



Permanent Water Quality Treatment Sand Filter Certification Letter

August 30, 2023

Project: Vollmer Substation

Site Location: No address, access from north end of Mohawk Rd, then go 0.65 mi east

Sand Filter Location: Immediately south of substation

Discussion: The permanent water quality treatment structure for Vollmer Substation is a sand filter. The required WQCV was calculated to be 0.020 ac-ft. Based upon as-built surveys by Edward-James Surveying and site inspections, the constructed WQCV is just over the design volume required.

The following notable discrepancies were identified when the surveyed/as-built pond was compared to the approved plans:

- Steps were not installed in the outlet structure.
- A 6" yard drain pipe out falling into the corner of the sand filter was added.

Additional minor discrepancies have been documented on the Sand Filter As-Built.

Based on periodic site visits to the project during significant/key phases of the installation and the survey, Terra Nova Engineering is of the opinion that the sand filter has been constructed in general compliance with the approved Grading, Erosion, & Sediment Control Plan; Construction Plans; and Specifications as filed with this project.

Statement of Engineer in Responsible Charge: I, Dane Frank, a registered Professional Engineer in the State of Colorado, in accordance with Sections 5.2 and 5.3 of the Bylaws and Rules of the State Board of Registration for Professional Engineers and Professional Land Surveyors, do hereby certify that I or a person under my responsible charge periodically observed the construction of the above mentioned project. Based on the on-site field observations and review of pertinent documentation, it is my professional opinion that the required stormwater treatment facilities have been installed and are in general compliance with the approved Grading, Erosion, & Sediment Control Plan; Construction Plans; and Specifications as filed with El Paso County; provide the required storage volume; and will meet the required release rates. For structures with a Water Quality Capture Volume (WQCV), I have attached the post-construction As-Built drawings. The As-Built drawings accurately depict the final installation of the stormwater facilities and verify the WQCV.

PREPARED BY:
TERRA NOVA ENGINEERING, INC.

Dane Frank

Dane Frank, P.E.
Colorado #50207
Project Engineer

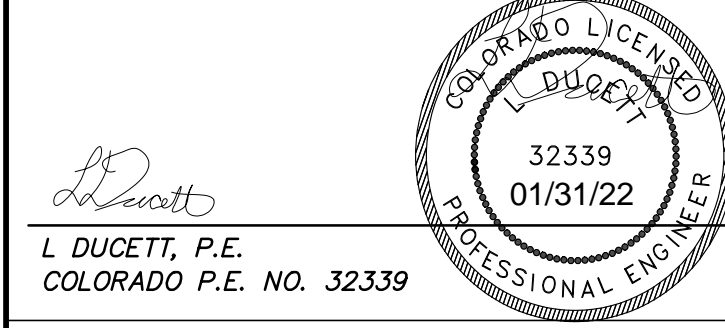


Jobs/184500/Drainage/Sand Filter Cert/184500 Sand Filter PE Cert.docx

Attachments

- Sand Filter As-Built, 2023/08/25
- Original UD-Detention Spreadsheet

THIS DESIGN WAS PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF TERRA NOVA ENGINEERING, INC.



VOLLMER SUBSTATION

EL PASO COUNTY, CO

GRADING, EROSION, & SEDIMENT CONTROL PLAN

JANUARY 2022

SAND FILTER AS-BUILT
DANE FRANK, TERRA NOVA ENGINEERING, 2023/08/25

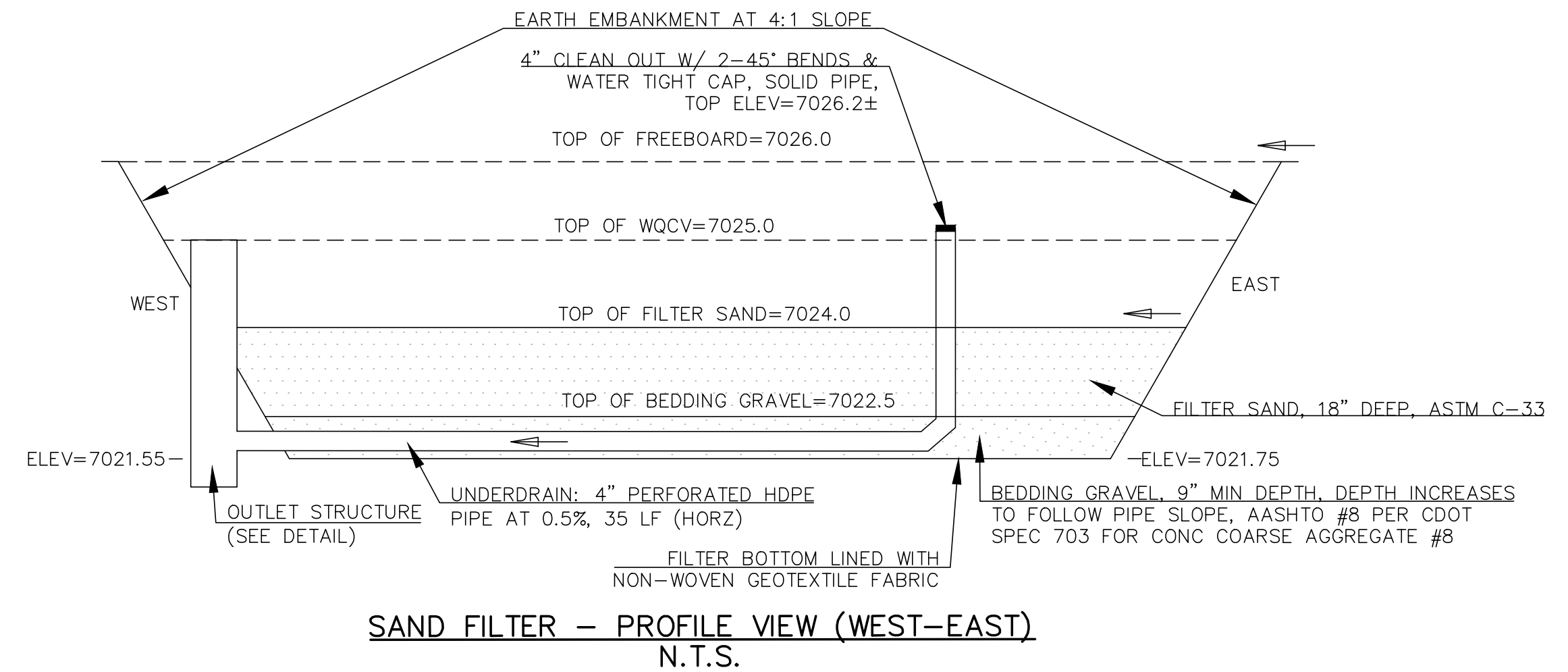
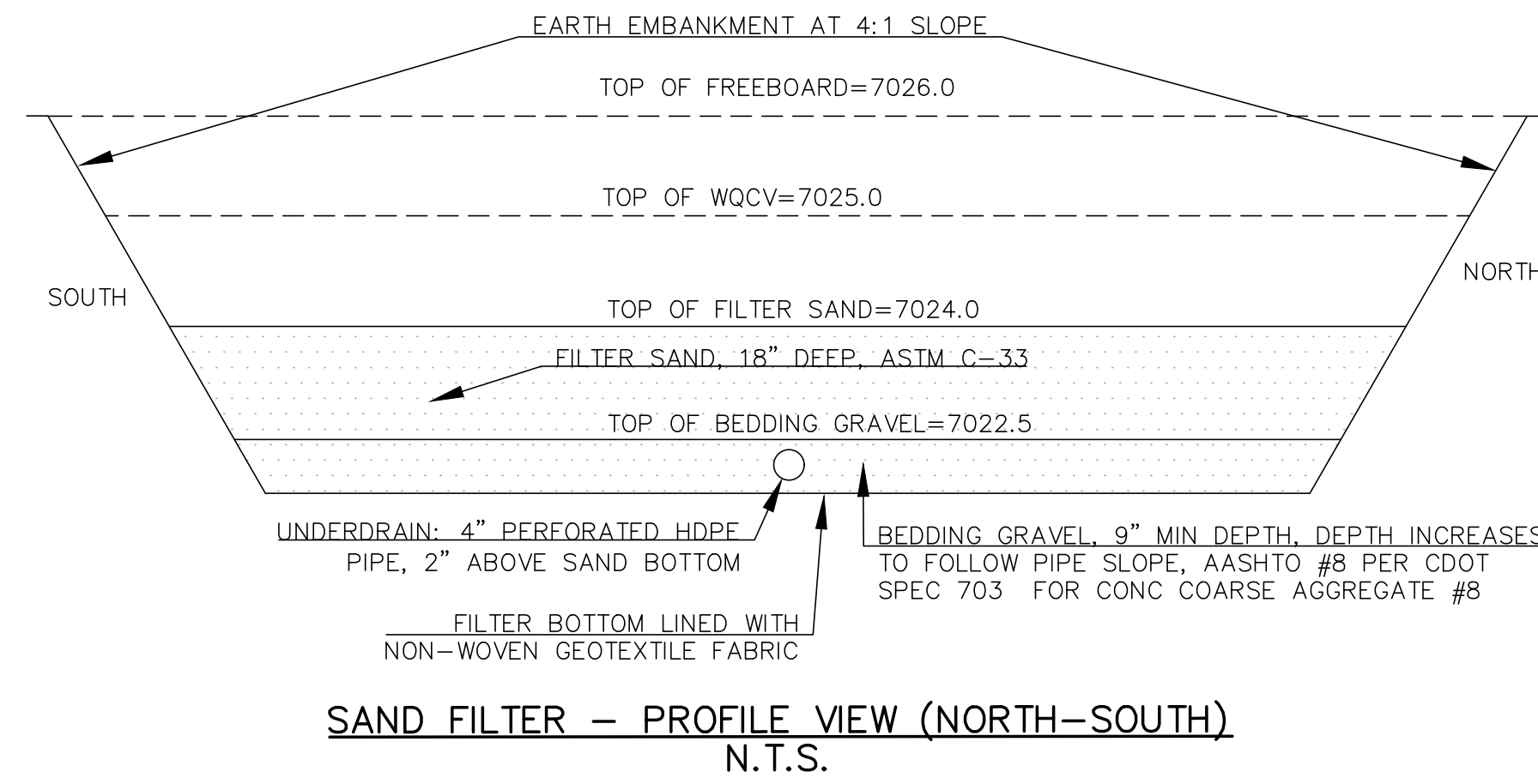


NOTES

1. PROTECT SAND FILTER FROM SEDIMENT LOADING DURING CONSTRUCTION ACTIVITIES. SITE MUST BE STABILIZED BEFORE ALLOWING FLOW INTO THE SAND FILTER.

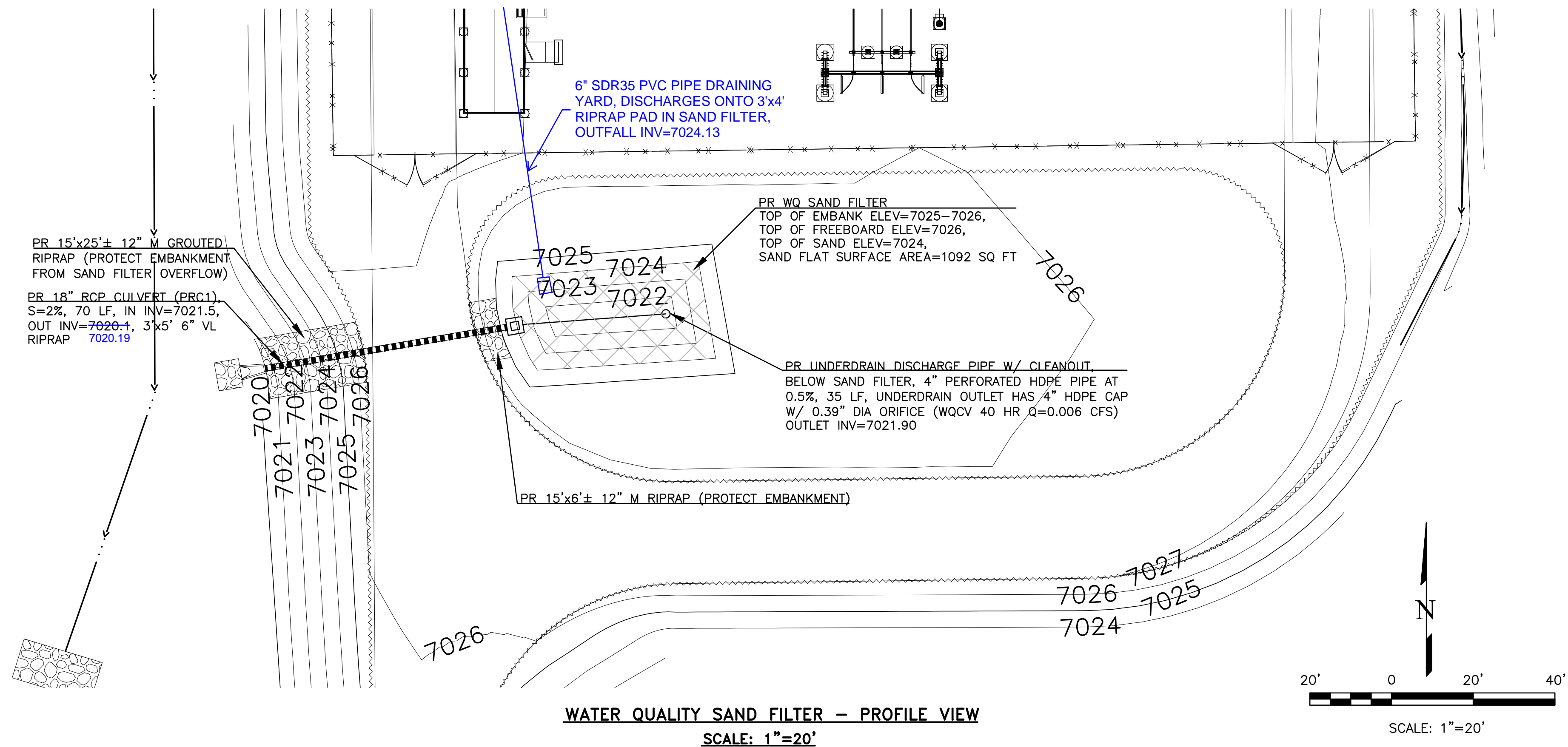
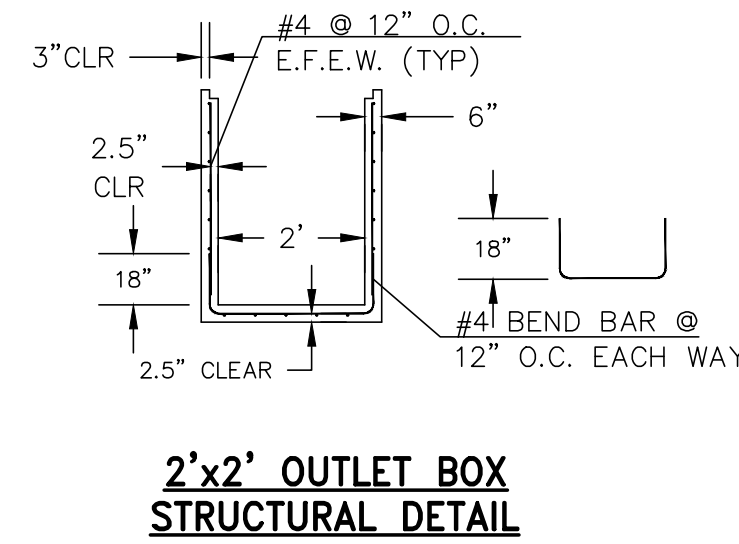
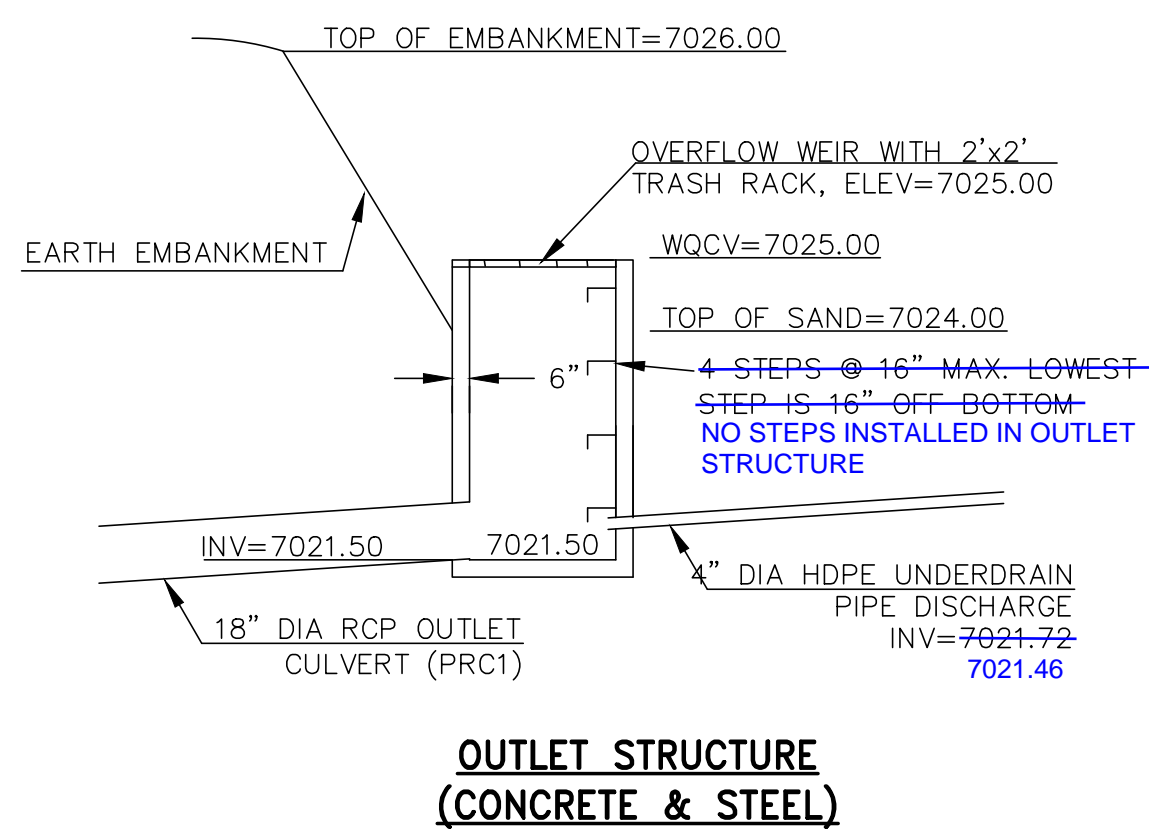
AS-BUILT NOTES

1. AS-BUILT 'REDLINES' ARE SHOWN IN BLUE.
2. AS-BUILT WQCV IS JUST ABOVE DESIGN VOLUME (<1%).



LEGEND

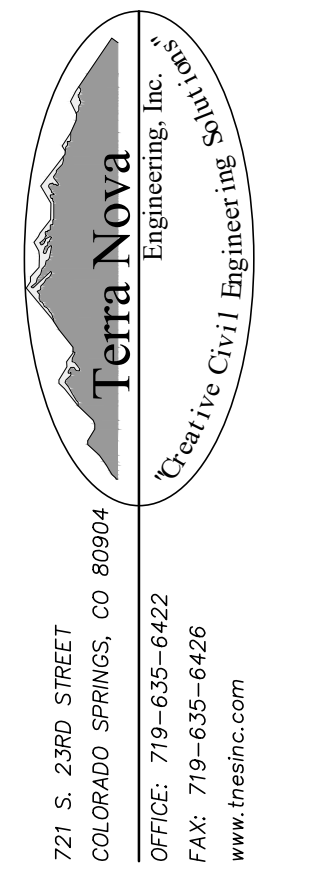
X	FENCE LINE
7261	PROPOSED 1' CONTOUR
7265	PROPOSED 5' CONTOUR
~~~~~	PROPOSED EDGE OF GRAVEL
PR	PROPOSED
EX	EXISTING



REVISIONS	NO.	DESCRIPTION	DATE
1.	NEW COUNTY REVIEW	01/10/22	

UNTL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE RELEVANT AGENCIES, THE REVIEWING ENGINEER AT TERRA NOVA ENGINEERING, INC. APPROVES THEIR USE ONLY FOR THE PROJECT AND MOST DESIGNED BY WRITTEN AUTHORIZATION.

PREPARED FOR:  
MVEA  
ATTN: DAVE WALDNER  
11140 E. WOODMEN RD  
PEYTON, CO 80831  
(719) 495-2283



VOLLMER SUBSTATION  
GRADING, EROSION, & SEDIMENT CONTROL PLAN  
SAND FILTER DETAILS

DESIGNED BY LD
DRAWN BY DLF
CHECKED BY LD
H-SCALE AS SHOWN
V-SCALE NA
JOB NO. 1845.00
DATE ISSUED 01/10/22
SHEET NO. 3 OF 8

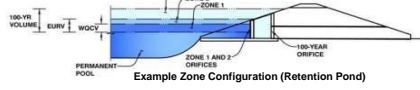
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**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

Project: **Vollmer Substation**

Basin ID: **PR-3 (Design Point 3)**



**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

Selected BMP Type =	<b>SF</b>
Watershed Area =	1.70 acres
Watershed Length =	180 ft
Watershed Slope =	0.010 ft/ft
Watershed Imperviousness =	40.00% percent
Percentage Hydrologic Soil Group A =	100.00% percent
Percentage Hydrologic Soil Group B =	0.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Desired WQC Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building
Water Quality Capture Volume (WQC) =	0.020 acre-feet
Excess Urban Runoff Volume (EURV) =	0.074 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.050 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.066 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.082 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.105 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.136 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	0.175 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	0.265 acre-feet
Approximate 2-yr Detention Volume =	0.047 acre-feet
Approximate 5-yr Detention Volume =	0.062 acre-feet
Approximate 10-yr Detention Volume =	0.077 acre-feet
Approximate 25-yr Detention Volume =	0.095 acre-feet
Approximate 50-yr Detention Volume =	0.107 acre-feet
Approximate 100-yr Detention Volume =	0.125 acre-feet

Note: L / W Ratio < 1  
L / W Ratio = 0.4

Drain Time Too Long

Optional User Override 1-hr Precipitation	1.19 inches
	1.50 inches
	1.75 inches
	2.00 inches
	2.25 inches
	2.52 inches

**Stage-Storage Calculation**

Zone 1 Volume (WQC) =	0.020 acre-feet
Select Zone 2 Storage Volume (Optional) =	acre-feet
Select Zone 3 Storage Volume (Optional) =	acre-feet
Total Detention Basin Volume =	0.020 acre-feet
Initial Surcharge Volume (ISV) =	N/A ft ³
Initial Surcharge Depth (ISD) =	N/A ft
Total Available Detention Depth (H _{total} ) =	1.00 ft
Depth of Trickle Channel (H _{TC} ) =	N/A ft
Slope of Trickle Channel (S _{TC} ) =	N/A ft/ft
Slopes of Main Basin Sides (S _{main} ) =	4:01 H:V
Basin Length-to-Width Ratio (R _{L/W} ) =	4
Initial Surcharge Area (A _{ISV} ) =	0 ft ²
Surcharge Volume Length (L _{SV} ) =	0.0 ft
Surcharge Volume Width (W _{SV} ) =	0.0 ft
Depth of Basin Floor (H _{1,000} ) =	0.00 ft
Length of Basin Floor (L _{1,000} ) =	59.2 ft
Width of Basin Floor (W _{1,000} ) =	14.8 ft
Area of Basin Floor (A _{1,000} ) =	875 ft ²
Volume of Basin Floor (V _{1,000} ) =	0 ft ³
Depth of Main Basin (H _{main} ) =	1.00 ft
Length of Main Basin (L _{main} ) =	59.5 ft
Width of Main Basin (W _{main} ) =	15.1 ft
Area of Main Basin (A _{main} ) =	900 ft ²
Volume of Main Basin (V _{main} ) =	888 ft ³
Calculated Total Basin Volume (V _{total} ) =	0.020 acre-feet

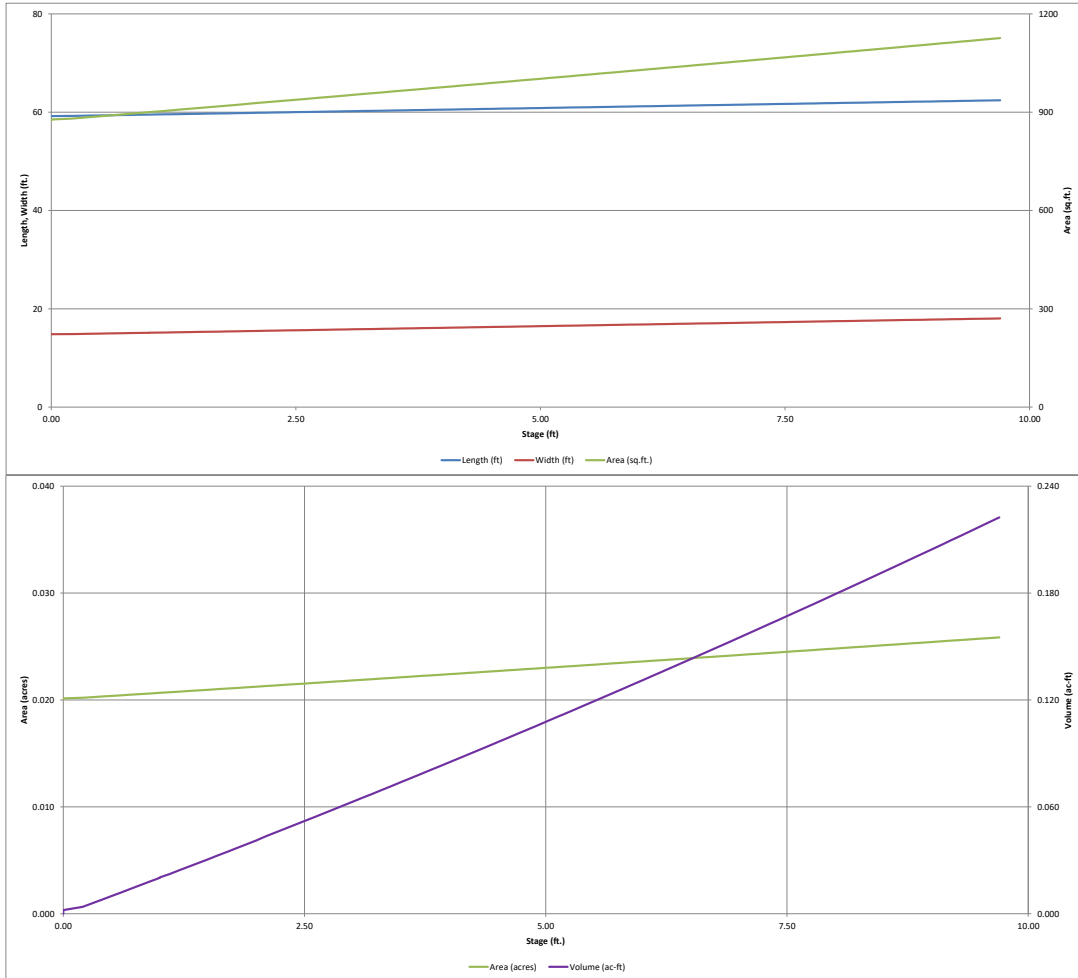
Total detention volume is less than 100-year volume.

Smain not typical.

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ² )	Optional Override Area (ft ² )	Area (acre)	Volume (ft ³ )	Volume (ac-ft)
<b>Media Surface</b>	0.00		59.2	14.8	875				
	0.10		59.2	14.8	878		0.020	88	0.002
	0.20		59.2	14.9	880		0.020	167	0.004
	0.30		59.3	14.9	883		0.020	255	0.006
	0.40		59.3	14.9	885		0.020	343	0.008
	0.50		59.3	15.0	888		0.020	432	0.010
	0.60		59.4	15.0	890		0.020	521	0.012
	0.70		59.4	15.0	893		0.020	610	0.014
	0.80		59.4	15.1	895		0.021	699	0.016
	0.90		59.5	15.1	898		0.021	789	0.018
	1.00		59.5	15.1	900		0.021	879	0.020
<b>Zone 1 (WQC)</b>	1.00		59.5	15.1	900		0.021	888	0.020
	1.10		59.5	15.2	903		0.021	969	0.022
	1.20		59.6	15.2	905		0.021	1,059	0.024
	1.30		59.6	15.2	908		0.021	1,150	0.026
	1.40		59.6	15.3	910		0.021	1,241	0.028
	1.50		59.7	15.3	913		0.021	1,332	0.031
	1.60		59.7	15.3	915		0.021	1,423	0.033
	1.70		59.7	15.4	918		0.021	1,515	0.035
	1.80		59.8	15.4	920		0.021	1,607	0.037
	1.90		59.8	15.4	923		0.021	1,699	0.039
	2.00		59.8	15.5	925		0.021	1,791	0.041
	2.10		59.9	15.5	928		0.021	1,883	0.043
	2.20		59.9	15.5	930		0.021	1,986	0.046
	2.30		59.9	15.6	933		0.021	2,079	0.048
	2.40		60.0	15.6	935		0.021	2,173	0.050
	2.50		60.0	15.6	938		0.022	2,267	0.052
	2.60		60.0	15.7	941		0.022	2,360	0.054
	2.70		60.1	15.7	943		0.022	2,455	0.056
	2.80		60.1	15.7	946		0.022	2,549	0.059
	2.90		60.1	15.8	948		0.022	2,644	0.061
	3.00		60.2	15.8	951		0.022	2,739	0.063
	3.10		60.2	15.8	953		0.022	2,834	0.065
	3.20		60.2	15.9	956		0.022	2,929	0.067
	3.30		60.3	15.9	958		0.022	3,025	0.069
	3.40		60.3	15.9	961		0.022	3,121	0.072
	3.50		60.3	16.0	963		0.022	3,217	0.074
	3.60		60.4	16.0	966		0.022	3,314	0.076
	3.70		60.4	16.0	969		0.022	3,410	0.078
	3.80		60.4	16.1	971		0.022	3,507	0.081
	3.90		60.5	16.1	974		0.022	3,605	0.083
	4.00		60.5	16.1	976		0.022	3,702	0.085
	4.10		60.5	16.2	979		0.022	3,800	0.087
	4.20		60.6	16.2	981		0.023	3,898	0.089
	4.30		60.6	16.2	984		0.023	3,996	0.092
	4.40		60.6	16.3	987		0.023	4,095	0.094
	4.50		60.7	16.3	989		0.023	4,194	0.096
	4.60		60.7	16.3	992		0.023	4,293	0.099
	4.70		60.7	16.4	994		0.023	4,392	0.101
	4.80		60.8	16.4	997		0.023	4,491	0.103
	4.90		60.8	16.4	999		0.023	4,591	0.105
	5.00		60.8	16.5	1,002		0.023	4,691	0.108
	5.10		60.9	16.5	1,005		0.023	4,792	0.110
	5.20		60.9	16.5	1,007		0.023	4,892	0.112
	5.30		60.9	16.6	1,010		0.023	4,993	0.115
	5.40		61.0	16.6	1,012		0.023	5,094	0.117
	5.50		61.0	16.6	1,015		0.023	5,196	0.119
	5.60		61.0	16.7	1,018		0.023	5,297	0.122
	5.70		61.1	16.7	1,020		0.023	5,399	0.124
	5.80		61.1	16.7	1,023		0.023	5,501	0.126
	5.90		61.2	16.8	1,025		0.024	5,604	0.129
	6.00		61.2	16.8	1,028		0.024	5,706	0.131
	6.10		61.2	16.8	1,031		0.024	5,809	0.133
	6.20		61.3	16.9	1,033		0.024	5,912	0.136
	6.30		61.3	16.9	1,036		0.024	6,016	0.138
	6.40		61.3	16.9	1,038		0.024	6,120	0.140
	6.50		61.4	17.0	1,041		0.024	6,224	0.143
	6.60		61.4	17.0	1,044		0.024	6,328	0.145
	6.70		61.4	17.0	1,046		0.024	6,432	0.148
	6.80		61.5	17.1	1,049		0.024	6,537	0.150
	6.90		61.5	17.1	1,052		0.024	6,642	0.152
	7.00		61.5	17.1	1,054		0.024	6,747	0.155
	7.10		61.6	17.2	1,057		0.024	6,853	0.157
	7.20		61.6	17.2	1,060		0.024	6,959	0.160
	7.30		61.6	17.2	1,062		0.024	7,065	0.162
	7.40		61.7	17.3	1,065		0.024	7,171	0.165
	7.50		61.7	17.3	1,067		0.025	7,278	0.167
	7.60		61.7	17.3	1,070		0.025	7,385	0.170
	7.70		61.8	17.4	1,073		0.025	7,492	0.172
	7.80		61.8	17.4	1,075		0.025	7,599	0.174
	7.90		61.8	17.4	1,078		0.025	7,707	0.177
	8.00		61.9	17.5	1,081		0.025	7,815	0.179
	8.10		61.9	17.5	1,083		0.025	7,923	0.182
	8.20		61.9	17.5	1,086		0.025	8,032	0.184
	8.30		62.0	17.6	1,089		0.025	8,140	0.187
	8.40		62.0	17.6	1,093		0.025	8,249	0.189
	8.50		62.0	17.6	1,094		0.025	8,359	0.192
	8.60		62.1	17.7	1,097		0.025	8,468	0.194
	8.70		62.1	17.7	1,099		0.025	8,578	0.197
	8.80		62.1	17.7	1,102		0.025	8,688	0.199
	8.90		62.2	17.8	1,105		0.025	8,798	0.202
	9.00		62.2	17.8	1,107		0.025	8,909	0.205
	9.10		62.2	17.8	1,110		0.025	9,020	0.207
	9.20		62.3	17.9	1,113		0.026	9,131	0.210
	9.30		62.3	17.9	1,115		0.026	9,242	0.212
	9.40		62.3	17.9	1,118		0.026	9,354	0.215
	9.50		62.4	18.0	1,121		0.026	9,466	0.217
	9.60		62.4	18.0	1,123		0.026	9,578	0.220
	9.70								

**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

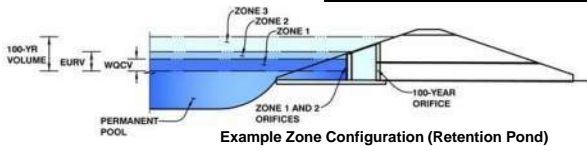
UD-Detention, Version 3.07 (February 2017)



## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: **Vollmer Substation**  
 Basin ID: **PR-3 (Design Point 3)**



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.00	0.020	Filtration Media
Zone 2			Weir&Pipe (Circular)
Zone 3			
		0.020	Total

**User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)**

Underdrain Orifice Invert Depth =	2.17	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	0.37	inches

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	0.0	ft ²
Underdrain Orifice Centroid =	0.02	feet

**User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)**

Invert of Lowest Orifice =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	N/A	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

**Calculated Parameters for Plate**

WQ Orifice Area per Row =	N/A	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

**User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)**

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**User Input: Vertical Orifice (Circular or Rectangular)**

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

**Calculated Parameters for Vertical Orifice**

	Not Selected	Not Selected	
Vertical Orifice Area =			ft ²
Vertical Orifice Centroid =			feet

**User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)**

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	1.00		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.00		feet
Overflow Grate Open Area % =	70%		% grate open area/total area
Debris Clogging % =	50%		%

**Calculated Parameters for Overflow Weir**

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H _g =	1.00		feet
Over Flow Weir Slope Length =	2.00		feet
Grate Open Area / 100-yr Orifice Area =	1.58		should be ≥ 4
Overflow Grate Open Area w/o Debris =	2.80		ft ²
Overflow Grate Open Area w/ Debris =	1.40		ft ²

**User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)**

	Zone 2 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	2.50		ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00		inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 2 Circular	Not Selected	
Outlet Orifice Area =	1.77		ft ²
Outlet Orifice Centroid =	0.75		feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

Spillway Invert Stage =		ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =		feet
Spillway End Slopes =		H:V
Freeboard above Max Water Surface =		feet

**Calculated Parameters for Spillway**

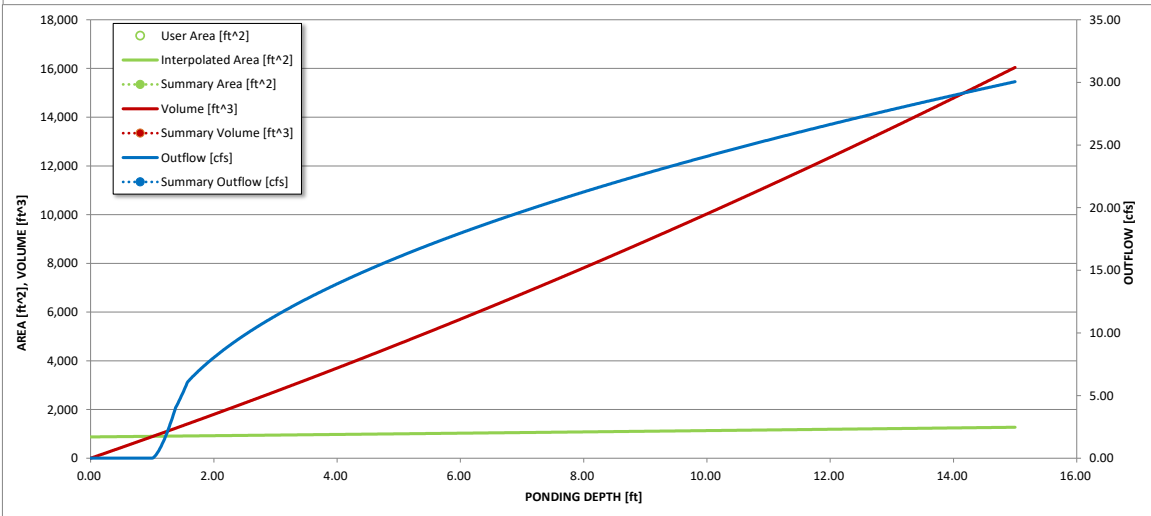
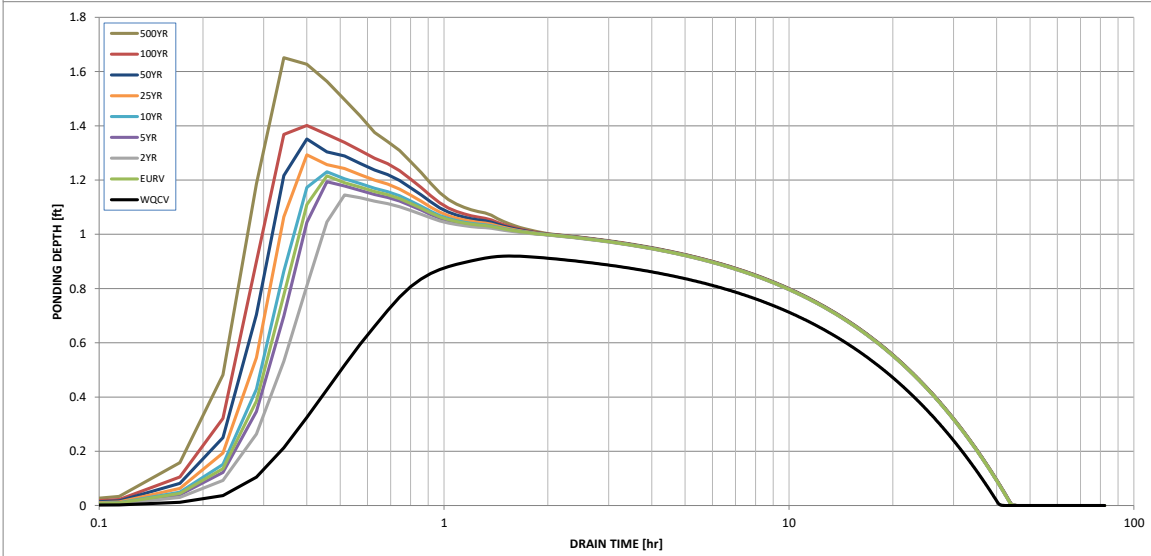
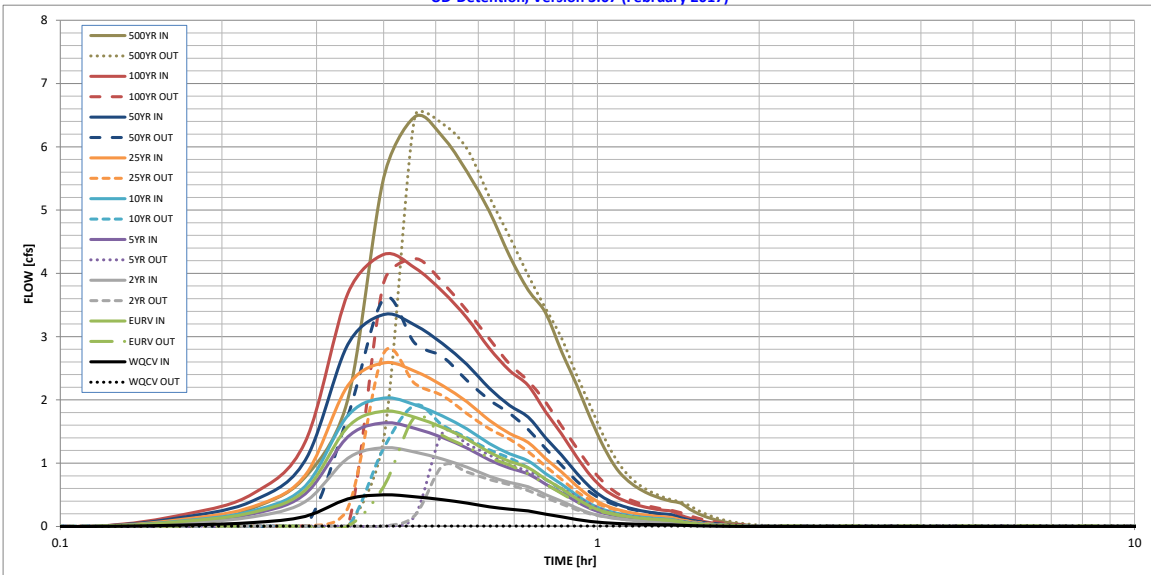
Spillway Design Flow Depth =		feet
Stage at Top of Freeboard =		feet
Basin Area at Top of Freeboard =		acres

### Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.14
Calculated Runoff Volume (acre-ft) =	0.020	0.074	0.050	0.066	0.082	0.105	0.136	0.175	0.265
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.020	0.073	0.049	0.065	0.081	0.104	0.136	0.175	0.265
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.01	0.01	0.03	0.23	0.56	1.25
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.9	2.1
Peak Inflow Q (cfs) =	0.5	1.8	1.2	1.6	2.0	2.6	3.3	4.3	6.5
Peak Outflow Q (cfs) =	0.0	1.7	1.0	1.5	1.9	2.7	3.6	4.2	6.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	144.1	80.3	53.1	9.1	4.5	3.1
Structure Controlling Flow =	Filtration Media	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1
Max Velocity through Grate 1 (fps) =	N/A	0.59	0.29	0.5	0.6	0.9	1.2	1.5	2.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	39	41	40	39	37	35	33	27
Time to Drain 99% of Inflow Volume (hours) =	40	43	43	43	42	42	41	40	38
Maximum Ponding Depth (ft) =	0.92	1.22	1.14	1.19	1.23	1.29	1.35	1.40	1.65
Area at Maximum Ponding Depth (acres) =	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Maximum Volume Stored (acre-ft) =	0.019	0.025	0.023	0.024	0.025	0.026	0.028	0.029	0.034

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



**S-A-V-D Chart Axis Override**

	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

