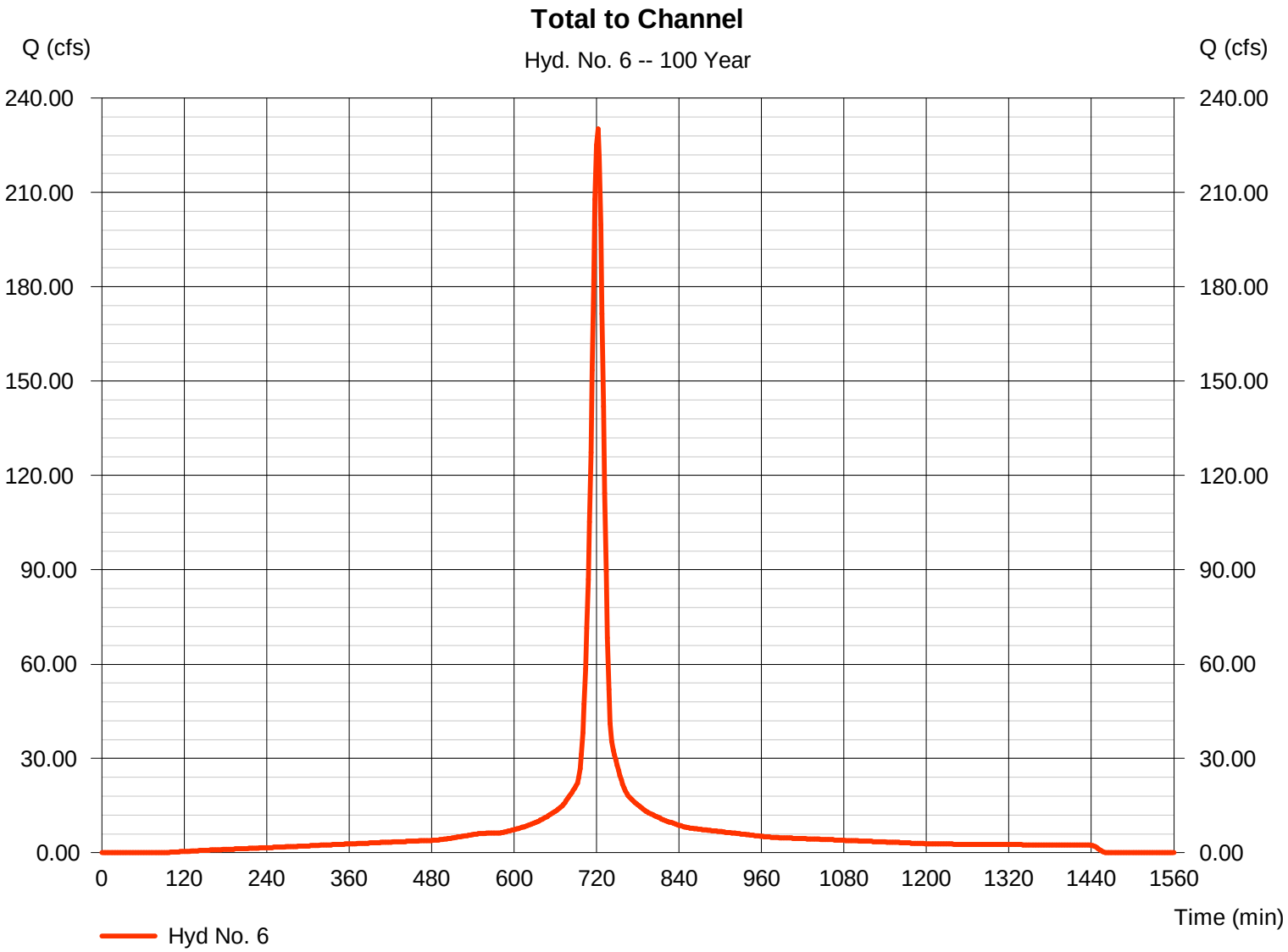


Hydrograph Report

Hyd. No. 6

Total to Channel

Hydrograph type	=	SCS Runoff	Peak discharge	=	230.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	723,592 cuft
Drainage area	=	28.000 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.90 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	76.3137	14.3000	0.8844	--------
3	0.0000	0.0000	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: wichita.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.52	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

Tc = 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	0.00	3.50	0.00	4.50	5.30	6.10	6.80	7.90
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

Hydraflow Table of Contents

Watershed Model Schematic 1

Hydrograph Return Period Recap 2

2 - Year

Summary Report 3
Hydrograph Reports 4
Hydrograph No. 1, SCS Runoff, Developed Site 4
Hydrograph No. 2, SCS Runoff, Existing Conditions 5
Hydrograph No. 3, SCS Runoff, North Offsite 6
Hydrograph No. 4, Combine, <no description> 7
Hydrograph No. 5, Reservoir, Commercial Pond 8
Pond Report - South Pond 9
Hydrograph No. 6, SCS Runoff, Total to Channel 10

5 - Year

Summary Report 11
Hydrograph Reports 12
Hydrograph No. 1, SCS Runoff, Developed Site 12
Hydrograph No. 2, SCS Runoff, Existing Conditions 13
Hydrograph No. 3, SCS Runoff, North Offsite 14
Hydrograph No. 4, Combine, <no description> 15
Hydrograph No. 5, Reservoir, Commercial Pond 16
Pond Report - South Pond 17
Hydrograph No. 6, SCS Runoff, Total to Channel 18

10 - Year

Summary Report 19
Hydrograph Reports 20
Hydrograph No. 1, SCS Runoff, Developed Site 20
Hydrograph No. 2, SCS Runoff, Existing Conditions 21
Hydrograph No. 3, SCS Runoff, North Offsite 22
Hydrograph No. 4, Combine, <no description> 23
Hydrograph No. 5, Reservoir, Commercial Pond 24
Pond Report - South Pond 25
Hydrograph No. 6, SCS Runoff, Total to Channel 26

25 - Year

Summary Report 27
Hydrograph Reports 28
Hydrograph No. 1, SCS Runoff, Developed Site 28
Hydrograph No. 2, SCS Runoff, Existing Conditions 29
Hydrograph No. 3, SCS Runoff, North Offsite 30
Hydrograph No. 4, Combine, <no description> 31
Hydrograph No. 5, Reservoir, Commercial Pond 32
Pond Report - South Pond 33
Hydrograph No. 6, SCS Runoff, Total to Channel 34

100 - Year

Summary Report 35
Hydrograph Reports 36
Hydrograph No. 1, SCS Runoff, Developed Site 36
Hydrograph No. 2, SCS Runoff, Existing Conditions 37
Hydrograph No. 3, SCS Runoff, North Offsite 38
Hydrograph No. 4, Combine, <no description> 39
Hydrograph No. 5, Reservoir, Commercial Pond 40
Pond Report - South Pond 41
Hydrograph No. 6, SCS Runoff, Total to Channel 42

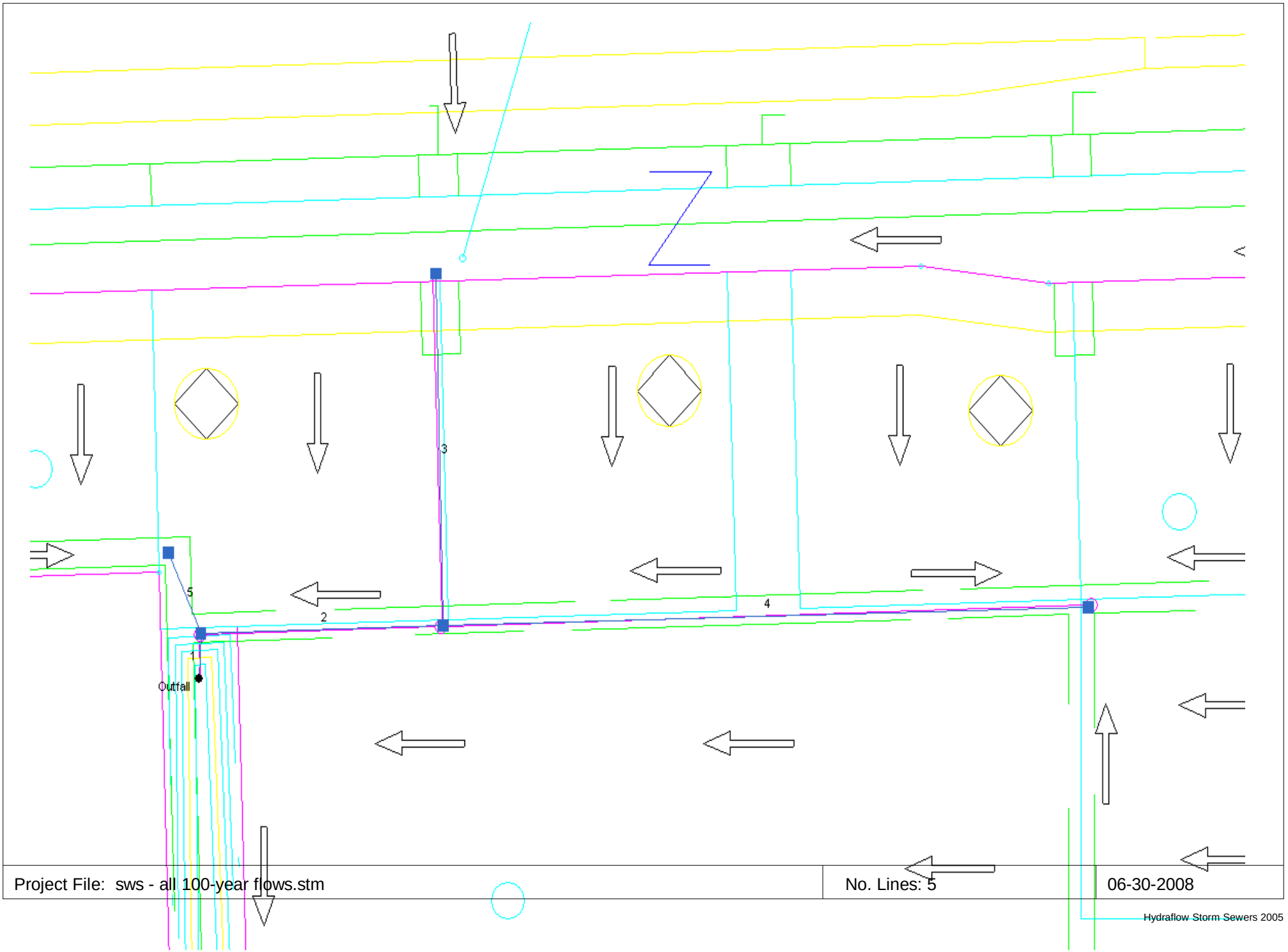
IDF Report 43

HydraFlow StormSewer

Coincident 100-year Peak
Offsite 100-year Peak
Onsite 100-year Peak

South System

Hydraflow Plan View



Project File: sws - all 100-year flows.stm | No. Lines: 5 | 06-30-2008

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	32.0	-87.6	DrGrt	0.50	0.00	0.00	0.0	1354.00	0.19	1354.06	48	Cir	0.013	1.50	1359.00	
2	1	189.2	86.0	DrGrt	9.00	0.00	0.00	0.0	1354.06	0.20	1354.44	48	Cir	0.013	1.50	1360.00	
3	2	249.6	-89.6	DrGrt	0.00	60.00	0.40	101.0	1354.44	0.20	1354.94	48	Cir	0.013	1.00	1360.00	
4	2	504.8	0.1	DrGrt	26.00	0.00	0.00	0.0	1354.44	0.20	1355.45	30	Cir	0.013	1.00	1360.00	
5	1	62.7	-26.2	DrGrt	18.00	0.00	0.00	0.0	1354.06	0.21	1354.19	24	Cir	0.013	1.00	1360.00	

Project File: sws - all 100-year flows.stm

Number of lines: 5

Date: 06-30-2008

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		119.0	48 c	32.0	1354.00	1354.06	0.188	1358.00*	1358.22*	n/a	1359.69 i	End
2		100.7	48 c	189.2	1354.06	1354.44	0.201	1359.69*	1360.62*	1.50	1362.12	1
3		65.98	48 c	249.6	1354.44	1354.94	0.200	1362.68*	1363.21*	0.43	1363.64	2
4		26.00	30 c	504.8	1354.44	1355.45	0.200	1362.68*	1364.71*	0.44	1365.14	2
5		18.00	24 c	62.7	1354.06	1354.19	0.207	1359.69*	1360.09*	0.51	1360.60	1

Project File: sws - all 100-year flows.stm | Number of lines: 5 | Run Date: 06-30-2008

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		0.50*	0.00	0.50	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.06	4.31	0.06	4.31	0.00	Off
2		9.00*	0.00	9.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.70	30.05	0.70	30.05	0.00	1
3		65.98	0.00	65.98	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	37.70	1509.94	37.70	1509.94	0.00	2
4		26.00*	0.00	26.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	5.85	236.13	5.85	236.13	0.00	2
5		18.00*	0.00	18.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	2.81	114.21	2.81	114.21	0.00	1

Project File: sws - all 100-year flows.stm | Number of lines: 5 | Run Date: 06-30-2008

NOTES: Inlet N-Values = 0.016 ; Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	48	119.0	1354.00	1358.00	4.00	12.56	9.47	1.40	1359.40	n/a	32.0	1354.06	1358.22	4.00	12.57	9.47	1.39	1359.62i	n/a	n/a	-1.175	1.50	n/a
2	48	100.7	1354.06	1359.69	4.00	12.56	8.01	1.00	1360.69	0.491	189	1354.44	1360.62	4.00	12.57	8.01	1.00	1361.62	0.491	0.491	0.929	1.50	1.50
3	48	65.98	1354.44	1362.68	4.00	12.56	5.25	0.43	1363.11	0.211	250	1354.94	1363.21	4.00	12.57	5.25	0.43	1363.64	0.211	0.211	0.527	1.00	0.43
4	30	26.00	1354.44	1362.68	2.50	4.91	5.30	0.44	1363.11	0.402	505	1355.45	1364.71	2.50	4.91	5.30	0.44	1365.14	0.402	0.402	2.030	1.00	0.44
5	24	18.00	1354.06	1359.69	2.00	3.14	5.73	0.51	1360.20	0.634	62.7	1354.19	1360.09	2.00	3.14	5.73	0.51	1360.60	0.633	0.634	0.397	1.00	0.51

Project File: sws - all 100-year flows.stm | Number of lines: 5 | Run Date: 06-30-2008

Hydraflow HGL Computation Procedure

General Procedure: Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles. The computed HGL is checked against inlet control.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

Col. 15 The upstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 16 Cross-sectional area of the flow at the upstream end.

Col. 17 The velocity of the flow at the upstream end, (Col. 3 / Col. 16).

Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

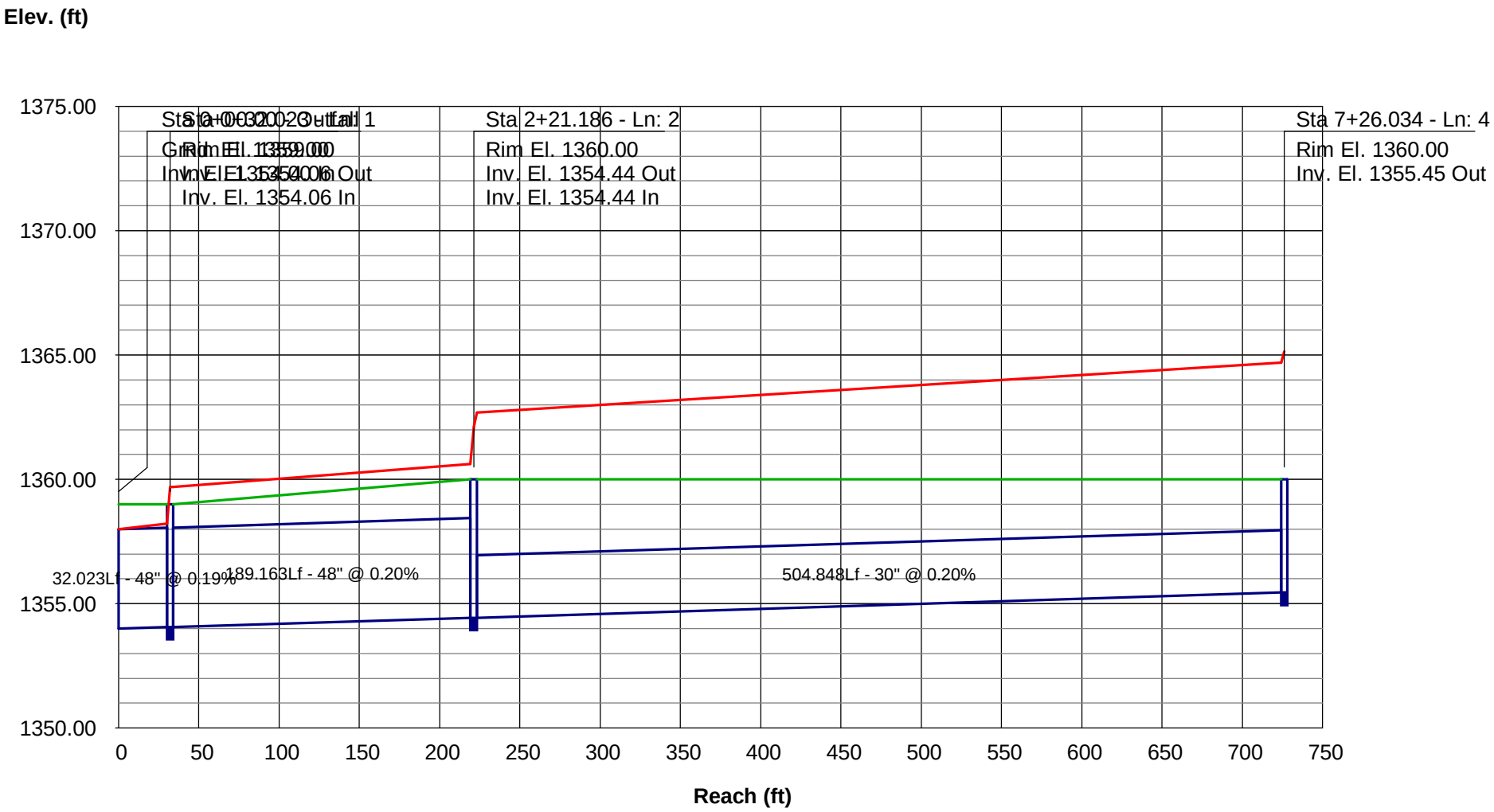
Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

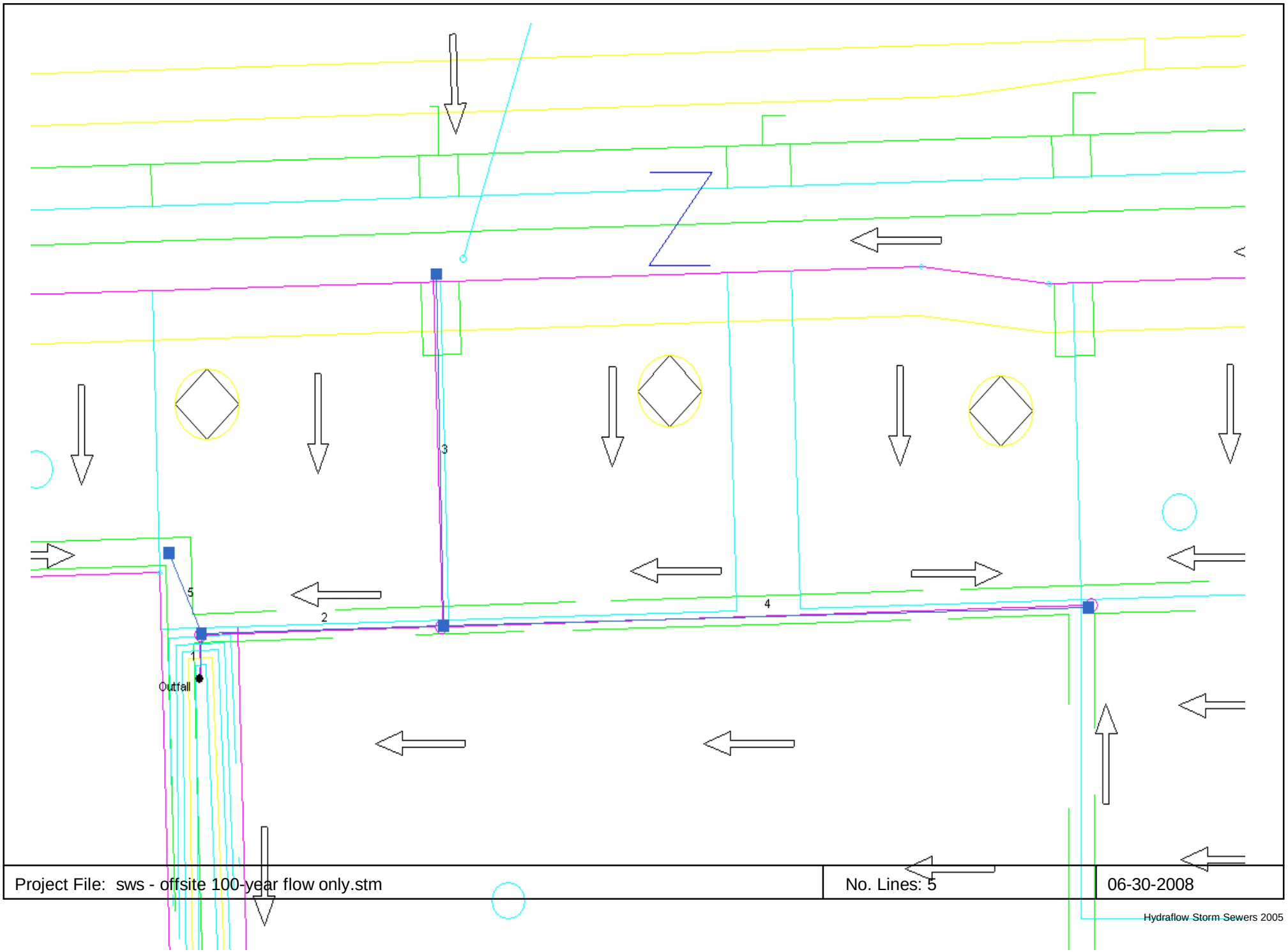
Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

Storm Sewer Profile

Proj. file: sws - all 100-year flows.stm



Hydraflow Plan View



Project File: sws - offsite 100-year flow only.stm	No. Lines: 5	06-30-2008

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	32.0	-87.6	DrGrt	1.00	0.00	0.00	0.0	1354.00	0.19	1354.06	48	Cir	0.013	1.50	1359.00	
2	1	189.2	86.0	DrGrt	1.00	0.00	0.00	0.0	1354.06	0.20	1354.44	48	Cir	0.013	1.50	1360.00	
3	2	249.6	-89.6	DrGrt	0.00	60.00	0.60	136.0	1354.44	0.20	1354.94	48	Cir	0.013	1.00	1360.00	
4	2	504.8	0.1	DrGrt	1.00	0.00	0.00	0.0	1354.44	0.20	1355.45	30	Cir	0.013	1.00	1360.00	
5	1	62.7	-26.2	DrGrt	1.00	0.00	0.00	0.0	1354.06	0.21	1354.19	24	Cir	0.013	1.00	1360.00	

Project File: sws - offsite 100-year flow only.stm

Number of lines: 5

Date: 06-30-2008

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		86.14	48 c	32.0	1354.00	1354.06	0.188	1356.75	1357.27	n/a	1358.24 i	End
2		84.32	48 c	189.2	1354.06	1354.44	0.201	1358.24*	1358.89*	1.05	1359.94	1
3		82.56	48 c	249.6	1354.44	1354.94	0.200	1359.97*	1360.79*	0.67	1361.47	2
4		1.00	30 c	504.8	1354.44	1355.45	0.200	1360.64*	1360.64*	0.00	1360.64	2
5		1.00	24 c	62.7	1354.06	1354.19	0.207	1358.24*	1358.24*	0.00	1358.24	1

Project File: sws - offsite 100-year flow only.stm | Number of lines: 5 | Run Date: 06-30-2008

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		1.00*	0.00	1.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.09	5.66	0.09	5.66	0.00	Off
2		1.00*	0.00	1.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.09	5.66	0.09	5.66	0.00	1
3		82.56	0.00	82.56	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	59.01	2362.45	59.01	2362.45	0.00	2
4		1.00*	0.00	1.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.09	5.66	0.09	5.66	0.00	2
5		1.00*	0.00	1.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.09	5.66	0.09	5.66	0.00	1

Project File: sws - offsite 100-year flow only.stm | Number of lines: 5 | Run Date: 06-30-2008

NOTES: Inlet N-Values = 0.016 ; Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	48	86.14	1354.00	1356.75	2.75	9.19	9.37	1.37	1358.11	n/a	32.0	1354.06	1357.27	3.21	10.79	7.98	0.99	1358.26i	n/a	n/a	-0.845	1.50	n/a
2	48	84.32	1354.06	1358.24	4.00	12.56	6.71	0.70	1358.94	0.345	189	1354.44	1358.89	4.00	12.57	6.71	0.70	1359.59	0.345	0.345	0.652	1.50	1.05
3	48	82.56	1354.44	1359.97	4.00	12.56	6.57	0.67	1360.64	0.330	250	1354.94	1360.79	4.00	12.57	6.57	0.67	1361.47	0.330	0.330	0.825	1.00	0.67
4	30	1.00	1354.44	1360.64	2.50	4.91	0.20	0.00	1360.64	0.001	505	1355.45	1360.64	2.50	4.91	0.20	0.00	1360.64	0.001	0.001	0.003	1.00	0.00
5	24	1.00	1354.06	1358.24	2.00	3.14	0.32	0.00	1358.24	0.002	62.7	1354.19	1358.24	2.00	3.14	0.32	0.00	1358.24	0.002	0.002	0.001	1.00	0.00

Project File: sws - offsite 100-year flow only.stm | Number of lines: 5 | Run Date: 06-30-2008

Hydraflow HGL Computation Procedure

General Procedure: Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles. The computed HGL is checked against inlet control.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

Col. 15 The upstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 16 Cross-sectional area of the flow at the upstream end.

Col. 17 The velocity of the flow at the upstream end, (Col. 3 / Col. 16).

Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

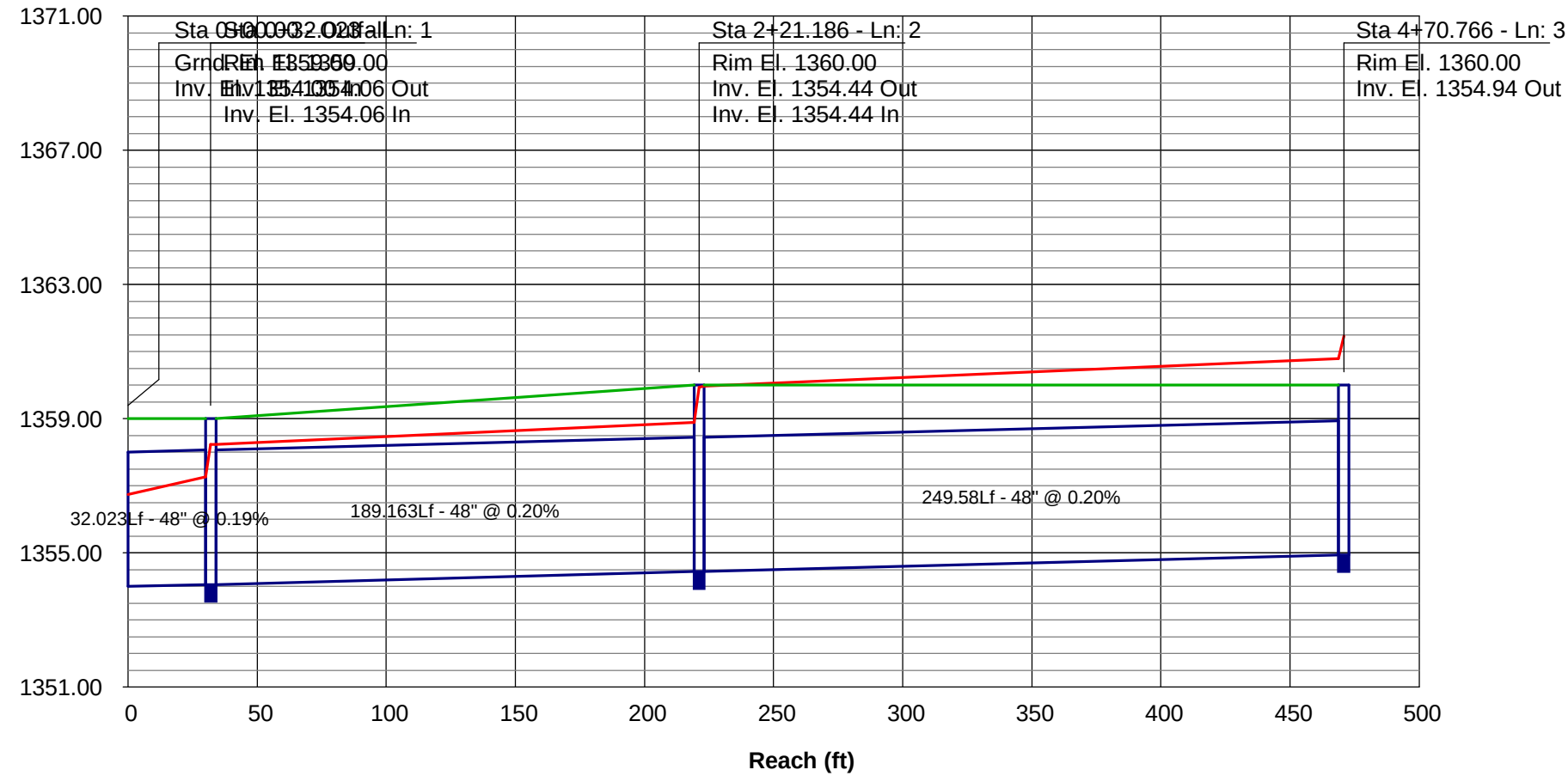
Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

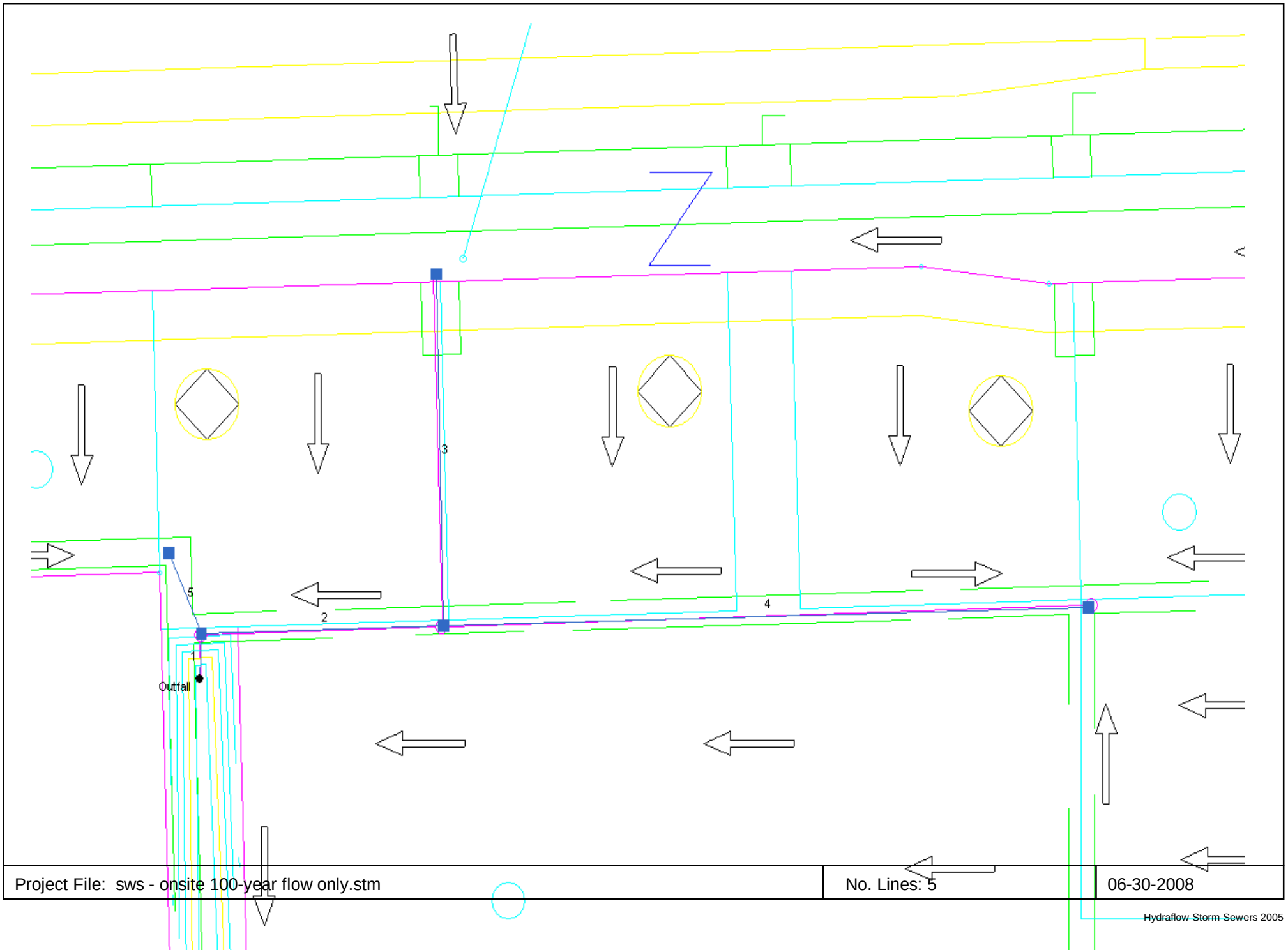
Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

Storm Sewer Profile

Proj. file: sws - offsite 100-year flow only.stm



Hydraflow Plan View



Project File: sws - onsite 100-year flow only.stm	No. Lines: 5	06-30-2008

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	32.0	-87.6	DrGrt	0.50	0.00	0.00	0.0	1354.00	0.19	1354.06	48	Cir	0.013	1.50	1359.00	
2	1	189.2	86.0	DrGrt	9.00	0.00	0.00	0.0	1354.06	0.20	1354.44	48	Cir	0.013	1.50	1360.00	
3	2	249.6	-89.6	DrGrt	1.00	0.00	0.00	0.0	1354.44	0.20	1354.94	48	Cir	0.013	1.00	1360.00	
4	2	504.8	0.1	DrGrt	26.00	0.00	0.00	0.0	1354.44	0.20	1355.45	30	Cir	0.013	1.00	1360.00	
5	1	62.7	-26.2	DrGrt	18.00	0.00	0.00	0.0	1354.06	0.21	1354.19	24	Cir	0.013	1.00	1360.00	

Project File: sws - onsite 100-year flow only.stm

Number of lines: 5

Date: 06-30-2008

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		54.50	48 c	32.0	1354.00	1354.06	0.188	1356.90	1356.96	0.73	1357.69	End
2		36.00	48 c	189.2	1354.06	1354.44	0.201	1358.02	1358.12	0.21	1358.33	1
3		1.00	48 c	249.6	1354.44	1354.94	0.200	1358.46	1358.46	0.00	1358.46	2
4		26.00	30 c	504.8	1354.44	1355.45	0.200	1358.33*	1360.36*	0.44	1360.79	2
5		18.00	24 c	62.7	1354.06	1354.19	0.207	1357.69*	1358.09*	0.51	1358.60	1

Project File: sws - onsite 100-year flow only.stm | Number of lines: 5 | Run Date: 06-30-2008

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown).

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		0.50*	0.00	0.50	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.06	4.31	0.06	4.31	0.00	Off
2		9.00*	0.00	9.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.70	30.05	0.70	30.05	0.00	1
3		1.00*	0.00	1.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	0.09	5.66	0.09	5.66	0.00	2
4		26.00*	0.00	26.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	5.85	236.13	5.85	236.13	0.00	2
5		18.00*	0.00	18.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	2.81	114.21	2.81	114.21	0.00	1

Project File: sws - onsite 100-year flow only.stm | Number of lines: 5 | Run Date: 06-30-2008

NOTES: Inlet N-Values = 0.016 ; Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	48	54.50	1354.00	1356.90	2.90	9.76	5.58	0.48	1357.39	0.188	32.0	1354.06	1356.96	2.90	9.76	5.58	0.48	1357.45	0.188	0.188	0.060	1.50	0.73
2	48	36.00	1354.06	1358.02	3.96	12.55	2.87	0.13	1358.15	0.058	189	1354.44	1358.12	3.68	12.09	2.98	0.14	1358.26	0.055	0.056	0.106	1.50	0.21
3	48	1.00	1354.44	1358.46	4.00	12.56	0.08	0.00	1358.46	0.000	250	1354.94	1358.46	3.52	11.70	0.09	0.00	1358.46	0.000	0.000	0.000	1.00	0.00
4	30	26.00	1354.44	1358.33	2.50	4.91	5.30	0.44	1358.76	0.402	505	1355.45	1360.36	2.50	4.91	5.30	0.44	1360.79	0.402	0.402	2.030	1.00	0.44
5	24	18.00	1354.06	1357.69	2.00	3.14	5.73	0.51	1358.20	0.634	62.7	1354.19	1358.09	2.00	3.14	5.73	0.51	1358.60	0.633	0.634	0.397	1.00	0.51

Project File: sws - onsite 100-year flow only.stm | Number of lines: 5 | Run Date: 06-30-2008

Hydraflow HGL Computation Procedure

General Procedure: Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles. The computed HGL is checked against inlet control.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

Col. 15 The upstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 16 Cross-sectional area of the flow at the upstream end.

Col. 17 The velocity of the flow at the upstream end, (Col. 3 / Col. 16).

Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

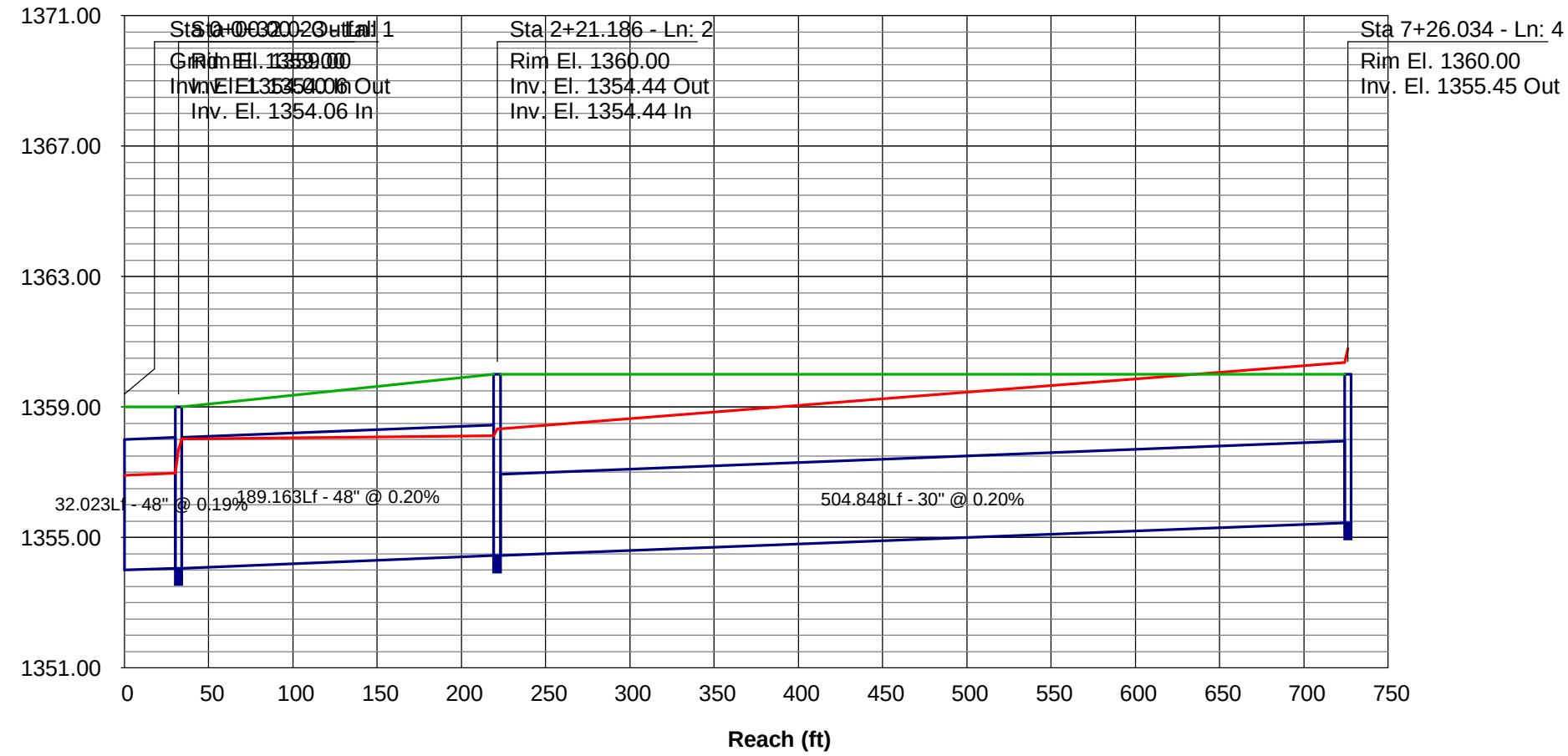
Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

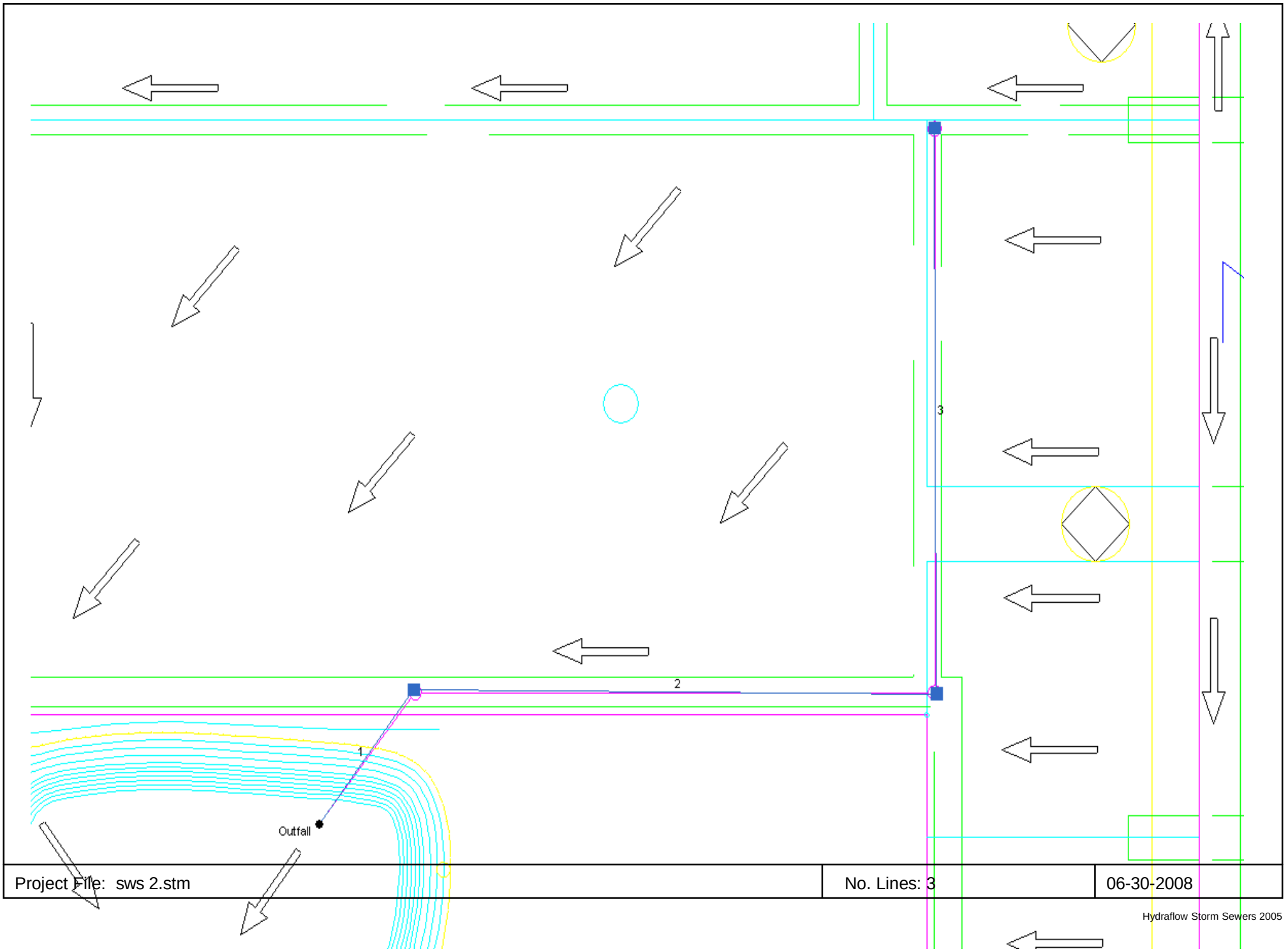
Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

Storm Sewer Profile

Proj. file: sws - onsite 100-year flow only.stm



Hydraflow Plan View



Project File: sws 2.stm	No. Lines: 3	06-30-2008

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	113.1	-52.2	DrGrt	20.00	0.00	0.00	0.0	1347.00	3.54	1351.00	36	Cir	0.013	1.24	1356.00	
2	1	384.8	52.6	DrGrt	21.00	0.00	0.00	0.0	1351.00	0.18	1351.69	36	Cir	0.013	1.50	1359.00	
3	2	377.6	-90.6	DrGrt	18.00	0.00	0.00	0.0	1351.69	0.20	1352.45	30	Cir	0.013	1.00	1360.00	

Project File: sws 2.stm | Number of lines: 3 | Date: 06-30-2008

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		59.00	36 c	113.1	1347.00	1351.00	3.537	1351.00	1353.45	n/a	1355.92 i	End
2		39.00	36 c	384.8	1351.00	1351.69	0.179	1355.92*	1357.23*	0.71	1357.94	1
3		18.00	30 c	377.6	1351.69	1352.45	0.201	1358.21*	1358.93*	0.21	1359.14	2

Project File: sws 2.stm | Number of lines: 3 | Run Date: 06-30-2008

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		20.00*	0.00	20.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	3.46	140.54	3.46	140.54	0.00	Off
2		21.00*	0.00	21.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	3.82	154.74	3.82	154.74	0.00	1
3		18.00*	0.00	18.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	2.81	114.21	2.81	114.21	0.00	2

Project File: sws 2.stm | Number of lines: 3 | Run Date: 06-30-2008

NOTES: Inlet N-Values = 0.016 ; Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; * Indicates Known Q added

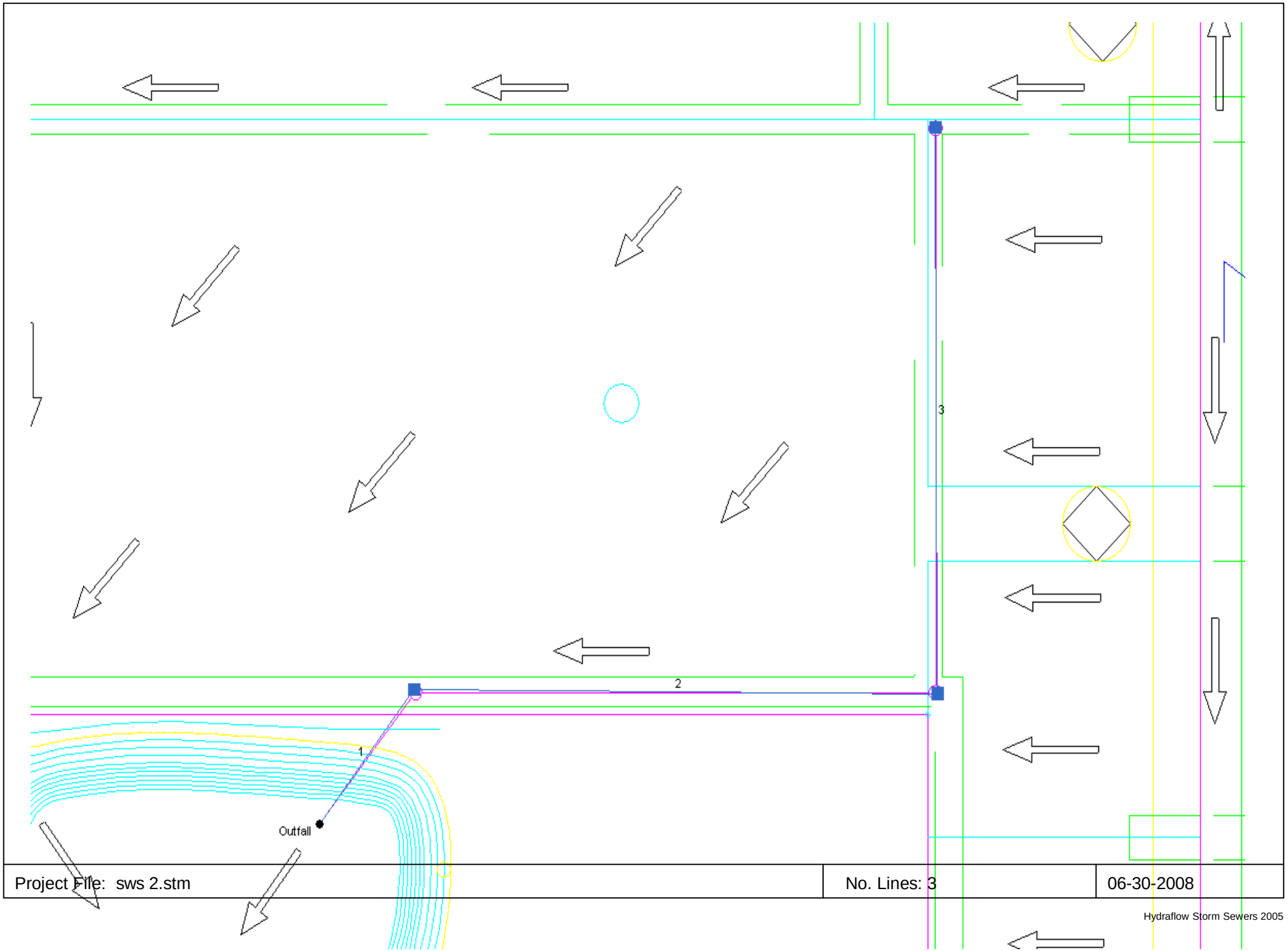
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	36	59.00	1347.00	1351.00	3.00	7.07	8.35	1.08	1352.08	n/a	113	1351.00	1353.45	2.45**	6.18	9.55	1.42	1354.87i	n/a	n/a	n/a	1.24	n/a
2	36	39.00	1351.00	1355.92	3.00	7.07	5.52	0.47	1356.39	0.342	385	1351.69	1357.23	3.00	7.07	5.52	0.47	1357.71	0.342	0.342	1.316	1.50	0.71
3	30	18.00	1351.69	1358.21	2.50	4.91	3.67	0.21	1358.42	0.193	378	1352.45	1358.93	2.50	4.91	3.67	0.21	1359.14	0.193	0.193	0.728	1.00	0.21

Project File: sws 2.stm | Number of lines: 3 | Run Date: 06-30-2008

Notes: ; ** Critical depth.

Hydraflow Plan View



Project File: sws 2.stm	No. Lines: 3	06-30-2008

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line type	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	113.1	-52.2	DrGrt	20.00	0.00	0.00	0.0	1347.00	3.54	1351.00	36	Cir	0.013	1.24	1356.00	
2	1	384.8	52.6	DrGrt	21.00	0.00	0.00	0.0	1351.00	0.18	1351.69	36	Cir	0.013	1.50	1359.00	
3	2	377.6	-90.6	DrGrt	18.00	0.00	0.00	0.0	1351.69	0.20	1352.45	30	Cir	0.013	1.00	1360.00	

Project File: sws 2.stm | Number of lines: 3 | Date: 06-30-2008

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		59.00	36 c	113.1	1347.00	1351.00	3.537	1351.00	1353.45	n/a	1355.92 i	End
2		39.00	36 c	384.8	1351.00	1351.69	0.179	1355.92*	1357.23*	0.71	1357.94	1
3		18.00	30 c	377.6	1351.69	1352.45	0.201	1358.21*	1358.93*	0.21	1359.14	2

Project File: sws 2.stm | Number of lines: 3 | Run Date: 06-30-2008

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; i - Inlet control.

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q byp (cfs)	Junc type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp line No
							Ht (in)	L (ft)	area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1		20.00*	0.00	20.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	3.46	140.54	3.46	140.54	0.00	Off
2		21.00*	0.00	21.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	3.82	154.74	3.82	154.74	0.00	1
3		18.00*	0.00	18.00	0.00	DrGrt	6.0	6.00	2.00	4.00	2.00	Sag	2.00	0.050	0.050	0.013	2.81	114.21	2.81	114.21	0.00	2

Project File: sws 2.stm | Number of lines: 3 | Run Date: 06-30-2008

NOTES: Inlet N-Values = 0.016 ; Intensity = 62.28 / (Inlet time + 10.10) ^ 0.66; Return period = 100 Yrs. ; * Indicates Known Q added

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
	(in)	(cfs)									(ft)											(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	36	59.00	1347.00	1351.00	3.00	7.07	8.35	1.08	1352.08	n/a	113	1351.00	1353.45	2.45**	6.18	9.55	1.42	1354.87i	n/a	n/a	n/a	1.24	n/a
2	36	39.00	1351.00	1355.92	3.00	7.07	5.52	0.47	1356.39	0.342	385	1351.69	1357.23	3.00	7.07	5.52	0.47	1357.71	0.342	0.342	1.316	1.50	0.71
3	30	18.00	1351.69	1358.21	2.50	4.91	3.67	0.21	1358.42	0.193	378	1352.45	1358.93	2.50	4.91	3.67	0.21	1359.14	0.193	0.193	0.728	1.00	0.21

Project File: sws 2.stm | Number of lines: 3 | Run Date: 06-30-2008

Notes: ; ** Critical depth.

Hydraflow HGL Computation Procedure

General Procedure: Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles. The computed HGL is checked against inlet control.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

Col. 15 The upstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 16 Cross-sectional area of the flow at the upstream end.

Col. 17 The velocity of the flow at the upstream end, (Col. 3 / Col. 16).

Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

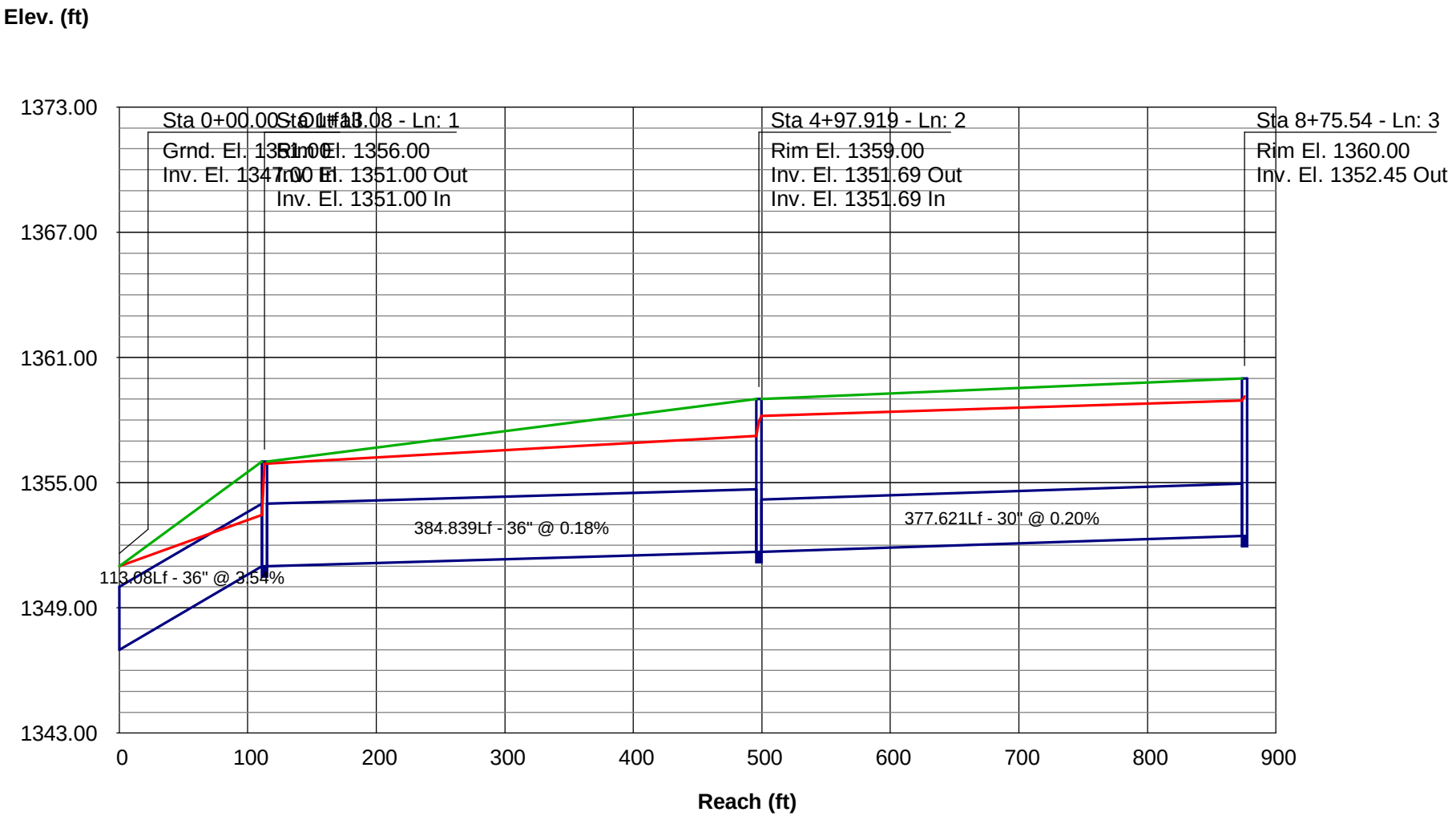
Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

Storm Sewer Profile

Proj. file: sws 2.stm



HydraFlow Express

Proposed Channel

Channel Report

Hydraflow Express by Intelisolve | Friday, Jun 27 2008

<Name>

Trapezoidal

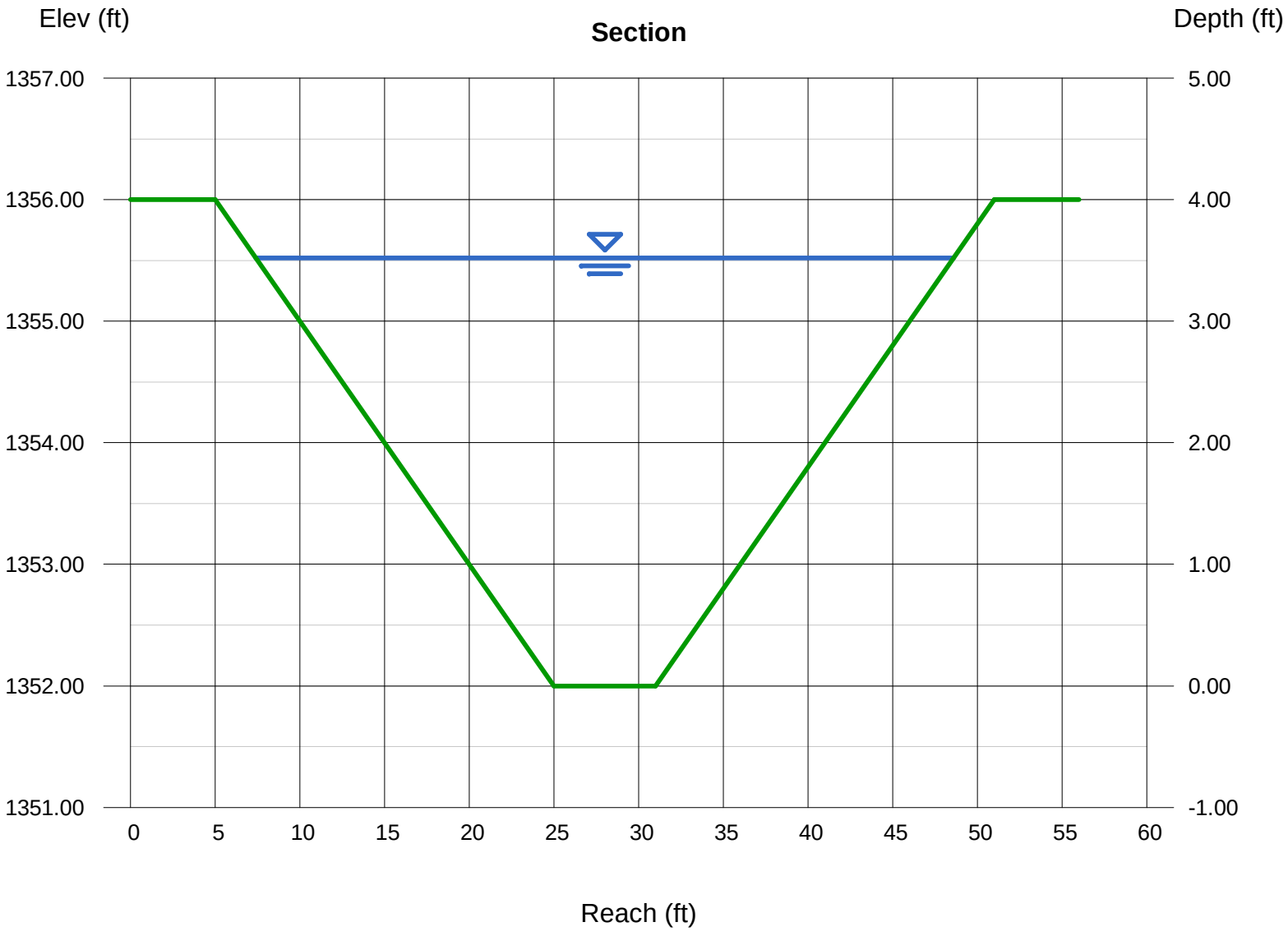
Botom Width (ft)	=	6.00
Side Slopes (z:1)	=	5.00, 5.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	1352.00
Slope (%)	=	0.30
N-Value	=	0.027

Calculations

Compute by:		Q vs Depth
No. Increments	=	50

Highlighted

Depth (ft)	=	3.52
Q (cfs)	=	395.32
Area (sqft)	=	83.07
Velocity (ft/s)	=	4.76
Wetted Perim (ft)	=	41.90
Crit Depth, Yc (ft)	=	2.70
Top Width (ft)	=	41.20
EGL (ft)	=	3.87



Channel Report

Hydraflow Express by Intelisolve | Friday, Jun 27 2008

<Name>

Trapezoidal

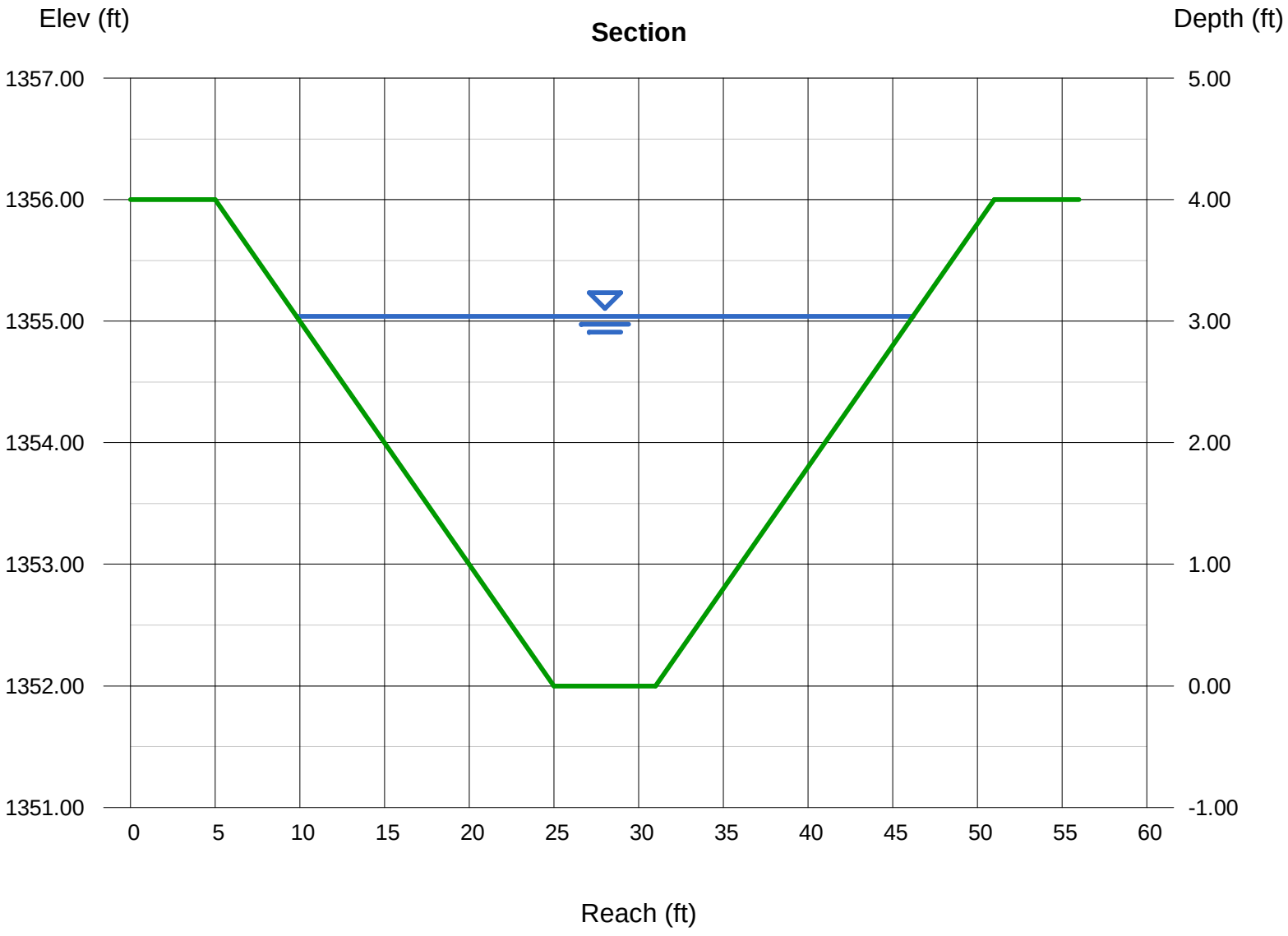
Botom Width (ft)	=	6.00
Side Slopes (z:1)	=	5.00, 5.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	1352.00
Slope (%)	=	0.30
N-Value	=	0.027

Calculations

Compute by:		Q vs Depth
No. Increments	=	50

Highlighted

Depth (ft)	=	3.04
Q (cfs)	=	281.29
Area (sqft)	=	64.45
Velocity (ft/s)	=	4.36
Wetted Perim (ft)	=	37.00
Crit Depth, Yc (ft)	=	2.29
Top Width (ft)	=	36.40
EGL (ft)	=	3.34



Channel Report

Hydraflow Express by Intelisolve | Friday, Jun 27 2008

<Name>

Trapezoidal

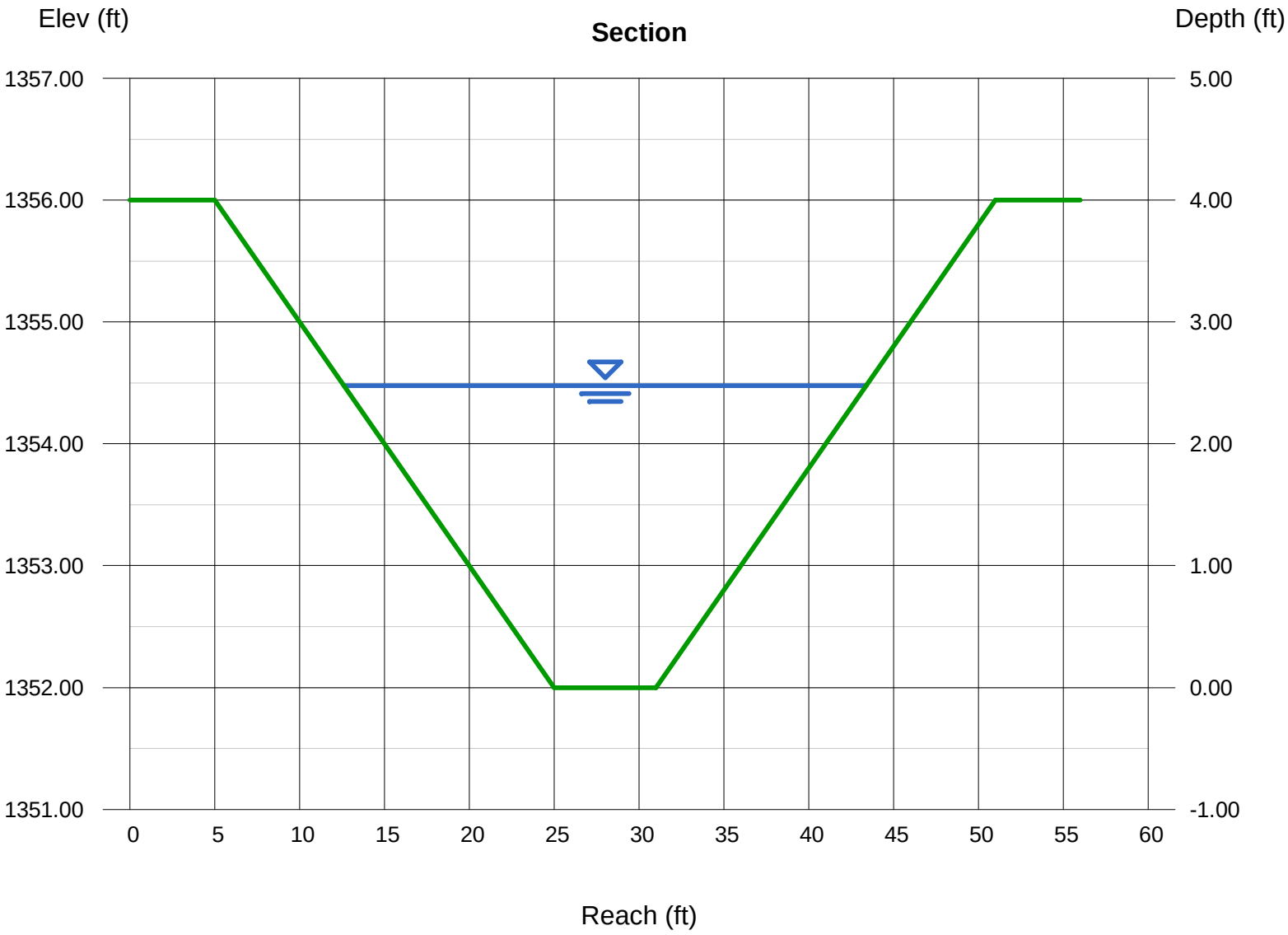
Botom Width (ft)	=	6.00
Side Slopes (z:1)	=	5.00, 5.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	1352.00
Slope (%)	=	0.30
N-Value	=	0.027

Calculations

Compute by:		Q vs Depth
No. Increments	=	50

Highlighted

Depth (ft)	=	2.48
Q (cfs)	=	176.92
Area (sqft)	=	45.63
Velocity (ft/s)	=	3.88
Wetted Perim (ft)	=	31.29
Crit Depth, Yc (ft)	=	1.82
Top Width (ft)	=	30.80
EGL (ft)	=	2.71



Channel Report

Hydraflow Express by Intelisolve | Friday, Jun 27 2008

<Name>

Trapezoidal

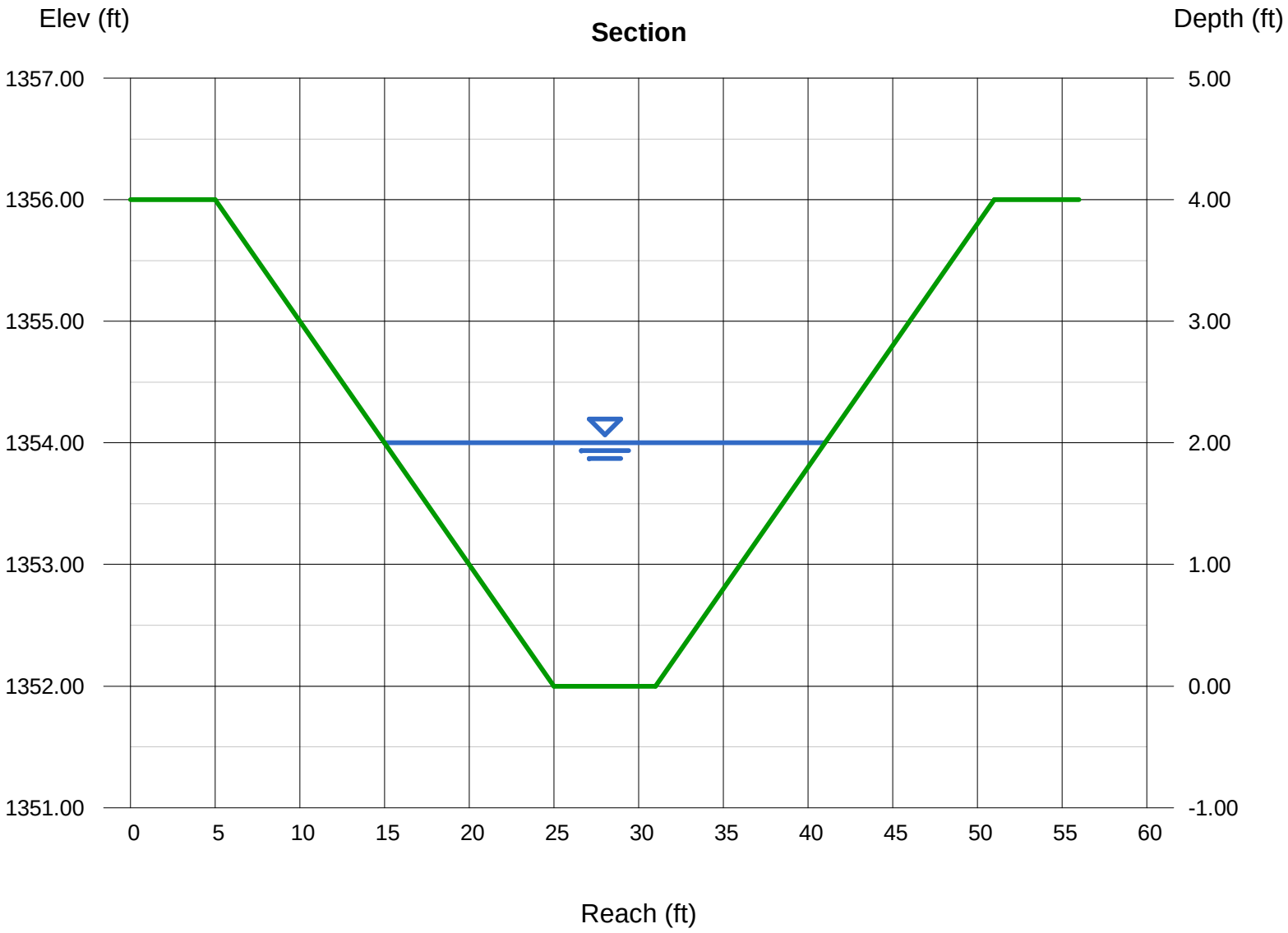
Botom Width (ft)	=	6.00
Side Slopes (z:1)	=	5.00, 5.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	1352.00
Slope (%)	=	0.30
N-Value	=	0.027

Calculations

Compute by:		Q vs Depth
No. Increments	=	50

Highlighted

Depth (ft)	=	2.00
Q (cfs)	=	109.68
Area (sqft)	=	32.00
Velocity (ft/s)	=	3.43
Wetted Perim (ft)	=	26.40
Crit Depth, Yc (ft)	=	1.42
Top Width (ft)	=	26.00
EGL (ft)	=	2.18



Channel Report

Hydraflow Express by Intelisolve — Friday, Jun 27 2008

<Name>

Trapezoidal

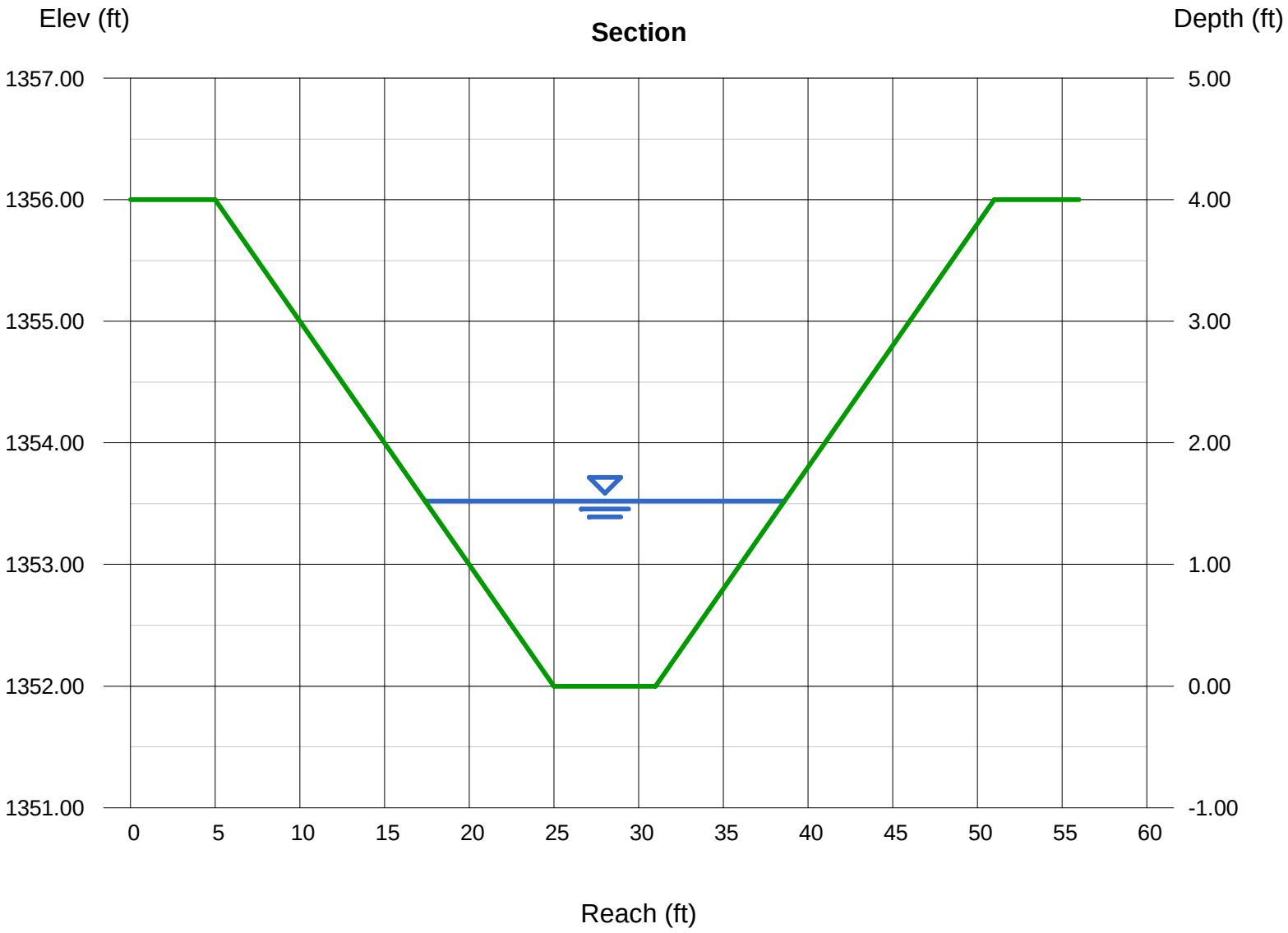
Botom Width (ft)	=	6.00
Side Slopes (z:1)	=	5.00, 5.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	1352.00
Slope (%)	=	0.30
N-Value	=	0.027

Calculations

Compute by:		Q vs Depth
No. Increments	=	50

Highlighted

Depth (ft)	=	1.52
Q (cfs)	=	60.70
Area (sqft)	=	20.67
Velocity (ft/s)	=	2.94
Wetted Perim (ft)	=	21.50
Crit Depth, Yc (ft)	=	1.03
Top Width (ft)	=	21.20
EGL (ft)	=	1.65



DRAINAGE & GRADING PLAN Scale 1:100