MACKENZIE.

DESIGN DRIVEN | CLIENT FOCUSED

STORMWATER MANAGEMENT REPORT

To
Clean Water Services

For
Sherwood Industrial Park

Submitted
September 30, 2022

Project Number
2200393.00

MACKENZIE
Since 1960

The Hudson Building | 101 E 6th Street, #200, Vancouver, WA 98660
T 360.695.7879 | T 360.693.6637 | www.mcknze.com

TABLE OF CONTENTS

APPENDICES

I. DESIGNER'S CERTIFICATION AND STATEMENT

I hereby certify that this Stormwater Management Report for Sherwood Industrial Park has been prepared by me or under my supervision and meets minimum standards of Clean Water Services and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities designed by me.

II. PROJECT OVERVIEW

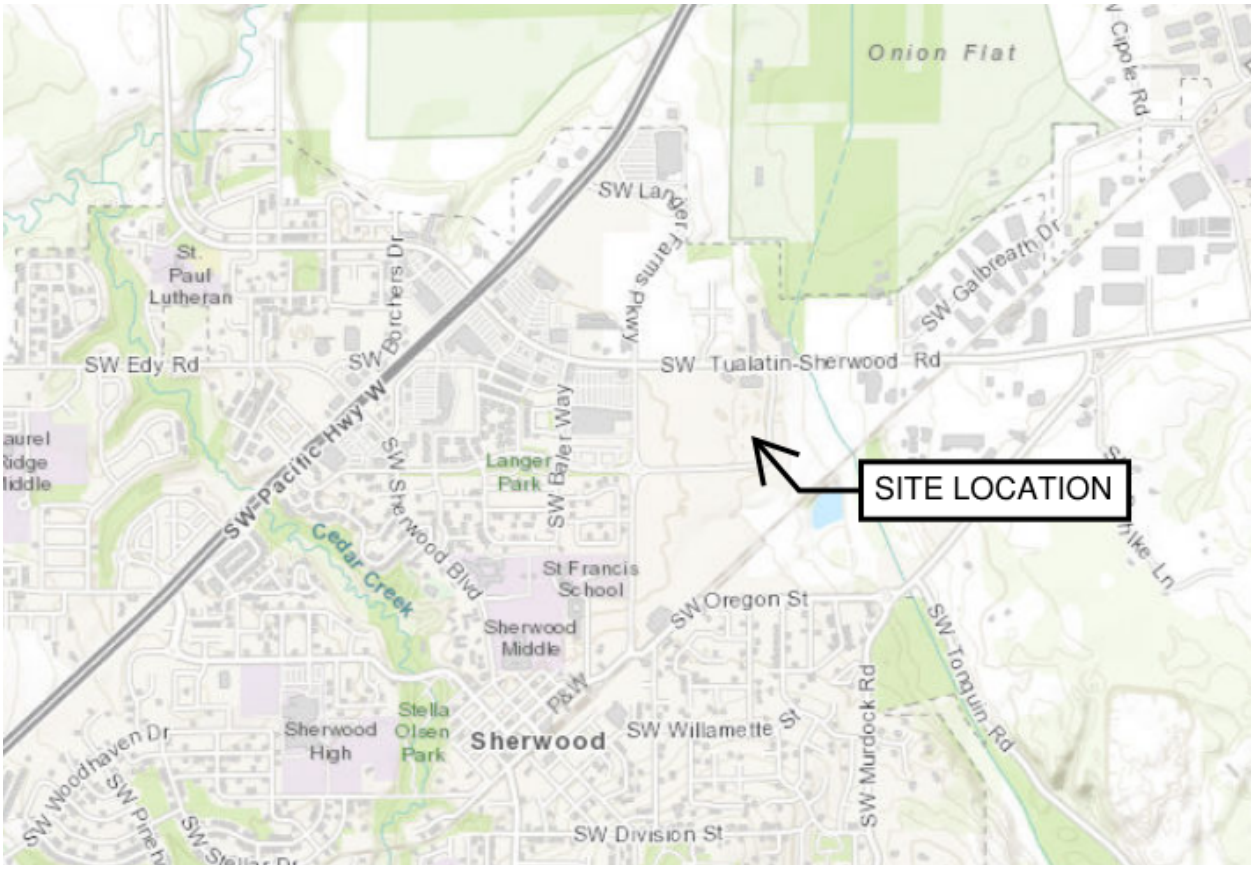


Figure 1: Vicinity Map

The proposed Sherwood Industrial project is located on tax lot 2S129D000150. The site is part of a greater development that is approximately 32-acres in size, with an existing regional stormwater facility that has been sized to accommodate the runoff from the proposed development, see Appendix F for existing stormwater design methodology. The property is zoned Light-Industrial (LI)

The existing site consists of open field with a Bonneville Power Administration powerline, electrical tower, and power poles.

The proposed improvements include two (2) retail buildings and associated paving, sidewalks, curbs, landscaping, and utilities.

Table 1: Site Improvements Impervious Area Summary

Area	On-Site Drainage Area
Building Area:	23,769 sf
Site Vehicle & Pedestrian Circulation Hardscape:	67,259 sf
Total Impervious Area:	**91,028 sf**

III. STORMWATER MANAGEMENT METHODOLOGY

Existing On-Site Drainage

The existing development drains into a regional, combined detention and water quality pond on the east side of the property. After treatment, the runoff is released at a controlled rate into the existing wetlands on site, to the east.

Proposed On-Site Drainage

The proposed development will maintain the existing stormwater methodology. The regional pond was designed to accommodate future development of the proposed site, therefore only minor modifications are proposed. Concern has been raised regarding potential groundwater seepage into the pond; modifications to existing design will include raising the pond bottom by 18", installing a 6" clay liner, installing a retaining wall in the western portion of the pond, and replacing the existing control manhole orifices consistent with the approved stormwater model. The updated stormwater pond has been intended to meet current CWS guidelines and will drain into the existing wetlands in similar fashion to the existing design.

Existing Off-Site Drainage

The existing SW Century Drive improvements were constructed as part of the existing development, all runoff from SW Century Drive drains into the existing stormwater quality and detention pond before releasing into the existing wetland to the east.

Proposed Off-Site Drainage

No frontage improvements have been proposed as part of the current project. The proposed pond improvements have been designed to account for all runoff from SW Century Drive.

IV. STORMWATER QUALITY TREATMENT

The existing pond has been modelled as a combined Extended Dry Basin and Detention pond to provide water quality treatment as well as flow control for the site. The pond has been designed such that the first 0.36 inches of rainfall in a 4 hour period is released at a rate that ensures water quality treatment occurs. Above the prescribed water quality elevation in the pond, larger orifices have been included to provide appropriate detention and restricted flow. In addition, a standing pool of 0.20' has been included to maintain planting health in the pond. All design elements have been selected in accordance with CWS section 4.09.5. See Appendix E for water quality orifice sizing and water quality volume calculations.

V. STORMWATER DETENTION / INFILTRATION ANALYSIS

The proposed development will route to the existing stormwater pond and has been designed to release runoff in accordance with the prescribed peak runoff target rates listed in Table 4-7, Section 4.08.6.c. To conform with current CWS guidelines and address concerns offered by the City of Sherwood, the pond has had minor modifications included in the proposed development as outline in Section III of this report. The existing orifices of the stormwater pond are to be replaced as modeled in Appendix B to accommodate new hydraulic conditions caused by the pond modifications.

Table 2: Detention Calculations Summary

Return Period	Pre-developed Runoff (cfs)	Mitigated Runoff (cfs)	System Storage Used (cu. ft)	System Storage Available (cu. ft)
2-yr	6.29	3.14	96,174	132,864
5-yr	9.39	5.45	114,024	132,864
10-yr	11.30	7.44	121,808	132,864
25-yr	13.81	10.08	131,649	132,864

Groundwater Depth Analysis

Because the updated pond will include an impermeable clay liner, there will be no mixing of under treated runoff with groundwater at the site, meeting the criteria for groundwater separation.

VI. STORMWATER CONVEYANCE ANALYSIS

Stormwater conveyance facilities at Sherwood Industrial Park, in accordance with Clean Water Services guidelines, will be sized to accommodate the 10-year storm peak runoff determined with the Rational Method. Final pipe sizing calculations will be provided at a later time, and a preliminary conveyance map is provided in Appendix C of this report. The Rational Method calculation parameters are summarized in the following table:

Table 5: Conveyance Design Values

Pavement Runoff Coefficient:	0.9
Landscape Runoff Coefficient:	0.4
Time of Concentration:	5 minutes
10-Year Rainfall Intensity for T_c:	3.0 in/hr

Using Q=CiA, the max tributary for each pipe size has been determined by rearranging the equation to be A=Q/Ci.

Per the conveyance basin map in Appendix C, the cumulative tributary area will establish each pipe size called out on plan. The total site drainage area is approximately 94,000 SF, so a maximum sized 18" at 1% has been determined to meet preliminary conveyance requirements.

Table 6: Maximum Tributary Areas for Pipe at 1% Slope

Pipe Size	Flow Capacity (cfs)	Max Tributary (Sq. Ft.)
4"	0.19	3,050
6"	0.56	9,150
8"	1.20	19,600
12"	3.55	56,600
18"	10.46	167,700

VII. ENGINEERING CONCLUSIONS

The private stormwater facility at the proposed Sherwood Industrial Park project have been designed in accordance with the Clean Water Services guidelines. Stormwater from the impervious areas pollution generating surfaces will be treated for water quality, and all runoff will be detained onsite and released at a controlled rate into the existing wetlands.

Appendix A:

Site Plan, Utility Plan, and Basin Map

***Refer to Appendix E for original project basin map. Project has been designed to treat the pre-designed basin areas of the existing stormwater pond. Proposed pervious areas onsite are greater than the original design values set when the original stormwater report was accepted (March 10, 2006) and therefore will be conservative in their resulting treatment flowrates.**

Appendix B:

Detention Calculations

Detention Volume Tabulation

Based on Proposed Pond Geometry

MACKENZIE.

DESIGN DRIVEN | CLIENT FOCUSED

Project:	Sherwood Industrial Park	
By:	ABP	
Date:	04/09/21	
Job:	2200393.00	
Bottom of Pond Elevation:	140.30'	
Top of Permanent Pool:	140.50'	**0.20' required per 4.09.5.b.1*
Water Quality Volume:	31,585 cu.ft.	**See Appendix E*
Water Quality Elevation:	142.27'	**See Appendix E*
2yr Storm Elevation:	145.14'	**See HydraFlow output*
5yr Storm Elevation:	145.82'	**See HydraFlow output*
10yr Storm Elevation:	146.11'	**See HydraFlow output*
25yr Storm Elevation:	146.46'	**See HydraFlow output*
Top of Pond Elevation:	147.50'	**See Appendix A*
Freeboard:	1.04'	**1.00' required per 4.09.5.c.5*

Pond Detention Volume - Existing

Contour Elevation (ft)	Contour Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)
139.50	10,641	0	0
140.00	11,295	5,484	5,484
141.00	13,631	12,463	17,947
142.00	15,175	14,403	32,350
143.00	16,857	16,016	48,366
144.00	18,600	17,728	66,095
145.00	20,404	19,502	85,597
146.00	22,267	21,336	106,932

Pond Detention Volume - Proposed

Contour Elevation (ft)	Contour Area (sf)	Incremental Volume (cf)	Cumulative Volume (cf)
140.50	15,609	0	0
141.00	16,996	8,148	8,148
142.00	19,166	18,068	26,216
143.00	21,123	20,135	46,351
144.00	23,102	22,103	68,454
145.00	25,133	24,108	92,562
146.00	27,193	26,154	118,715
146.50	28,307	27,226	132,864
147.00	29,421	28,297	147,012
147.50	30,598	15,002	162,015

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	SBUH Runoff	------	-------	6.287	-------	9.393	11.30	13.81	-------	-------	Onsite PRE
2	SBUH Runoff	------	-------	16.25	-------	20.81	23.45	26.84	-------	-------	Onsite POST
3	Reservoir	2	-------	3.149	-------	5.447	7.441	10.08	-------	-------	Route to Detention

*Control manhole orifices have been sized to restrict runoff to meet CWS 4.08.6.c., Table 4-7

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

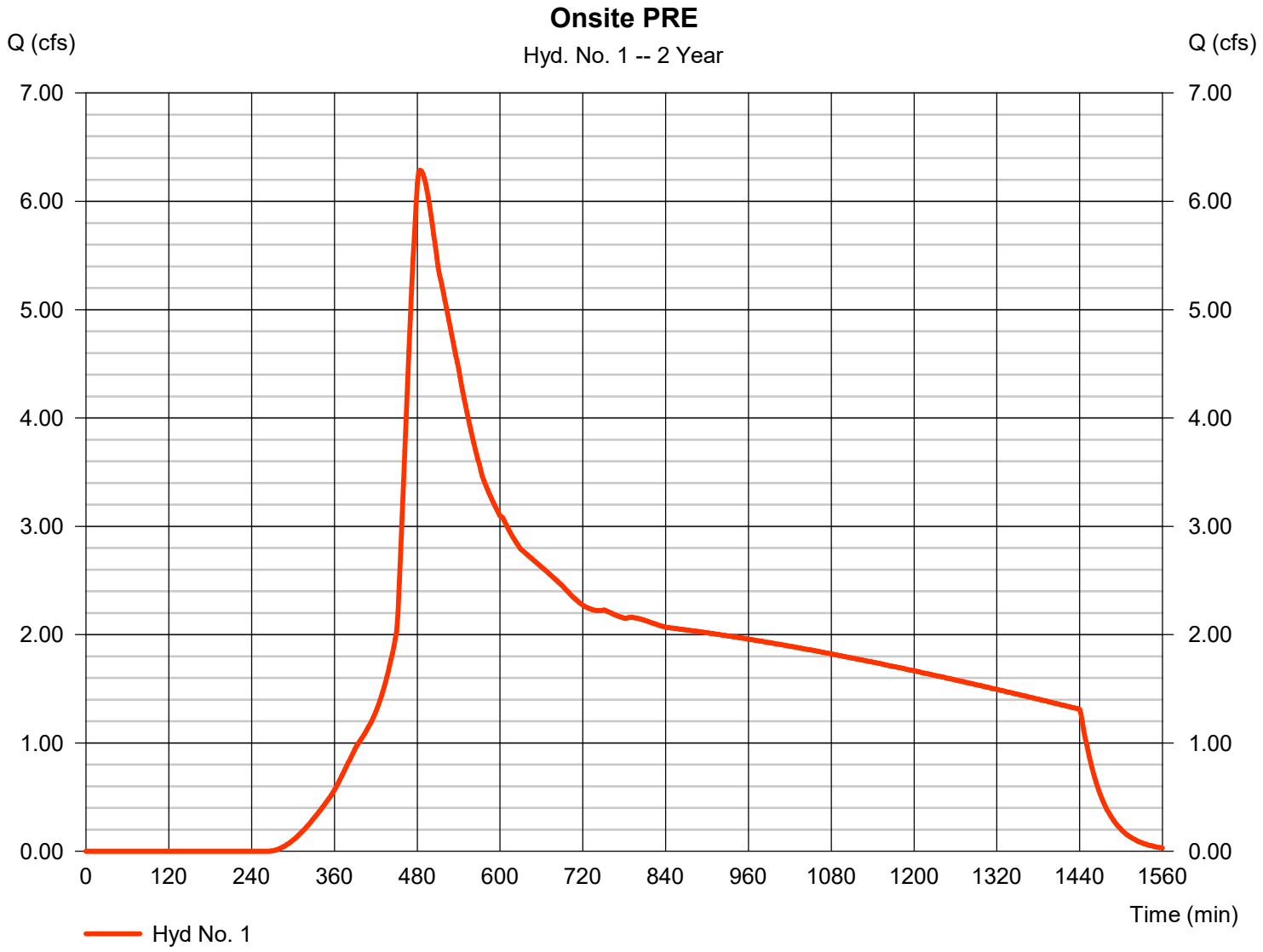
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	6.287	2	484	146,970	------	------	------	Onsite PRE
2	SBUH Runoff	16.25	2	480	243,628	------	------	------	Onsite POST
3	Reservoir	3.149	2	698	241,073	2	145.14	96,174	Route to Detention

Hydrograph Report

Hyd. No. 1

Onsite PRE

Hydrograph type	=	SBUH Runoff	Peak discharge	=	6.287 cfs
Storm frequency	=	2 yrs	Time to peak	=	484 min
Time interval	=	2 min	Hyd. volume	=	146,970 cuft
Drainage area	=	32.560 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	31.60 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

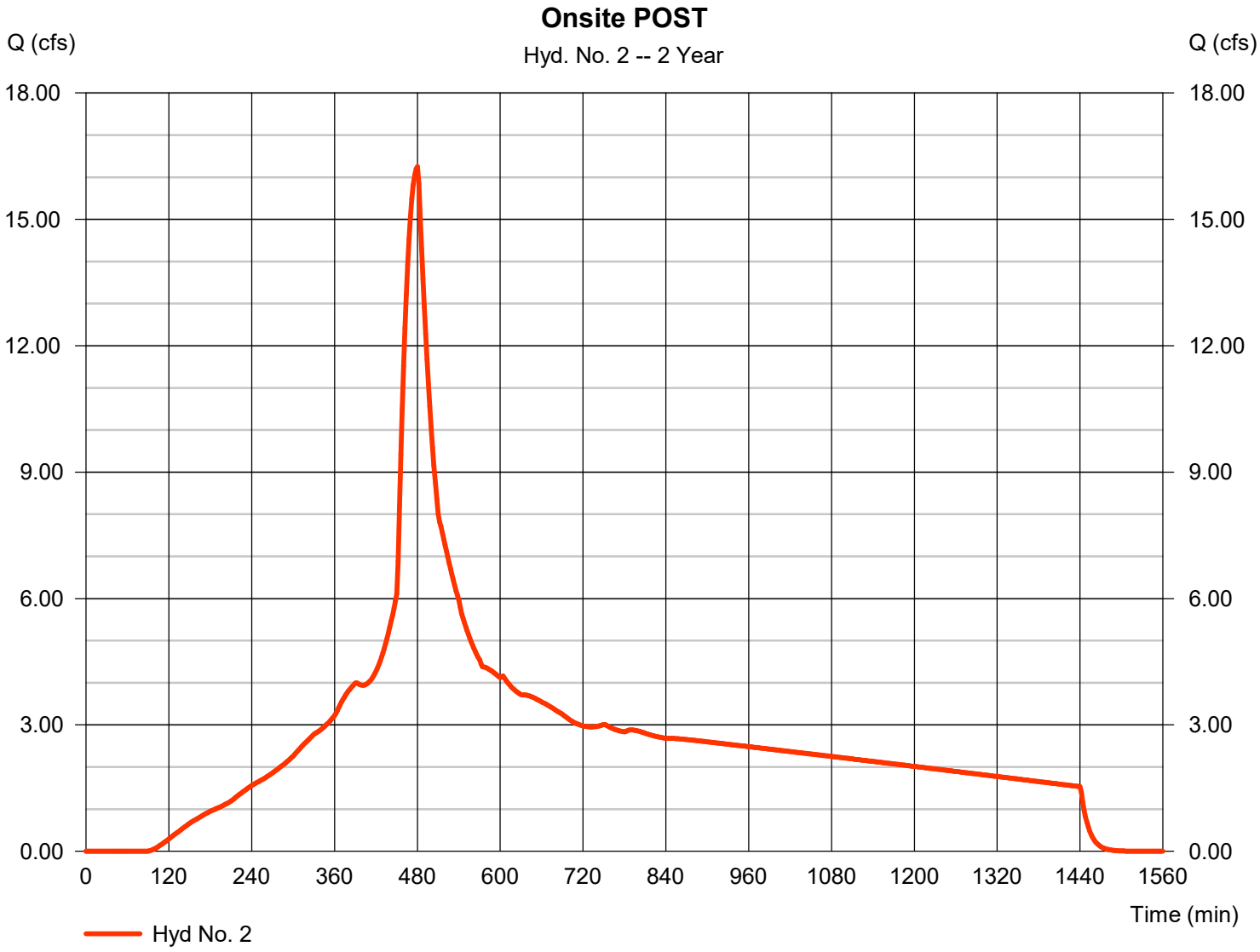


Hydrograph Report

Hyd. No. 2

Onsite POST

Hydrograph type	=	SBUH Runoff	Peak discharge	=	16.25 cfs
Storm frequency	=	2 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	243,628 cuft
Drainage area	=	32.560 ac	Curve number	=	96
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.10 min
Total precip.	=	2.50 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a



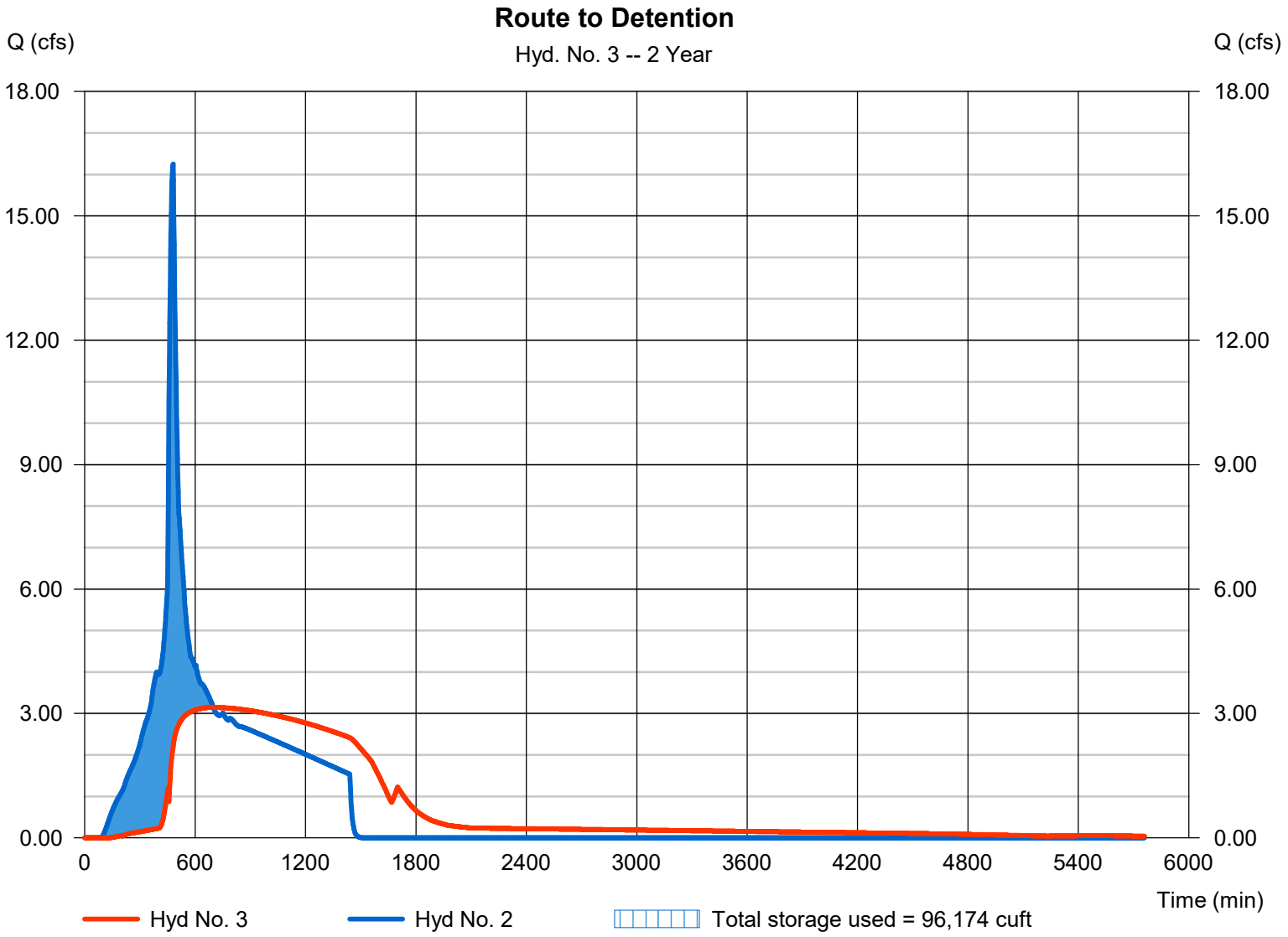
Hydrograph Report

Hyd. No. 3

Route to Detention

Hydrograph type	=	Reservoir	Peak discharge	=	3.149 cfs
Storm frequency	=	2 yrs	Time to peak	=	698 min
Time interval	=	2 min	Hyd. volume	=	241,073 cuft
Inflow hyd. No.	=	2 - Onsite POST	Max. Elevation	=	145.14 ft
Reservoir name	=	Regional Detention	Max. Storage	=	96,174 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Regional Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 140.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	140.50	15,609	0	0
0.50	141.00	16,996	8,148	8,148
1.50	142.00	19,166	18,068	26,216
2.50	143.00	21,123	20,135	46,351
3.50	144.00	23,102	22,103	68,454
4.50	145.00	25,133	24,108	92,562
5.50	146.00	27,193	26,154	118,715
6.50	147.00	29,421	28,297	147,012

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 2.58	8.00	18.00	Inactive
Span (in)	= 2.58	8.00	18.00	0.00
No. Barrels	= 1	1	1	1
Invert El. (ft)	= 140.50	142.27	145.20	0.00
Length (ft)	= 0.50	0.50	0.50	0.50
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.62	0.62	0.62	0.62
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)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	140.50	0.00	0.00	0.00	---	---	---	---	---	---	---	0.000
0.50	8,148	141.00	0.11 ic	0.00	0.00	---	---	---	---	---	---	---	0.113
1.50	26,216	142.00	0.21 ic	0.00	0.00	---	---	---	---	---	---	---	0.213
2.50	46,351	143.00	0.28 ic	0.57 oc	0.00	---	---	---	---	---	---	---	0.850
3.50	68,454	144.00	0.33 ic	2.05 ic	0.00	---	---	---	---	---	---	---	2.385
4.50	92,562	145.00	0.38 ic	2.69 ic	0.00	---	---	---	---	---	---	---	3.067
5.50	118,715	146.00	0.42 ic	3.20 ic	3.02 ic	---	---	---	---	---	---	---	6.639
6.50	147,012	147.00	0.46 ic	3.64 ic	6.32 oc	---	---	---	---	---	---	---	10.42

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

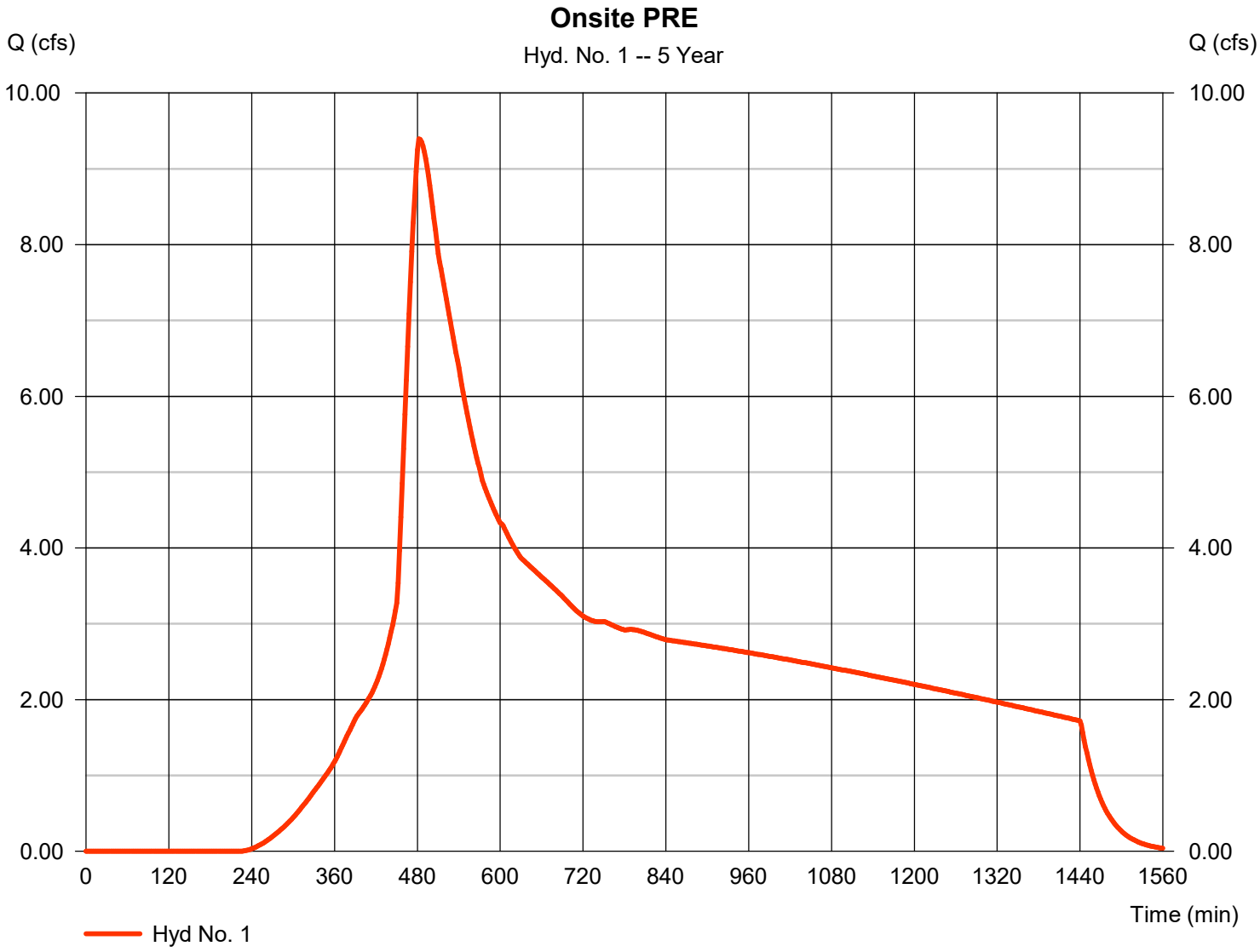
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	9.393	2	482	206,658	------	------	------	Onsite PRE
2	SBUH Runoff	20.81	2	480	313,278	------	------	------	Onsite POST
3	Reservoir	5.447	2	584	310,482	2	145.82	114,024	Route to Detention

Hydrograph Report

Hyd. No. 1

Onsite PRE

Hydrograph type	= SBUH Runoff	Peak discharge	= 9.393 cfs
Storm frequency	= 5 yrs	Time to peak	= 482 min
Time interval	= 2 min	Hyd. volume	= 206,658 cuft
Drainage area	= 32.560 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 31.60 min
Total precip.	= 3.10 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= n/a

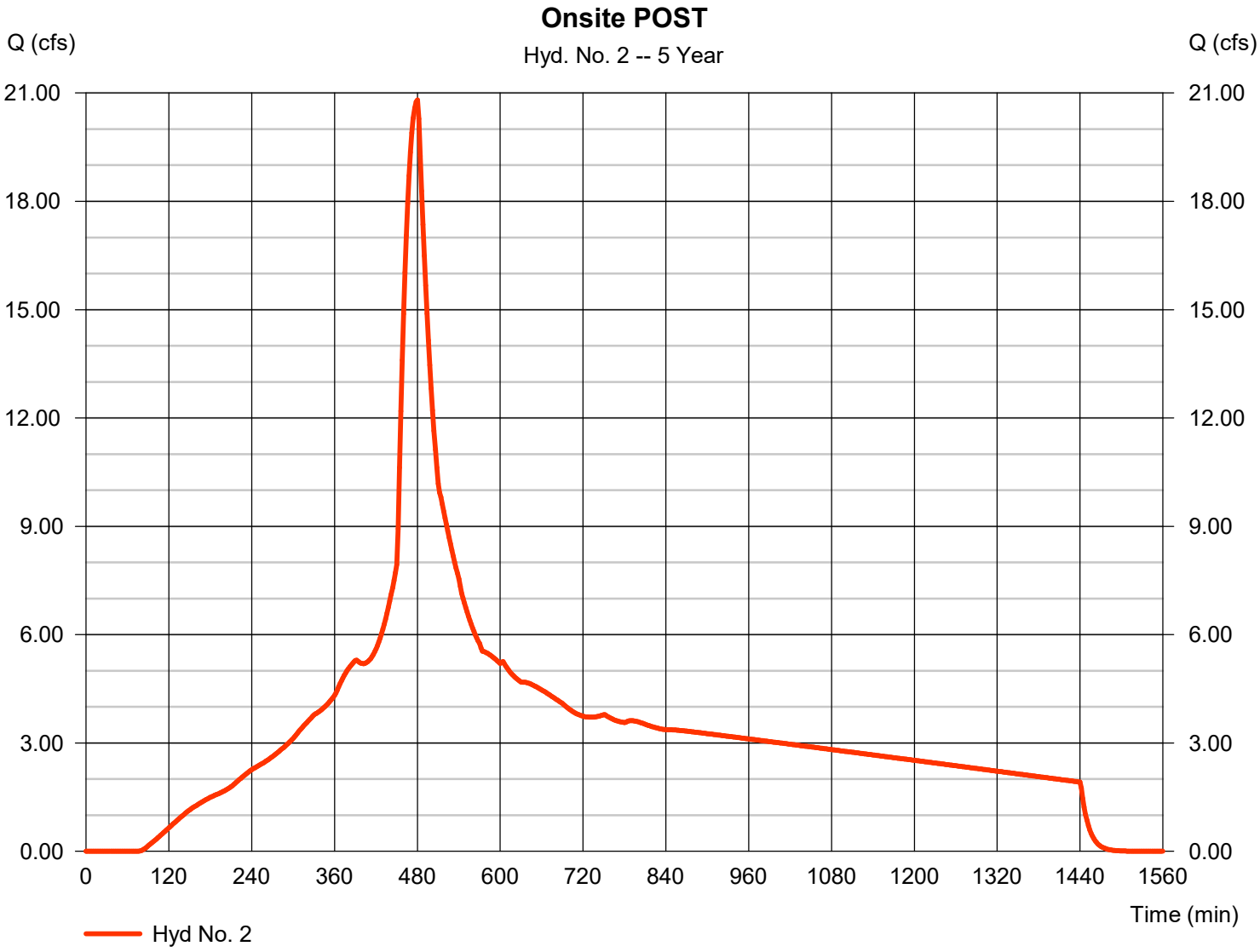


Hydrograph Report

Hyd. No. 2

Onsite POST

Hydrograph type	=	SBUH Runoff	Peak discharge	=	20.81 cfs
Storm frequency	=	5 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	313,278 cuft
Drainage area	=	32.560 ac	Curve number	=	96
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.10 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a



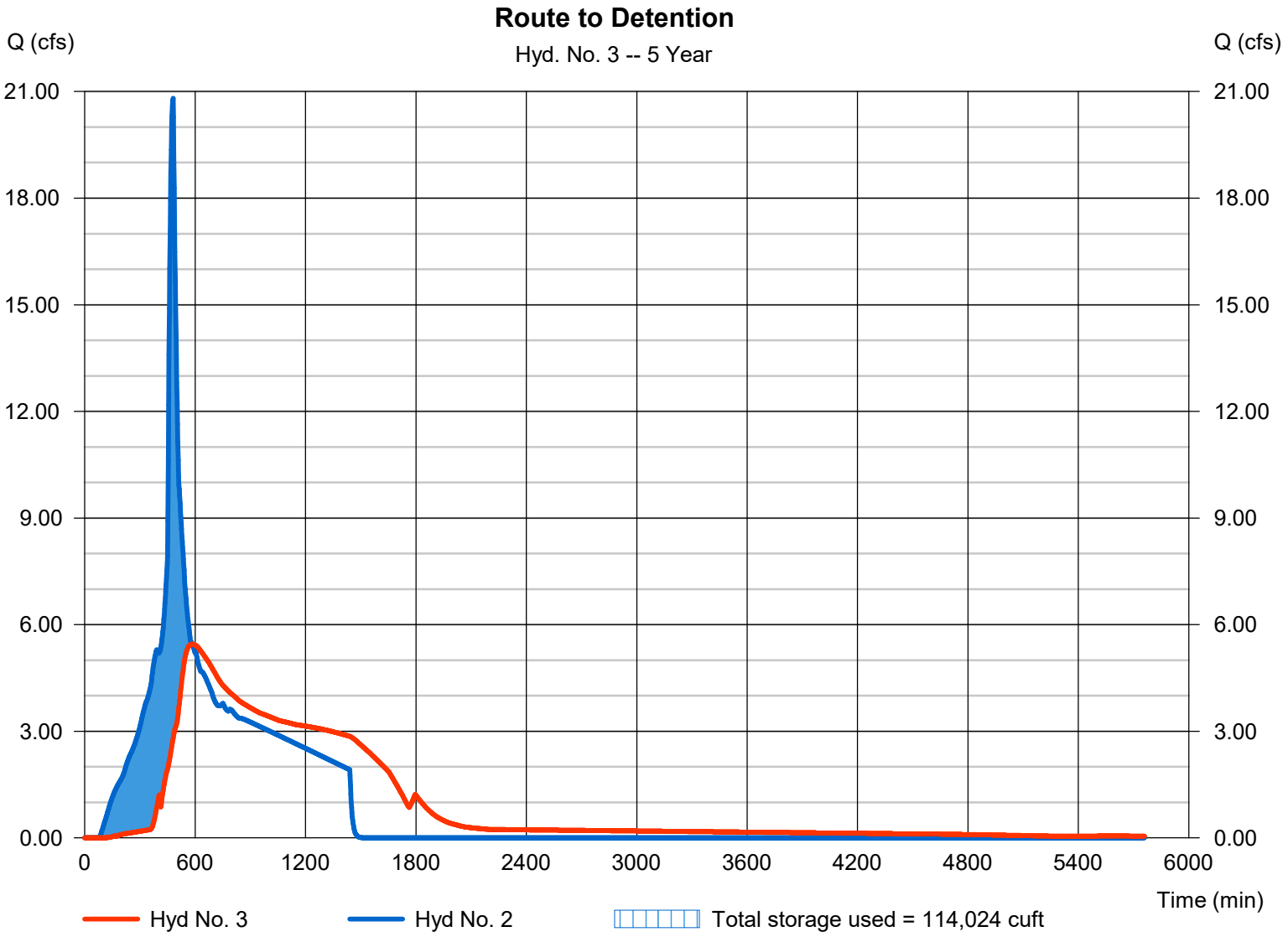
Hydrograph Report

Hyd. No. 3

Route to Detention

Hydrograph type	=	Reservoir	Peak discharge	=	5.447 cfs
Storm frequency	=	5 yrs	Time to peak	=	584 min
Time interval	=	2 min	Hyd. volume	=	310,482 cuft
Inflow hyd. No.	=	2 - Onsite POST	Max. Elevation	=	145.82 ft
Reservoir name	=	Regional Detention	Max. Storage	=	114,024 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

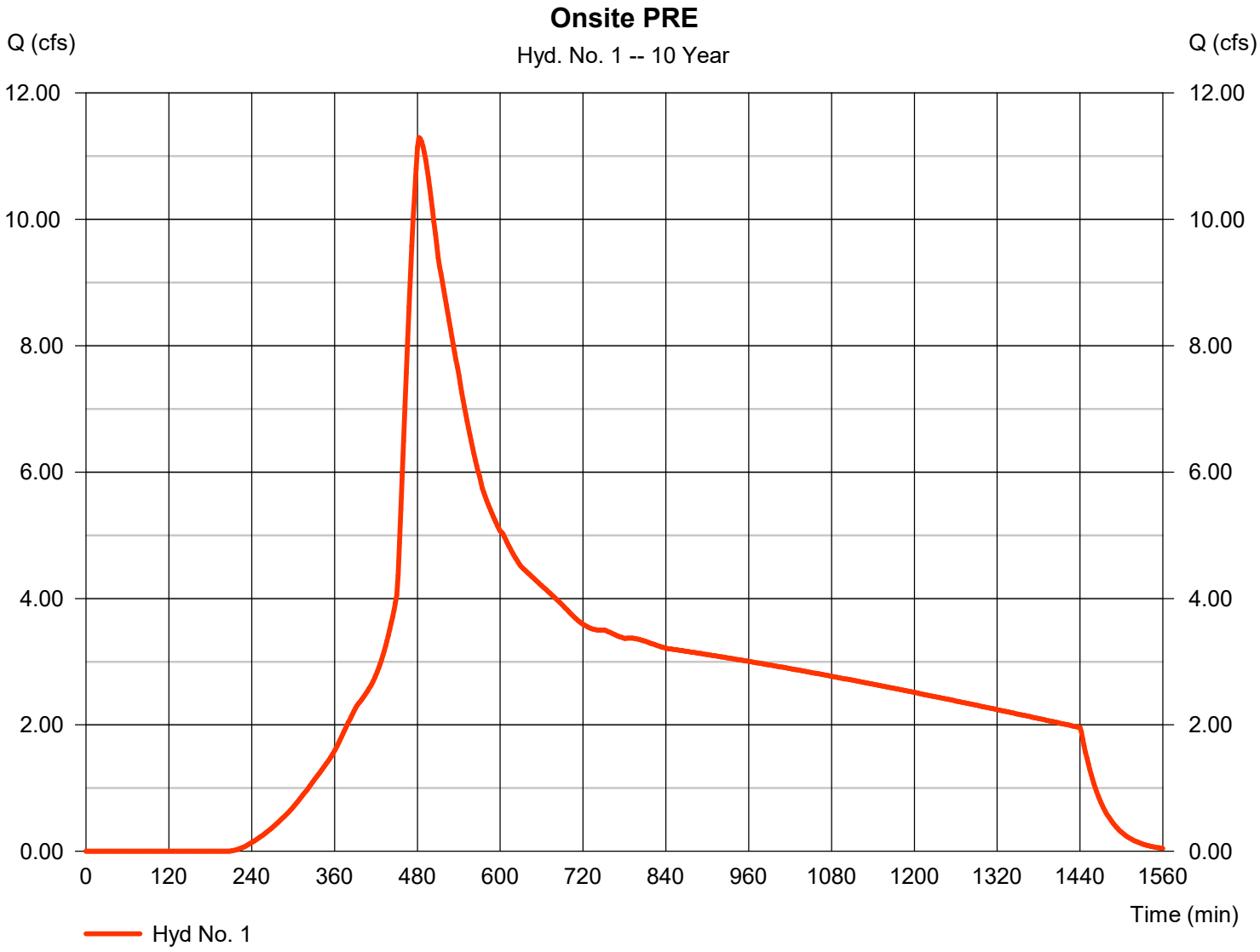
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SBUH Runoff	11.30	2	482	242,786	------	------	------	Onsite PRE
2	SBUH Runoff	23.45	2	480	354,092	------	------	------	Onsite POST
3	Reservoir	7.441	2	552	351,204	2	146.11	121,808	Route to Detention

Hydrograph Report

Hyd. No. 1

Onsite PRE

Hydrograph type	=	SBUH Runoff	Peak discharge	=	11.30 cfs
Storm frequency	=	10 yrs	Time to peak	=	482 min
Time interval	=	2 min	Hyd. volume	=	242,786 cuft
Drainage area	=	32.560 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	31.60 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

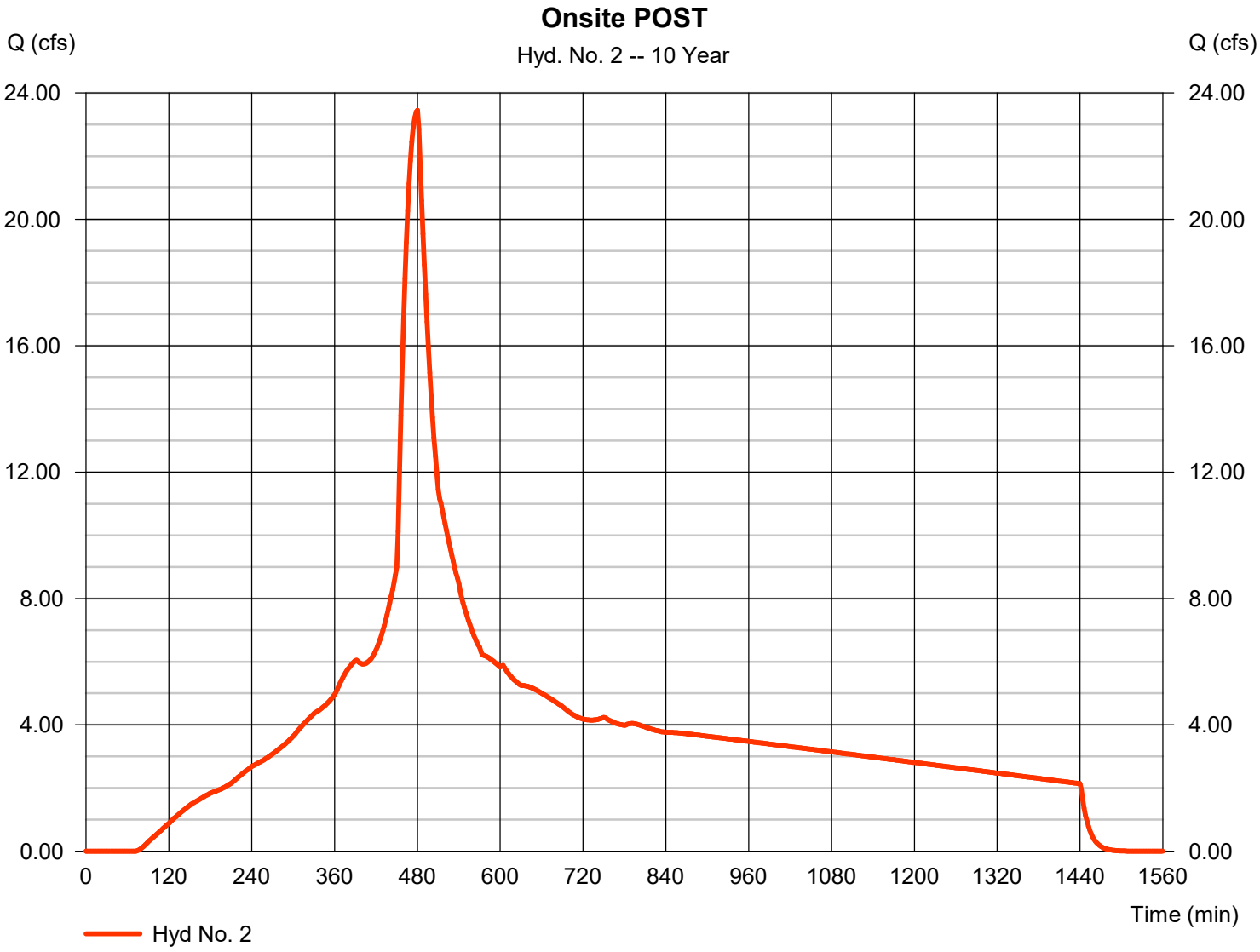


Hydrograph Report

Hyd. No. 2

Onsite POST

Hydrograph type	=	SBUH Runoff	Peak discharge	=	23.45 cfs
Storm frequency	=	10 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	354,092 cuft
Drainage area	=	32.560 ac	Curve number	=	96
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.10 min
Total precip.	=	3.45 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a



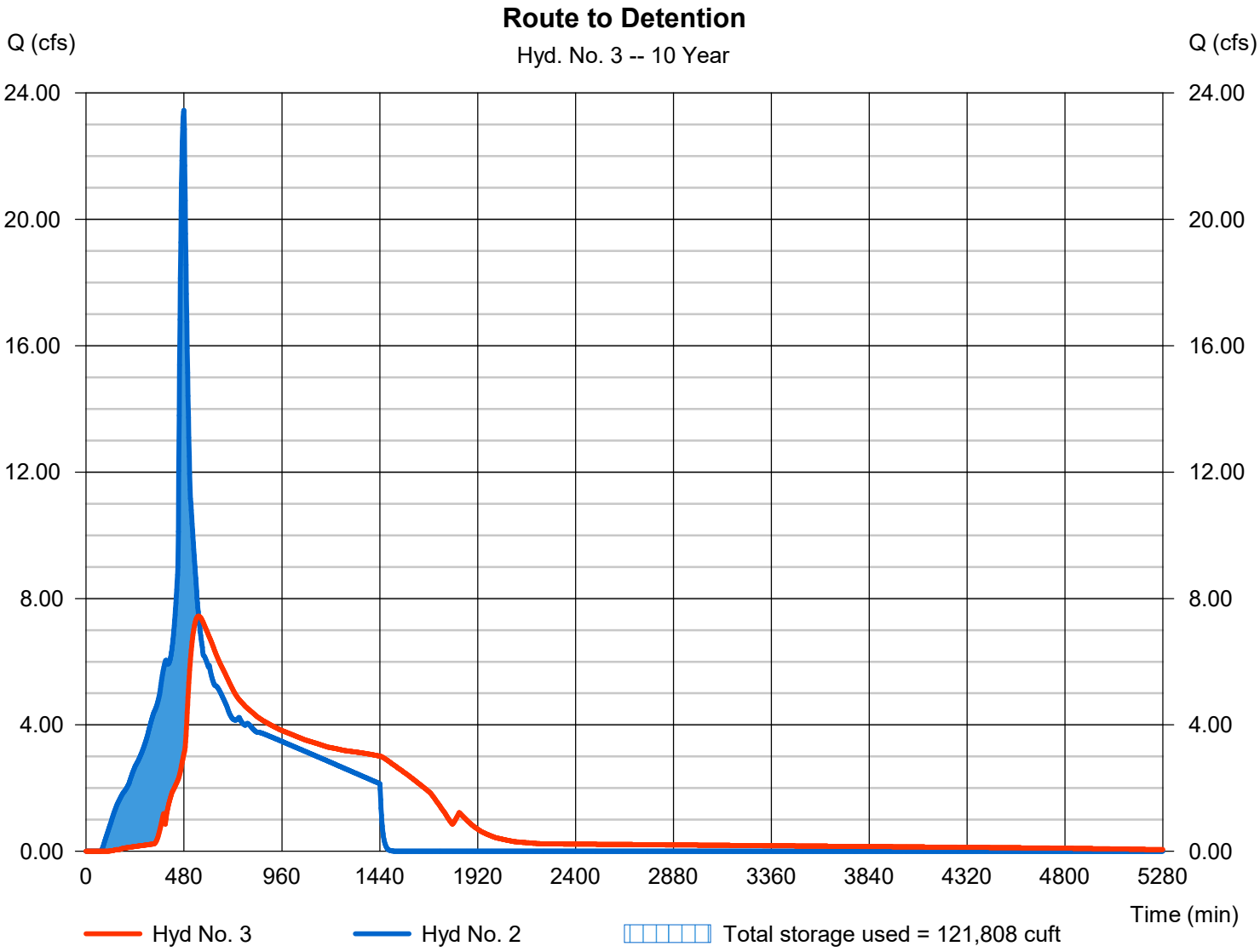
Hydrograph Report

Hyd. No. 3

Route to Detention

Hydrograph type	=	Reservoir	Peak discharge	=	7.441 cfs
Storm frequency	=	10 yrs	Time to peak	=	552 min
Time interval	=	2 min	Hyd. volume	=	351,204 cuft
Inflow hyd. No.	=	2 - Onsite POST	Max. Elevation	=	146.11 ft
Reservoir name	=	Regional Detention	Max. Storage	=	121,808 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

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	SBUH Runoff	13.81	2	482	290,271	------	------	------	Onsite PRE
2	SBUH Runoff	26.84	2	480	406,702	------	------	------	Onsite POST
3	Reservoir	10.08	2	536	403,724	2	146.46	131,649	Route to Detention

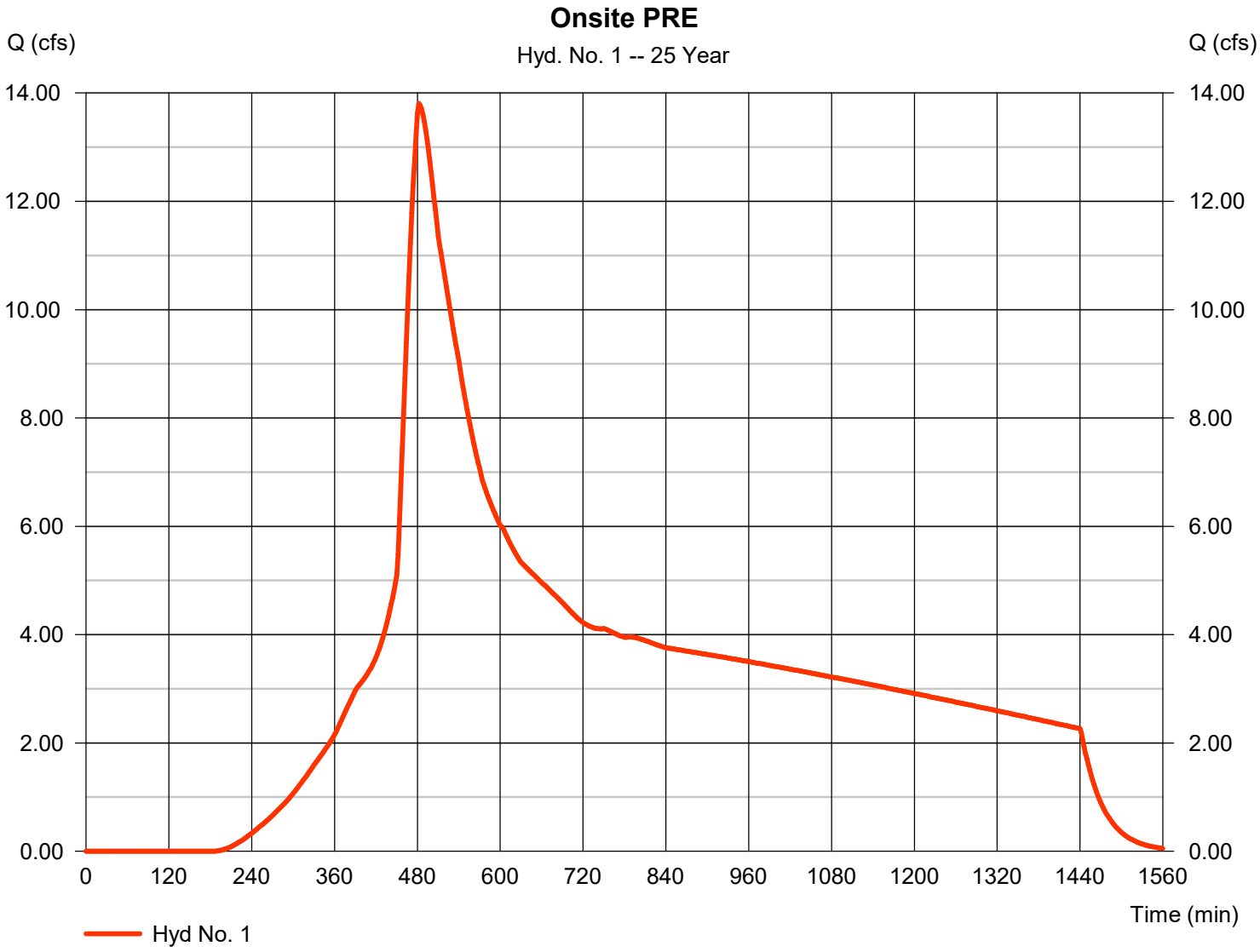
*Top of pond = 147.50', per CWS 4.09.2.c.5 at least 1.0' of freeboard has been provided above the 25-year storm maximum elevation

Hydrograph Report

Hyd. No. 1

Onsite PRE

Hydrograph type	=	SBUH Runoff	Peak discharge	=	13.81 cfs
Storm frequency	=	25 yrs	Time to peak	=	482 min
Time interval	=	2 min	Hyd. volume	=	290,271 cuft
Drainage area	=	32.560 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	31.60 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a

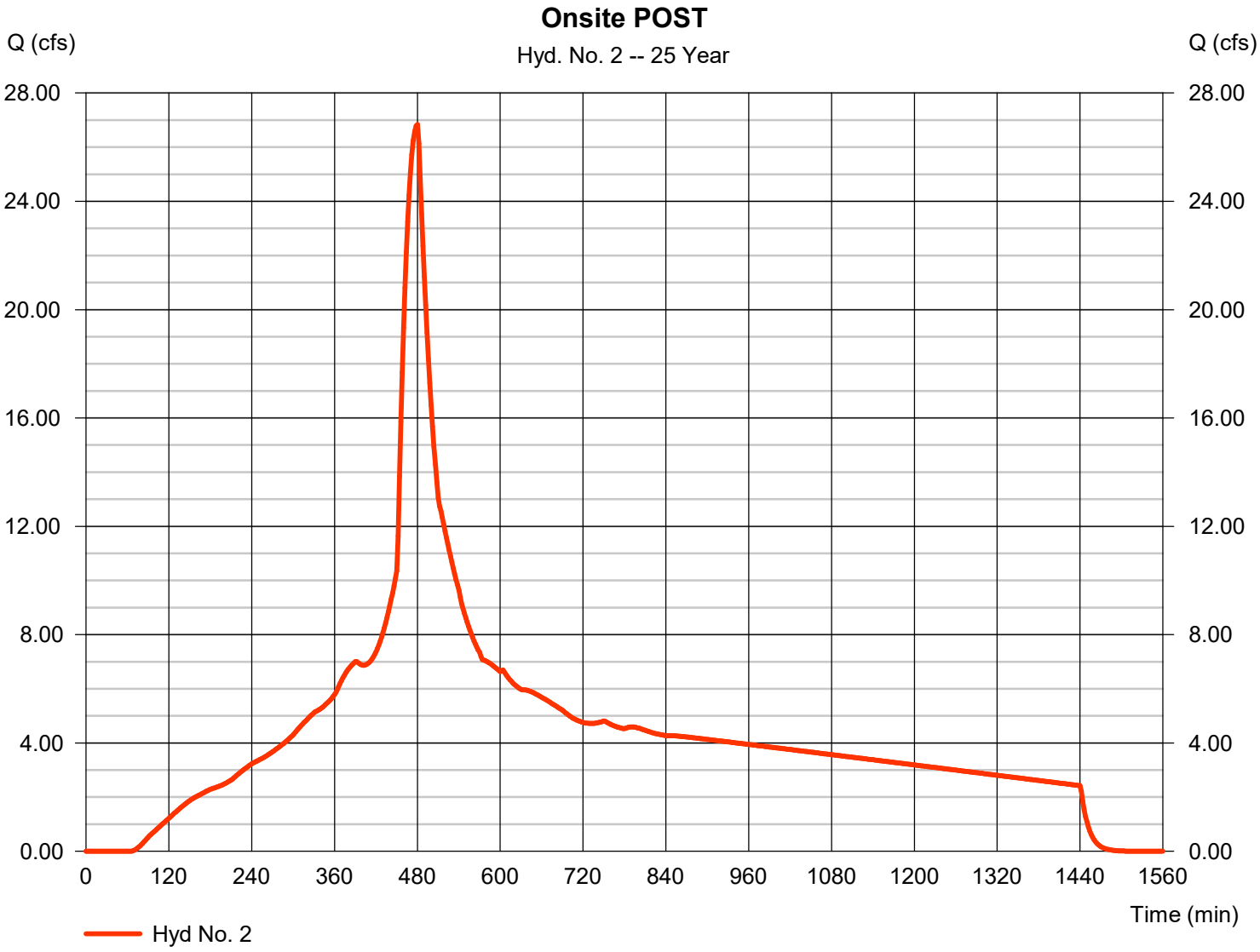


Hydrograph Report

Hyd. No. 2

Onsite POST

Hydrograph type	=	SBUH Runoff	Peak discharge	=	26.84 cfs
Storm frequency	=	25 yrs	Time to peak	=	480 min
Time interval	=	2 min	Hyd. volume	=	406,702 cuft
Drainage area	=	32.560 ac	Curve number	=	96
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	11.10 min
Total precip.	=	3.90 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	n/a



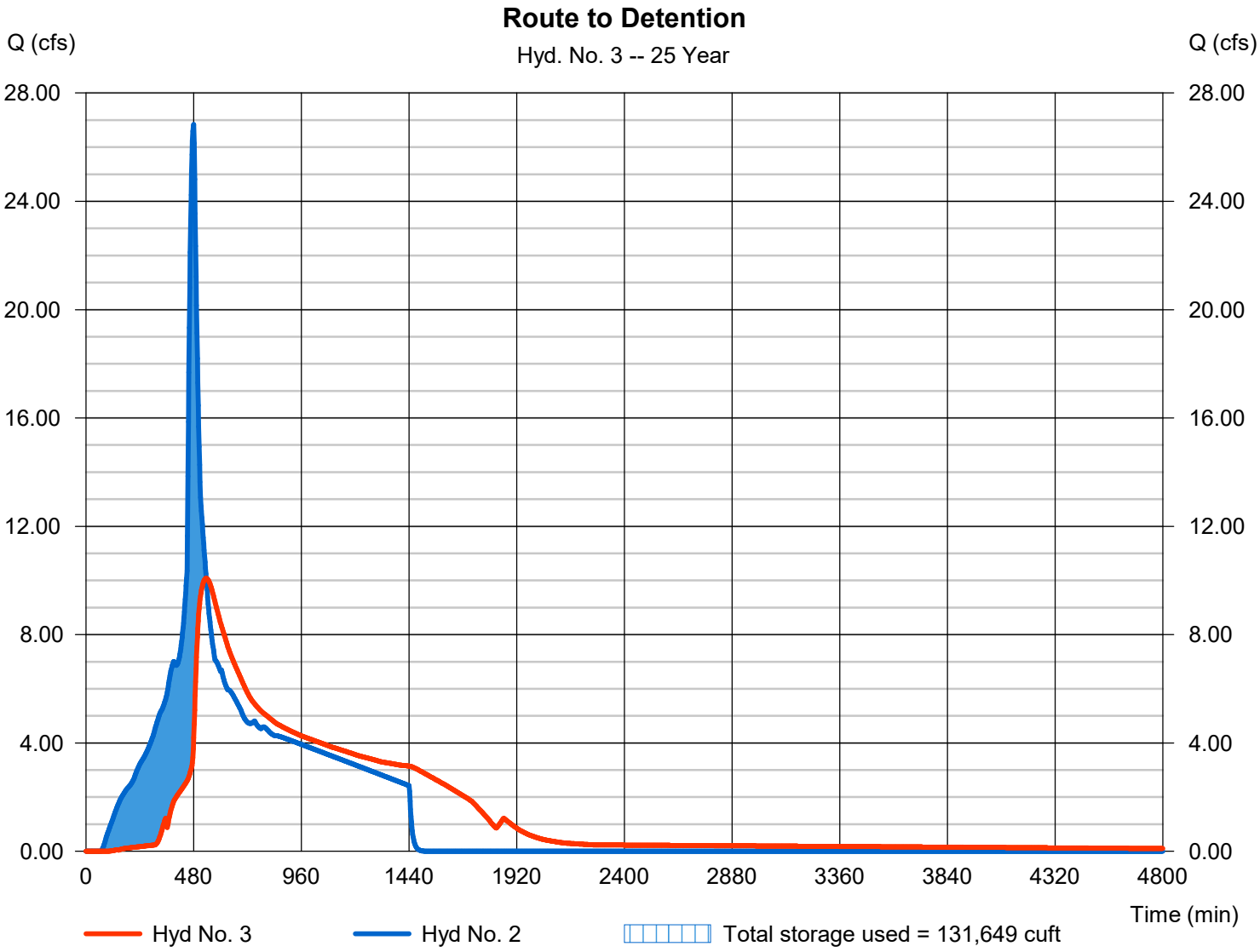
Hydrograph Report

Hyd. No. 3

Route to Detention

Hydrograph type	=	Reservoir	Peak discharge	=	10.08 cfs
Storm frequency	=	25 yrs	Time to peak	=	536 min
Time interval	=	2 min	Hyd. volume	=	403,724 cuft
Inflow hyd. No.	=	2 - Onsite POST	Max. Elevation	=	146.46 ft
Reservoir name	=	Regional Detention	Max. Storage	=	131,649 cuft

Storage Indication method used.



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	412.4210	42.3999	1.4735	--------
3	0.0000	0.0000	0.0000	--------
5	50.2780	18.4000	1.0230	--------
10	32.7846	13.4000	0.9127	--------
25	28.1281	10.7000	0.8511	--------
50	30.1149	10.7000	0.8378	--------
100	32.1694	10.7000	0.8271	--------

File name: Marion.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	1.40	1.21	1.06	0.93	0.83	0.75	0.68	0.62	0.57	0.52	0.48	0.45
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	2.00	1.64	1.39	1.20	1.06	0.95	0.86	0.78	0.72	0.67	0.62	0.58
10	2.30	1.85	1.55	1.33	1.17	1.05	0.95	0.87	0.80	0.74	0.69	0.65
25	2.70	2.13	1.77	1.53	1.34	1.20	1.09	1.00	0.92	0.85	0.80	0.75
50	3.00	2.38	1.98	1.71	1.51	1.35	1.23	1.12	1.04	0.97	0.90	0.85
100	3.30	2.62	2.19	1.89	1.67	1.50	1.36	1.25	1.16	1.08	1.01	0.95

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\Users\gim\Desktop\Agency References\County of Marion\Marion.pcp

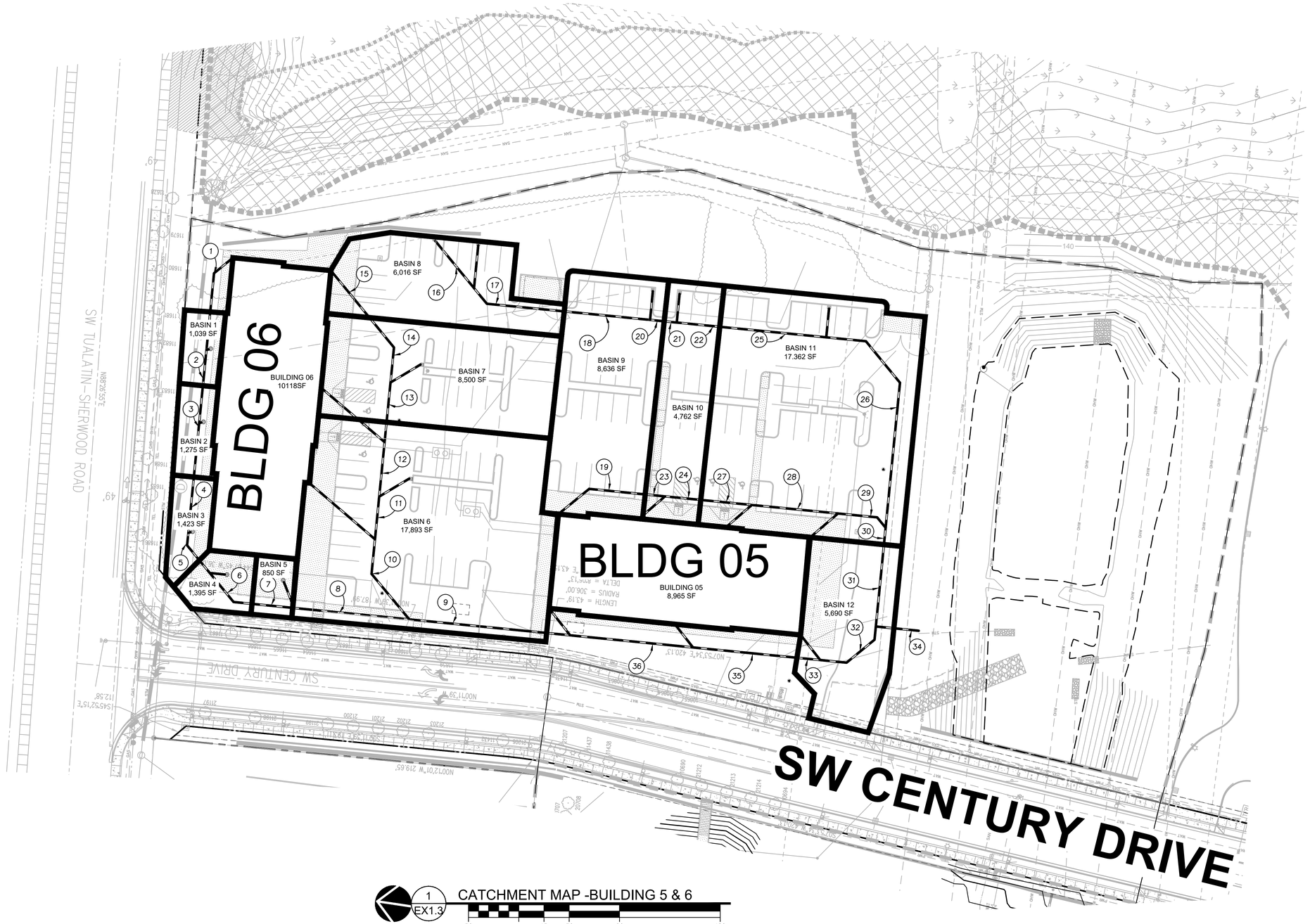
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	1.40	2.50	0.00	3.10	3.45	3.90	0.00	4.10
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*Rainfall values are per CWS 4.08.2, Table 4-4.

Appendix C:

Storm Conveyance Sizing Calculations

Official Storm Conveyance Sizing Calculations to be completed upon further design and analysis.



1 EX1.3 CATCHMENT MAP -BUILDING 5 & 6

30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

Architecture ▪ Interiors
Planning ▪ Engineering

Portland, OR
503.224.9560
Vancouver, WA
360.695.7879
Seattle, WA
206.749.9993
www.mcknze.com

MACKENZIE.
DESIGN DRIVEN | CLIENT FOCUSED

Client
ORWA SHERWOOD, LLC

8320 NE HIGHWAY 99
VANCOUVER, WA 98665

Project
SHERWOOD INDUSTRIAL PARK (PHASE 3)

REVISION SCHEDULE

Delta	Issued As	Issue Date

SHEET TITLE:
CATCHMENT MAP BUILDINGS 5 & 6

DRAWN BY:

CHECKED BY:

SHEET:
EX1.3

JOB NO. **2200393.00**

PRELIMINARY ONLY

Appendix D:

Geotechnical Engineering Report

***Official Geotechnical Report provided by NV5 services, dated July 2, 2021, has been provided separately.**

Appendix E:

Existing Stormwater Report

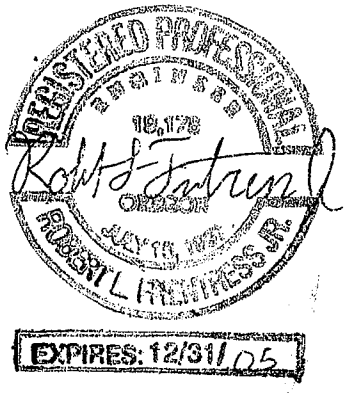
GROUP MACKENZIE

STORMWATER CALCULATIONS

Sherwood Industrial Park

Sherwood,
Oregon

WATER QUALITY,
DETENTION, &
PIPE SIZING



PROJECT # 2040263.00

October 7, 2004
Revised 12-28-05
Revised 2-28-06

Index

Project Narrative

The following report provides detailed stormwater information and calculations to fulfill a site development requirement to create water quality and detention for the proposed Sherwood Industrial Park development. The required detention will help prevent potential downstream flooding of Rock Creek. The purpose of the calculations is to show also that water quality meets the City of Sherwood and Clean Water Services requirements and can be accomplished for the proposed development. The developable portion of the proposed Sherwood Industrial Park is approximately 32-acres located south of Tualatin/Sherwood Road and west of Rock Creek. The site drains easterly to Rock Creek, which flows through the eastern undeveloped portion of the site. Phase one of the proposed development consists of one flex light industrial building with associated parking, drive isles and truck docks along with a propose public road to the pad. The Stormwater facilities have been designed to accommodate not only phase one, but also the full build out of the park.

Storm Water Detention

Flood storage detention is proposed to be located in a proposed pond designed to detain phase one and two of the proposed development (see attached plan). The existing run-off drainage area around Rock Creek was previously approved and constructed via a separate permit Corps and DSL permit. The proposed pond is located in an existing BPA easement.

The off-site area to the west of the site is proposed to be by-passed around the site and thus will not be routed through the water quality and detention pond. Calculations for by-passing off-site storm water will be provided at the time of phase two submittal.

It is proposed that a control structure will be constructed to meter flows out of the detention basin. Flows up to 25-yr storm event will be released at the pre-developed runoff rate. The control system has been designed to release at or below the existing 2, 10, and 25-year runoff rates. The flood storage will accumulate to the 145.74-ft level. An armored overflow has been designed in to the pond to provide maximum flow during major events exceeding the 25-year storm or if orifices become plugged. Access to the orifice structure will be provided for maintenance of the structure will be provided ultimately through Pad 'G'.

The detention and routing calculations were accomplished using an SCS based software package "Stormshed" assuming a type 1a rainfall distribution and a Santa Barbara Urban Huydrograph. The pond has been designed to accommodate full build out of the Park, which has been assume to consist of 24.87 acres of impervious area which includes the pond area. The calculations show that the total storage volume provided in the detention area is 69,791-cf.

Storm Water Conveyance

Pipes in Century drive will be designed to accommodate the undetained 25yr flows from the project and route them to the pond. Pipes stubbed to each building pad have been sized to accommodate the 25year storm event as calculated using the SCS based software package "StormShed".

Water Quality

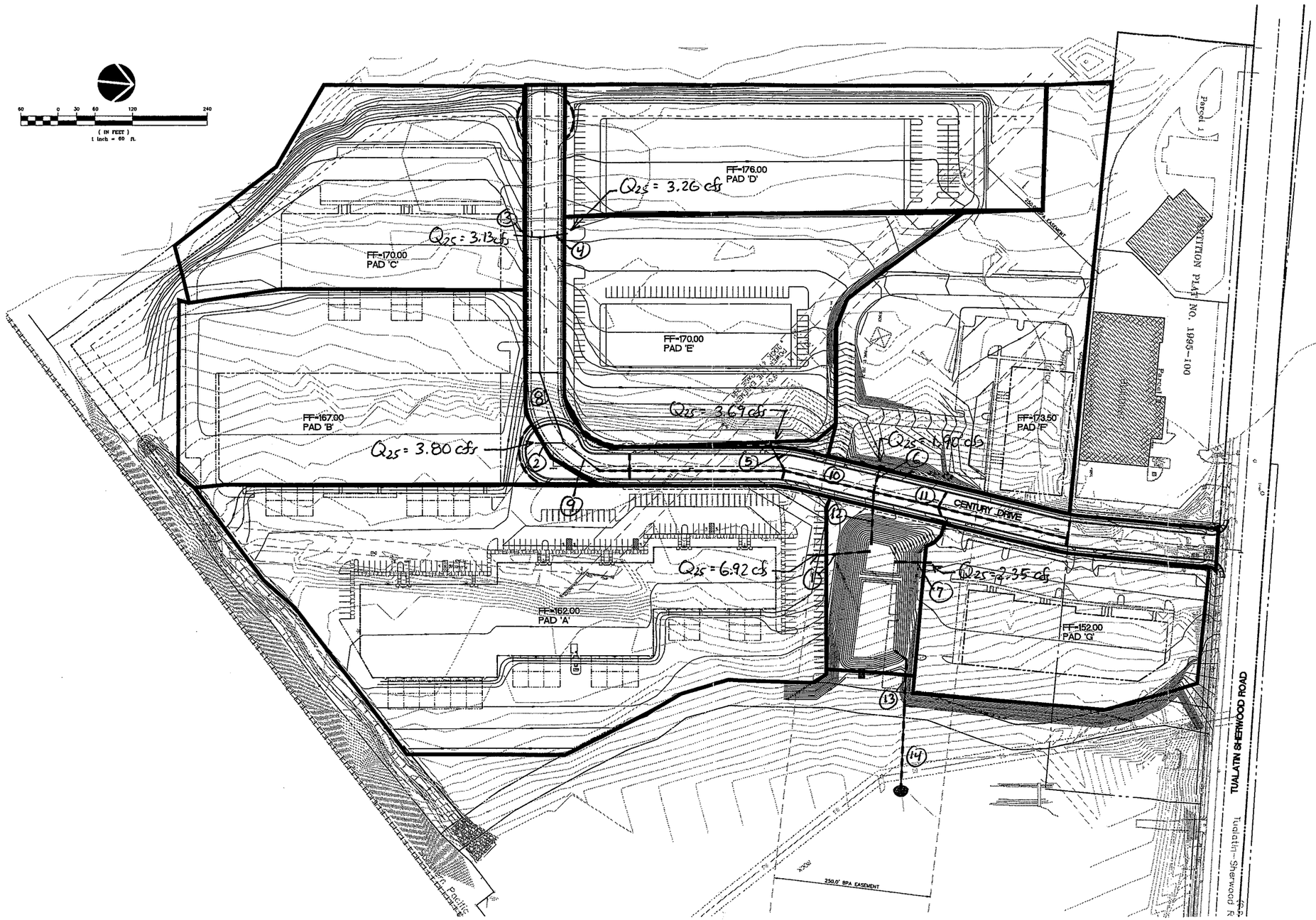
Per the City of Sherwood and Clean Water Services standards, water quality treatment of storm runoff is required for all new development. All hardscape areas including the parking area, drive isles, loading docks, roofs and sidewalks will be collected via trapped and sumped catch basins. This is the first line of defense to trap oil and grease and to settle out heavy metals and sediments. The catch basins are designed to allow for periodic scheduled maintenance for initial cleansing and vacuuming post summer storm events. Storm water from the catch basins will be routed via a storm pipe collection system to a "dry" detention pond centrally located in the BPA easement to serve the entire development. The pond has been designed to treat the "summer" storm event as defined as the first 0.36" of rainfall falling in a four hour period. The proposed pond will incorporate a two-cell design. The pond has been designed with one foot of permanent water to help maintain an appropriate variety of wetland type plant materials to help provide water quality benefits.

The pond has been designed to provide for both water quality and detention.

The attached water quality and detention calculations are intended to show that the pond has been designed to conform to the City of Sherwood and Clean Water Services requirements.

Off-Site Flows

Upstream flows will be conveyed around the proposed project. An 18" pipe has been stubbed to the west end of Century Drive and has been designed to accommodate upstream flows. The by-pass pipe was designed to accommodate the 10yr existing runoff rate from the upstream basin. The upstream basin consists of approximately 33 acres and it has been assumed that future build out upstream will accommodate storm water detention.



LEDGEND

PROPOSED CONTOUR	141
EXISTING CONTOUR	141
COMPOST BERM	
SEDIMENT FENCING	

NOTES

1. SEE SHEET RS.0 FOR POND DESIGN AND DETAILS
2. THIS STORMWATER PLAN IS INTENDED TO PROVIDE AN OVERALL PICTURE OF STORMWATER FOR THIS SITE. SEE CONSTRUCTION DOCUMENTS FOR DETAILS.
3. LATERALS SIZED TO ACCOMODATE THE 25YR STORM.
4. POND SIZED TO ACCOMODATE FULL BUILD OUT OF SITE.
5. UPSTREAM FLOWS WILL BY-PASS THE DETETNION AND WATER QUALITY POND.

GROUP MACKENZIE
Civil Engineering
Structural Engineering
Transportation Planning
Architecture
Interior Design
Land Use Planning
Portland OR 503.224.9560
Vancouver WA 360.695.7879
Tacoma WA 253.471.0551
Seattle WA 206.749.9993

Client
OREGON-WASHINGTON LUMBER COMPANY
501 NW MURRAY BLVD.
PORTLAND, OREGON 97229

Project
SHERWOOD INDUSTRIAL PARK
SITE IMPROVEMENTS

Surveyor
WELKEN ENGINEERING, PC.
8000 SW PFAFFLE STREET
TIGARD, Oregon 97223
Phone: (503)598-8956

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 25, 1997
DANIEL L. FREDERICK
EXPIRES: 12/31/05

REVISIONS:

SECTION	REVISIONS	REVISION DELTA	CLOSING DATE
THIS SHEET			

SHEET TITLE:
STORM BASIN PLAN

DRAWN BY:

CHECKED BY:

SHEET
STRM

JOB NO. 2040263.00

POND BASIN AREA

			CN
TOTAL AREA	=	32.56 Ac	
IMPER. AREA	=	24.87 Ac	98
PERVIOUS AREA	=	7.69 Ac	86

EXISTING

			CN
AREA	=	32.56 Ac	86

POND BASIN AREA

	AREA	IMPER AREA	PER AREA
PAD 'A'	7.56 Ac	6.05 Ac	1.51 Ac
PAD 'B'	4.06 Ac	3.25 Ac	0.81 Ac
PAD 'C'	3.35 Ac	2.68 Ac	0.67 Ac
PAD 'D'	3.61 Ac	2.75 Ac	0.86 Ac
PAD 'E'	4.62 Ac	3.43 Ac	0.89 Ac
✓ PAD 'F'	4.15 Ac	2.25 Ac	11.90 Ac
PAD 'G'	2.53 Ac	1.95 Ac	0.58 Ac
ROAD	2.34 Ac	2.11 Ac	0.23 Ac
POND	0.94 Ac	0.70 Ac	0.24 Ac
	32.56 Ac	24.87	7.69 Ac

GROUP MACKENZIE
Portland, Oregon | Tacoma, Washington | Vancouver, Washington
www.groupmackenzie.com

By _____
Date _____
Job # _____
Sht. _____ of _____

Pipe Sizing Calculation

Based on SCS flow inputs
(Flows calculated in "Stormshed")

GROUP MACKENZIE
0690 SW Bancroft Street / PO Box 69039 Portland, OR 97201
Tel: 503.224.9560 Net: info@grpmack.com Fax: 503.228.1285

Project: Sherwood Industrial Park
By: rlf
Date: 10/7/2004
Job: 2040263

Mannings n= 0.013

Link (#)	Storm Input Descriptions	Incremental Flow (cfs)	Total Flow (cfs)	Pipe Slope (%)	Pipe Diameter (inches)	Pipe Capacity (cfs)	Pipe Velocity (fps)
1	Pad 'A'		6.93	0.5	18	7.42	4.20
2	Pad 'B'		3.8	0.5	15	4.56	3.72
3	Pad 'C'		3.13	0.5	15	4.56	3.72
4	Pad 'D'		3.26	0.5	15	4.56	3.72
5	Pad 'E'		3.69	0.5	15	4.56	3.72
6	Pad 'F'		3.6	0.5	15	4.56	3.72
7	Pad 'G'		2.35	0.5	15	4.56	3.72
8	Pad 'C', Pad 'D' & Road		7.84	0.5	24	15.98	5.09
9	Pad 'B'	3.8	11.64	1.3	24	25.76	8.20
10	Pad ' E'	3.69	15.33	4	24	45.19	14.39
11	Road		0.71	0.5	12	2.52	3.20
12	6+10+11		19.64	3.25	24	40.74	12.97
13	1+7+12+pond	0.9	29.82	8.8	24	67.03	21.35
14			29.82	1.1	24	23.70	7.55

SIZING FOR STORM STUB

DESCRIPTION	AREA	IMP.	PER	Q_{25}	SIZE @ 0.5%
AREA 'A'	7.56	6.05	1.51	6.92	18"
AREA 'B'	4.06	3.25	0.81	3.80	15"
AREA 'C'	3.35	2.68	0.67	3.13	15"
AREA 'D'	3.61	2.75	0.86	3.26	15"
AREA 'E'	4.02	3.13	0.89	3.69	15"
AREA 'F'	4.15	2.25	1.90	3.60	15"
AREA 'G'	2.53	1.95	0.58	2.35	15"
AREA 'R'	2.34	2.11	0.23	2.17	12"
POND	0.94	0.7	0.24	0.90	

Storm Stub Sizing

A Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
A	6.92	8.00	2.5275	7.56	SBUH/SCS	TYPE1A	25 yr

Drainage Area: A

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	1.5100 ac	86.00	0.18 hrs	
Impervious	6.0500 ac	98.00	0.18 hrs	
Total	7.5600 ac			

Supporting Data:

Pervious CN Data:

landscape	86.00	1.5100 ac

Impervious CN Data:

None Entered	98.00	6.0500 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	700.00 ft	0.50%	42.0000	3.93 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	700.00 ft	0.50%	42.0000	3.93 min

B Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
B	3.80	8.00	1.3574	4.06	SBUH/SCS	TYPE1A	25 yr

Drainage Area: B

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.8100 ac	86.00	0.15 hrs	
Impervious	3.2500 ac	98.00	0.15 hrs	
Total	4.0600 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.8100 ac

Impervious CN Data:

None Entered	98.00	3.2500 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min

Sheet	AC		250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE		450.00 ft	0.50%	42.0000	2.53 min
Impervious TC Data:						
Flow type:	Description:		Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered		20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC		250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE		450.00 ft	0.50%	42.0000	2.53 min

C Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
C	3.13	8.00	1.1199	3.35	SBUH/SCS	TYPE1A	25 yr

Drainage Area: C

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.6700 ac	86.00	0.15 hrs	
Impervious	2.6800 ac	98.00	0.15 hrs	
Total	3.3500 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.6700 ac

Impervious CN Data:

None Entered	98.00	2.6800 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	450.00 ft	0.50%	42.0000	2.53 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	450.00 ft	0.50%	42.0000	2.53 min

D Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
D	3.26	8.00	1.1923	3.61	SBUH/SCS	TYPE1A	25 yr

Drainage Area: D

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.8600 ac	86.00	0.18 hrs	
Impervious	2.7500 ac	98.00	0.18 hrs	
Total	3.6100 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.8600 ac

Impervious CN Data:

None Entered	98.00	2.7500 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	720.00 ft	0.50%	42.0000	4.04 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	720.00 ft	0.50%	42.0000	4.04 min

E Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
E	3.69	8.00	1.3348	4.02	SBUH/SCS	TYPE1A	25 yr

Drainage Area: E

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.8900 ac	86.00	0.17 hrs	
Impervious	3.1300 ac	98.00	0.17 hrs	
Total	4.0200 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.8900 ac

Impervious CN Data:

None Entered	98.00	3.1300 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	600.00 ft	0.50%	42.0000	3.37 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	600.00 ft	0.50%	42.0000	3.37 min

F Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
F	3.59	8.00	1.2749	4.15	SBUH/SCS	TYPE1A	25 yr

Drainage Area: F

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	1.9000 ac	86.00	0.15 hrs	

Impervious	2.2500 ac	98.00	0.15 hrs
Total	4.1500 ac		

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	1.9000 ac

Impervious CN Data:

None Entered	98.00	2.2500 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	400.00 ft	0.50%	42.0000	2.24 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	400.00 ft	0.50%	42.0000	2.24 min

G Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
G	2.35	8.00	0.8380	2.53	SBUH/SCS	TYPE1A	25 yr

Drainage Area: G

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.5800 ac	86.00	0.15 hrs	
Impervious	1.9500 ac	98.00	0.15 hrs	
Total	2.5300 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.5800 ac

Impervious CN Data:

None Entered	98.00	1.9500 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	450.00 ft	0.50%	42.0000	2.53 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	450.00 ft	0.50%	42.0000	2.53 min

R Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
R	2.17	8.00	0.8072	2.34	SBUH/SCS	TYPE1A	25 yr

Drainage Area: R

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.2300 ac	86.00	0.20 hrs	
Impervious	2.1100 ac	98.00	0.20 hrs	
Total	2.3400 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.2300 ac

Impervious CN Data:

None Entered	98.00	2.1100 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	900.00 ft	0.50%	42.0000	5.05 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	None Entered	20.00 ft	2.00%	0.2000	3.85 min
Sheet	AC	250.00 ft	2.00%	0.0110	2.85 min
Channel	PIPE	900.00 ft	0.50%	42.0000	5.05 min

pond Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
-------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
pond	0.90	8.00	0.3088	0.94	SBUH/SCS	TYPE1A	25 yr

Drainage Area: pond

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	0.2400 ac	86.00	0.08 hrs	
Impervious	0.7000 ac	98.00	0.08 hrs	
Total	0.9400 ac			

Supporting Data:

Pervious CN Data:

Prototype subarea	86.00	0.2400 ac

Impervious CN Data:

pond	98.00	0.7000 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Fixed	None Entered	0.00 ft	0.00%	5.0000	5.00 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Fixed	None Entered	0.00 ft	0.00%	5.0000	5.00 min

WQ VOL.

	IMPER AREA (Ac)
PAD 'A'	6.05
PAD 'B'	3.25
PAD 'C'	2.68
PAD 'D'	2.75
PAD 'E'	3.13
PAD 'F'	2.25
PAD 'G'	1.95
ROAD	2.11
POND	—

TOTAL IMPER. = 24.17 Ac

$$\text{WQ VOL} = 24.17\ \text{Ac} \times 0.36\ \text{in} \times \frac{43{,}560\ \text{ft}^2}{1\ \text{Ac}} \times \frac{1\ \text{ft}}{12\ \text{in}} = 31{,}585\ \text{ft}^3$$

$$Q_{rel} = \frac{31{,}585\ \text{ft}^3}{48\ \text{HRS}} \times \frac{1\ \text{HR}}{3600\ \text{s}} = 0.20\ \text{cfs} \qquad 0.18$$

TOTAL POND VOLUME

ELEV (ft)	AREA (SF)	VOL (CF)	Cumm VOL (CF)	
139.50	10,641			
140	11,295	5484	5484	
141	13,631	12,463	17,947	← WQ VOL 31,585 ft³ @ ELEV. = 141.95'
142	15,175	14,403	32,350	
143	16,857	16,016	48,366	
144	18,600	17,728	66,095	
145	20,404	19,502	85,597	
146	22,267	21,336	106,932	

GROUP MACKENZIE

Portland, Oregon | Seattle, Washington | Vancouver, Washington
www.groupmackenzie.com

By _____

Date _____

Job # _____

Sht. _____ of _____

ORIFICE SIZING (WATER QUALITY)

$Q = CA\sqrt{2gh}$

$A = \dfrac{Q}{C\sqrt{2gh}}$

$A = \dfrac{0.20}{0.62\sqrt{2 \times 32.2 \times 1.23}}$

$A = 0.0362$

$d = \sqrt{\dfrac{4A}{\pi}}$

$d = 0.215' = 2.58''$

$Q = 0.20$ cfs

$g = 32.2$

$h = \dfrac{141.95 + 139.50}{2} - 139.50 = 1.23'$

$C = 0.62$

$A = \dfrac{\pi d^2}{4}$

$d = \sqrt{\dfrac{4A}{\pi}}$

DETENTION SUMMARY

	INFLOW (cfs)	EXIST. RUNOFF (cfs)	RELEASE RATE (cfs)	PEAK STAGE (ft)
Q_2	14.84	66.06	6.05	144.05
Q_{10}	21.58	10.86	10.79	144.89
Q_{25}	29.11	16.53	15.82	145.74

DETENTION VOLUME

ELEV (FT)	AREA (SF)	VOL (CF)	CUMM VOL (CF)
✓ 141.95	15,097		
142	15,175	756	756
143	16,857	16,016	16,773
144	18,600	17,728	34,501
145	20,404	19,502	54,003
146	22,267	21,335	75,338

GROUP MACKENZIE

Portland, Oregon | Seattle, Washington | Vancouver, Washington
www.groupmackenzie.com

By _____

Date _____

Job # _____

Sht. _____ of _____

Pond Design
Sherwood Industrial Park
Project 2040263.00
February 28, 2006

RLPCOMPUTE [FACILITIES] SUMMARY

2 yr	Match Q: 6.0575 cfs Peak Out Q: 6.0533 cfs - Peak Stg: 144.05 ft - Active Vol: 1.5408 acft
10 yr	Match Q: 10.8600 cfs Peak Out Q: 10.7863 cfs - Peak Stg: 144.89 ft - Active Vol: 1.9153 acft
25 yr	Match Q: 16.5265 cfs Peak Out Q: 15.8192 cfs - Peak Stg: 145.74 ft - Active Vol: 2.3296 acft

RLPCOMPUTE [FACILITIES] DETAILED

2 yr event

Time	I1	I2	2S	Sum I+2S	O1	O2S	Elev
70.00	0.04	0.04	105.43	105.62	0.00	105.62	141.95
80.00	0.15	0.15	105.31	105.74	0.31	105.43	141.95
90.00	0.28	0.28	105.12	105.82	0.31	105.51	141.94
100.00	0.42	0.42	105.20	106.17	0.31	105.86	141.95
110.00	0.55	0.55	105.46	106.70	0.41	106.29	141.95
120.00	0.69	0.69	105.69	107.18	0.60	106.58	141.96
130.00	0.80	0.80	105.89	107.61	0.69	106.91	141.96
140.00	0.92	0.92	106.13	108.08	0.78	107.30	141.96
150.00	1.03	1.03	106.43	108.58	0.87	107.71	141.97
160.00	1.12	1.12	106.75	109.06	0.96	108.11	141.98
170.00	1.20	1.20	107.08	109.53	1.03	108.50	141.98
180.00	1.26	1.26	107.40	109.97	1.10	108.87	141.99
190.00	1.32	1.32	107.71	110.40	1.16	109.23	142.00
200.00	1.37	1.37	108.02	110.80	1.21	109.59	142.00
210.00	1.41	1.41	108.32	111.19	1.26	109.93	142.01
220.00	1.45	1.45	108.62	111.59	1.30	110.29	142.01
230.00	1.52	1.52	108.94	112.05	1.35	110.70	142.02
240.00	1.59	1.59	109.30	112.54	1.40	111.14	142.03
250.00	1.64	1.64	109.69	113.07	1.45	111.62	142.03
260.00	1.74	1.74	110.12	113.72	1.50	112.22	142.04
270.00	1.86	1.86	110.65	114.43	1.56	112.87	142.05
280.00	1.92	1.92	111.24	115.19	1.63	113.56	142.06
290.00	2.03	2.03	111.87	116.07	1.70	114.37	142.08
300.00	2.17	2.17	112.60	117.02	1.77	115.25	142.09
310.00	2.25	2.25	113.40	118.02	1.85	116.17	142.10
320.00	2.37	2.37	114.25	119.13	1.93	117.21	142.12
330.00	2.51	2.51	115.20	120.31	2.01	118.30	142.14
340.00	2.59	2.59	116.21	121.52	2.09	119.43	142.16
350.00	2.72	2.72	117.25	122.84	2.18	120.67	142.18
360.00	2.87	2.87	118.40	124.22	2.26	121.96	142.20
370.00	2.95	2.95	119.61	125.71	2.35	123.36	142.22
380.00	3.15	3.15	120.92	127.48	2.44	125.04	142.25
390.00	3.41	3.41	122.49	129.43	2.55	126.89	142.27
400.00	3.53	3.53	124.23	131.60	2.66	128.95	142.31
410.00	3.84	3.84	126.17	134.24	2.77	131.47	142.34
420.00	4.22	4.22	128.56	137.18	2.91	134.27	142.39
430.00	4.40	4.40	131.21	140.40	3.06	137.34	142.44
440.00	4.78	4.78	134.14	144.17	3.21	140.96	142.49
450.00	5.25	5.25	137.58	148.29	3.38	144.92	142.56
460.00	5.46	5.46	141.36	155.49	3.55	151.94	142.63
470.00	8.66	8.66	148.09	169.85	3.84	166.01	142.75
480.00	13.09	13.09	161.64	189.69	4.37	185.32	143.01
490.00	14.96	14.96	180.38	208.49	4.94	203.55	143.32
500.00	13.15	13.15	198.12	221.16	5.43	215.73	143.62
510.00	9.88	9.88	210.00	228.56	5.73	222.83	143.83
520.00	8.67	8.67	216.93	233.16	5.90	227.26	143.94
530.00	7.56	7.56	221.26	235.30	6.00	229.30	144.01
540.00	6.48	6.48	223.26	235.83	6.04	229.78	144.05
550.00	6.08	6.08	223.73	235.30	6.05	229.25	144.05

560.00	5.49	5.49	223.21	233.52	6.04	227.48	144.04
570.00	4.82	4.82	221.47	230.86	6.01	224.86	144.02
580.00	4.57	4.57	218.91	227.83	5.95	221.88	143.98
590.00	4.35	4.35	216.00	224.47	5.88	218.60	143.93
600.00	4.13	4.13	212.80	220.98	5.80	215.18	143.87
610.00	4.05	4.05	209.46	217.39	5.72	211.68	143.82
620.00	3.89	3.89	206.05	213.62	5.63	207.99	143.76
630.00	3.69	3.69	202.45	209.76	5.54	204.22	143.70
640.00	3.62	3.62	198.77	205.90	5.45	200.45	143.64
650.00	3.50	3.50	195.10	201.97	5.35	196.63	143.57
660.00	3.37	3.37	191.38	198.07	5.25	192.82	143.51
670.00	3.32	3.32	187.67	194.25	5.15	189.11	143.45
680.00	3.26	3.26	184.06	190.51	5.05	185.46	143.39
690.00	3.19	3.19	180.52	186.88	4.95	181.93	143.33
700.00	3.17	3.17	177.09	183.37	4.85	178.53	143.27
710.00	3.12	3.12	173.78	179.95	4.75	175.20	143.21
720.00	3.05	3.05	170.55	176.63	4.65	171.98	143.16
730.00	3.03	3.03	167.43	173.43	4.55	168.88	143.11
740.00	2.97	2.97	164.42	170.31	4.46	165.85	143.05
750.00	2.91	2.91	161.49	167.29	4.36	162.93	143.00
760.00	2.89	2.89	158.67	164.39	4.26	160.13	142.95
770.00	2.83	2.83	155.97	161.57	4.16	157.42	142.90
780.00	2.77	2.77	153.36	158.87	4.06	154.81	142.85
790.00	2.74	2.74	150.86	156.34	3.96	152.38	142.81
800.00	2.74	2.74	148.52	153.99	3.86	150.13	142.76
810.00	2.73	2.73	146.36	151.83	3.77	148.06	142.72
820.00	2.74	2.74	144.38	149.80	3.68	146.12	142.68
830.00	2.69	2.69	142.51	147.83	3.60	144.23	142.65
840.00	2.63	2.63	140.71	145.94	3.52	142.41	142.62
850.00	2.60	2.60	138.97	144.17	3.44	140.73	142.58
860.00	2.60	2.60	137.37	142.56	3.37	139.19	142.55
870.00	2.59	2.59	135.90	141.09	3.29	137.79	142.53
880.00	2.60	2.60	134.57	139.71	3.23	136.48	142.50
890.00	2.55	2.55	133.32	138.35	3.17	135.19	142.48
900.00	2.49	2.49	132.08	137.03	3.10	133.93	142.45
910.00	2.46	2.46	130.89	135.81	3.04	132.77	142.43
920.00	2.45	2.45	129.79	134.70	2.98	131.72	142.41
930.00	2.45	2.45	128.79	133.70	2.92	130.77	142.39
940.00	2.45	2.45	127.90	132.76	2.87	129.88	142.38
950.00	2.41	2.41	127.06	131.81	2.83	128.98	142.36
960.00	2.34	2.34	126.21	130.86	2.78	128.09	142.34
970.00	2.32	2.32	125.36	129.99	2.73	127.26	142.33
980.00	2.31	2.31	124.59	129.20	2.68	126.53	142.31
990.00	2.31	2.31	123.89	128.50	2.63	125.87	142.30
1000.00	2.31	2.31	123.27	127.89	2.60	125.29	142.29
1010.00	2.31	2.31	122.73	127.35	2.56	124.79	142.28
1020.00	2.31	2.31	122.26	126.87	2.53	124.34	142.27
1030.00	2.31	2.31	121.84	126.41	2.50	123.91	142.26
1040.00	2.26	2.26	121.43	125.90	2.48	123.42	142.25
1050.00	2.20	2.20	120.97	125.35	2.44	122.90	142.25
1060.00	2.17	2.17	120.49	124.83	2.41	122.42	142.24
1070.00	2.17	2.17	120.04	124.37	2.38	121.99	142.23
1080.00	2.16	2.16	119.63	123.96	2.35	121.61	142.22
1090.00	2.16	2.16	119.28	123.56	2.33	121.23	142.21
1100.00	2.12	2.12	118.93	123.10	2.30	120.80	142.21
1110.00	2.05	2.05	118.52	122.60	2.27	120.33	142.20
1120.00	2.03	2.03	118.09	122.13	2.24	119.89	142.19
1130.00	2.02	2.02	117.68	121.71	2.21	119.51	142.18
1140.00	2.01	2.01	117.33	121.35	2.18	119.17	142.18
1150.00	2.01	2.01	117.02	120.99	2.16	118.84	142.17
1160.00	1.97	1.97	116.70	120.57	2.13	118.44	142.17
1170.00	1.90	1.90	116.34	120.11	2.10	118.01	142.16
1180.00	1.88	1.88	115.94	119.68	2.07	117.61	142.15
1190.00	1.87	1.87	115.57	119.30	2.04	117.26	142.14
1200.00	1.86	1.86	115.25	118.97	2.01	116.96	142.14
1210.00	1.86	1.86	114.97	118.70	1.99	116.71	142.13
1220.00	1.86	1.86	114.74	118.46	1.97	116.49	142.13
1230.00	1.86	1.86	114.54	118.27	1.95	116.32	142.13
1240.00	1.86	1.86	114.38	118.11	1.94	116.17	142.12
1250.00	1.86	1.86	114.25	117.97	1.93	116.05	142.12

1260.00	1.86	1.86	114.13	117.86	1.92	115.95	142.12
1270.00	1.87	1.87	114.04	117.77	1.91	115.87	142.12
1280.00	1.87	1.87	113.97	117.70	1.90	115.80	142.11
1290.00	1.87	1.87	113.90	117.64	1.89	115.74	142.11
1300.00	1.87	1.87	113.85	117.59	1.89	115.70	142.11
1310.00	1.87	1.87	113.81	117.55	1.89	115.66	142.11
1320.00	1.87	1.87	113.78	117.52	1.88	115.63	142.11
1330.00	1.87	1.87	113.75	117.44	1.88	115.56	142.11
1340.00	1.82	1.82	113.69	117.26	1.87	115.39	142.11
1350.00	1.76	1.76	113.53	117.01	1.86	115.15	142.11
1360.00	1.73	1.73	113.31	116.77	1.84	114.93	142.10
1370.00	1.72	1.72	113.11	116.54	1.82	114.72	142.10
1380.00	1.72	1.72	112.92	116.36	1.80	114.55	142.10
1390.00	1.72	1.72	112.77	116.20	1.79	114.41	142.09
1400.00	1.72	1.72	112.64	116.07	1.77	114.30	142.09
1410.00	1.72	1.72	112.53	115.97	1.76	114.20	142.09
1420.00	1.72	1.72	112.45	115.88	1.76	114.13	142.09
1430.00	1.72	1.72	112.38	115.81	1.75	114.06	142.09
1440.00	1.72	1.72	112.32	115.76	1.74	114.02	142.08
1450.00	1.72	1.72	112.28	115.18	1.74	113.44	142.08
1460.00	1.19	1.19	111.76	113.40	1.69	111.71	142.07
1470.00	0.45	0.45	110.20	110.82	1.51	109.31	142.04
1480.00	0.17	0.17	108.09	108.32	1.22	107.10	142.00
1490.00	0.07	0.07	106.27	106.36	0.83	105.54	141.97
1500.00	0.02	0.02	105.23	105.26	0.31	104.95	141.95
1510.00	0.01	0.01	104.64	104.65	0.31	104.35	141.93
1520.00	0.00	0.00	104.04	104.04	0.31	103.73	141.92
1530.00	0.00	0.00	103.43	103.43	0.31	103.12	141.91
1540.00	0.00	0.00	102.81	102.81	0.31	102.50	141.90
1550.00	0.00	0.00	102.20	102.20	0.31	101.89	141.88
1560.00	0.00	0.00	101.59	101.59	0.31	101.28	141.87
1570.00	0.00	0.00	100.97	100.97	0.31	100.67	141.86
1580.00	0.00	0.00	100.36	100.36	0.30	100.06	141.84
1590.00	0.00	0.00	99.76	99.76	0.30	99.45	141.83
1600.00	0.00	0.00	99.15	99.15	0.30	98.85	141.82
1610.00	0.00	0.00	98.54	98.54	0.30	98.24	141.81
1620.00	0.00	0.00	97.94	97.94	0.30	97.64	141.79
1630.00	0.00	0.00	97.33	97.33	0.30	97.03	141.78
1640.00	0.00	0.00	96.73	96.73	0.30	96.43	141.77
1650.00	0.00	0.00	96.13	96.13	0.30	95.83	141.76
1660.00	0.00	0.00	95.53	95.53	0.30	95.23	141.74
1670.00	0.00	0.00	94.94	94.94	0.30	94.64	141.73
1680.00	0.00	0.00	94.34	94.34	0.30	94.04	141.72
1690.00	0.00	0.00	93.74	93.74	0.30	93.45	141.71
1700.00	0.00	0.00	93.15	93.15	0.30	92.85	141.69
1710.00	0.00	0.00	92.56	92.56	0.30	92.26	141.68
1720.00	0.00	0.00	91.97	91.97	0.30	91.67	141.67
1730.00	0.00	0.00	91.38	91.38	0.29	91.08	141.66
1740.00	0.00	0.00	90.79	90.79	0.29	90.50	141.64
1750.00	0.00	0.00	90.20	90.20	0.29	89.91	141.63
1760.00	0.00	0.00	89.62	89.62	0.29	89.32	141.62
1770.00	0.00	0.00	89.03	89.03	0.29	88.74	141.61
1780.00	0.00	0.00	88.45	88.45	0.29	88.16	141.60
1790.00	0.00	0.00	87.87	87.87	0.29	87.58	141.58
1800.00	0.00	0.00	87.29	87.29	0.29	87.00	141.57
1810.00	0.00	0.00	86.71	86.71	0.29	86.42	141.56
1820.00	0.00	0.00	86.13	86.13	0.29	85.84	141.55
1830.00	0.00	0.00	85.56	85.56	0.29	85.27	141.54
1840.00	0.00	0.00	84.98	84.98	0.29	84.70	141.52
1850.00	0.00	0.00	84.41	84.41	0.29	84.12	141.51
1860.00	0.00	0.00	83.84	83.84	0.29	83.55	141.50
1870.00	0.00	0.00	83.27	83.27	0.28	82.98	141.49

10 yr event

Time	I1	I2	2S	Sum I+2S	O1	O2S	Elev
50.00	0.01	0.01	105.43	105.54	0.00	105.54	141.95
60.00	0.10	0.10	105.23	105.60	0.31	105.29	141.95
70.00	0.27	0.27	104.98	105.73	0.31	105.42	141.94
80.00	0.49	0.49	105.11	106.32	0.31	106.01	141.94
90.00	0.72	0.72	105.52	107.17	0.48	106.69	141.95

100.00	0.92	0.92	105.96	108.01	0.72	107.29	141.96
110.00	1.12	1.12	106.42	108.85	0.87	107.98	141.97
120.00	1.31	1.31	106.98	109.75	1.01	108.74	141.98
130.00	1.46	1.46	107.60	110.67	1.14	109.53	142.00
140.00	1.62	1.62	108.28	111.66	1.25	110.41	142.01
150.00	1.77	1.77	109.05	112.70	1.36	111.33	142.02
160.00	1.88	1.88	109.86	113.72	1.47	112.25	142.04
170.00	1.97	1.97	110.68	114.69	1.57	113.13	142.05
180.00	2.05	2.05	111.47	115.63	1.66	113.97	142.07
190.00	2.11	2.11	112.24	116.51	1.73	114.77	142.08
200.00	2.16	2.16	112.97	117.34	1.81	115.53	142.10
210.00	2.21	2.21	113.66	118.13	1.87	116.26	142.11
220.00	2.26	2.26	114.33	118.93	1.93	117.00	142.12
230.00	2.35	2.35	115.01	119.82	1.99	117.83	142.13
240.00	2.46	2.46	115.77	120.77	2.06	118.72	142.15
250.00	2.54	2.54	116.59	121.83	2.12	119.70	142.16
260.00	2.70	2.70	117.51	123.09	2.19	120.89	142.18
270.00	2.88	2.88	118.61	124.48	2.28	122.20	142.20
280.00	2.99	2.99	119.84	125.98	2.37	123.61	142.22
290.00	3.16	3.16	121.16	127.67	2.46	125.21	142.25
300.00	3.35	3.35	122.65	129.47	2.56	126.91	142.28
310.00	3.46	3.46	124.25	131.35	2.66	128.69	142.31
320.00	3.63	3.63	125.93	133.40	2.76	130.64	142.34
330.00	3.84	3.84	127.78	135.56	2.87	132.69	142.37
340.00	3.94	3.94	129.72	137.78	2.97	134.81	142.41
350.00	4.12	4.12	131.72	140.17	3.08	137.09	142.45
360.00	4.33	4.33	133.90	142.66	3.19	139.46	142.49
370.00	4.43	4.43	136.16	145.32	3.31	142.01	142.53
380.00	4.73	4.73	138.59	148.42	3.42	144.99	142.58
390.00	5.10	5.10	141.44	151.80	3.55	148.25	142.63
400.00	5.27	5.27	144.56	155.53	3.69	151.84	142.69
410.00	5.71	5.71	148.00	159.98	3.84	156.14	142.75
420.00	6.26	6.26	152.13	164.91	4.01	160.90	142.83
430.00	6.51	6.51	156.72	170.28	4.18	166.10	142.92
440.00	7.06	7.06	161.73	176.50	4.37	172.14	143.01
450.00	7.72	7.72	167.58	183.31	4.56	178.76	143.11
460.00	8.01	8.01	174.00	194.68	4.75	189.93	143.22
470.00	12.67	12.67	184.86	216.59	5.07	211.53	143.40
480.00	19.07	19.07	205.90	246.67	5.63	241.04	143.76
490.00	21.71	21.71	233.47	274.21	7.58	266.63	144.20
500.00	19.04	19.04	257.09	290.40	9.55	280.85	144.57
510.00	14.27	14.27	270.49	297.25	10.36	286.89	144.77
520.00	12.49	12.49	276.20	299.57	10.68	288.89	144.86
530.00	10.87	10.87	278.10	298.29	10.79	287.50	144.89
540.00	9.31	9.31	276.78	294.82	10.72	284.11	144.87
550.00	8.73	8.73	273.57	290.17	10.54	279.63	144.82
560.00	7.87	7.87	269.33	284.11	10.30	273.81	144.75
570.00	6.90	6.90	263.84	277.28	9.97	267.31	144.67
580.00	6.54	6.54	257.72	270.47	9.59	260.89	144.58
590.00	6.21	6.21	251.71	263.82	9.18	254.64	144.48
600.00	5.90	5.90	245.89	257.58	8.75	248.83	144.39
610.00	5.78	5.78	240.53	251.86	8.30	243.56	144.31
620.00	5.55	5.55	235.73	246.54	7.83	238.71	144.24
630.00	5.27	5.27	231.40	241.82	7.31	234.51	144.17
640.00	5.16	5.16	227.85	238.01	6.66	231.34	144.12
650.00	4.99	4.99	225.26	235.05	6.09	228.97	144.08
660.00	4.80	4.80	222.93	232.46	6.04	226.43	144.04
670.00	4.73	4.73	220.44	229.82	5.98	223.83	144.00
680.00	4.64	4.64	217.91	227.09	5.92	221.17	143.96
690.00	4.54	4.54	215.31	224.36	5.86	218.50	143.92
700.00	4.51	4.51	212.70	221.64	5.80	215.85	143.87
710.00	4.43	4.43	210.11	218.88	5.73	213.15	143.83
720.00	4.34	4.34	207.48	216.12	5.67	210.46	143.78
730.00	4.30	4.30	204.85	213.39	5.60	207.78	143.74
740.00	4.23	4.23	202.25	210.61	5.54	205.08	143.69
750.00	4.13	4.13	199.61	207.84	5.47	202.37	143.65
760.00	4.10	4.10	196.98	205.10	5.40	199.70	143.61
770.00	4.02	4.02	194.37	202.32	5.33	196.99	143.56
780.00	3.93	3.93	191.73	199.55	5.26	194.29	143.52
790.00	3.89	3.89	189.11	196.88	5.19	191.69	143.47

800.00	3.88	3.88	186.58	194.33	5.12	189.22	143.43
810.00	3.88	3.88	184.17	191.93	5.05	186.88	143.39
820.00	3.88	3.88	181.89	189.58	4.98	184.60	143.35
830.00	3.81	3.81	179.68	187.21	4.92	182.29	143.31
840.00	3.72	3.72	177.44	184.85	4.86	179.99	143.27
850.00	3.69	3.69	175.20	182.57	4.79	177.78	143.24
860.00	3.68	3.68	173.06	180.41	4.73	175.68	143.20
870.00	3.67	3.67	171.02	178.37	4.66	173.71	143.17
880.00	3.67	3.67	169.10	176.39	4.60	171.78	143.13
890.00	3.61	3.61	167.24	174.36	4.55	169.82	143.10
900.00	3.52	3.52	165.33	172.33	4.49	167.85	143.07
910.00	3.48	3.48	163.42	170.38	4.42	165.96	143.04
920.00	3.47	3.47	161.59	168.53	4.36	164.17	143.01
930.00	3.47	3.47	159.87	166.80	4.30	162.50	142.97
940.00	3.47	3.47	158.26	165.13	4.24	160.89	142.94
950.00	3.40	3.40	156.70	163.41	4.18	159.23	142.92
960.00	3.31	3.31	155.11	161.69	4.12	157.57	142.89
970.00	3.28	3.28	153.51	160.05	4.06	155.99	142.86
980.00	3.26	3.26	151.99	158.51	4.00	154.51	142.83
990.00	3.26	3.26	150.57	157.09	3.94	153.14	142.80
1000.00	3.26	3.26	149.25	155.77	3.89	151.88	142.78
1010.00	3.26	3.26	148.04	154.56	3.84	150.72	142.75
1020.00	3.26	3.26	146.93	153.45	3.79	149.66	142.73
1030.00	3.26	3.26	145.91	152.36	3.75	148.61	142.71
1040.00	3.20	3.20	144.91	151.20	3.71	147.50	142.69
1050.00	3.10	3.10	143.84	150.01	3.66	146.35	142.67
1060.00	3.07	3.07	142.74	148.86	3.61	145.25	142.65
1070.00	3.06	3.06	141.68	147.79	3.57	144.23	142.63
1080.00	3.05	3.05	140.71	146.81	3.52	143.29	142.62
1090.00	3.05	3.05	139.81	145.84	3.48	142.36	142.60
1100.00	2.98	2.98	138.92	144.80	3.44	141.36	142.58
1110.00	2.89	2.89	137.97	143.72	3.39	140.32	142.56
1120.00	2.86	2.86	136.98	142.68	3.35	139.33	142.55
1130.00	2.84	2.84	136.03	141.71	3.30	138.41	142.53
1140.00	2.84	2.84	135.15	140.83	3.26	137.58	142.51
1150.00	2.84	2.84	134.36	139.97	3.22	136.75	142.50
1160.00	2.77	2.77	133.57	139.02	3.18	135.84	142.48
1170.00	2.68	2.68	132.71	138.03	3.13	134.89	142.47
1180.00	2.64	2.64	131.81	137.08	3.09	133.99	142.45
1190.00	2.63	2.63	130.95	136.21	3.04	133.17	142.43
1200.00	2.63	2.63	130.17	135.42	3.00	132.42	142.42
1210.00	2.62	2.62	129.46	134.71	2.96	131.75	142.41
1220.00	2.62	2.62	128.82	134.07	2.93	131.14	142.39
1230.00	2.62	2.62	128.25	133.50	2.89	130.61	142.38
1240.00	2.62	2.62	127.74	132.99	2.86	130.13	142.37
1250.00	2.63	2.63	127.29	132.54	2.84	129.70	142.36
1260.00	2.63	2.63	126.89	132.14	2.82	129.32	142.36
1270.00	2.63	2.63	126.53	131.78	2.79	128.99	142.35
1280.00	2.63	2.63	126.21	131.47	2.78	128.69	142.34
1290.00	2.63	2.63	125.93	131.19	2.76	128.43	142.34
1300.00	2.63	2.63	125.68	130.94	2.74	128.20	142.33
1310.00	2.63	2.63	125.47	130.72	2.73	127.99	142.33
1320.00	2.63	2.63	125.27	130.53	2.72	127.81	142.33
1330.00	2.63	2.63	125.10	130.30	2.71	127.59	142.32
1340.00	2.56	2.56	124.89	129.92	2.70	127.22	142.32
1350.00	2.47	2.47	124.55	129.45	2.68	126.78	142.31
1360.00	2.43	2.43	124.13	128.98	2.65	126.33	142.31
1370.00	2.42	2.42	123.71	128.55	2.62	125.92	142.30
1380.00	2.42	2.42	123.32	128.15	2.60	125.56	142.29
1390.00	2.41	2.41	122.98	127.81	2.58	125.23	142.28
1400.00	2.41	2.41	122.67	127.50	2.56	124.94	142.28
1410.00	2.41	2.41	122.40	127.23	2.54	124.69	142.27
1420.00	2.41	2.41	122.17	127.00	2.52	124.47	142.27
1430.00	2.42	2.42	121.96	126.79	2.51	124.28	142.26
1440.00	2.42	2.42	121.78	126.62	2.50	124.12	142.26
1450.00	2.42	2.42	121.63	125.71	2.49	123.22	142.26
1460.00	1.67	1.67	120.79	123.09	2.43	120.66	142.24
1470.00	0.63	0.63	118.40	119.27	2.26	117.01	142.20
1480.00	0.24	0.24	115.02	115.35	1.99	113.36	142.13
1490.00	0.09	0.09	111.68	111.81	1.68	110.13	142.07

1500.00	0.03	0.03	108.80	108.85	1.33	107.52	142.02
1510.00	0.01	0.01	106.60	106.62	0.92	105.70	141.97
1520.00	0.01	0.01	105.39	105.39	0.31	105.08	141.95
1530.00	0.00	0.00	104.77	104.78	0.31	104.47	141.94
1540.00	0.00	0.00	104.16	104.16	0.31	103.85	141.92
1550.00	0.00	0.00	103.54	103.54	0.31	103.23	141.91
1560.00	0.00	0.00	102.93	102.93	0.31	102.62	141.90
1570.00	0.00	0.00	102.31	102.31	0.31	102.01	141.89
1580.00	0.00	0.00	101.70	101.70	0.31	101.39	141.87
1590.00	0.00	0.00	101.09	101.09	0.31	100.78	141.86
1600.00	0.00	0.00	100.48	100.48	0.30	100.17	141.85
1610.00	0.00	0.00	99.87	99.87	0.30	99.57	141.83
1620.00	0.00	0.00	99.26	99.26	0.30	98.96	141.82
1630.00	0.00	0.00	98.66	98.66	0.30	98.35	141.81
1640.00	0.00	0.00	98.05	98.05	0.30	97.75	141.80
1650.00	0.00	0.00	97.45	97.45	0.30	97.15	141.78
1660.00	0.00	0.00	96.85	96.85	0.30	96.54	141.77
1670.00	0.00	0.00	96.24	96.24	0.30	95.94	141.76
1680.00	0.00	0.00	95.65	95.65	0.30	95.35	141.75
1690.00	0.00	0.00	95.05	95.05	0.30	94.75	141.73
1700.00	0.00	0.00	94.45	94.45	0.30	94.15	141.72
1710.00	0.00	0.00	93.86	93.86	0.30	93.56	141.71
1720.00	0.00	0.00	93.26	93.26	0.30	92.96	141.70
1730.00	0.00	0.00	92.67	92.67	0.30	92.37	141.68
1740.00	0.00	0.00	92.08	92.08	0.30	91.78	141.67
1750.00	0.00	0.00	91.49	91.49	0.29	91.19	141.66
1760.00	0.00	0.00	90.90	90.90	0.29	90.61	141.65
1770.00	0.00	0.00	90.31	90.31	0.29	90.02	141.64
1780.00	0.00	0.00	89.73	89.73	0.29	89.43	141.62
1790.00	0.00	0.00	89.14	89.14	0.29	88.85	141.61
1800.00	0.00	0.00	88.56	88.56	0.29	88.27	141.60
1810.00	0.00	0.00	87.98	87.98	0.29	87.69	141.59
1820.00	0.00	0.00	87.40	87.40	0.29	87.11	141.57
1830.00	0.00	0.00	86.82	86.82	0.29	86.53	141.56
1840.00	0.00	0.00	86.24	86.24	0.29	85.95	141.55
1850.00	0.00	0.00	85.66	85.66	0.29	85.38	141.54
1860.00	0.00	0.00	85.09	85.09	0.29	84.80	141.53
1870.00	0.00	0.00	84.52	84.52	0.29	84.23	141.51

25 yr event

Time	I1	I2	2S	Sum I+2S	O1	O2S	Elev
50.00	0.10	0.10	105.43	105.87	0.00	105.87	141.95
60.00	0.34	0.34	105.46	106.44	0.41	106.03	141.95
70.00	0.63	0.63	105.53	107.13	0.49	106.63	141.95
80.00	0.96	0.96	105.93	108.19	0.71	107.49	141.96
90.00	1.30	1.30	106.58	109.45	0.91	108.53	141.97
100.00	1.57	1.57	107.43	110.82	1.11	109.72	141.99
110.00	1.83	1.83	108.44	112.33	1.28	111.05	142.01
120.00	2.07	2.07	109.61	113.93	1.44	112.49	142.03
130.00	2.24	2.24	110.89	115.58	1.59	113.98	142.06
140.00	2.44	2.44	112.25	117.31	1.74	115.57	142.08
150.00	2.63	2.63	113.70	119.08	1.88	117.20	142.11
160.00	2.76	2.76	115.20	120.80	2.01	118.80	142.14
170.00	2.85	2.85	116.67	122.46	2.13	120.33	142.17
180.00	2.94	2.94	118.09	124.04	2.24	121.80	142.19
190.00	3.02	3.02	119.47	125.58	2.34	123.25	142.22
200.00	3.10	3.10	120.81	127.09	2.43	124.66	142.24
210.00	3.18	3.18	122.13	128.56	2.52	126.04	142.27
220.00	3.25	3.25	123.43	130.06	2.61	127.45	142.29
230.00	3.38	3.38	124.76	131.67	2.69	128.98	142.32
240.00	3.53	3.53	126.21	133.37	2.78	130.59	142.34
250.00	3.63	3.63	127.73	135.18	2.86	132.32	142.37
260.00	3.83	3.83	129.37	137.28	2.96	134.33	142.40
270.00	4.08	4.08	131.27	139.57	3.06	136.51	142.44
280.00	4.22	4.22	133.35	142.00	3.17	138.84	142.48
290.00	4.44	4.44	135.56	144.71	3.28	141.43	142.52
300.00	4.71	4.71	138.03	147.58	3.40	144.18	142.57
310.00	4.84	4.84	140.66	150.57	3.52	147.05	142.61
320.00	5.07	5.07	143.41	153.82	3.64	150.18	142.67
330.00	5.34	5.34	146.41	157.22	3.77	153.45	142.72

340.00	5.48	5.48	149.55	160.74	3.90	156.83	142.78
350.00	5.71	5.71	152.80	164.49	4.03	160.46	142.84
360.00	5.98	5.98	156.29	168.39	4.17	164.22	142.91
370.00	6.12	6.12	159.92	172.55	4.30	168.24	142.98
380.00	6.51	6.51	163.80	177.32	4.44	172.88	143.04
390.00	7.00	7.00	168.30	182.53	4.58	177.95	143.12
400.00	7.23	7.23	173.22	188.27	4.73	183.54	143.20
410.00	7.82	7.82	178.65	195.03	4.89	190.13	143.29
420.00	8.56	8.56	185.06	202.50	5.07	197.43	143.40
430.00	8.88	8.88	192.16	210.65	5.27	205.38	143.52
440.00	9.61	9.61	199.90	220.01	5.47	214.54	143.65
450.00	10.50	10.50	208.83	230.21	5.70	224.51	143.81
460.00	10.88	10.88	218.57	246.59	5.94	240.66	143.97
470.00	17.14	17.14	233.12	276.01	7.54	268.47	144.20
480.00	25.75	25.75	258.81	313.79	9.66	304.14	144.59
490.00	29.23	29.23	291.57	346.40	12.56	333.83	145.09
500.00	25.59	25.59	319.19	363.93	14.65	349.28	145.48
510.00	19.15	19.15	333.73	369.63	15.55	354.07	145.68
520.00	16.74	16.74	338.25	369.55	15.82	353.73	145.74
530.00	14.55	14.55	337.93	364.93	15.80	349.13	145.74
540.00	12.45	12.45	333.59	357.70	15.54	342.15	145.68
550.00	11.66	11.66	327.01	349.18	15.14	334.04	145.59
560.00	10.51	10.51	319.38	339.09	14.66	324.44	145.48
570.00	9.21	9.21	310.39	328.32	14.05	314.27	145.35
580.00	8.72	8.72	300.92	317.93	13.35	304.58	145.22
590.00	8.28	8.28	291.97	308.12	12.60	295.51	145.09
600.00	7.86	7.86	283.78	299.35	11.73	287.62	144.98
610.00	7.70	7.70	276.90	291.99	10.72	281.27	144.87
620.00	7.39	7.39	270.88	285.28	10.39	274.89	144.78
630.00	7.01	7.01	264.86	278.73	10.03	268.70	144.69
640.00	6.87	6.87	259.03	272.54	9.67	262.87	144.60
650.00	6.64	6.64	253.56	266.59	9.31	257.28	144.51
660.00	6.38	6.38	248.34	261.02	8.93	252.08	144.43
670.00	6.29	6.29	243.53	255.99	8.56	247.43	144.36
680.00	6.17	6.17	239.25	251.45	8.18	243.27	144.29
690.00	6.04	6.04	235.47	247.49	7.81	239.69	144.23
700.00	5.99	5.99	232.26	244.13	7.43	236.71	144.18
710.00	5.89	5.89	229.66	241.31	7.04	234.27	144.14
720.00	5.76	5.76	227.66	239.13	6.61	232.53	144.11
730.00	5.71	5.71	226.42	237.74	6.11	231.63	144.09
740.00	5.61	5.61	225.54	236.64	6.09	230.54	144.08
750.00	5.49	5.49	224.48	235.40	6.07	229.33	144.06
760.00	5.44	5.44	223.29	234.06	6.04	228.02	144.05
770.00	5.33	5.33	222.00	232.54	6.02	226.53	144.03
780.00	5.21	5.21	220.54	230.91	5.99	224.93	144.00
790.00	5.16	5.16	218.98	229.29	5.95	223.34	143.98
800.00	5.15	5.15	217.43	227.71	5.91	221.80	143.95
810.00	5.14	5.14	215.93	226.21	5.88	220.33	143.93
820.00	5.14	5.14	214.49	224.69	5.84	218.84	143.90
830.00	5.05	5.05	213.04	223.03	5.81	217.22	143.88
840.00	4.93	4.93	211.45	221.27	5.77	215.51	143.85
850.00	4.89	4.89	209.78	219.54	5.73	213.82	143.82
860.00	4.87	4.87	208.13	217.87	5.68	212.19	143.79
870.00	4.87	4.87	206.54	216.28	5.64	210.63	143.77
880.00	4.87	4.87	205.03	214.67	5.61	209.07	143.74
890.00	4.78	4.78	203.50	212.93	5.57	207.37	143.72
900.00	4.66	4.66	201.84	211.11	5.52	205.59	143.69
910.00	4.61	4.61	200.11	209.32	5.48	203.84	143.66
920.00	4.60	4.60	198.40	207.59	5.44	202.15	143.63
930.00	4.59	4.59	196.76	205.94	5.39	200.55	143.60
940.00	4.59	4.59	195.19	204.29	5.35	198.93	143.57
950.00	4.50	4.50	193.63	202.51	5.31	197.20	143.55
960.00	4.38	4.38	191.93	200.65	5.26	195.38	143.52
970.00	4.33	4.33	190.17	198.82	5.22	193.60	143.49
980.00	4.32	4.32	188.43	197.06	5.17	191.89	143.46
990.00	4.31	4.31	186.77	195.39	5.12	190.27	143.43
1000.00	4.31	4.31	185.19	193.81	5.08	188.73	143.41
1010.00	4.31	4.31	183.70	192.32	5.04	187.28	143.38
1020.00	4.31	4.31	182.29	190.91	5.00	185.91	143.36
1030.00	4.31	4.31	180.96	189.49	4.96	184.53	143.33

1040.00	4.22	4.22	179.61	187.94	4.92	183.02	143.31
1050.00	4.10	4.10	178.15	186.30	4.88	181.43	143.29
1060.00	4.06	4.06	176.60	184.69	4.83	179.86	143.26
1070.00	4.04	4.04	175.07	183.15	4.79	178.36	143.23
1080.00	4.03	4.03	173.62	181.68	4.74	176.94	143.21
1090.00	4.03	4.03	172.24	180.22	4.70	175.52	143.19
1100.00	3.94	3.94	170.86	178.62	4.66	173.96	143.16
1110.00	3.82	3.82	169.35	176.94	4.61	172.33	143.14
1120.00	3.77	3.77	167.77	175.30	4.56	170.74	143.11
1130.00	3.76	3.76	166.22	173.73	4.51	169.21	143.08
1140.00	3.75	3.75	164.75	172.25	4.47	167.78	143.06
1150.00	3.75	3.75	163.36	170.76	4.42	166.34	143.04
1160.00	3.66	3.66	161.97	169.16	4.38	164.78	143.01
1170.00	3.54	3.54	160.46	167.48	4.32	163.16	142.99
1180.00	3.49	3.49	158.89	165.85	4.27	161.59	142.96
1190.00	3.47	3.47	157.38	164.32	4.21	160.11	142.93
1200.00	3.47	3.47	155.95	162.88	4.16	158.72	142.90
1210.00	3.46	3.46	154.62	161.55	4.10	157.44	142.88
1220.00	3.46	3.46	153.39	160.31	4.06	156.26	142.85
1230.00	3.46	3.46	152.25	159.17	4.01	155.16	142.83
1240.00	3.46	3.46	151.19	158.12	3.97	154.15	142.81
1250.00	3.46	3.46	150.22	157.15	3.93	153.22	142.79
1260.00	3.46	3.46	149.33	156.26	3.89	152.37	142.78
1270.00	3.47	3.47	148.51	155.44	3.86	151.58	142.76
1280.00	3.47	3.47	147.75	154.68	3.83	150.85	142.75
1290.00	3.47	3.47	147.06	153.99	3.80	150.19	142.73
1300.00	3.47	3.47	146.42	153.35	3.77	149.58	142.72
1310.00	3.47	3.47	145.83	152.77	3.75	149.02	142.71
1320.00	3.47	3.47	145.30	152.23	3.72	148.51	142.70
1330.00	3.47	3.47	144.81	151.65	3.70	147.95	142.69
1340.00	3.38	3.38	144.27	150.91	3.68	147.23	142.68
1350.00	3.26	3.26	143.58	150.04	3.65	146.39	142.67
1360.00	3.21	3.21	142.78	149.18	3.61	145.57	142.65
1370.00	3.19	3.19	141.99	148.37	3.58	144.79	142.64
1380.00	3.19	3.19	141.24	147.61	3.55	144.07	142.63
1390.00	3.18	3.18	140.55	146.92	3.51	143.40	142.61
1400.00	3.18	3.18	139.92	146.28	3.49	142.80	142.60
1410.00	3.18	3.18	139.34	145.71	3.46	142.25	142.59
1420.00	3.18	3.18	138.82	145.18	3.43	141.75	142.58
1430.00	3.18	3.18	138.34	144.71	3.41	141.29	142.57
1440.00	3.18	3.18	137.90	144.27	3.39	140.88	142.56
1450.00	3.18	3.18	137.51	142.89	3.37	139.52	142.56
1460.00	2.20	2.20	136.21	139.24	3.31	135.93	142.53
1470.00	0.84	0.84	132.80	133.95	3.14	130.81	142.47
1480.00	0.32	0.32	127.93	128.37	2.88	125.50	142.38
1490.00	0.12	0.12	122.92	123.09	2.57	120.52	142.28
1500.00	0.05	0.05	118.27	118.33	2.25	116.08	142.20
1510.00	0.02	0.02	114.16	114.18	1.92	112.27	142.12
1520.00	0.01	0.01	110.70	110.71	1.57	109.14	142.05
1530.00	0.00	0.00	107.94	107.94	1.20	106.74	142.00
1540.00	0.00	0.00	106.00	106.01	0.73	105.27	141.96
1550.00	0.00	0.00	104.96	104.96	0.31	104.65	141.94
1560.00	0.00	0.00	104.34	104.34	0.31	104.03	141.93
1570.00	0.00	0.00	103.73	103.73	0.31	103.42	141.91
1580.00	0.00	0.00	103.11	103.11	0.31	102.80	141.90
1590.00	0.00	0.00	102.49	102.49	0.31	102.19	141.89
1600.00	0.00	0.00	101.88	101.88	0.31	101.57	141.88
1610.00	0.00	0.00	101.27	101.27	0.31	100.96	141.86
1620.00	0.00	0.00	100.66	100.66	0.30	100.35	141.85
1630.00	0.00	0.00	100.05	100.05	0.30	99.74	141.84
1640.00	0.00	0.00	99.44	99.44	0.30	99.14	141.83
1650.00	0.00	0.00	98.83	98.83	0.30	98.53	141.81
1660.00	0.00	0.00	98.23	98.23	0.30	97.93	141.80
1670.00	0.00	0.00	97.63	97.63	0.30	97.32	141.79
1680.00	0.00	0.00	97.02	97.02	0.30	96.72	141.77
1690.00	0.00	0.00	96.42	96.42	0.30	96.12	141.76
1700.00	0.00	0.00	95.82	95.82	0.30	95.52	141.75
1710.00	0.00	0.00	95.22	95.22	0.30	94.93	141.74
1720.00	0.00	0.00	94.63	94.63	0.30	94.33	141.72
1730.00	0.00	0.00	94.03	94.03	0.30	93.73	141.71

1740.00	0.00	0.00	93.44	93.44	0.30	93.14	141.70
1750.00	0.00	0.00	92.84	92.84	0.30	92.55	141.69
1760.00	0.00	0.00	92.25	92.25	0.30	91.96	141.68
1770.00	0.00	0.00	91.66	91.66	0.29	91.37	141.66
1780.00	0.00	0.00	91.07	91.07	0.29	90.78	141.65
1790.00	0.00	0.00	90.49	90.49	0.29	90.19	141.64
1800.00	0.00	0.00	89.90	89.90	0.29	89.61	141.63
1810.00	0.00	0.00	89.31	89.31	0.29	89.02	141.61
1820.00	0.00	0.00	88.73	88.73	0.29	88.44	141.60
1830.00	0.00	0.00	88.15	88.15	0.29	87.86	141.59
1840.00	0.00	0.00	87.57	87.57	0.29	87.28	141.58
1850.00	0.00	0.00	86.99	86.99	0.29	86.70	141.57
1860.00	0.00	0.00	86.41	86.41	0.29	86.12	141.55
1870.00	0.00	0.00	85.83	85.83	0.29	85.55	141.54
1880.00	0.00	0.00	85.26	85.26	0.29	84.97	141.53

2 yr Match Q: 6.0575 cfs Peak Out Q: 6.0533 cfs - Peak Stg: 144.05 ft - Active Vol: 1.5408 acft
10 yr Match Q: 10.8600 cfs Peak Out Q: 10.7863 cfs - Peak Stg: 144.89 ft - Active Vol: 1.9153 acft
25 yr Match Q: 16.5265 cfs Peak Out Q: 15.8192 cfs - Peak Stg: 145.74 ft - Active Vol: 2.3296 acft

Running H:\PROJECTS\204026300\CALCS\FACILITIES Report.pgm on Tuesday, February 28, 2006

Summary Report of all RLPool Data

Project Precips

[2 yr]	2.50 in
[10 yr]	3.45 in
[25 yr]	4.50 in

BASLIST2

[EXISTING] Using [TYPE1A] As [2 yr]
[EXISTING] Using [TYPE1A] As [10 yr]
[EXISTING] Using [TYPE1A] As [25 yr]
[DEVELOPED] Using [TYPE1A] As [2 yr]
[DEVELOPED] Using [TYPE1A] As [10 yr]
[DEVELOPED] Using [TYPE1A] As [25 yr]

LSTEND

BasinID	Peak Q (cfs)	Peak T (hrs)	Peak Vol (ac-ft)	Area ac	Method /Loss	Raintype	Event
EXISTING	6.0575	8.17	3.3736	32.56	SBUH/SCS	TYPE1A	2 yr
EXISTING	10.8600	8.17	5.5736	32.56	SBUH/SCS	TYPE1A	10 yr
EXISTING	16.5265	8.17	8.1487	32.56	SBUH/SCS	TYPE1A	25 yr
DEVELOPED	14.9581	8.00	5.5025	32.56	SBUH/SCS	TYPE1A	2 yr
DEVELOPED	21.7069	8.00	7.9827	32.56	SBUH/SCS	TYPE1A	10 yr
DEVELOPED	29.2338	8.00	10.7609	32.56	SBUH/SCS	TYPE1A	25 yr

BASLIST [TYPE1A] AS [2 yr] DETAILED

[EXISTING] [DEVELOPED]

LSTEND

Drainage Area: EXISTING

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	32.5600 ac	86.00	0.53 hrs	
Impervious	0.0000 ac	0.00	0.00 hrs	
Total	32.5600 ac			

Supporting Data:

Pervious CN Data:

EXISTING	86.00	32.5600 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	GRASS	300.00 ft	5.00%	0.2000	23.29 min
Shallow	GRASS	250.00 ft	5.00%	10.0000	1.86 min
Channel	GRASS	870.00 ft	5.00%	10.0000	6.48 min

Drainage Area: DEVELOPED

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	7.6900 ac	86.00	0.19 hrs	
Impervious	24.8700 ac	98.00	0.19 hrs	
Total	32.5600 ac			

Supporting Data:

Pervious CN Data:

LANDSCAPE	86.00	7.6900 ac

Impervious CN Data:

IMPERVIOUS	98.00	24.8700 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	30.00 ft	10.00%	0.2000	2.80 min
Sheet	AC	200.00 ft	2.00%	0.0110	2.39 min
Channel	PIPE	1500.00 ft	1.00%	42.0000	5.95 min

Impervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	LANDSCAPE	30.00 ft	10.00%	0.2000	2.80 min
Sheet	AC	200.00 ft	2.00%	0.0110	2.39 min
Channel	PIPE	1500.00 ft	1.00%	42.0000	5.95 min

HYDLIST SUMMARY

[OUT2] [OUT10] [OUT25]

LSTEND

HydID	Peak Q (cfs)	Peak T (hrs)	Peak Vol (ac-ft)	Cont Area (ac)
OUT2	6.05	9.00	5.6589	32.5600
OUT10	10.79	8.67	8.1306	32.5600
OUT25	15.82	8.50	10.9030	32.5600

STORLIST
[pond]
LSTEND

Node ID: pond

Desc:	Manhole structure			
Start El:	139.5000 ft		Max El:	146.0000 ft
Contrib Basin:			Contrib Hyd:	
Stage	Input	Volume	Volume	
139.50	0.00 cf	0.00 cf	0.0000	acft
140.00	5484.00 cf	5484.00 cf	0.1259	acft
141.00	17947.00 cf	17947.00 cf	0.4120	acft
142.00	32350.00 cf	32350.00 cf	0.7427	acft
143.00	48366.00 cf	48366.00 cf	1.1103	acft
144.00	66095.00 cf	66095.00 cf	1.5173	acft
145.00	85597.00 cf	85597.00 cf	1.9650	acft
146.00	106932.00 cf	106932.00 cf	2.4548	acft

DISCHLIST
[orifice]
LSTEND

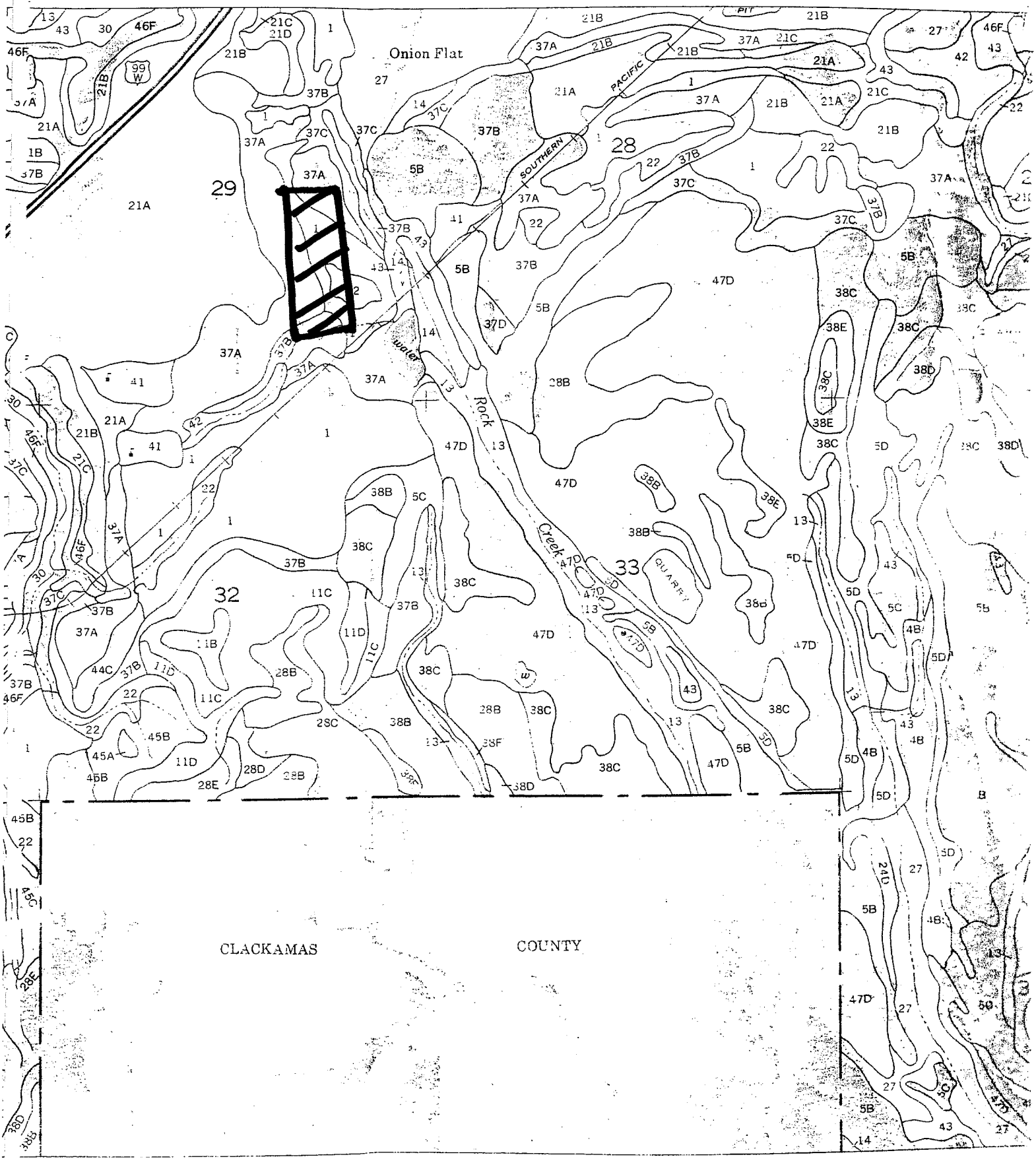
Control Structure ID: orifice - Multiple Orifice Structure

Descrip:	Multiple Orifice			
Start El	Max El	Increment		
139.0000 ft	146.5000 ft	0.10		
Orif Coeff:	0.62		Bottom El:	139.00 ft
			Lowest Diam:	2.5800 in
out to 2nd:	2.9500 ft		Diam:	11.9800 in
2nd to 3rd:	2.1500 ft		Diam:	12.3413 in
3rd to 4th:	0.8200 ft		Diam:	10.0000 in

Table III-1.3 SCS Western Washington Runoff Curve Numbers
(Published by SCS in 1982) Runoff curve numbers for selected agricultural, suburban and urban land use for Type 1A rainfall distribution, 24-hour storm duration.

LAND USE DESCRIPTION		CURVE NUMBERS BY HYDROLOGIC SOIL GROUP A	B	C	D
Cultivated land(1):	winter condition	86	91	94	95
Mountain open areas:	low growing brush & grasslands	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	undisturbed	42	64	76	81
Wood or forest land:	young second growth or brush	55	72	81	86
Orchard:	with cover crop	81	88	92	94
Open spaces, lawns, parks, golf courses, cemeteries, landscaping.					
Good condition:	grass cover on ≥75% of the area	68	80	86	90
Fair condition:	grass cover on 50-75% of the area	77	85	90	92
Gravel roads & parking lots:		76	85	89	91
Dirt roads & parking lots:		72	82	87	89
Impervious surfaces, pavement, roofs etc.		98	98	98	98
Open water bodies:	lakes, wetlands, ponds etc.	100	100	100	100
Single family residential(2):					
Dwelling Unit/Gross Acre	%Impervious(3)				
1.0 DU/GA	15				
1.5 DU/GA	20				
2.0 DU/GA	25				
2.5 DU/GA	30				
3.0 DU/GA	34				
3.5 DU/GA	38				
4.0 DU/GA	42				
4.5 DU/GA	46				
5.0 DU/GA	48				
5.5 DU/GA	50				
6.0 DU/GA	52				
6.5 DU/GA	54				
7.0 DU/GA	56				
PUD's, condos, apartments, commercial businesses & industrial areas	%impervious must be computed	Separate curve number shall be selected for pervious & impervious portions of the site or basin			

(1) For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Sec. 4, Hydrology, Chapter 9, August 1972.
(2) Assumes roof and driveway runoff is directed into street/storm system.
(3) The remaining pervious areas (lawn) are considered to be in good condition for these curve numbers.



Scale 1:20000

TABLE 13.—*Soil and*

[Absence of an entry indicates the feature is not a concern. See Glossary for descriptions of such

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Aloha: 1	C	None		
Amity: 2	C	None		
Astoria: 3E, 3F	B	None		
Briedwell: 4B, 5B, 5C, 5D	B	None		
Carlton: 6B, 6C	B	None		
Cascade: 7B, 7C, 7D, 7E, 7F	C	None		
Chehalem: 8C	C	None		
Chehalis: 9, 10	B	Common	Brief	Nov-Mar
Cornelius: [1] 11B, [1] 11C, [1] 11D, [1] 11E, [1] 11F:				
Cornelius part	C	None		
Kinton part	C	None		
Cornelius Variant: 12A, 12B, 12C	C	None		
Cove: 13, 14	D	Common	Brief	Dec-Apr
Dayton: 15	D	None		
Delena: 16C	D	None		
Goble: 17B, 17C, 17D, 17E, 18E, 18F	C	None		
Helvetia: 19B, 19C, 19D, 19E	C	None		
Hembre: 20E, 20F, 20G	B	None		
Hillsboro: 21A, 21B, 21C, 21D	B	None		
Huberly: 22	D	None		
Jory: 23B, 23C, 23D, 23E, 23F	C	None		
Kilchis: [1] 24G:				
Kilchis part	C	None		
Klickitat part	B	None		

TABLE 13.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Klickitat: 25E, 25F, 25G	B	None		
Knappa: 26	B	None		
Labish: 27	D	Frequent	Very long	Dec-Apr
Laurelwood: 28B, 28C, 28D, 28E, 29E, 29F	B	None		
McBee: 30	B	Frequent	Brief	Nov-May
Melbourne: 31B, 31C, 31D, 31E, 31F	B	None		
Melby: 32C, 32D, 32E, 33E, 33F, 33G	C	None		
Olyic: 34C, 34D, 34E, 35E, 35F, 35G	B	None		
Pervina: 36C, 36D, 36E, 36F	C	None		
* Quatama: 37A, 37B, 37C, 37D	C	None		
Saum: 38B, 38C, 38D, 38E, 38F	C	None		
Tolke: 39E, 39F	B	None		
Udifluvents: 40	B	Frequent	Very brief	Nov-Apr
Verboort: 42	D	Frequent	Brief	Dec-Apr
Wapato: 43	D	Frequent	Brief	Dec-Apr
Willamette: 44A, 44B, 44C, 44D	B	None		
Woodburn: 45A, 45B, 45C, 45D	C	None		
Xerochrepts: [1] 46F: Xerochrepts part	B	None		
Haploxerolls part	C	None		
[1] 47D: Xerochrepts part	D	None		
Rock outcrop part.				

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

OFF-SITE FLOWS

		CN
OFF-SITE AREA	= 33 Ac	86

THE ASSUMPTION IS THAT THE UPSTREAM BASIN COMPRISING ~33 Ac WILL PROVIDE DETENTION PRIOR TO DISCHARGING TO THE PROPOSED 18" PIPE. THEREFORE THE PIPE HAS BEEN DESIGNED TO ACCOMODATE EXISTING NON DEVELOPED FLOW RATES. ✓

OR

~~Between now and the time when the off-site basin is developed, what is the proposed psm the collection of the off-site runoff?~~

GROUP MACKENZIE

Portland, Oregon | Seattle, Washington | Vancouver, Washington
www.groupmackenzie.com

Off-site flows

Sherwood Industrial Project
January 6, 2006
Project #2040263

Off-site Event Summary:

BasinID	Peak Q Event	Peak T	Peak Vol	Area	Method	Raintype	
--------	(cfs)	(hrs)	(ac-ft)	ac	/Loss		
Off-site	9.66	8.17	5.6489	33.00	SBUH/SCS	TYPE1A	10 yr

Drainage Area: Off-site

Hyd Method:	SBUH Hyd		Loss Method:	SCS CN Number
Peak Factor:	484.00		SCS Abs:	0.20
Storm Dur:	24.00 hrs		Intv:	10.00 min
	Area	CN	TC	
Pervious	33.0000 ac	86.00	0.73 hrs	
Impervious	0.0000 ac	0.00	0.00 hrs	
Total	33.0000 ac			

Supporting Data:

Pervious CN Data:

Off-site contributing area	86.00	33.0000 ac

Pervious TC Data:

Flow type:	Description:	Length:	Slope:	Coeff:	Travel Time
Sheet	Sheet flow	300.00 ft	2.00%	0.2400	38.88 min
Shallow	overland flow	300.00 ft	2.00%	10.0000	3.54 min
Channel	grass	200.00 ft	2.00%	17.0000	1.39 min

Pipe Sizing Calculation

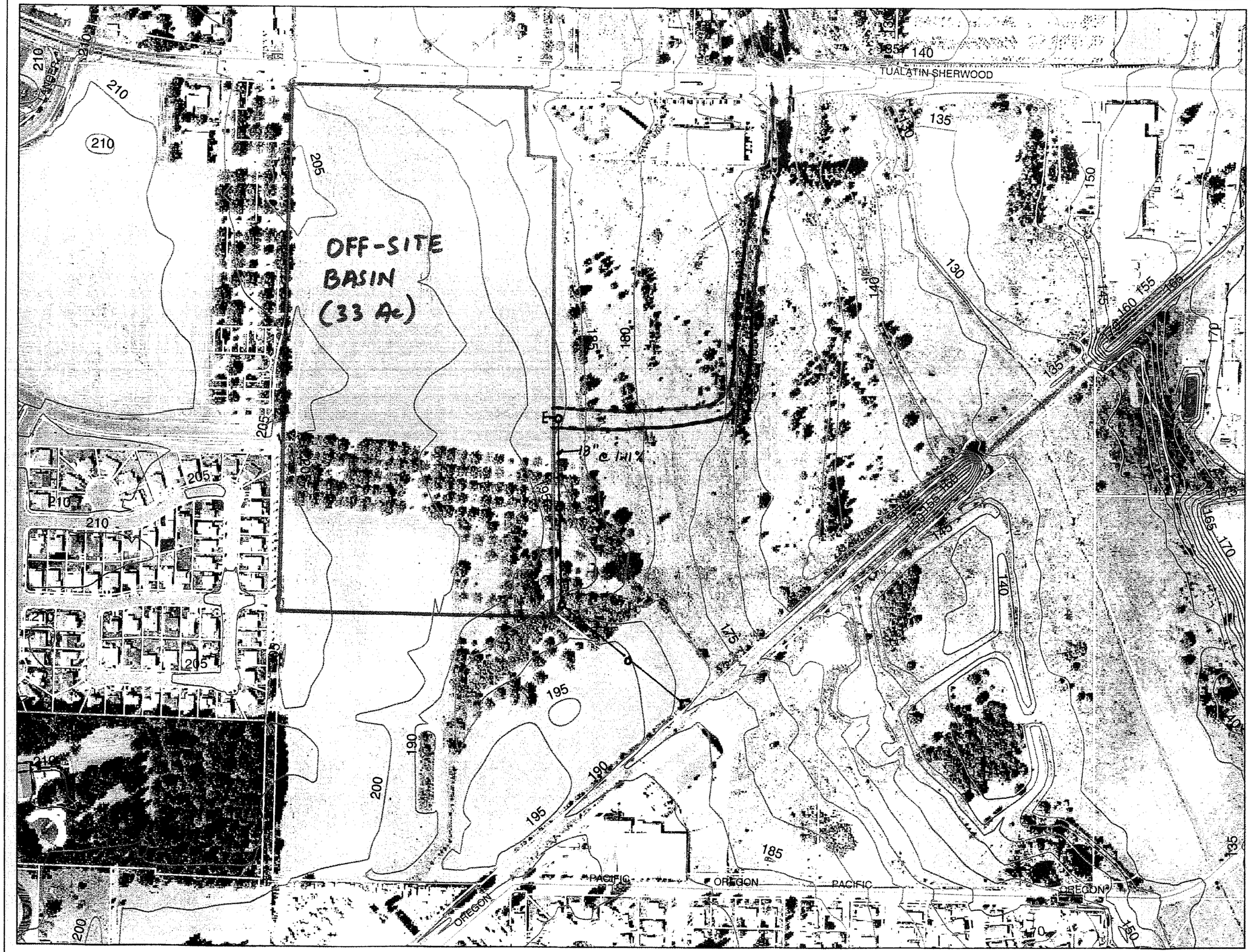
Based on SCS flow inputs
(Flows calculated in "Stormshed")

GROUP MACKENZIE
0690 SW Bancroft Street / PO Box 69039 Portland, OR 97201
Tel: 503.224.9560 Net: info@grpmack.com Fax: 503.228.1285

Project: Sherwood Industrial Park -Offsite
By: rlf
Date: 1/6/2006
Job: 2040263

Mannings n= 0.012

Link (#)	Storm Input Descriptions	Incremental Flow (cfs)	Total Flow (cfs)	Pipe Slope (%)	Pipe Diameter (inches)	Pipe Capacity (cfs)	Pipe Velocity (fps)
1	Off-site	9.66	9.66	1.11	18	11.97	6.78



0 150 300 600 Feet

SCALE

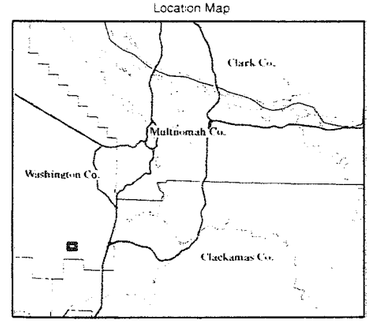
Source Data

Base Data: Metro RLIS Lite November 2005

Geographic Projection Information

NAD 83 HARN Oregon North
Lambert Conformal Conic

Location Map



GROUP MACKENZIE
0690 SW Bancroft Street | PO Box 69039 | Portland, OR 97239
www.groupmackenzie.com | info@grpmack.com
tel: 503.224.9560 | 360.695.7879 | fax: 503.226.1285

Date: 1/05/06
File: Sherwood_rlf.mxd

Map Created by: RK
Project No.

FRICTION LOSS IN PIPE

h_f = SLOPE REQUIRED

$$AR^{2/3} = \frac{Qn}{1.486\ (S)^{1/2}}$$

$$S^{1/2} = \frac{Qn}{1.486\ AR^{2/3}}$$

$$S = \left[\frac{Qn}{1.486\ AR^{2/3}}\right]^2$$

$$S = \left[\frac{16.52 * 0.012}{1.486 * 3.141\left[0.5\right]^{2/3}}\right]^2$$

$Q = 16.52$ cfs (25 YR)

$A = 3.141\ ft^2$

$R = \frac{A}{P} = \frac{3.141}{6.282} = 0.5$

$n = 0.012$

$S = 0.0045\ ft/ft$

$h_f = 0.0045 \times 22' = 0.10' = 1.20''$

By _____

Date _____

Job # _____

Sht. _____ of _____

GROUP MACKENZIE

Portland, Oregon | Seattle, Washington | Vancouver, Washington
www.groupmackenzie.com