EXHIBIT 17
CEC PRELIMINARY DRAINAGE REPORT

PRELIMINARY DRAINAGE REPORT

COFFIN BUTTE LANDFILL
CORVALLIS, OREGON

Prepared For:

REPUBLIC SERVICES

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
PHOENIX, ARIZONA

CEC Project: 332-142

JANUARY 2024

EXPIRES: 06-30-2024

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1.0 INTRODUCTION

The purpose of this drainage report is to provide the analysis for the proposed Coffin Butte Landfill expansion project located at 28972 Coffin Butte Road, Corvallis, OR 97330. The proposed project will be an expansion of the landfill to the south side of Coffin Butte Road. This will be referred to in this report as the Proposed Development Area. For the design, the SCS method within Civil 3D's HydraFlow was used to calculate onsite flows. For onsite stormwater management, a combination detention and wet pond facility was designed using the Corvallis stormwater design standards. The outflow of all onsite stormwater is conveyed by way of a graded swale to a 12-inch culvert crossing to the north side of Coffin Butte Road and ultimately discharging into an existing detention facility.

2.0 EXISTING DRAINAGE CONDITIONS

The existing expansion area drains from west to east towards Coffin Butte Road which includes a drainage ditch. To the north of Coffin Butte Road is another existing drainage channel conveying flows for the existing landfill area.

3.0 PROPOSED DRAINAGE CONDITIONS

3.1 STORMWATER DRAINAGE ANALYSIS

3.1.1 General

The drainage control systems for the Coffin Butte Landfill expansion have been designed to accommodate the anticipated volume of precipitation and resulting run-off generated from the peak 25-year, 24-hour rainfall event. The stormwater hydrology was calculated using the SCS method within Civil 3D's HydraFlow. It was then used to determine the 25-year, 24-hour stormwater discharge based on intensities for a 10-min time of concentration. Pond routing was performed to attenuate the peak flows of a 25-year, 24-hour storm event.

3.1.2 Rainfall Distribution

Rainfall distribution is represented as one of the four regional time-distribution types, which define the portion of rainfall that falls at any time within the 24-hour storm event type. Shown in **Figure 1**, all of western Oregon, including the Proposed Development Area, is located within the Soil Conversation Service (SCS) Type IA rainfall distribution zone. Thus, the Type IA rainfall distribution was used for the current drainage analysis.

3.1.3 Rainfall Amount

The rainfall amounts used in the hydrologic analysis of the Proposed Development Area were obtained from National Oceanic and Atmospheric Administration (NOAA) Atlas 2 rainfall frequency maps. The peak 2-year, 5-year, 10-year, and 25-year, 24-hour storm events were determined to be 3.1, 3.8, 4.4, and 5.1 inches, respectively. The corresponding rainfall frequency maps are shown in **Figures 2, 3, 4,** and **5**.

3.2 PEAK RUN-OFF DETERMINATION

The SCS Unit Hydrograph method was used within Civil 3D's HydraFlow to compute the onsite peak discharges for the 2-year, 24-hour and 25-year, 24-hour storm events, assuming a 10-minute time of concentration. A runoff curve number (CN) of 84 was used, which is representative of a hydrologic soil type D material with grass covering 50-75% of the area.
Refer to **Appendix A** for Hydrologic Calculations.

3.3 ONSITE HYDRAULICS AND DRAINAGE INFRASTRUCTURE

Onsite drainage for the site will be captured by graded swales and conveyed to proposed catch basins. The proposed catch basins direct flows to a combined detention and wet pond facility. The design 25-year, 24-hour storm event was estimated to generate a total site peak discharge of approximately 45.13 cubic feet/second (cfs). The use of an 8-inch HDPE storm pipe with an orifice restrictor plate in the combined wet pond detention facility outfall structure was designed to limit the outlet flow. The outlet flow is designed to outfall to an existing channel north of Coffin Butte Road and is conveyed to an existing detention facility located on the southeast corner of the Coffin Butte Landfill.
Refer to **Appendix B** for Hydraulic Calculations.

3.3.1 Stormwater management

The combined detention and wet pond were designed for the project site according to the Corvallis, Oregon Stormwater Design Standards, dated December 2015. The manual outlines the design criteria and process for both a wet pond and a detention facility. When combined, the detention facility can be stacked above the wet pond to reduce loss of development area. Both criteria are required when designing a combined system. When conflicting requirements are encountered, the stricter requirements are utilized for design. Wet ponds using this design criteria are expected to meet a treatment goal of 70 percent TSS removal. For wet pond analysis, the required wet pond volume ($V_b = fV_r$) is used to determine the overall dimensions of the storage facility. To calculate the wet pond volume, a minimum volume factor (f) of 3 is applied to the final required volume found for the site, as per Corvallis Stormwater Design Standards. Based on the 100-yr, 24-hr storm event, the rainfall from the mean annual storm (R) is reported in the design standards as 0.61 inches. Finally, the runoff from the mean annual storm (V_r) is calculated based on the soil type for the developed site. There are four soil types that are considered for this method of analysis that correspond to soil types associated with SCS hydrological soil group classifications:

- Impervious (hard, non-penetrable surfaces).
- Till grass (post-development grass or landscaped area and onsite forested land on Type C or D soils).
- Till forest (permanent onsite forest and shrub cover located on type C or D soils); and
- Outwash (soil that infiltrates well and produces small amounts of runoff, type A and B soils).

For the proposed site, type D soil was used with the assumption of the till grass option (A_{tg}), landscaped areas and post-development grass. The overall area for the development is approximately 68.60 acres or 2,988,124 sf. The runoff from the mean annual storm is calculated using the following formula:

$$V_r = \left(0.9Ai + 0.25A_{tg} + 0.10A_{tf} + 0.01A_o\right) \times R$$

Where:

$V_r = Volume\ of\ runoff\ from\ mean\ annual\ storm\ (cf)$

$A_i = Area\ of\ impervious\ surface\ (sf)$

$A_{tg} = Area\ of\ till\ soil\ covered\ with\ grass\ (sf)$

$A_{tf} = Area\ of\ soil\ covered\ with\ forest\ (sf)$

$A_o = Area\ of\ outwash\ soil\ covered\ with\ grass\ or\ forest\ (sf)$

$R = Rainfall\ from\ mean\ annual\ storm\ (ft)$

$$V_r = (0 + 0.25(2{,}988{,}124\ sf) + 0 + 0) \times \left(\frac{0.61}{12} ft\right) \approx 37{,}974\ cf$$

Therefore, the wet pond volume is calculated as follows:

$$V_b = fV_r$$
$$V_b = 3 \times 37{,}975\ cf \approx 113{,}922\ cf$$

To determine the dimensions of the wet pond, the first wet pool cell must have the capacity to hold 25% to 35% of the wet pond volume. Refer to **Figure 6** for a typical plan view of a combined detention and wet pond design. For the proposed wet pond 35% of the required volume was used for design.

$$0.35 \times 113{,}922\ cf \approx 39{,}873\ cf$$

The overall wet pond dimensions were designed to be approximately 275 ft x 165 ft measured at the highest elevation, with a berm separating the primary and secondary cells. The primary cell dimensions are approximately 90 ft x 165 ft with a maximum depth (not including the sediment storage depth) of eight (8) ft, giving an approximate volume of 66,000 cf. The proposed wet pond design exceeds required capacity.

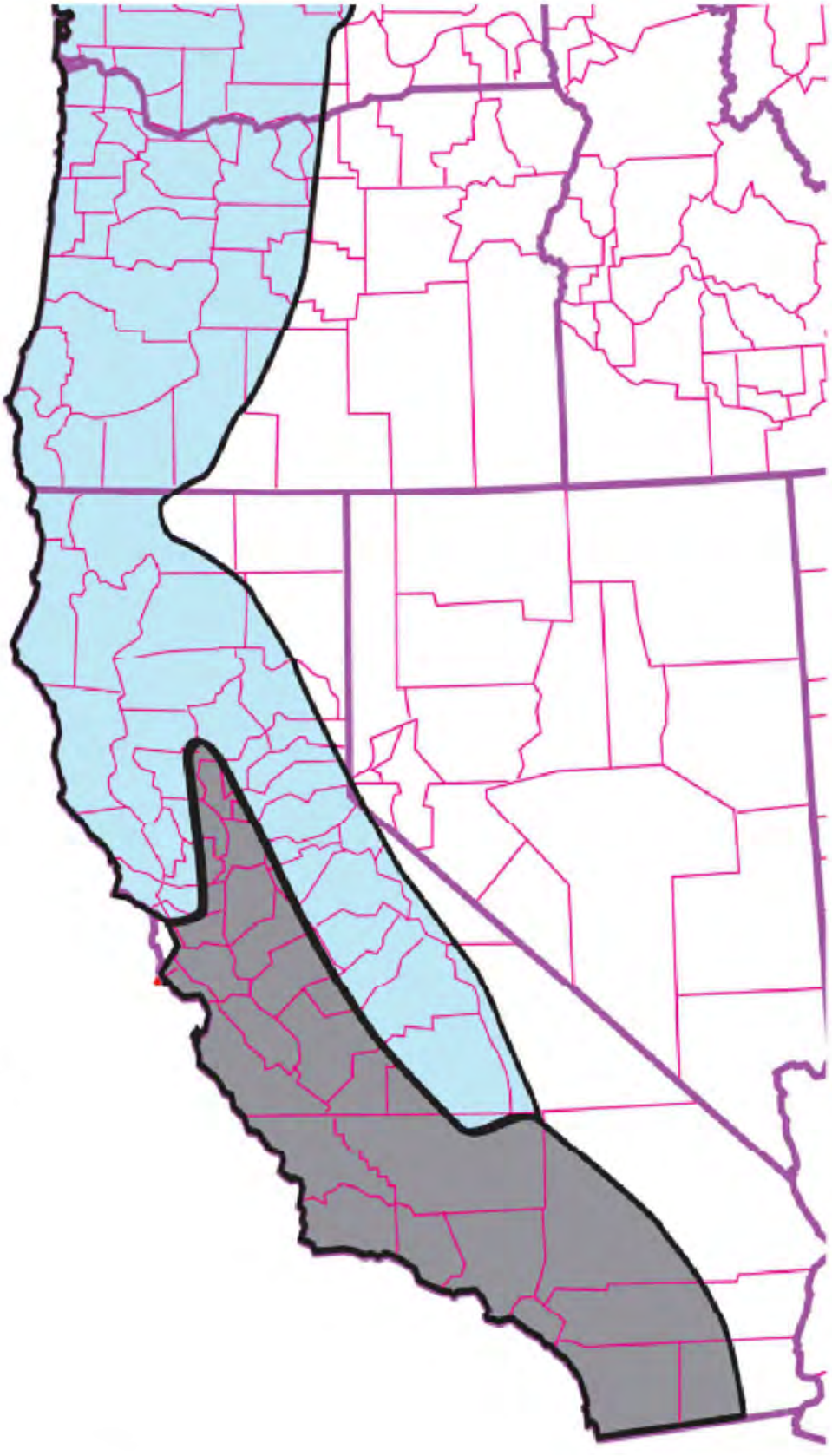
Refer to **Appendix A** for Stage Storage Report.

4.0 CONCLUSION

- The Coffin Butte Landfill expansion project will adhere to Corvallis stormwater design standards for Storm Drainage Facilities.
- When the Coffin Butte Landfill expansion area reaches final grades, the detention and wet pond facility will exceed the required stormwater storage capacity.
- An attenuated flow of 1.21 cfs will be added to the existing drainage channel north of Coffin Butte Road, ultimately discharging into the existing detention pond.

5.0 REFERENCES

- 2015 Stormwater Design Standards, Corvallis, Oregon.
- National Oceanic and Atmospheric Administration (NOAA) Atlas 2.



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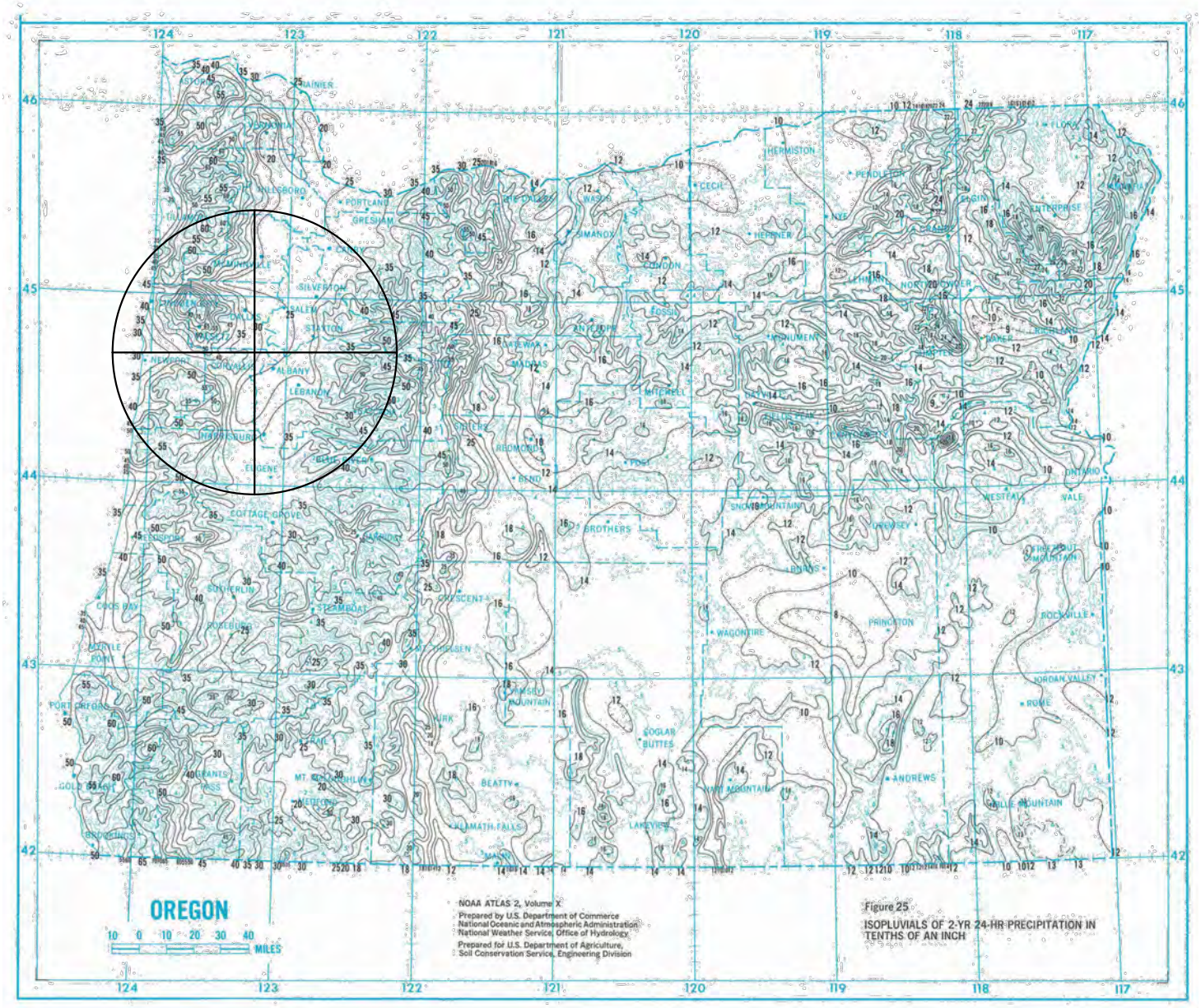
28972 COFFIN BUTTE ROAD
CORVALLIS, OR 97330

CONDITIONAL USE PERMIT APPLICATION
SCS RAINFALL DISTRIBUTION

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	1
DATE:	JANUARY 2024	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		

P:\320-000\322-142\-CADD\Dwg\Exhibits\Drainage Report Exhibits\322142-1-SCS Rainfall Distribution.dwg{1} LS:(10/10/2023 - dbegell) - LP: 1/25/2024 3:52 PM



2–YEAR 24–HOUR STORM = 3.10 IN

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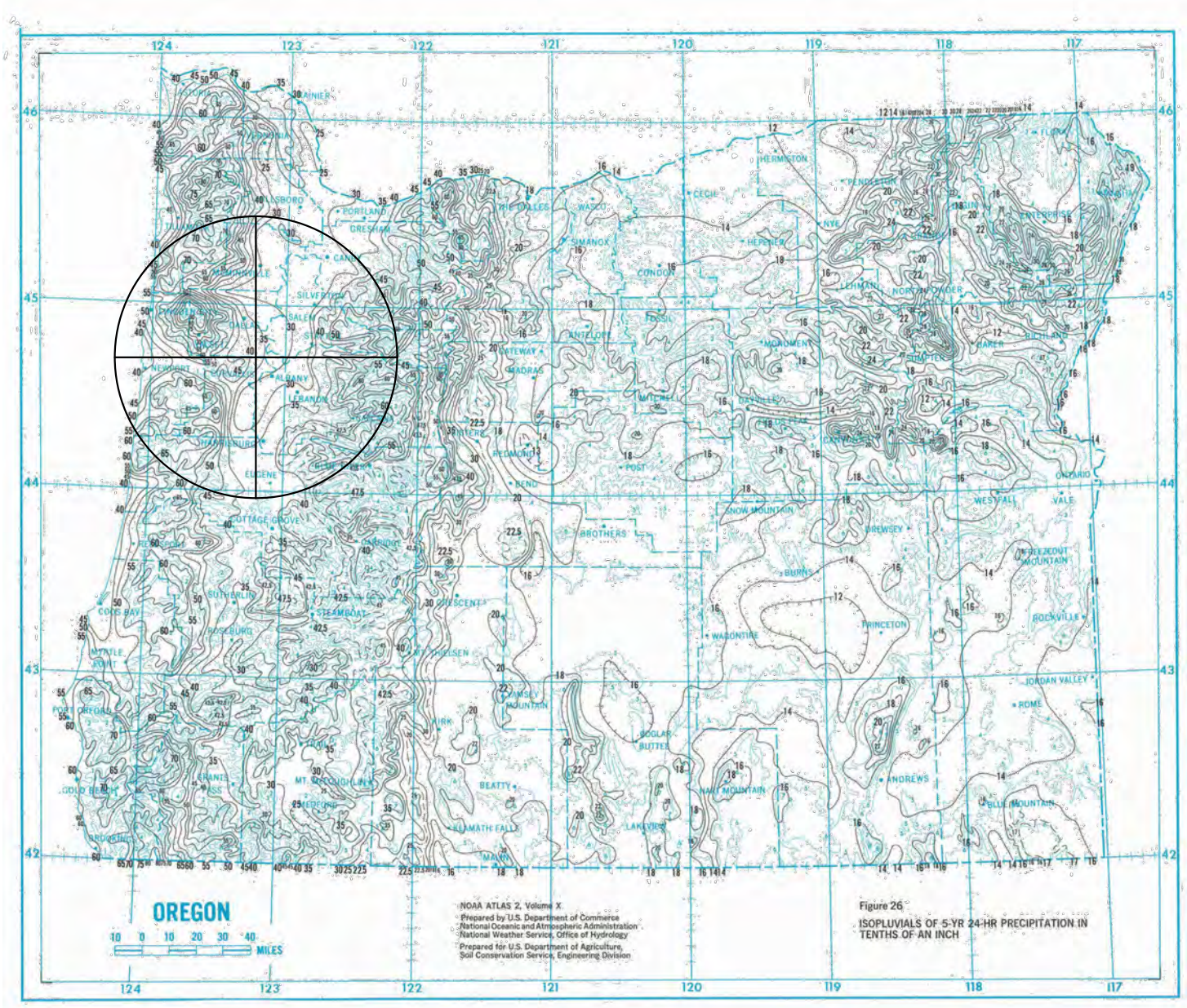
CONDITIONAL USE PERMIT APPLICATION
2-YR 24-HR RAINFALL DISTRIBUTION MAP

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:
DATE:	JANUARY 2024	DWG SCALE:	N.T.S.	PROJECT NO:	322-142	2

P:\320-000\322-142\-CADD\Dwg\Exhibits\Drainage Report Exhibits\322142-2-Storm event 1.dwg{1} LS:(1/25/2024 - jshah) - LP: 1/25/2024 4:22 PM



5–YEAR 24–HOUR STORM = 3.80 IN

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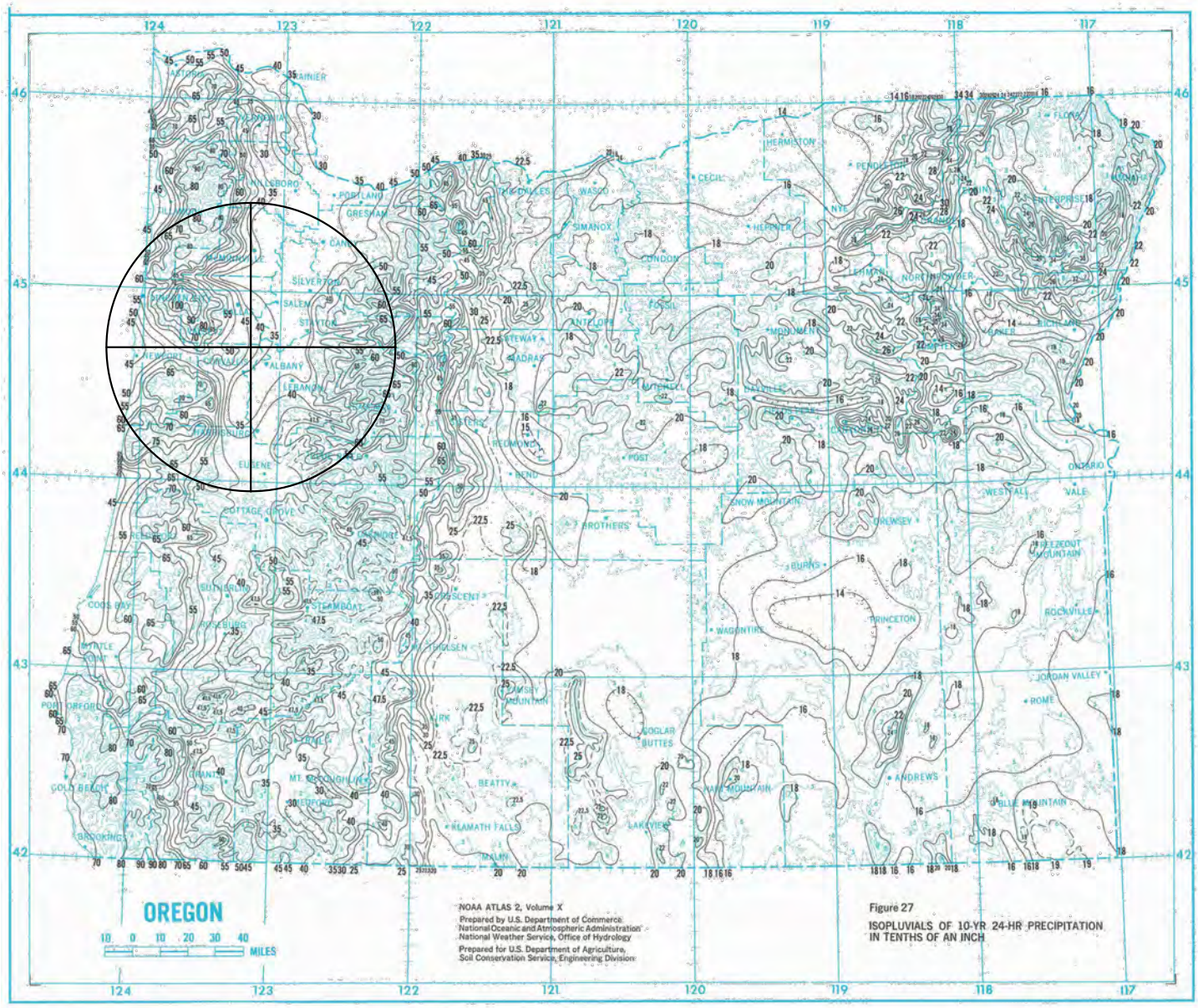
CONDITIONAL USE PERMIT APPLICATION
5-YR 24-HR RAINFALL DISTRIBUTION MAP

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	3
DATE:	JANUARY 2024	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		

P:\320-000\322-142\-CADD\Dwg\Exhibits\Drainage Report Exhibits\322142-5 Yr Storm event.dwg{2} LS:(1/25/2024 - jshah) - LP: 1/26/2024 9:11 AM



10–YEAR 24–HOUR STORM = 4.40 IN

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CONDITIONAL USE PERMIT APPLICATION
10-YR 24-HR RAINFALL DISTRIBUTION MAP

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	4
DATE:	JANUARY 2024	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		

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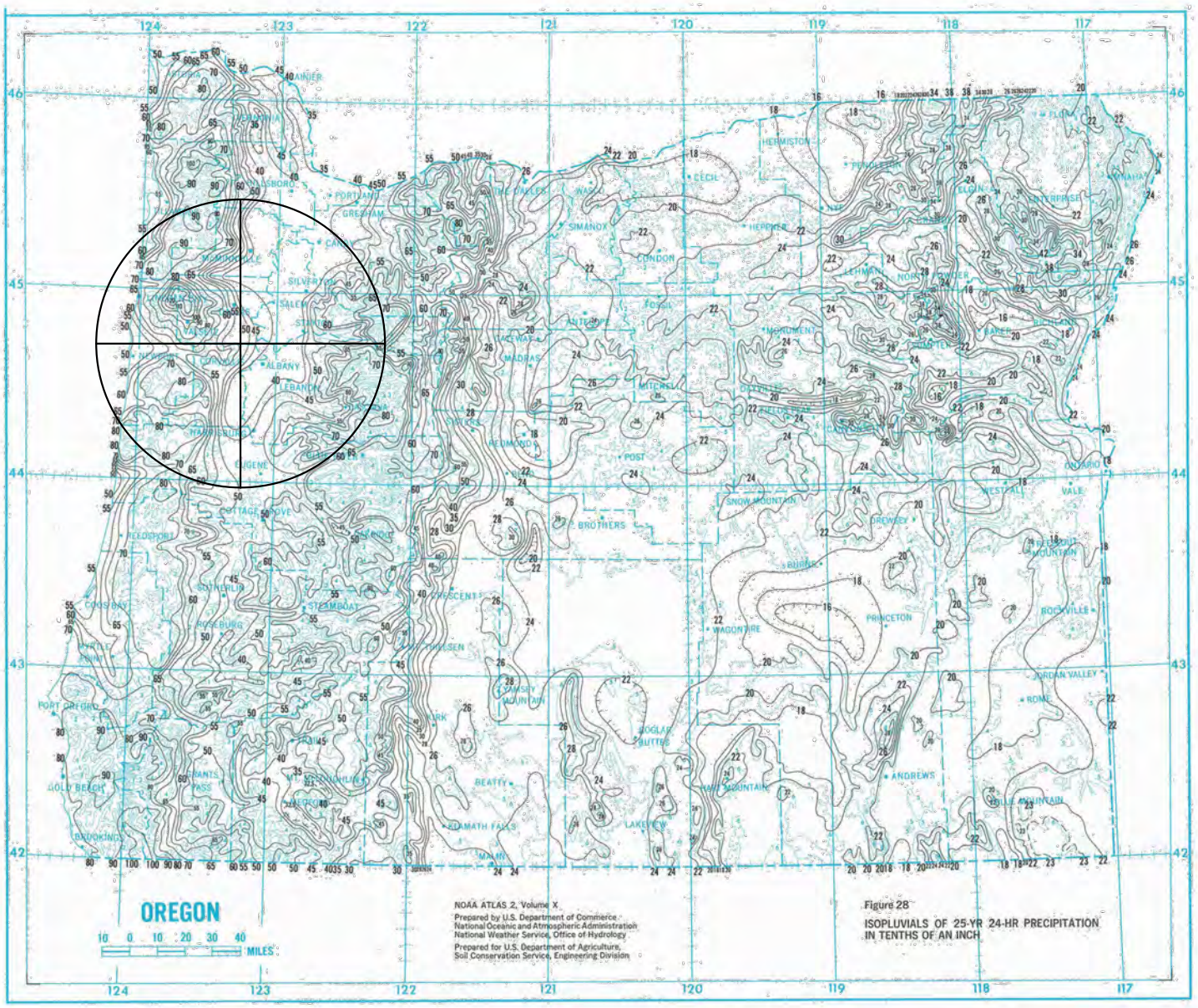

25–YEAR 24–HOUR STORM = 5.10 IN

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CONDITIONAL USE PERMIT APPLICATION
25-YR 24-HR RAINFALL DISTRIBUTION MAP

DRAWN BY:	JS	CHECKED BY:	JAS	APPROVED BY:	JAS	FIGURE NO.:	5
DATE:	JANUARY 2024	DWG SCALE:	N.T.S.	PROJECT NO:	322-142		

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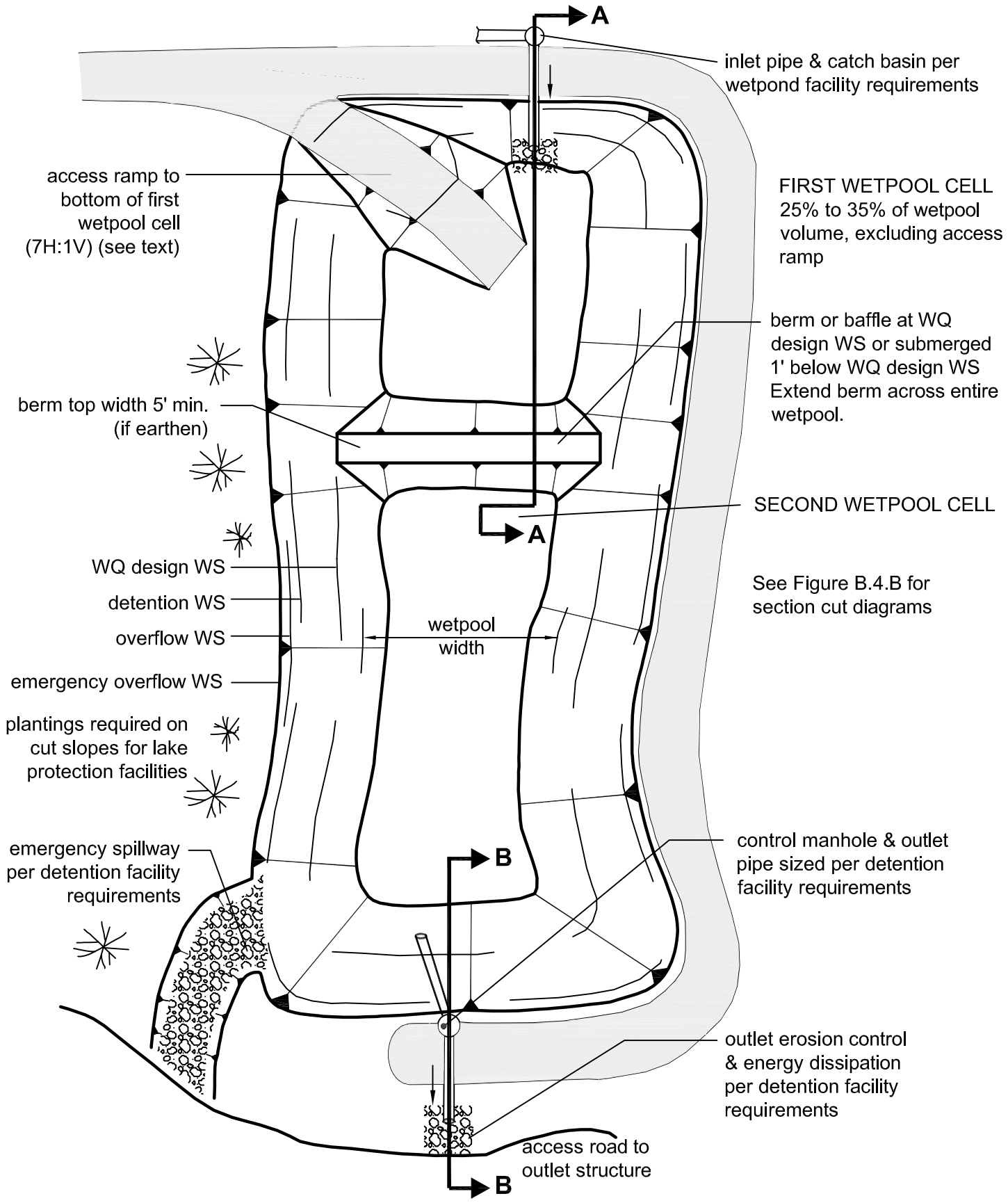
FIGURE 6. COMBINED DETENTION AND WETPOND



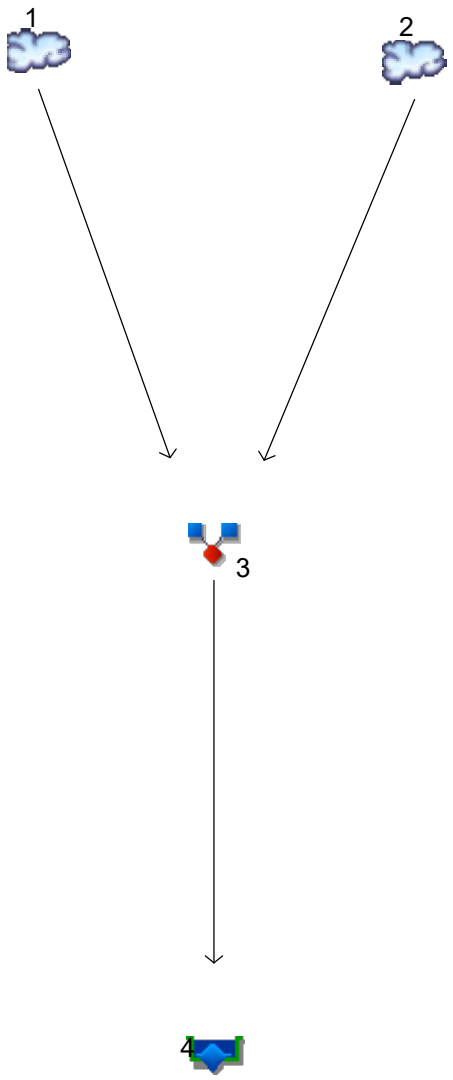
PLAN VIEW
NTS

2015 Stormwater Design Standards, Oregon.

APPENDIX A

HYDROLOGIC CALCULATIONS

Watershed Model Schematic



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	6.757	2	480	103,789	------	------	------	DA-1
2	SCS Runoff	19.98	2	480	306,819	------	------	------	DA-2
3	Combine	24.62	2	476	372,682	1, 2	------	------	Combine
4	Reservoir	0.686	2	1446	141,428	3	243.46	353,891	Pond Routing

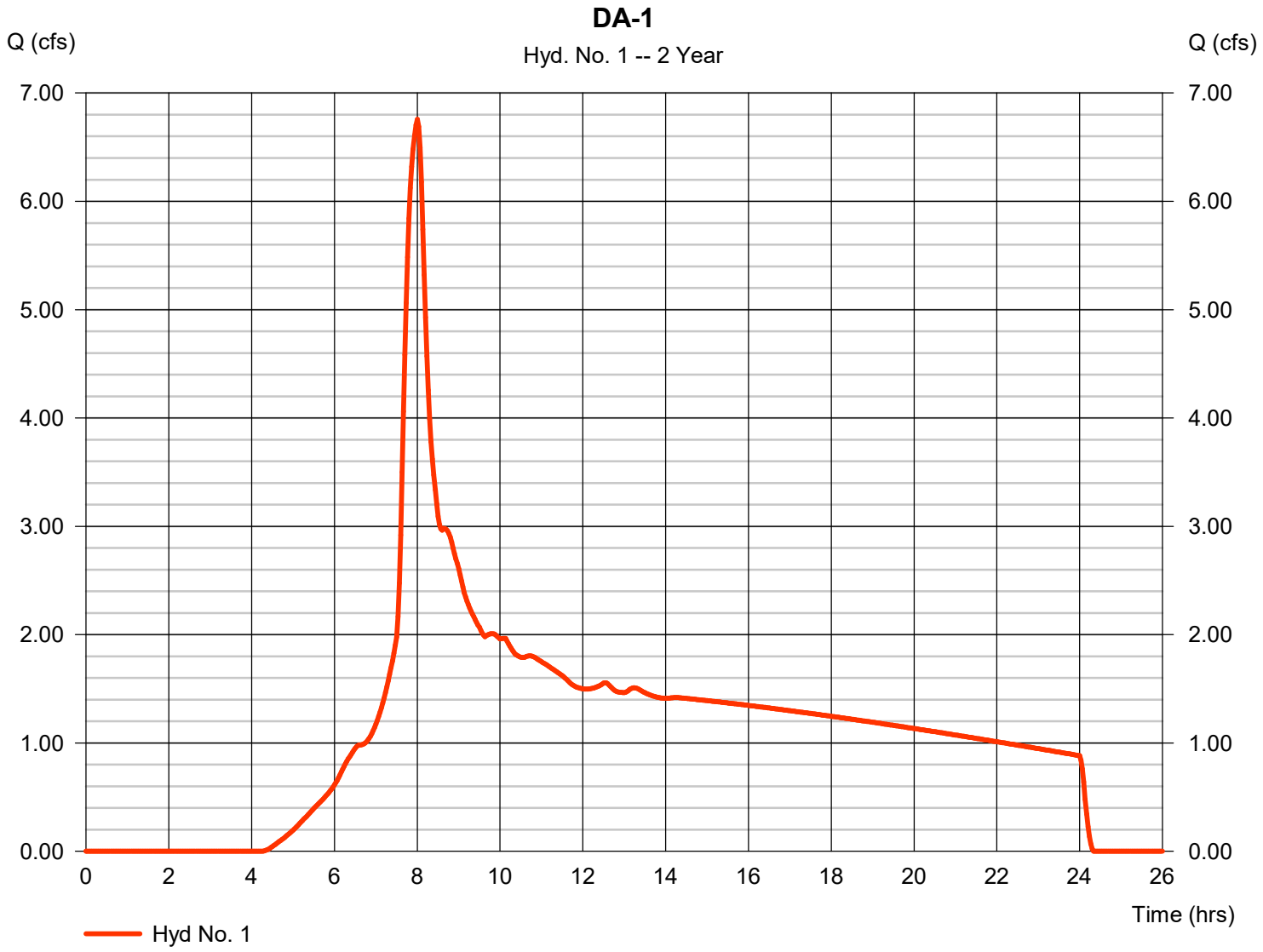
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Hyd. No. 1

DA-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.757 cfs
Storm frequency	=	2 yrs	Time to peak	=	8.00 hrs
Time interval	=	2 min	Hyd. volume	=	103,789 cuft
Drainage area	=	17.340 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



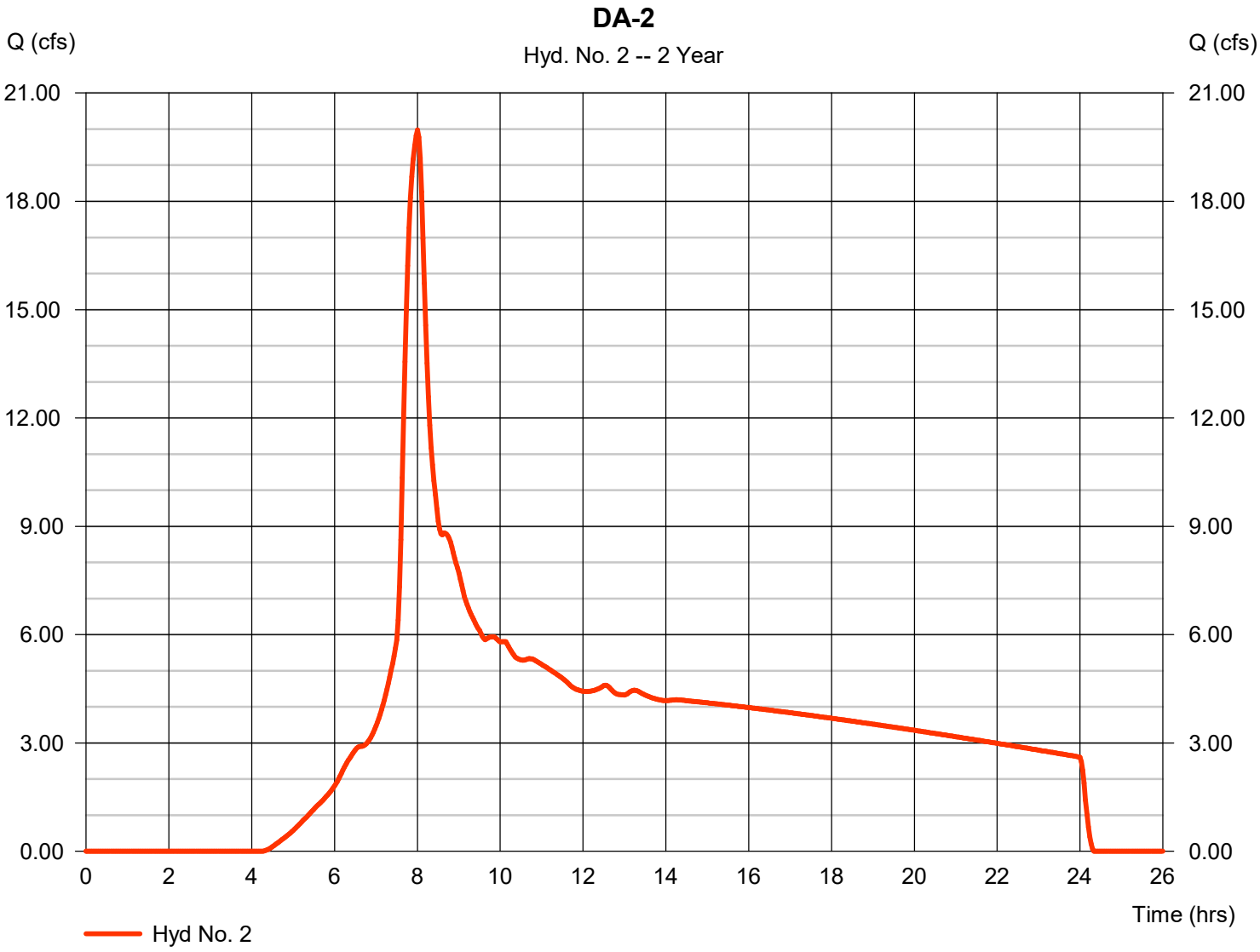
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Hyd. No. 2

DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.98 cfs
Storm frequency	=	2 yrs	Time to peak	=	8.00 hrs
Time interval	=	2 min	Hyd. volume	=	306,819 cuft
Drainage area	=	51.260 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	3.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



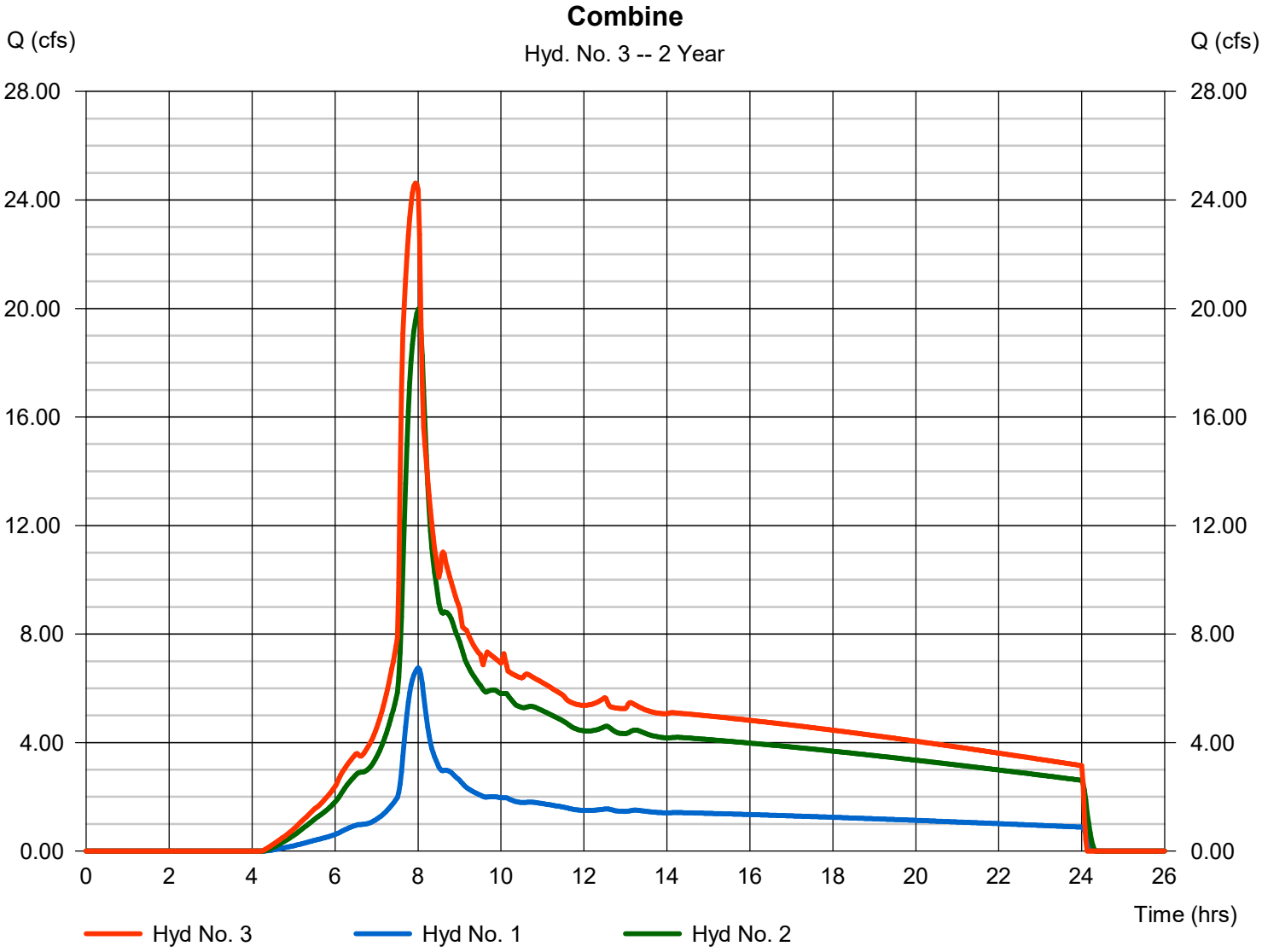
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Hyd. No. 3

Combine

Hydrograph type	=	Combine	Peak discharge	=	24.62 cfs
Storm frequency	=	2 yrs	Time to peak	=	7.93 hrs
Time interval	=	2 min	Hyd. volume	=	372,682 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	68.600 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	15.27	2	480	218,233	------	------	------	DA-1
2	SCS Runoff	45.13	2	480	645,134	------	------	------	DA-2
3	Combine	55.48	2	474	783,620	1, 2	------	------	Combine
4	Reservoir	1.211	2	1446	327,037	3	249.45	728,996	Pond Routing

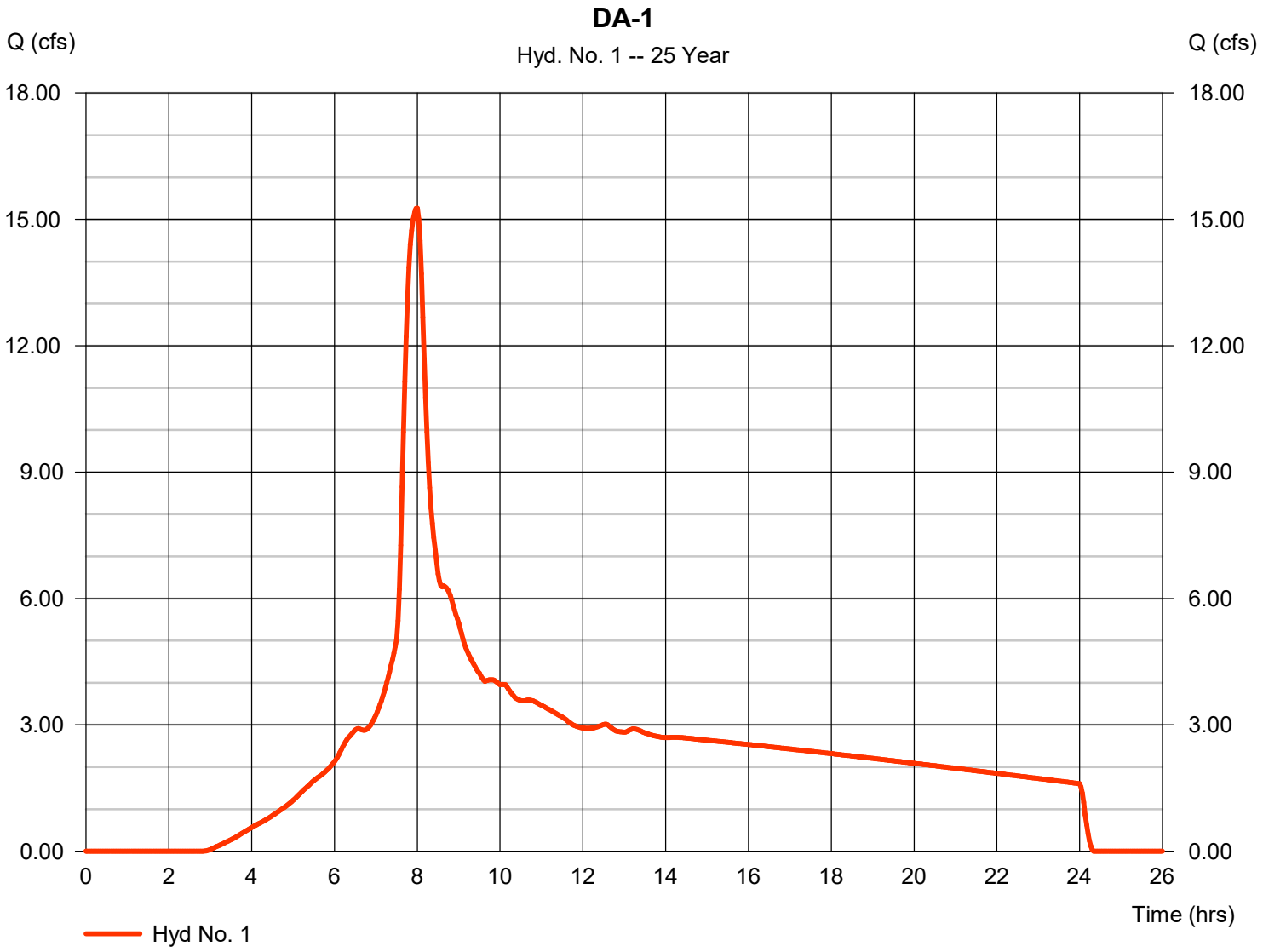
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Hyd. No. 1

DA-1

Hydrograph type	=	SCS Runoff	Peak discharge	=	15.27 cfs
Storm frequency	=	25 yrs	Time to peak	=	8.00 hrs
Time interval	=	2 min	Hyd. volume	=	218,233 cuft
Drainage area	=	17.340 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



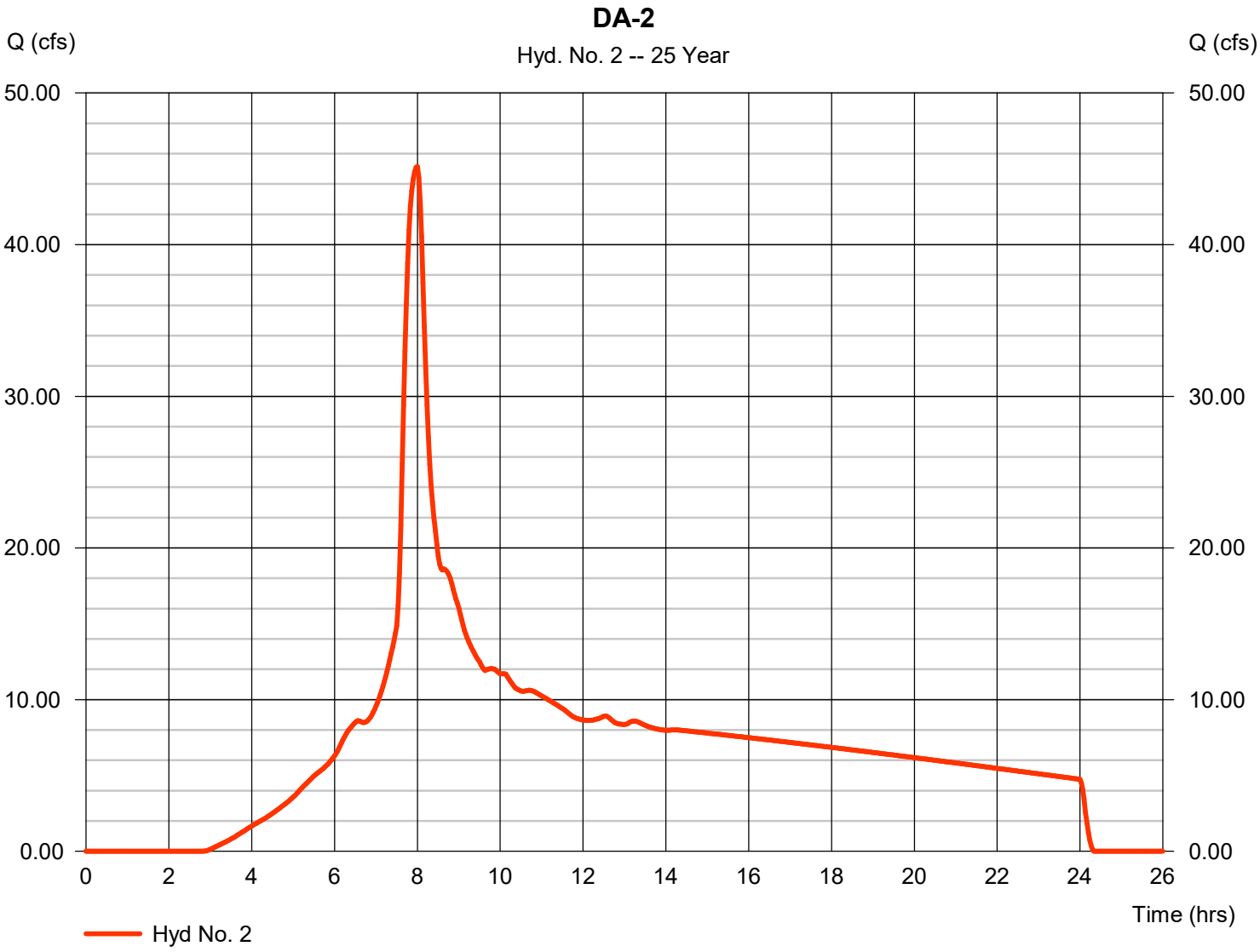
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Hyd. No. 2

DA-2

Hydrograph type	=	SCS Runoff	Peak discharge	=	45.13 cfs
Storm frequency	=	25 yrs	Time to peak	=	8.00 hrs
Time interval	=	2 min	Hyd. volume	=	645,134 cuft
Drainage area	=	51.260 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.10 in	Distribution	=	Type IA
Storm duration	=	24 hrs	Shape factor	=	484



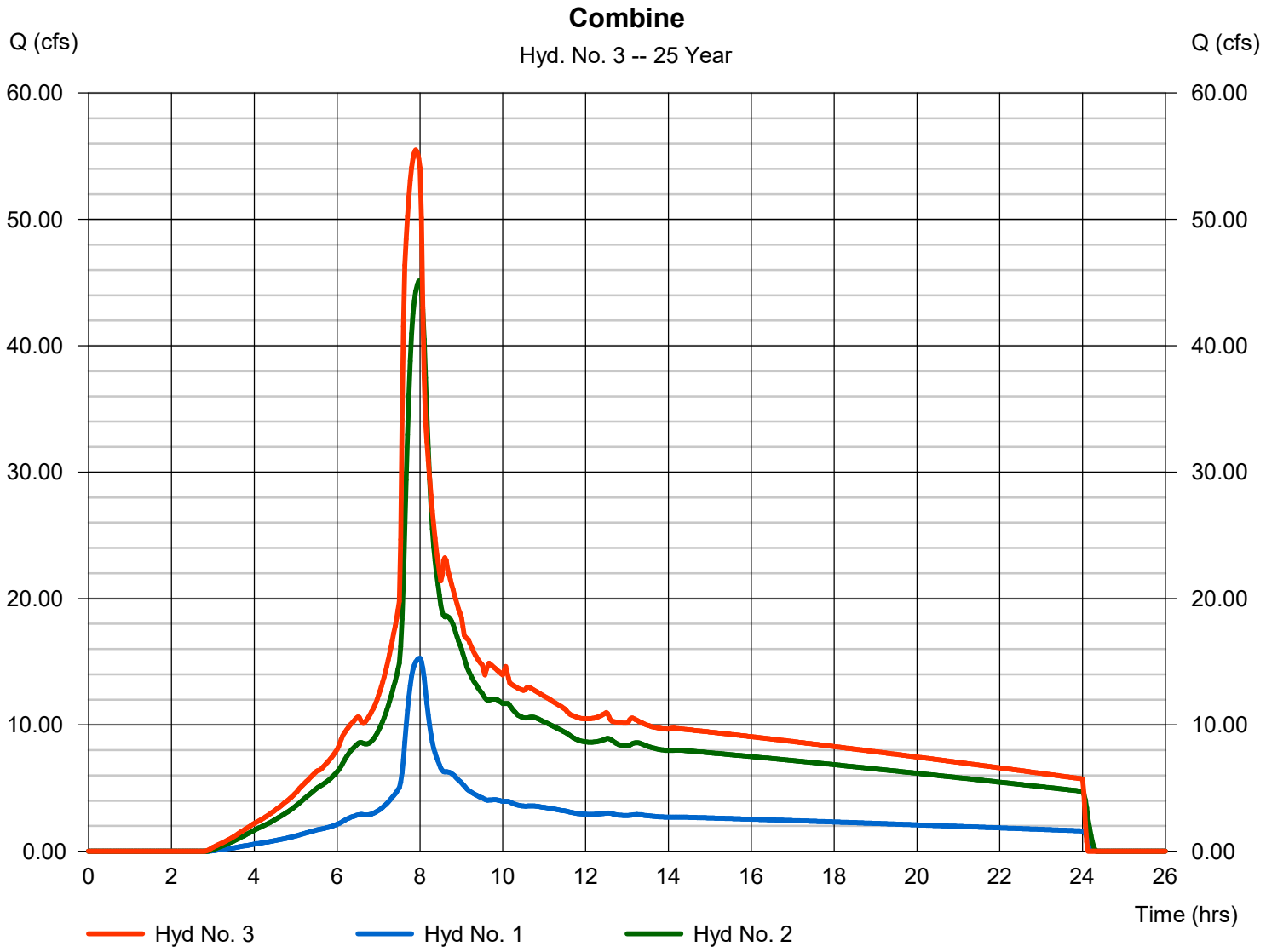
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Hyd. No. 3

Combine

Hydrograph type	=	Combine	Peak discharge	=	55.48 cfs
Storm frequency	=	25 yrs	Time to peak	=	7.90 hrs
Time interval	=	2 min	Hyd. volume	=	783,620 cuft
Inflow hyds.	=	1, 2	Contrib. drain. area	=	68.600 ac



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024 Thursday, 01 / 25 / 2024

Pond No. 1 - Pond 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 234.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	234.00	22,907	0	0
2.00	236.00	28,323	51,129	51,129
4.00	238.00	34,399	62,618	113,747
6.00	240.00	41,042	75,336	189,083
8.00	242.00	48,702	89,626	278,709
10.00	244.00	54,668	103,303	382,012
12.00	246.00	60,881	115,482	497,493
14.00	248.00	67,458	128,270	625,763
16.00	250.00	74,547	141,932	767,696

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	4.00	0.00	0.00
Span (in)	= 8.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 240.29	240.29	0.00	0.00
Length (ft)	= 40.00	0.00	0.00	0.00
Slope (%)	= 2.52	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	Yes	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	234.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
2.00	51,129	236.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
4.00	113,747	238.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
6.00	189,083	240.00	0.00	0.00	---	---	---	---	---	---	---	---	0.000
8.00	278,709	242.00	0.48 ic	0.48 ic	---	---	---	---	---	---	---	---	0.481
10.00	382,012	244.00	0.75 ic	0.75 ic	---	---	---	---	---	---	---	---	0.749
12.00	497,493	246.00	0.95 ic	0.95 ic	---	---	---	---	---	---	---	---	0.946
14.00	625,763	248.00	1.11 ic	1.11 ic	---	---	---	---	---	---	---	---	1.107
16.00	767,696	250.00	1.25 ic	1.25 ic	---	---	---	---	---	---	---	---	1.248

APPENDIX B

HYDRAULIC CALCULATIONS

Worksheet for 8" HDPE Pipe @ 2.52%

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	2.520 %
Normal Depth	8.0 in
Diameter	8.0 in

Results	
Discharge	1.92 cfs
Flow Area	0.3 ft²
Wetted Perimeter	2.1 ft
Hydraulic Radius	2.0 in
Top Width	0.00 ft
Critical Depth	7.4 in
Percent Full	100.0 %
Critical Slope	2.179 %
Velocity	5.50 ft/s
Velocity Head	0.47 ft
Specific Energy	1.14 ft
Froude Number	(N/A)
Maximum Discharge	2.06 cfs
Discharge Full	1.92 cfs
Slope Full	2.520 %
Flow Type	Undefined

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	8.0 in
Critical Depth	7.4 in
Channel Slope	2.520 %
Critical Slope	2.179 %

Worksheet for 18" HDPE Pipe @ S=0.2%

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.200 %
Normal Depth	18.0 in
Diameter	18.0 in

Results	
Discharge	4.70 cfs
Flow Area	1.8 ft²
Wetted Perimeter	4.7 ft
Hydraulic Radius	4.5 in
Top Width	0.00 ft
Critical Depth	10.0 in
Percent Full	100.0 %
Critical Slope	0.566 %
Velocity	2.66 ft/s
Velocity Head	0.11 ft
Specific Energy	1.61 ft
Froude Number	(N/A)
Maximum Discharge	5.05 cfs
Discharge Full	4.70 cfs
Slope Full	0.200 %
Flow Type	Undefined

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	0.0 %
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	18.0 in
Critical Depth	10.0 in
Channel Slope	0.200 %
Critical Slope	0.566 %

Worksheet for 18" HDPE Pipe @ S=3.98%

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Roughness Coefficient	0.013
Channel Slope	3.980 %
Normal Depth	18.0 in
Diameter	18.0 in

Results	
Discharge	20.95 cfs
Flow Area	1.8 ft²
Wetted Perimeter	4.7 ft
Hydraulic Radius	4.5 in
Top Width	0.00 ft
Critical Depth	17.7 in
Percent Full	100.0 %
Critical Slope	3.580 %
Velocity	11.86 ft/s
Velocity Head	2.19 ft
Specific Energy	3.69 ft
Froude Number	(N/A)
Maximum Discharge	22.54 cfs
Discharge Full	20.95 cfs
Slope Full	3.980 %
Flow Type	Undefined

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	100.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	18.0 in
Critical Depth	17.7 in
Channel Slope	3.980 %
Critical Slope	3.580 %