

**TERAKEE VILLAGE
APPROX. 900 S 4500 W
WEST WEBER, UTAH 84404
STORM WATER STUDY**

Project No. 16N719

4-5-2019

General Site Information:

The Terakee Village is located on the north side of 900 South Street and on the east side of 4700 West Street in West Weber, Utah. Construction will consist of a 36-lot residential subdivision, agricultural areas, a small senior assisted living center, common space / park features, roadways, a small parking lot, sidewalks, curb and gutter, and underground utilities when completed.

Storm water from the site will be collected in inlet boxes and catch basins and will continue via storm drain to the south end of the site. Storm water will be detained in one of three detention ponding areas located adjacent to 900 South Street. The site is allowed a unit-release of 0.1 cfs per acre for the 100-yr storm into an existing storm drainage system in 900 South Street and will continue westerly along 900 South in a historical fashion. The attached figure shows the project site and location of the storm water outfalls along 900 South. Detention calculations have been provided for the site. (See attached figure and calculations).

The study area is broken up into 6 drainage areas (labeled A-1 through A-6). A detention facility will be provided to serve A-1 and A-2, another facility to serve A-3 and A-4, and a third facility to serve A-5 and A-6. Improvements in A-3, A-4, A-5, and A-6 will occur at a future date, and the corresponding detention facilities will be required at that time. However, the facility to serve A-1 and A-2 will be installed as part of Phase 1 of this subdivision and will be constructed soon. A runoff coefficient of 0.15 is used for natural ground and landscaped areas. A runoff coefficient of 0.90 is used for asphalt, concrete, buildings, and other hard surfaced areas. An average runoff coefficient of 0.46 was calculated for A-1 and A-2, 0.48 for A-3 and A-4, and 0.27 for A-5 and A-6. This yields a coefficient of 0.39 for the study area as a whole.

Times of concentration are calculated using the FAA method assuming flow resistance coefficients of $K=0.35$ for landscape and $K=0.91$ for hardscape for each of the areas. The times of concentration range from about 8 to 24 minutes for the six drainage areas. These times are based on the hydraulically longest drainage path inside each respective drainage area over grass or other vegetation, asphalt, concrete, and/or through a pipeline as applicable. Times calculated to be less than 5 minutes should be rounded to 5 minutes when using this method. Rainfall Intensities were taken from the NOAA website for pipe sizing and detention requirements. The values obtained were interpolated as necessary. A copy of these data is attached.

Data showing area information, runoff coefficient, time of concentration, peak flow, and required detention for the site are also provided and can be found in the attached calculations.

Pipe Sizes:

Storm water pipes in the project are proposed to be polyvinylchloride pipes (PVC), concrete pipe (CP), and/or reinforced concrete pipe (RCP). All pipes in the project are sloped to provide the design capacity while maintaining a minimum scour speed of at least 2 feet per second when the pipes are flowing at least half full. The pipes and inlet boxes have sufficient capacity to convey the 10-year storm without surcharging.

Orifice Plates:

An orifice plate will be used at each facility to control the rate that storm water flows from the project. They will be located at the structures labeled as nodes 33, 58, and 60 (See attached figure). The orifice plate opening at node 33 will have a diameter of 5.26 inches for that detention facility to utilize its capacity during the required 100-yr design storm with an allowable release rate of 0.1 cfs/ac. The orifice plates for the other two facilities will be determined as the designs for those phases are finalized. The orifice plates will allow small flows to pass through without detention. As the rate of storm water into the pipes and detention facilities increases, the orifice plates will restrict the flow. The maximum flow through the plates will occur when the detention basins reach their maximum design depth. A detail of the orifice plates will be provided in the construction documents for the different phases.

Required Detention:

The required detention for the 100-year storm with a release rate of 0.1 cfs/acre is 40,529 cubic feet (cf) for the facility serving A-1 and A-2. The available volume in that detention facility is 40,583 cf. This includes an available 23,271 cf in the ponding area on the east side of Blackbird Lane, 16,258 cf on the west side of Blackbird Lane, and 1,055 cf within the adjacent 30" diameter storm drain pipes. There is a small excess capacity built into this design. Calculations for the other two detention facility requirements are also provided herein. In the event any of the detention facilities experiences a storm larger than the design storm water will then spill out onto 900 South and continue westerly in a historical fashion.

Great Basin Engineering, Inc.

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Storm Water Calculations
 Terakee Village
 Approx. 900 S 4500 W West Weber, UT 84404
 16N719 SWS-2.dwg

4/5/2019

6 Detained Areas

Hardscape C = 0.90
 Landscape C = 0.15

	Zone 1 (ft ²)
Avg. lot size	11477
Avg. home size	2700
Avg. patio/driveway size	1200
C =	0.405

Category Runoff Coefficients

Drainage Areas	Total Area (acres)	0.735 0.900		0.250 0.405		C
		50' Road Area (acres)	24' Road Area (acres)	Common Area (acres)	Zone 1 Area (acres)	
Σ Det. Areas	51.801	6.307	0.821	22.143	22.530	0.387
Σ All Areas	51.801	6.307	0.821	22.143	22.530	0.387
A-1	6.157	1.407	0.000	0.860	3.890	0.459
A-2	10.365	1.949	0.000	0.450	7.967	0.460
A-3	5.595	1.252	0.000	0.000	4.343	0.479
A-4	8.029	1.699	0.000	0.000	6.330	0.475
A-5	12.602	0.000	0.000	12.602	0.000	0.250
A-6	9.052	0.000	0.821	8.231	0.000	0.309

Time of Concentration--use FAA Method

For FAA Method, use K's of..

K = 0.35 for landscape
 K = 0.91 for hardscape

$$t_c = \frac{1.8(1.1 - K)\sqrt{L}}{\sqrt[3]{S}}$$

Assume Pipe Flow is at 2 ft/s Scour Speed

**Note: S is in percent, 5 min is smallest allowed Tc

Area	Length on Landscape (ft)	Slope of Landscape (%)	Time on Landscape (min.)	Length on Hardscape (ft)	Slope of Hardscape (%)	Time on Hardscape (min.)	Length in Pipe (ft)	Time in Pipe (min.)	TC for entire Area (min.)
A-1	102.00	2.00	10.82	83.00	1.00	3.12	676.00	5.63	19.57
A-2	135.00	2.00	12.45	76.00	1.00	2.98	946.00	7.88	23.31
A-3	115.00	2.00	11.49	260.00	1.00	5.51	375.00	3.13	20.13
A-4	136.00	2.00	12.50	268.00	1.00	5.60	668.00	5.57	23.66
A-5	0.00	2.00	0.00	400.00	1.00	6.84	170.00	1.42	8.26
A-6	138.00	2.00	12.59	72.00	1.00	2.90	341.00	2.84	18.33

Rainfall Intensities
Data From NOAA

10-Year and 100-Year Intensities

The equations used for the 10-Year and 100-Year Intensities were found using the attached Rainfall data as well as Interpolated data where applicable.

Storm Intensities			
AREA	Tc (minutes)	I (10-yr.) (in./hr.)	I (100-yr.) (in./hr.)
A-1	19.6	1.76	3.53
A-2	23.3	1.60	3.20
A-3	20.1	1.73	3.47
A-4	23.7	1.58	3.17
A-5	8.3	2.74	5.49
A-6	18.3	1.84	3.68

Peak Flow Information
 Use Rational Method
 10-Year and 100-Year Intensities

Q=CIA

					Peak Flows	
Σ detained =					37.02	74.26
AREA	C	I10 (in./hr.)	I100 (in./hr.)	A (acres)	Q (10-yr.) (cfs)	Q (100-yr.) (cfs)
A-1	0.459	1.761	3.533	6.16	4.97	9.98
A-2	0.460	1.597	3.204	10.36	7.62	15.28
A-3	0.479	1.730	3.470	5.60	4.63	9.29
A-4	0.475	1.582	3.175	8.03	6.03	12.10
A-5	0.250	2.738	5.490	12.60	8.63	17.30
A-6	0.309	1.837	3.684	9.05	5.14	10.30

Node Inlet Requirements

Size pipes for		10	year storm
Area	Node #	% of Total	Q (cfs)
A-1	1	10.0%	0.50
A-1	2	8.0%	0.40
A-1	3	12.0%	0.60
A-1	4	8.0%	0.40
A-1	5	4.0%	0.20
A-1	6	4.0%	0.20
A-1	7	3.0%	0.15
A-1	8	3.0%	0.15
A-1	9	3.0%	0.15
A-1	10	5.0%	0.25
A-1	11	13.0%	0.65
A-1	12	4.0%	0.20
A-1	13	13.0%	0.65
A-1	14	5.0%	0.25
A-1	15	1.0%	0.05
A-1	16	4.0%	0.20
A-2	17	4.0%	0.30
A-2	18	9.0%	0.69
A-2	19	9.0%	0.69
A-2	20	5.0%	0.38
A-2	21	5.0%	0.38
A-2	22	2.0%	0.15
A-2	23	10.0%	0.76
A-2	24	3.0%	0.23
A-2	25	9.0%	0.69
A-2	26	9.0%	0.69
A-2	27	5.0%	0.38
A-2	28	5.0%	0.38
A-2	29	2.0%	0.15
A-2	30	10.0%	0.76
A-2	31	3.0%	0.23
A-2	32	3.0%	0.23
A-2	33	7.0%	0.53
A-3	34	26.0%	1.20
A-3	35	8.0%	0.37
A-3	36	6.0%	0.28
A-3	37	5.0%	0.23
A-3	38	20.0%	0.93
A-3	39	20.0%	0.93
A-3	40	5.0%	0.23
A-3	41	2.0%	0.09
A-3	42	8.0%	0.37
A-4	43	7.0%	0.42

A-4	44	12.0%	0.72
A-4	45	3.0%	0.18
A-4	46	3.0%	0.18
A-4	47	10.0%	0.60
A-4	48	10.0%	0.60
A-4	49	7.0%	0.42
A-4	50	12.0%	0.72
A-4	51	15.0%	0.90
A-4	52	5.0%	0.30
A-4	53	2.0%	0.12
A-4	54	2.0%	0.12
A-4	55	7.0%	0.42
A-4	56	2.0%	0.12
A-4	57	3.0%	0.18
A-5	58	100.0%	8.63
A-6	59	85.0%	4.37
A-6	60	15.0%	0.77

PIPE FLOWS

Upstream Node	Downstream node	Pipe Flow (cfs)
1	2	0.50
2	4	0.90
3	4	0.60
4	5	1.89
5	7	2.09
6	7	0.20
7	8	2.44
8	9	2.59
9	10	2.74
10	16	2.98
11	12	0.65
12	14	0.85
13	14	0.65
14	15	1.74
15	16	1.79
16	23	4.97
17	18	0.30
18	21	0.99
19	20	0.69
20	21	1.07
21	22	2.44
22	23	2.59
23	30	8.33
24	25	0.23
25	28	0.91
26	27	0.69
27	28	1.07
28	29	2.36
29	30	2.51
30	32	11.60
31	32	0.23
32	33	12.06
33	Outfall 1	12.59
34	35	1.20
35	36	1.58
36	37	1.85
37	42	2.09
38	39	0.93
39	40	1.85
40	41	2.09
41	42	2.18
42	47	4.63
43	44	0.42
44	45	1.15

45	46	1.33
46	47	1.51
47	48	6.74
48	49	7.35
49	50	7.77
50	51	8.49
51	52	9.40
52	54	9.70
53	54	0.12
54	56	9.94
55	56	0.42
56	57	10.48
57	Outfall 2	10.66
58	59	8.63
59	60	12.99
60	Outfall 3	13.77

Options for Pipe Sizes Between the Specified Nodes

Up Stream Node	Dn Stream Node	Q (cfs)	Pipe Size (in)	Design Min Slope (%)	Area (ft ²)	Rh (ft)	Manning's n	Scour Min. Slope (%)	First Trial Pipe Size
1	2	0.50	15	0.006%	1.227	0.313	0.013	0.150%	15
		0.50	18	0.002%	1.767	0.375	0.013	0.120%	
		0.50	24	0.000%	3.142	0.500	0.013	0.080%	
2	4	0.90	15	0.019%	1.227	0.313	0.013	0.150%	15
		0.90	18	0.007%	1.767	0.375	0.013	0.120%	
		0.90	24	0.002%	3.142	0.500	0.013	0.080%	
3	4	0.60	15	0.009%	1.227	0.313	0.013	0.150%	15
		0.60	18	0.003%	1.767	0.375	0.013	0.120%	
		0.60	24	0.001%	3.142	0.500	0.013	0.080%	
4	5	1.89	15	0.086%	1.227	0.313	0.013	0.150%	15
		1.89	18	0.032%	1.767	0.375	0.013	0.120%	
		1.89	24	0.007%	3.142	0.500	0.013	0.080%	
5	7	2.09	15	0.105%	1.227	0.313	0.013	0.150%	15
		2.09	18	0.040%	1.767	0.375	0.013	0.120%	
		2.09	24	0.009%	3.142	0.500	0.013	0.080%	
6	7	0.20	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.20	18	0.000%	1.767	0.375	0.013	0.120%	
		0.20	24	0.000%	3.142	0.500	0.013	0.080%	
7	8	2.44	15	0.142%	1.227	0.313	0.013	0.150%	15
		2.44	18	0.054%	1.767	0.375	0.013	0.120%	
		2.44	24	0.012%	3.142	0.500	0.013	0.080%	
8	9	2.59	15	0.160%	1.227	0.313	0.013	0.150%	15
		2.59	18	0.061%	1.767	0.375	0.013	0.120%	
		2.59	24	0.013%	3.142	0.500	0.013	0.080%	
9	10	2.74	15	0.179%	1.227	0.313	0.013	0.150%	15
		2.74	18	0.068%	1.767	0.375	0.013	0.120%	
		2.74	24	0.015%	3.142	0.500	0.013	0.080%	
10	16	2.98	15	0.213%	1.227	0.313	0.013	0.150%	15
		2.98	18	0.081%	1.767	0.375	0.013	0.120%	
		2.98	24	0.017%	3.142	0.500	0.013	0.080%	
11	12	0.65	15	0.010%	1.227	0.313	0.013	0.150%	15
		0.65	18	0.004%	1.767	0.375	0.013	0.120%	
		0.65	24	0.001%	3.142	0.500	0.013	0.080%	
12	14	0.85	15	0.017%	1.227	0.313	0.013	0.150%	15
		0.85	18	0.006%	1.767	0.375	0.013	0.120%	
		0.85	24	0.001%	3.142	0.500	0.013	0.080%	
13	14	0.65	15	0.010%	1.227	0.313	0.013	0.150%	15
		0.65	18	0.004%	1.767	0.375	0.013	0.120%	
		0.65	24	0.001%	3.142	0.500	0.013	0.080%	
14	15	1.74	15	0.073%	1.227	0.313	0.013	0.150%	15
		1.74	18	0.027%	1.767	0.375	0.013	0.120%	
		1.74	24	0.006%	3.142	0.500	0.013	0.080%	

15	16	1.79	15	0.077%	1.227	0.313	0.013	0.150%	15
		1.79	18	0.029%	1.767	0.375	0.013	0.120%	
		1.79	24	0.006%	3.142	0.500	0.013	0.080%	
16	23	4.97	15	0.593%	1.227	0.313	0.013	0.150%	18
		4.97	18	0.224%	1.767	0.375	0.013	0.120%	
		4.97	24	0.048%	3.142	0.500	0.013	0.080%	
17	18	0.30	15	0.002%	1.227	0.313	0.013	0.150%	15
		0.30	18	0.001%	1.767	0.375	0.013	0.120%	
		0.30	24	0.000%	3.142	0.500	0.013	0.080%	
18	21	0.99	15	0.023%	1.227	0.313	0.013	0.150%	15
		0.99	18	0.009%	1.767	0.375	0.013	0.120%	
		0.99	24	0.002%	3.142	0.500	0.013	0.080%	
19	20	0.69	15	0.011%	1.227	0.313	0.013	0.150%	15
		0.69	18	0.004%	1.767	0.375	0.013	0.120%	
		0.69	24	0.001%	3.142	0.500	0.013	0.080%	
20	21	1.07	15	0.027%	1.227	0.313	0.013	0.150%	15
		1.07	18	0.010%	1.767	0.375	0.013	0.120%	
		1.07	24	0.002%	3.142	0.500	0.013	0.080%	
21	22	2.44	15	0.142%	1.227	0.313	0.013	0.150%	15
		2.44	18	0.054%	1.767	0.375	0.013	0.120%	
		2.44	24	0.012%	3.142	0.500	0.013	0.080%	
22	23	2.59	15	0.161%	1.227	0.313	0.013	0.150%	15
		2.59	18	0.061%	1.767	0.375	0.013	0.120%	
		2.59	24	0.013%	3.142	0.500	0.013	0.080%	
23	30	8.33	15	1.661%	1.227	0.313	0.013	0.150%	24
		8.33	18	0.628%	1.767	0.375	0.013	0.120%	
		8.33	24	0.135%	3.142	0.500	0.013	0.080%	
24	25	0.23	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.23	18	0.000%	1.767	0.375	0.013	0.120%	
		0.23	24	0.000%	3.142	0.500	0.013	0.080%	
25	28	0.91	15	0.020%	1.227	0.313	0.013	0.150%	15
		0.91	18	0.008%	1.767	0.375	0.013	0.120%	
		0.91	24	0.002%	3.142	0.500	0.013	0.080%	
26	27	0.69	15	0.011%	1.227	0.313	0.013	0.150%	15
		0.69	18	0.004%	1.767	0.375	0.013	0.120%	
		0.69	24	0.001%	3.142	0.500	0.013	0.080%	

27	28	1.07	15	0.027%	1.227	0.313	0.013	0.150%	15
		1.07	18	0.010%	1.767	0.375	0.013	0.120%	
		1.07	24	0.002%	3.142	0.500	0.013	0.080%	
28	29	2.36	15	0.134%	1.227	0.313	0.013	0.150%	15
		2.36	18	0.051%	1.767	0.375	0.013	0.120%	
		2.36	24	0.011%	3.142	0.500	0.013	0.080%	
29	30	2.51	15	0.151%	1.227	0.313	0.013	0.150%	15
		2.51	18	0.057%	1.767	0.375	0.013	0.120%	
		2.51	24	0.012%	3.142	0.500	0.013	0.080%	
30	32	11.60	15	3.225%	1.227	0.313	0.013	0.150%	24
		11.60	18	1.220%	1.767	0.375	0.013	0.120%	
		11.60	24	0.263%	3.142	0.500	0.013	0.080%	
31	32	0.23	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.23	18	0.000%	1.767	0.375	0.013	0.120%	
		0.23	24	0.000%	3.142	0.500	0.013	0.080%	
32	33	12.06	15	3.484%	1.227	0.313	0.013	0.150%	24
		12.06	18	1.318%	1.767	0.375	0.013	0.120%	
		12.06	24	0.284%	3.142	0.500	0.013	0.080%	
33	Outfall 1	12.59	15	3.799%	1.227	0.313	0.013	0.150%	24
		12.59	18	1.437%	1.767	0.375	0.013	0.120%	
		12.59	24	0.310%	3.142	0.500	0.013	0.080%	
34	35	1.20	15	0.035%	1.227	0.313	0.013	0.150%	15
		1.20	18	0.013%	1.767	0.375	0.013	0.120%	
		1.20	24	0.003%	3.142	0.500	0.013	0.080%	
35	36	1.58	15	0.059%	1.227	0.313	0.013	0.150%	15
		1.58	18	0.022%	1.767	0.375	0.013	0.120%	
		1.58	24	0.005%	3.142	0.500	0.013	0.080%	
36	37	1.85	15	0.082%	1.227	0.313	0.013	0.150%	15
		1.85	18	0.031%	1.767	0.375	0.013	0.120%	
		1.85	24	0.007%	3.142	0.500	0.013	0.080%	
37	42	2.09	15	0.104%	1.227	0.313	0.013	0.150%	15
		2.09	18	0.039%	1.767	0.375	0.013	0.120%	
		2.09	24	0.008%	3.142	0.500	0.013	0.080%	
38	39	0.93	15	0.021%	1.227	0.313	0.013	0.150%	15
		0.93	18	0.008%	1.767	0.375	0.013	0.120%	
		0.93	24	0.002%	3.142	0.500	0.013	0.080%	
39	40	1.85	15	0.082%	1.227	0.313	0.013	0.150%	15
		1.85	18	0.031%	1.767	0.375	0.013	0.120%	
		1.85	24	0.007%	3.142	0.500	0.013	0.080%	
40	41	2.09	15	0.104%	1.227	0.313	0.013	0.150%	15
		2.09	18	0.039%	1.767	0.375	0.013	0.120%	
		2.09	24	0.008%	3.142	0.500	0.013	0.080%	
41	42	2.18	15	0.114%	1.227	0.313	0.013	0.150%	15
		2.18	18	0.043%	1.767	0.375	0.013	0.120%	
		2.18	24	0.009%	3.142	0.500	0.013	0.080%	

42	47	4.63	15	0.514%	1.227	0.313	0.013	0.150%	18
		4.63	18	0.195%	1.767	0.375	0.013	0.120%	
		4.63	24	0.042%	3.142	0.500	0.013	0.080%	
43	44	0.42	15	0.004%	1.227	0.313	0.013	0.150%	15
		0.42	18	0.002%	1.767	0.375	0.013	0.120%	
		0.42	24	0.000%	3.142	0.500	0.013	0.080%	
44	45	1.15	15	0.031%	1.227	0.313	0.013	0.150%	15
		1.15	18	0.012%	1.767	0.375	0.013	0.120%	
		1.15	24	0.003%	3.142	0.500	0.013	0.080%	
45	46	1.33	15	0.042%	1.227	0.313	0.013	0.150%	15
		1.33	18	0.016%	1.767	0.375	0.013	0.120%	
		1.33	24	0.003%	3.142	0.500	0.013	0.080%	
46	47	1.51	15	0.054%	1.227	0.313	0.013	0.150%	15
		1.51	18	0.021%	1.767	0.375	0.013	0.120%	
		1.51	24	0.004%	3.142	0.500	0.013	0.080%	
47	48	6.74	15	1.090%	1.227	0.313	0.013	0.150%	18
		6.74	18	0.412%	1.767	0.375	0.013	0.120%	
		6.74	24	0.089%	3.142	0.500	0.013	0.080%	
48	49	7.35	15	1.294%	1.227	0.313	0.013	0.150%	18
		7.35	18	0.489%	1.767	0.375	0.013	0.120%	
		7.35	24	0.105%	3.142	0.500	0.013	0.080%	
49	50	7.77	15	1.446%	1.227	0.313	0.013	0.150%	24
		7.77	18	0.547%	1.767	0.375	0.013	0.120%	
		7.77	24	0.118%	3.142	0.500	0.013	0.080%	
50	51	8.49	15	1.729%	1.227	0.313	0.013	0.150%	24
		8.49	18	0.654%	1.767	0.375	0.013	0.120%	
		8.49	24	0.141%	3.142	0.500	0.013	0.080%	
51	52	9.40	15	2.116%	1.227	0.313	0.013	0.150%	24
		9.40	18	0.800%	1.767	0.375	0.013	0.120%	
		9.40	24	0.173%	3.142	0.500	0.013	0.080%	
52	54	9.70	15	2.254%	1.227	0.313	0.013	0.150%	24
		9.70	18	0.853%	1.767	0.375	0.013	0.120%	
		9.70	24	0.184%	3.142	0.500	0.013	0.080%	
53	54	0.12	15	0.000%	1.227	0.313	0.013	0.150%	15
		0.12	18	0.000%	1.767	0.375	0.013	0.120%	
		0.12	24	0.000%	3.142	0.500	0.013	0.080%	
54	56	9.94	15	2.368%	1.227	0.313	0.013	0.150%	24
		9.94	18	0.895%	1.767	0.375	0.013	0.120%	
		9.94	24	0.193%	3.142	0.500	0.013	0.080%	
55	56	0.42	15	0.004%	1.227	0.313	0.013	0.150%	15
		0.42	18	0.002%	1.767	0.375	0.013	0.120%	
		0.42	24	0.000%	3.142	0.500	0.013	0.080%	
56	57	10.48	15	2.634%	1.227	0.313	0.013	0.150%	24
		10.48	18	0.996%	1.767	0.375	0.013	0.120%	
		10.48	24	0.215%	3.142	0.500	0.013	0.080%	

57	Outfall 2	10.66	15	2.725%	1.227	0.313	0.013	0.150%	24
		10.66	18	1.031%	1.767	0.375	0.013	0.120%	
		10.66	24	0.222%	3.142	0.500	0.013	0.080%	
58	59	8.63	15	1.784%	1.227	0.313	0.013	0.150%	24
		8.63	18	0.675%	1.767	0.375	0.013	0.120%	
		8.63	24	0.145%	3.142	0.500	0.013	0.080%	
59	60	12.99	15	4.046%	1.227	0.313	0.013	0.150%	24
		12.99	18	1.530%	1.767	0.375	0.013	0.120%	
		12.99	24	0.330%	3.142	0.500	0.013	0.080%	
60	Outfall 3	13.77	15	4.540%	1.227	0.313	0.013	0.150%	24
		13.77	18	1.717%	1.767	0.375	0.013	0.120%	
		13.77	24	0.370%	3.142	0.500	0.013	0.080%	

Terakee Village

Detention Facility Serving A-1 and A-2

C = **0.46** Remaining Unit Discharge = **0.100** cfs/acre
 Area = **16.52** acres Release through Restriction = **1.652** cfs

Detention Pond Sized For The **100** Year Storm

Time min	Rainfall Intensity in./hr.	Accumulated Volume (CF)	Allowable Release (CF)	Needed Detention (CF)
5	6.50	14809	496	14313
10	4.95	22555	991	21564
15	4.09	27954	1487	26467
20	3.48	31719	1983	29736
25	3.06	34893	2478	32415
30	2.75	37591	2974	34617
35	2.52	40192	3470	36723
40	2.29	41795	3965	37830
45	2.10	43157	4461	38696
50	1.94	44270	4957	39313
55	1.81	45315	5452	39863
60	1.70	46477	5948	40529
90	1.21	49451	8922	40529
120	0.93	50742	11896	38846
180	0.63	51917	17844	34073
360	0.35	57904	35688	22217
720	0.22	70535	71375	-840
1440	0.12	78081	142751	-64670

<- Det

Required Storage Volume = **40529** ft³

Terakee Village

Detention Facility Serving A-3 and A-4

C = **0.48** Remaining Unit Discharge = **0.100** cfs/acre
 Area = **13.62** acres Release through Restriction = **1.362** cfs

Detention Pond Sized For The **100** Year Storm

Time min	Rainfall Intensity in./hr.	Accumulated Volume (CF)	Allowable Release (CF)	Needed Detention (CF)
5	6.50	12656	409	12247
10	4.95	19275	817	18458
15	4.09	23890	1226	22664
20	3.48	27107	1635	25472
25	3.06	29820	2044	27776
30	2.75	32126	2452	29673
35	2.52	34348	2861	31487
40	2.29	35718	3270	32448
45	2.10	36882	3679	33204
50	1.94	37833	4087	33746
55	1.81	38727	4496	34231
60	1.70	39719	4905	34814
90	1.21	42261	7357	34904
120	0.93	43364	9809	33555
180	0.63	44369	14714	29654
360	0.35	49485	29428	20057
720	0.22	60280	58857	1423
1440	0.12	66728	117714	-50985

<- Det

Required Storage Volume = **34904** ft³

Terakee Village

Detention Facility Serving A-5 and A-6

C = **0.27** Remaining Unit Discharge = **0.100** cfs/acre
 Area = **21.65** acres Release through Restriction = **2.165** cfs

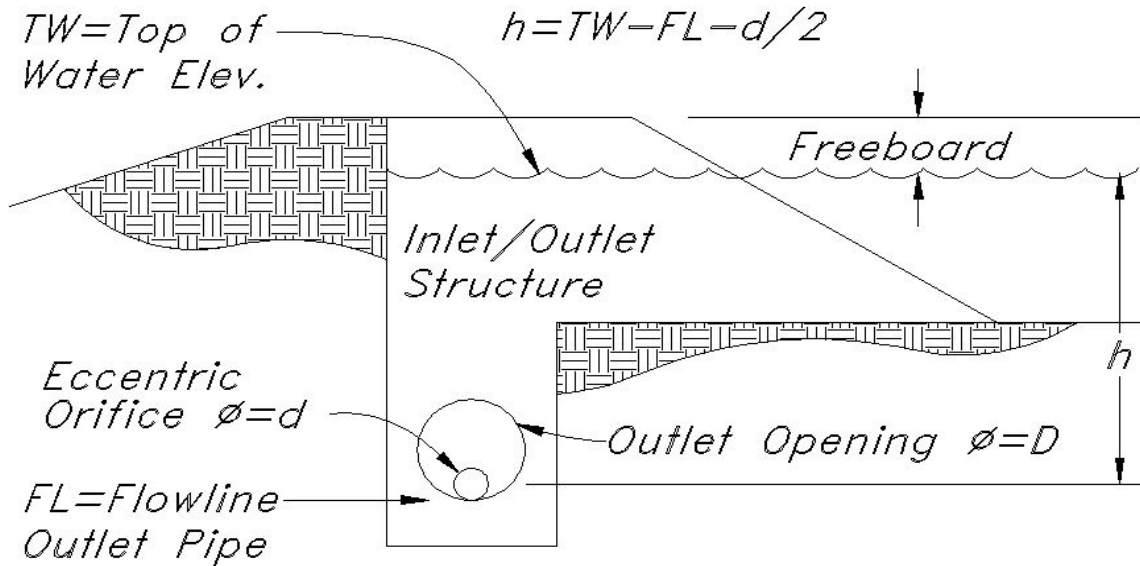
Detention Pond Sized For The **100** Year Storm

Time min	Rainfall Intensity in./hr.	Accumulated Volume (CF)	Allowable Release (CF)	Needed Detention (CF)
5	6.50	11597	650	10948
10	4.95	17663	1299	16364
15	4.09	21892	1949	19943
20	3.48	24840	2599	22241
25	3.06	27326	3248	24078
30	2.75	29439	3898	25541
35	2.52	31476	4547	26928
40	2.29	32731	5197	27534
45	2.10	33798	5847	27951
50	1.94	34669	6496	28173
55	1.81	35488	7146	28342
60	1.70	36397	7796	28602
90	1.21	38727	11693	27033
120	0.93	39737	15591	24146
180	0.63	40658	23387	17271
360	0.35	45347	46773	-1427
720	0.22	55238	93547	-38309
1440	0.12	61147	187093	-125946

<- Det

Required Storage Volume = **28602** ft³

ORIFICE PLATE CALCULATIONS



$Q = \text{Total Discharge Rate}$

$$Q = 0.62 \cdot A_o \cdot \sqrt{64.4 \cdot h}$$

$$A_o = \frac{\pi \cdot d^2}{4}$$

Solving for d, we have.....

$$d = \sqrt{\frac{4 \cdot Q}{0.62 \cdot \pi \cdot \sqrt{64.4 \cdot (TW - FL - d/2)}}}$$

Let $\Delta = d - \sqrt{\frac{4 \cdot Q}{0.62 \cdot \pi \cdot \sqrt{64.4 \cdot (TW - FL - d/2)}}}$

Goal-seek Δ to zero by changing "trial d"

Calculations for Pond Serving A-1 and A-2.

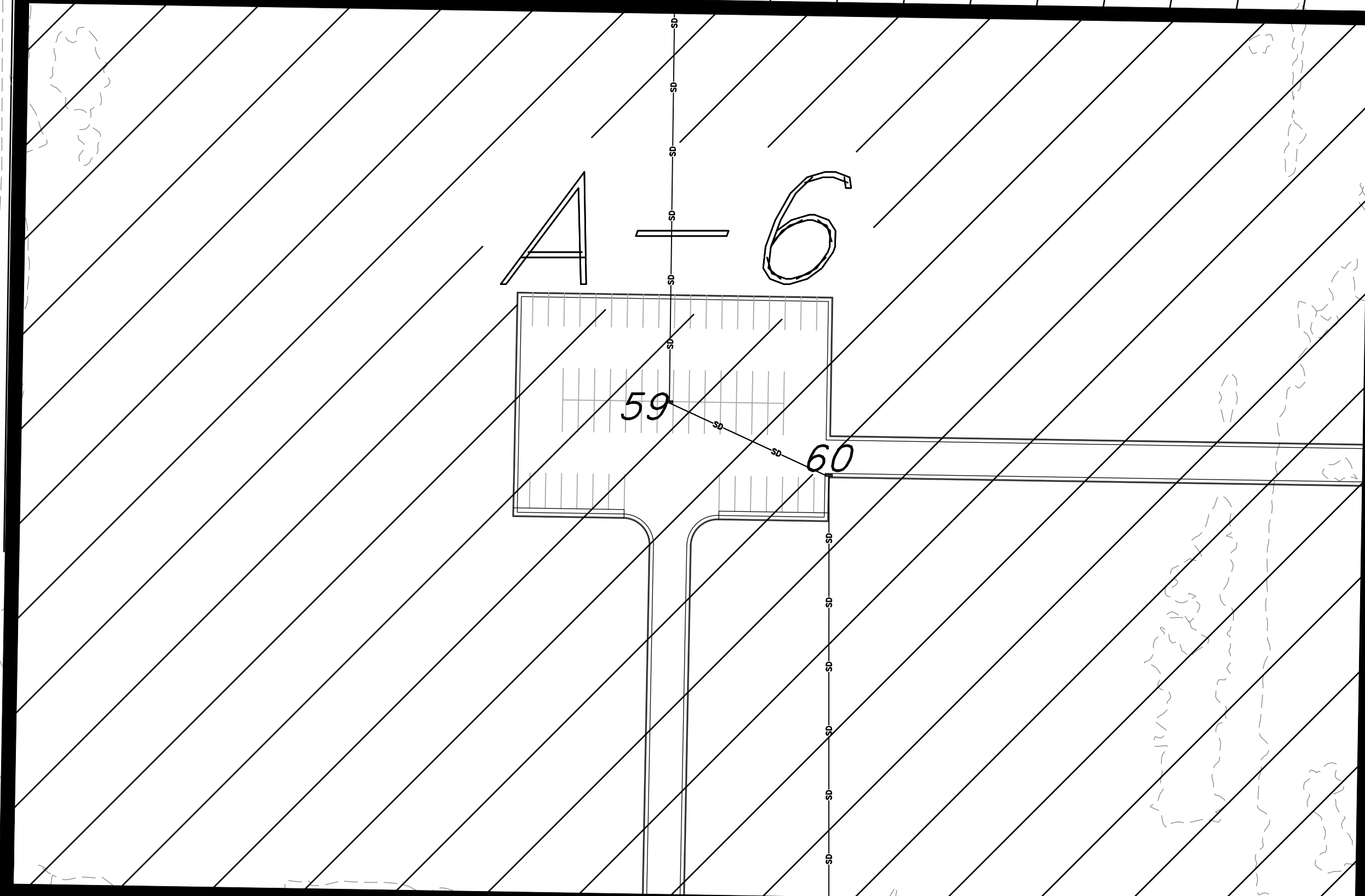
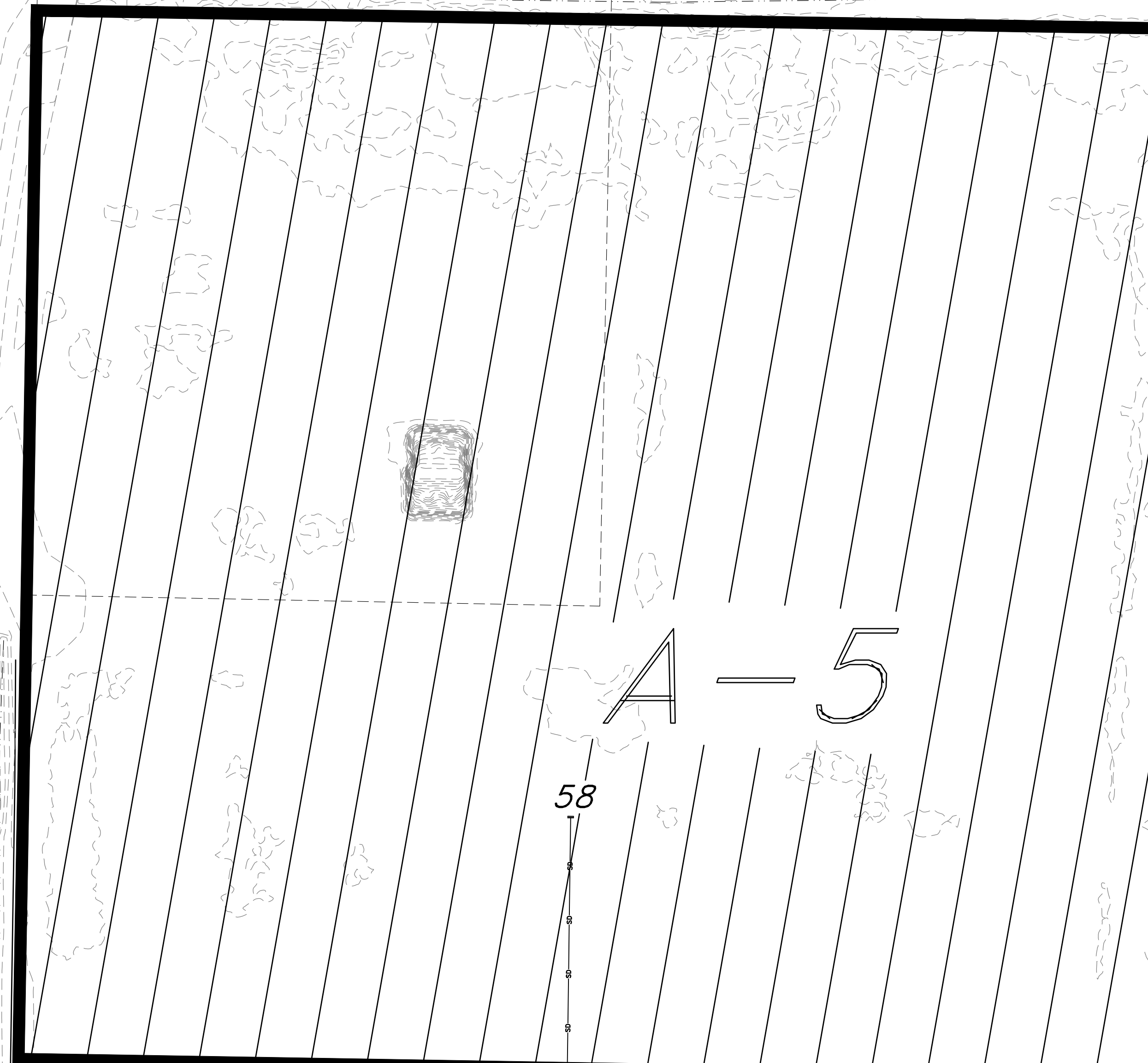
TW =	37.50	
FL =	34.00	
Q =	1.362	cfs
trial d =	0.4387	ft
$\Delta =$	0.000	ft
d =	5.26	inches

Farm
staff
ist

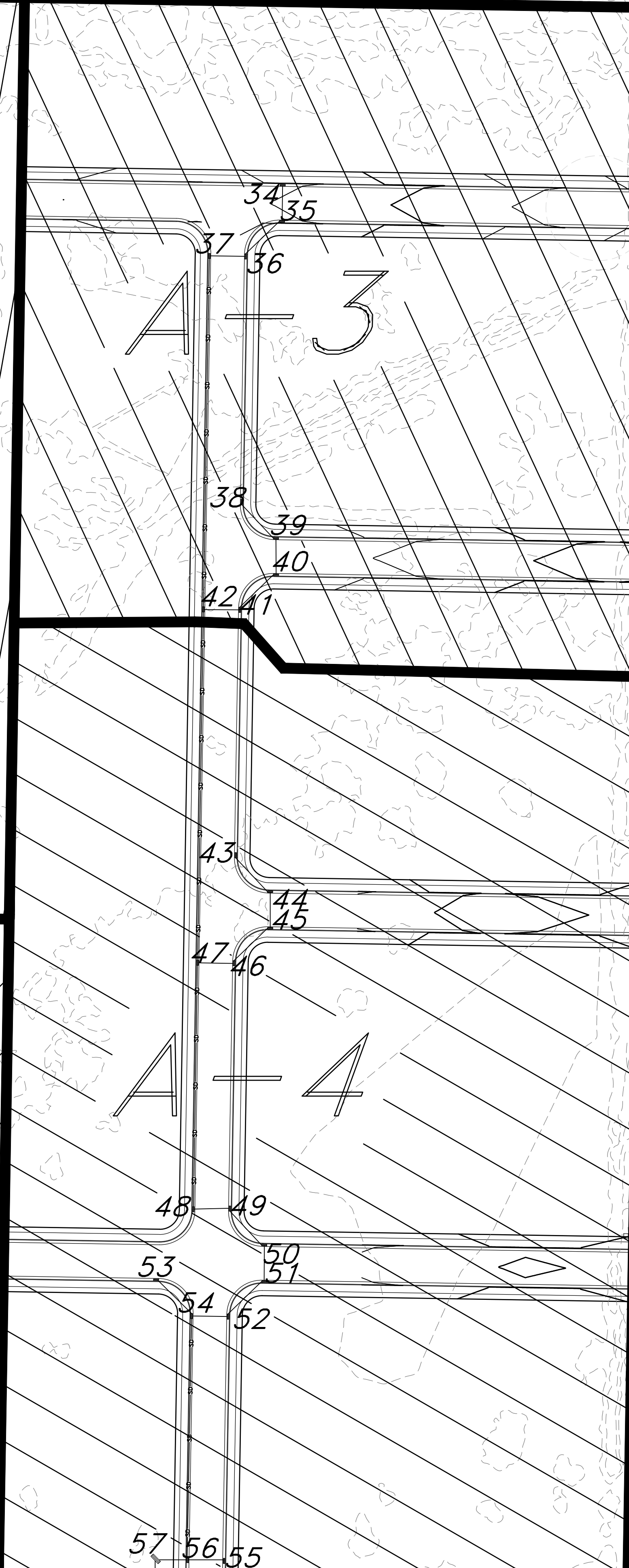
as R.
er

Farm

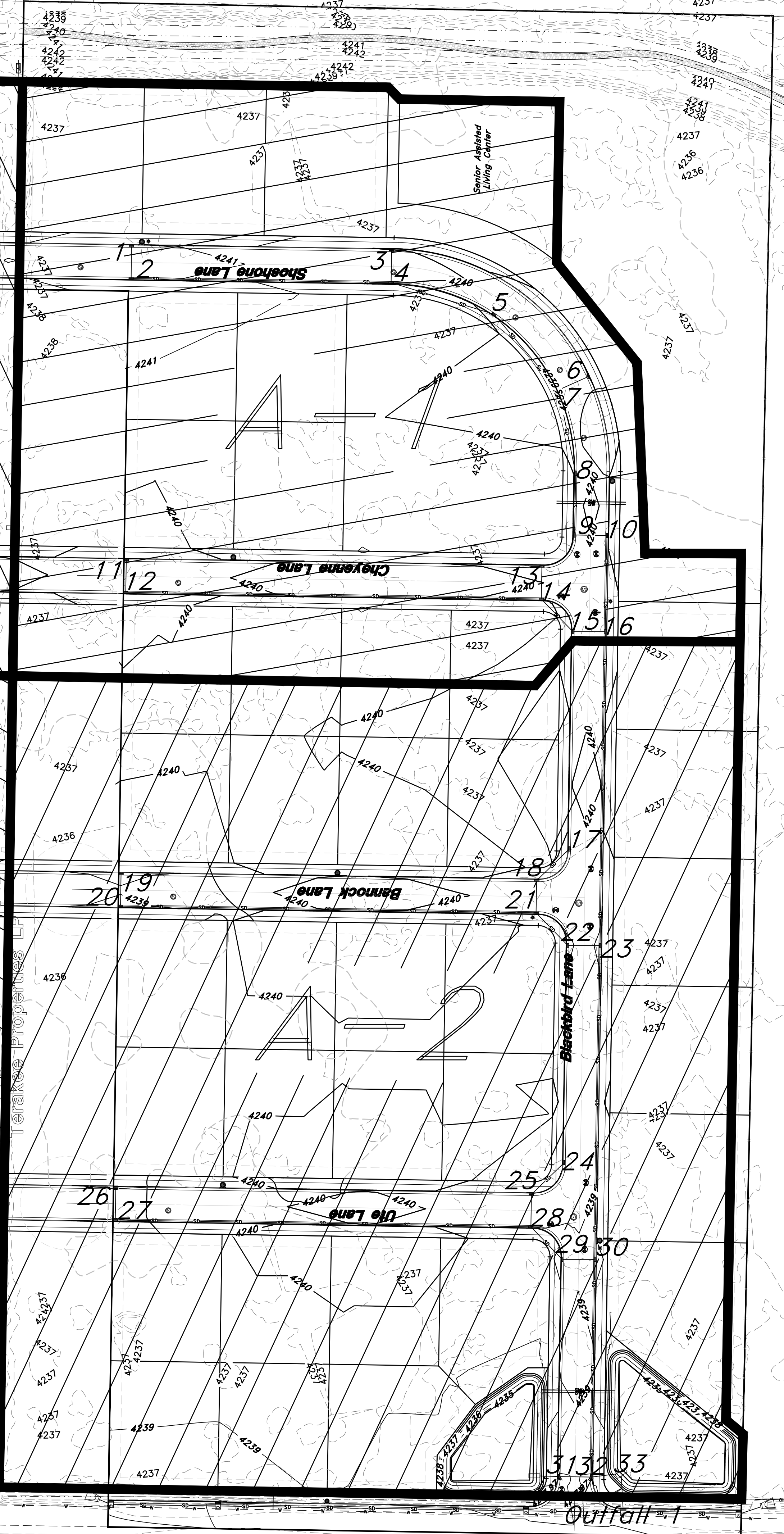
4700 West Street



Outfall 3



Outfall 2



Outfall 1

900 South Street

Dario & Mary R. Costesso

Robert W. ...
Melinda ...
Dico



NOAA Atlas 14, Volume 1, Version 5
Location name: Ogden, Utah, USA*
Latitude: 41.25°, Longitude: -112.085°
Elevation: 4236.57 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.50 (1.31-1.74)	1.88 (1.67-2.20)	2.59 (2.27-3.00)	3.24 (2.82-3.77)	4.31 (3.66-5.04)	5.30 (4.36-6.29)	6.50 (5.16-7.79)	7.92 (6.05-9.67)	10.2 (7.36-12.9)	12.3 (8.46-15.9)
10-min	1.15 (0.996-1.33)	1.44 (1.27-1.67)	1.97 (1.72-2.29)	2.47 (2.14-2.87)	3.28 (2.78-3.84)	4.04 (3.32-4.79)	4.95 (3.92-5.92)	6.03 (4.60-7.36)	7.78 (5.60-9.79)	9.40 (6.44-12.1)
15-min	0.944 (0.824-1.10)	1.19 (1.05-1.38)	1.63 (1.42-1.89)	2.04 (1.77-2.37)	2.71 (2.30-3.17)	3.34 (2.74-3.96)	4.09 (3.24-4.90)	4.98 (3.80-6.09)	6.42 (4.63-8.09)	7.76 (5.32-10.0)
30-min	0.636 (0.554-0.736)	0.800 (0.706-0.930)	1.10 (0.960-1.27)	1.37 (1.19-1.60)	1.82 (1.55-2.14)	2.25 (1.85-2.66)	2.75 (2.18-3.30)	3.35 (2.56-4.10)	4.33 (3.11-5.45)	5.23 (3.58-6.73)
60-min	0.394 (0.343-0.456)	0.495 (0.437-0.576)	0.678 (0.594-0.787)	0.849 (0.738-0.988)	1.13 (0.958-1.32)	1.39 (1.14-1.65)	1.70 (1.35-2.04)	2.08 (1.58-2.54)	2.68 (1.93-3.37)	3.24 (2.22-4.17)
2-hr	0.248 (0.220-0.283)	0.310 (0.274-0.354)	0.401 (0.353-0.458)	0.488 (0.425-0.560)	0.634 (0.540-0.734)	0.768 (0.638-0.901)	0.928 (0.744-1.11)	1.12 (0.864-1.36)	1.42 (1.04-1.79)	1.71 (1.18-2.19)
3-hr	0.193 (0.173-0.217)	0.237 (0.213-0.268)	0.298 (0.266-0.335)	0.353 (0.314-0.399)	0.444 (0.386-0.506)	0.528 (0.450-0.609)	0.633 (0.525-0.742)	0.758 (0.608-0.909)	0.962 (0.734-1.20)	1.15 (0.841-1.48)
6-hr	0.131 (0.120-0.144)	0.160 (0.146-0.176)	0.193 (0.176-0.214)	0.224 (0.202-0.248)	0.270 (0.240-0.302)	0.309 (0.271-0.348)	0.353 (0.305-0.403)	0.403 (0.340-0.468)	0.505 (0.411-0.610)	0.598 (0.472-0.747)
12-hr	0.083 (0.076-0.090)	0.101 (0.093-0.111)	0.122 (0.112-0.134)	0.141 (0.128-0.154)	0.168 (0.152-0.186)	0.191 (0.170-0.212)	0.215 (0.188-0.243)	0.241 (0.207-0.277)	0.282 (0.234-0.331)	0.315 (0.255-0.378)
24-hr	0.050 (0.047-0.055)	0.062 (0.057-0.067)	0.074 (0.068-0.080)	0.084 (0.077-0.091)	0.098 (0.090-0.106)	0.108 (0.099-0.117)	0.119 (0.109-0.129)	0.130 (0.118-0.141)	0.145 (0.130-0.168)	0.160 (0.139-0.191)
2-day	0.029 (0.027-0.032)	0.036 (0.033-0.039)	0.042 (0.039-0.046)	0.048 (0.044-0.052)	0.055 (0.051-0.060)	0.061 (0.056-0.066)	0.067 (0.061-0.072)	0.072 (0.066-0.078)	0.080 (0.072-0.086)	0.085 (0.077-0.097)
3-day	0.021 (0.020-0.023)	0.026 (0.024-0.028)	0.031 (0.029-0.033)	0.035 (0.032-0.038)	0.040 (0.037-0.043)	0.044 (0.041-0.048)	0.049 (0.045-0.053)	0.053 (0.048-0.057)	0.059 (0.053-0.064)	0.063 (0.057-0.070)
4-day	0.017 (0.016-0.018)	0.021 (0.019-0.023)	0.025 (0.023-0.027)	0.028 (0.026-0.030)	0.033 (0.030-0.035)	0.036 (0.033-0.039)	0.040 (0.036-0.043)	0.043 (0.040-0.047)	0.048 (0.043-0.052)	0.052 (0.046-0.057)
7-day	0.011 (0.011-0.012)	0.014 (0.013-0.015)	0.017 (0.016-0.018)	0.019 (0.018-0.020)	0.022 (0.020-0.024)	0.024 (0.022-0.026)	0.026 (0.024-0.028)	0.028 (0.026-0.031)	0.031 (0.029-0.034)	0.033 (0.030-0.037)
10-day	0.009 (0.008-0.010)	0.011 (0.010-0.012)	0.013 (0.012-0.014)	0.015 (0.014-0.016)	0.017 (0.016-0.018)	0.019 (0.017-0.020)	0.020 (0.019-0.022)	0.022 (0.020-0.023)	0.023 (0.021-0.025)	0.025 (0.023-0.027)
20-day	0.006 (0.005-0.006)	0.007 (0.007-0.008)	0.008 (0.008-0.009)	0.009 (0.009-0.010)	0.011 (0.010-0.011)	0.012 (0.011-0.012)	0.012 (0.011-0.013)	0.013 (0.012-0.014)	0.014 (0.013-0.015)	0.015 (0.014-0.016)
30-day	0.005 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.007)	0.007 (0.007-0.008)	0.008 (0.008-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.010)	0.010 (0.010-0.011)	0.011 (0.010-0.012)	0.011 (0.011-0.012)
45-day	0.004 (0.004-0.004)	0.005 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.006)	0.007 (0.006-0.007)	0.007 (0.007-0.008)	0.008 (0.007-0.008)	0.008 (0.008-0.009)	0.009 (0.008-0.009)	0.009 (0.008-0.010)
60-day	0.003 (0.003-0.004)	0.004 (0.004-0.004)	0.005 (0.005-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.007)	0.007 (0.007-0.008)	0.008 (0.007-0.008)	0.008 (0.007-0.009)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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