Supplemental Drainage Report – Northeast Drainage

This report includes updated drawings and more a detailed explanation of the drainage basin that drains to the northeast in the Waterfront Residential Addition (WFR). This report supplements the Drainage Report for the Waterfront Commercial, Waterfront Residential, and Greenwich Office Park Additions revised August 2007.

The sentences referring to 1.7 acre feet of storage in Section I. of Tab 3 were remnants of the April 2007 report and should have been omitted from the August 2007 report. This section should have read as follows:

> The hotel pond will be modified to provide additional storage, which is reflected in Table 8. The residential and commercial detention areas will have a normal pool of 1379.0 and a 100-year elevation of 1383.9. The East Detention pond will provide 4.7 acre-feet of storage and have a normal pool elevation of 1385.0 and a 100-year elevation of 1389.6.

Under pre-project conditions, a total of 19.5 acres drains from the residential area to the northeast as shown in the Pre-Project Northeast Basin Map, Appendix A (designated in yellow). Approximately half of this drainage basin sheet flows to the east and the remaining portion flows to the northeast into the railroad right-of-way. No detention will be provided in the northeast basin. In order to reduce peak flow rates from this basin 4.2 acres of the basin (designated as blue) will be routed to a detention facility to the east and 0.9 acres was routed to the detention facilities to the west. The area draining to the northeast has been reduced by 5.1 acres to 14.4 acres, as shown in the Post-Project Northeast Basin Map, Appendix B. The peak flow rate in this direction has not increased in any of the design storms as shown in Table 1. The Hydraflow Hydrographs Output from Figure 3.1 of the August 2007 drainage report has bee updated to include the interim detention pond and is included as Appendix C.

Table 1. Summary of Flow Rates.

Description	Area (ac)	Design Storm Flows (cfs)			
		2-Yr	5-Yr	10-Yr	100-Yr
Pre-Project WFR to NE	19.5	20.9	31.2	38.0	63.6
Pre-Project WFR to Laham	0.0	0.0	0.0	0.0	0.0
Pre-Project to Greenwich Rd	30.0	51.3	76.8	93.8	156.4
Post-Project WFR to NE	14.4	18.1	26.8	32.7	54.0
Post-Project WFR to Laham	4.2	9.3	13.7	16.7	27.4
Interim to Greenwich Rd	34.2	41.5	65.3	81.8	142.5
Post-Project to Greenwich Rd	34.2	50.2	75.5	91.4	141.2

A storm sewer pipe has been designed to convey backyard drainage to the northeast. This pipe has been designed to convey a 2-year design storm. Additional rainfall over the capacity of the pipe will flow through backyard swales to the east to the hedgerow along the east property line. Runoff will flow to the north and will sheet flow to the east as it does under existing conditions. The flow rate has been decreased from pre-project conditions and the 2-year design storm is piped; therefore any sheet flow that flows to the east will be less than pre-project conditions.

A detention facility will be constructed east of the residential site to provide detention for the northeast basin of this site and the commercial development proposed on the east property. This pond will provide approximately 4.7 acre-feet of detention in a 100-yer design event.

To provide adequate detention in the interim, a temporary detention facility has been constructed. This detention facility provides 2.0 acre-feet of detention. The outlet structure for the temporary detention facility is an earthen v-notch weir with a crest elevation of 1385.8 and a broader v-notch weir with a crest elevation of 1386.8. The 100-year water surface elevation of the temporary detention is 1388.7. The interim detention provides detention for all design storms.

When the commercial development is developed east of the site the temporary detention facility will be enlarged and a permanent outlet structure will be constructed. The outlet structure has been modified since the August 2007 report. A description of the current outlet structure is shown on the Post-Project Northeast Basin Plan, Appendix B. Flow rates to Greenwich Road (designated as green) both the interim and permanent detention facilities are summarized in Table 1 and shown on the post project map. Flow rates for each design storm do not increase with the interim development or with the commercial development.

Appendix A

Pre-Project Northeast Basin Map

AREA=19.5 AC
CN=84
Q2= 20.9 CFS
Q10= 31.2 CFS
Q25= 38.0 CFS
Q100=63.6 CFS

TO GREENWICH
AREA=30.0 AC
CN=84
Q2= 51.3 CFS
Q10= 76.8 CFS
Q25= 93.8 CFS
Q100=156.4 CFS

SUMMERFIELD CIR.
SUMMERFIELD CT.
CRESTWOOD
CRESTWOOD CT.
VERANDA
MOSAIC
GENOVA
HEDGE ROW
BLDG.
STBK.
GRASS FIELD
PLM
NP=1374.2
100-YR WSE=1377.5
WATERFRONT 6TH ADDITION
GREENWICH OFFICE PARK
RESERVE "B"

LEGEND

- 6IN - CONIFEROUS TREE
- 3IN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SECTION CORNER
- BM - BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UNDERGROUND ELEC.
- OVERHEAD ELECTRIC
- FIBER OPTIC CABLE !
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW

A17 - AREA FOR SWS SIZING

N

SCALE: 1" = 100'

100 0 100 200

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MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

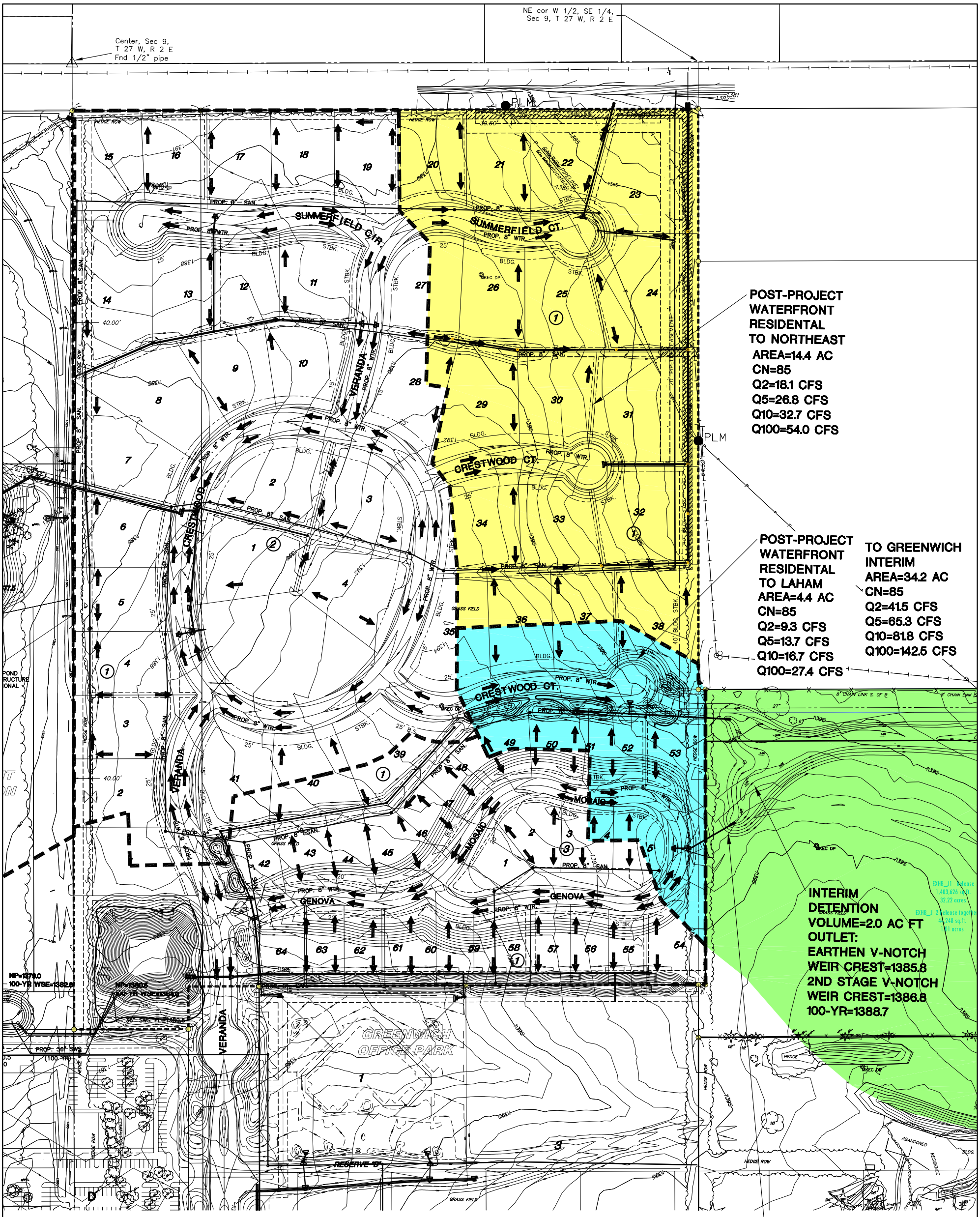
WATERFRONT RESIDENTIAL
PROJECT NAME

PRE-PROJECT NORTHEAST BASIN
SHEET TITLE

KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
JUNE 2009	02014	1 / 1
DATE	JOB NO.	SHEET/OF

Appendix B

Post-Project Northeast Basin Map



LEGEND

- 6IN - CONIFEROUS TREE
- 3IN - DECIDUOUS TREE
- SN - SIGN
- PP - POWER POLE
- ELEC BOX - ELECTRIC BOX
- LP - LIGHT POLE
- FH - FIRE HYDRANT
- WV - WATER VALVE
- WM - WATER METER
- SECTION CORNER
- BM - BENCHMARK
- EASEMENT
- BUILDING SETBACK
- FENCE
- STORM SEWER PIPE
- WATER LINE
- SANITARY SEWER LINE
- GAS LINE
- GAS PIPELINE
- TELEPHONE LINE
- UNDERGROUND ELEC.
- OVERHEAD ELECTRIC
- FIBER OPTIC CABLE !
- DRAINAGE SUB BASIN
- DRAINAGE BASIN
- FLOW ARROW
- A17 - AREA FOR SWS SIZING

N

SCALE: 1" = 100'

100 0 100 200

POST PROJECT TO GREENWICH
AREA=34.2 AC
CN=85
Q2=50.2 CFS
Q5=75.5 CFS
Q10=91.4 CFS
Q100=141.2 CFS

POST PROJECT DETENTION
VOLUME=4.7 AC FT
OUTLET:
4X4 RISER TOP=1387.4
6" CIRCULAR HOLE=1385.0
24" RCP =1380.0
100-YR=1389.7

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MKEC ENGINEERING CONSULTANTS, INC.
411 N. WEBB ROAD
WICHITA, KS. 67206
316 - 684 - 9600

WATERFRONT RESIDENTIAL
PROJECT NAME

POST PROJECT NORTHEAST BASIN
SHEET TITLE

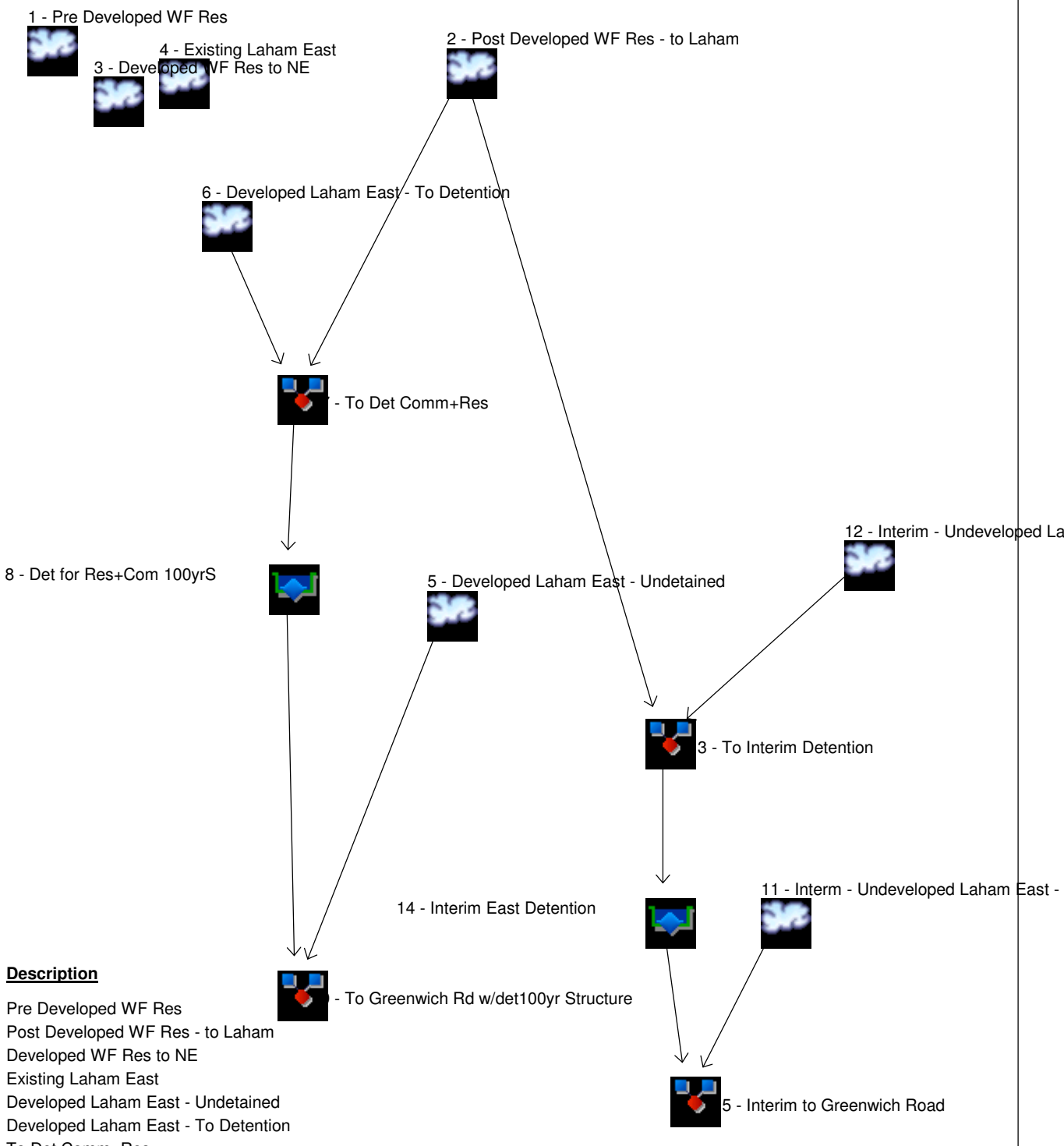
KLA	CMJ	GJA
DESIGN BY:	DRAWN BY:	CHECKED BY:
JUNE 2009	02014	1 / 1
DATE	JOB NO.	SHEET/OF

Appendix C

Hydraflow Hydrographs Output

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre Developed WF Res
2	SCS Runoff	Post Developed WF Res - to Laham
3	SCS Runoff	Developed WF Res to NE
4	SCS Runoff	Existing Laham East
5	SCS Runoff	Developed Laham East - Undetained
6	SCS Runoff	Developed Laham East - To Detention
7	Combine	To Det Comm+Res
8	Reservoir	Det for Res+Com 100yrS
9	Combine	To Greenwich Rd w/det100yr Structure
11	SCS Runoff	Interm - Undeveloped Laham East - Undetained
12	SCS Runoff	Interim - Undeveloped Laham East - To Detention
13	Combine	To Interim Detention
14	Reservoir	Interim East Detention
15	Combine	Interim to Greenwich Road

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	------	-------	20.88	-------	31.16	38.04	48.55	56.58	63.61	Pre Developed WF Res
2	SCS Runoff	------	-------	9.296	-------	13.73	16.66	21.08	24.45	27.39	Post Developed WF Res - to Laham
3	SCS Runoff	------	-------	18.10	-------	26.84	32.65	41.42	48.11	53.96	Developed WF Res to NE
4	SCS Runoff	------	-------	51.27	-------	76.80	93.83	119.56	139.22	156.41	Existing Laham East
5	SCS Runoff	------	-------	49.45	-------	66.25	77.17	93.46	105.83	116.63	Developed Laham East - Undetained
6	SCS Runoff	------	-------	43.27	-------	57.97	67.52	81.78	92.60	102.05	Developed Laham East - To Detentio
7	Combine	2, 6	-------	52.57	-------	71.70	84.18	102.86	117.05	129.44	To Det Comm+Res
8	Reservoir	7	-------	12.00	-------	22.64	24.30	25.21	25.68	26.05	Det for Res+Com 100yrS
9	Combine	5, 8	-------	50.80	-------	75.46	91.44	115.91	129.96	141.23	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	------	-------	36.91	-------	55.30	67.56	86.08	100.24	112.61	Interm - Undeveloped Laham East -
12	SCS Runoff	------	-------	14.36	-------	21.50	26.27	33.48	38.98	43.79	Interim - Undeveloped Laham East -
13	Combine	2, 12	-------	23.01	-------	34.10	41.47	52.57	61.03	68.43	To Interim Detention
14	Reservoir	13	-------	7.493	-------	14.74	19.02	26.23	32.05	37.83	Interim East Detention
15	Combine	11, 14	-------	41.50	-------	65.34	81.83	106.07	125.24	142.47	Interim to Greenwich Road

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	20.88	6	750	3.119	------	------	------	Pre Developed WF Res
2	SCS Runoff	9.296	6	720	0.656	------	------	------	Post Developed WF Res - to Laham
3	SCS Runoff	18.10	6	744	2.339	------	------	------	Developed WF Res to NE
4	SCS Runoff	51.27	6	726	4.798	------	------	------	Existing Laham East
5	SCS Runoff	49.45	6	720	3.649	------	------	------	Developed Laham East - Undetained
6	SCS Runoff	43.27	6	720	3.193	------	------	------	Developed Laham East - To Detentio
7	Combine	52.57	6	720	3.849	2, 6	------	------	To Det Comm+Res
8	Reservoir	12.00	6	738	3.848	7	1387.99	1.93	Det for Res+Com 100yrS
9	Combine	50.80	6	720	7.498	5, 8	------	------	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	36.91	6	726	3.455	------	------	------	Interm - Undeveloped Laham East -
12	SCS Runoff	14.36	6	726	1.344	------	------	------	Interim - Undeveloped Laham East -
13	Combine	23.01	6	726	1.999	2, 12	------	------	To Interim Detention
14	Reservoir	7.493	6	750	1.993	13	1387.63	0.840	Interim East Detention
15	Combine	41.50	6	732	5.448	11, 14	------	------	Interim to Greenwich Road

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	31.16	6	750	4.650	------	------	------	Pre Developed WF Res
2	SCS Runoff	13.73	6	720	0.970	------	------	------	Post Developed WF Res - to Laham
3	SCS Runoff	26.84	6	738	3.457	------	------	------	Developed WF Res to NE
4	SCS Runoff	76.80	6	726	7.154	------	------	------	Existing Laham East
5	SCS Runoff	66.25	6	720	4.968	------	------	------	Developed Laham East - Undetained
6	SCS Runoff	57.97	6	720	4.347	------	------	------	Developed Laham East - To Detentio
7	Combine	71.70	6	720	5.316	2, 6	------	------	To Det Comm+Res
8	Reservoir	22.64	6	738	5.315	7	1388.37	2.50	Det for Res+Com 100yrS
9	Combine	75.46	6	726	10.283	5, 8	------	------	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	55.30	6	726	5.151	------	------	------	Interm - Undeveloped Laham East -
12	SCS Runoff	21.50	6	726	2.003	------	------	------	Interim - Undeveloped Laham East -
13	Combine	34.10	6	726	2.973	2, 12	------	------	To Interim Detention
14	Reservoir	14.74	6	744	2.966	13	1388.01	1.15	Interim East Detention
15	Combine	65.34	6	732	8.117	11, 14	------	------	Interim to Greenwich Road

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	38.04	6	744	5.687	------	------	------	Pre Developed WF Res
2	SCS Runoff	16.66	6	720	1.181	------	------	------	Post Developed WF Res - to Laham
3	SCS Runoff	32.65	6	738	4.212	------	------	------	Developed WF Res to NE
4	SCS Runoff	93.83	6	726	8.750	------	------	------	Existing Laham East
5	SCS Runoff	77.17	6	720	5.834	------	------	------	Developed Laham East - Undetained
6	SCS Runoff	67.52	6	720	5.105	------	------	------	Developed Laham East - To Detentio
7	Combine	84.18	6	720	6.286	2, 6	------	------	To Det Comm+Res
8	Reservoir	24.30	6	738	6.285	7	1388.64	2.93	Det for Res+Com 100yrS
9	Combine	91.44	6	726	12.119	5, 8	------	------	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	67.56	6	726	6.300	------	------	------	Interm - Undeveloped Laham East -
12	SCS Runoff	26.27	6	726	2.450	------	------	------	Interim - Undeveloped Laham East -
13	Combine	41.47	6	726	3.631	2, 12	------	------	To Interim Detention
14	Reservoir	19.02	6	744	3.625	13	1388.18	1.36	Interim East Detention
15	Combine	81.83	6	732	9.925	11, 14	------	------	Interim to Greenwich Road

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	48.55	6	744	7.277	------	------	------	Pre Developed WF Res
2	SCS Runoff	21.08	6	720	1.505	------	------	------	Post Developed WF Res - to Laham
3	SCS Runoff	41.42	6	738	5.366	------	------	------	Developed WF Res to NE
4	SCS Runoff	119.56	6	726	11.195	------	------	------	Existing Laham East
5	SCS Runoff	93.46	6	720	7.137	------	------	------	Developed Laham East - Undetained
6	SCS Runoff	81.78	6	720	6.245	------	------	------	Developed Laham East - To Detentio
7	Combine	102.86	6	720	7.750	2, 6	------	------	To Det Comm+Res
8	Reservoir	25.21	6	738	7.749	7	1389.10	3.65	Det for Res+Com 100yrS
9	Combine	115.91	6	720	14.886	5, 8	------	------	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	86.08	6	726	8.060	------	------	------	Interm - Undeveloped Laham East -
12	SCS Runoff	33.48	6	726	3.135	------	------	------	Interim - Undeveloped Laham East -
13	Combine	52.57	6	726	4.639	2, 12	------	------	To Interim Detention
14	Reservoir	26.23	6	744	4.633	13	1388.43	1.64	Interim East Detention
15	Combine	106.07	6	732	12.694	11, 14	------	------	Interim to Greenwich Road

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	56.58	6	744	8.507	------	------	------	Pre Developed WF Res
2	SCS Runoff	24.45	6	720	1.755	------	------	------	Post Developed WF Res - to Laham
3	SCS Runoff	48.11	6	738	6.257	------	------	------	Developed WF Res to NE
4	SCS Runoff	139.22	6	726	13.087	------	------	------	Existing Laham East
5	SCS Runoff	105.83	6	720	8.132	------	------	------	Developed Laham East - Undetained
6	SCS Runoff	92.60	6	720	7.115	------	------	------	Developed Laham East - To Detentio
7	Combine	117.05	6	720	8.870	2, 6	------	------	To Det Comm+Res
8	Reservoir	25.68	6	738	8.869	7	1389.40	4.22	Det for Res+Com 100yrS
9	Combine	129.96	6	720	17.001	5, 8	------	------	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	100.24	6	726	9.423	------	------	------	Interm - Undeveloped Laham East -
12	SCS Runoff	38.98	6	726	3.664	------	------	------	Interim - Undeveloped Laham East -
13	Combine	61.03	6	726	5.419	2, 12	------	------	To Interim Detention
14	Reservoir	32.05	6	744	5.413	13	1388.60	1.83	Interim East Detention
15	Combine	125.24	6	732	14.836	11, 14	------	------	Interim to Greenwich Road

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (acft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (acft)	Hydrograph description
1	SCS Runoff	63.61	6	744	9.593	------	------	------	Pre Developed WF Res
2	SCS Runoff	27.39	6	720	1.975	------	------	------	Post Developed WF Res - to Laham
3	SCS Runoff	53.96	6	738	7.044	------	------	------	Developed WF Res to NE
4	SCS Runoff	156.41	6	726	14.758	------	------	------	Existing Laham East
5	SCS Runoff	116.63	6	720	9.003	------	------	------	Developed Laham East - Undetained
6	SCS Runoff	102.05	6	720	7.877	------	------	------	Developed Laham East - To Detentio
7	Combine	129.44	6	720	9.853	2, 6	------	------	To Det Comm+Res
8	Reservoir	26.05	6	744	9.852	7	1389.66	4.72	Det for Res+Com 100yrS
9	Combine	141.23	6	720	18.855	5, 8	------	------	To Greenwich Rd w/det100yr Structur
11	SCS Runoff	112.61	6	726	10.626	------	------	------	Interm - Undeveloped Laham East -
12	SCS Runoff	43.79	6	726	4.132	------	------	------	Interim - Undeveloped Laham East -
13	Combine	68.43	6	726	6.108	2, 12	------	------	To Interim Detention
14	Reservoir	37.83	6	738	6.102	13	1388.73	2.01	Interim East Detention
15	Combine	142.47	6	732	16.728	11, 14	------	------	Interim to Greenwich Road

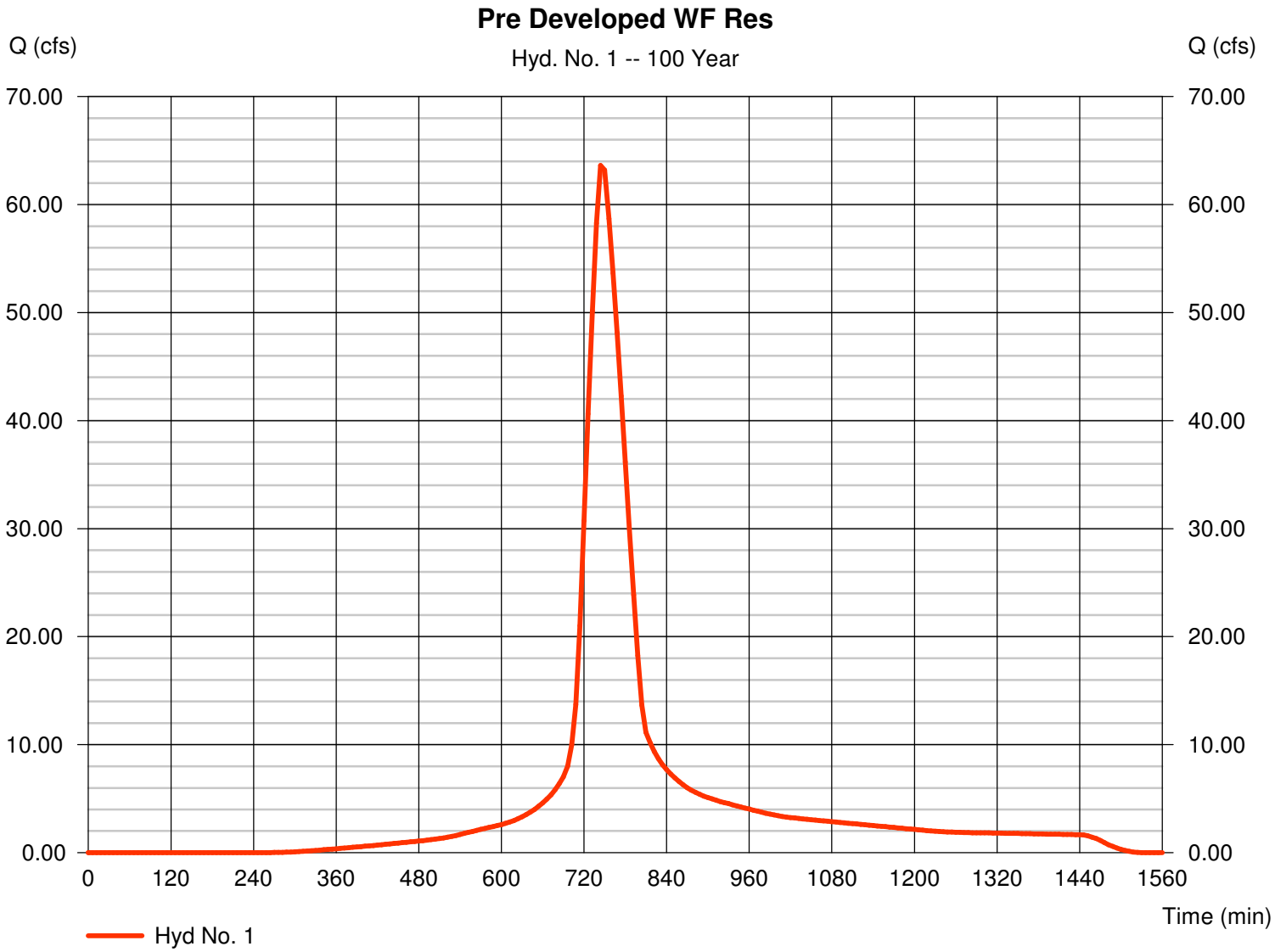
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. v6.066 Wednesday, Jul 1, 2009

Hyd. No. 1

Pre Developed WF Res

Hydrograph type	=	SCS Runoff	Peak discharge	=	63.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	9.593 acft
Drainage area	=	19.500 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	51.40 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

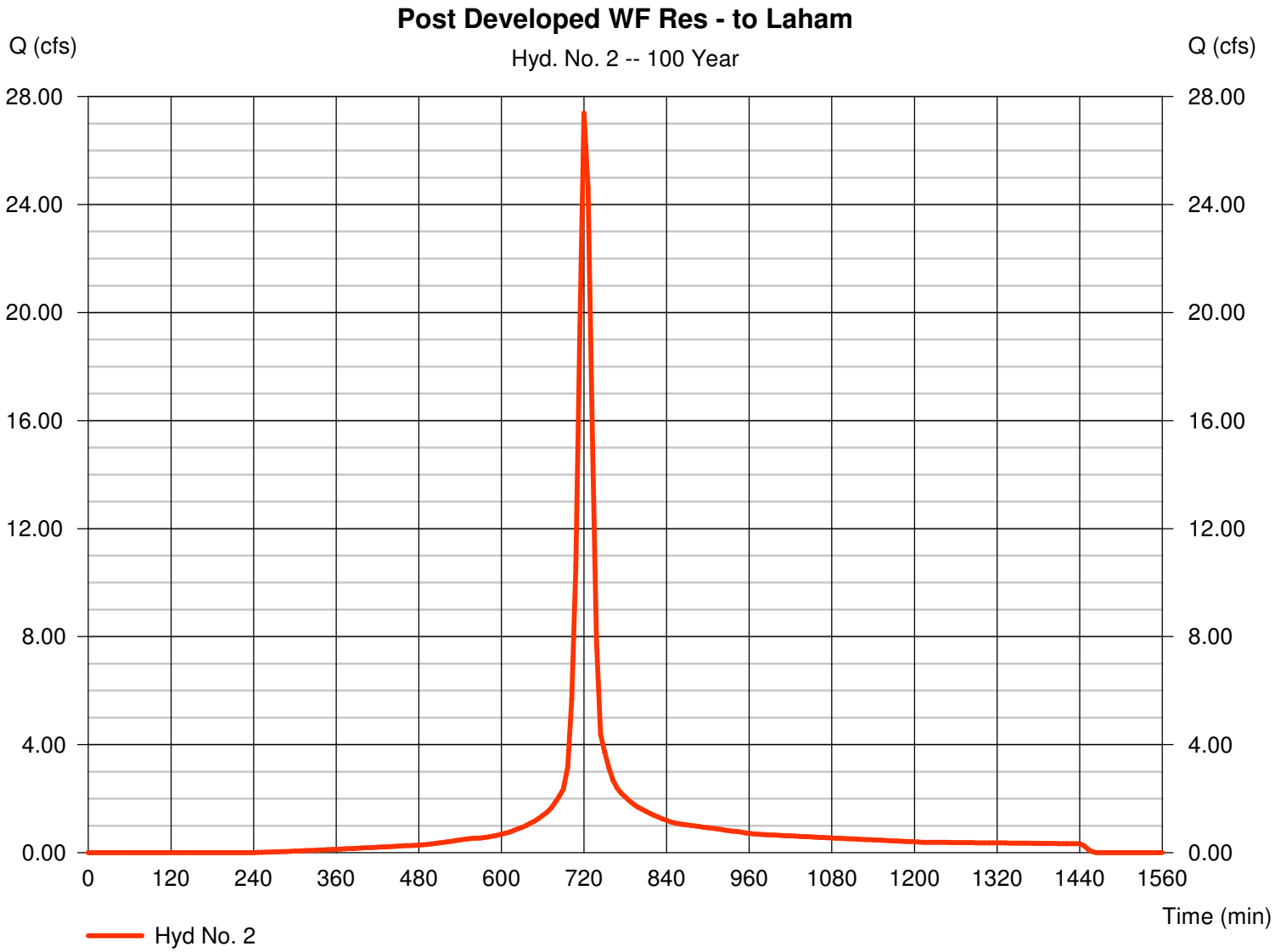


Hydrograph Report

Hyd. No. 2

Post Developed WF Res - to Laham

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.39 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	1.975 acft
Drainage area	=	4.200 ac	Curve number	=	85
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

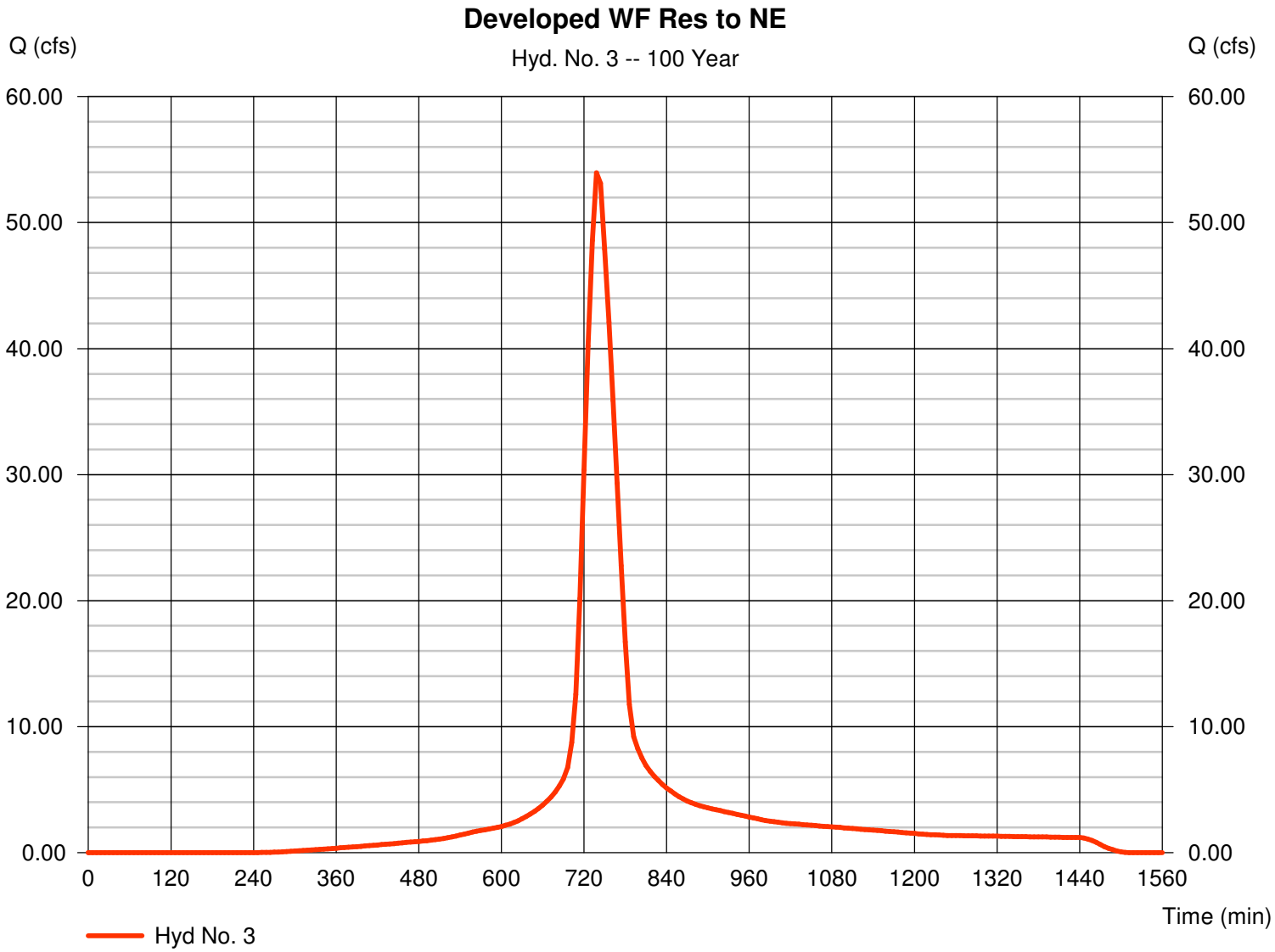


Hydrograph Report

Hyd. No. 3

Developed WF Res to NE

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.96 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	7.044 acft
Drainage area	=	14.400 ac	Curve number	=	85
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	40.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

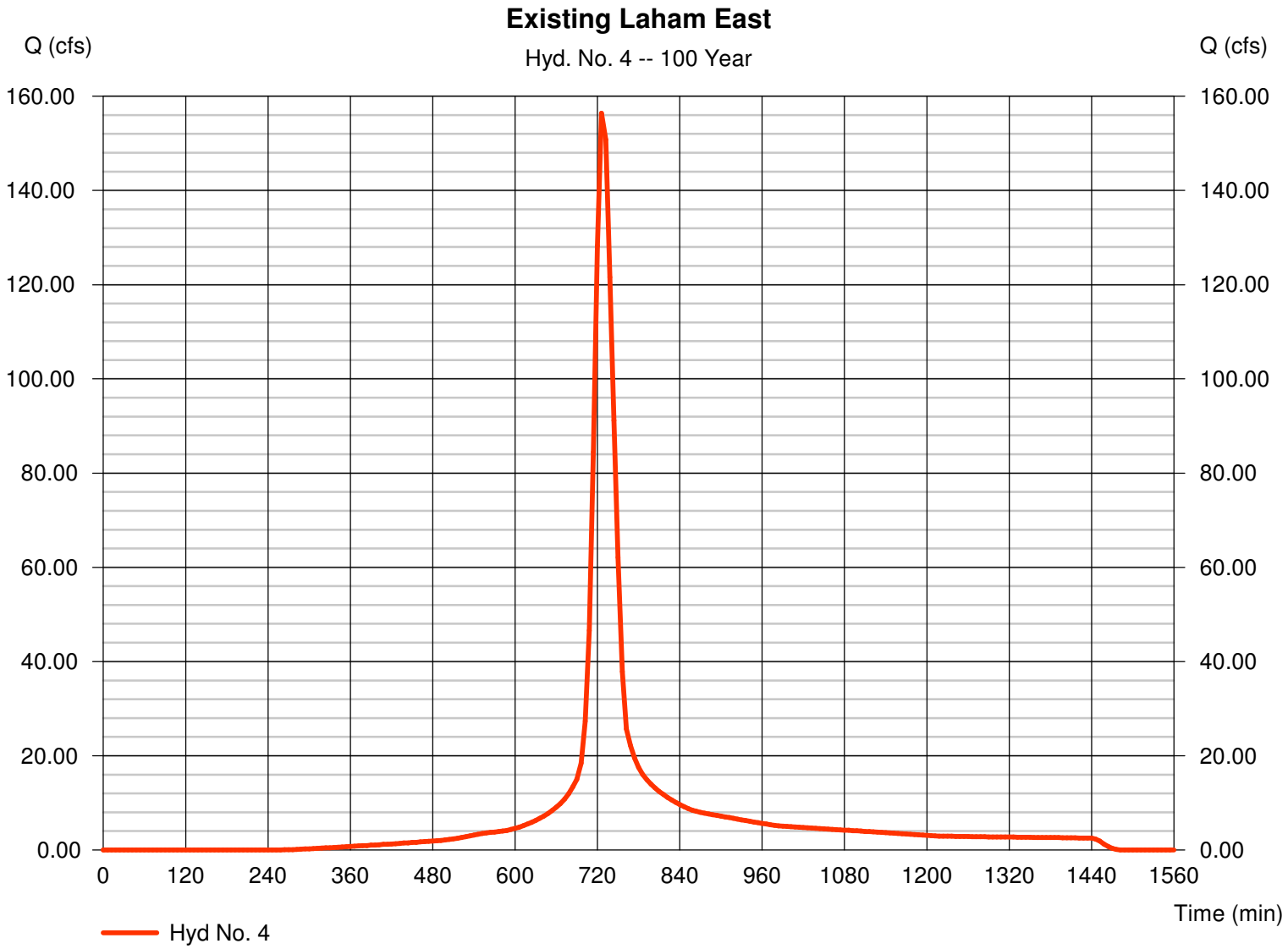


Hydrograph Report

Hyd. No. 4

Existing Laham East

Hydrograph type	=	SCS Runoff	Peak discharge	=	156.41 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	14.758 acft
Drainage area	=	30.000 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	25.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

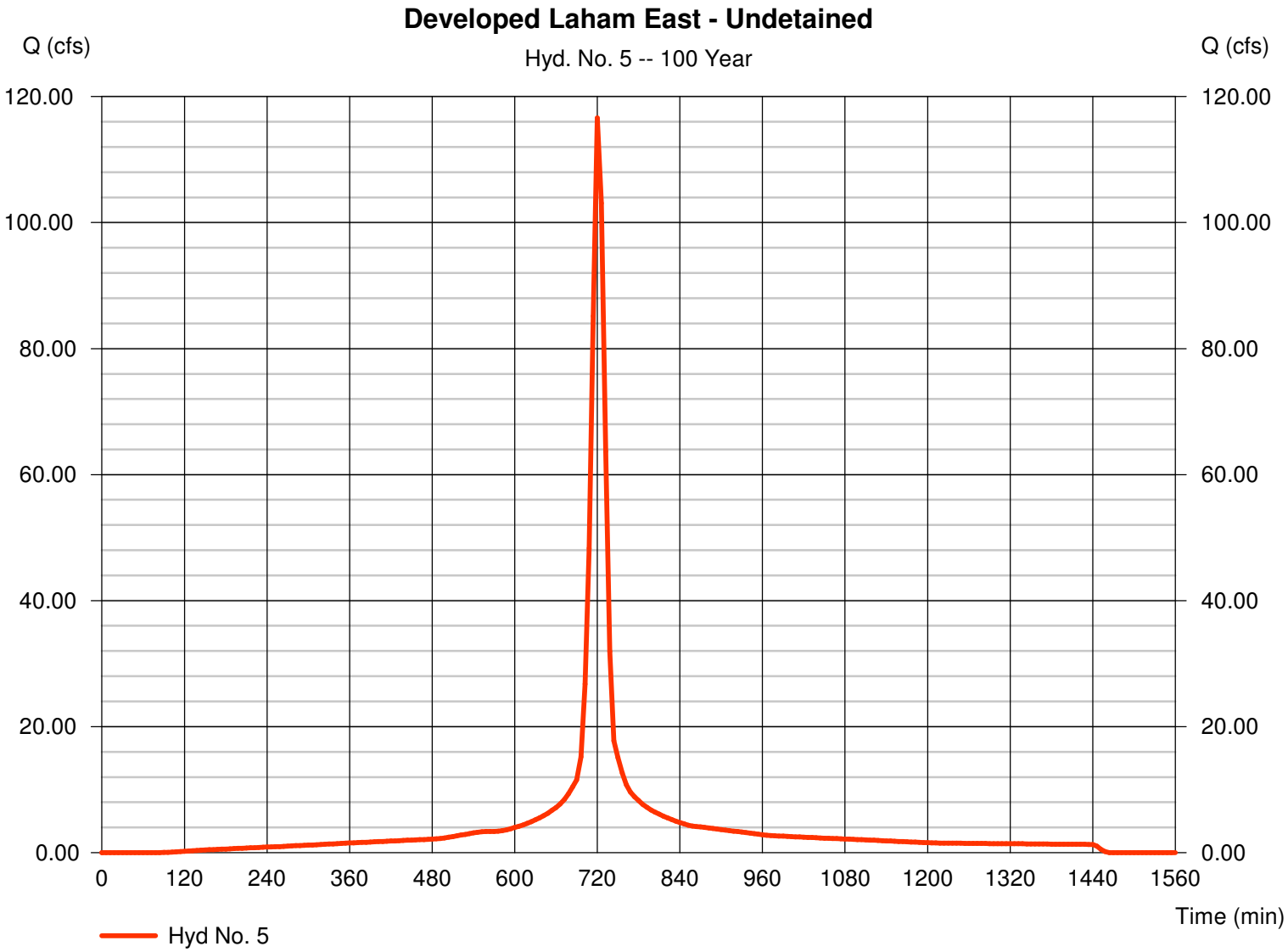


Hydrograph Report

Hyd. No. 5

Developed Laham East - Undetained

Hydrograph type	=	SCS Runoff	Peak discharge	=	116.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	9.003 acft
Drainage area	=	16.000 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

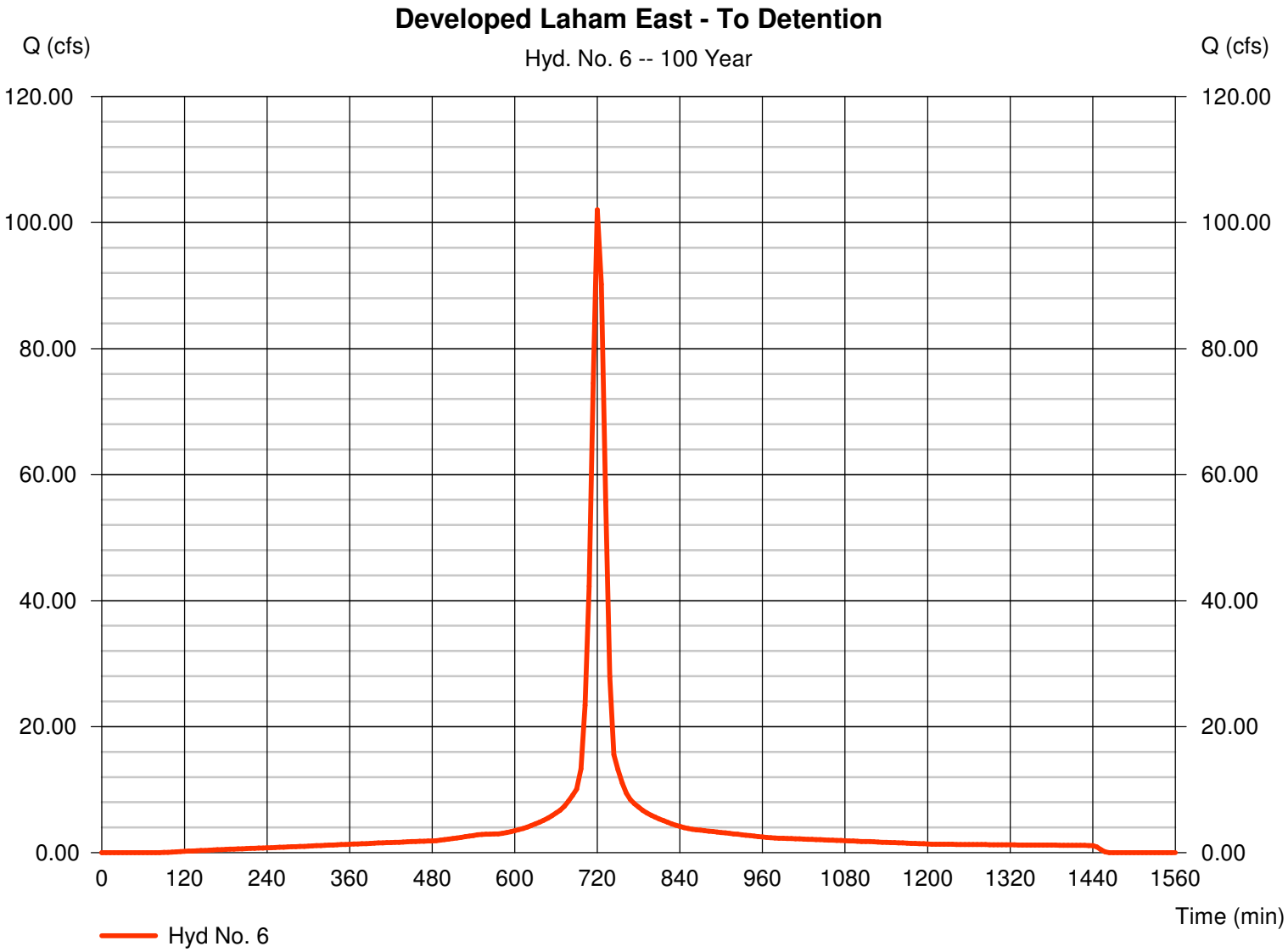


Hydrograph Report

Hyd. No. 6

Developed Laham East - To Detention

Hydrograph type	=	SCS Runoff	Peak discharge	=	102.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	7.877 acft
Drainage area	=	14.000 ac	Curve number	=	95
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	15.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

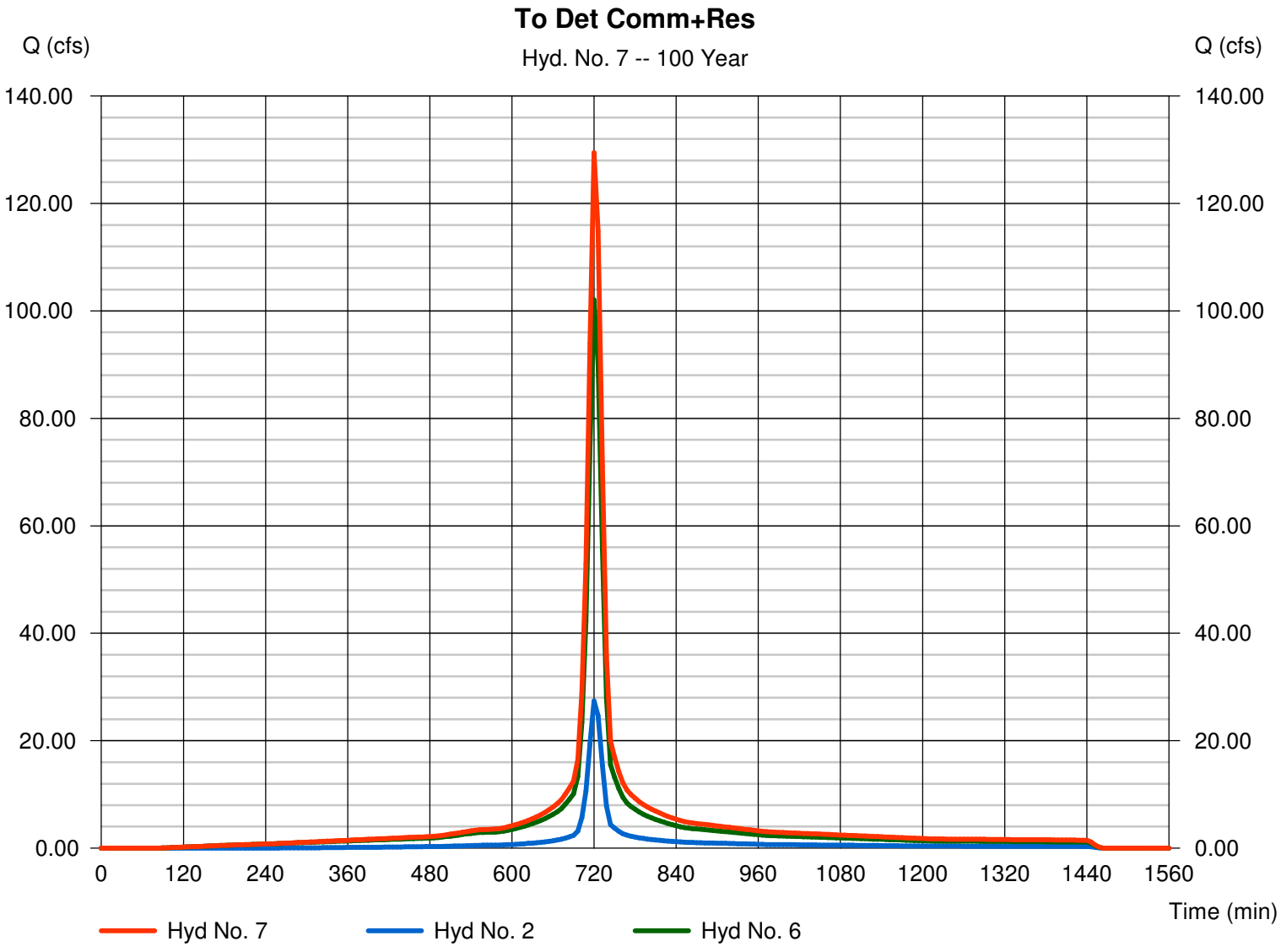


Hydrograph Report

Hyd. No. 7

To Det Comm+Res

Hydrograph type	= Combine	Peak discharge	= 129.44 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 6 min	Hyd. volume	= 9.853 acft
Inflow hyds.	= 2, 6	Contrib. drain. area	= 18.200 ac



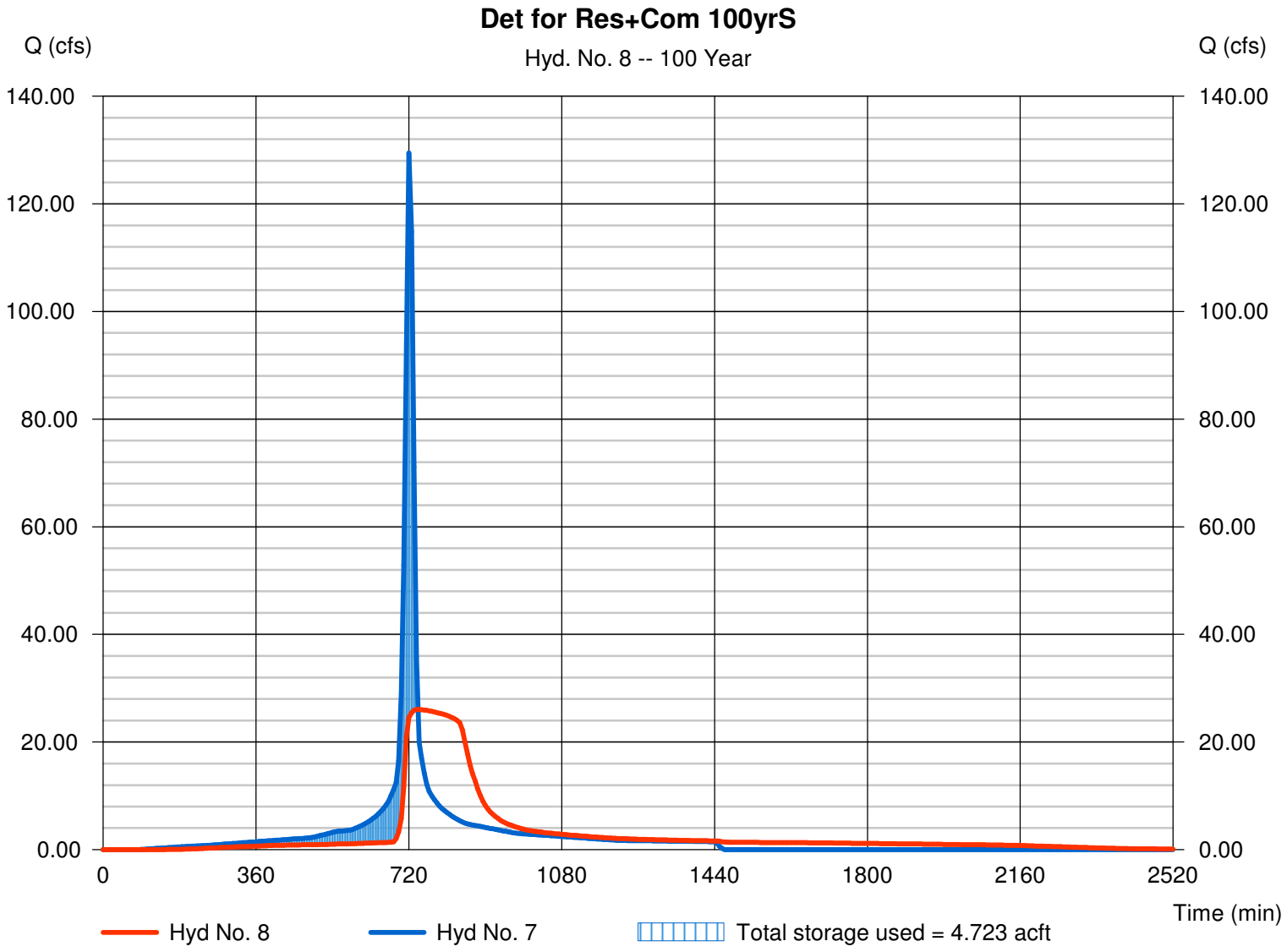
Hydrograph Report

Hyd. No. 8

Det for Res+Com 100yrS

Hydrograph type	=	Reservoir	Peak discharge	=	26.05 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	9.852 acft
Inflow hyd. No.	=	7 - To Det Comm+Res	Max. Elevation	=	1389.66 ft
Reservoir name	=	Contours 11-27-07 - Pipe	Max. Storage	=	4.723 acft

Storage Indication method used.



Pond No. 8 - Contours 11-27-07 - Pipe

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1385.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1385.00	4,959	0.000	0.000
1.00	1386.00	17,975	0.248	0.248
2.00	1387.00	37,699	0.625	0.873
3.00	1388.00	56,795	1.077	1.950
4.00	1389.00	77,000	1.530	3.480
5.00	1390.00	90,000	1.915	5.394

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	6.00	0.00	0.00
Span (in)	= 24.00	6.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1380.00	1385.00	0.00	0.00
Length (ft)	= 650.00	0.50	0.00	0.00
Slope (%)	= 0.40	0.40	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	0.00	0.00	0.00
Crest El. (ft)	= 1387.40	0.00	0.00	0.00
Weir Coeff.	= 1.47	3.33	3.33	3.33
Weir Type	= Riser	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1385.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	0.025	1385.10	19.34 oc	0.03 ic	---	---	0.00	---	---	---	---	---	0.031
0.20	0.050	1385.20	19.34 oc	0.11 ic	---	---	0.00	---	---	---	---	---	0.114
0.30	0.074	1385.30	19.34 oc	0.23 ic	---	---	0.00	---	---	---	---	---	0.230
0.40	0.099	1385.40	19.34 oc	0.36 ic	---	---	0.00	---	---	---	---	---	0.363
0.50	0.124	1385.50	19.34 oc	0.47 ic	---	---	0.00	---	---	---	---	---	0.473
0.60	0.149	1385.60	19.34 oc	0.56 ic	---	---	0.00	---	---	---	---	---	0.559
0.70	0.173	1385.70	19.34 oc	0.63 ic	---	---	0.00	---	---	---	---	---	0.634
0.80	0.198	1385.80	19.34 oc	0.70 ic	---	---	0.00	---	---	---	---	---	0.701
0.90	0.223	1385.90	19.34 oc	0.76 ic	---	---	0.00	---	---	---	---	---	0.762
1.00	0.248	1386.00	19.34 oc	0.82 ic	---	---	0.00	---	---	---	---	---	0.819
1.10	0.310	1386.10	19.34 oc	0.87 ic	---	---	0.00	---	---	---	---	---	0.872
1.20	0.373	1386.20	19.34 oc	0.92 ic	---	---	0.00	---	---	---	---	---	0.921
1.30	0.435	1386.30	19.34 oc	0.97 ic	---	---	0.00	---	---	---	---	---	0.969
1.40	0.498	1386.40	19.34 oc	1.01 ic	---	---	0.00	---	---	---	---	---	1.014
1.50	0.560	1386.50	19.34 oc	1.06 ic	---	---	0.00	---	---	---	---	---	1.057
1.60	0.623	1386.60	19.34 oc	1.10 ic	---	---	0.00	---	---	---	---	---	1.098
1.70	0.685	1386.70	19.34 oc	1.14 ic	---	---	0.00	---	---	---	---	---	1.138
1.80	0.748	1386.80	19.34 oc	1.18 ic	---	---	0.00	---	---	---	---	---	1.177
1.90	0.810	1386.90	19.34 oc	1.21 ic	---	---	0.00	---	---	---	---	---	1.214
2.00	0.873	1387.00	19.34 oc	1.25 ic	---	---	0.00	---	---	---	---	---	1.251
2.10	0.981	1387.10	19.34 oc	1.29 ic	---	---	0.00	---	---	---	---	---	1.286
2.20	1.088	1387.20	19.34 oc	1.32 ic	---	---	0.00	---	---	---	---	---	1.320
2.30	1.196	1387.30	19.34 oc	1.35 ic	---	---	0.00	---	---	---	---	---	1.353
2.40	1.304	1387.40	19.34 oc	1.39 ic	---	---	0.00	---	---	---	---	---	1.386
2.50	1.411	1387.50	19.34 oc	1.42 ic	---	---	0.74	---	---	---	---	---	2.159
2.60	1.519	1387.60	19.34 oc	1.45 ic	---	---	2.10	---	---	---	---	---	3.546
2.70	1.627	1387.70	19.34 oc	1.48 ic	---	---	3.85	---	---	---	---	---	5.332
2.80	1.735	1387.80	19.34 oc	1.51 ic	---	---	5.93	---	---	---	---	---	7.444
2.90	1.842	1387.90	19.34 oc	1.54 ic	---	---	8.29	---	---	---	---	---	9.832
3.00	1.950	1388.00	19.34 oc	1.57 ic	---	---	10.90	---	---	---	---	---	12.47
3.10	2.103	1388.10	19.34 oc	1.60 ic	---	---	13.74	---	---	---	---	---	15.33
3.20	2.256	1388.20	19.34 oc	1.62 ic	---	---	16.78	---	---	---	---	---	18.41
3.30	2.409	1388.30	21.38 oc	1.36 ic	---	---	20.03	---	---	---	---	---	21.38
3.40	2.562	1388.40	23.42 oc	0.84 ic	---	---	22.58 s	---	---	---	---	---	23.42
3.50	2.715	1388.50	23.87 oc	0.71 ic	---	---	23.16 s	---	---	---	---	---	23.87
3.60	2.868	1388.60	24.19 oc	0.63 ic	---	---	23.56 s	---	---	---	---	---	24.19
3.70	3.021	1388.70	24.45 oc	0.56 ic	---	---	23.89 s	---	---	---	---	---	24.45

Continues on next page...

Contours 11-27-07 - Pipe

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.80	3.174	1388.80	24.68 oc	0.51 ic	---	---	24.17 s	---	---	---	---	---	24.67
3.90	3.327	1388.90	24.88 oc	0.46 ic	---	---	24.41 s	---	---	---	---	---	24.87
4.00	3.480	1389.00	25.06 oc	0.42 ic	---	---	24.64 s	---	---	---	---	---	25.06
4.10	3.671	1389.10	25.23 oc	0.39 ic	---	---	24.84 s	---	---	---	---	---	25.23
4.20	3.863	1389.20	25.40 oc	0.36 ic	---	---	25.03 s	---	---	---	---	---	25.39
4.30	4.054	1389.30	25.55 oc	0.34 ic	---	---	25.21 s	---	---	---	---	---	25.55
4.40	4.246	1389.40	25.70 oc	0.32 ic	---	---	25.38 s	---	---	---	---	---	25.70
4.50	4.437	1389.50	25.85 oc	0.30 ic	---	---	25.55 s	---	---	---	---	---	25.85
4.60	4.629	1389.60	25.99 oc	0.28 ic	---	---	25.70 s	---	---	---	---	---	25.98
4.70	4.820	1389.70	26.13 oc	0.26 ic	---	---	25.86 s	---	---	---	---	---	26.13
4.80	5.012	1389.80	26.27 oc	0.25 ic	---	---	26.02 s	---	---	---	---	---	26.26
4.90	5.203	1389.90	26.41 oc	0.24 ic	---	---	26.17 s	---	---	---	---	---	26.41
5.00	5.394	1390.00	26.54 oc	0.23 ic	---	---	26.31 s	---	---	---	---	---	26.54

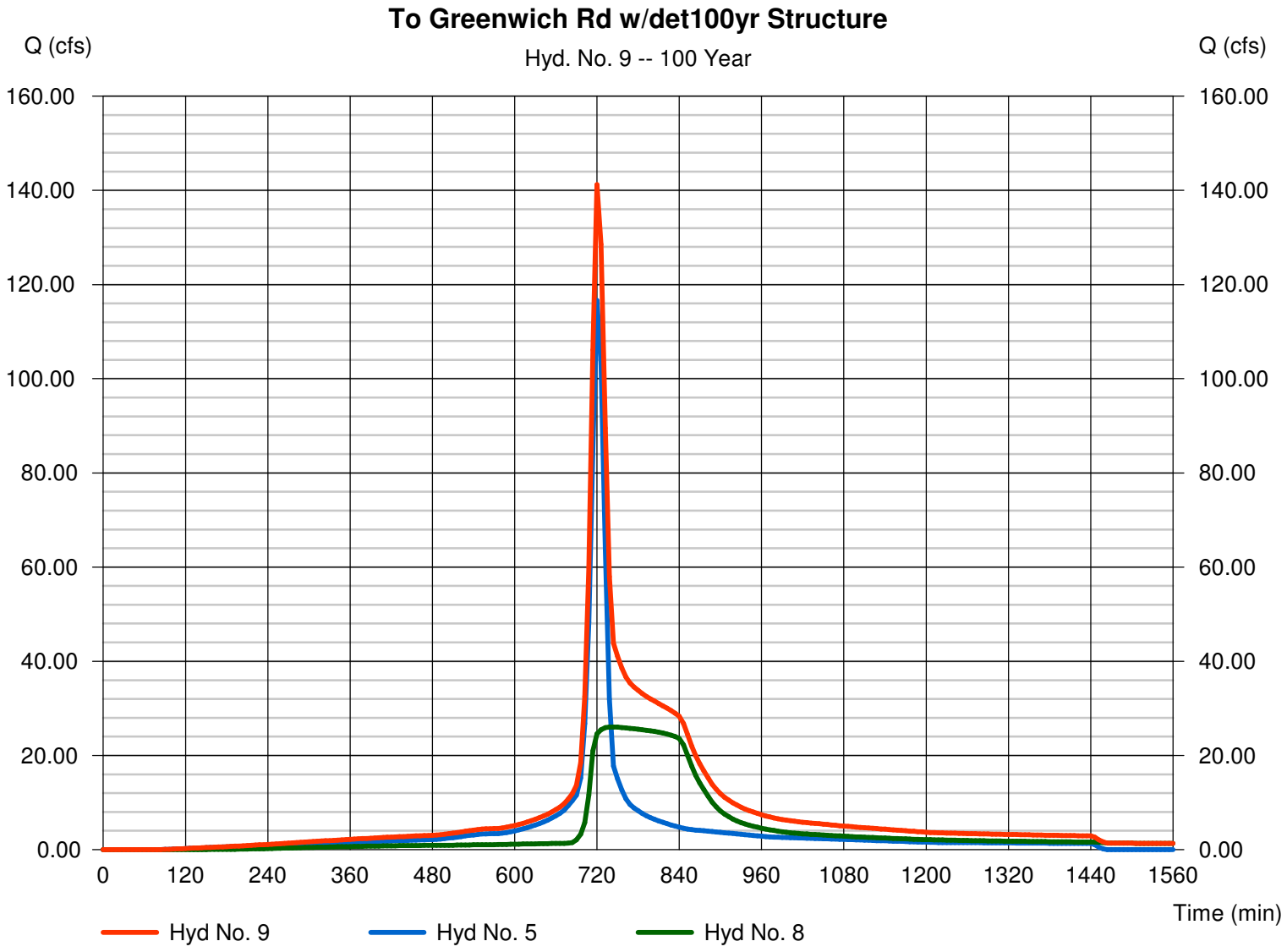
...End

Hydrograph Report

Hyd. No. 9

To Greenwich Rd w/det100yr Structure

Hydrograph type	= Combine	Peak discharge	= 141.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 6 min	Hyd. volume	= 18.855 acft
Inflow hyds.	= 5, 8	Contrib. drain. area	= 16.000 ac

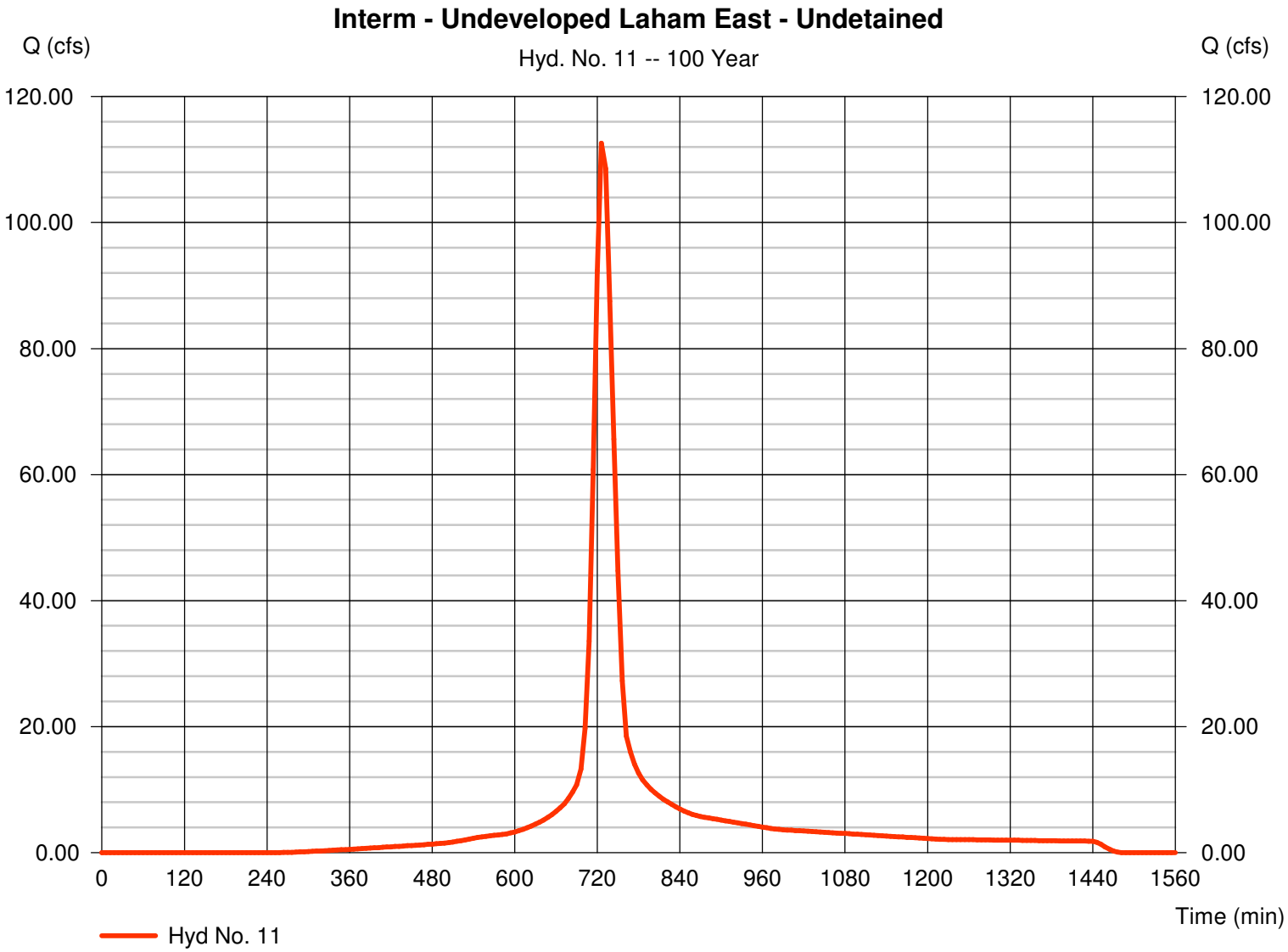


Hydrograph Report

Hyd. No. 11

Interm - Undeveloped Laham East - Undetained

Hydrograph type	=	SCS Runoff	Peak discharge	=	112.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	10.626 acft
Drainage area	=	21.600 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	25.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

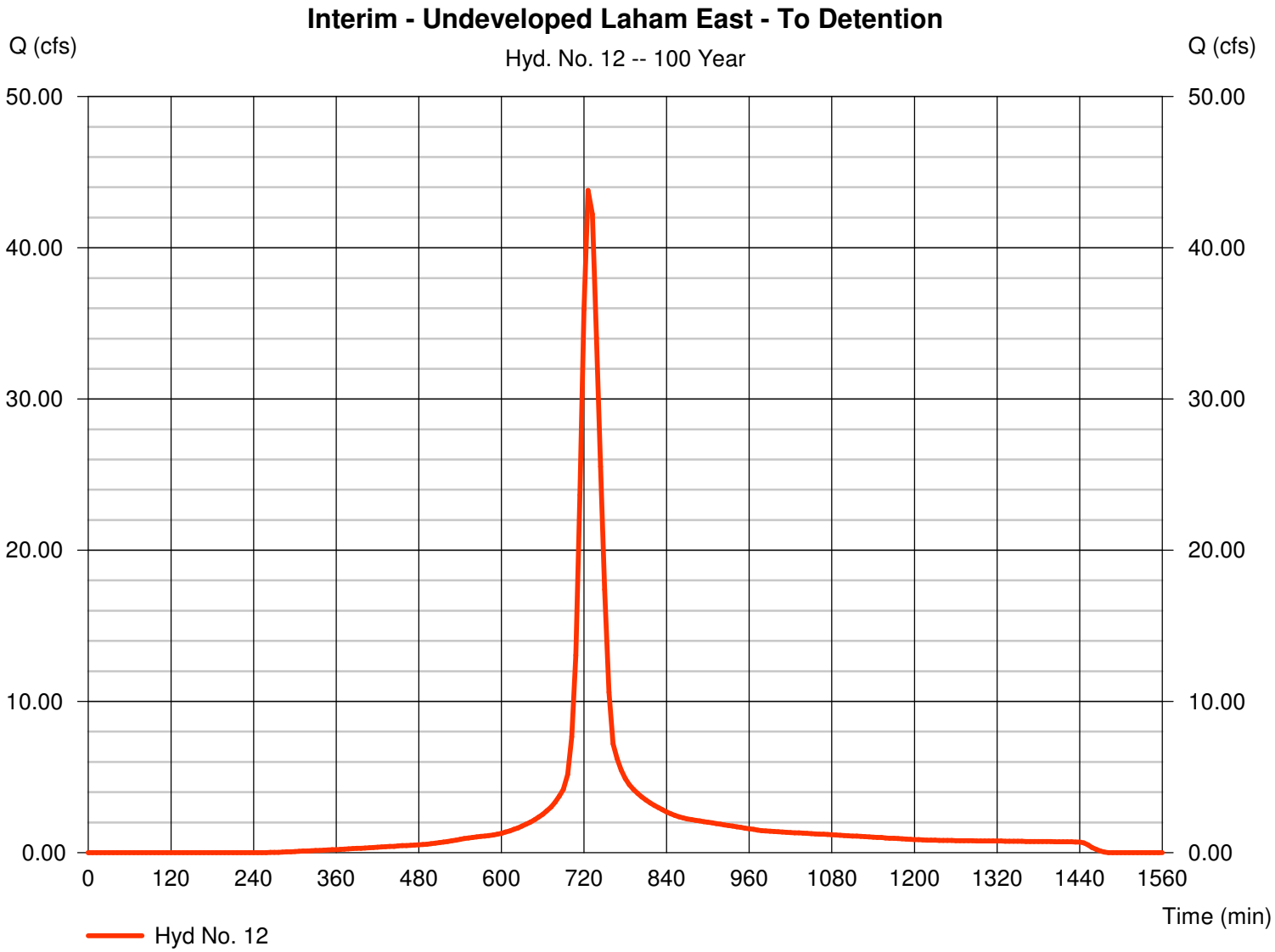


Hydrograph Report

Hyd. No. 12

Interim - Undeveloped Laham East - To Detention

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	4.132 acft
Drainage area	=	8.400 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	USER	Time of conc. (Tc)	=	20.00 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

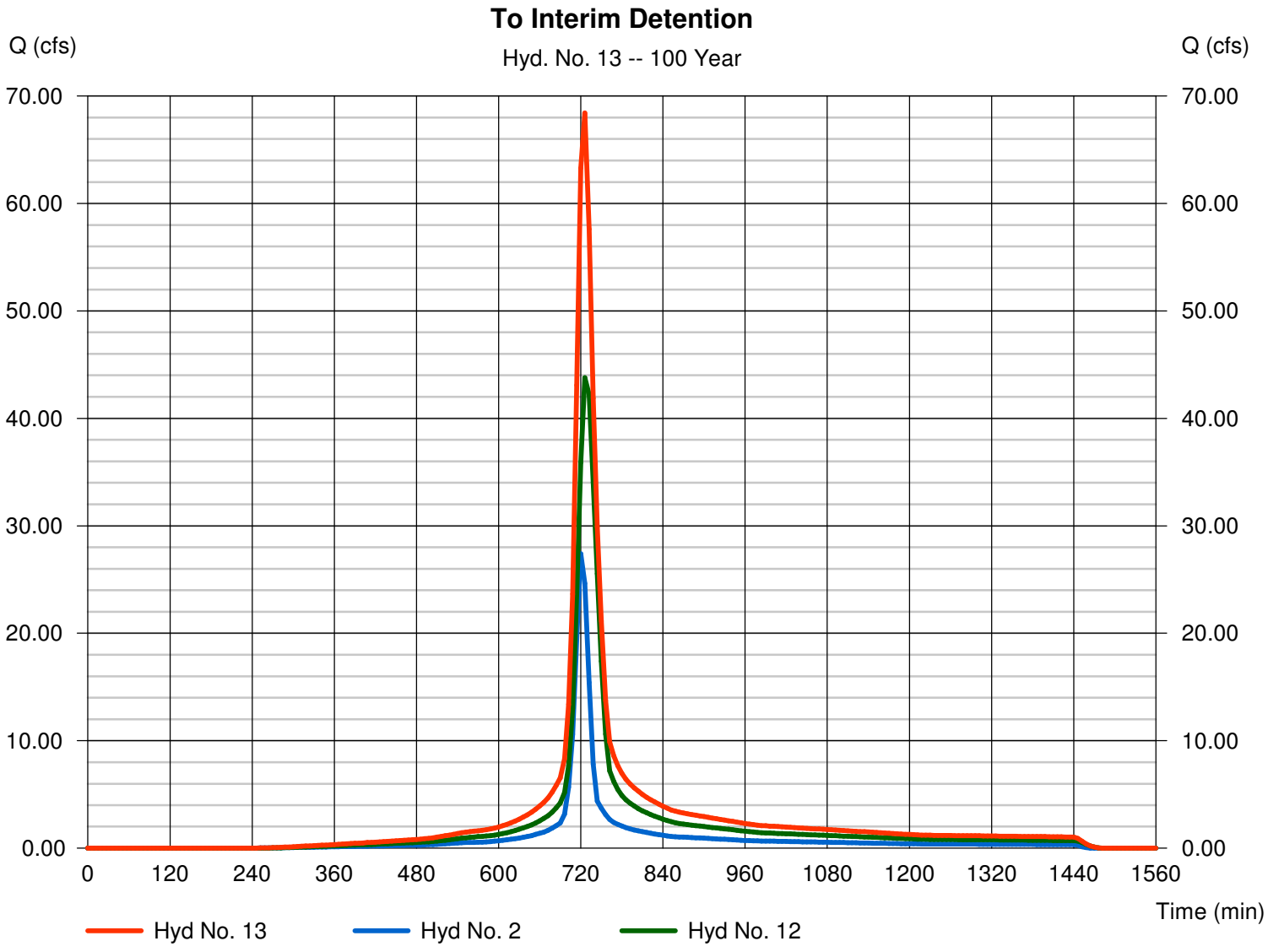


Hydrograph Report

Hyd. No. 13

To Interim Detention

Hydrograph type	= Combine	Peak discharge	= 68.43 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 6 min	Hyd. volume	= 6.108 acft
Inflow hyds.	= 2, 12	Contrib. drain. area	= 12.600 ac



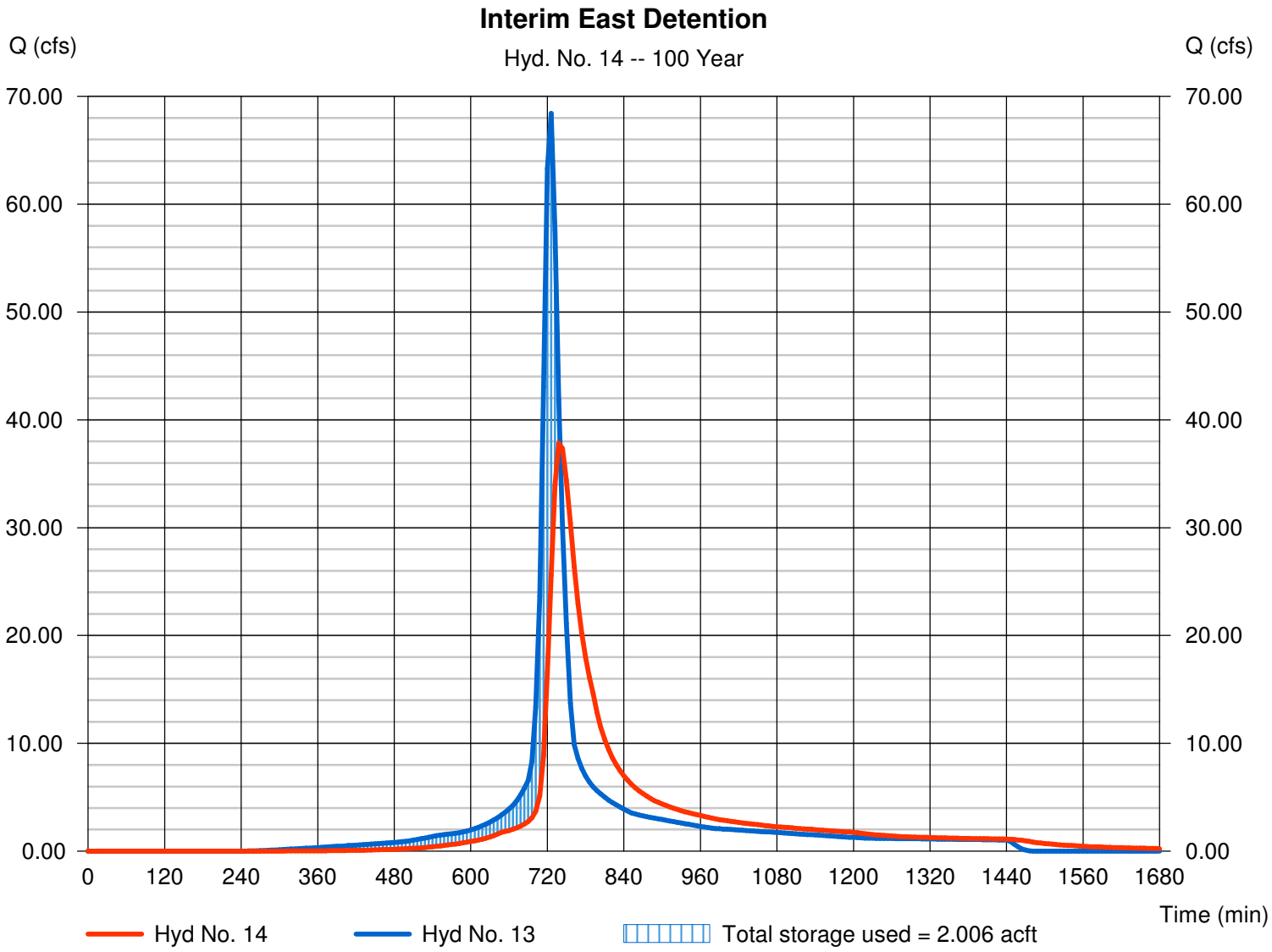
Hydrograph Report

Hyd. No. 14

Interim East Detention

Hydrograph type	=	Reservoir	Peak discharge	=	37.83 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	6.102 acft
Inflow hyd. No.	=	13 - To Interim Detention	Max. Elevation	=	1388.73 ft
Reservoir name	=	Interim East Detention	Max. Storage	=	2.006 acft

Storage Indication method used.



Pond No. 10 - Interim East Detention

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1385.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (acft)	Total storage (acft)
0.00	1385.50	00	0.000	0.000
0.20	1386.00	4,553	0.007	0.007
1.20	1387.00	27,042	0.327	0.334
2.20	1388.00	44,084	0.808	1.142
3.20	1389.00	60,853	1.199	2.341
4.20	1389.70	91,094	1.732	4.074

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)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 1385.80	1386.80	0.00	0.00
Weir Coeff.	= 1.05	4.40	3.33	3.33
Weir Type	= 45 degV	120degV	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0.000	1385.50	---	---	---	---	---	---	---	---	---	---	0.000
0.02	0.001	1385.52	---	---	---	---	---	---	---	---	---	---	0.000
0.04	0.001	1385.54	---	---	---	---	---	---	---	---	---	---	0.000
0.06	0.002	1385.56	---	---	---	---	---	---	---	---	---	---	0.000
0.08	0.003	1385.58	---	---	---	---	---	---	---	---	---	---	0.000
0.10	0.003	1385.60	---	---	---	---	---	---	---	---	---	---	0.000
0.12	0.004	1385.62	---	---	---	---	---	---	---	---	---	---	0.000
0.14	0.005	1385.64	---	---	---	---	---	---	---	---	---	---	0.000
0.16	0.006	1385.66	---	---	---	---	---	---	---	---	---	---	0.000
0.18	0.006	1385.68	---	---	---	---	---	---	---	---	---	---	0.000
0.20	0.007	1386.00	---	---	---	---	0.02	---	---	---	---	---	0.019
0.30	0.040	1386.10	---	---	---	---	0.05	---	---	---	---	---	0.052
0.40	0.072	1386.20	---	---	---	---	0.11	---	---	---	---	---	0.106
0.50	0.105	1386.30	---	---	---	---	0.19	---	---	---	---	---	0.186
0.60	0.138	1386.40	---	---	---	---	0.29	---	---	---	---	---	0.293
0.70	0.170	1386.50	---	---	---	---	0.43	---	---	---	---	---	0.431
0.80	0.203	1386.60	---	---	---	---	0.60	---	---	---	---	---	0.602
0.90	0.236	1386.70	---	---	---	---	0.81	---	---	---	---	---	0.808
1.00	0.268	1386.80	---	---	---	---	1.05	---	---	---	---	---	1.051
1.10	0.301	1386.90	---	---	---	---	1.33	0.01	---	---	---	---	1.348
1.20	0.334	1387.00	---	---	---	---	1.66	0.08	---	---	---	---	1.738
1.30	0.414	1387.10	---	---	---	---	2.03	0.22	---	---	---	---	2.244
1.40	0.495	1387.20	---	---	---	---	2.44	0.44	---	---	---	---	2.884
1.50	0.576	1387.30	---	---	---	---	2.90	0.78	---	---	---	---	3.676
1.60	0.657	1387.40	---	---	---	---	3.41	1.23	---	---	---	---	4.632
1.70	0.738	1387.50	---	---	---	---	3.96	1.80	---	---	---	---	5.765
1.80	0.819	1387.60	---	---	---	---	4.57	2.52	---	---	---	---	7.088
1.90	0.900	1387.70	---	---	---	---	5.23	3.38	---	---	---	---	8.612
2.00	0.980	1387.80	---	---	---	---	5.95	4.40	---	---	---	---	10.35
2.10	1.061	1387.90	---	---	---	---	6.72	5.58	---	---	---	---	12.30
2.20	1.142	1388.00	---	---	---	---	7.55	6.94	---	---	---	---	14.49
2.30	1.262	1388.10	---	---	---	---	8.44	8.48	---	---	---	---	16.91
2.40	1.382	1388.20	---	---	---	---	9.39	10.20	---	---	---	---	19.59
2.50	1.502	1388.30	---	---	---	---	10.39	12.12	---	---	---	---	22.51
2.60	1.622	1388.40	---	---	---	---	11.47	14.24	---	---	---	---	25.71
2.70	1.742	1388.50	---	---	---	---	12.60	16.57	---	---	---	---	29.17
2.80	1.862	1388.60	---	---	---	---	13.80	19.12	---	---	---	---	32.92
2.90	1.981	1388.70	---	---	---	---	15.06	21.88	---	---	---	---	36.95

Continues on next page...

Interim East Detention

Stage / Storage / Discharge Table

Stage ft	Storage acft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.00	2.101	1388.80	---	---	---	---	16.40	24.88	---	---	---	---	41.27
3.10	2.221	1388.90	---	---	---	---	17.80	28.10	---	---	---	---	45.90
3.20	2.341	1389.00	---	---	---	---	19.27	31.58	---	---	---	---	50.85
3.30	2.514	1389.10	---	---	---	---	20.81	35.29	---	---	---	---	56.10
3.40	2.688	1389.20	---	---	---	---	22.42	39.25	---	---	---	---	61.67
3.50	2.861	1389.30	---	---	---	---	24.11	43.47	---	---	---	---	67.57
3.60	3.034	1389.40	---	---	---	---	25.87	47.94	---	---	---	---	73.81
3.70	3.207	1389.50	---	---	---	---	27.70	52.69	---	---	---	---	80.39
3.80	3.381	1389.60	---	---	---	---	29.61	57.70	---	---	---	---	87.31
3.90	3.554	1389.70	---	---	---	---	31.59	62.99	---	---	---	---	94.58
4.00	3.727	1389.80	---	---	---	---	33.66	68.56	---	---	---	---	102.22
4.10	3.900	1389.90	---	---	---	---	35.80	74.42	---	---	---	---	110.22
4.20	4.074	1389.70	---	---	---	---	31.60	63.00	---	---	---	---	94.59

...End

Hydrograph Report

Hyd. No. 15

Interim to Greenwich Road

Hydrograph type	= Combine	Peak discharge	= 142.47 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 16.728 acft
Inflow hyds.	= 11, 14	Contrib. drain. area	= 21.600 ac