Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A1		0.097	0.131	25.0	4.03	13.0	2.84	6.7	85	164,729	0.57	94,676	35.0	31	94,308	0.68
B1		0.092	0.139	18.2	3.44	9.5	2.43	5.7	95	134,310	0.58	77,837	30.0	29	77,220	0.80
B2		0.093	0.113	33.3	4.40	17.3	3.11	7.3	35	90,351	0.56	50,405	35.0	12	50,284	0.48
B3		0.109	0.171	35.1	6.09	18.2	4.30	10.2	159	431,607	0.31	135,184	35.0	37	135,109	0.31
C1		0.089	0.205	15.3	3.91	7.9	2.76	6.5	238	281,797	0.64	181,072	30.0	76	180,336	0.97
D1		0.092	0.115	17.3	3.03	9.0	2.14	5.1	66	88,318	0.67	59,557	30.0	24	58,560	0.99
D2		0.084	0.229	15.9	4.30	8.3	3.04	7.2	229	282,777	0.87	246,138	30.0	98	245,292	1.26
E1		0.114	0.151	26.8	4.61	13.9	3.25	7.7	155	321,618	0.41	131,675	35.0	47	131,227	0.53
F1		0.107	0.097	32.8	3.94	17.1	2.78	6.6	48	122,440	0.47	56,968	35.0	16	56,751	0.48
F2		0.088	0.198	21.9	4.83	11.4	3.41	8.1	145	245,533	0.75	184,862	35.0	60	183,986	0.89
F3		0.092	0.087	20.4	2.87	10.6	2.03	4.8	30	46,609	0.68	31,862	30.0	11	31,302	0.88
F4		0.121	0.121	41.5	5.37	21.6	3.79	8.9	58	186,981	0.36	67,763	35.0	17	67,675	0.34
G1		0.096	0.093	25.2	3.31	13.1	2.34	5.5	37	73,072	0.59	43,083	30.0	14	42,758	0.68
G2		0.107	0.067	37.3	3.43	19.4	2.42	5.7	19	54,958	0.47	25,571	35.0	7	25,468	0.43
H1		0.109	0.078	39.3	3.85	20.4	2.72	6.4	25	75,177	0.31	23,258	35.0	6	23,195	0.27
H2		0.092	0.101	20.5	3.09	10.6	2.18	5.2	42	67,337	0.67	45,076	30.0	16	44,528	0.88
H3		0.094	0.058	19.2	2.36	10.0	1.67	3.9	15	21,816	0.64	13,878	30.0	5	13,432	0.87
H4		0.095	0.111	22.8	3.45	11.9	2.44	5.7	57	100,370	0.61	61,173	30.0	21	60,592	0.76

Printouts for Unit Hydrographs

flow in cfs

time in minutes	A1	B1	B2	B3	C1	D1	D2	E1	F1	F2	F3	F4	G1	G2	H1	H2	H3	H4
5	77.33	93.25	30.09	102.59	220.53	65.84	199.90	128.93	44.36	115.64	29.50	42.62	37.03	18.62	23.03	42.42	14.61	55.54
10	82.78	86.57	34.71	158.92	211.37	57.29	212.53	153.31	47.44	142.37	26.77	58.18	35.84	18.73	24.44	38.99	12.72	53.96
15	70.87	64.60	32.47	154.15	146.87	42.55	148.71	136.86	43.94	117.23	20.78	56.54	30.18	17.61	23.25	30.20	9.82	43.13
20	57.63	49.16	28.07	139.10	107.74	32.08	108.63	110.77	37.50	92.72	16.66	52.59	24.96	15.66	21.07	24.25	7.67	35.72
25	47.82	39.67	24.21	116.79	80.83	25.68	83.75	93.90	32.69	72.89	13.46	46.34	20.75	13.62	18.22	19.53	6.26	28.56
30	39.89	30.81	21.23	103.58	53.91	19.28	58.88	77.26	28.57	61.39	11.05	41.06	17.44	12.21	16.48	16.06	5.00	24.34
35	34.20	21.94	18.25	90.37	40.79	13.08	41.89	67.52	24.45	50.16	8.64	37.09	14.97	10.80	14.74	12.59	3.73	20.17
40	28.51	17.08	16.20	78.14	31.82	10.94	33.60	57.77	21.87	38.93	6.23	33.12	12.50	9.45	13.00	9.12	2.78	16.00
45	22.81	14.12	14.45	70.52	22.85	8.81	25.30	48.03	19.44	28.50	5.21	29.15	10.02	8.61	11.70	7.55	2.35	11.83
50	17.12	11.17	12.70	62.89	13.88	6.68	17.01	38.28	17.01	24.76	4.40	26.80	7.55	7.77	10.67	6.39	1.93	10.13
55	15.14	8.21	10.96	55.26	4.91	4.55	8.72	30.20	14.58	21.02	3.60	24.47	6.69	6.93	9.63	5.24	1.51	8.74
60	13.25	5.26	9.21	47.63	0.00	2.41	0.43	26.95	12.15	17.28	2.80	22.14	5.86	6.09	8.60	4.08	1.09	7.35
65	11.35	2.30	7.46	40.01		0.28	0.00	23.70	9.73	13.53	1.99	19.80	5.04	5.25	7.56	2.92	0.66	5.96
70	9.45	0.00	6.57	32.38		0.00		20.45	8.85	9.79	1.19	17.47	4.21	4.41	6.53	1.77	0.24	4.57
75	7.55		5.99	29.45				17.20	8.04	6.05	0.39	15.14	3.39	3.73	5.49	0.61	0.00	3.18
80	5.65		5.41	26.90				13.96	7.23	2.30	0.00	12.80	2.56	3.45	4.78	0.00		1.79
85	3.76		4.83	24.36				10.71	6.42	0.00		11.25	1.74	3.17	4.43			0.40
90	1.86		4.24	21.82				7.46	5.61			10.48	0.92	2.89	4.09			0.00
95	0.00		3.66	19.28				4.21	4.80			9.70	0.09	2.61	3.74			
100			3.08	16.73				0.96	3.99			8.92	0.00	2.33	3.40			
105			2.50	14.19				0.00	3.18			8.14		2.05	3.05			
110			1.91	11.65					2.37			7.37		1.77	2.71			
115			1.33	9.11					1.57			6.59		1.49	2.36			
120			0.75	6.57					0.76			5.81		1.21	2.02			
125			0.16	4.02					0.00			5.03		0.93	1.67			
130			0.00	1.48								4.25		0.65	1.33			
135				0.00								3.48		0.37	0.98			
140												2.70		0.09	0.64			
145												1.92		0.00	0.29			
150												1.14			0.00			
155												0.37						
160												0.00						

Printouts for Storm Hydrographs

flow in cfs

time in minutes	A1	B1	B2	B3	C1	D1	D2	E1	F1	F2	F3	F4	G1	G2	H1	H2	H3	H4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.36	0.64	0.20	0.23	1.74	0.44	2.08	0.18	0.10	0.95	0.20	0.04	0.18	0.04	0.05	0.28	0.09	0.30
15	2.32	4.09	1.30	1.64	11.12	2.79	13.53	1.21	0.67	6.30	1.29	0.24	1.17	0.28	0.33	1.79	0.56	1.93
20	6.67	9.83	3.33	5.52	26.84	6.88	33.61	5.50	2.52	16.68	3.21	1.29	3.22	1.04	1.05	4.47	1.38	5.10
25	20.87	22.60	7.93	17.10	59.49	18.93	77.51	25.66	9.83	42.33	8.75	7.68	9.89	4.07	3.28	12.38	4.00	15.21
30	30.38	29.46	11.46	31.45	75.68	24.15	98.47	43.67	15.39	59.83	11.36	14.72	13.78	6.23	5.43	16.24	5.21	20.93
35	30.72	26.67	12.02	36.88	66.79	21.82	89.51	46.88	16.28	60.11	10.60	17.33	13.54	6.55	5.68	15.19	4.80	20.15
40	27.81	22.58	11.45	35.92	54.47	18.39	74.71	42.71	15.34	53.80	9.29	17.30	12.26	6.29	5.48	13.31	4.14	17.97
45	24.51	19.22	10.58	32.86	44.66	15.44	62.27	37.28	13.93	46.86	8.06	16.18	10.85	5.79	5.07	11.52	3.55	15.68
50	21.78	16.55	9.82	29.65	36.85	13.05	52.12	32.55	12.68	41.47	7.06	14.80	9.70	5.34	4.66	10.08	3.07	13.90
55	19.37	13.99	9.08	26.95	30.79	10.72	43.60	28.65	11.43	36.51	6.07	13.55	8.65	4.91	4.30	8.67	2.59	12.22
60	17.19	12.08	8.45	24.37	26.55	9.18	37.60	25.43	10.42	31.82	5.18	12.40	7.70	4.50	3.96	7.40	2.19	10.64
65	15.12	10.81	7.94	22.29	22.96	8.12	32.85	22.34	9.59	27.79	4.57	11.31	6.80	4.17	3.65	6.51	1.94	9.21
70	13.24	9.76	7.45	20.59	19.65	7.15	28.46	19.37	8.80	25.18	4.16	10.45	5.97	3.90	3.41	5.91	1.74	8.23
75	11.79	8.53	6.89	18.85	16.26	6.00	23.71	16.54	7.92	22.91	3.71	9.69	5.33	3.60	3.17	5.26	1.52	7.41
80	10.62	7.22	6.30	17.03	13.53	4.85	19.26	14.42	6.99	20.51	3.23	8.91	4.82	3.27	2.93	4.59	1.29	6.62
85	9.57	6.07	5.76	15.23	12.11	3.89	16.78	12.86	6.11	18.18	2.78	8.12	4.36	2.94	2.68	3.95	1.07	5.87
90	8.59	5.20	5.35	13.56	11.42	3.34	15.58	11.48	5.49	15.96	2.36	7.34	3.93	2.63	2.44	3.35	0.88	5.16
95	7.65	4.76	5.07	12.35	10.98	3.08	14.84	10.17	5.07	13.90	2.00	6.56	3.52	2.36	2.21	2.83	0.74	4.47
100	6.58	4.29	4.75	11.49	9.92	2.75	13.45	8.75	4.63	11.66	1.65	5.77	3.04	2.14	2.00	2.33	0.63	3.69
105	5.52	3.91	4.43	10.66	9.00	2.49	12.15	7.33	4.21	9.81	1.45	5.11	2.58	1.98	1.85	2.03	0.57	2.99
110	4.54	3.64	4.12	9.86	8.35	2.30	11.26	5.94	3.80	8.73	1.33	4.64	2.14	1.83	1.74	1.86	0.53	2.52
115	3.70	3.43	3.83	9.09	7.88	2.17	10.60	4.61	3.41	8.10	1.24	4.29	1.76	1.69	1.63	1.74	0.49	2.27
120	3.19	3.19	3.52	8.32	7.31	2.00	9.84	3.37	3.02	7.53	1.15	3.97	1.51	1.55	1.52	1.61	0.46	2.09
125	2.62	2.47	3.05	7.36	5.48	1.52	7.54	2.39	2.55	6.26	0.91	3.63	1.23	1.38	1.38	1.28	0.35	1.70
130	2.11	1.84	2.57	6.30	3.83	1.12	5.34	1.80	2.09	4.91	0.70	3.29	0.99	1.21	1.23	0.99	0.27	1.34
135	1.69	1.37	2.11	5.27	2.67	0.82	3.79	1.42	1.65	3.82	0.54	2.96	0.80	1.05	1.09	0.76	0.20	1.06
140	1.35	1.02	1.70	4.28	1.82	0.60	2.64	1.13	1.23	2.98	0.42	2.63	0.64	0.89	0.95	0.58	0.15	0.84
145	1.08	0.74	1.34	3.35	1.21	0.42	1.78	0.90	0.87	2.30	0.31	2.32	0.51	0.74	0.82	0.44	0.11	0.65
150	0.86	0.52	1.07	2.50	0.80	0.29	1.19	0.71	0.64	1.75	0.23	2.01	0.41	0.59	0.69	0.33	0.08	0.50
155	0.67	0.37	0.89	1.83	0.51	0.20	0.79	0.56	0.52	1.31	0.17	1.71	0.32	0.45	0.57	0.24	0.06	0.38
160	0.51	0.25	0.74	1.42	0.29	0.14	0.47	0.43	0.42	0.98	0.13	1.41	0.25	0.33	0.45	0.18	0.04	0.29
165	0.40	0.16	0.62	1.18	0.13	0.08	0.23	0.33	0.34	0.73	0.09	1.12	0.19	0.24	0.34	0.13	0.03	0.22
170	0.31	0.09	0.51	0.98	0.03	0.04	0.08	0.25	0.28	0.52	0.06	0.83	0.15	0.18	0.25	0.09	0.02	0.16
175	0.23	0.04	0.42	0.82	0.00	0.01	0.00	0.19	0.22	0.36	0.04	0.55	0.11	0.15	0.19	0.05	0.01	0.11
180	0.17	0.01	0.35	0.67	0.00	0.00	0.00	0.14	0.18	0.23	0.02	0.35	0.08	0.12	0.15	0.03	0.00	0.08
185	0.12	0.00	0.29	0.56	0.00	0.00	0.00	0.10	0.14	0.13	0.01	0.24	0.06	0.10	0.13	0.01	0.00	0.05
190	0.08	0.00	0.23	0.46	0.00	0.00	0.00	0.07	0.11	0.06	0.00	0.19	0.04	0.08	0.11	0.00	0.00	0.03
195	0.05	0.00	0.19	0.38	0.00	0.00	0.00	0.05	0.09	0.02	0.00	0.15	0.02	0.07	0.09	0.00	0.00	0.01
200	0.02	0.00	0.15	0.30	0.00	0.00	0.00	0.03	0.07	0.00	0.00	0.12	0.01	0.05	0.08	0.00	0.00	0.00
205	0.01	0.00	0.11	0.24	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.10	0.00	0.04	0.06	0.00	0.00	0.00
210	0.00	0.00	0.08	0.18	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.08	0.00	0.03	0.05	0.00	0.00	0.00
215	0.00	0.00	0.06	0.14	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.06	0.00	0.03	0.04	0.00	0.00	0.00
220	0.00	0.00	0.04	0.10	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.05	0.00	0.02	0.03	0.00	0.00	0.00
225	0.00	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.01	0.03	0.00	0.00	0.00
230	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.01	0.02	0.00	0.00	0.00
235	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.00
240	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00
245	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
255	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
260	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
265	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
270	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
275	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
A1		0.096	0.134	24.4	4.01	12.7	2.83	6.7	87	164,729	1.93	317,756	40.0	101	316,720	2.22
B1		0.091	0.141	17.8	3.42	9.2	2.42	5.7	98	134,310	1.82	243,813	35.0	97	241,630	2.62
B2		0.092	0.115	32.5	4.38	16.9	3.09	7.3	36	90,351	1.79	161,555	40.0	42	161,041	1.70
B3		0.089	0.250	19.5	5.26	10.2	3.72	8.8	285	431,607	1.88	813,554	40.0	295	807,930	2.48
C1		0.088	0.210	14.7	3.88	7.6	2.74	6.5	247	281,797	1.91	539,141	35.0	238	535,192	3.07
D1		0.092	0.116	17.1	3.02	8.9	2.14	5.0	67	88,318	2.03	179,570	35.0	70	176,587	2.88
D2		0.083	0.230	15.8	4.30	8.2	3.04	7.2	231	282,777	2.25	634,968	35.0	252	632,818	3.24
E1		0.113	0.150	26.5	4.56	13.8	3.23	7.6	157	321,618	1.75	563,176	40.0	178	561,356	2.01
F1		0.106	0.096	32.4	3.90	16.9	2.76	6.5	49	122,440	1.81	221,916	40.0	59	221,037	1.75
F2		0.088	0.199	21.7	4.82	11.3	3.40	8.0	146	245,533	2.12	520,116	40.0	171	517,601	2.53
F3		0.091	0.088	20.1	2.86	10.5	2.02	4.8	30	46,609	2.04	95,234	35.0	33	93,473	2.56
F4		0.090	0.168	22.4	4.39	11.7	3.10	7.3	108	186,981	2.06	385,413	40.0	125	383,174	2.42
G1		0.095	0.095	24.6	3.29	12.8	2.33	5.5	38	73,072	1.94	142,048	40.0	44	140,977	2.18
G2		0.106	0.067	36.8	3.40	19.2	2.41	5.7	19	54,958	1.81	99,609	45.0	24	99,196	1.58
H1		0.107	0.078	38.6	3.80	20.1	2.69	6.3	25	75,177	1.49	111,730	45.0	28	111,424	1.33
H2		0.092	0.102	20.2	3.08	10.5	2.18	5.1	43	67,337	2.03	136,549	35.0	48	134,796	2.57
H3		0.093	0.059	18.9	2.36	9.8	1.66	3.9	15	21,816	1.99	43,454	35.0	16	42,019	2.60
H4		0.094	0.113	22.3	3.44	11.6	2.43	5.7	58	100,370	1.96	197,106	35.0	65	195,054	2.34

Printouts for Storm Hydrographs

flow in cfs

time in minutes	A1	B1	B2	B3	C1	D1	D2	E1	F1	F2	F3	F4	G1	G2	H1	H2	H3	H4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.94	1.68	0.52	4.22	4.78	1.15	5.37	0.48	0.27	2.45	0.53	1.71	0.48	0.11	0.13	0.73	0.23	0.79
15	3.15	5.42	1.79	15.33	15.49	3.64	18.05	1.65	0.90	8.65	1.69	5.85	1.57	0.37	0.45	2.35	0.73	2.57
20	8.70	11.45	4.00	34.16	32.52	8.58	40.38	7.60	3.38	20.68	4.00	14.14	4.16	1.40	1.40	5.60	1.74	6.52
25	28.66	29.50	10.41	82.19	78.37	24.79	95.14	38.37	14.16	53.76	11.42	39.02	13.48	5.86	4.98	16.26	5.32	20.51
30	74.80	79.47	28.38	209.96	197.61	59.58	206.21	118.53	40.66	125.47	27.36	93.76	34.55	16.72	18.14	39.34	13.13	51.86
35	97.97	97.08	39.09	293.34	238.03	70.07	252.18	167.02	54.90	167.34	32.93	122.79	43.48	22.15	25.18	47.62	15.60	64.71
40	100.64	91.72	42.26	295.27	217.83	65.95	236.84	178.04	58.95	170.90	31.93	124.89	43.95	23.88	27.51	46.23	14.96	64.17
45	95.76	81.74	41.60	270.79	188.54	59.25	209.67	171.37	58.16	160.16	29.55	117.59	41.86	23.95	27.62	42.78	13.70	60.43
50	88.61	71.93	39.52	241.02	158.77	52.39	182.92	159.94	55.68	145.90	26.81	107.63	38.81	23.14	26.37	38.80	12.35	55.33
55	80.64	61.06	36.70	210.38	128.15	44.77	154.98	145.85	52.10	131.63	23.79	97.40	35.39	21.94	24.69	34.43	10.81	49.97
60	73.72	51.53	33.93	181.32	108.02	38.53	133.43	134.19	48.66	118.30	21.04	88.02	32.46	20.78	23.06	30.45	9.45	45.14
65	67.40	45.18	31.76	156.70	93.56	34.56	118.85	123.94	46.04	106.27	18.72	79.39	29.76	19.73	21.51	27.09	8.44	40.65
70	57.62	37.36	28.86	133.61	72.90	28.24	97.25	107.68	41.56	90.84	15.78	67.48	25.37	18.01	19.61	22.80	7.03	34.05
75	48.65	30.42	25.90	111.95	54.03	22.66	76.20	90.77	36.98	77.55	13.35	57.62	21.48	16.38	17.89	19.26	5.84	28.96
80	41.32	23.90	22.84	92.09	37.59	17.26	56.56	75.87	32.23	65.51	11.01	48.88	18.30	14.67	16.16	15.88	4.69	24.47
85	35.33	18.17	19.94	74.04	27.23	12.61	40.76	64.74	27.82	54.76	8.95	41.21	15.71	13.05	14.51	12.91	3.68	20.55
90	30.19	13.24	17.37	58.22	21.17	8.92	31.25	55.66	23.97	45.42	7.12	34.55	13.49	11.51	12.93	10.27	2.78	17.14
95	25.62	9.81	15.52	44.14	17.61	6.75	25.52	47.90	21.14	36.94	5.47	28.49	11.50	10.09	11.40	7.89	2.02	14.01
100	21.38	7.91	14.06	33.30	15.21	5.47	21.73	40.83	18.87	29.27	4.09	22.92	9.66	8.92	9.98	5.89	1.52	11.11
105	17.42	6.73	12.77	27.35	13.68	4.57	19.13	34.26	16.87	22.78	3.22	17.88	7.94	8.04	8.89	4.60	1.23	8.49
110	13.78	5.95	11.60	23.68	12.61	3.96	17.35	28.05	15.05	18.35	2.68	13.86	6.34	7.30	8.07	3.81	1.03	6.41
115	10.62	5.43	10.50	21.24	11.96	3.53	16.10	22.23	13.36	15.62	2.31	11.46	4.94	6.63	7.37	3.28	0.89	5.17
120	8.32	5.07	9.45	19.57	11.75	3.23	15.37	16.77	11.75	13.81	2.05	9.95	3.86	6.02	6.74	2.90	0.79	4.39
125	6.31	3.83	8.12	15.88	8.79	2.37	11.92	11.58	10.02	11.03	1.55	7.84	2.90	5.36	6.08	2.19	0.58	3.35
130	4.73	2.80	6.80	11.73	6.09	1.72	8.39	8.10	8.35	8.30	1.14	5.91	2.18	4.72	5.44	1.60	0.42	2.49
135	3.52	2.07	5.52	8.70	4.24	1.26	6.01	5.78	6.72	6.17	0.83	4.41	1.63	4.12	4.82	1.17	0.31	1.84
140	2.61	1.55	4.31	6.55	2.89	0.93	4.27	4.12	5.15	4.58	0.63	3.26	1.22	3.56	4.24	0.88	0.23	1.34
145	1.91	1.13	3.21	4.92	1.91	0.66	2.93	2.90	3.70	3.47	0.47	2.44	0.90	3.00	3.67	0.66	0.17	0.99
150	1.39	0.81	2.32	3.64	1.29	0.47	2.00	2.02	2.57	2.64	0.35	1.86	0.66	2.45	3.11	0.50	0.13	0.75
155	1.04	0.58	1.76	2.65	0.79	0.33	1.33	1.36	1.85	1.99	0.26	1.41	0.49	1.91	2.56	0.37	0.09	0.57
160	0.80	0.40	1.36	1.97	0.41	0.22	0.80	0.91	1.35	1.51	0.20	1.08	0.37	1.40	2.02	0.28	0.07	0.44
165	0.62	0.26	1.05	1.39	0.15	0.13	0.40	0.69	0.98	1.15	0.14	0.84	0.29	0.96	1.49	0.20	0.05	0.34
170	0.49	0.14	0.81	0.91	0.02	0.07	0.13	0.54	0.70	0.85	0.10	0.63	0.23	0.68	1.00	0.14	0.03	0.25
175	0.37	0.06	0.63	0.53	0.00	0.02	0.00	0.43	0.50	0.58	0.06	0.45	0.18	0.50	0.66	0.09	0.02	0.18
180	0.28	0.02	0.49	0.26	0.00	0.00	0.00	0.33	0.35	0.37	0.03	0.30	0.13	0.36	0.46	0.05	0.01	0.12
185	0.19	0.00	0.39	0.08	0.00	0.00	0.00	0.25	0.26	0.21	0.01	0.18	0.09	0.26	0.33	0.02	0.00	0.07
190	0.12	0.00	0.32	0.00	0.00	0.00	0.00	0.18	0.21	0.09	0.00	0.09	0.06	0.19	0.24	0.00	0.00	0.04
195	0.07	0.00	0.26	0.00	0.00	0.00	0.00	0.12	0.17	0.02	0.00	0.03	0.03	0.13	0.18	0.00	0.00	0.01
200	0.03	0.00	0.21	0.00	0.00	0.00	0.00	0.07	0.13	0.00	0.00	0.00	0.02	0.10	0.13	0.00	0.00	0.00
205	0.01	0.00	0.16	0.00	0.00	0.00	0.00	0.04	0.10	0.00	0.00	0.00	0.00	0.08	0.10	0.00	0.00	0.00
210	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.01	0.08	0.00	0.00	0.00	0.00	0.06	0.07	0.00	0.00	0.00
215	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.06	0.00	0.00	0.00
220	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.04	0.05	0.00	0.00	0.00
225	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.03	0.04	0.00	0.00	0.00
230	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00
235	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
240	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
245	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
255	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
260	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
265	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Printouts for Unit Hydrographs

flow in cfs

time in minutes	A1	B1	B2	B3	C1	D1	D2	E1	F1	F2	F3	F4	G1	G2	H1	H2	H3	H4
5	79.48	95.51	30.93	212.33	229.82	66.81	201.50	131.02	45.09	117.17	29.92	92.63	37.90	18.89	23.57	43.06	14.85	56.70
10	84.67	87.92	35.54	282.68	215.27	57.76	213.46	154.59	47.98	143.83	27.05	104.96	36.56	18.95	24.84	39.42	12.85	54.86
15	71.63	65.18	33.09	218.45	147.65	42.75	148.95	137.43	44.32	117.53	20.92	85.95	30.43	17.77	23.57	30.43	9.89	43.38
20	58.21	48.97	28.30	170.33	107.98	32.20	108.75	111.17	37.59	92.99	16.68	69.02	25.18	15.74	21.25	24.29	7.66	35.92
25	47.87	39.61	24.48	132.75	78.94	25.61	83.53	93.98	32.85	72.85	13.48	54.84	20.77	13.71	18.39	19.57	6.27	28.68
30	40.08	30.32	21.34	107.50	49.89	19.02	58.31	77.43	28.63	61.37	11.00	46.28	17.51	12.26	16.59	16.00	4.96	24.34
35	34.09	21.04	18.21	82.24	39.94	13.05	41.79	67.50	24.41	49.89	8.52	38.16	14.92	10.82	14.79	12.42	3.65	20.00
40	28.10	16.93	16.26	57.04	30.26	10.85	33.38	57.58	21.90	38.40	6.04	30.04	12.33	9.48	12.98	8.85	2.77	15.66
45	22.11	13.83	14.43	48.62	20.58	8.66	24.98	47.65	19.41	28.45	5.18	21.93	9.74	8.62	11.74	7.51	2.33	11.51
50	16.99	10.74	12.59	40.20	10.90	6.46	16.57	37.72	16.92	24.63	4.35	18.95	7.50	7.76	10.67	6.32	1.89	10.06
55	15.00	7.64	10.76	31.78	1.22	4.26	8.16	30.14	14.43	20.80	3.52	16.25	6.63	6.90	9.60	5.12	1.46	8.61
60	13.00	4.55	8.92	23.36	0.00	2.07	0.00	26.83	11.95	16.97	2.70	13.54	5.77	6.04	8.53	3.93	1.02	7.17
65	11.00	1.45	7.15	14.94		0.00		23.53	9.65	13.14	1.87	10.83	4.91	5.18	7.46	2.74	0.58	5.72
70	9.01	0.00	6.53	6.53				20.22	8.82	9.32	1.04	8.13	4.04	4.32	6.39	1.55	0.15	4.27
75	7.01		5.92	0.00				16.91	7.99	5.49	0.22	5.42	3.18	3.72	5.32	0.36	0.00	2.82
80	5.01		5.31					13.60	7.16	1.66	0.00	2.72	2.31	3.43	4.76	0.00		1.38
85	3.02		4.70					10.29	6.33	0.00		0.01	1.45	3.15	4.41			0.00
90	1.02		4.09					6.98	5.50			0.00	0.59	2.86	4.05			
95	0.00		3.47					3.67	4.67				0.00	2.57	3.69			
100			2.86					0.36	3.84					2.29	3.34			
105			2.25					0.00	3.01					2.00	2.98			
110			1.64						2.18					1.71	2.62			
115			1.03						1.35					1.43	2.27			
120			0.41						0.52					1.14	1.91			
125			0.00						0.00					0.85	1.55			
130														0.57	1.19			
135														0.28	0.84			
140														0.00	0.48			
145															0.12			
150															0.00			

Appendix C

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  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
  --------------------------------------------------------------
SWMM Pre Development 5 Year

  ***********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ***********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... CFS
  Process Models:
    Rainfall/Runoff ........ NO
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Flow Routing Method ...... KINWAVE
  Starting Date ............ 01/01/2005 00:00:00
  Ending Date .............. 01/01/2005 06:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:05:00
  Routing Time Step ........ 30.00 sec


  *************************        Volume        Volume
  Flow Routing Continuity        acre-feet      10^6 gal
  *************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.000         0.000
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........        12.024         3.918
  External Outflow .........        12.024         3.918
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....        -0.002
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****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.08	0.31	6945.31	0 00:35	0.30
24	JUNCTION	0.10	0.44	6934.44	0 00:40	0.44
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.10	0.48	6911.48	0 00:35	0.48
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.11	0.48	6900.48	0 00:35	0.48
65	JUNCTION	0.17	0.69	6880.69	0 00:36	0.69
66	JUNCTION	0.24	0.89	6868.89	0 00:40	0.89
70	JUNCTION	0.00	0.00	6923.00	0 00:00	0.00
71	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0 00:00	0.00
73	JUNCTION	0.11	0.43	6902.43	0 00:35	0.42

80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.11	0.48	6872.48	0	00:35	0.47
85	JUNCTION	0.06	0.30	6874.30	0	00:35	0.30
PondC	JUNCTION	0.00	0.00	6956.00	0	00:00	0.00
PondA	JUNCTION	0.00	0.00	6949.00	0	00:00	0.00
PondB	JUNCTION	0.11	0.44	6911.44	0	00:41	0.43
PondE	JUNCTION	0.00	0.00	6923.00	0	00:00	0.00
PondG	JUNCTION	0.11	0.42	6900.42	0	00:36	0.42
PondH	JUNCTION	0.11	0.47	6866.47	0	00:36	0.47
PondF	JUNCTION	0.24	0.89	6866.89	0	00:41	0.88
PondD	JUNCTION	0.10	0.48	6881.48	0	00:37	0.47
Outfall2	OUTFALL	0.00	0.00	6910.00	0	00:00	0.00
Outfall1	OUTFALL	0.00	0.00	6947.00	0	00:00	0.00
Outfall4	OUTFALL	0.00	0.00	6865.00	0	00:00	0.00
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00
31	OUTFALL	0.00	0.00	6953.00	0	00:00	0.00
51	OUTFALL	0.00	0.00	6920.00	0	00:00	0.00
74	OUTFALL	0.00	0.00	6897.00	0	00:00	0.00
67	OUTFALL	0.00	0.00	6865.50	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	13.03	13.03	0 00:35	0.304	0.304	0.000
20	JUNCTION	4.33	4.33	0 00:35	0.085	0.085	0.000
21	JUNCTION	1.66	1.66	0 00:40	0.0573	0.0573	0.000

22		JUNCTION	11.85	11.85	0	00:40	0.274	0.274	0.000
23		JUNCTION	0.00	5.99	0	00:35	0	0.142	0.000
24		JUNCTION	0.00	11.85	0	00:40	0	0.274	0.000
30		JUNCTION	9.95	9.95	0	00:35	0.179	0.179	0.000
40		JUNCTION	8.12	8.12	0	00:35	0.162	0.162	0.000
41		JUNCTION	22.23	22.23	0	00:40	0.522	0.522	0.000
42		JUNCTION	0.00	8.12	0	00:35	0	0.162	0.000
50		JUNCTION	32.34	32.34	0	00:35	0.593	0.593	0.000
60		JUNCTION	9.70	9.70	0	00:35	0.226	0.226	0.000
61		JUNCTION	16.46	16.46	0	00:40	0.453	0.453	0.000
62		JUNCTION	3.65	3.65	0	00:35	0.0858	0.0858	0.000
63		JUNCTION	12.98	12.98	0	00:40	0.345	0.345	0.000
64		JUNCTION	0.00	13.35	0	00:35	0	0.311	0.000
65		JUNCTION	0.00	26.04	0	00:36	0	0.657	0.000
66		JUNCTION	0.00	16.46	0	00:40	0	0.453	0.000
70		JUNCTION	5.57	5.57	0	00:35	0.135	0.135	0.000
71		JUNCTION	3.87	3.87	0	00:35	0.101	0.101	0.000
72		JUNCTION	0.00	3.87	0	00:35	0	0.101	0.000
73		JUNCTION	0.00	3.87	0	00:35	0	0.101	0.000
80		JUNCTION	1.85	1.85	0	00:35	0.0476	0.0476	0.000
81		JUNCTION	5.37	5.37	0	00:35	0.124	0.124	0.000
82		JUNCTION	1.92	1.92	0	00:35	0.0398	0.0398	0.000
83		JUNCTION	8.07	8.07	0	00:35	0.185	0.185	0.000
84		JUNCTION	0.00	7.22	0	00:35	0	0.172	0.000

85	JUNCTION	0.00	1.92	0	00:35	0	0.0398	0.000
PondC	JUNCTION	0.00	9.95	0	00:35	0	0.179	0.000
PondA	JUNCTION	0.00	13.03	0	00:35	0	0.304	0.000
PondB	JUNCTION	0.00	17.56	0	00:41	0	0.416	0.000
PondE	JUNCTION	0.00	32.34	0	00:35	0	0.593	0.000
PondG	JUNCTION	0.00	9.42	0	00:36	0	0.236	0.000
PondH	JUNCTION	0.00	17.11	0	00:36	0	0.397	0.000
PondF	JUNCTION	0.00	42.32	0	00:41	0	1.11	0.000
PondD	JUNCTION	0.00	30.00	0	00:38	0	0.685	0.000
Outfall2	OUTFALL	0.00	17.56	0	00:41	0	0.416	0.000
Outfall1	OUTFALL	0.00	13.03	0	00:35	0	0.304	0.000
Outfall4	OUTFALL	0.00	17.11	0	00:36	0	0.397	0.000
Outfall3	OUTFALL	0.00	30.00	0	00:38	0	0.685	0.000
31	OUTFALL	0.00	9.95	0	00:35	0	0.179	0.000
51	OUTFALL	0.00	32.34	0	00:35	0	0.593	0.000
74	OUTFALL	0.00	9.42	0	00:36	0	0.236	0.000
67	OUTFALL	0.00	42.32	0	00:41	0	1.11	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall2	67.36	3.82	17.56	0.416
Outfall1	55.28	3.40	13.03	0.304
Outfall4	59.31	4.14	17.11	0.397
Outfall3	60.56	7.00	30.00	0.685
31	50.97	2.17	9.95	0.179
51	51.53	7.12	32.34	0.593
74	58.61	2.49	9.42	0.236
67	65.97	10.41	42.32	1.110
System	58.70	40.55	169.75	3.918

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	13.03	0 00:35			
200	DUMMY	4.33	0 00:35			
201	DUMMY	1.66	0 00:40			
202	CONDUIT	5.95	0 00:36	10.09	0.00	0.04
204	DUMMY	11.85	0 00:40			
205	CONDUIT	11.83	0 00:41	11.82	0.01	0.06
300	DUMMY	9.95	0 00:35			
400	DUMMY	8.12	0 00:35			
401	CONDUIT	8.03	0 00:37	8.38	0.02	0.10
402	DUMMY	22.23	0 00:40			
500	DUMMY	32.34	0 00:35			
601	DUMMY	16.46	0 00:40			
602	CONDUIT	16.42	0 00:41	6.99	0.07	0.18
603	DUMMY	9.70	0 00:35			
604	DUMMY	3.65	0 00:35			
605	CONDUIT	13.32	0 00:36	11.62	0.01	0.07
606	DUMMY	12.98	0 00:40			
607	CONDUIT	26.04	0 00:36	12.42	0.02	0.09
700	DUMMY	5.57	0 00:35			
701	DUMMY	3.87	0 00:35			
702	DUMMY	3.87	0 00:35			
703	CONDUIT	3.86	0 00:36	4.80	0.01	0.08
801	DUMMY	1.85	0 00:35			

802	DUMMY	5.37	0	00:35			
803	CONDUIT	7.18	0	00:36	6.34	0.01	0.07
804	DUMMY	1.92	0	00:35			
806	DUMMY	8.07	0	00:35			
805	CONDUIT	1.91	0	00:37	4.00	0.01	0.06
301	DUMMY	9.95	0	00:35			
101	DUMMY	13.03	0	00:35			
206	DUMMY	17.56	0	00:41			
501	DUMMY	32.34	0	00:35			
704	DUMMY	9.42	0	00:36			
807	DUMMY	17.11	0	00:36			
608	DUMMY	42.32	0	00:41			
403	DUMMY	30.00	0	00:38			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Apr 10 17:42:01 2020
Analysis ended on: Fri Apr 10 17:42:01 2020
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/01/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Flow Routing Continuity **********	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	193.874	63.177
External Outflow	193.874	63.177
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	-0.000	

****
Highest Flow Instability Indexes
****
Link 205 (1)
Link 206 (1)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.08	0.31	6945.31	0 00:35	0.30
24	JUNCTION	0.13	0.58	6934.58	0 00:40	0.58
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.10	0.48	6911.48	0 00:35	0.48
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.11	0.48	6900.48	0 00:35	0.48
65	JUNCTION	0.17	0.69	6880.69	0 00:36	0.69
66	JUNCTION	0.24	0.89	6868.89	0 00:40	0.89
70	JUNCTION	0.00	0.00	6923.00	0 00:00	0.00
71	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0 00:00	0.00

73	JUNCTION	0.11	0.43	6902.43	0	00:35	0.42
80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.11	0.48	6872.48	0	00:35	0.47
85	JUNCTION	0.06	0.30	6874.30	0	00:35	0.30
PondC	JUNCTION	0.00	0.00	6956.00	0	00:00	0.00
PondA	JUNCTION	0.00	0.00	6949.00	0	00:00	0.00
PondB	JUNCTION	0.13	0.58	6911.58	0	00:40	0.58
PondE	JUNCTION	0.00	0.00	6923.00	0	00:00	0.00
PondG	JUNCTION	0.11	0.42	6900.42	0	00:36	0.42
PondH	JUNCTION	0.11	0.47	6866.47	0	00:36	0.47
PondF	JUNCTION	0.24	0.89	6866.89	0	00:41	0.88
PondD	JUNCTION	0.10	0.48	6881.48	0	00:37	0.47
31	JUNCTION	0.00	0.00	6953.00	0	00:00	0.00
51	JUNCTION	0.00	0.00	6920.00	0	00:00	0.00
67	JUNCTION	0.00	0.00	6865.50	0	00:00	0.00
74	JUNCTION	0.00	0.00	6897.00	0	00:00	0.00
OS1	JUNCTION	0.00	0.00	6950.00	0	00:00	0.00
OS2	JUNCTION	0.00	0.00	6924.00	0	00:00	0.00
OS3	JUNCTION	0.00	0.00	6930.00	0	00:00	0.00
OS4	JUNCTION	0.00	0.00	6905.00	0	00:00	0.00
Outfall2	OUTFALL	0.00	0.00	6910.00	0	00:00	0.00
Outfall1	OUTFALL	0.00	0.00	6947.00	0	00:00	0.00
Outfall4	OUTFALL	0.00	0.00	6865.00	0	00:00	0.00
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	13.03	13.03	0 00:35	0.304		

0.304	0.000						
20		JUNCTION	4.33	4.33	0	00:35	0.085
0.085	0.000						
21		JUNCTION	1.66	1.66	0	00:40	0.0573
0.0573	0.000						
22		JUNCTION	11.85	11.85	0	00:40	0.274
0.274	0.000						
23		JUNCTION	0.00	5.99	0	00:35	0
0.142	0.000						
24		JUNCTION	0.00	21.23	0	00:40	0
0.452	0.000						
30		JUNCTION	9.95	9.95	0	00:35	0.179
0.179	0.000						
40		JUNCTION	8.12	8.12	0	00:35	0.162
0.162	0.000						
41		JUNCTION	22.23	22.23	0	00:40	0.522
0.522	0.000						
42		JUNCTION	0.00	8.12	0	00:35	0
0.162	0.000						
50		JUNCTION	32.34	32.34	0	00:35	0.593
0.593	0.000						
60		JUNCTION	9.70	9.70	0	00:35	0.226
0.226	0.000						
61		JUNCTION	16.46	16.46	0	00:40	0.453
0.453	0.000						
62		JUNCTION	3.65	3.65	0	00:35	0.0858
0.0858	0.000						
63		JUNCTION	12.98	12.98	0	00:40	0.345
0.345	0.000						
64		JUNCTION	0.00	13.35	0	00:35	0
0.311	0.000						
65		JUNCTION	0.00	26.04	0	00:36	0
0.657	0.000						
66		JUNCTION	0.00	16.46	0	00:40	0
0.453	0.000						
70		JUNCTION	5.57	5.57	0	00:35	0.135
0.135	0.000						
71		JUNCTION	3.87	3.87	0	00:35	0.101
0.101	0.000						
72		JUNCTION	0.00	3.87	0	00:35	0
0.101	0.000						
73		JUNCTION	0.00	3.87	0	00:35	0
0.101	0.000						
80		JUNCTION	1.85	1.85	0	00:35	0.0476
0.0476	0.000						
81		JUNCTION	5.37	5.37	0	00:35	0.124
0.124	0.000						
82		JUNCTION	1.92	1.92	0	00:35	0.0398

0.0398	0.000						
83		JUNCTION	8.07	8.07	0	00:35	0.185
0.185	0.000						
84		JUNCTION	0.00	7.22	0	00:35	0
0.172	0.000						
85		JUNCTION	0.00	1.92	0	00:35	0
0.0398	0.000						
PondC		JUNCTION	0.00	9.95	0	00:35	0
0.179	0.000						
PondA		JUNCTION	0.00	13.03	0	00:35	0
0.304	0.000						
PondB		JUNCTION	0.00	26.96	0	00:40	0
0.594	0.000						
PondE		JUNCTION	0.00	32.34	0	00:35	0
0.593	0.000						
PondG		JUNCTION	0.00	189.42	0	00:36	0
29.3	0.000						
PondH		JUNCTION	0.00	17.11	0	00:36	0
0.397	0.000						
PondF		JUNCTION	0.00	42.32	0	00:41	0
1.11	0.000						
PondD		JUNCTION	0.00	30.00	0	00:38	0
0.685	0.000						
31		JUNCTION	0.00	9.95	0	00:35	0
0.179	0.000						
51		JUNCTION	0.00	93.34	0	00:35	0
10.4	0.000						
67		JUNCTION	0.00	231.47	0	00:40	0
30.4	0.000						
74		JUNCTION	0.00	189.42	0	00:36	0
29.3	0.000						
OS1		JUNCTION	67.00	67.00	0	00:00	10.8
10.8	0.000						
OS2		JUNCTION	59.00	59.00	0	00:00	9.53
9.53	0.000						
OS3		JUNCTION	61.00	61.00	0	00:00	9.86
9.85	0.000						
OS4		JUNCTION	180.00	180.00	0	00:00	29.1
29.1	0.000						
Outfall2		OUTFALL	0.00	85.96	0	00:40	0
10.1	0.000						
Outfall1		OUTFALL	0.00	80.03	0	00:35	0
11.1	0.000						
Outfall4		OUTFALL	0.00	341.05	0	00:36	0
41.2	0.000						
Outfall3		OUTFALL	0.00	30.00	0	00:38	0
0.685	0.000						

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall2	100.00	62.68	85.96	10.120
Outfall1	100.00	68.88	80.03	11.121
Outfall4	100.00	255.45	341.05	41.246
Outfall3	60.56	7.00	30.00	0.685
System	90.14	394.01	536.81	63.172

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	13.03	0	00:35			
200	DUMMY	4.33	0	00:35			
201	DUMMY	1.66	0	00:40			
202	CONDUIT	5.95	0	00:36	10.09	0.00	0.04
204	DUMMY	11.85	0	00:40			
205	CONDUIT	21.20	0	00:40	14.13	0.01	0.08
300	DUMMY	9.95	0	00:35			
400	DUMMY	8.12	0	00:35			
401	CONDUIT	8.03	0	00:37	8.38	0.02	0.10
402	DUMMY	22.23	0	00:40			
500	DUMMY	32.34	0	00:35			
601	DUMMY	16.46	0	00:40			
602	CONDUIT	16.42	0	00:41	6.99	0.07	0.18
603	DUMMY	9.70	0	00:35			

604	DUMMY	3.65	0	00:35			
605	CONDUIT	13.32	0	00:36	11.62	0.01	0.07
606	DUMMY	12.98	0	00:40			
607	CONDUIT	26.04	0	00:36	12.42	0.02	0.09
700	DUMMY	5.57	0	00:35			
701	DUMMY	3.87	0	00:35			
702	DUMMY	3.87	0	00:35			
703	CONDUIT	3.86	0	00:36	4.80	0.01	0.08
801	DUMMY	1.85	0	00:35			
802	DUMMY	5.37	0	00:35			
803	CONDUIT	7.18	0	00:36	6.34	0.01	0.07
804	DUMMY	1.92	0	00:35			
806	DUMMY	8.07	0	00:35			
805	CONDUIT	1.91	0	00:37	4.00	0.01	0.06
301	DUMMY	9.95	0	00:35			
101	DUMMY	13.03	0	00:35			
206	DUMMY	26.96	0	00:40			
501	DUMMY	32.34	0	00:35			
704	DUMMY	189.42	0	00:36			
807	DUMMY	17.11	0	00:36			
608	DUMMY	42.32	0	00:41			
403	DUMMY	30.00	0	00:38			
41	DUMMY	9.95	0	00:35			
42	DUMMY	93.34	0	00:35			
43	DUMMY	231.47	0	00:40			
44	DUMMY	189.42	0	00:36			
45	DUMMY	180.00	0	00:00			
46	DUMMY	67.00	0	00:00			
47	DUMMY	59.00	0	00:00			
48	DUMMY	61.00	0	00:00			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Sep 21 16:32:27 2020
Analysis ended on: Mon Sep 21 16:32:27 2020
Total elapsed time: < 1 sec

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
  --------------------------------------------------------------
SWMM 100 Year Pre Development

  ***********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ***********************************************************

  ****************
  Analysis Options
  ****************
  Flow Units ............... CFS
  Process Models:
    Rainfall/Runoff ........ NO
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Flow Routing Method ...... KINWAVE
  Starting Date ............ 01/01/2005 00:00:00
  Ending Date .............. 01/01/2005 06:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:05:00
  Routing Time Step ........ 30.00 sec


  *************************        Volume        Volume
  Flow Routing Continuity        acre-feet      10^6 gal
  *************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.000         0.000
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........        82.644        26.931
  External Outflow .........        82.609        26.919
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....         0.043
```

****
Highest Flow Instability Indexes
****
Link 608 (1)

****
Routing Time Step Summary
****

Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.04
Percent Not Converging	:	0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.21	0.59	6945.59	0 00:45	0.58
24	JUNCTION	0.36	1.43	6935.43	0 00:45	1.42
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.24	1.05	6912.05	0 00:40	1.05
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.27	1.04	6901.04	0 00:45	1.03
65	JUNCTION	0.43	1.52	6881.52	0 00:45	1.52
66	JUNCTION	0.61	2.08	6870.08	0 00:50	2.08
70	JUNCTION	0.00	0.00	6923.00	0 00:00	0.00
71	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0 00:00	0.00
73	JUNCTION	0.27	0.94	6902.94	0 00:45	0.94

80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.32	1.19	6873.19	0	00:45	1.18
85	JUNCTION	0.15	0.64	6874.64	0	00:40	0.64
PondC	JUNCTION	0.00	0.00	6956.00	0	00:00	0.00
PondA	JUNCTION	0.00	0.00	6949.00	0	00:00	0.00
PondB	JUNCTION	0.39	1.43	6912.43	0	00:46	1.42
PondE	JUNCTION	0.00	0.00	6923.00	0	00:00	0.00
PondG	JUNCTION	0.27	0.94	6900.94	0	00:46	0.94
PondH	JUNCTION	0.32	1.18	6867.18	0	00:46	1.18
PondF	JUNCTION	0.61	2.08	6868.08	0	00:51	2.08
PondD	JUNCTION	0.25	1.05	6882.05	0	00:42	1.05
Outfall2	OUTFALL	0.00	0.00	6910.00	0	00:00	0.00
Outfall1	OUTFALL	0.00	0.00	6947.00	0	00:00	0.00
Outfall4	OUTFALL	0.00	0.00	6865.00	0	00:00	0.00
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00
31	OUTFALL	0.00	0.00	6953.00	0	00:00	0.00
51	OUTFALL	0.00	0.00	6920.00	0	00:00	0.00
74	OUTFALL	0.00	0.00	6897.00	0	00:00	0.00
67	OUTFALL	0.00	0.00	6865.50	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	13.03	13.03	0 00:35	0.304	0.304	0.000
20	JUNCTION	4.33	4.33	0 00:35	0.085	0.085	0.000
21	JUNCTION	20.74	20.74	0 00:50	0.794	0.794	0.000

22		JUNCTION	140.35	140.35	0	00:45	3.79	3.79 0.000
23		JUNCTION	0.00	23.90	0	00:45	0	0.879 0.000
24		JUNCTION	0.00	140.35	0	00:45	0	3.79 0.000
30		JUNCTION	110.70	110.70	0	00:40	2.47	2.47 0.000
40		JUNCTION	40.00	40.00	0	00:40	1.03	1.03 0.000
41		JUNCTION	114.87	114.87	0	00:45	3.31	3.31 0.000
42		JUNCTION	0.00	40.00	0	00:40	0	1.03 0.000
50		JUNCTION	157.99	157.99	0	00:40	3.76	3.76 0.000
60		JUNCTION	49.45	49.45	0	00:45	1.43	1.43 0.000
61		JUNCTION	86.73	86.73	0	00:50	2.87	2.87 0.000
62		JUNCTION	18.42	18.42	0	00:45	0.544	0.544 0.000
63		JUNCTION	67.82	67.82	0	00:45	2.19	2.19 0.000
64		JUNCTION	0.00	67.87	0	00:45	0	1.97 0.000
65		JUNCTION	0.00	135.62	0	00:45	0	4.16 0.000
66		JUNCTION	0.00	86.73	0	00:50	0	2.87 0.000
70		JUNCTION	28.46	28.46	0	00:45	0.853	0.853 0.000
71		JUNCTION	20.06	20.06	0	00:45	0.641	0.641 0.000
72		JUNCTION	0.00	20.06	0	00:45	0	0.641 0.000
73		JUNCTION	0.00	20.06	0	00:45	0	0.641 0.000
80		JUNCTION	21.89	21.89	0	00:45	0.659	0.659 0.000
81		JUNCTION	27.12	27.12	0	00:45	0.786	0.786 0.000
82		JUNCTION	9.51	9.51	0	00:40	0.252	0.252 0.000
83		JUNCTION	40.86	40.86	0	00:45	1.17	1.17 0.000
84		JUNCTION	0.00	49.01	0	00:45	0	1.44 0.000

85	JUNCTION	0.00	9.51	0	00:40	0	0.252	0.000
PondC	JUNCTION	0.00	110.70	0	00:40	0	2.47	0.000
PondA	JUNCTION	0.00	13.03	0	00:35	0	0.304	0.000
PondB	JUNCTION	0.00	164.21	0	00:46	0	4.66	0.000
PondE	JUNCTION	0.00	157.99	0	00:40	0	3.76	0.000
PondG	JUNCTION	0.00	48.48	0	00:45	0	1.49	0.000
PondH	JUNCTION	0.00	99.16	0	00:45	0	2.87	0.000
PondF	JUNCTION	0.00	221.11	0	00:46	0	7.02	0.000
PondD	JUNCTION	0.00	154.35	0	00:45	0	4.34	0.000
Outfall2	OUTFALL	0.00	164.21	0	00:46	0	4.66	0.000
Outfall1	OUTFALL	0.00	13.03	0	00:35	0	0.304	0.000
Outfall4	OUTFALL	0.00	99.16	0	00:45	0	2.87	0.000
Outfall3	OUTFALL	0.00	154.35	0	00:45	0	4.34	0.000
31	OUTFALL	0.00	110.70	0	00:40	0	2.47	0.000
51	OUTFALL	0.00	157.99	0	00:40	0	3.76	0.000
74	OUTFALL	0.00	48.48	0	00:45	0	1.49	0.000
67	OUTFALL	0.00	221.11	0	00:46	0	7.02	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall2	76.53	37.73	164.21	4.665
Outfall1	55.28	3.40	13.03	0.304
Outfall4	67.08	26.46	99.16	2.867
Outfall3	67.92	39.52	154.35	4.336
31	53.89	28.39	110.70	2.472
51	58.47	39.76	157.99	3.757
74	67.08	13.78	48.48	1.494
67	74.31	58.49	221.11	7.022
System	65.07	247.53	962.28	26.917

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	13.03	0 00:35			
200	DUMMY	4.33	0 00:35			
201	DUMMY	20.74	0 00:50			
202	CONDUIT	23.89	0 00:46	15.49	0.01	0.08
204	DUMMY	140.35	0 00:45			
205	CONDUIT	140.32	0 00:46	24.86	0.09	0.20
300	DUMMY	110.70	0 00:40			
400	DUMMY	40.00	0 00:40			
401	CONDUIT	39.84	0 00:42	13.30	0.10	0.21
402	DUMMY	114.87	0 00:45			
500	DUMMY	157.99	0 00:40			
601	DUMMY	86.73	0 00:50			
602	CONDUIT	86.65	0 00:51	11.22	0.36	0.42
603	DUMMY	49.45	0 00:45			
604	DUMMY	18.42	0 00:45			
605	CONDUIT	67.80	0 00:45	19.12	0.05	0.15
606	DUMMY	67.82	0 00:45			
607	CONDUIT	135.63	0 00:46	20.33	0.08	0.19
700	DUMMY	28.46	0 00:45			
701	DUMMY	20.06	0 00:45			
702	DUMMY	20.06	0 00:45			
703	CONDUIT	20.04	0 00:46	7.87	0.08	0.19
801	DUMMY	21.89	0 00:45			

802	DUMMY	27.12	0	00:45			
803	CONDUIT	48.96	0	00:46	11.36	0.06	0.17
804	DUMMY	9.51	0	00:40			
806	DUMMY	40.86	0	00:45			
805	CONDUIT	9.46	0	00:42	6.45	0.04	0.13
301	DUMMY	110.70	0	00:40			
101	DUMMY	13.03	0	00:35			
206	DUMMY	164.21	0	00:46			
501	DUMMY	157.99	0	00:40			
704	DUMMY	48.48	0	00:45			
807	DUMMY	99.16	0	00:45			
608	DUMMY	221.11	0	00:46			
403	DUMMY	154.35	0	00:45			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Apr 10 13:11:18 2020
Analysis ended on: Fri Apr 10 13:11:18 2020
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/01/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Flow Routing Continuity **********	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	836.701	272.651
External Outflow	836.646	272.634
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.007	

****
Highest Flow Instability Indexes
****
Link 205 (1)
Link 608 (1)
Link 206 (1)

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.03
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.28	0.97	6945.97	0 00:45	0.97
24	JUNCTION	0.45	1.91	6935.91	0 00:45	1.91
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.24	1.05	6912.05	0 00:40	1.05
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.27	1.04	6901.04	0 00:45	1.03
65	JUNCTION	0.43	1.52	6881.52	0 00:45	1.52
66	JUNCTION	0.61	2.08	6870.08	0 00:50	2.08
70	JUNCTION	0.00	0.00	6923.00	0 00:00	0.00
71	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00

72	JUNCTION	0.00	0.00	6904.00	0	00:00	0.00
73	JUNCTION	0.27	0.94	6902.94	0	00:45	0.94
80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.32	1.19	6873.19	0	00:45	1.18
85	JUNCTION	0.15	0.64	6874.64	0	00:40	0.64
PondC	JUNCTION	0.00	0.00	6956.00	0	00:00	0.00
PondA	JUNCTION	0.00	0.00	6949.00	0	00:00	0.00
PondB	JUNCTION	0.48	1.91	6912.91	0	00:45	1.90
PondE	JUNCTION	0.00	0.00	6923.00	0	00:00	0.00
PondG	JUNCTION	0.27	0.94	6900.94	0	00:46	0.94
PondH	JUNCTION	0.32	1.18	6867.18	0	00:46	1.18
PondF	JUNCTION	0.61	2.08	6868.08	0	00:51	2.08
PondD	JUNCTION	0.25	1.05	6882.05	0	00:42	1.05
31	JUNCTION	0.00	0.00	6953.00	0	00:00	0.00
51	JUNCTION	0.00	0.00	6920.00	0	00:00	0.00
67	JUNCTION	0.00	0.00	6865.50	0	00:00	0.00
74	JUNCTION	0.00	0.00	6897.00	0	00:00	0.00
OS1	JUNCTION	0.00	0.00	6950.00	0	00:00	0.00
OS2	JUNCTION	0.00	0.00	6924.00	0	00:00	0.00
OS3	JUNCTION	0.00	0.00	6930.00	0	00:00	0.00
OS4	JUNCTION	0.00	0.00	6905.00	0	00:00	0.00
Outfall2	OUTFALL	0.00	0.00	6910.00	0	00:00	0.00
Outfall1	OUTFALL	0.00	0.00	6947.00	0	00:00	0.00
Outfall4	OUTFALL	0.00	0.00	6865.00	0	00:00	0.00
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent

10		JUNCTION	66.80	66.80	0	00:45	1.92	1.92
0.000								
20		JUNCTION	48.76	48.76	0	00:40	1.18	1.18
0.000								
21		JUNCTION	20.74	20.74	0	00:50	0.794	0.794
0.000								
22		JUNCTION	140.35	140.35	0	00:45	3.79	3.79
0.000								
23		JUNCTION	0.00	68.56	0	00:45	0	1.97
0.000								
24		JUNCTION	0.00	249.20	0	00:45	0	6.26
0.000								
30		JUNCTION	110.70	110.70	0	00:40	2.47	2.47
0.000								
40		JUNCTION	40.00	40.00	0	00:40	1.03	1.03
0.000								
41		JUNCTION	114.87	114.87	0	00:45	3.31	3.31
0.000								
42		JUNCTION	0.00	40.00	0	00:40	0	1.03
0.000								
50		JUNCTION	157.99	157.99	0	00:40	3.76	3.76
0.000								
60		JUNCTION	49.45	49.45	0	00:45	1.43	1.43
0.000								
61		JUNCTION	86.73	86.73	0	00:50	2.87	2.87
0.000								
62		JUNCTION	18.42	18.42	0	00:45	0.544	0.544
0.000								
63		JUNCTION	67.82	67.82	0	00:45	2.19	2.19
0.000								
64		JUNCTION	0.00	67.87	0	00:45	0	1.97
0.000								
65		JUNCTION	0.00	135.62	0	00:45	0	4.16
0.000								
66		JUNCTION	0.00	86.73	0	00:50	0	2.87
0.000								
70		JUNCTION	28.46	28.46	0	00:45	0.853	0.853
0.000								
71		JUNCTION	20.06	20.06	0	00:45	0.641	0.641
0.000								
72		JUNCTION	0.00	20.06	0	00:45	0	0.641
0.000								
73		JUNCTION	0.00	20.06	0	00:45	0	0.641
0.000								
80		JUNCTION	21.89	21.89	0	00:45	0.659	0.659
0.000								
81		JUNCTION	27.12	27.12	0	00:45	0.786	0.786
0.000								

82	JUNCTION	9.51	9.51	0	00:40	0.252	0.252	0.000
83	JUNCTION	40.86	40.86	0	00:45	1.17	1.17	0.000
84	JUNCTION	0.00	49.01	0	00:45	0	1.44	0.000
85	JUNCTION	0.00	9.51	0	00:40	0	0.252	0.000
PondC	JUNCTION	0.00	110.70	0	00:40	0	2.47	0.000
PondA	JUNCTION	0.00	66.80	0	00:45	0	1.92	0.000
PondB	JUNCTION	0.00	317.41	0	00:45	0	8.22	0.000
PondE	JUNCTION	0.00	157.99	0	00:40	0	3.76	0.000
PondG	JUNCTION	0.00	643.48	0	00:45	0	97.6	0.000
PondH	JUNCTION	0.00	99.16	0	00:45	0	2.87	0.000
PondF	JUNCTION	0.00	221.11	0	00:46	0	7.02	0.000
PondD	JUNCTION	0.00	154.35	0	00:45	0	4.34	0.000
31	JUNCTION	0.00	110.70	0	00:40	0	2.47	0.000
51	JUNCTION	0.00	374.99	0	00:40	0	38.8	0.000
67	JUNCTION	0.00	864.52	0	00:46	0	105	0.000
74	JUNCTION	0.00	643.48	0	00:45	0	97.6	0.000
OS1	JUNCTION	413.00	413.00	0	00:00	66.7	66.7	0.000
OS2	JUNCTION	280.00	280.00	0	00:00	45.2	45.2	0.000
OS3	JUNCTION	217.00	217.00	0	00:00	35.1	35	0.000
OS4	JUNCTION	595.00	595.00	0	00:00	96.1	96.1	0.000
Outfall2	OUTFALL	0.00	597.41	0	00:45	0	53.4	0.000
Outfall1	OUTFALL	0.00	479.80	0	00:45	0	68.6	0.000
Outfall4	OUTFALL	0.00	1335.77	0	00:45	0	146	0.000
Outfall3	OUTFALL	0.00	154.35	0	00:45	0	4.34	0.000

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall2	100.00	330.89	597.41	53.430
Outfall1	100.00	424.90	479.80	68.605
Outfall4	100.00	905.71	1335.77	146.242
Outfall3	67.92	39.52	154.35	4.336
System	91.98	1701.02	2567.34	272.613

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	66.80	0	00:45			
200	DUMMY	48.76	0	00:40			
201	DUMMY	20.74	0	00:50			
202	CONDUIT	68.51	0	00:45	21.36	0.04	0.14
204	DUMMY	140.35	0	00:45			
205	CONDUIT	248.90	0	00:45	29.30	0.16	0.27
300	DUMMY	110.70	0	00:40			
400	DUMMY	40.00	0	00:40			
401	CONDUIT	39.84	0	00:42	13.30	0.10	0.21
402	DUMMY	114.87	0	00:45			
500	DUMMY	157.99	0	00:40			
601	DUMMY	86.73	0	00:50			
602	CONDUIT	86.65	0	00:51	11.22	0.36	0.42

603	DUMMY	49.45	0	00:45			
604	DUMMY	18.42	0	00:45			
605	CONDUIT	67.80	0	00:45	19.12	0.05	0.15
606	DUMMY	67.82	0	00:45			
607	CONDUIT	135.63	0	00:46	20.33	0.08	0.19
700	DUMMY	28.46	0	00:45			
701	DUMMY	20.06	0	00:45			
702	DUMMY	20.06	0	00:45			
703	CONDUIT	20.04	0	00:46	7.87	0.08	0.19
801	DUMMY	21.89	0	00:45			
802	DUMMY	27.12	0	00:45			
803	CONDUIT	48.96	0	00:46	11.36	0.06	0.17
804	DUMMY	9.51	0	00:40			
806	DUMMY	40.86	0	00:45			
805	CONDUIT	9.46	0	00:42	6.45	0.04	0.13
301	DUMMY	110.70	0	00:40			
101	DUMMY	66.80	0	00:45			
206	DUMMY	317.41	0	00:45			
501	DUMMY	157.99	0	00:40			
704	DUMMY	643.48	0	00:45			
807	DUMMY	99.16	0	00:45			
608	DUMMY	221.11	0	00:46			
403	DUMMY	154.35	0	00:45			
41	DUMMY	110.70	0	00:40			
42	DUMMY	374.99	0	00:40			
43	DUMMY	864.52	0	00:46			
44	DUMMY	643.48	0	00:45			
45	DUMMY	595.00	0	00:00			
46	DUMMY	413.00	0	00:00			
47	DUMMY	280.00	0	00:00			
48	DUMMY	217.00	0	00:00			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Sep 21 16:37:19 2020
Analysis ended on: Mon Sep 21 16:37:19 2020
Total elapsed time: < 1 sec

SWMM 5 Year Post Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/02/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

Flow Routing Continuity	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	39.629	12.914
External Outflow	23.957	7.807
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	15.654	5.101
Continuity Error (%)	0.045	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.01
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.04	0.75	6945.75	0 00:30	0.74
24	JUNCTION	0.21	1.17	6935.17	0 00:30	1.16
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
31	JUNCTION	0.17	0.20	6953.20	0 02:23	0.20
67	JUNCTION	0.16	0.59	6866.09	0 01:57	0.59
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.03	0.82	6911.82	0 00:30	0.81
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
51	JUNCTION	0.03	0.21	6920.21	0 01:12	0.21
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.03	0.66	6900.66	0 00:35	0.66
65	JUNCTION	0.05	1.10	6881.10	0 00:35	1.10
66	JUNCTION	0.08	1.71	6869.71	0 00:35	1.71

70	JUNCTION	0.00	0.00	6923.00	0	00:00	0.00
71	JUNCTION	0.00	0.00	6908.00	0	00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0	00:00	0.00
73	JUNCTION	0.03	0.55	6902.55	0	00:35	0.54
74	JUNCTION	0.02	0.24	6897.24	0	01:15	0.24
80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.04	0.80	6872.80	0	00:30	0.79
85	JUNCTION	0.02	0.48	6874.48	0	00:30	0.47
Outfall2	OUTFALL	0.00	0.00	6910.00	0	00:00	0.00
Outfall1	OUTFALL	0.00	0.00	6947.00	0	00:00	0.00
Outfall4	OUTFALL	0.16	0.59	6865.59	0	01:57	0.59
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00
PondB	STORAGE	5.89	6.37	6917.37	0	01:30	6.37
PondC	STORAGE	4.70	5.56	6961.56	0	02:23	5.56
PondA	STORAGE	4.01	4.67	6953.67	0	01:46	4.67
PondD	STORAGE	5.54	6.51	6887.51	0	02:25	6.51
PondE	STORAGE	4.04	4.77	6927.77	0	01:12	4.77
PondF	STORAGE	5.76	6.73	6872.73	0	02:02	6.73
PondG	STORAGE	0.11	1.20	6901.20	0	01:15	1.20
PondH	STORAGE	4.49	5.12	6871.12	0	02:09	5.12

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	30.72	30.72	0 00:35	0.705	0.705	0.000
20	JUNCTION	29.46	29.46	0 00:30	0.578	0.578	0.000
21	JUNCTION	12.02	12.02	0 00:35	0.376		

0.376	0.000							
22		JUNCTION	92.76	92.76	0	00:30	2.04	
2.04	0.000							
23		JUNCTION	0.00	40.92	0	00:30	0	
0.954	0.000							
24		JUNCTION	0.00	93.26	0	00:30	0	
2.96	0.000							
30		JUNCTION	77.99	77.99	0	00:30	1.38	
1.38	0.000							
31		JUNCTION	0.00	1.52	0	02:23	0	
0.925	0.000							
67		JUNCTION	0.00	23.06	0	01:57	0	
2.4	-0.000							
40		JUNCTION	24.15	24.15	0	00:30	0.438	
0.438	0.000							
41		JUNCTION	98.47	98.47	0	00:30	1.83	
1.83	0.000							
42		JUNCTION	0.00	24.15	0	00:30	0	
0.438	-0.000							
50		JUNCTION	46.88	46.88	0	00:35	0.982	
0.982	0.000							
51		JUNCTION	0.00	18.70	0	01:12	0	
0.69	0.000							
60		JUNCTION	16.28	16.28	0	00:35	0.424	
0.424	0.000							
61		JUNCTION	60.11	60.11	0	00:35	1.38	
1.38	0.000							
62		JUNCTION	11.36	11.36	0	00:30	0.234	
0.234	0.000							
63		JUNCTION	42.32	42.32	0	00:30	0.975	
0.975	0.000							
64		JUNCTION	0.00	26.88	0	00:35	0	
0.659	0.000							
65		JUNCTION	0.00	69.12	0	00:35	0	
1.63	0.000							
66		JUNCTION	0.00	60.11	0	00:35	0	
1.38	0.000							
70		JUNCTION	13.78	13.78	0	00:30	0.32	
0.32	0.000							
71		JUNCTION	6.55	6.55	0	00:35	0.191	
0.191	0.000							
72		JUNCTION	0.00	6.55	0	00:35	0	
0.191	0.000							
73		JUNCTION	0.00	6.55	0	00:35	0	
0.191	0.000							
74		JUNCTION	0.00	9.05	0	01:15	0	
0.51	-0.000							
80		JUNCTION	5.68	5.68	0	00:35	0.173	

0.173	0.000						
81		JUNCTION	16.24	16.24	0	00:30	0.333
0.333	0.000						
82		JUNCTION	5.21	5.21	0	00:30	0.1
0.1	0.000						
83		JUNCTION	20.93	20.93	0	00:30	0.453
0.453	0.000						
84		JUNCTION	0.00	21.67	0	00:30	0
0.507	0.000						
85		JUNCTION	0.00	5.21	0	00:30	0
0.1	0.000						
Outfall2		OUTFALL	0.00	34.45	0	01:30	0
2.22	0.000						
Outfall1		OUTFALL	0.00	5.43	0	01:46	0
0.441	0.000						
Outfall4		OUTFALL	0.00	35.27	0	01:51	0
3.71	0.000						
Outfall3		OUTFALL	0.00	2.52	0	02:25	0
1.43	0.000						
PondB		STORAGE	0.00	134.27	0	00:31	0
3.91	0.047						
PondC		STORAGE	0.00	77.99	0	00:30	0
1.38	0.005						
PondA		STORAGE	0.00	30.72	0	00:35	0
0.705	0.012						
PondD		STORAGE	0.00	120.96	0	00:30	0
2.27	0.003						
PondE		STORAGE	0.00	46.88	0	00:35	0
0.982	0.118						
PondF		STORAGE	0.00	129.20	0	00:35	0
3.01	0.014						
PondG		STORAGE	0.00	20.07	0	00:35	0
0.51	0.116						
PondH		STORAGE	0.00	47.25	0	00:32	0
1.06	0.001						

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

	Average	Avg	Evap	Exfil	Maximum	Max	Time of Max	Maximum
	Volume	Pcnt	Pcnt	Pcnt	Volume	Pcnt		Occurrence	Outflow
Storage Unit	1000 ft3	Full	Loss	Loss	1000 ft3	Full	days	hr:min	CFS
PondB	241.825	30	0	0	296.729	37	0	01:30	34.45
PondC	111.256	19	0	0	174.130	30	0	02:23	1.52
PondA	53.736	15	0	0	79.797	22	0	01:46	5.43
PondD	192.634	28	0	0	287.984	41	0	02:24	2.52
PondE	56.473	16	0	0	85.437	24	0	01:11	18.70
PondF	235.289	29	0	0	351.325	44	0	02:02	16.38
PondG	2.647	0	0	0	31.290	6	0	01:15	9.05
PondH	88.617	17	0	0	127.653	25	0	02:09	4.21

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall2	99.64	2.76	34.45	2.223
Outfall1	99.67	0.55	5.43	0.441
Outfall4	99.67	4.61	35.27	3.709
Outfall3	99.69	1.78	2.52	1.434
System	99.67	9.70	73.13	7.806

****

Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	30.72	0	00:35			
200	DUMMY	29.46	0	00:30			
201	DUMMY	12.02	0	00:35			
202	CONDUIT	40.84	0	00:31	18.27	0.02	0.11
203	CONDUIT	1.52	0	02:24	6.34	0.00	0.05
204	DUMMY	92.76	0	00:30			
205	CONDUIT	93.43	0	00:31	22.09	0.06	0.17
300	DUMMY	77.99	0	00:30			
400	DUMMY	24.15	0	00:30			
401	CONDUIT	23.53	0	00:32	11.46	0.06	0.16
402	DUMMY	98.47	0	00:30			
500	DUMMY	46.88	0	00:35			
601	DUMMY	60.11	0	00:35			
602	CONDUIT	60.09	0	00:35	10.17	0.25	0.34
603	DUMMY	16.28	0	00:35			
604	DUMMY	11.36	0	00:30			
605	CONDUIT	26.88	0	00:35	14.61	0.02	0.09
606	DUMMY	42.32	0	00:30			
607	CONDUIT	69.12	0	00:31	16.65	0.04	0.14
700	DUMMY	13.78	0	00:30			
701	DUMMY	6.55	0	00:35			
702	DUMMY	6.55	0	00:35			
703	CONDUIT	6.54	0	00:36	5.62	0.03	0.11
801	DUMMY	5.68	0	00:35			
802	DUMMY	16.24	0	00:30			
803	CONDUIT	21.49	0	00:32	8.87	0.03	0.11
804	DUMMY	5.21	0	00:30			
806	DUMMY	20.93	0	00:30			
805	CONDUIT	5.08	0	00:32	5.42	0.02	0.09
808	CONDUIT	23.06	0	01:57	2.25	0.00	0.06
800	CONDUIT	8.95	0	01:25	2.34	0.00	0.02
600	CONDUIT	18.26	0	01:17	5.75	0.00	0.03
101	DUMMY	5.43	0	01:46			
206	DUMMY	34.45	0	01:30			
301	DUMMY	1.52	0	02:23			
501	DUMMY	18.70	0	01:12			
704	DUMMY	9.05	0	01:15			
807	DUMMY	4.21	0	02:09			
608	DUMMY	16.38	0	02:02			
403	DUMMY	2.52	0	02:25			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Apr 13 19:10:46 2020
Analysis ended on: Mon Apr 13 19:10:46 2020
Total elapsed time: < 1 sec

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/02/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Flow Routing Continuity **********	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	949.387	309.372
External Outflow	930.375	303.177
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	20.095	6.548
Continuity Error (%)	-0.114	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.00
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.04	0.75	6945.75	0 00:30	0.74
24	JUNCTION	0.21	1.17	6935.17	0 00:30	1.16
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
31	JUNCTION	0.17	0.20	6953.20	0 02:23	0.20
67	JUNCTION	1.87	1.97	6867.47	0 01:59	1.97
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.03	0.82	6911.82	0 00:30	0.81
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
51	JUNCTION	0.71	0.71	6920.71	0 00:32	0.71
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.03	0.66	6900.66	0 00:35	0.66
65	JUNCTION	0.05	1.10	6881.10	0 00:35	1.10
66	JUNCTION	0.08	1.71	6869.71	0 00:35	1.71
70	JUNCTION	0.00	0.00	6923.00	0 00:00	0.00

71	JUNCTION	0.00	0.00	6908.00	0	00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0	00:00	0.00
73	JUNCTION	0.03	0.55	6902.55	0	00:35	0.54
74	JUNCTION	1.36	1.40	6898.40	0	01:15	1.40
80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.04	0.80	6872.80	0	00:30	0.79
85	JUNCTION	0.02	0.48	6874.48	0	00:30	0.47
OS1	JUNCTION	0.45	0.45	6953.05	0	00:00	0.45
OS3	JUNCTION	0.71	0.71	6923.51	0	00:00	0.71
OS4	JUNCTION	1.21	1.21	6901.01	0	00:00	1.21
OS2	JUNCTION	0.42	0.42	6924.42	0	00:00	0.42
Outfall2	OUTFALL	0.42	0.42	6910.42	0	03:03	0.42
Outfall1	OUTFALL	0.45	0.45	6947.45	0	01:12	0.45
Outfall4	OUTFALL	1.87	1.97	6866.97	0	01:59	1.97
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00
PondB	STORAGE	6.42	6.96	6917.96	0	02:52	6.96
PondC	STORAGE	4.70	5.56	6961.56	0	02:23	5.56
PondA	STORAGE	5.16	6.43	6955.43	0	02:35	6.43
PondD	STORAGE	5.57	6.66	6887.66	0	02:07	6.65
PondE	STORAGE	3.99	4.85	6927.85	0	01:03	4.85
PondF	STORAGE	5.76	6.72	6872.72	0	02:04	6.72
PondG	STORAGE	0.11	1.20	6901.20	0	01:15	1.20
PondH	STORAGE	4.38	5.01	6871.01	0	02:39	5.01

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	30.72	30.72	0 00:35	0.705	0.705	0.000

20	JUNCTION	29.46	29.46	0	00:30	0.578	0.578	0.000
21	JUNCTION	12.02	12.02	0	00:35	0.376	0.376	0.000
22	JUNCTION	92.76	92.76	0	00:30	2.04	2.04	0.000
23	JUNCTION	0.00	40.92	0	00:30	0	0.954	0.000
24	JUNCTION	0.00	93.26	0	00:30	0	2.96	0.000
30	JUNCTION	77.99	77.99	0	00:30	1.38	1.38	0.000
31	JUNCTION	0.00	1.52	0	02:23	0	0.925	0.000
67	JUNCTION	0.00	201.42	0	01:59	0	147	0.000
40	JUNCTION	24.15	24.15	0	00:30	0.438	0.438	0.000
41	JUNCTION	98.47	98.47	0	00:30	1.83	1.83	0.000
42	JUNCTION	0.00	24.15	0	00:30	0	0.438	-0.000
50	JUNCTION	46.88	46.88	0	00:35	0.982	0.982	0.000
51	JUNCTION	0.00	85.04	0	01:03	0	50	0.000
60	JUNCTION	16.28	16.28	0	00:35	0.424	0.424	0.000
61	JUNCTION	60.11	60.11	0	00:35	1.38	1.38	0.000
62	JUNCTION	11.36	11.36	0	00:30	0.234	0.234	0.000
63	JUNCTION	42.32	42.32	0	00:30	0.975	0.975	0.000
64	JUNCTION	0.00	26.88	0	00:35	0	0.659	0.000
65	JUNCTION	0.00	69.12	0	00:35	0	1.63	0.000
66	JUNCTION	0.00	60.11	0	00:35	0	1.38	0.000
70	JUNCTION	13.78	13.78	0	00:30	0.32	0.32	0.000
71	JUNCTION	6.55	6.55	0	00:35	0.191	0.191	0.000
72	JUNCTION	0.00	6.55	0	00:35	0	0.191	0.000
73	JUNCTION	0.00	6.55	0	00:35	0	0.191	0.000

74		JUNCTION	0.00	189.05	0	01:15	0	
146	0.000							
80		JUNCTION	5.68	5.68	0	00:35	0.173	
0.173	0.000							
81		JUNCTION	16.24	16.24	0	00:30	0.333	
0.333	0.000							
82		JUNCTION	5.21	5.21	0	00:30	0.1	
0.1	0.000							
83		JUNCTION	20.93	20.93	0	00:30	0.453	
0.453	0.000							
84		JUNCTION	0.00	21.67	0	00:30	0	
0.507	0.000							
85		JUNCTION	0.00	5.21	0	00:30	0	
0.1	0.000							
OS1		JUNCTION	67.00	67.00	0	00:00	54.1	
54.1	0.000							
OS3		JUNCTION	61.00	61.00	0	00:00	49.3	
49.3	0.000							
OS4		JUNCTION	180.00	180.00	0	00:00	145	
145	0.000							
OS2		JUNCTION	59.00	59.00	0	00:00	47.7	
47.7	0.000							
Outfall2		OUTFALL	0.00	61.68	0	02:52	0	
49.4	0.000							
Outfall1		OUTFALL	0.00	67.69	0	02:35	0	
54.5	0.000							
Outfall4		OUTFALL	0.00	276.10	0	01:07	0	
198	0.000							
Outfall3		OUTFALL	0.00	8.58	0	02:07	0	
1.45	0.000							
PondB		STORAGE	0.00	134.27	0	00:31	0	
3.91	-0.000							
PondC		STORAGE	0.00	77.99	0	00:30	0	
1.38	0.005							
PondA		STORAGE	0.00	30.72	0	00:35	0	
0.705	0.003							
PondD		STORAGE	0.00	120.96	0	00:30	0	
2.27	0.003							
PondE		STORAGE	0.00	46.88	0	00:35	0	
0.982	0.190							
PondF		STORAGE	0.00	129.20	0	00:35	0	
3.01	0.010							
PondG		STORAGE	0.00	20.07	0	00:35	0	
0.51	0.116							
PondH		STORAGE	0.00	47.25	0	00:32	0	
1.06	0.003							

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
PondB	321.956	38	0	0	389.908	46	0 02:51	2.68
PondC	111.256	19	0	0	174.130	30	0 02:23	1.52
PondA	59.417	29	0	0	88.970	44	0 02:35	0.69
PondD	184.527	30	0	0	278.950	45	0 02:07	8.58
PondE	46.471	16	0	0	72.497	25	0 01:03	24.04
PondF	238.240	29	0	0	353.902	43	0 02:03	15.59
PondG	2.647	0	0	0	31.289	6	0 01:15	9.05
PondH	86.593	14	0	0	132.766	21	0 02:39	1.11

****
Outfall Loading Summary
****

	Flow Freq	Avg Flow	Max Flow	Total Volume

Outfall Node	Pcnt	CFS	CFS	10^6 gal
Outfall2	99.97	61.16	61.68	49.385
Outfall1	99.97	67.44	67.69	54.456
Outfall4	99.89	245.24	276.10	197.866
Outfall3	99.69	1.80	8.58	1.447
System	99.88	375.63	407.24	303.154

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	30.72	0	00:35			
200	DUMMY	29.46	0	00:30			
201	DUMMY	12.02	0	00:35			
202	CONDUIT	40.84	0	00:31	18.27	0.02	0.11
203	CONDUIT	1.52	0	02:24	6.34	0.00	0.05
204	DUMMY	92.76	0	00:30			
205	CONDUIT	93.43	0	00:31	22.09	0.06	0.17
300	DUMMY	77.99	0	00:30			
400	DUMMY	24.15	0	00:30			
401	CONDUIT	23.53	0	00:32	11.46	0.06	0.16
402	DUMMY	98.47	0	00:30			
500	DUMMY	46.88	0	00:35			
601	DUMMY	60.11	0	00:35			
602	CONDUIT	60.09	0	00:35	10.17	0.25	0.34
603	DUMMY	16.28	0	00:35			
604	DUMMY	11.36	0	00:30			
605	CONDUIT	26.88	0	00:35	14.61	0.02	0.09
606	DUMMY	42.32	0	00:30			
607	CONDUIT	69.12	0	00:31	16.65	0.04	0.14
700	DUMMY	13.78	0	00:30			
701	DUMMY	6.55	0	00:35			
702	DUMMY	6.55	0	00:35			
703	CONDUIT	6.54	0	00:36	5.62	0.03	0.11
801	DUMMY	5.68	0	00:35			
802	DUMMY	16.24	0	00:30			
803	CONDUIT	21.49	0	00:32	8.87	0.03	0.11
804	DUMMY	5.21	0	00:30			
806	DUMMY	20.93	0	00:30			
805	CONDUIT	5.08	0	00:32	5.42	0.02	0.09

808	CONDUIT	201.42	0	01:59	4.47	0.03	0.20
800	CONDUIT	189.04	0	01:19	6.57	0.02	0.14
600	CONDUIT	84.88	0	01:06	9.93	0.00	0.06
EastForkTrib	CONDUIT	61.00	0	00:32	3.08	0.01	0.07
EastFork	CONDUIT	180.00	0	00:24	4.29	0.03	0.15
MainStem	CONDUIT	67.00	0	01:15	2.39	0.00	0.05
MainStemTrib	CONDUIT	59.00	0	03:06	2.28	0.00	0.04
101	DUMMY	0.69	0	02:35			
206	DUMMY	2.68	0	02:52			
301	DUMMY	1.52	0	02:23			
501	DUMMY	24.04	0	01:03			
704	DUMMY	9.05	0	01:15			
807	DUMMY	1.11	0	02:39			
608	DUMMY	15.59	0	02:04			
403	DUMMY	8.58	0	02:07			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Sep 21 16:22:13 2020
Analysis ended on: Mon Sep 21 16:22:14 2020
Total elapsed time: 00:00:01

SWMM 100 Year Post Development

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/02/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Flow Routing Continuity **********	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	123.320	40.186
External Outflow	105.086	34.244
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	18.084	5.893
Continuity Error (%)	0.122	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 30.00 sec
Average Time Step : 30.00 sec
Maximum Time Step : 30.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 1.02
Percent Not Converging : 0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.06	1.35	6946.35	0 00:35	1.34
24	JUNCTION	0.27	2.22	6936.22	0 00:51	2.22
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
31	JUNCTION	0.24	1.68	6954.68	0 00:59	1.68
67	JUNCTION	0.24	2.30	6867.80	0 01:13	2.30
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.05	1.40	6912.40	0 00:35	1.38
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
51	JUNCTION	0.04	0.74	6920.74	0 00:49	0.74
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.06	1.19	6901.19	0 00:40	1.19
65	JUNCTION	0.09	1.92	6881.92	0 00:40	1.92

66	JUNCTION	0.13	3.12	6871.12	0	00:40	3.12
70	JUNCTION	0.00	0.00	6923.00	0	00:00	0.00
71	JUNCTION	0.00	0.00	6908.00	0	00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0	00:00	0.00
73	JUNCTION	0.06	1.02	6903.02	0	00:45	1.02
74	JUNCTION	0.05	0.60	6897.60	0	01:12	0.60
80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.07	1.45	6873.45	0	00:40	1.45
85	JUNCTION	0.03	0.82	6874.82	0	00:35	0.81
Outfall2	OUTFALL	0.00	0.00	6910.00	0	00:00	0.00
Outfall1	OUTFALL	0.00	0.00	6947.00	0	00:00	0.00
Outfall4	OUTFALL	0.24	2.30	6867.30	0	01:13	2.30
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00
PondB	STORAGE	6.72	9.85	6920.85	0	01:16	9.85
PondC	STORAGE	5.17	7.08	6963.08	0	00:59	7.08
PondA	STORAGE	5.81	8.60	6957.60	0	01:13	8.59
PondD	STORAGE	5.66	8.08	6889.08	0	01:04	8.08
PondE	STORAGE	4.04	5.84	6928.84	0	00:49	5.84
PondF	STORAGE	5.86	8.17	6874.17	0	01:09	8.17
PondG	STORAGE	0.20	2.69	6902.69	0	01:12	2.68
PondH	STORAGE	4.95	6.51	6872.51	0	01:12	6.51

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	100.64	100.64	0 00:40	2.37	2.37	0.000
20	JUNCTION	97.08	97.08	0 00:35	1.81	1.81	0.000

21		JUNCTION	42.26	42.26	0	00:40	1.2	1.2	0.000
22		JUNCTION	295.27	295.27	0	00:40	6.04	6.04	0.000
23		JUNCTION	0.00	136.17	0	00:35	0	3.01	0.000
24		JUNCTION	0.00	334.84	0	00:51	0	9.43	-0.000
30		JUNCTION	238.03	238.03	0	00:35	4	4	0.000
31		JUNCTION	0.00	115.75	0	00:59	0	3.39	0.000
67		JUNCTION	0.00	270.41	0	01:13	0	9.72	-0.000
40		JUNCTION	70.07	70.07	0	00:35	1.32	1.32	0.000
41		JUNCTION	252.18	252.18	0	00:35	4.73	4.73	0.000
42		JUNCTION	0.00	70.07	0	00:35	0	1.32	0.000
50		JUNCTION	178.04	178.04	0	00:40	4.2	4.2	0.000
51		JUNCTION	0.00	164.75	0	00:49	0	3.95	0.000
60		JUNCTION	58.95	58.95	0	00:40	1.65	1.65	0.000
61		JUNCTION	170.90	170.90	0	00:40	3.87	3.87	0.000
62		JUNCTION	32.93	32.93	0	00:35	0.699	0.699	0.000
63		JUNCTION	124.89	124.89	0	00:40	2.87	2.87	0.000
64		JUNCTION	0.00	90.88	0	00:40	0	2.35	0.000
65		JUNCTION	0.00	215.63	0	00:40	0	5.22	0.000
66		JUNCTION	0.00	170.90	0	00:40	0	3.87	0.000
70		JUNCTION	43.95	43.95	0	00:40	1.05	1.05	0.000
71		JUNCTION	23.95	23.95	0	00:45	0.742	0.742	0.000
72		JUNCTION	0.00	23.95	0	00:45	0	0.742	0.000
73		JUNCTION	0.00	23.95	0	00:45	0	0.742	0.000
74		JUNCTION	0.00	42.13	0	01:12	0	1.79	-0.000

80	JUNCTION	27.62	27.62	0	00:45	0.833	0.833	0.000
81	JUNCTION	47.62	47.62	0	00:35	1.01	1.01	0.000
82	JUNCTION	15.60	15.60	0	00:35	0.314	0.314	0.000
83	JUNCTION	64.71	64.71	0	00:35	1.46	1.46	0.000
84	JUNCTION	0.00	73.73	0	00:40	0	1.84	0.000
85	JUNCTION	0.00	15.60	0	00:35	0	0.314	0.000
Outfall2	OUTFALL	0.00	256.11	0	01:16	0	10.3	0.000
Outfall1	OUTFALL	0.00	53.95	0	01:13	0	2.03	0.000
Outfall4	OUTFALL	0.00	478.86	0	01:05	0	16.7	0.000
Outfall3	OUTFALL	0.00	160.70	0	01:04	0	5.21	0.000
PondB	STORAGE	0.00	447.00	0	00:49	0	12.4	0.062
PondC	STORAGE	0.00	238.03	0	00:35	0	4	0.130
PondA	STORAGE	0.00	100.64	0	00:40	0	2.37	0.096
PondD	STORAGE	0.00	320.21	0	00:35	0	6.05	0.105
PondE	STORAGE	0.00	178.04	0	00:40	0	4.2	0.178
PondF	STORAGE	0.00	385.87	0	00:41	0	9.08	0.109
PondG	STORAGE	0.00	67.73	0	00:40	0	1.8	0.079
PondH	STORAGE	0.00	153.03	0	00:38	0	3.61	0.143

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

	Average	Avg	Evap	Exfil	Maximum	Max	Time of Max	Maximum
	Volume	Pcnt	Pcnt	Pcnt	Volume	Pcnt		Outflow
Storage Unit	1000 ft3	Full	Loss	Loss	1000 ft3	Full	days hr:min	CFS
PondB	363.135	43	0	0	827.701	97	0 01:15	256.11
PondC	146.763	26	0	0	299.338	52	0 00:58	115.75
PondA	75.030	37	0	0	152.554	76	0 01:12	53.95
PondD	192.591	31	0	0	418.291	67	0 01:04	160.70
PondE	48.028	17	0	0	106.230	37	0 00:48	164.75
PondF	250.108	31	0	0	549.589	67	0 01:09	229.20
PondG	5.811	1	0	0	88.594	16	0 01:11	42.13
PondH	131.315	21	0	0	268.983	42	0 01:12	80.17

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall2	99.64	12.77	256.11	10.280
Outfall1	99.69	2.53	53.95	2.035
Outfall4	99.67	20.76	478.86	16.717
Outfall3	99.69	6.47	160.70	5.209
System	99.67	42.53	924.48	34.241

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	100.64	0	00:40			
200	DUMMY	97.08	0	00:35			
201	DUMMY	42.26	0	00:40			
202	CONDUIT	136.36	0	00:36	26.17	0.08	0.19
203	CONDUIT	115.74	0	00:59	23.03	0.37	0.42
204	DUMMY	295.27	0	00:40			
205	CONDUIT	334.86	0	00:51	31.89	0.22	0.32
300	DUMMY	238.03	0	00:35			
400	DUMMY	70.07	0	00:35			
401	CONDUIT	69.37	0	00:36	15.63	0.17	0.28
402	DUMMY	252.18	0	00:35			
500	DUMMY	178.04	0	00:40			
601	DUMMY	170.90	0	00:40			
602	CONDUIT	170.58	0	00:41	13.26	0.71	0.62
603	DUMMY	58.95	0	00:40			
604	DUMMY	32.93	0	00:35			
605	CONDUIT	90.74	0	00:41	20.83	0.06	0.17
606	DUMMY	124.89	0	00:40			
607	CONDUIT	215.42	0	00:40	23.26	0.13	0.24
700	DUMMY	43.95	0	00:40			
701	DUMMY	23.95	0	00:45			
702	DUMMY	23.95	0	00:45			
703	CONDUIT	23.94	0	00:45	8.29	0.09	0.20
801	DUMMY	27.62	0	00:45			
802	DUMMY	47.62	0	00:35			
803	CONDUIT	73.66	0	00:40	12.80	0.09	0.21
804	DUMMY	15.60	0	00:35			
806	DUMMY	64.71	0	00:35			
805	CONDUIT	15.43	0	00:37	7.47	0.06	0.16
808	CONDUIT	270.40	0	01:13	4.87	0.04	0.23
800	CONDUIT	41.98	0	01:17	4.06	0.00	0.06
600	CONDUIT	164.38	0	00:51	12.48	0.01	0.09
101	DUMMY	53.95	0	01:13			
206	DUMMY	256.11	0	01:16			
301	DUMMY	115.75	0	00:59			
501	DUMMY	164.75	0	00:49			
704	DUMMY	42.13	0	01:12			
807	DUMMY	80.17	0	01:12			
608	DUMMY	229.20	0	01:09			

403 DUMMY 160.70 0 01:04

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Apr 13 19:00:38 2020
Analysis ended on: Mon Apr 13 19:00:38 2020
Total elapsed time: < 1 sec

SWMM 100 Year Output 9-21-20

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... NO
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Flow Routing Method ..... KINWAVE
Starting Date 01/01/2005 00:00:00
Ending Date 01/02/2005 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Routing Time Step ..... 30.00 sec

********** Flow Routing Continuity **********	Volume acre-feet	Volume 10^6 gal
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	3854.070	1255.906
External Outflow	3828.229	1247.485
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	28.186	9.185
Continuity Error (%)	-0.061	

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****

Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.02
Percent Not Converging	:	0.00

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
10	JUNCTION	0.00	0.00	6975.00	0 00:00	0.00
20	JUNCTION	0.00	0.00	6982.00	0 00:00	0.00
21	JUNCTION	0.00	0.00	6953.00	0 00:00	0.00
22	JUNCTION	0.00	0.00	6936.00	0 00:00	0.00
23	JUNCTION	0.06	1.35	6946.35	0 00:35	1.34
24	JUNCTION	0.27	2.22	6936.22	0 00:51	2.22
30	JUNCTION	0.00	0.00	6985.00	0 00:00	0.00
31	JUNCTION	0.24	1.68	6954.68	0 00:59	1.68
67	JUNCTION	3.45	4.11	6869.61	0 01:12	4.11
40	JUNCTION	0.00	0.00	6918.00	0 00:00	0.00
41	JUNCTION	0.00	0.00	6888.00	0 00:00	0.00
42	JUNCTION	0.05	1.40	6912.40	0 00:35	1.38
50	JUNCTION	0.00	0.00	6945.00	0 00:00	0.00
51	JUNCTION	1.48	1.48	6921.48	0 00:21	1.48
60	JUNCTION	0.00	0.00	6942.00	0 00:00	0.00
61	JUNCTION	0.00	0.00	6893.00	0 00:00	0.00
62	JUNCTION	0.00	0.00	6908.00	0 00:00	0.00
63	JUNCTION	0.00	0.00	6882.00	0 00:00	0.00
64	JUNCTION	0.06	1.19	6901.19	0 00:40	1.19
65	JUNCTION	0.09	1.92	6881.92	0 00:40	1.92
66	JUNCTION	0.13	3.12	6871.12	0 00:40	3.12
70	JUNCTION	0.00	0.00	6923.00	0 00:00	0.00

71	JUNCTION	0.00	0.00	6908.00	0	00:00	0.00
72	JUNCTION	0.00	0.00	6904.00	0	00:00	0.00
73	JUNCTION	0.06	1.02	6903.02	0	00:45	1.02
74	JUNCTION	2.57	2.66	6899.66	0	01:12	2.66
80	JUNCTION	0.00	0.00	6890.00	0	00:00	0.00
81	JUNCTION	0.00	0.00	6896.00	0	00:00	0.00
82	JUNCTION	0.00	0.00	6886.00	0	00:00	0.00
83	JUNCTION	0.00	0.00	6878.00	0	00:00	0.00
84	JUNCTION	0.07	1.45	6873.45	0	00:40	1.45
85	JUNCTION	0.03	0.82	6874.82	0	00:35	0.81
OS1	JUNCTION	1.33	1.33	6953.93	0	00:00	1.33
OS3	JUNCTION	1.48	1.48	6924.28	0	00:00	1.48
OS4	JUNCTION	2.38	2.38	6902.18	0	00:00	2.38
OS2	JUNCTION	1.06	1.06	6925.06	0	00:00	1.06
Outfall2	OUTFALL	1.06	1.06	6911.06	0	01:47	1.06
Outfall1	OUTFALL	1.33	1.33	6948.33	0	00:39	1.33
Outfall4	OUTFALL	3.45	4.11	6869.11	0	01:12	4.11
Outfall3	OUTFALL	0.00	0.00	6880.00	0	00:00	0.00
PondB	STORAGE	6.72	9.85	6920.85	0	01:16	9.85
PondC	STORAGE	5.17	7.08	6963.08	0	00:59	7.08
PondA	STORAGE	5.81	8.60	6957.60	0	01:13	8.59
PondD	STORAGE	5.66	8.08	6889.08	0	01:04	8.08
PondE	STORAGE	4.04	5.84	6928.84	0	00:49	5.84
PondF	STORAGE	5.86	8.17	6874.17	0	01:09	8.17
PondG	STORAGE	0.20	2.69	6902.69	0	01:12	2.68
PondH	STORAGE	4.95	6.51	6872.51	0	01:12	6.51

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
10	JUNCTION	100.64	100.64	0 00:40	2.37	2.37	0.000

20		JUNCTION	97.08	97.08	0	00:35	1.81	1.81	0.000
21		JUNCTION	42.26	42.26	0	00:40	1.2	1.2	0.000
22		JUNCTION	295.27	295.27	0	00:40	6.04	6.04	0.000
23		JUNCTION	0.00	136.17	0	00:35	0	3.01	0.000
24		JUNCTION	0.00	334.84	0	00:51	0	9.43	-0.000
30		JUNCTION	238.03	238.03	0	00:35	4	4	0.000
31		JUNCTION	0.00	115.75	0	00:59	0	3.39	0.000
67		JUNCTION	0.00	865.98	0	01:12	0	489	0.000
40		JUNCTION	70.07	70.07	0	00:35	1.32	1.32	0.000
41		JUNCTION	252.18	252.18	0	00:35	4.73	4.73	0.000
42		JUNCTION	0.00	70.07	0	00:35	0	1.32	0.000
50		JUNCTION	178.04	178.04	0	00:40	4.2	4.2	0.000
51		JUNCTION	0.00	381.75	0	00:49	0	179	0.000
60		JUNCTION	58.95	58.95	0	00:40	1.65	1.65	0.000
61		JUNCTION	170.90	170.90	0	00:40	3.87	3.87	0.000
62		JUNCTION	32.93	32.93	0	00:35	0.699	0.699	0.000
63		JUNCTION	124.89	124.89	0	00:40	2.87	2.87	0.000
64		JUNCTION	0.00	90.88	0	00:40	0	2.35	0.000
65		JUNCTION	0.00	215.63	0	00:40	0	5.22	0.000
66		JUNCTION	0.00	170.90	0	00:40	0	3.87	0.000
70		JUNCTION	43.95	43.95	0	00:40	1.05	1.05	0.000
71		JUNCTION	23.95	23.95	0	00:45	0.742	0.742	0.000
72		JUNCTION	0.00	23.95	0	00:45	0	0.742	0.000
73		JUNCTION	0.00	23.95	0	00:45	0	0.742	0.000

74	JUNCTION	0.00	637.13	0	01:12	0	482 0.000
80	JUNCTION	27.62	27.62	0	00:45	0.833	0.833 0.000
81	JUNCTION	47.62	47.62	0	00:35	1.01	1.01 0.000
82	JUNCTION	15.60	15.60	0	00:35	0.314	0.314 0.000
83	JUNCTION	64.71	64.71	0	00:35	1.46	1.46 0.000
84	JUNCTION	0.00	73.73	0	00:40	0	1.84 0.000
85	JUNCTION	0.00	15.60	0	00:35	0	0.314 0.000
OS1	JUNCTION	413.00	413.00	0	00:00	334	334 0.000
OS3	JUNCTION	217.00	217.00	0	00:00	175	175 -0.000
OS4	JUNCTION	595.00	595.00	0	00:00	481	481 0.000
OS2	JUNCTION	280.00	280.00	0	00:00	226	226 0.000
Outfall2	OUTFALL	0.00	536.11	0	01:16	0	236 0.000
Outfall1	OUTFALL	0.00	466.95	0	01:13	0	335 0.000
Outfall4	OUTFALL	0.00	1291.25	0	01:05	0	671 0.000
Outfall3	OUTFALL	0.00	160.70	0	01:04	0	5.21 0.000
PondB	STORAGE	0.00	447.00	0	00:49	0	12.4 0.062
PondC	STORAGE	0.00	238.03	0	00:35	0	4 0.130
PondA	STORAGE	0.00	100.64	0	00:40	0	2.37 0.096
PondD	STORAGE	0.00	320.21	0	00:35	0	6.05 0.105
PondE	STORAGE	0.00	178.04	0	00:40	0	4.2 0.178
PondF	STORAGE	0.00	385.87	0	00:41	0	9.08 0.109
PondG	STORAGE	0.00	67.73	0	00:40	0	1.8 0.079
PondH	STORAGE	0.00	153.03	0	00:38	0	3.61 0.143

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
PondB	363.135	43	0	0	827.701	97	0 01:15	256.11
PondC	146.763	26	0	0	299.338	52	0 00:58	115.75
PondA	75.030	37	0	0	152.554	76	0 01:12	53.95
PondD	192.591	31	0	0	418.291	67	0 01:04	160.70
PondE	48.028	17	0	0	106.230	37	0 00:48	164.75
PondF	250.108	31	0	0	549.589	67	0 01:09	229.20
PondG	5.811	1	0	0	88.594	16	0 01:11	42.13
PondH	131.315	21	0	0	268.983	42	0 01:12	80.17

****
Outfall Loading Summary
****

	Flow Freq	Avg Flow	Max Flow	Total Volume

Outfall Node	Pcnt	CFS	CFS	10^6 gal
Outfall2	99.97	292.00	536.11	235.796
Outfall1	99.97	415.18	466.95	335.258
Outfall4	99.92	831.58	1291.25	671.130
Outfall3	99.69	6.47	160.70	5.209
System	99.89	1545.23	2428.13	1247.393

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
100	DUMMY	100.64	0	00:40			
200	DUMMY	97.08	0	00:35			
201	DUMMY	42.26	0	00:40			
202	CONDUIT	136.36	0	00:36	26.17	0.08	0.19
203	CONDUIT	115.74	0	00:59	23.03	0.37	0.42
204	DUMMY	295.27	0	00:40			
205	CONDUIT	334.86	0	00:51	31.89	0.22	0.32
300	DUMMY	238.03	0	00:35			
400	DUMMY	70.07	0	00:35			
401	CONDUIT	69.37	0	00:36	15.63	0.17	0.28
402	DUMMY	252.18	0	00:35			
500	DUMMY	178.04	0	00:40			
601	DUMMY	170.90	0	00:40			
602	CONDUIT	170.58	0	00:41	13.26	0.71	0.62
603	DUMMY	58.95	0	00:40			
604	DUMMY	32.93	0	00:35			
605	CONDUIT	90.74	0	00:41	20.83	0.06	0.17
606	DUMMY	124.89	0	00:40			
607	CONDUIT	215.42	0	00:40	23.26	0.13	0.24
700	DUMMY	43.95	0	00:40			
701	DUMMY	23.95	0	00:45			
702	DUMMY	23.95	0	00:45			
703	CONDUIT	23.94	0	00:45	8.29	0.09	0.20
801	DUMMY	27.62	0	00:45			
802	DUMMY	47.62	0	00:35			
803	CONDUIT	73.66	0	00:40	12.80	0.09	0.21
804	DUMMY	15.60	0	00:35			
806	DUMMY	64.71	0	00:35			
805	CONDUIT	15.43	0	00:37	7.47	0.06	0.16

808	CONDUIT	865.97	0	01:12	6.70	0.14	0.41
800	CONDUIT	637.10	0	01:15	9.35	0.06	0.27
600	CONDUIT	381.54	0	00:50	16.34	0.02	0.15
EastForkTrib	CONDUIT	217.00	0	00:21	4.75	0.02	0.15
EastFork	CONDUIT	595.00	0	00:16	6.34	0.10	0.30
MainStem	CONDUIT	413.00	0	00:40	4.75	0.03	0.13
MainStemTrib	CONDUIT	280.00	0	01:49	4.12	0.02	0.11
101	DUMMY	53.95	0	01:13			
206	DUMMY	256.11	0	01:16			
301	DUMMY	115.75	0	00:59			
501	DUMMY	164.75	0	00:49			
704	DUMMY	42.13	0	01:12			
807	DUMMY	80.17	0	01:12			
608	DUMMY	229.20	0	01:09			
403	DUMMY	160.70	0	01:04			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Mon Sep 21 16:06:21 2020
Analysis ended on: Mon Sep 21 16:06:21 2020
Total elapsed time: < 1 sec

Appendix D

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond A
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters		
	User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	10	10	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	0.61	0.61	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	3.40	3.40	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	2.96	2.96	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	4.50	4.50	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters		
	User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	370.3	370.3	ft
B) Width of Basin at Top of EURV, W_{PCM} =	113.6	113.6	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	4.60	4.60	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	371.1	371.1	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	114.4	114.4	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	13.03				57.08	

B) Adjust "Time Interval" to match hydrograph data

Time Interval: 5.0 minutes

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time	Post-Development Storm Inflow Hydrographs (cfs)						
(min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		0.32				0.84	
0:10		2.12				2.93	
0:15		6.24				8.14	
0:20		19.45				26.66	
0:25		29.43				70.19	
0:30		30.68				95.65	
0:35		28.10				100.37	
0:40		24.84				96.25	
0:45		22.05				89.32	
0:50		19.61				81.43	
0:55		17.40				74.41	
1:00		15.33				68.04	
1:05		13.43				58.60	
1:10		11.93				49.54	
1:15		10.74				42.06	
1:20		9.68				35.93	
1:25		8.69				30.71	
1:30		7.74				26.07	
1:35		6.69				21.81	
1:40		5.63				17.82	
1:45		4.64				14.14	
1:50		3.79				10.94	
1:55		3.24				8.55	
2:00		2.68				6.51	
2:05		2.16				4.89	
2:10		1.73				3.64	
2:15		1.39				2.70	
2:20		1.11				1.98	
2:25		0.88				1.45	
2:30		0.68				1.07	
2:35		0.53				0.82	
2:40		0.41				0.64	
2:45		0.32				0.50	
2:50		0.24				0.39	
2:55		0.17				0.29	
3:00		0.12				0.20	
3:05		0.08				0.13	
3:10		0.05				0.07	
3:15		0.02				0.03	
3:20		0.01				0.01	
3:25		0.00				0.00	
3:30							
3:35							
3:40							
3:45							
3:50							
3:55							
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5:40							
5:45							
5:50							
5:55							
6:00							

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond A
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters: User Input	Input Parameters: COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft) $H_{weir\ front}$ =	4.50	4.50	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox) $L_{weir\ front}$ =	8.00	9.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate) $S_{weir\ sides}$ =	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox) Horizontal $L_{weir\ sides}$ =	8.00	5.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area) Grate Open Area =	70%	70%	%
F) Debris Clogging % Debris Clogging =	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox) $H_{grate\ top}$ =	4.50	4.50	ft
H) Overflow Grate Slope Length (inside edge of dropbox) Slope $L_{weir\ sides}$ =	8.00	5.00	ft
I) Overflow Grate Open Area (without debris) Open Area $_{(No\ Clogging)}$ =	44.80	31.50	sq ft
J) Overflow Grate Open Area (with debris) Open Area $_{(Clogged)}$ =	22.40	15.75	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters: User Input	Input Parameters: COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft) Pipe Invert Depth =	1.50	1.50	ft
C) Outlet Pipe Diameter Pipe Diameter =	36.00	30.00	inches
D) Restrictor Plate Height above Pipe Invert Plate Height =	22.42	28.11	inches
E) Half-Central Angle of Restrictor Plate on Pipe Theta =	1.82	2.63	radians
F) Outlet Orifice Area Outlet Ao =	4.63	4.78	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert $Outlet_{centroid}$ =	1.06	1.22	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4) Open Area Ratio =	9.68	6.59	

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters: User Input	Input Parameters: COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft) $H_{spillway\ invert}$ =	5.90	6.00	ft
B) Spillway Crest Length $L_{spillway\ crest}$ =	42.00	33.00	ft
C) Spillway End Slopes (H:V) $S_{spillway\ ends}$ =	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface Freeboard Depth=	1.00	1.00	ft
E) Spillway Design Flow Depth Flow $Depth_{spillway}$ =	0.80	1.00	ft
F) Stage at Top of Freeboard Freeboard Top Stage =	7.70	8.00	ft
G) Basin Area at Top of Freeboard Max Basin Area =	1.27	1.29	acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	0.64	1.66		2.16				7.27	
Predevelopment Peak Q (cfs) =	N/A	N/A		13.0				57.1	
Peak Inflow (cfs) =	N/A	N/A		30.7				100.4	
Peak Outflow (cfs) =	0.3	0.5		4.6				56.3	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.4				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.1				1.2	
Time to Drain 97% of Volume (hr) =	39	69		73				61	
Time to Drain 99% of Volume (hr) =	41	72		77				72	
Maximum Ponding Depth (ft) =	3.40	4.50		4.70				5.90	
Area at Max Ponding Depth (ac) =	0.80	0.97		0.98				1.09	
Maximum Volume Stored (ac-ft) =	0.64	1.66		1.87				3.11	

Results based on COS DCM Inputs

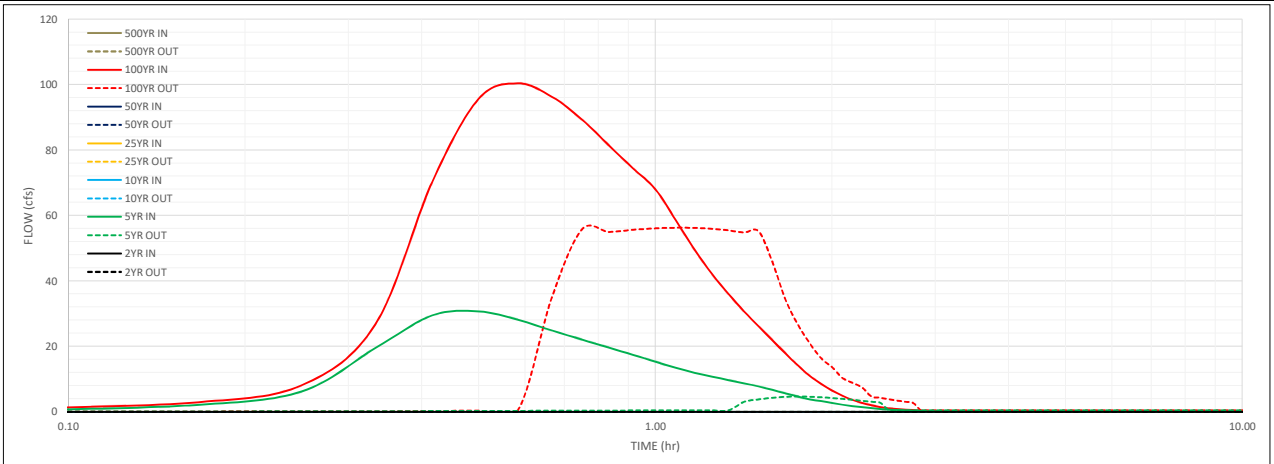
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	0.64	1.66		2.16				7.27	
Predevelopment Peak Q (cfs) =	N/A	N/A		13.0				57.1	
Peak Inflow (cfs) =	N/A	N/A		30.7				100.4	
Peak Outflow (cfs) =	0.3	0.5		4.3				57.5	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.3				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.2				1.8	
Time to Drain 97% of Volume (hr) =	39	69		73				61	
Time to Drain 99% of Volume (hr) =	41	72		77				72	
Maximum Ponding Depth (ft) =	3.40	4.50		4.70				5.90	
Area at Max Ponding Depth (ac) =	0.80	0.97		0.98				1.09	
Maximum Volume Stored (ac-ft) =	0.64	1.66		1.87				3.11	

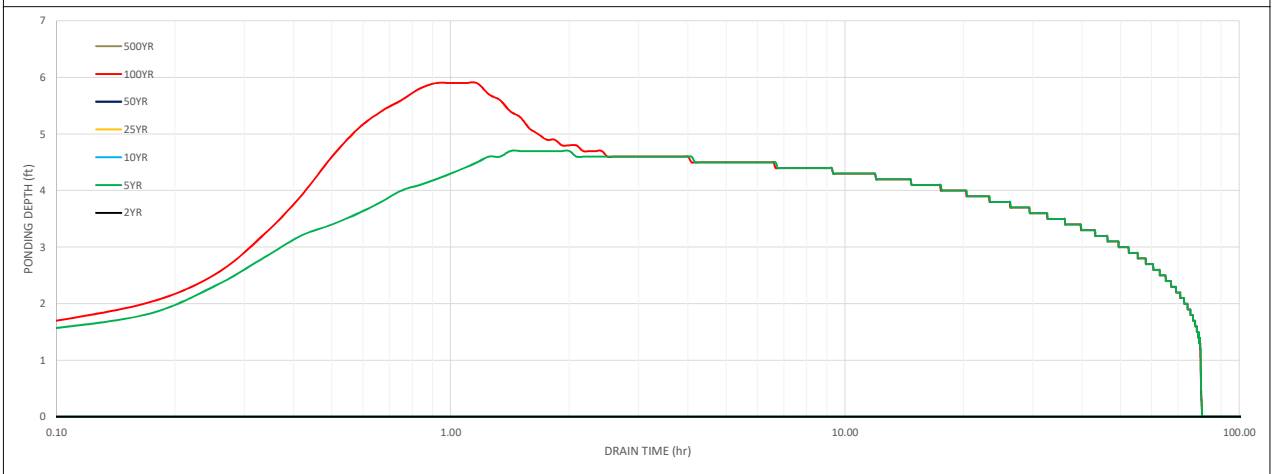
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

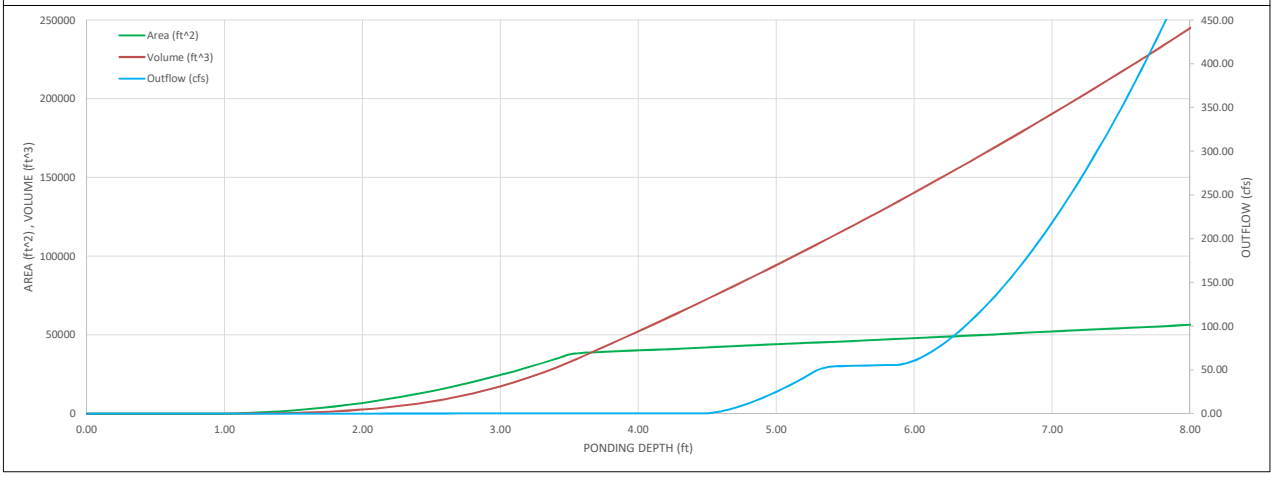
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond A
Date: April 6, 2020 — Last Edited: April 13, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond B
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters		
	User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	14	14	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	1.49	1.49	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	4.70	4.70	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	1.49	1.49	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	6.00	6.00	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters		
	User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	644.7	644.7	ft
B) Width of Basin at Top of EURV, W_{PCM} =	191.2	191.2	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	6.10	6.10	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	645.5	645.5	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	192.0	192.0	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	17.56				164.21	

B) Adjust "Time Interval" to match hydrograph data

Time Interval: 5.0 minutes

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time	Post-Development Storm Inflow Hydrographs (cfs)						
(min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		0.69				2.08	
0:10		5.80				8.30	
0:15		16.64				20.58	
0:20		42.42				58.80	
0:25		68.16				179.82	
0:30		75.65				276.49	
0:35		71.78				307.62	
0:40		64.91				331.81	
0:45		58.24				366.22	
0:50		52.24				365.58	
0:55		47.02				346.26	
1:00		42.99				321.76	
1:05		39.68				290.00	
1:10		36.25				252.97	
1:15		32.60				216.52	
1:20		29.09				182.15	
1:25		26.07				152.09	
1:30		23.97				127.70	
1:35		22.28				109.78	
1:40		20.74				96.42	
1:45		19.35				85.46	
1:50		18.07				76.27	
1:55		16.77				68.63	
2:00		14.81				60.20	
2:05		12.66				51.42	
2:10		10.67				42.95	
2:15		8.88				35.32	
2:20		7.28				28.18	
2:25		5.90				21.64	
2:30		4.82				15.96	
2:35		4.08				11.89	
2:40		3.58				9.39	
2:45		3.19				7.53	
2:50		2.86				6.09	
2:55		2.60				4.98	
3:00		2.39				4.12	
3:05		2.22				3.47	
3:10		2.09				2.97	
3:15		1.97				2.55	
3:20		1.86				2.21	
3:25		1.77				2.08	
3:30		1.70				1.98	
3:35		1.63				1.88	
3:40		1.58				1.81	
3:45		1.54				1.75	
3:50		1.51				1.70	
3:55		1.49				1.67	
4:00		1.47				1.65	
4:05		1.46				1.64	
4:10		1.46				1.64	
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4:50		1.44				1.63	
4:55		1.44				1.63	
5:00		1.44				1.62	
5:05		1.44				1.62	
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5:20		1.43				1.62	
5:25		1.43				1.61	
5:30		1.43				1.61	
5:35		1.43				1.61	

5:40		1.42				1.61	
5:45		1.42				1.61	
5:50		1.42				1.60	
5:55		1.42				1.60	
6:00							

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond B
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	User Input	COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft)	6.00	6.00	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox)	17.00	17.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate)	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox)	17.00	7.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area)	70%	70%	%
F) Debris Clogging %	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox)	6.00	6.00	ft
H) Overflow Grate Slope Length (inside edge of dropbox)	17.00	7.00	ft
I) Overflow Grate Open Area (without debris)	202.30	83.30	sq ft
J) Overflow Grate Open Area (with debris)	101.15	41.65	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	User Input	COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft)	1.50	1.50	ft
C) Outlet Pipe Diameter	54.00	48.00	inches
D) Restrictor Plate Height above Pipe Invert	37.00	42.00	inches
E) Half-Central Angle of Restrictor Plate on Pipe	1.95	2.42	radians
F) Outlet Orifice Area	11.61	11.66	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert	1.73	1.87	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4)	17.42	7.14	

8. Emergency Spillway (Rectangular or Trapezoidal)

	User Input	COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft)	9.50	9.30	ft
B) Spillway Crest Length	136.00	122.00	ft
C) Spillway End Slopes (H:V)	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface	1.00	1.00	ft
E) Spillway Design Flow Depth	0.90	1.00	ft
F) Stage at Top of Freeboard	11.40	11.30	ft
G) Basin Area at Top of Freeboard	3.70	3.68	acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	2.41	5.73		6.67				31.72	
Predevelopment Peak Q (cfs) =	N/A	N/A		17.6				164.2	
Peak Inflow (cfs) =	N/A	N/A		75.7				366.2	
Peak Outflow (cfs) =	1.1	1.4		1.4				166.4	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.1				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.0				0.8	
Time to Drain 97% of Volume (hr) =	40	68		76				61	
Time to Drain 99% of Volume (hr) =	42	72		80				73	
Maximum Ponding Depth (ft) =	4.70	6.00		6.10				9.10	
Area at Max Ponding Depth (ac) =	1.92	2.83		2.85				3.32	
Maximum Volume Stored (ac-ft) =	2.41	5.73		6.04				15.28	

Results based on COS DCM Inputs

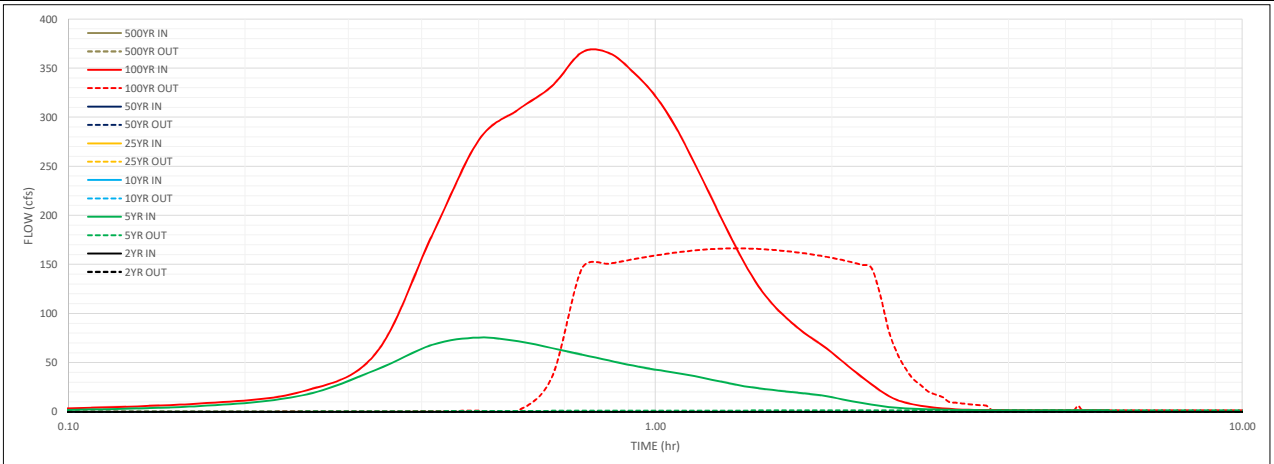
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	2.41	5.73		6.67				31.72	
Predevelopment Peak Q (cfs) =	N/A	N/A		17.6				164.2	
Peak Inflow (cfs) =	N/A	N/A		75.7				366.2	
Peak Outflow (cfs) =	1.1	1.4		1.4				166.5	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.1				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.0				2.0	
Time to Drain 97% of Volume (hr) =	40	68		76				61	
Time to Drain 99% of Volume (hr) =	42	72		80				73	
Maximum Ponding Depth (ft) =	4.70	6.00		6.10				9.20	
Area at Max Ponding Depth (ac) =	1.92	2.83		2.85				3.34	
Maximum Volume Stored (ac-ft) =	2.41	5.73		6.04				15.62	

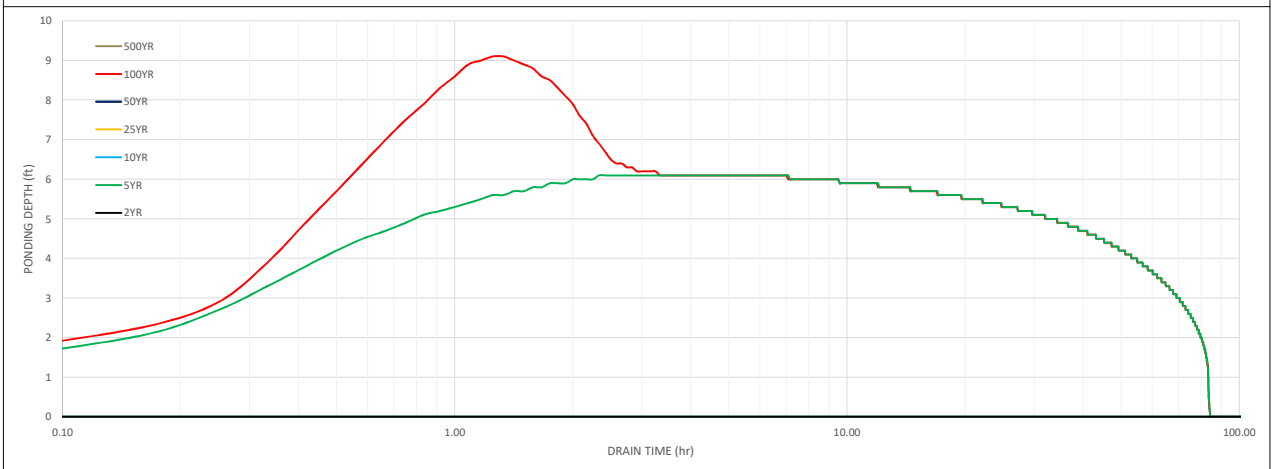
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

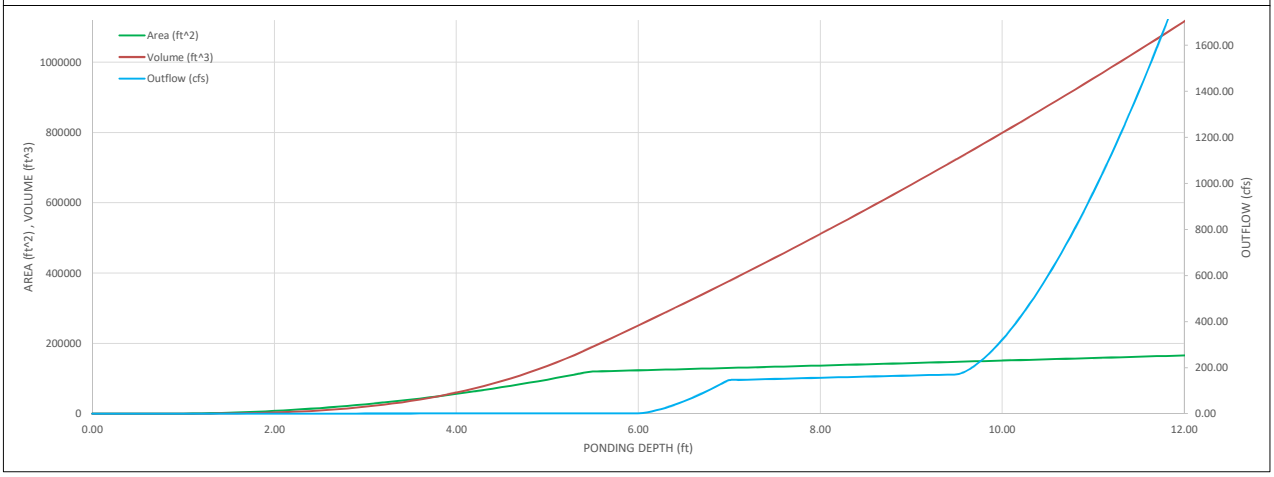
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond B
Date: April 6, 2020 — Last Edited: April 13, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond C
Date: April 6, 2020 — Last Edited: April 08, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

A) Average Infiltration Rate of WQCV
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface
C) Underdrain Outlet Orifice Area
D) Number of WQCV Orifice Rows
E) Vertical Spacing between WQCV Orifice Rows
F) WQCV Orifice Area (A_o) per Row
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth)
H) EURV Orifice Area (A_o) in Single Row
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth)
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s)

Input Parameters	User Input	COS DCM	
i =	N/A	N/A	in / hr
y =	N/A	N/A	inches
Underdrain Ao =	N/A	N/A	sq in
# WQCV rows =	12	12	
Orifice Spacing =	4.0	4.0	inches
WQCV Ao =	1.05	1.05	sq in
Max Stage $_{WQCV}$ =	4.00	4.00	ft
EURV Ao =	17.07	17.07	sq in
Max Stage $_{EURV}$ =	6.00	6.00	ft
Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

A) Length of Basin at Top of EURV
B) Width of Basin at Top of EURV
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge)
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge)
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge)
F) Average Side Slopes of Flood Control Surcharge above Transition Bench
   (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.)

Input Parameters	User Input	COS DCM	
L_{PCM} =	453.3	453.3	ft
W_{PCM} =	177.8	177.8	ft
Stage at Top of Bench =	6.10	6.10	ft
L_{Bench} =	454.1	454.1	ft
W_{Bench} =	178.6	178.6	ft
$Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	9.95				120.21	

B) Adjust "Time Interval" to match hydrograph data

Time Interval: 5.0 minutes

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time	Post-Development Storm Inflow Hydrographs (cfs)						
(min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		1.75				4.56	
0:10		11.33				15.20	
0:15		27.93				32.42	
0:20		61.14				76.70	
0:25		78.99				190.43	
0:30		71.29				238.04	
0:35		58.22				222.59	
0:40		47.28				193.29	
0:45		38.58				162.70	
0:50		32.22				131.89	
0:55		27.64				110.47	
1:00		23.60				95.05	
1:05		20.00				74.37	
1:10		16.49				54.92	
1:15		14.05				38.35	
1:20		12.80				27.93	
1:25		12.09				21.76	
1:30		11.62				18.07	
1:35		10.55				15.64	
1:40		9.56				14.06	
1:45		8.84				12.98	
1:50		8.33				12.35	
1:55		7.74				12.15	
2:00		5.88				9.32	
2:05		4.08				6.49	
2:10		2.79				4.48	
2:15		1.86				3.04	
2:20		1.21				1.99	
2:25		0.80				1.32	
2:30		0.49				0.80	
2:35		0.25				0.40	
2:40		0.09				0.14	
2:45		0.01				0.01	
2:50		0.00				0.00	
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Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond C
Date: April 6, 2020 — Last Edited: April 08, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters: User Input	Input Parameters: COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft)	6.00	6.00	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox)	12.00	11.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate)	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox)	12.00	11.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area)	70%	70%	%
F) Debris Clogging %	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox)	6.00	6.00	ft
H) Overflow Grate Slope Length (inside edge of dropbox)	12.00	11.00	ft
I) Overflow Grate Open Area (without debris)	100.80	84.70	sq ft
J) Overflow Grate Open Area (with debris)	50.40	42.35	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters: User Input	Input Parameters: COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft)	1.50	1.50	ft
C) Outlet Pipe Diameter	48.00	42.00	inches
D) Restrictor Plate Height above Pipe Invert	33.13	39.36	inches
E) Half-Central Angle of Restrictor Plate on Pipe	1.96	2.63	radians
F) Outlet Orifice Area	9.25	9.37	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert	1.54	1.71	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4)	10.90	9.04	

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters: User Input	Input Parameters: COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft)	8.00	999.00	ft
B) Spillway Crest Length	79.00	42.00	ft
C) Spillway End Slopes (H:V)	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface	1.00	1.00	ft
E) Spillway Design Flow Depth	1.00		ft
F) Stage at Top of Freeboard	10.00		ft
G) Basin Area at Top of Freeboard	2.34		acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	1.36	4.79		4.34				12.42	
Predevelopment Peak Q (cfs) =	N/A	N/A		10.0				120.2	
Peak Inflow (cfs) =	N/A	N/A		79.0				238.0	
Peak Outflow (cfs) =	0.6	1.7		1.5				119.2	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.2				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Orifice Plate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		N/A				1.2	
Time to Drain 97% of Volume (hr) =	39	67		65				63	
Time to Drain 99% of Volume (hr) =	41	72		69				72	
Maximum Ponding Depth (ft) =	4.00	6.00		5.60				7.10	
Area at Max Ponding Depth (ac) =	1.32	1.85		1.80				1.98	
Maximum Volume Stored (ac-ft) =	1.36	4.79		4.07				6.91	

Results based on COS DCM Inputs

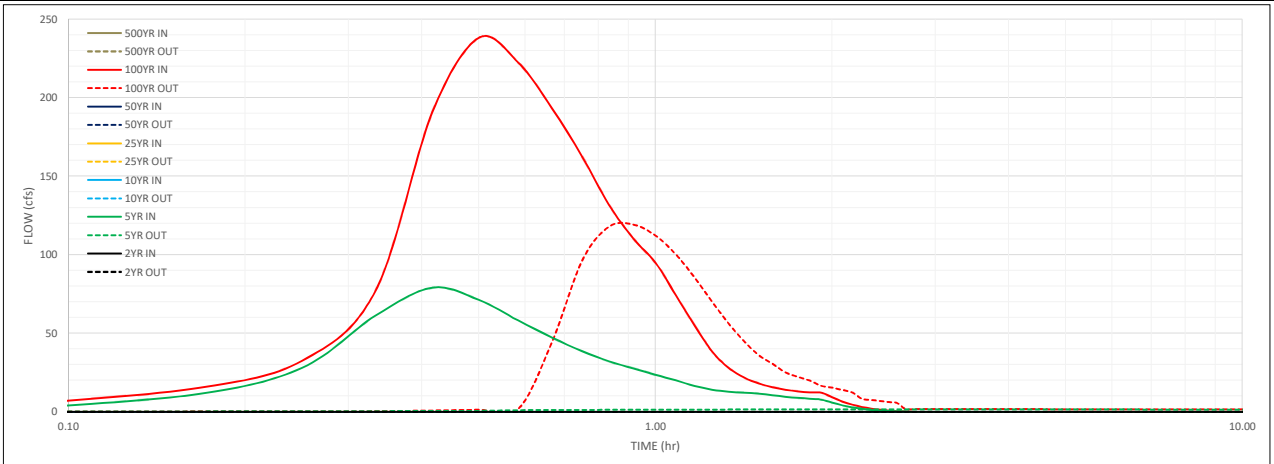
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	1.36	4.79		4.34				12.42	
Predevelopment Peak Q (cfs) =	N/A	N/A		10.0				120.2	
Peak Inflow (cfs) =	N/A	N/A		79.0				238.0	
Peak Outflow (cfs) =	0.6	1.7		1.5				116.8	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.2				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Orifice Plate				Overflow Grate	
Max Velocity through Grate =	N/A	N/A		N/A				1.3	
Time to Drain 97% of Volume (hr) =	39	67		65				63	
Time to Drain 99% of Volume (hr) =	41	72		69				72	
Maximum Ponding Depth (ft) =	4.00	6.00		5.60				7.10	
Area at Max Ponding Depth (ac) =	1.32	1.85		1.80				1.98	
Maximum Volume Stored (ac-ft) =	1.36	4.79		4.07				6.91	

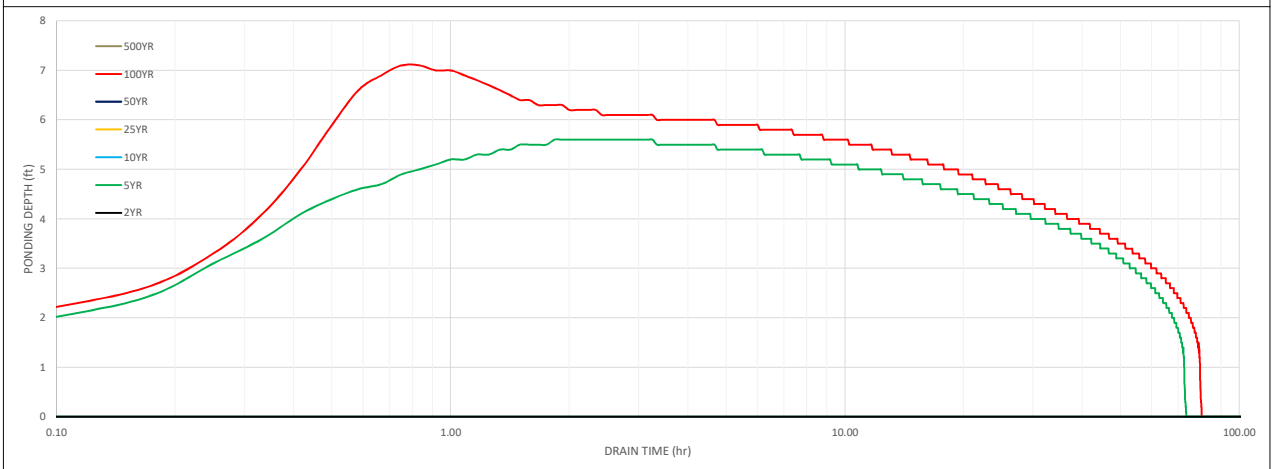
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

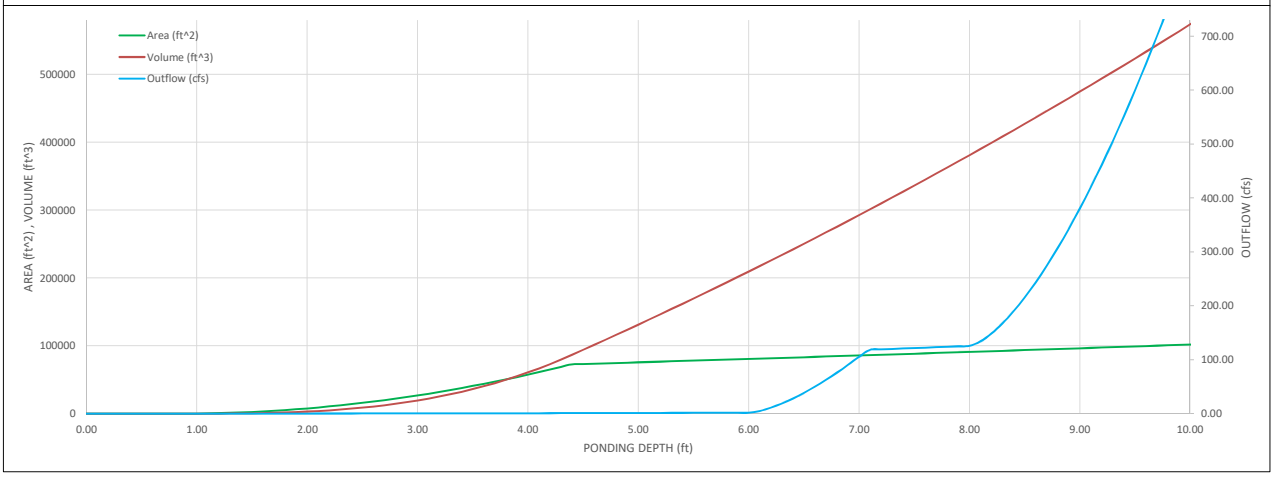
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond C
Date: April 6, 2020 — Last Edited: April 08, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 1 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond D
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters		
	User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	13	13	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	1.34	1.34	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	4.50	4.50	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	20.83	20.83	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	6.50	6.50	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters		
	User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	588.5	588.5	ft
B) Width of Basin at Top of EURV, W_{PCM} =	180.1	180.1	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	6.60	6.60	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	589.3	589.3	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	180.9	180.9	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	30.00				154.35	

B) Adjust "Time Interval" to match hydrograph data

Time Interval: 5.0 minutes

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time	Post-Development Storm Inflow Hydrographs (cfs)						
(min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		1.91				5.05	
0:10		13.55				18.88	
0:15		36.44				44.44	
0:20		87.25				108.47	
0:25		118.48				244.10	
0:30		113.01				314.40	
0:35		95.70				305.49	
0:40		80.03				273.09	
0:45		67.12				239.63	
0:50		56.09				204.40	
0:55		48.05				175.96	
1:00		41.91				156.02	
1:05		36.47				129.55	
1:10		30.68				102.47	
1:15		25.11				77.55	
1:20		21.41				56.75	
1:25		19.34				42.46	
1:30		18.14				33.79	
1:35		16.52				28.16	
1:40		14.92				24.40	
1:45		13.77				21.80	
1:50		12.92				19.98	
1:55		12.02				18.83	
2:00		9.58				15.10	
2:05		6.95				10.86	
2:10		4.98				7.82	
2:15		3.53				5.61	
2:20		2.44				3.93	
2:25		1.66				2.73	
2:30		1.13				1.86	
2:35		0.72				1.18	
2:40		0.41				0.67	
2:45		0.20				0.31	
2:50		0.08				0.11	
2:55		0.04				0.05	
3:00		0.02				0.02	
3:05		0.01				0.01	
3:10		0.01				0.01	
3:15		0.00				0.00	
3:20						0.00	
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Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond D
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters: User Input	Input Parameters: COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft)	$H_{weir\ front}$ =	6.50	6.50 ft
B) Overflow Weir Front Edge Length (inside edge of dropbox)	$L_{weir\ front}$ =	11.00	9.00 ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate)	$S_{weir\ sides}$ =	0.00	0.00 ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox)	Horizontal $L_{weir\ sides}$ =	11.00	9.00 ft
E) Overflow Grate Open Area % (grate open area / total grate area)	Grate Open Area =	70%	70% %
F) Debris Clogging %	Debris Clogging =	50%	50% %
G) Height of Grate Upper Edge (at back side of dropbox)	$H_{grate\ top}$ =	6.50	6.50 ft
H) Overflow Grate Slope Length (inside edge of dropbox)	Slope $L_{weir\ sides}$ =	11.00	9.00 ft
I) Overflow Grate Open Area (without debris)	Open Area $_{(No\ Clogging)}$ =	84.70	56.70 sq ft
J) Overflow Grate Open Area (with debris)	Open Area $_{(Clogged)}$ =	42.35	28.35 sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction (Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters: User Input	Input Parameters: COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft)	Pipe Invert Depth =	1.50	1.50 ft
C) Outlet Pipe Diameter	Pipe Diameter =	48.00	48.00 inches
D) Restrictor Plate Height above Pipe Invert	Plate Height =	44.00	44.00 inches
E) Half-Central Angle of Restrictor Plate on Pipe	Theta =	2.56	2.56 radians
F) Outlet Orifice Area	Outlet Ao =	12.07	12.07 sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert	$Outlet_{centroid}$ =	1.93	1.93 ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4)	Open Area Ratio =	7.02	4.70

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters: User Input	Input Parameters: COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft)	$H_{spillway\ invert}$ =	8.00	999.00 ft
B) Spillway Crest Length	$L_{spillway\ crest}$ =	105.00	42.00 ft
C) Spillway End Slopes (H:V)	$S_{spillway\ ends}$ =	4.00	4.00 ft / ft
D) Freeboard above Maximum Water Surface	Freeboard Depth=	1.00	1.00 ft
E) Spillway Design Flow Depth	Flow $Depth_{spillway}$ =	1.00	ft
F) Stage at Top of Freeboard	Freeboard Top Stage =	10.00	ft
G) Basin Area at Top of Freeboard	Max Basin Area =	2.95	acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	1.96	6.56		6.97				18.57	
Predevelopment Peak Q (cfs) =	N/A	N/A		30.0				154.4	
Peak Inflow (cfs) =	N/A	N/A		118.5				314.4	
Peak Outflow (cfs) =	0.9	2.2		2.2				161.7	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.1				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Orifice Plate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		N/A				1.8	
Time to Drain 97% of Volume (hr) =	40	67		70				62	
Time to Drain 99% of Volume (hr) =	42	72		75				72	
Maximum Ponding Depth (ft) =	4.50	6.50		6.50				7.90	
Area at Max Ponding Depth (ac) =	1.71	2.43		2.43				2.63	
Maximum Volume Stored (ac-ft) =	1.96	6.56		6.59				10.13	

Results based on COS DCM Inputs

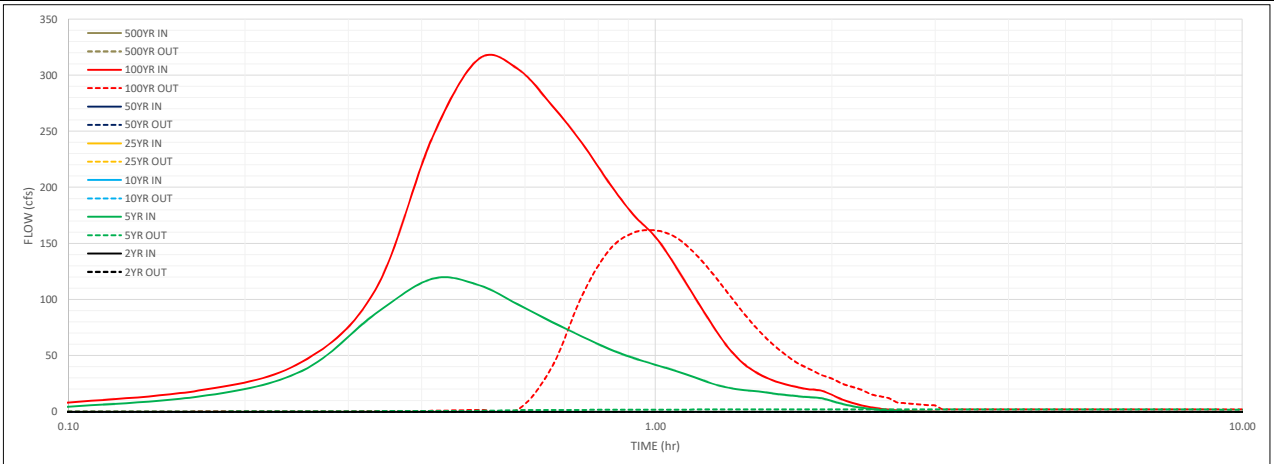
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	1.96	6.56		6.97				18.57	
Predevelopment Peak Q (cfs) =	N/A	N/A		30.0				154.4	
Peak Inflow (cfs) =	N/A	N/A		118.5				314.4	
Peak Outflow (cfs) =	0.9	2.2		2.2				153.1	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.1				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Orifice Plate				Overflow Grate	
Max Velocity through Grate =	N/A	N/A		N/A				2.8	
Time to Drain 97% of Volume (hr) =	40	67		70				63	
Time to Drain 99% of Volume (hr) =	42	72		75				72	
Maximum Ponding Depth (ft) =	4.50	6.50		6.50				8.10	
Area at Max Ponding Depth (ac) =	1.71	2.43		2.43				2.66	
Maximum Volume Stored (ac-ft) =	1.96	6.56		6.59				10.66	

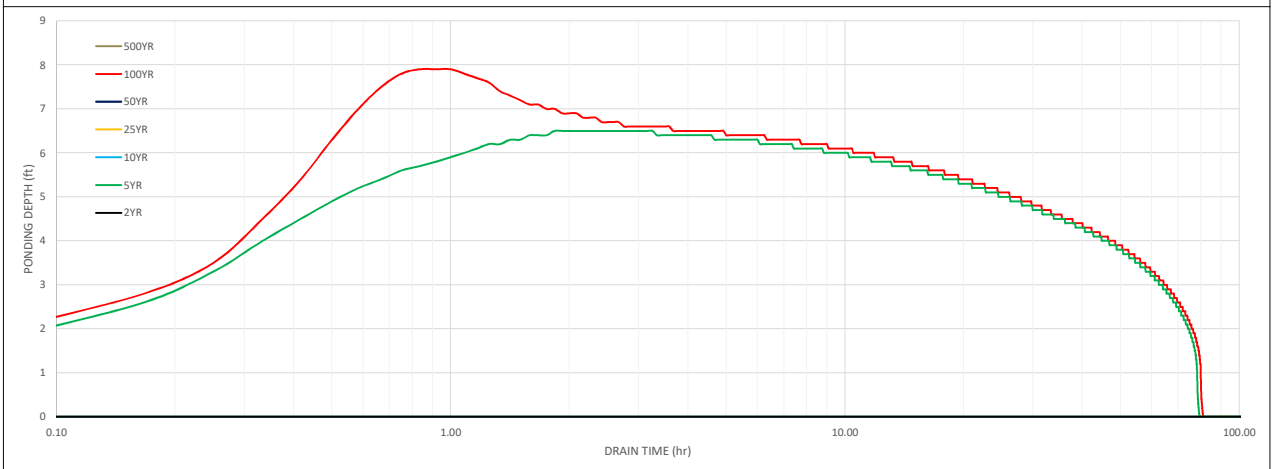
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

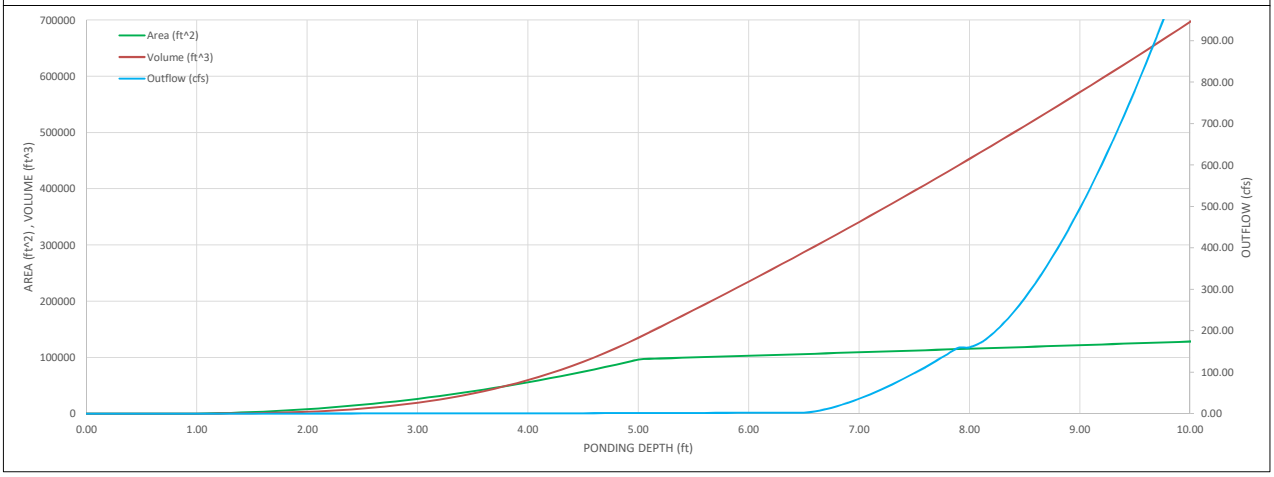
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond D
Date: April 6, 2020 — Last Edited: April 13, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond E
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters: User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	10	10	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	0.67	0.67	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	3.60	3.60	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	0.67	0.67	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	4.50	4.50	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters: User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	327.0	327.8	ft
B) Width of Basin at Top of EURV, W_{PCM} =	127.7	127.7	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	4.60	4.60	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	327.8	327.8	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	128.5	128.5	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	32.34				157.99	

B) Adjust "Time Interval" to match hydrograph data

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time Interval: 5.0 minutes

Post-Development Storm Inflow Hydrographs (cfs)

Time (min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		0.16				0.43	
0:10		1.11				1.54	
0:15		5.07				7.00	
0:20		23.64				35.29	
0:25		41.87				110.52	
0:30		46.56				162.17	
0:35		43.13				176.94	
0:40		37.83				172.03	
0:45		33.03				161.08	
0:50		29.04				147.26	
0:55		25.75				135.35	
1:00		22.65				124.96	
1:05		19.67				109.31	
1:10		16.82				92.46	
1:15		14.63				77.36	
1:20		13.01				65.86	
1:25		11.61				56.57	
1:30		10.30				48.68	
1:35		8.90				41.54	
1:40		7.47				34.92	
1:45		6.08				28.67	
1:50		4.75				22.81	
1:55		3.50				17.32	
2:00		2.49				12.10	
2:05		1.86				8.45	
2:10		1.45				6.02	
2:15		1.16				4.29	
2:20		0.92				3.03	
2:25		0.73				2.11	
2:30		0.57				1.42	
2:35		0.44				0.96	
2:40		0.34				0.71	
2:45		0.26				0.55	
2:50		0.20				0.44	
2:55		0.15				0.34	
3:00		0.11				0.26	
3:05		0.07				0.19	
3:10		0.05				0.13	
3:15		0.03				0.08	
3:20		0.02				0.04	
3:25		0.01				0.02	
3:30		0.00				0.00	
3:35		0.00				0.00	
3:40		0.00					
3:45		0.00					
3:50		0.00					
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Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond E
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters User Input	COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft) $H_{weir\ front}$ =	4.50	4.50	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox) $L_{weir\ front}$ =	15.00	9.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate) $S_{weir\ sides}$ =	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox) Horizontal $L_{weir\ sides}$ =	15.00	9.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area) Grate Open Area =	70%	70%	%
F) Debris Clogging % Debris Clogging =	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox) $H_{grate\ top}$ =	4.50	4.50	ft
H) Overflow Grate Slope Length (inside edge of dropbox) Slope $L_{weir\ sides}$ =	15.00	9.00	ft
I) Overflow Grate Open Area (without debris) Open Area $_{(No\ Clogging)}$ =	157.50	56.70	sq ft
J) Overflow Grate Open Area (with debris) Open Area $_{(Clogged)}$ =	78.75	28.35	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters User Input	COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft) Pipe Invert Depth =	1.50	1.50	ft
C) Outlet Pipe Diameter Pipe Diameter =	60.00	54.00	inches
D) Restrictor Plate Height above Pipe Invert Plate Height =	43.00	50.00	inches
E) Half-Central Angle of Restrictor Plate on Pipe Theta =	2.02	2.59	radians
F) Outlet Orifice Area Outlet Ao =	15.06	15.37	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert $Outlet_{centroid}$ =	1.99	2.18	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4) Open Area Ratio =	10.46	3.69	

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters User Input	COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft) $H_{spillway\ invert}$ =	5.80	999.00	ft
B) Spillway Crest Length $L_{spillway\ crest}$ =	100.00	42.00	ft
C) Spillway End Slopes (H:V) $S_{spillway\ ends}$ =	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface Freeboard Depth=	1.00	1.00	ft
E) Spillway Design Flow Depth Flow $Depth_{spillway}$ =	0.70		ft
F) Stage at Top of Freeboard Freeboard Top Stage =	7.50		ft
G) Basin Area at Top of Freeboard Max Basin Area =	1.22		acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	0.81	1.70		3.01				12.89	
Predevelopment Peak Q (cfs) =	N/A	N/A		32.3				158.0	
Peak Inflow (cfs) =	N/A	N/A		46.6				176.9	
Peak Outflow (cfs) =	0.3	0.4		18.0				164.2	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.6				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.1				1.0	
Time to Drain 97% of Volume (hr) =	44	69		71				54	
Time to Drain 99% of Volume (hr) =	46	72		76				69	
Maximum Ponding Depth (ft) =	3.60	4.50		4.80				5.70	
Area at Max Ponding Depth (ac) =	0.88	0.96		0.98				1.06	
Maximum Volume Stored (ac-ft) =	0.81	1.70		1.99				2.91	

Results based on COS DCM Inputs

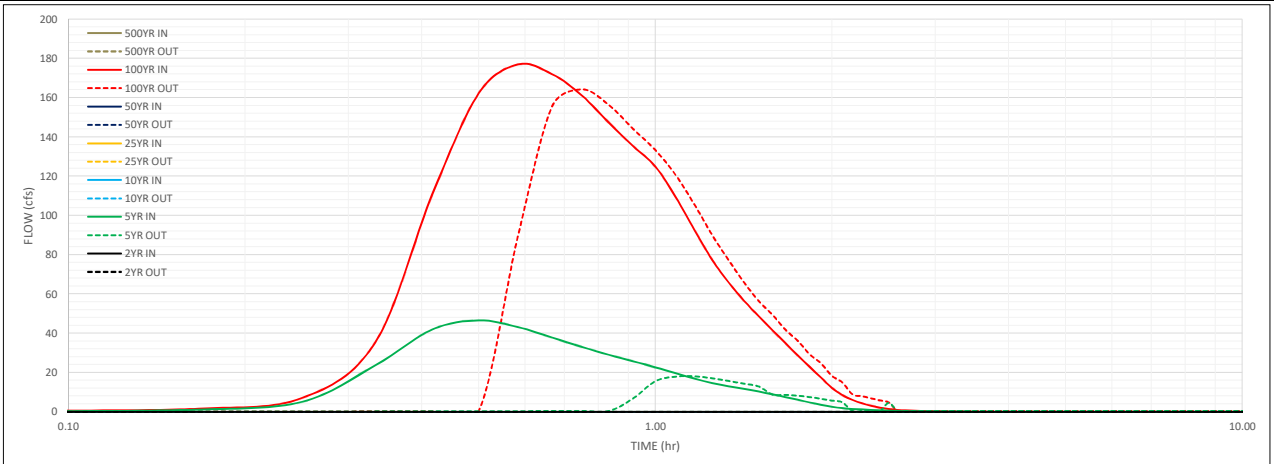
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	0.81	1.70		3.01				12.89	
Predevelopment Peak Q (cfs) =	N/A	N/A		32.3				158.0	
Peak Inflow (cfs) =	N/A	N/A		46.6				176.9	
Peak Outflow (cfs) =	0.3	0.4		16.3				153.2	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.5				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Overflow Grate	
Max Velocity through Grate =	N/A	N/A		0.3				2.8	
Time to Drain 97% of Volume (hr) =	44	69		71				54	
Time to Drain 99% of Volume (hr) =	46	72		76				69	
Maximum Ponding Depth (ft) =	3.60	4.50		4.90				6.10	
Area at Max Ponding Depth (ac) =	0.88	0.96		0.99				1.10	
Maximum Volume Stored (ac-ft) =	0.81	1.70		2.09				3.34	

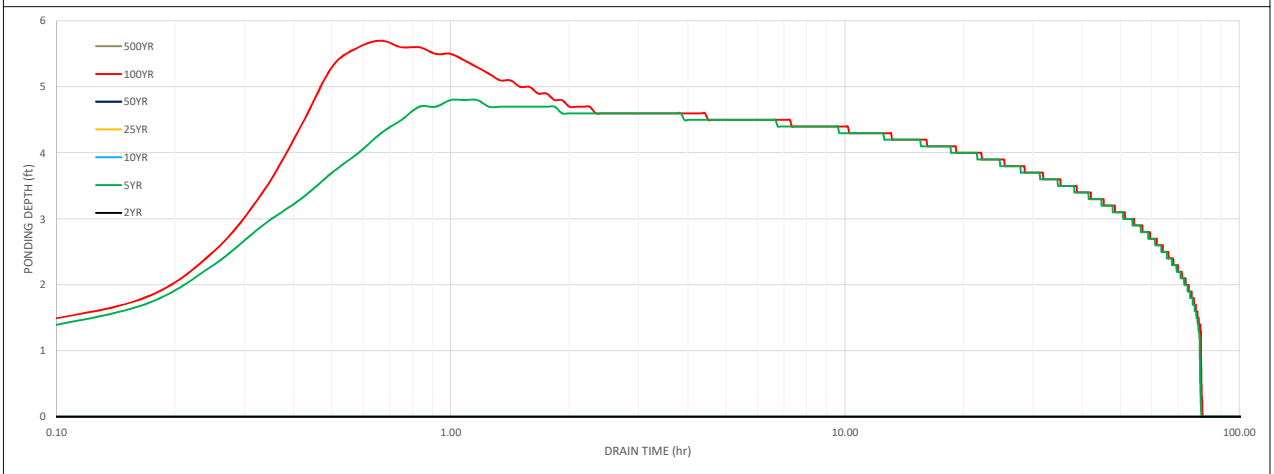
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

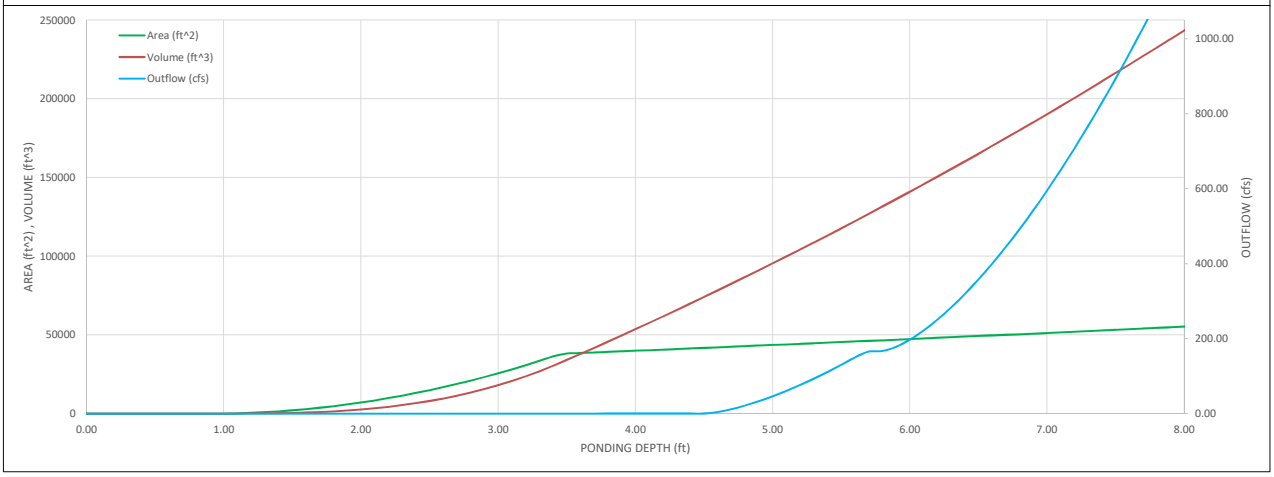
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond E
Date: April 6, 2020 — Last Edited: April 13, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond F
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters: User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	14	13	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	1.55	1.47	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	4.80	4.50	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	1.55	7.84	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	6.00	6.00	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters: User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	570.9	570.9	ft
B) Width of Basin at Top of EURV, W_{PCM} =	217.0	217.0	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	6.10	6.10	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	571.7	571.7	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	217.8	217.8	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	42.34				221.11	

B) Adjust "Time Interval" to match hydrograph data

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time Interval: 5.0 minutes

Post-Development Storm Inflow Hydrographs (cfs)

Time (min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		0.52				1.80	
0:10		5.98				8.99	
0:15		19.71				25.32	
0:20		58.79				77.64	
0:25		94.74				207.48	
0:30		103.82				301.83	
0:35		97.47				329.97	
0:40		87.23				323.46	
0:45		77.84				304.34	
0:50		69.34				281.05	
0:55		61.26				257.82	
1:00		54.52				237.51	
1:05		49.46				211.11	
1:10		45.22				185.26	
1:15		40.70				161.15	
1:20		36.24				139.03	
1:25		32.06				119.17	
1:30		28.34				101.90	
1:35		24.61				86.26	
1:40		21.24				72.79	
1:45		19.05				62.33	
1:50		17.44				54.79	
1:55		16.04				48.91	
2:00		13.99				42.35	
2:05		11.69				35.81	
2:10		9.57				29.96	
2:15		7.79				24.91	
2:20		6.28				20.57	
2:25		5.03				16.95	
2:30		4.03				13.95	
2:35		3.21				11.42	
2:40		2.52				9.20	
2:45		1.92				7.18	
2:50		1.38				5.32	
2:55		0.95				3.69	
3:00		0.65				2.49	
3:05		0.46				1.70	
3:10		0.33				1.17	
3:15		0.24				0.81	
3:20		0.18				0.56	
3:25		0.14				0.38	
3:30		0.11				0.26	
3:35		0.08				0.18	
3:40		0.06				0.13	
3:45		0.05				0.10	
3:50		0.03				0.07	
3:55		0.02				0.05	
4:00		0.02				0.04	
4:05		0.01				0.03	
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Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond F
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters User Input	COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft)	$H_{weir\ front}$ =	6.00	6.00	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox)	$L_{weir\ front}$ =	13.00	10.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate)	$S_{weir\ sides}$ =	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox)	Horizontal $L_{weir\ sides}$ =	13.00	10.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area)	Grate Open Area =	70%	70%	%
F) Debris Clogging %	Debris Clogging =	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox)	$H_{grate\ top}$ =	6.00	6.00	ft
H) Overflow Grate Slope Length (inside edge of dropbox)	Slope $L_{weir\ sides}$ =	13.00	10.00	ft
I) Overflow Grate Open Area (without debris)	Open Area $_{(No\ Clogging)}$ =	118.30	70.00	sq ft
J) Overflow Grate Open Area (with debris)	Open Area $_{(Clogged)}$ =	59.15	35.00	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters User Input	COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft)	Pipe Invert Depth =	1.50	1.50	ft
C) Outlet Pipe Diameter	Pipe Diameter =	66.00	60.00	inches
D) Restrictor Plate Height above Pipe Invert	Plate Height =	46.05	54.00	inches
E) Half-Central Angle of Restrictor Plate on Pipe	Theta =	1.98	2.50	radians
F) Outlet Orifice Area	Outlet Ao =	17.70	18.61	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert	$Outlet_{centroid}$ =	2.14	2.38	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4)	Open Area Ratio =	6.68	3.76	

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters User Input	COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft)	$H_{spillway\ invert}$ =	7.60	999.00	ft
B) Spillway Crest Length	$L_{spillway\ crest}$ =	126.00	42.00	ft
C) Spillway End Slopes (H:V)	$S_{spillway\ ends}$ =	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface	Freeboard Depth=	1.00	1.00	ft
E) Spillway Design Flow Depth	Flow $Depth_{spillway}$ =	0.90		ft
F) Stage at Top of Freeboard	Freeboard Top Stage =	9.50		ft
G) Basin Area at Top of Freeboard	Max Basin Area =	3.37		acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	2.62	5.94		7.80				26.37	
Predevelopment Peak Q (cfs) =	N/A	N/A		42.3				221.1	
Peak Inflow (cfs) =	N/A	N/A		103.8				330.0	
Peak Outflow (cfs) =	1.1	1.5		15.1				227.3	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.4				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.2				1.9	
Time to Drain 97% of Volume (hr) =	42	68		72				61	
Time to Drain 99% of Volume (hr) =	45	72		77				72	
Maximum Ponding Depth (ft) =	4.80	6.00		6.30				7.60	
Area at Max Ponding Depth (ac) =	2.12	2.84		2.89				3.08	
Maximum Volume Stored (ac-ft) =	2.62	5.94		6.82				10.70	

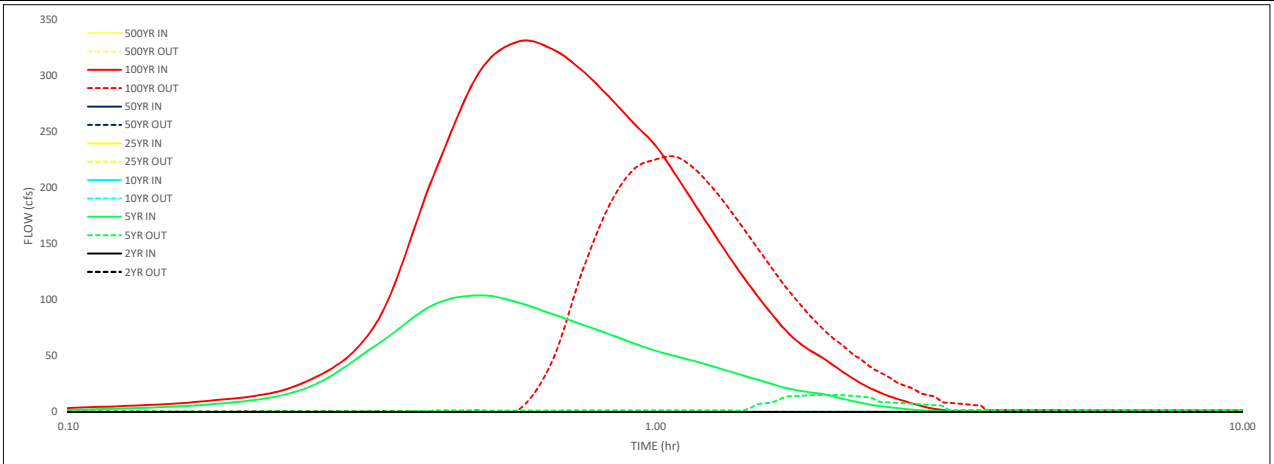
Results based on COS DCM Inputs

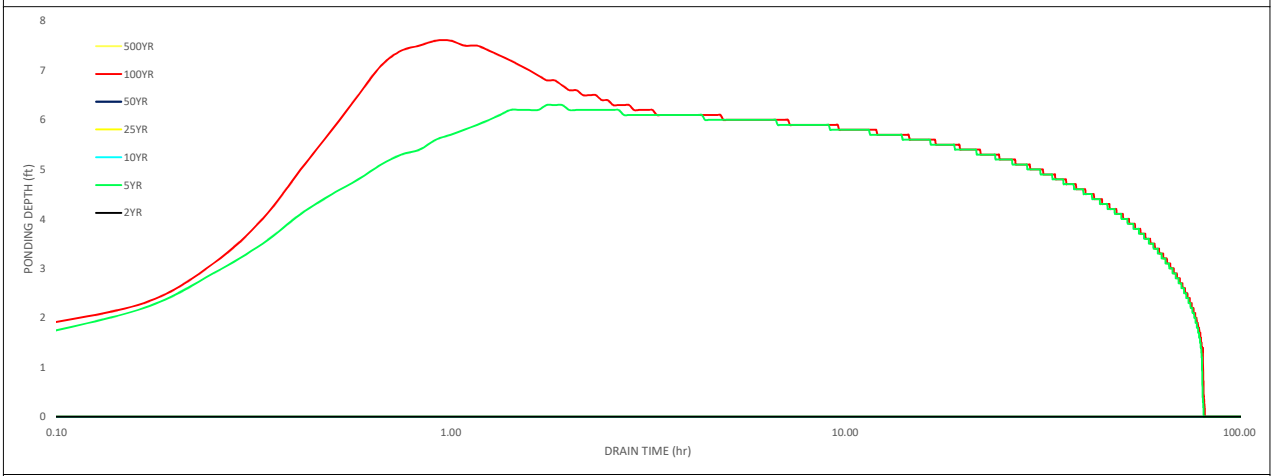
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	2.21	5.94		7.80				26.37	
Predevelopment Peak Q (cfs) =	N/A	N/A		42.3				221.1	
Peak Inflow (cfs) =	N/A	N/A		103.8				330.0	
Peak Outflow (cfs) =	1.1	1.4		13.2				214.5	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.3				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Overflow Grate	
Max Velocity through Grate =	N/A	N/A		0.2				3.0	
Time to Drain 97% of Volume (hr) =	36	69		74				63	
Time to Drain 99% of Volume (hr) =	38	73		78				73	
Maximum Ponding Depth (ft) =	4.50	6.00		6.30				7.80	
Area at Max Ponding Depth (ac) =	1.81	2.84		2.89				3.11	
Maximum Volume Stored (ac-ft) =	2.21	5.94		6.82				11.32	

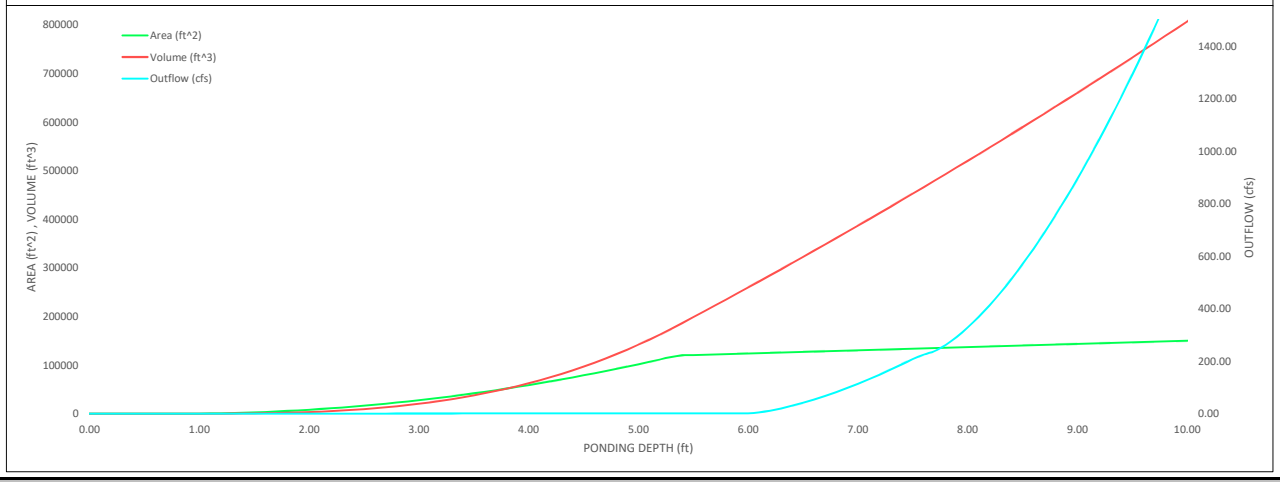
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond F
Date: April 6, 2020 — Last Edited: April 13, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond G
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters		
	User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	9	9	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	0.49	0.49	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	3.20	3.20	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	1.94	1.94	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	4.00	4.00	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters		
	User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	349.7	349.7	ft
B) Width of Basin at Top of EURV, W_{PCM} =	105.4	105.4	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	4.10	4.10	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	350.5	350.5	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	106.2	106.2	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	9.42				48.48	

B) Adjust "Time Interval" to match hydrograph data

Time Interval: 5.0 minutes

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time	Post-Development Storm Inflow Hydrographs (cfs)						
(min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		0.18				0.49	
0:10		1.27				1.75	
0:15		3.86				5.05	
0:20		12.69				17.55	
0:25		19.21				47.38	
0:30		20.06				63.86	
0:35		18.72				67.51	
0:40		16.88				66.01	
0:45		15.24				62.38	
0:50		13.74				57.86	
0:55		12.37				53.71	
1:00		11.12				49.93	
1:05		10.01				44.10	
1:10		9.05				38.52	
1:15		8.20				33.58	
1:20		7.42				29.30	
1:25		6.67				25.48	
1:30		5.98				22.03	
1:35		5.28				18.97	
1:40		4.64				16.31	
1:45		4.05				13.93	
1:50		3.52				11.83	
1:55		3.12				10.10	
2:00		2.67				8.48	
2:05		2.26				7.10	
2:10		1.90				5.93	
2:15		1.58				4.93	
2:20		1.30				4.04	
2:25		1.05				3.25	
2:30		0.82				2.54	
2:35		0.62				1.90	
2:40		0.46				1.36	
2:45		0.35				0.99	
2:50		0.28				0.73	
2:55		0.22				0.54	
3:00		0.17				0.39	
3:05		0.13				0.28	
3:10		0.10				0.19	
3:15		0.07				0.13	
3:20		0.05				0.09	
3:25		0.04				0.07	
3:30		0.03				0.06	
3:35		0.02				0.04	
3:40		0.02				0.03	
3:45		0.01				0.03	
3:50		0.01				0.02	
3:55		0.01				0.01	
4:00		0.00				0.01	
4:05						0.00	
4:10							
4:15							
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Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond G
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters User Input	COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft) $H_{weir\ front}$ =	4.00	4.00	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox) $L_{weir\ front}$ =	26.00	26.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate) $S_{weir\ sides}$ =	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox) Horizontal $L_{weir\ sides}$ =	26.00	26.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area) Grate Open Area =	70%	70%	%
F) Debris Clogging % Debris Clogging =	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox) $H_{grate\ top}$ =	4.00	4.00	ft
H) Overflow Grate Slope Length (inside edge of dropbox) Slope $L_{weir\ sides}$ =	26.00	26.00	ft
I) Overflow Grate Open Area (without debris) Open Area $_{(No\ Clogging)}$ =	473.20	473.20	sq ft
J) Overflow Grate Open Area (with debris) Open Area $_{(Clogged)}$ =	236.60	236.60	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters User Input	COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft) Pipe Invert Depth =	1.50	1.50	ft
C) Outlet Pipe Diameter Pipe Diameter =	30.00	27.00	inches
D) Restrictor Plate Height above Pipe Invert Plate Height =	22.22	26.24	inches
E) Half-Central Angle of Restrictor Plate on Pipe Theta =	2.07	2.80	radians
F) Outlet Orifice Area Outlet Ao =	3.90	3.94	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert $Outlet_{centroid}$ =	1.03	1.12	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4) Open Area Ratio =	121.39	119.97	

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters User Input	COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft) $H_{spillway\ invert}$ =	5.40	4.90	ft
B) Spillway Crest Length $L_{spillway\ crest}$ =	136.00	23.00	ft
C) Spillway End Slopes (H:V) $S_{spillway\ ends}$ =	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface Freeboard Depth=	1.00	1.00	ft
E) Spillway Design Flow Depth Flow $Depth_{spillway}$ =	0.30	0.90	ft
F) Stage at Top of Freeboard Freeboard Top Stage =	6.70	6.80	ft
G) Basin Area at Top of Freeboard Max Basin Area =	1.08	1.09	acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	0.47	1.15		1.57				5.51	
Predevelopment Peak Q (cfs) =	N/A	N/A		9.4				48.5	
Peak Inflow (cfs) =	N/A	N/A		20.1				67.5	
Peak Outflow (cfs) =	0.2	0.3		9.4				47.1	
Ratio (Outflow/Predevelopment) =	N/A	N/A		1.0				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.0				0.1	
Time to Drain 97% of Volume (hr) =	41	69		73				63	
Time to Drain 99% of Volume (hr) =	43	72		78				74	
Maximum Ponding Depth (ft) =	3.20	4.00		4.10				4.80	
Area at Max Ponding Depth (ac) =	0.67	0.85		0.85				0.91	
Maximum Volume Stored (ac-ft) =	0.47	1.15		1.24				1.85	

Results based on COS DCM Inputs

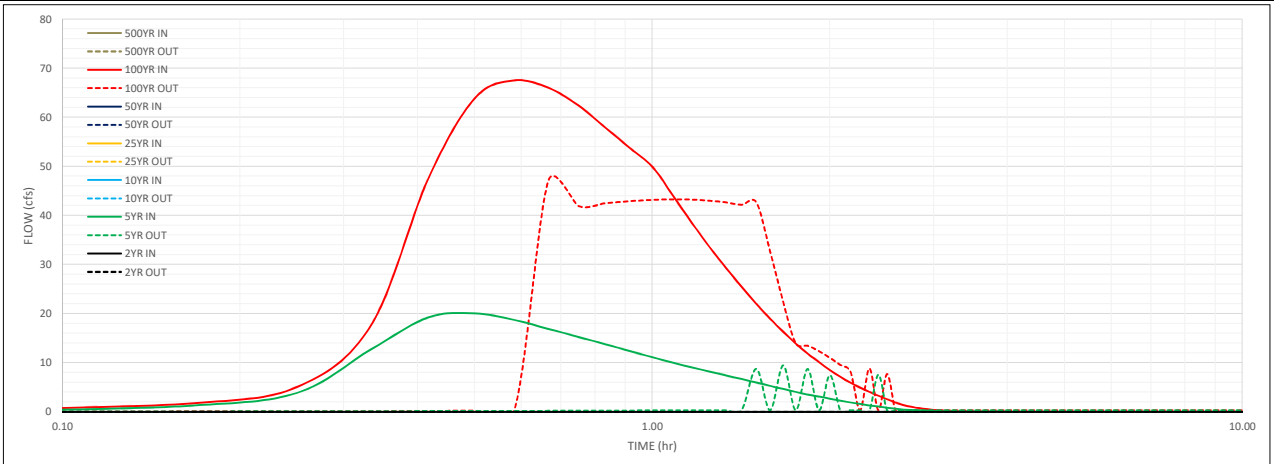
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	0.47	1.15		1.57				5.51	
Predevelopment Peak Q (cfs) =	N/A	N/A		9.4				48.5	
Peak Inflow (cfs) =	N/A	N/A		20.1				67.5	
Peak Outflow (cfs) =	0.2	0.3		9.4				47.1	
Ratio (Outflow/Predevelopment) =	N/A	N/A		1.0				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.0				0.1	
Time to Drain 97% of Volume (hr) =	41	69		73				63	
Time to Drain 99% of Volume (hr) =	43	72		78				74	
Maximum Ponding Depth (ft) =	3.20	4.00		4.10				4.80	
Area at Max Ponding Depth (ac) =	0.67	0.85		0.85				0.91	
Maximum Volume Stored (ac-ft) =	0.47	1.15		1.24				1.85	

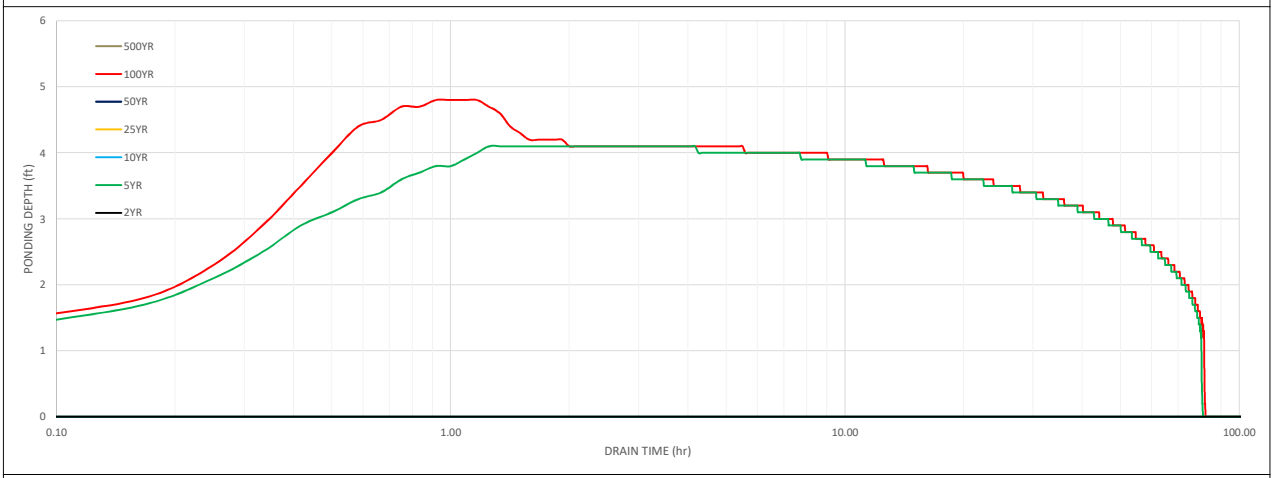
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

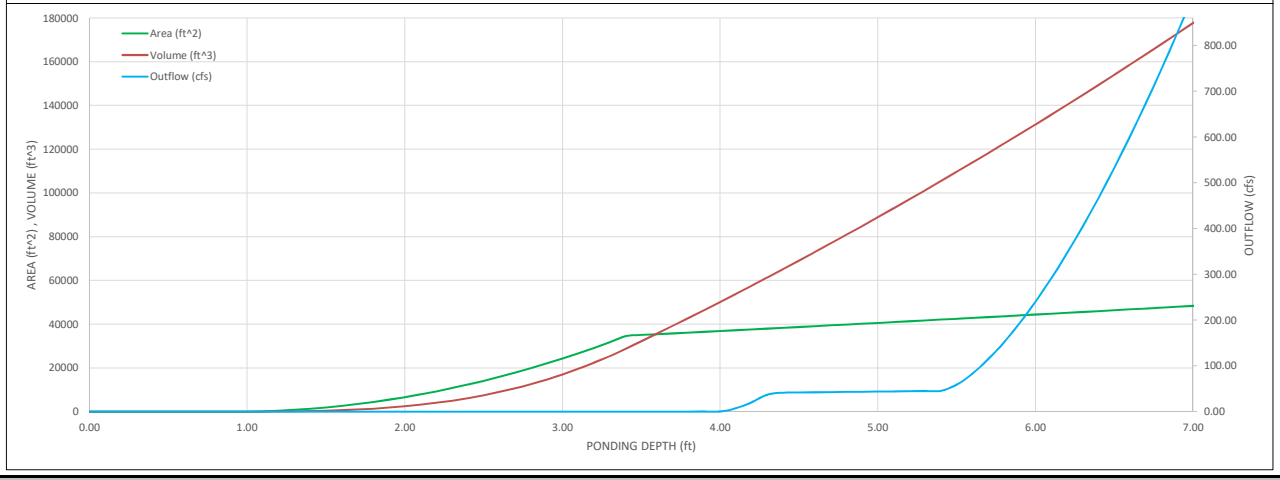
Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond G
Date: April 6, 2020 — Last Edited: April 13, 2020







Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — **Sheet 1 of 3**

Designer: Chris McFarland
Project: Grandview Reserve Pond G
Date: April 6, 2020 — Last Edited: April 13, 2020

1. Select WQCV/EURV PCM Type:
   Imports the Stage-Area-Volume-Discharge information from the corresponding PCM worksheet. The selected PCM worksheet must be completed before the import will work.

Extended Detention Basin (EDB)

2. WQCV/EURV Outlet Details

	Input Parameters: User Input	COS DCM	
A) Average Infiltration Rate of WQCV, i =	N/A	N/A	in / hr
B) Depth to Centroid of Underdrain Outlet Orifice from filter media surface, y =	N/A	N/A	inches
C) Underdrain Outlet Orifice Area, Underdrain Ao =	N/A	N/A	sq in
D) Number of WQCV Orifice Rows, # WQCV rows =	11	11	
E) Vertical Spacing between WQCV Orifice Rows, Orifice Spacing =	4.0	4.0	inches
F) WQCV Orifice Area (A_o) per Row, WQCV Ao =	0.86	0.86	sq in
G) Maximum Stage of WQCV (includes ISD and Trickle Channel Depth), Max Stage $_{WQCV}$ =	3.80	3.80	ft
H) EURV Orifice Area (A_o) in Single Row, EURV Ao =	4.73	4.73	sq in
I) Maximum Stage of EURV (includes ISD and Trickle Channel Depth), Max Stage $_{EURV}$ =	5.00	5.00	ft
J) Discharge Coefficient for all WQCV/EURV Outlet Orifice(s), Cd =	0.60	0.60	

3. Flood Control Surcharge Basin Geometry (above EURV) - See Figure
   Default Flood Surcharge Geometry inputs represent a continuation of the PCM Geometry in an upward direction without a transition bench.

	Input Parameters: User Input	COS DCM	
A) Length of Basin at Top of EURV, L_{PCM} =	468.4	468.4	ft
B) Width of Basin at Top of EURV, W_{PCM} =	141.1	141.1	ft
C) Stage at Top of Transition Bench (Bottom of Flood Control Surcharge), Stage at Top of Bench =	5.10	5.10	ft
D) Length of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), L_{Bench} =	469.2	469.2	ft
E) Width of Basin at Top of Transition Bench (Bottom of Flood Control Surcharge), W_{Bench} =	141.9	141.9	ft
F) Average Side Slopes of Flood Control Surcharge above Transition Bench (Recommend no steeper than 3H:1V slope. Use zero for vertical walls.), $Z_{Surcharge}$ =	4.00	4.00	ft / ft

User can override default flood surcharge geometry inputs to create a transition bench between the top of the PCM and the Flood Surcharge Volume by entering larger dimensions in C), D), and E).
See the Figure to the right.

Bench Slope is 4H:1V in length direction
Bench Slope is 4H:1V in width direction

4. Tributary Watershed Hydrology

A) Input hydrology data (copy/paste) from model runs

Pre-Development Peak Flow (cfs)						
2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
	17.11				99.16	

B) Adjust "Time Interval" to match hydrograph data

Time Interval: 5.0 minutes

5-yr and 100-yr Hydrology Required (Other Storms are Optional)

Time	Post-Development Storm Inflow Hydrographs (cfs)						
(min)	2 Year	**5 Year**	10 Year	25 Year	50 Year	**100 Year**	500 Year
0:00		0.00				0.00	
0:05		0.41				1.20	
0:10		3.42				4.91	
0:15		10.22				13.16	
0:20		29.97				40.46	
0:25		45.35				109.08	
0:30		46.22				147.68	
0:35		41.85				152.97	
0:40		36.79				145.92	
0:45		32.51				134.77	
0:50		28.57				122.07	
0:55		24.90				110.10	
1:00		21.86				99.42	
1:05		19.69				85.33	
1:10		17.78				73.97	
1:15		15.86				63.12	
1:20		14.00				53.39	
1:25		12.24				44.73	
1:30		10.61				36.81	
1:35		9.00				29.80	
1:40		7.68				24.16	
1:45		6.80				19.99	
1:50		6.25				17.20	
1:55		5.79				15.20	
2:00		4.96				12.77	
2:05		4.07				10.46	
2:10		3.32				8.57	
2:15		2.70				7.04	
2:20		2.18				5.80	
2:25		1.75				4.76	
2:30		1.37				3.85	
2:35		1.07				3.04	
2:40		0.81				2.31	
2:45		0.60				1.65	
2:50		0.43				1.12	
2:55		0.31				0.76	
3:00		0.23				0.51	
3:05		0.17				0.34	
3:10		0.12				0.23	
3:15		0.09				0.16	
3:20		0.07				0.12	
3:25		0.06				0.09	
3:30		0.05				0.07	
3:35		0.04				0.06	
3:40		0.03				0.05	
3:45		0.03				0.04	
3:50		0.02				0.03	
3:55		0.01				0.02	
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Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

5:40							
5:45							
5:50							
5:55							
6:00							

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 2 of 3

Designer: Chris McFarland
Project: Grandview Reserve Pond G
Date: April 6, 2020 — Last Edited: April 13, 2020

5. Flood Control Outlet Structure Type

A) Select Flood Control Outlet Structure Type: Overflow Weir/Grate, Outlet Pipe Restriction & Emergency Spillway

6. Overflow Weir (Dropbox) and Grate (Flat or Sloped)
(Assumes that top of grate is flush with the top of the concrete dropbox)

	Input Parameters User Input	COS DCM	
A) Overflow Weir Front Edge Height (relative to Stage = 0 ft) $H_{weir\ front}$ =	5.00	5.00	ft
B) Overflow Weir Front Edge Length (inside edge of dropbox) $L_{weir\ front}$ =	9.00	7.00	ft
C) Overflow Weir Grate Slope (H:V, enter zero for flat grate) $S_{weir\ sides}$ =	0.00	0.00	ft / ft
D) Horizontal Length of Weir Sides (inside edge of dropbox) Horizontal $L_{weir\ sides}$ =	9.00	7.00	ft
E) Overflow Grate Open Area % (grate open area / total grate area) Grate Open Area =	70%	70%	%
F) Debris Clogging % Debris Clogging =	50%	50%	%
G) Height of Grate Upper Edge (at back side of dropbox) $H_{grate\ top}$ =	5.00	5.00	ft
H) Overflow Grate Slope Length (inside edge of dropbox) Slope $L_{weir\ sides}$ =	9.00	7.00	ft
I) Overflow Grate Open Area (without debris) Open Area $_{(No\ Clogging)}$ =	56.70	34.30	sq ft
J) Overflow Grate Open Area (with debris) Open Area $_{(Clogged)}$ =	28.35	17.15	sq ft

7. Outlet Pipe with Flow Restriction Plate

A) Select Type of Outlet Restriction
(Circular Pipe w/ Restrictor Plate, Circular Orifice or Rectangular Orifice): Circular Outlet Pipe w/ Restrictor Plate

	Input Parameters User Input	COS DCM	
B) Depth to Invert of Outlet Pipe (relative to Stage = 0 ft) Pipe Invert Depth =	1.50	1.50	ft
C) Outlet Pipe Diameter Pipe Diameter =	42.00	42.00	inches
D) Restrictor Plate Height above Pipe Invert Plate Height =	34.00	34.00	inches
E) Half-Central Angle of Restrictor Plate on Pipe Theta =	2.24	2.24	radians
F) Outlet Orifice Area Outlet Ao =	8.34	8.34	sq ft
G) Height of Outlet Orifice Centroid above Outlet Pipe Invert $Outlet_{centroid}$ =	1.54	1.54	ft
H) Ratio of Grate Open Area / 100-yr Orifice Area (should be ≥ 4) Open Area Ratio =	6.80	4.11	

8. Emergency Spillway (Rectangular or Trapezoidal)

	Input Parameters User Input	COS DCM	
A) Spillway Invert Stage (relative to Stage = 0 ft) $H_{spillway\ invert}$ =	6.70	999.00	ft
B) Spillway Crest Length $L_{spillway\ crest}$ =	136.00	27.00	ft
C) Spillway End Slopes (H:V) $S_{spillway\ ends}$ =	4.00	4.00	ft / ft
D) Freeboard above Maximum Water Surface Freeboard Depth=	1.00	1.00	ft
E) Spillway Design Flow Depth Flow $Depth_{spillway}$ =	0.50		ft
F) Stage at Top of Freeboard Freeboard Top Stage =	8.20		ft
G) Basin Area at Top of Freeboard Max Basin Area =	1.89		acres

9. Routed Hydrograph Results

Results based on User Input

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	1.03	2.73		3.25				11.08	
Predevelopment Peak Q (cfs) =	N/A	N/A		17.1				99.2	
Peak Inflow (cfs) =	N/A	N/A		46.2				153.0	
Peak Outflow (cfs) =	0.4	0.7		4.2				101.9	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.2				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Outlet Pipe	
Max Velocity through Grate =	N/A	N/A		0.0				1.7	
Time to Drain 97% of Volume (hr) =	39	68		73				62	
Time to Drain 99% of Volume (hr) =	41	72		77				72	
Maximum Ponding Depth (ft) =	3.80	5.00		5.10				6.20	
Area at Max Ponding Depth (ac) =	1.09	1.52		1.53				1.65	
Maximum Volume Stored (ac-ft) =	1.03	2.73		2.90				4.65	

Results based on COS DCM Inputs

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Inflow Hydrograph Volume (ac-ft) =	1.03	2.73		3.25				11.08	
Predevelopment Peak Q (cfs) =	N/A	N/A		17.1				99.2	
Peak Inflow (cfs) =	N/A	N/A		46.2				153.0	
Peak Outflow (cfs) =	0.4	0.7		3.6				98.1	
Ratio (Outflow/Predevelopment) =	N/A	N/A		0.2				1.0	
Structure Controlling Flow =	Orifice Plate	Orifice Plate		Overflow Grate				Overflow Grate	
Max Velocity through Grate =	N/A	N/A		0.2				2.8	
Time to Drain 97% of Volume (hr) =	39	68		73				62	
Time to Drain 99% of Volume (hr) =	41	72		77				73	
Maximum Ponding Depth (ft) =	3.80	5.00		5.20				6.40	
Area at Max Ponding Depth (ac) =	1.09	1.52		1.54				1.68	
Maximum Volume Stored (ac-ft) =	1.03	2.73		3.05				4.98	

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

COS PCM-FSD Preliminary Design (Beta Version 1.00, September 2019) — Sheet 3 of 3

Designer: Chris McFarland
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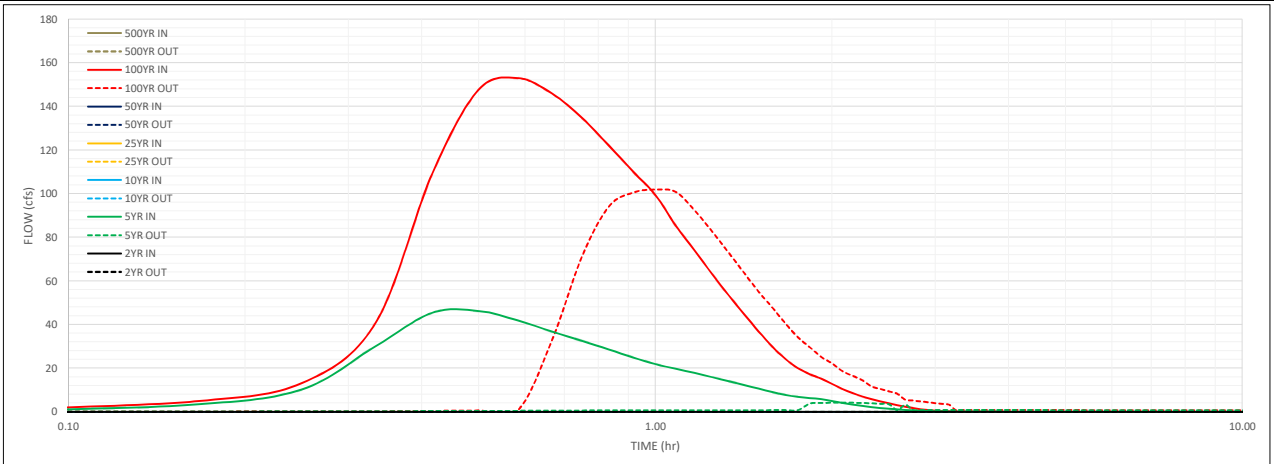
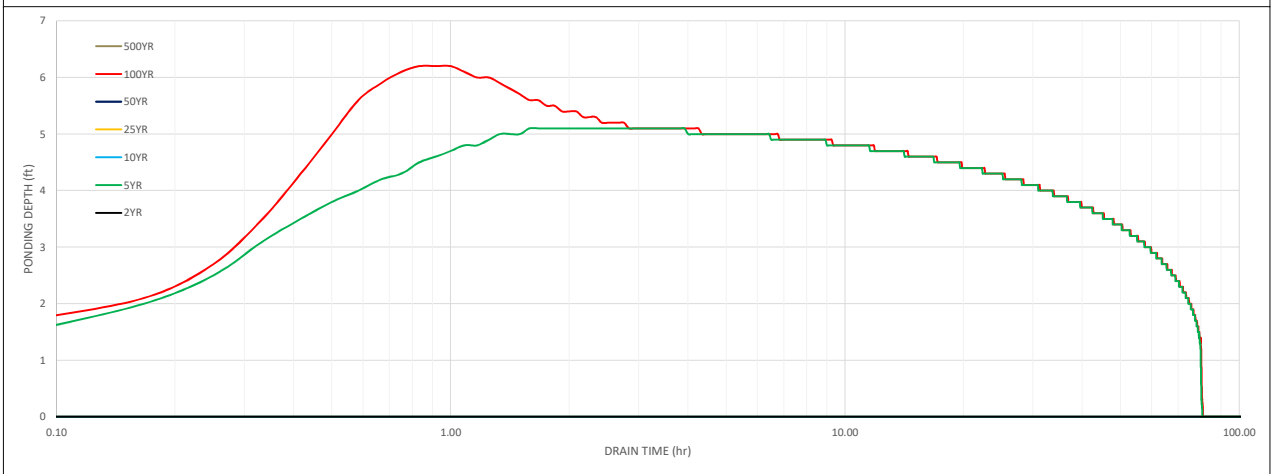
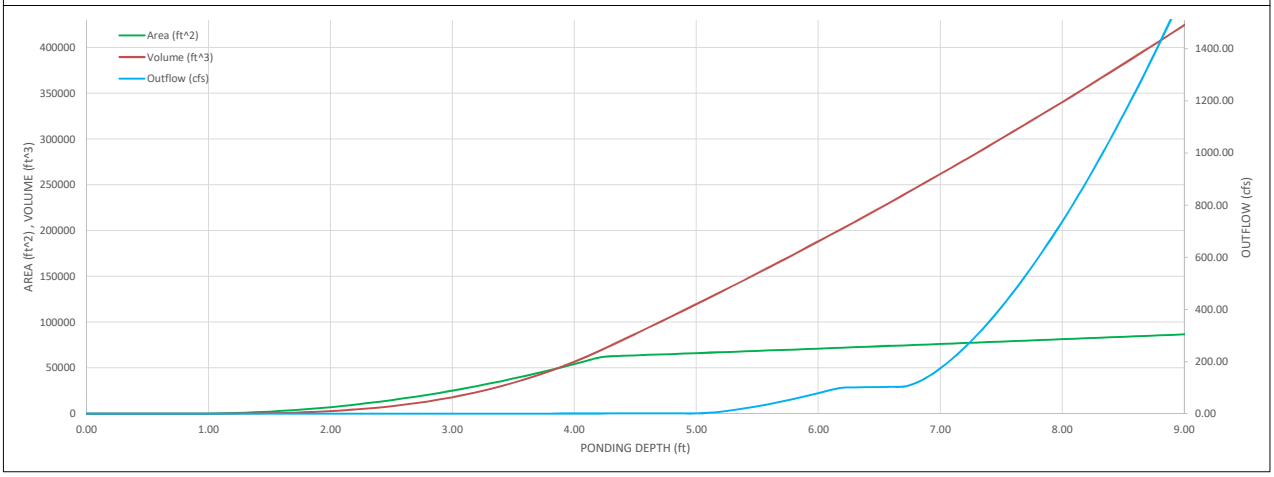
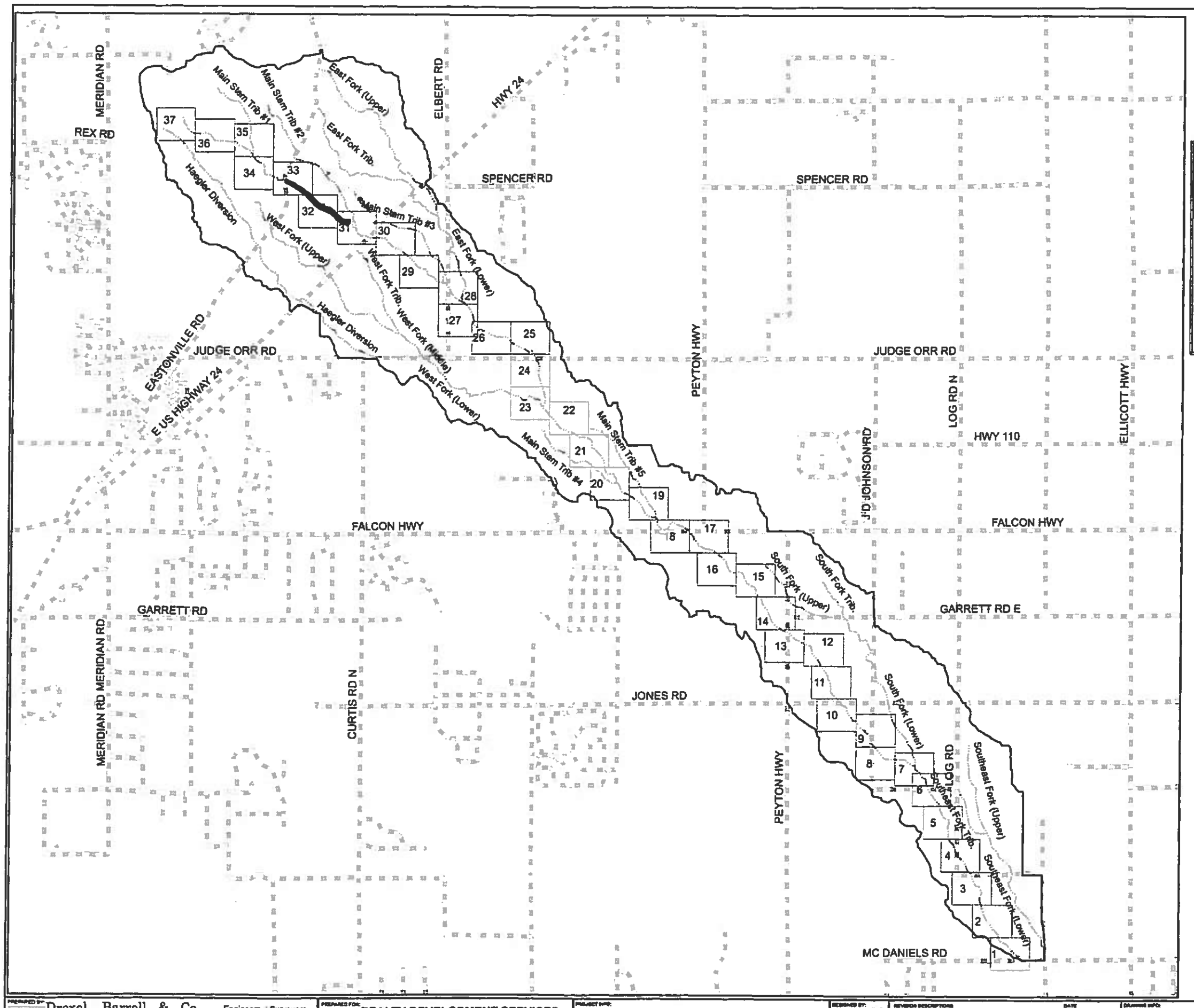






Preliminary Design Procedure Form: Full Spectrum Detention (FSD) Routing

Appendix E



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Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

Drexel, Barrell & Co. Engineers Surveyors
1800 38TH STREET
2 S 7TH STREET
6513 W 4TH STREET
CONTACT: ROBERT BENNETT
BOULDER, COLORADO 80301 (303) 442-4338
COLORADO SPRINGS, COLORADO 80905 (719) 268-0887
GREELEY, COLORADO 80634 (970) 381-8645

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1622

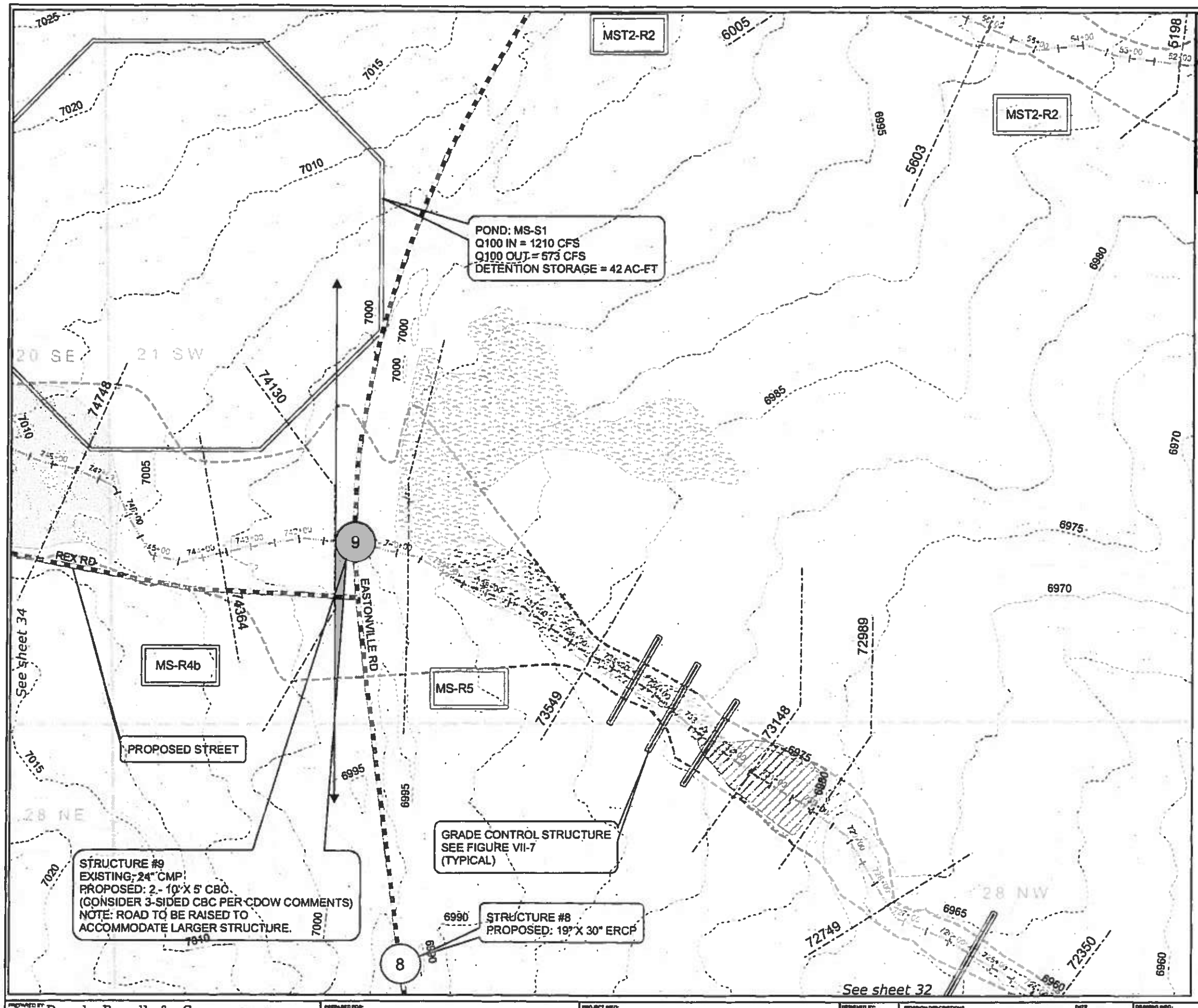
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: SLF
CHECKED BY: RJB

REVISION DESCRIPTIONS | DATE

DRAWING INFO: GIECK RANCH
KEY MAP
MAIN STEM

DATE: AUGUST 2007
SCALE: H: 1" = 6000' V:
JOB NO: C7706-1
DRAWING NO: 6D 038
SET: PL
SHEET: K1



Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

0 100 200 Feet

Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

Reach	Slope (%)	Q_{100} (cfs)	V_{100} (ft/s)
MS-R4b	1.76	1094	4.24
MS-R5	1.88	573	5.00

RECOMMENDED PLAN IMPROVEMENTS

Reach	
MS-R4b	Channelization
MS-R5	Vegetation Augmentation

Note:
See Technical Addenda for grade control data.

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Drexel, Barrell & Co. Engineers Surveyors
1800 28TH STREET, BOULDER, COLORADO 80301 (303) 443-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
6313 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-0845
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

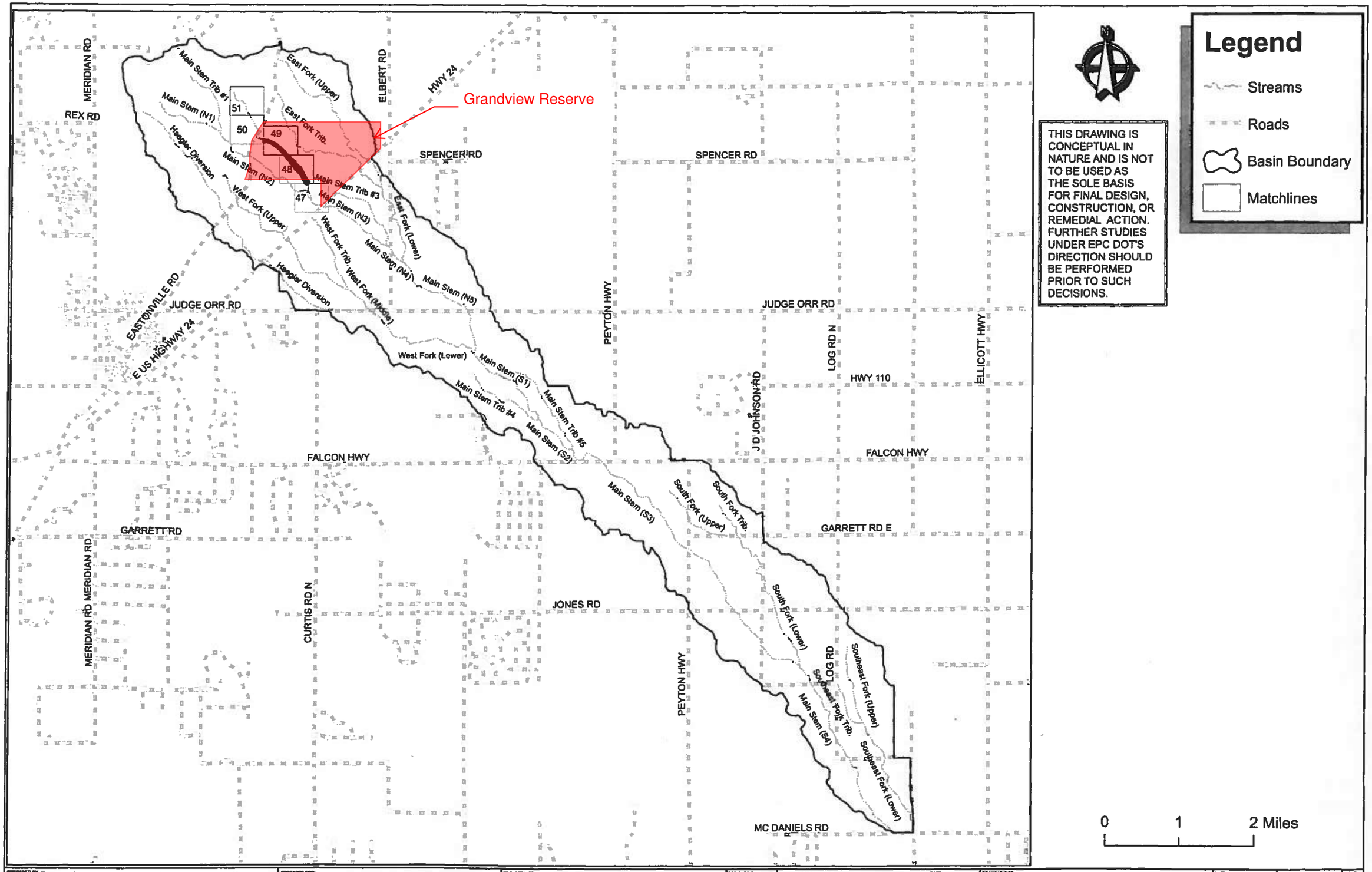
PROJECT INFO:
GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/NLM
CHECKED BY: RJB/TML

REVISION DESCRIPTIONS	DATE
PER EPC/DOT COMMENTS	FEBRUARY 2008
PER EPC FINAL REVIEW	JANUARY 2010

DRAWING INFO:
GIECK RANCH DBPS
PLAN VIEW
MAIN STEM #33

DATE: AUGUST 2007
JOB NO: C7706-2
SET: PL
SCALE: H: 1" = 200' V: NONE
DRAWING NO: 6D 038
SHEET: 33



PREPARED BY: Drexel, Barrell & Co. Engineers | Surveyors
1560 30TH STREET
3 S 7TH STREET
6513 W 4TH STREET
CONTACT: ROBERT BENNETT
SOULDER, COLORADO 80301 (303) 442-4338
COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
GREELEY, COLORADO 80634 (970) 351-9646

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

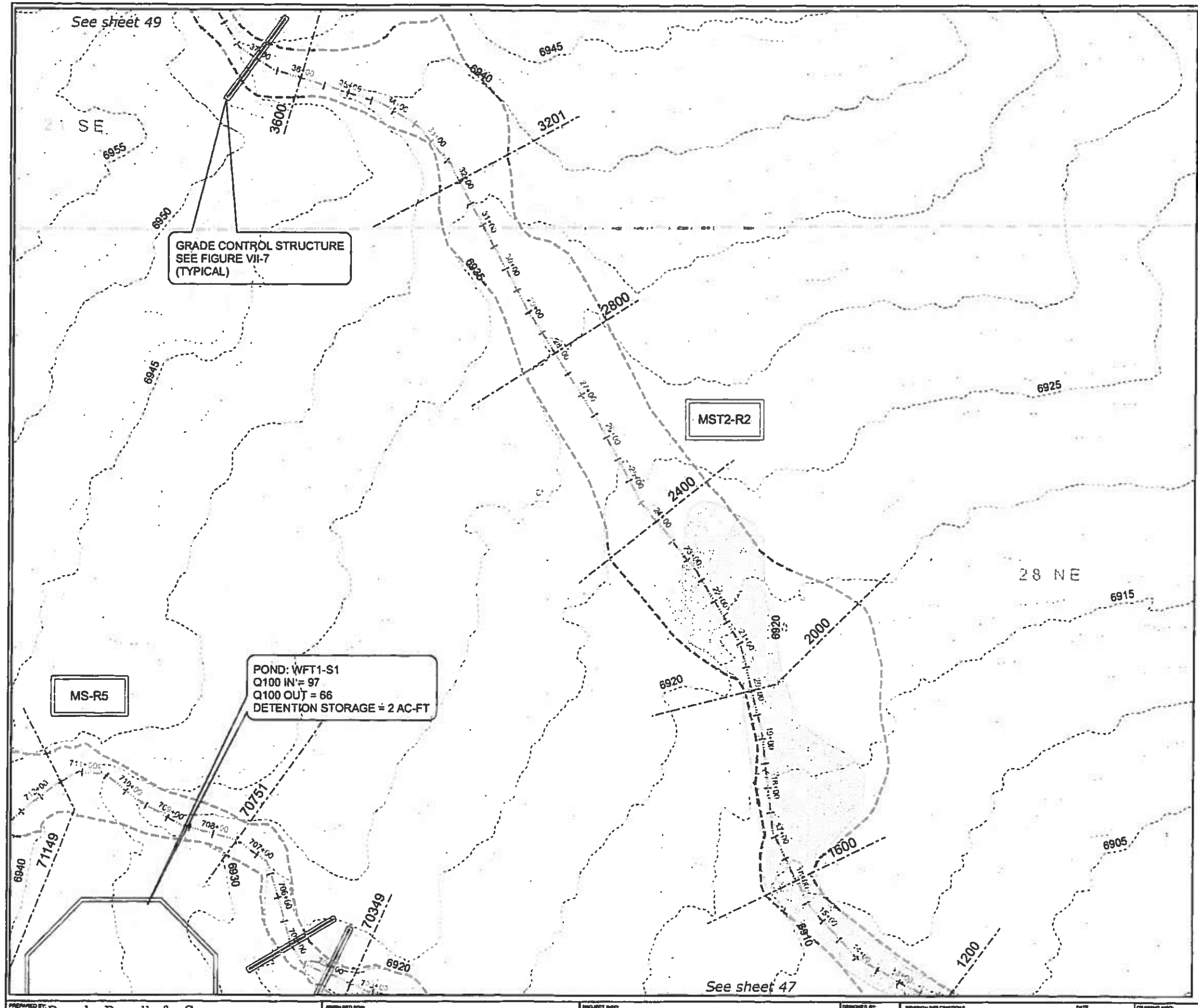
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF
CHECKED BY: RJB

REVISION DESCRIPTIONS | DATE

DRAWING INFO: GIECK RANCH
KEY MAP
MAIN STEM TRIBUTARY #2

DATE: AUGUST 2007
JOB NO: C7706-1
SET: PL
SCALE: H 1" = 6000' V
DRAWING NO.: 6D 038
SHEET: K5



Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

0 100 200 Feet

Reach	Slope (%)	Q_{100} (cfs)	V_{100} (ft/s)
MST2-R2	1.93	271	3.16

RECOMMENDED PLAN IMPROVEMENTS

Reach	
MST2-R2	Vegetation Augmentation

Note:
See Technical Addenda for grade control data.

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PREPARED BY: Drexel, Barrell & Co. Engineers · Surveyors
1609 35TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
5313 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-9648
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 308
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

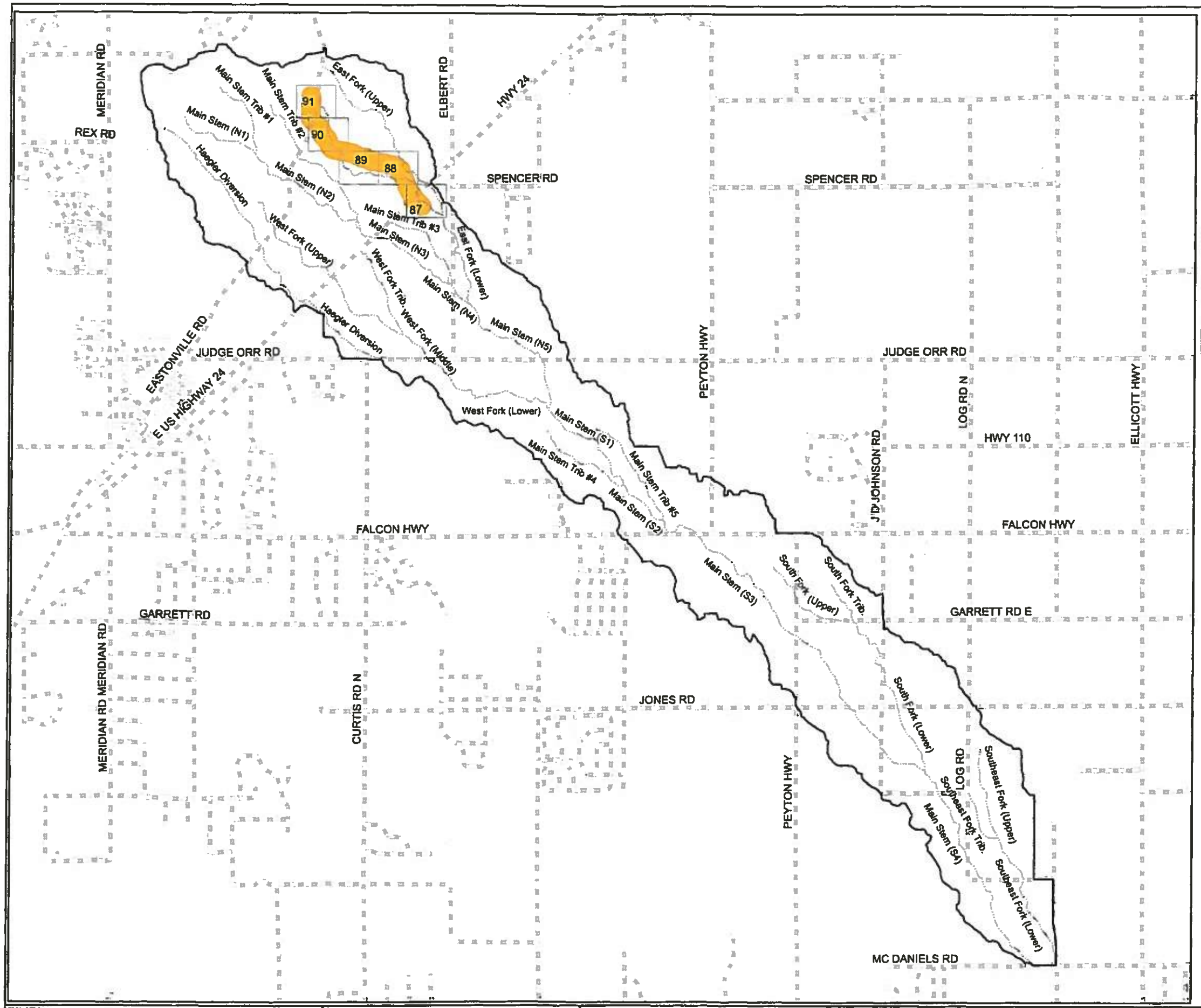
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

REVISION DESCRIPTIONS	DATE
PER EPCDOT COMMENTS	FEBRUARY 2008
PER EPC FINAL REVIEW	JANUARY 2010

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
MAIN STEM TRIBUTARY-2 #2

DATE: AUGUST 2007
JOB NO: C7706-2
SET: PL
SCALE: 1" = 200' / NONE
DRAWING NO: 6D 038
SHEET: 48



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Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

PREPARED BY: Drexel, Barrell & Co. Engineers Surveyors
1638 38TH STREET
3 S 7TH STREET
5313 W 4TH STREET
CONTACT: ROBERT BENNETT
BOULDER, COLORADO 80301 (303) 443-4335
COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
GREELEY, COLORADO 80634 (970) 351-6845

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1922

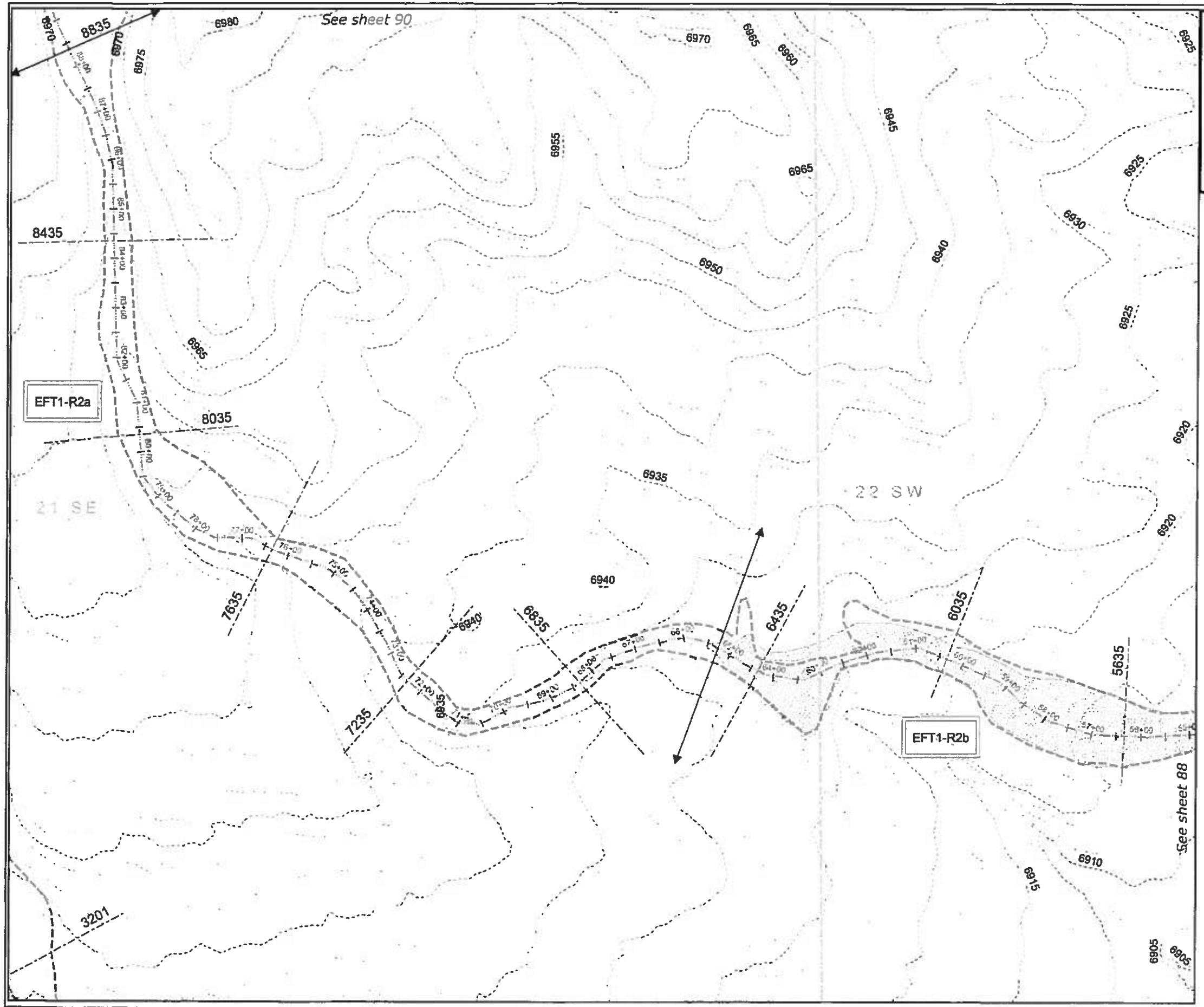
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF
CHECKED BY: RJB

REVISION DESCRIPTIONS — DATE

DRAWING INFO: GIECK RANCH
KEY MAP
EAST FORK TRIBUTARY

DATE: AUGUST 2007
JOB NO: C7706-1
SCALE: H: 1" = 6000' V:
DRAWING NO.: 6D 038
SHEET: K11



Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

0 100 200 Feet

Reach	Slope (%)	Q_{100} (cfs)	V_{100} (ft/s)
EFT1-R2a	1.83	217	3.73
EFT1-R2b	1.60	217	2.68

RECOMMENDED PLAN IMPROVEMENTS

Reach	
EFT1-R2a	As-needed Improvements
EFT1-R2b	As-needed Improvements

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PREPARED BY: Drexel, Barrell & Co. Engineers · Surveyors
1800 28TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
5613 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-6445
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY D' SULLIVAN (719) 227-1022

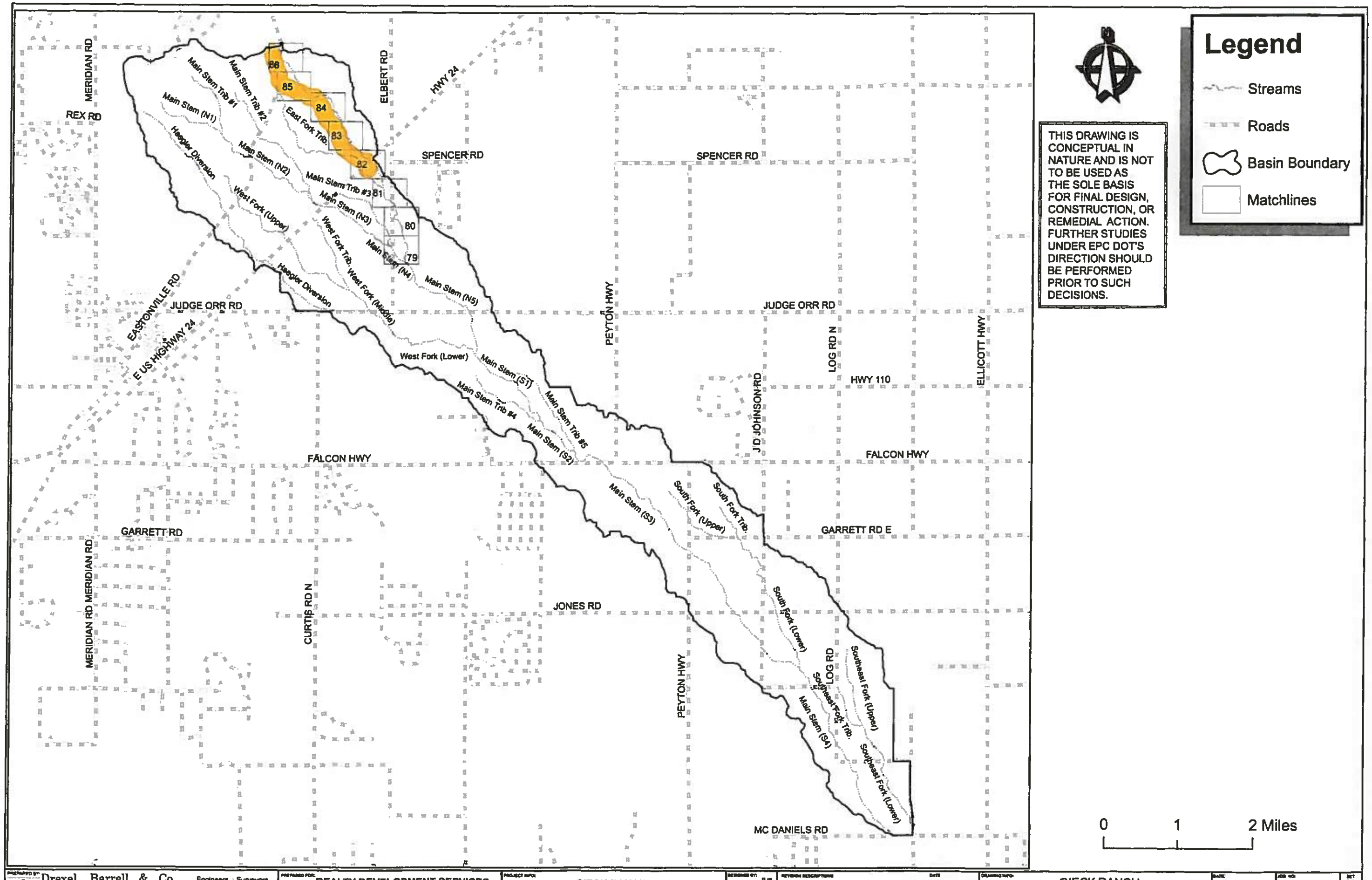
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

REVISION DESCRIPTION: PER EPC FINAL REVIEW — DATE: JANUARY 2010

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
EAST FORK TRIBUTARY #3

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 89



PREPARED BY: Drexel, Barrell & Co. Engineers · Surveyors
1898 38TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 358-0887
6313 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-0648
CONTACT: ROBERT BENNETT

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1822

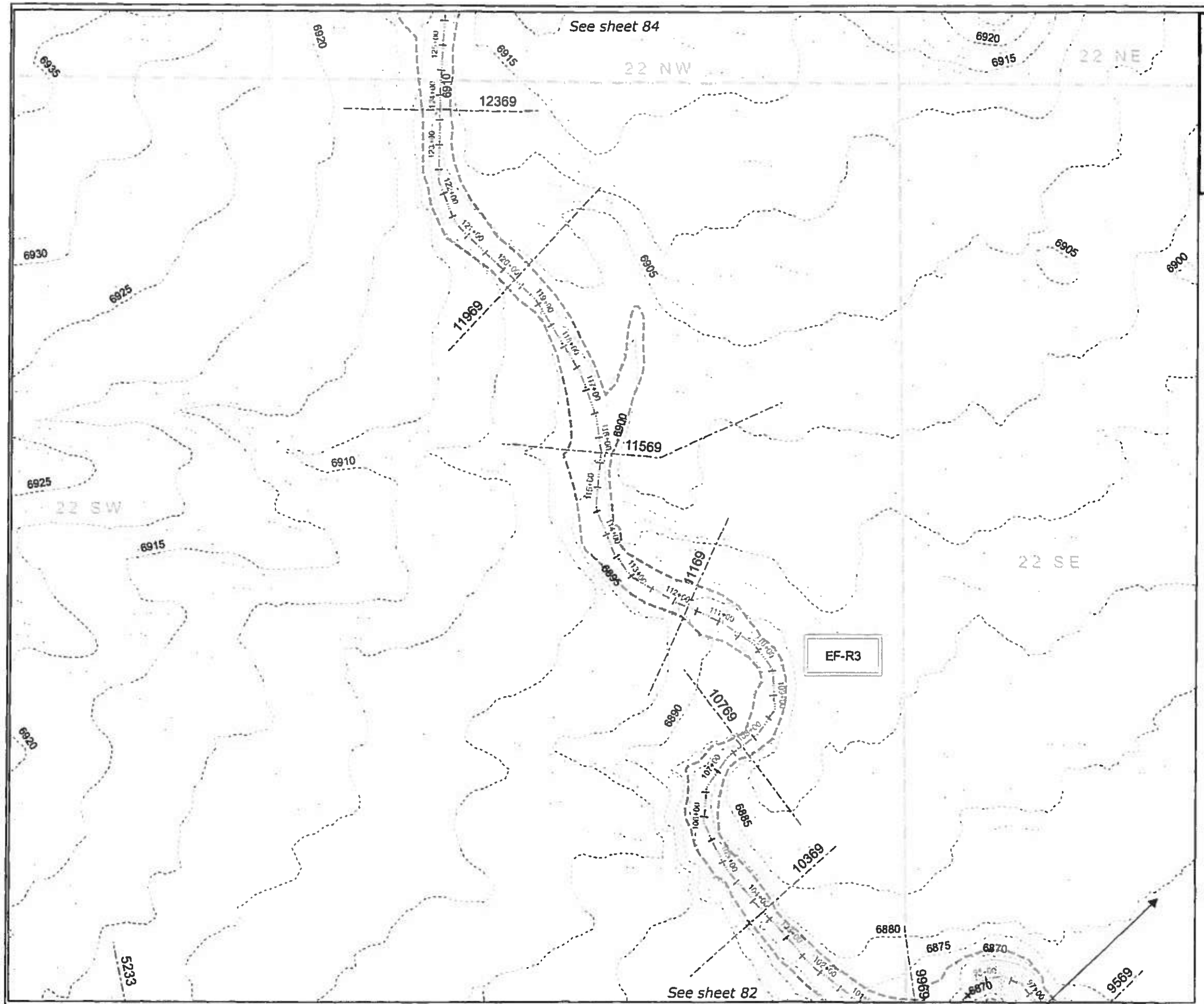
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: SLF
CHECKED BY: RJB

REVISION DESCRIPTIONS | DATE

DRAWING INFO: GIECK RANCH
KEY MAP
EAST FORK

DATE: AUGUST 2007
SCALE: H: 1" = 6000' V:
JOB NO: C7706-1
DRAWING NO: 6D 038
SHT: PL
SHEET: K10



Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

0 100 200 Feet

Reach	Slope (%)	Q_{100} (cfs)	V_{100} (ft/s)
EF-R3	1.53	595	5.09

RECOMMENDED PLAN IMPROVEMENTS

Reach	
EF-R3	As-needed Improvements

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Drexel, Barrell & Co. Engineers Surveyors
1888 38TH STREET
3 S 7TH STREET
8513 W 4TH STREET
BOULDER, COLORADO 80301 (303) 443-4335
COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
GREELEY, COLORADO 80634 (970) 351-9445
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
23 NORTH TEJON STREET, SUITE 200
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: SLF/MLM
CHECKED BY: RJB/TML

REVISION DESCRIPTION: PER EPC FINAL REVIEW
DATE: JANUARY 2010

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
EAST FORK #5

DATE: AUGUST 2007
JOB NO: C7706-2
SHEET: PL
SCALE: 1" = 200' / NONE
DRAWING NO.: 6D 038
SHEET: 83

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 25 2019

East Fork Tributary 1 Reach 3 - Proposed Channel_Capacity

Trapezoidal

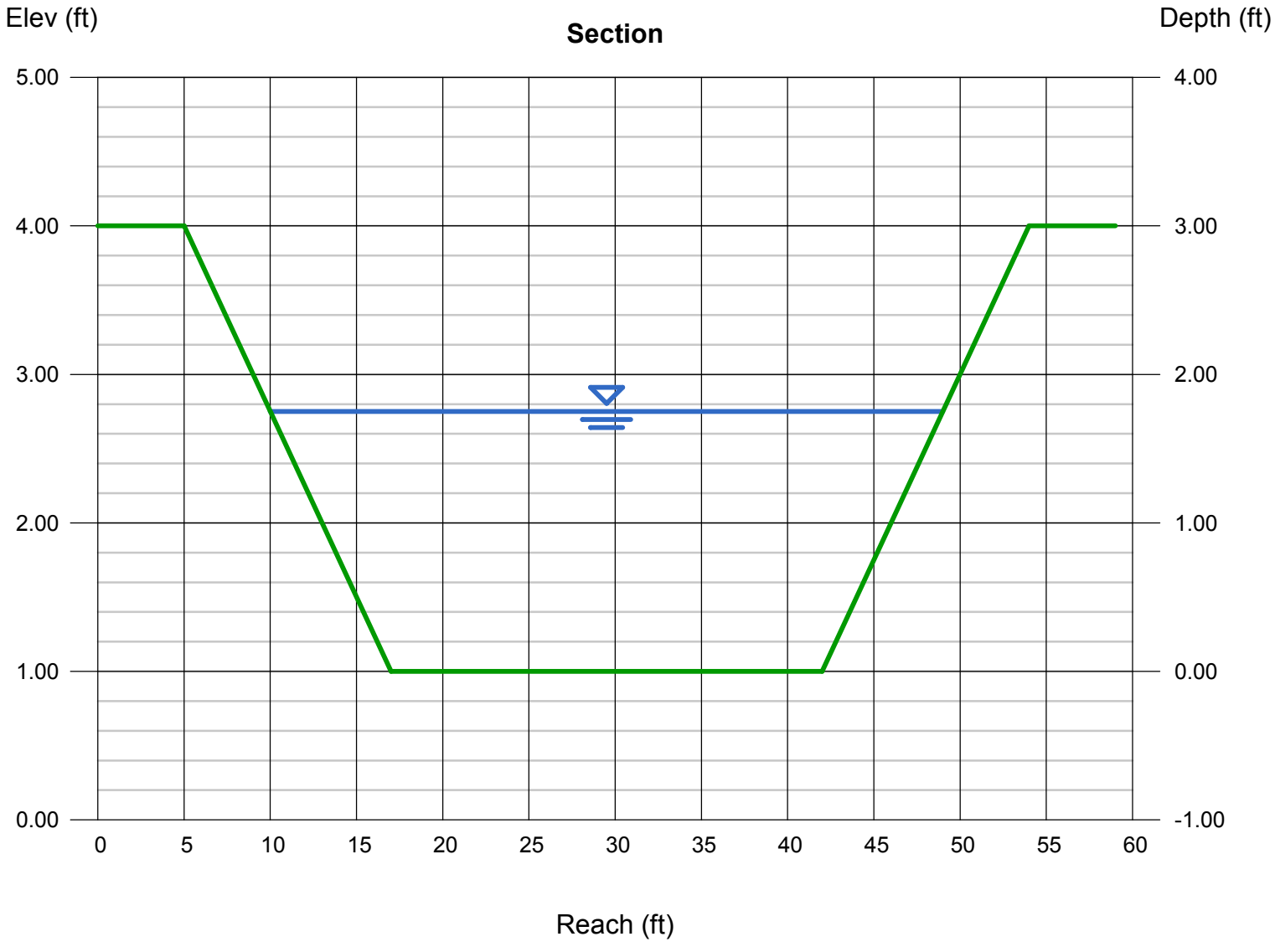
Bottom Width (ft)	= 25.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.69
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 217.00

Highlighted

Depth (ft)	= 1.75
Q (cfs)	= 217.00
Area (sqft)	= 56.00
Velocity (ft/s)	= 3.88
Wetted Perim (ft)	= 39.43
Crit Depth, Yc (ft)	= 1.24
Top Width (ft)	= 39.00
EGL (ft)	= 1.98



Channel Report

East Fork Tributary 1 Reach 3 - Proposed Channel_Velocity

Trapezoidal

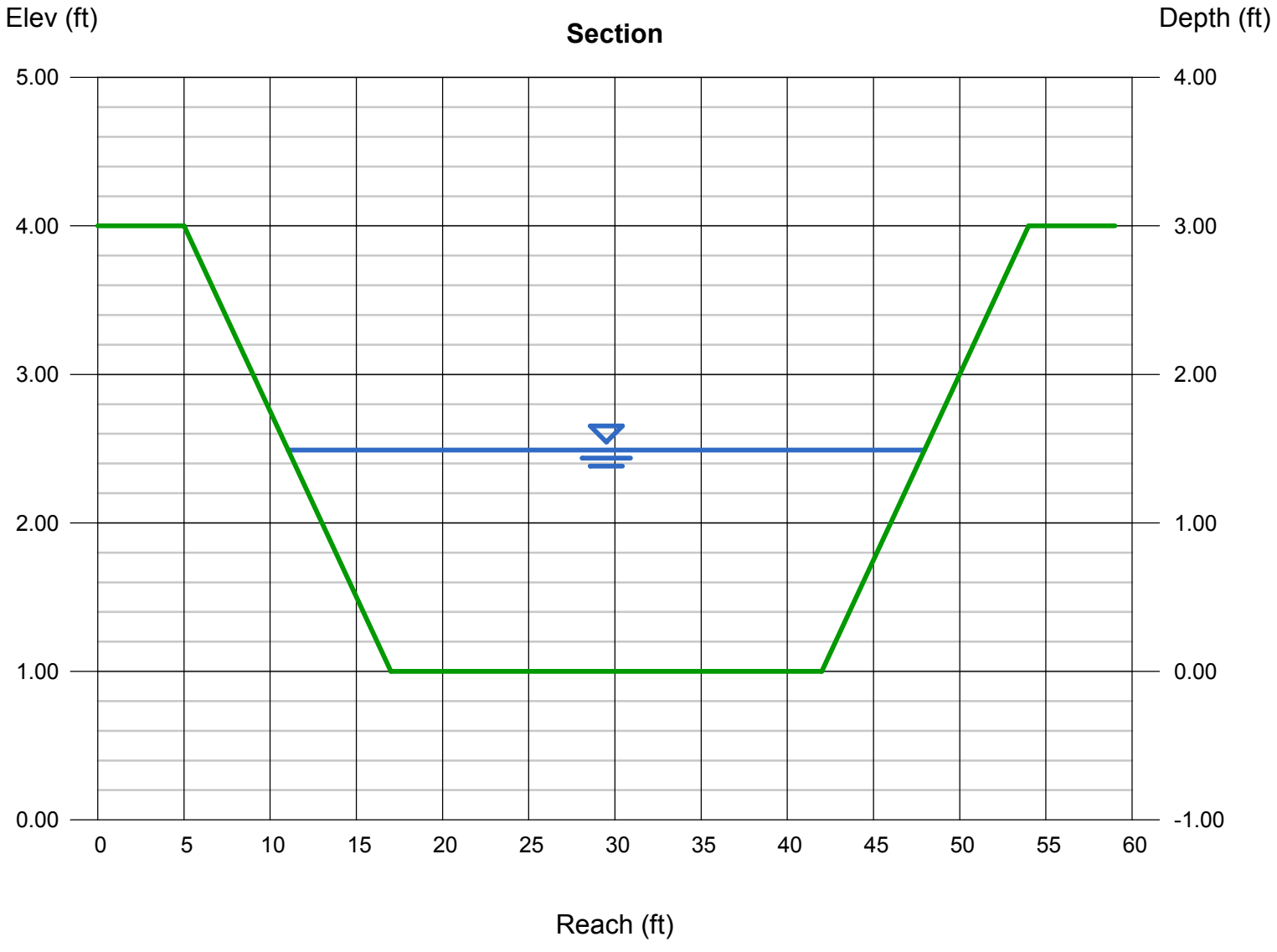
Bottom Width (ft)	= 25.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.69
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 217.00

Highlighted

Depth (ft)	= 1.49
Q (cfs)	= 217.00
Area (sqft)	= 46.13
Velocity (ft/s)	= 4.70
Wetted Perim (ft)	= 37.29
Crit Depth, Yc (ft)	= 1.24
Top Width (ft)	= 36.92
EGL (ft)	= 1.83



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 18 2019

East Fork Tributary 1 Reach 2 - Proposed Channel_Capacity

Trapezoidal

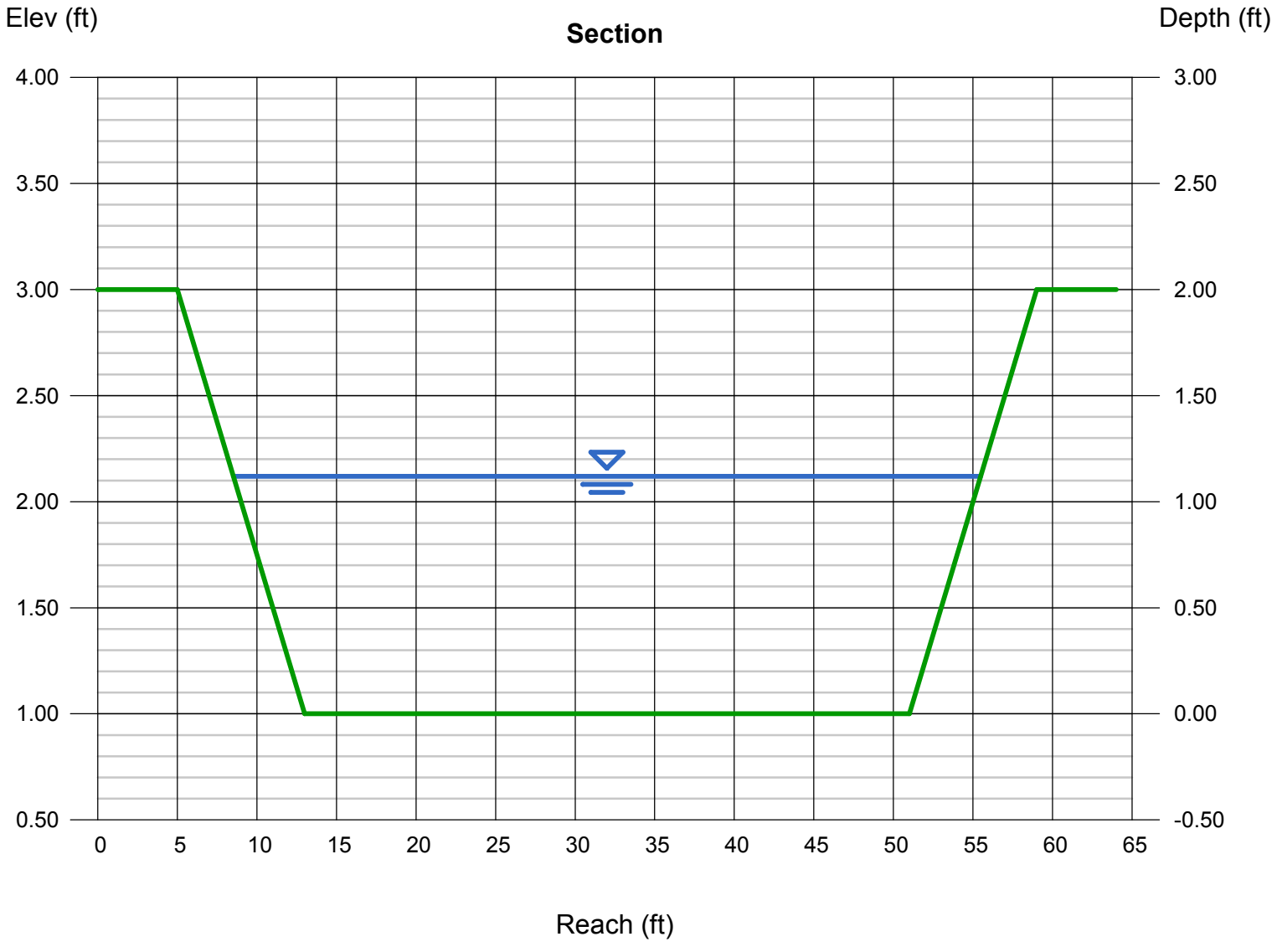
Bottom Width (ft)	= 38.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.58
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 177.00

Highlighted

Depth (ft)	= 1.12
Q (cfs)	= 177.00
Area (sqft)	= 47.58
Velocity (ft/s)	= 3.72
Wetted Perim (ft)	= 47.24
Crit Depth, Yc (ft)	= 0.86
Top Width (ft)	= 46.96
EGL (ft)	= 1.34



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Jan 18 2019

East Fork Tributary 1 Reach 2 - Proposed Channel_Velocity

Trapezoidal

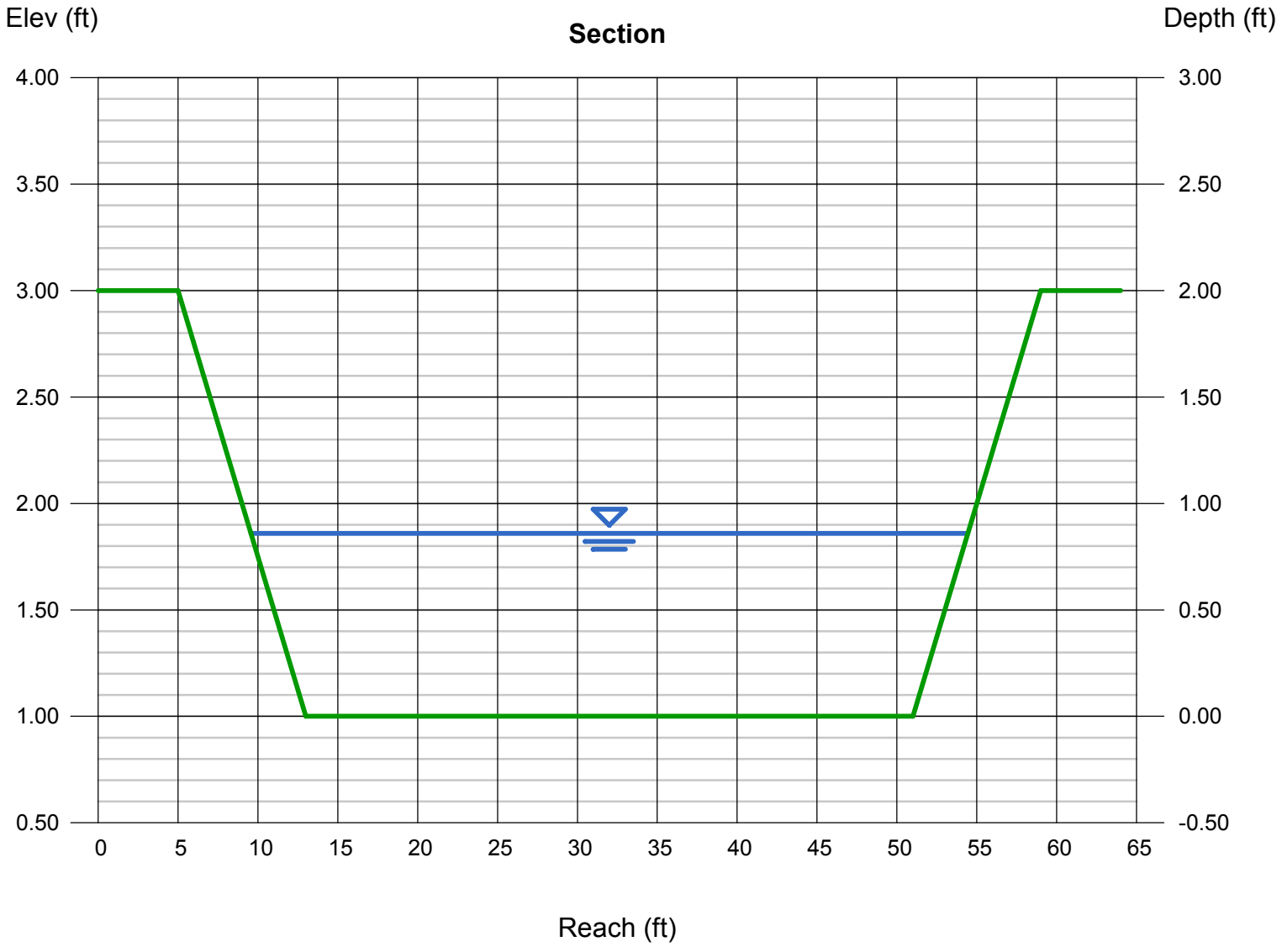
Bottom Width (ft)	= 38.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.58
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 177.00

Highlighted

Depth (ft)	= 0.86
Q (cfs)	= 177.00
Area (sqft)	= 35.64
Velocity (ft/s)	= 4.97
Wetted Perim (ft)	= 45.09
Crit Depth, Yc (ft)	= 0.86
Top Width (ft)	= 44.88
EGL (ft)	= 1.24



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Jan 17 2019

Main Stem Trib 2

Gieck Ranch Tributary 2 - Proposed Channel Section Capacity Check

Trapezoidal

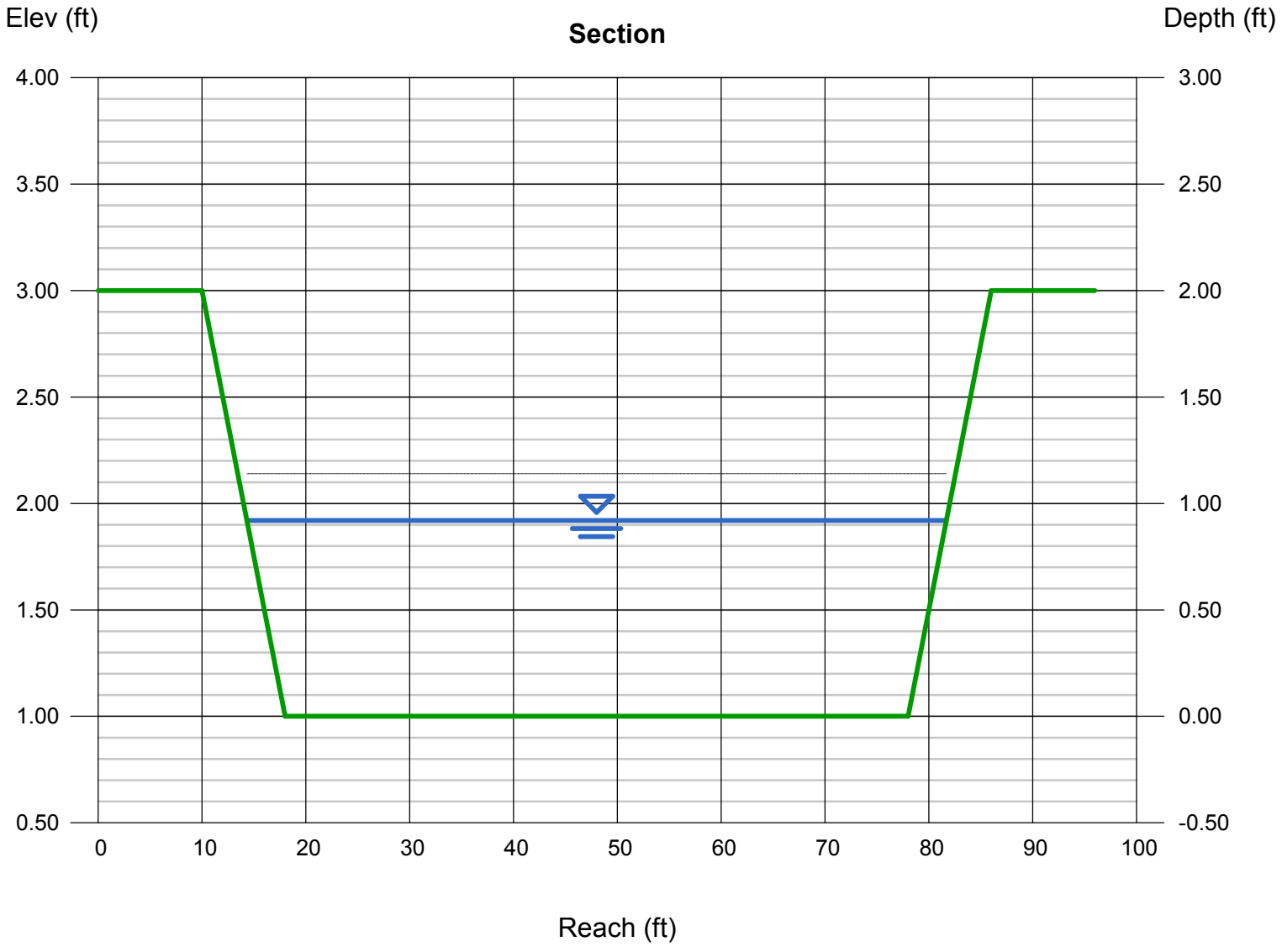
Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 220.00

Highlighted

Depth (ft)	= 0.92
Q (cfs)	= 220.00
Area (sqft)	= 58.59
Velocity (ft/s)	= 3.76
Wetted Perim (ft)	= 67.59
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 67.36
EGL (ft)	= 1.14



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Jan 17 2019

Main Stem Trib 2

Gieck Ranch Tributary 2 - Proposed Channel Section Velocity Check

Trapezoidal

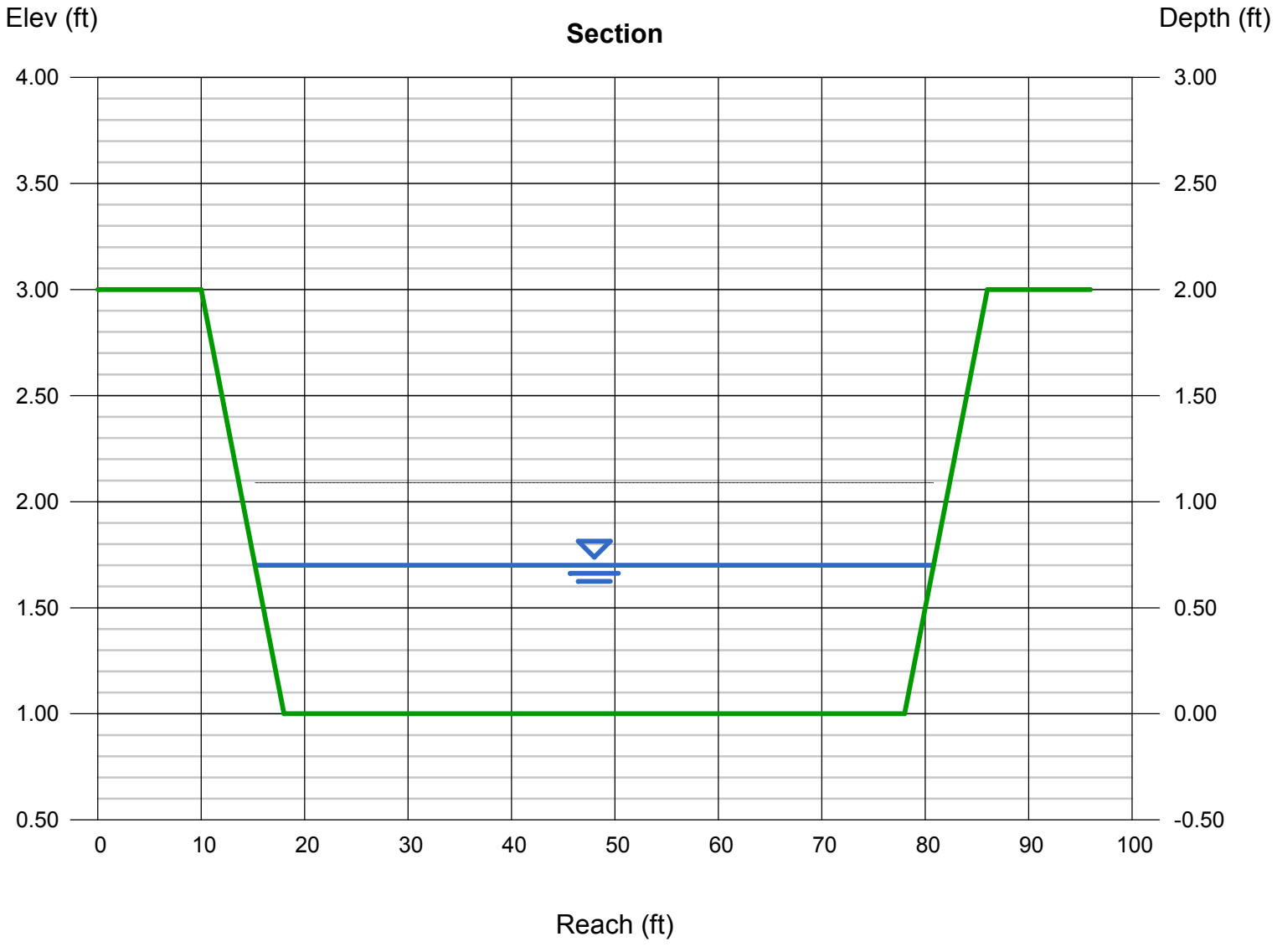
Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 220.00

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 220.00
Area (sqft)	= 43.96
Velocity (ft/s)	= 5.00
Wetted Perim (ft)	= 65.77
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 65.60
EGL (ft)	= 1.09



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Jan 17 2019

Gieck Ranch Tributary 2_Reach 1 - Proposed Channel Section Capacity Check

Main Stem

Trapezoidal

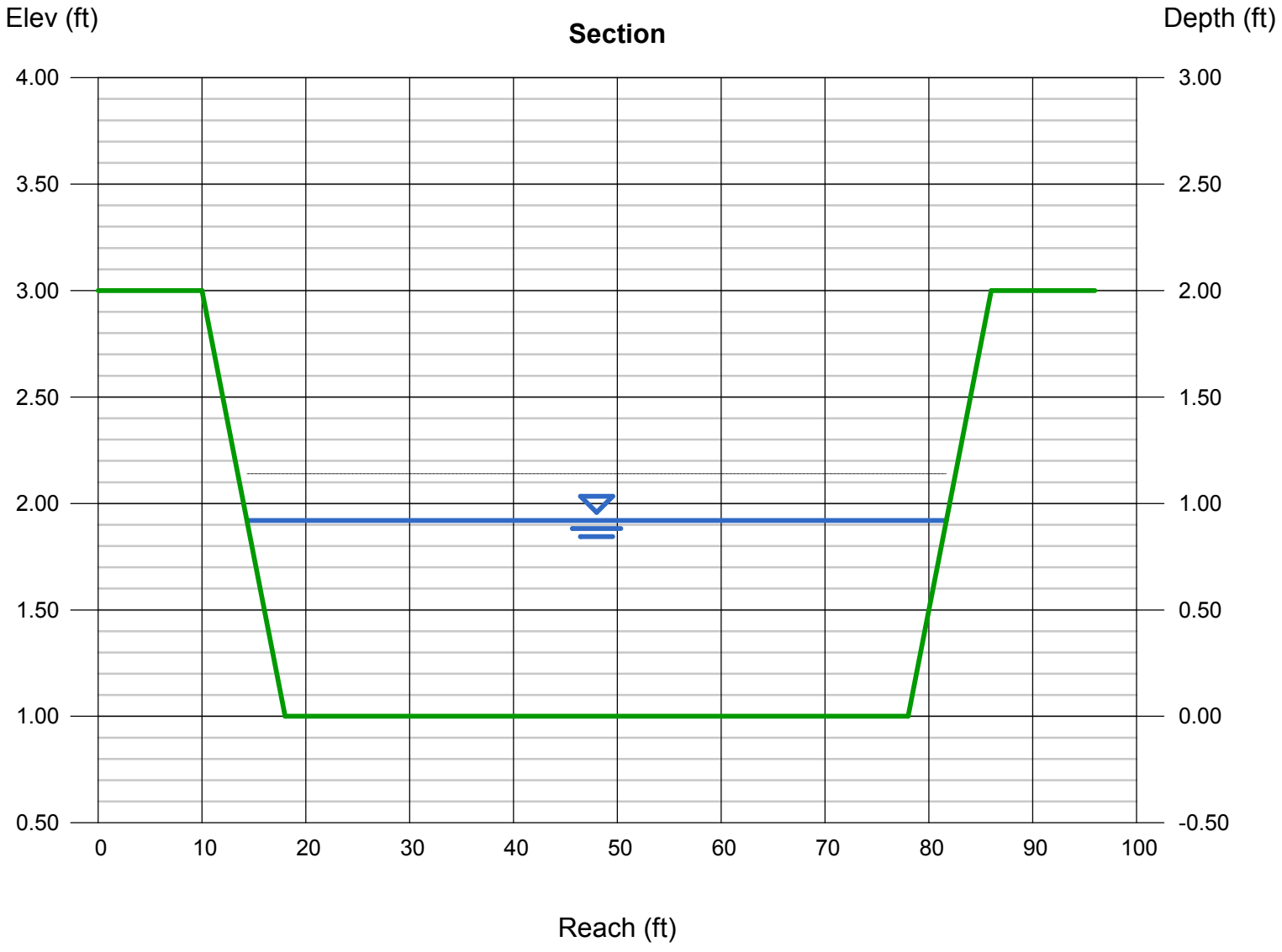
Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 220.00

Highlighted

Depth (ft)	= 0.92
Q (cfs)	= 220.00
Area (sqft)	= 58.59
Velocity (ft/s)	= 3.76
Wetted Perim (ft)	= 67.59
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 67.36
EGL (ft)	= 1.14



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Jan 17 2019

Gieck Ranch Tributary 2, Reach 1 - Proposed Channel Section Velocity Check

Main Stem

Trapezoidal

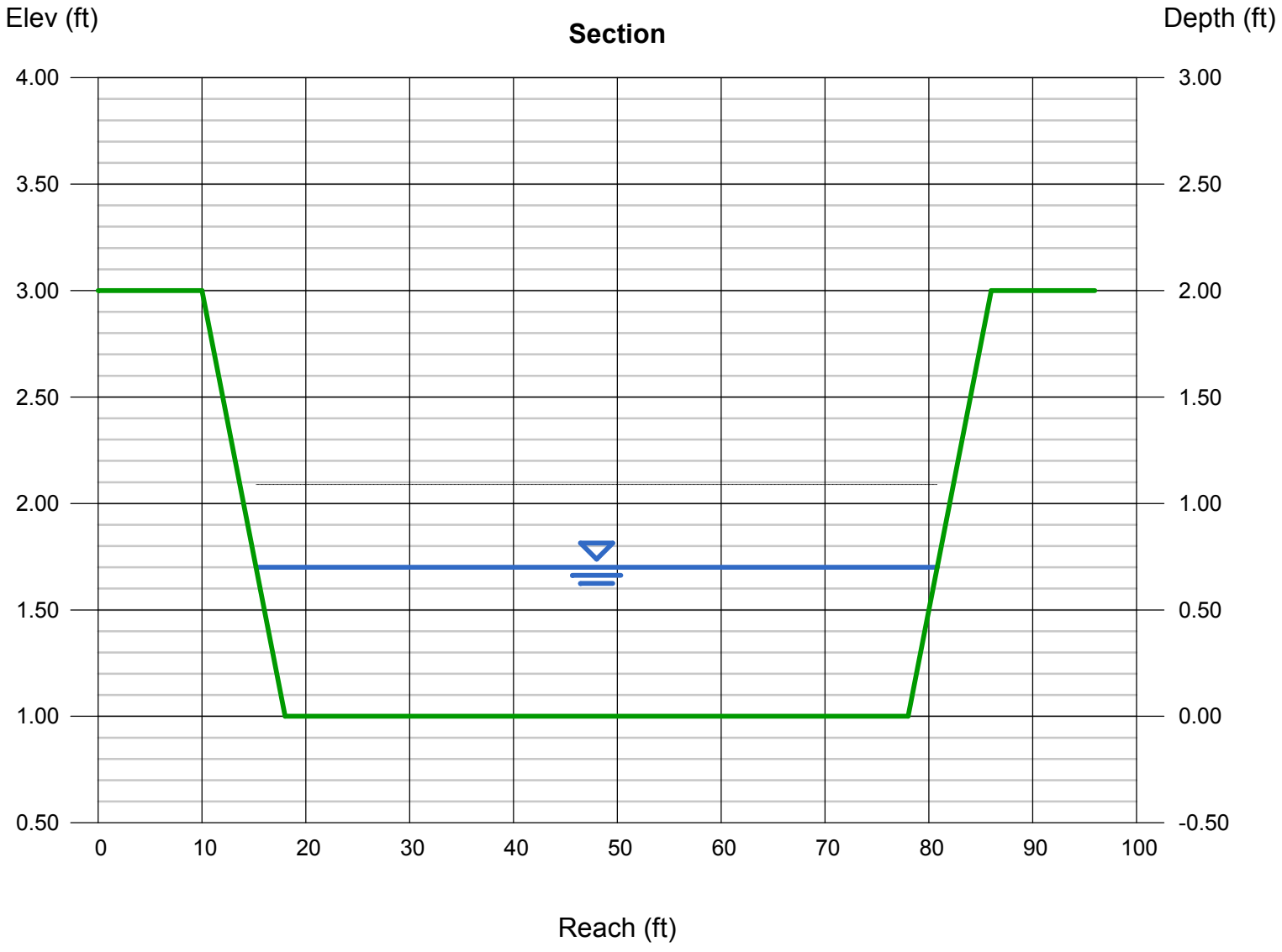
Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 220.00

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 220.00
Area (sqft)	= 43.96
Velocity (ft/s)	= 5.00
Wetted Perim (ft)	= 65.77
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 65.60
EGL (ft)	= 1.09



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Jan 17 2019

Gieck Ranch Tributary 2, Reach 2 - Proposed Channel Section Capacity Check

Main Stem

Trapezoidal

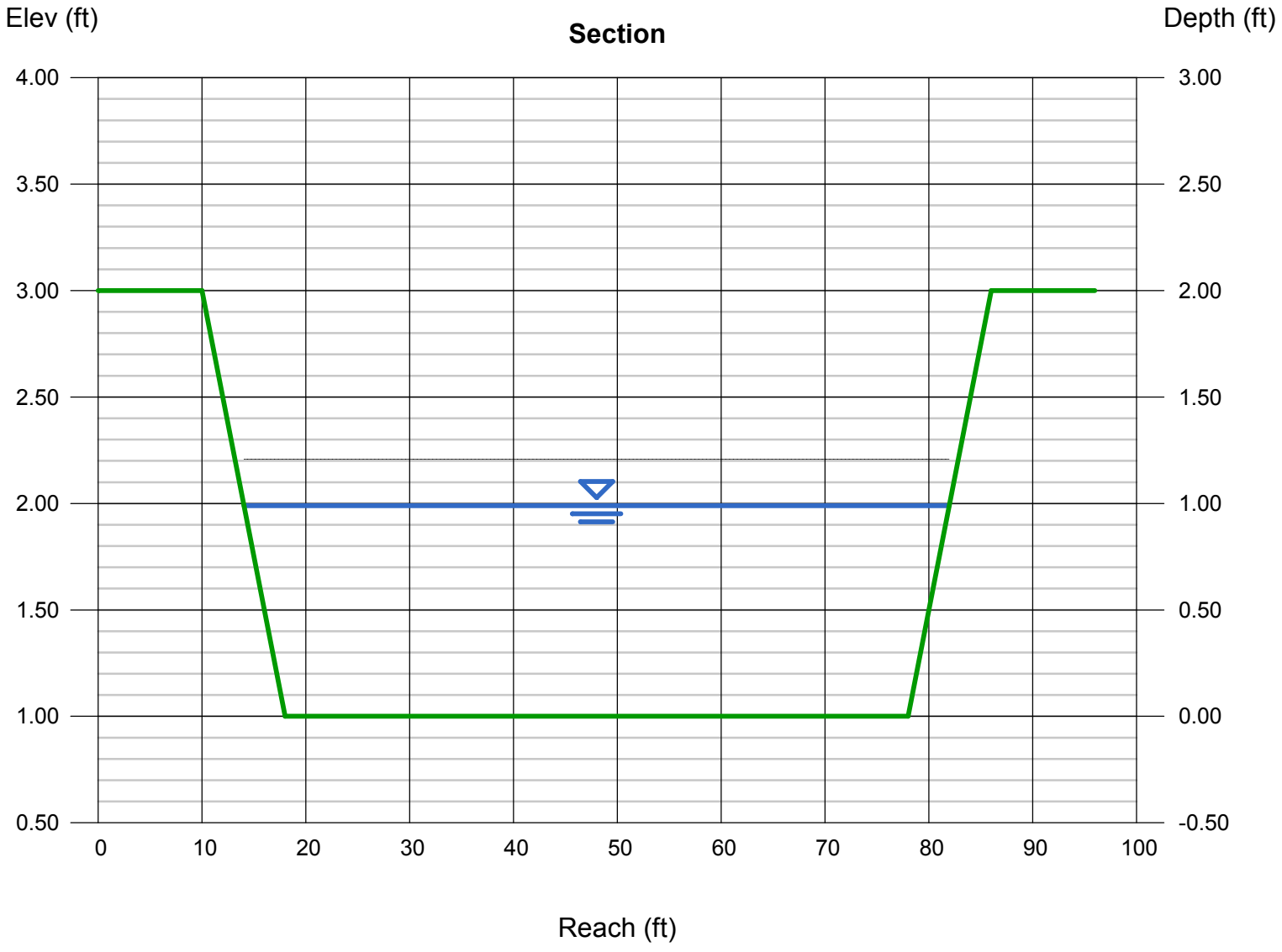
Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.80
N-Value	= 0.050

Calculations

Compute by:	Known Q
Known Q (cfs)	= 237.00

Highlighted

Depth (ft)	= 0.99
Q (cfs)	= 237.00
Area (sqft)	= 63.32
Velocity (ft/s)	= 3.74
Wetted Perim (ft)	= 68.16
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 67.92
EGL (ft)	= 1.21



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Jan 17 2019

Gieck Ranch Tributary 2_Reach 2 - Proposed Channel Section Velocity Check

Main Stem

Trapezoidal

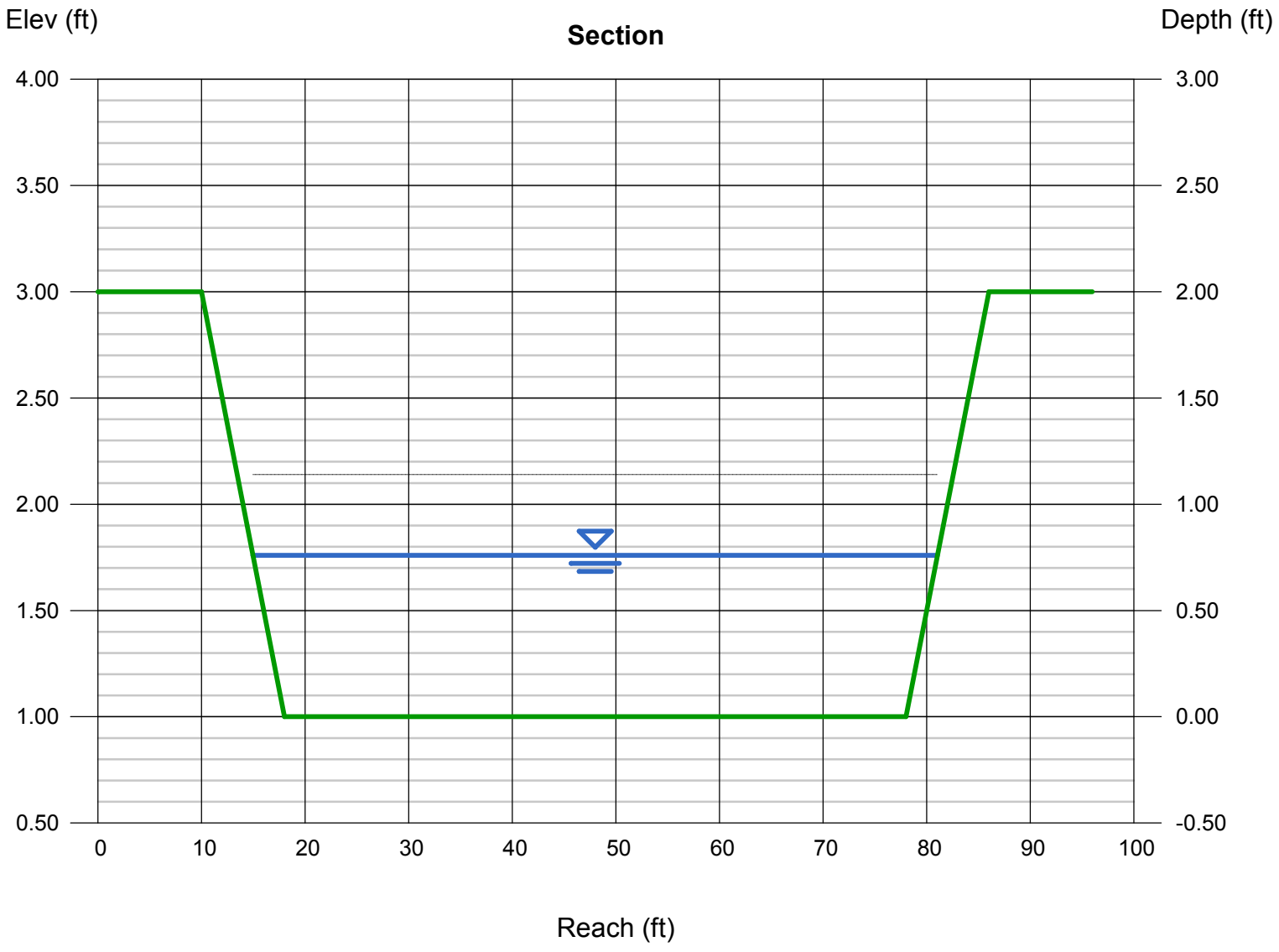
Bottom Width (ft)	= 60.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.80
N-Value	= 0.032

Calculations

Compute by:	Known Q
Known Q (cfs)	= 237.00

Highlighted

Depth (ft)	= 0.76
Q (cfs)	= 237.00
Area (sqft)	= 47.91
Velocity (ft/s)	= 4.95
Wetted Perim (ft)	= 66.27
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 66.08
EGL (ft)	= 1.14



MASTER DEVELOPMENT DRAINAGE PLAN
MERIDIAN RANCH

OFFSITE FLOWS ONTO GRANDVIEW RESERVE

GRANDVIEW RESERVE

EXISTING 36" CMP

EXISTING 36" CMP

EXISTING 48" CMP

EXISTING 18" CMP

EXISTING 18" CMP

EXISTING 18" CMP

3-EXISTING 48" RCP'S

EXISTING 48" RCP 24" CMP (PLUGGED)

4-EXISTING 36" RCP'S

29" x18" ARCH CMP

29" x18" ARCH CMP (floats?)

18" CMP

18" CMP

18" CMP

HP

24" CMP

36" CMP

18" CMP

18" CMP

24" CMP

OS1 998

OS2 142

OS3 127

OS4 87

OS5 37

OS6 84

OS7 21

OS8 26

OS9 99

HB1 15

HB2 68

HB3 81

HB4 39

HB5 88

HB6 105

HB7 20

HB8 86

HB9 195

HB10 195

HB11 58

HB12 51

HG1 35

HG2 58

HG3 117

HG4 57

HG5 72

HG6A 88

HG6B 66

HG7 63

HG8 85

HG9 114

HG10 88

HG11 131

HG12 83

HG13 54

HG14 147

HG15 164

HG18 21

HG19 3

HG20 1

HG21 14

HF01 44

HH1 63

FUTURE POND B

BENNETT RANCH
CHWS1200

GIECK RANCH
CHMS0400

FALCON
CHWS1400

HAEGLER RANCH
CHMS0200

GIECK BASIN

BENNETT BASIN

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)

1 inch = 500 ft.

LEGEND

MAJOR BASIN BOUNDARY

MINOR BASIN BOUNARY

SCS MODEL ID / SIZE ACRES — EB15 / 65 — BASIN IDENTIFICATION

H8 B10 DESIGN POINTS

MAJOR CONTOUR INTERVAL

MINOR CONTOUR INTERVAL

100 YEAR FLOOD PLAIN

HISTORIC CONDITIONS - SCS MAP

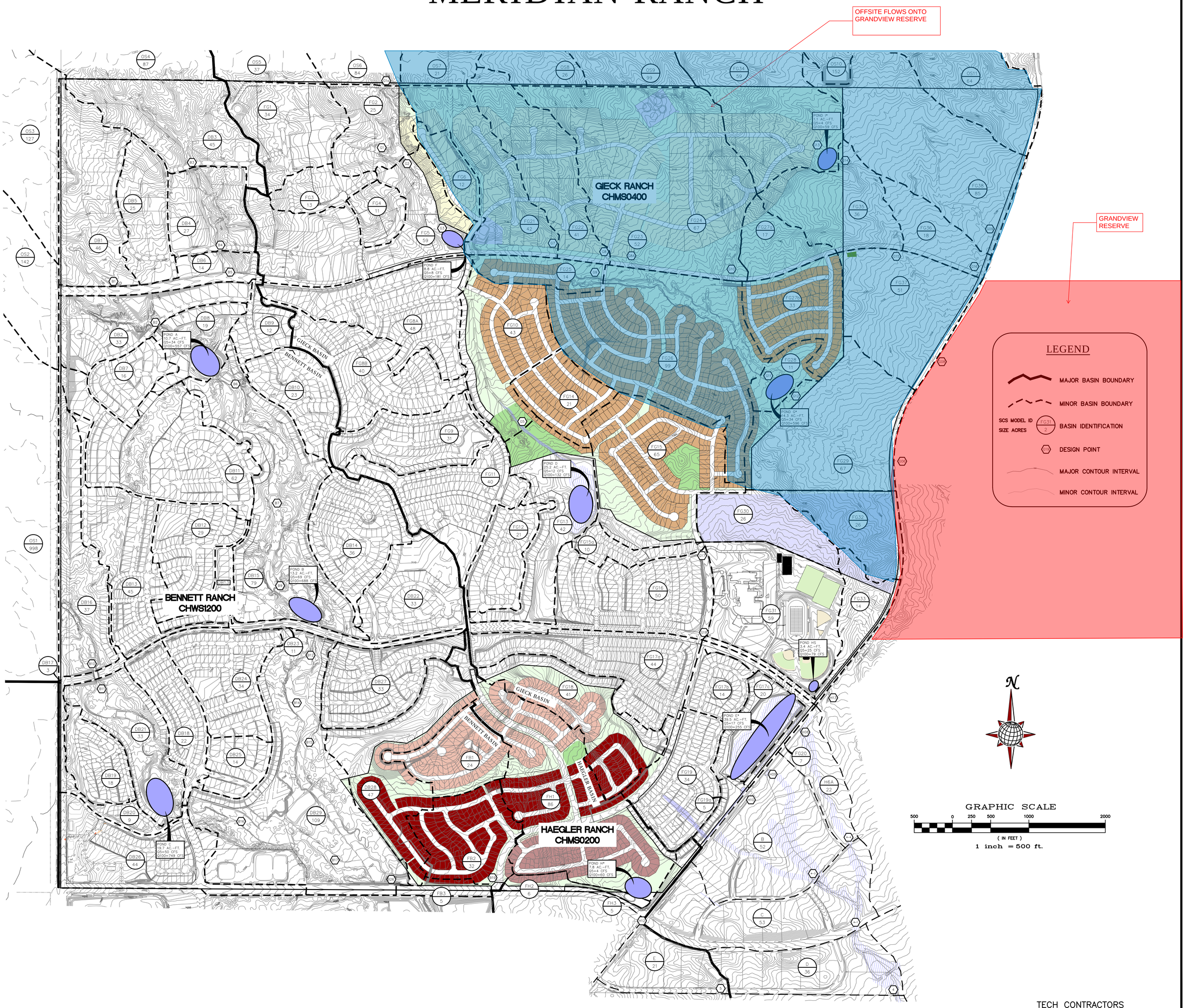
AUG 2017

TECH CONTRACTORS
10305 ANGELES ROAD
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.7608

FIGURE 4

S:\Civil Proj\Meridian Ranch MDDP\dwg\Plan Sheets\2017 Basin Maps\2017-MDDP-HIST.dwg, HIS-SCS-MAP, 8/17/2017 10:59:19 AM

MASTER DEVELOPMENT DRAINAGE PLAN
MERIDIAN RANCH



*NOTE: PRELIMINARY STORAGE VOLUMES AND OUTFLOW QUANTITIES HAVE BEEN PROVIDED FOR EACH OF THE FUTURE DETENTION FACILITIES LOCATED WITHIN THE DEVELOPMENT. THE ACTUAL STORAGE VOLUMES AND DISCHARGE RATES WILL BE DETERMINED UPON A COMPLETE ANALYSIS FOR EACH DETENTION FACILITY PRIOR TO CONSTRUCTION. THE VALUES GIVEN FOR DISCHARGE AND VOLUME ARE ESTIMATES FOR PLANNING PURPOSES ONLY.

DEVELOPED CONDITIONS - SCS MAP

NOV 2017

FIGURE 5

TECH CONTRACTORS
10305 ANGELES ROAD
FALCON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.7608

S:\Civil\Proj\Meridian Ranch MDDP\dwg\Plan Sheets\2017 Basin Maps\2017-MDDP-DEV.dwg, DEV-SCS-MAP, 11/29/2017 9:43:04 AM

Appendix F

MCFARLAND, CHRISTIAN, 11/3/2020 11:50 AM

HRGreen DRAWING PATH:J:\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins-Overall-EXISTING.dwg

OFFSITE CONTRIBUTION
Q100 ~ 280 CFS
Q5 ~ 59 CFS
OFFSITE AREA ~0.44 SQUARE MILES
CN VALUE~56.49
SEE STREAMSTATS MAP

OFFSITE CONTRIBUTION
Q100 ~ 217 CFS
Q5 ~ 61 CFS
OFFSITE AREA ~0.22 SQUARE MILES
CN VALUE~54.53
SEE STREAMSTATS MAP

OFFSITE CONTRIBUTION
Q100 ~ 595 CFS
Q5 ~ 180 CFS
OFFSITE AREA ~0.84 SQUARE MILES
CN VALUE~58.28
SEE STREAMSTATS MAP

OFFSITE CONTRIBUTION
Q100 ~ 413 CFS
Q5 ~ 67 CFS
OFFSITE AREA ~0.17 SQUARE MILES
CN VALUE ~55.04
SEE STREAMSTATS MAP

EASTONVILLE ROAD

EAST FORK

EAST FORK TRIBUTARY

MAIN STEM TRIBUTARY NUMBER 2

MAIN STEM

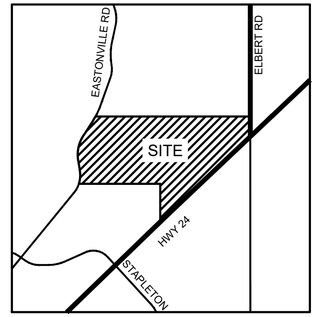
STATE HIGHWAY 24

EXISTING 24" CMP CULVERT

EXISTING 18" CMP CULVERT

EXISTING BRIDGE

Basin	Design Point	5 Year Pre Devlopment	100 Year Pre Development
A1	10	13.03	66.80
B1	20	4.33	48.76
B2	21	1.66	20.74
	22	11.85	140.35
	23	5.99	68.56
B3	24	21.23	249.20
C1	30	9.95	110.70
	31	9.95	110.70
D1	40	8.12	40.00
D2	41	22.23	114.87
	42	8.12	40.00
E1	50	32.34	157.99
	51	93.34	374.99
F1	60	9.70	49.45
F2	61	16.46	86.73
F3	62	3.65	18.42
F4	63	12.98	67.82
	64	13.35	67.87
	65	26.04	135.62
	66	16.46	86.73
	67	231.47	864.52
G1	70	5.57	28.46
G2	71	3.87	20.06
	72	3.87	20.06
	73	3.87	20.06
	74	189.42	643.48
H1	80	1.85	21.89
H2	81	5.37	27.12
H3	82	1.92	9.51
H4	83	8.07	40.86
	84	7.22	49.01
	85	1.92	9.51
OS1	OS1	67.00	413.00
OS2	OS2	59.00	280.00
OS3	OS3	61.00	217.00
OS4	OS4	180.00	595.00
	Outfall1	80.03	479.80
	Outfall2	85.96	597.41
	Outfall3	30.00	154.35
	Outfall4	341.05	1335.77



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX) BASIN DESIGNATION; AREA (AC.) (XX) C5, (XX) C100

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 200 100

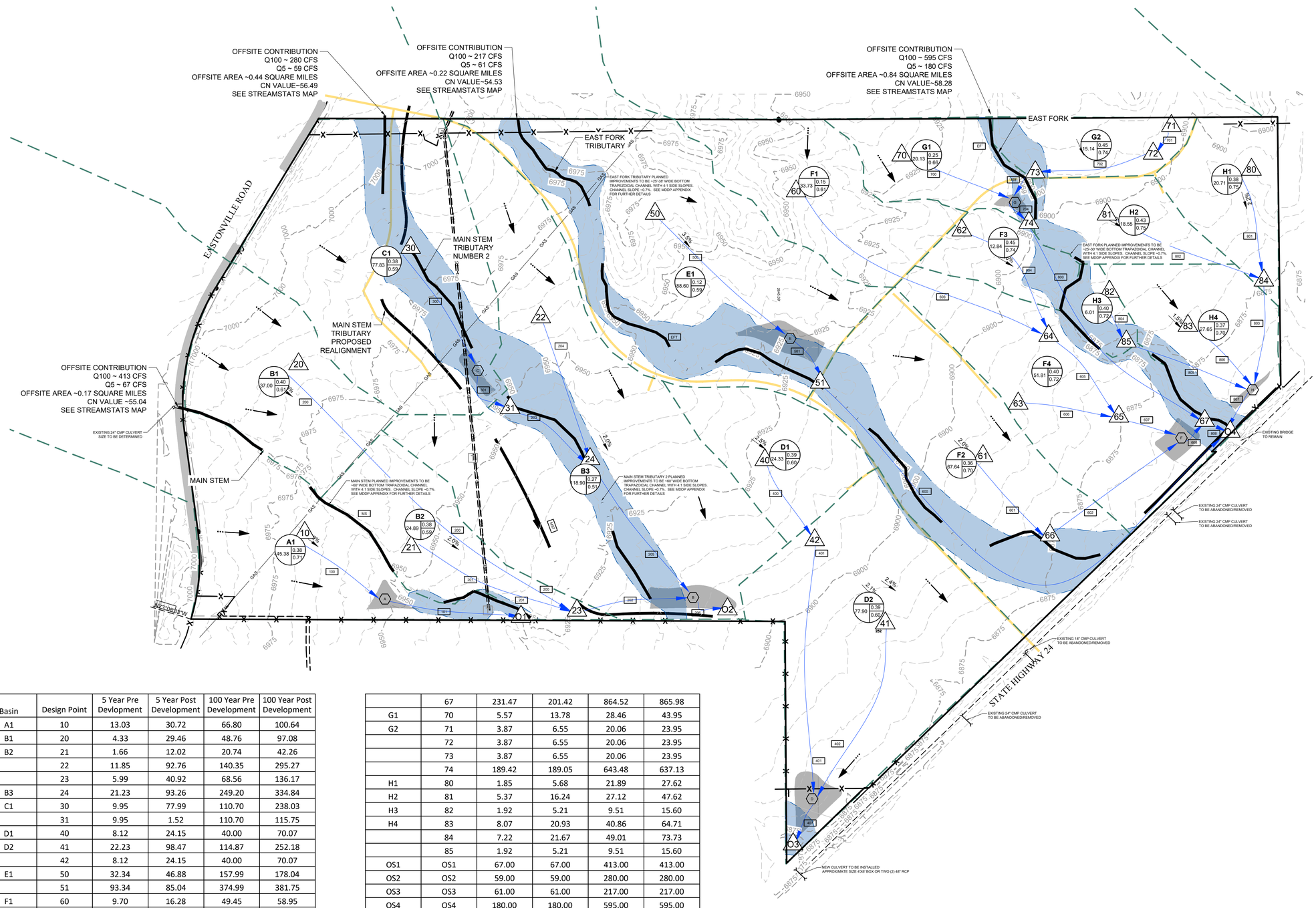
HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

EXISTING EX1

FIG.EX1

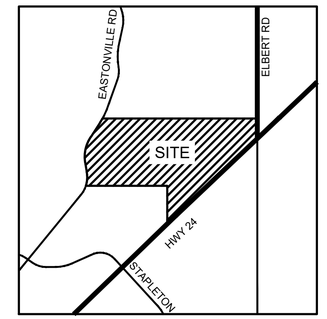
MCFARLAND, CHRISTIAN, 11/3/2020 12:56 PM



Basin	Design Point	5 Year Pre Devlopment	5 Year Post Development	100 Year Pre Development	100 Year Post Development
A1	10	13.03	30.72	66.80	100.64
B1	20	4.33	29.46	48.76	97.08
B2	21	1.66	12.02	20.74	42.26
	22	11.85	92.76	140.35	295.27
	23	5.99	40.92	68.56	136.17
B3	24	21.23	93.26	249.20	334.84
C1	30	9.95	77.99	110.70	238.03
	31	9.95	1.52	110.70	115.75
D1	40	8.12	24.15	40.00	70.07
D2	41	22.23	98.47	114.87	252.18
	42	8.12	24.15	40.00	70.07
E1	50	32.34	46.88	157.99	178.04
	51	93.34	85.04	374.99	381.75
F1	60	9.70	16.28	49.45	58.95
F2	61	16.46	60.11	86.73	170.90
F3	62	3.65	11.36	18.42	32.93
F4	63	12.98	42.32	67.82	124.89
	64	13.35	26.88	67.87	90.88
	65	26.04	69.12	135.62	215.63
	66	16.46	60.11	86.73	170.90

	67	231.47	201.42	864.52	865.98
G1	70	5.57	13.78	28.46	43.95
G2	71	3.87	6.55	20.06	23.95
	72	3.87	6.55	20.06	23.95
	73	3.87	6.55	20.06	23.95
	74	189.42	189.05	643.48	637.13
H1	80	1.85	5.68	21.89	27.62
H2	81	5.37	16.24	27.12	47.62
H3	82	1.92	5.21	9.51	15.60
H4	83	8.07	20.93	40.86	64.71
	84	7.22	21.67	49.01	73.73
	85	1.92	5.21	9.51	15.60
OS1	OS1	67.00	67.00	413.00	413.00
OS2	OS2	59.00	59.00	280.00	280.00
OS3	OS3	61.00	61.00	217.00	217.00
OS4	OS4	180.00	180.00	595.00	595.00
	Outfall1	80.03	67.69	479.80	466.95
	Outfall2	85.96	61.68	597.41	536.11
	Outfall3	30.00	8.58	154.35	160.70*
	Outfall4	341.05	276.10	1335.77	1291.25

*THIS VALUE IS HIGHER THAN PRE-EXISTING AND WILL BE ADJUSTED TO MEET CRITERIA WITH THE PRELIMINARY DRAINAGE REPORT



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX) BASIN DESIGNATION; AREA (AC.) XX C5, XX C100

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

PRELIMINARY CHANNEL GEOMETRY (BY OTHERS)

MAIN STEM
BOTTOM WIDTH: 60'
SIDE SLOPES: 4:1

MAIN STEM TRIBUTARY 2
BOTTOM WIDTH: 60'
SIDE SLOPES: 4:1

EAST FORK TRIBUTARY 1 REACH 2
BOTTOM WIDTH: 38'
SIDE SLOPES: 4:1

EAST FORK TRIBUTARY 1 REACH 1
BOTTOM WIDTH: 25'
SIDE SLOPES: 4:1

NORTH
0 400
200

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR1

FIG.DR1

HRGreen DRAWING PATH:J:\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins-Overall.dwg

IGEL, TREVOR, 4/16/2020 2:53 PM

EASTONVILLE ROAD

EAST FORK TRIBUTARY

MAIN STEM TRIBUTARY NUMBER 2

MAIN STEM TRIBUTARY PROPOSED REALIGNMENT

SEE DR3

SEE SHEET DR3

SEE SHEET DR5

234

30

C1

77.83

0.36

0.50

300

234

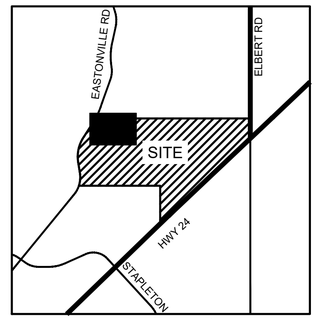
22

177

2.6%

2.2%

2.3%



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX) BASIN DESIGNATION; AREA (AC.) XX XX % IMPERVIOUSNESS

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 100

50

HRGreen

Job No.:	191897.01
Prepared By:	CMM
Date:	4/9/2020

PROPOSED DR2

FIG.DR2

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

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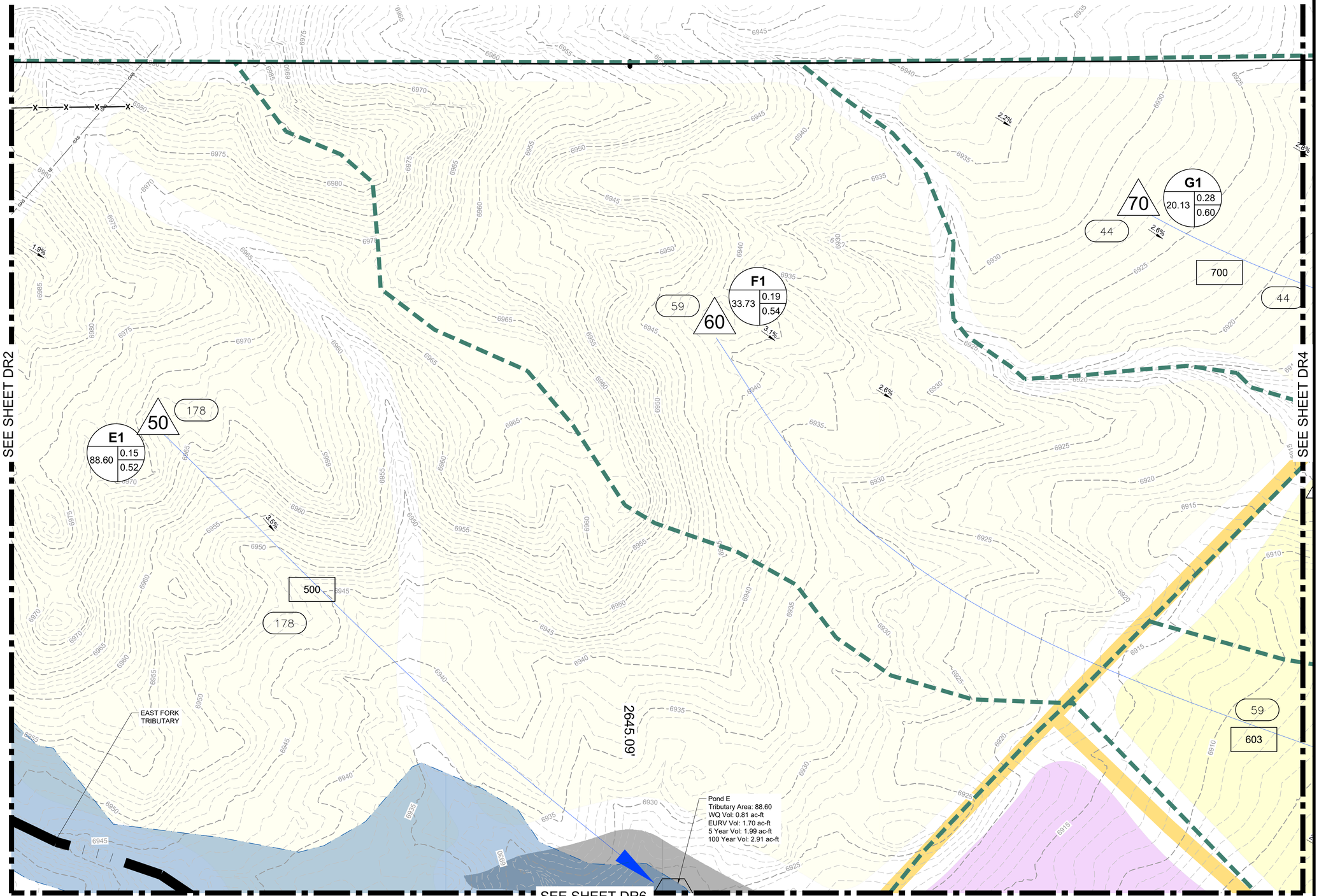
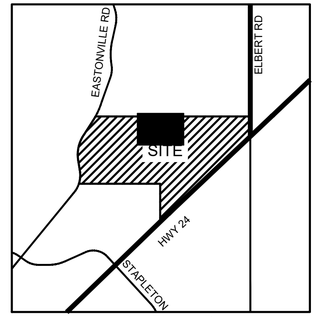
SEE SHEET DR2

SEE SHEET DR4

SEE SHEET DR6





VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (A)
- PROPOSED BASIN LABEL (XX) — BASIN DESIGNATION; AREA (AC.) (XX) (XX) — % IMPERVIOUSNESS

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 50 100

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR3

FIG.DR3

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

IGEL, TREVOR, 4/16/2020 2:54 PM

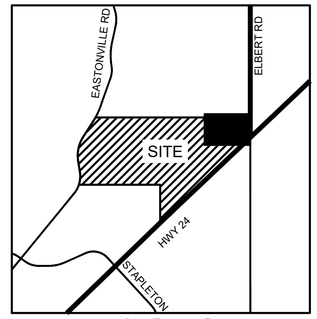
SEE SHEET DR3

EAST FORK

Pond G
Tributary Area: 35.27
WQ Vol: 0.47 ac-ft
EURV Vol: 1.15 ac-ft
5 Year Vol: 1.24 ac-ft
100 Year Vol: 1.85 ac-ft

G2 15.14 | 0.19 | 0.54
H1 20.71 | 0.15 | 0.30
H2 18.55 | 0.35 | 0.63
F3 12.84 | 0.42 | 0.64
H3 6.01 | 0.32 | 0.61
H4 27.65 | 0.30 | 0.60

SEE SHEET DR7



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR (5250)
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR (5250)
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX | XX | XX) — BASIN DESIGNATION / AREA (AC.) / % IMPERVIOUSNESS

LAND USE
- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 50 100

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR4

FIG.DR4

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

IGEL, TREVOR, 4/16/2020 2:54 PM

SEE SHEET DR2

EASTONVILLE ROAD

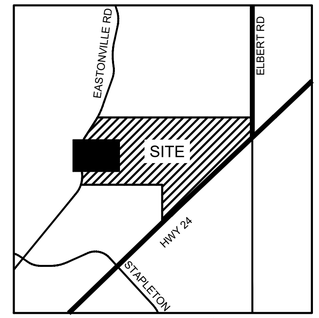
MAIN STEM TRIBUTARY NUMBER 2

Pond C
Tributary Area: 77.63
WQ Vol: 1.36 ac-ft
EURV Vol: 4.79 ac-ft
5 Year Vol: 4.07 ac-ft
100 Year Vol: 6.91 ac-ft

97
20
B1
37.00 | 0.31 | 0.46
200
97
C
114
301
T
MAIN STEM
101
10
A1
45.38 | 0.27 | 0.59
B2
24.89 | 0.39 | 0.44
21
42
200
97

SEE SHEET DR6

SEE SHEET DR9



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX = BASIN DESIGNATION; AREA (AC.) XX | XX % IMPERVIOUSNESS)

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 100
50

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR5

FIG.DR5

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

IGEL, TREVOR, 4/16/2020 2:55 PM

SEE SHEET DR3

SEE SHEET DR5

SEE SHEET DR7

SEE SHEET DR10

EAST FORK TRIBUTARY

MAIN STEM TRIBUTARY NUMBER 2

204
177

203
114

501
165

205
267

401
69

400
70

B3
118.90 | 0.15 | 0.30

D1
24.33 | 0.31 | 0.46

31

24

51

40

42

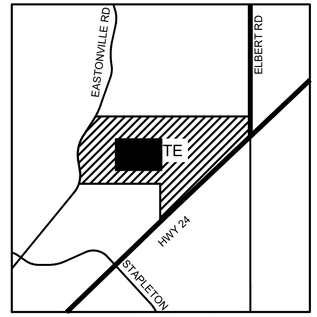
2.0%

1.8%

2.5%

1.9%

1.5%



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX) BASIN DESIGNATION
- AREA (AC.) (XX) (XX) % IMPERVIOUSNESS

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 100 50

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR6

FIG.DR6

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

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SEE SHEET DR2

SEE SHEET DR3

SEE SHEET DR6

SEE SHEET DR8

SEE SHEET DR11

EAST FORK TRIBUTARY

EAST FORK

EAST FORK TRIBUTARY

F4
51.81 | 0.11 | 0.50

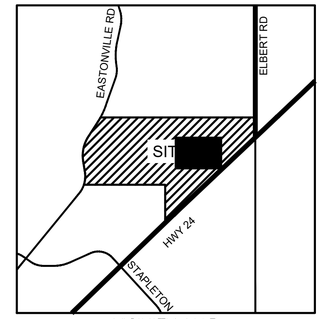
F2
67.64 | 0.41 | 0.67

Pond F
Tributary Area: 165.72
WQ Vol: 2.62 ac-ft
EURV Vol: 5.94 ac-ft
5 Year Vol: 6.82 ac-ft
100 Year Vol: 10.70 ac-ft

64 85 63 65 61 66

605 91 74 606 607 162 600 164 601 171 602 171

1.9% 2.0% 2.3%



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX / AREA (AC.) / XX XX / BASIN DESIGNATION / % IMPERVIOUSNESS)

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 50 100

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR7

FIG.DR7

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

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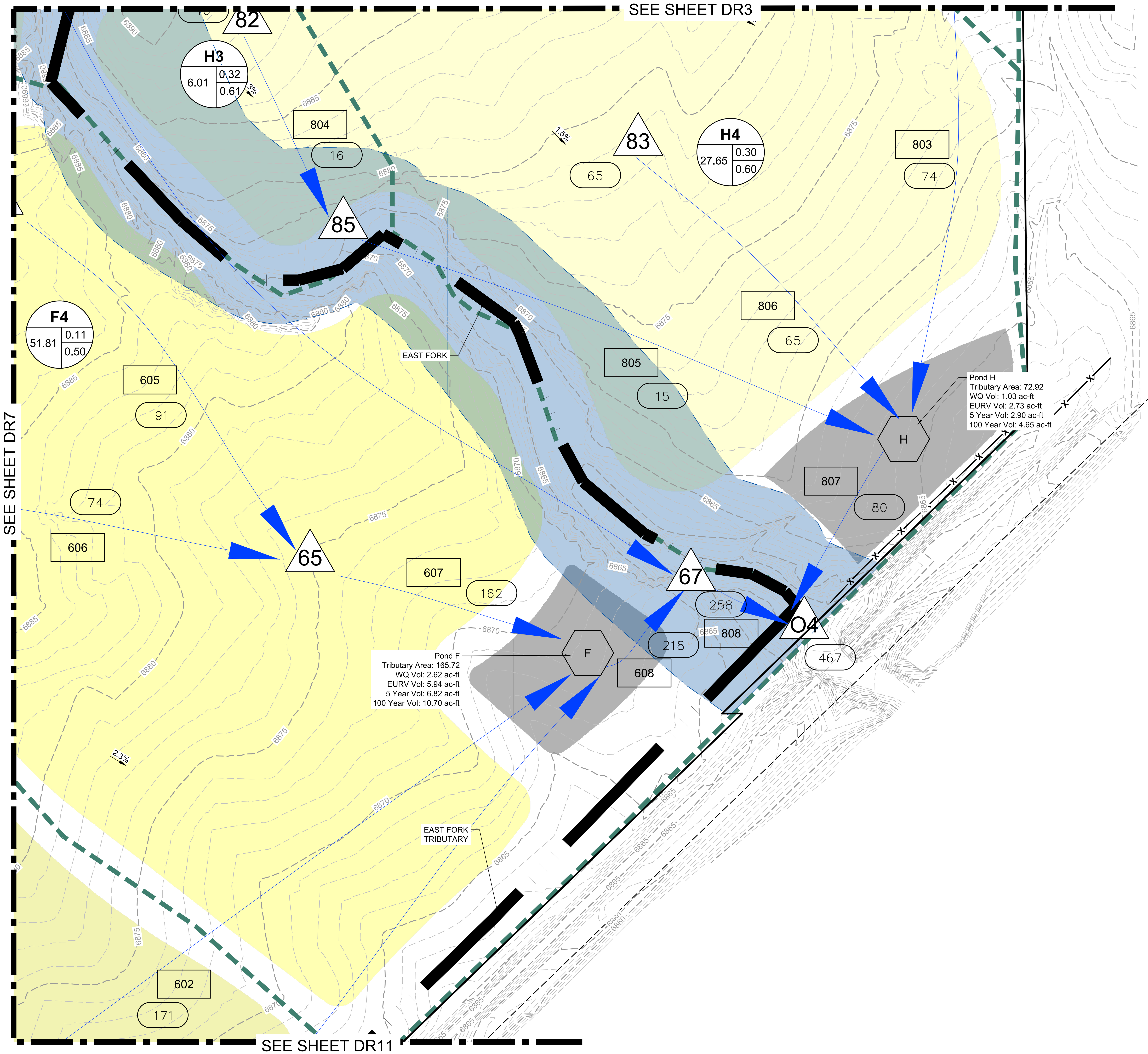

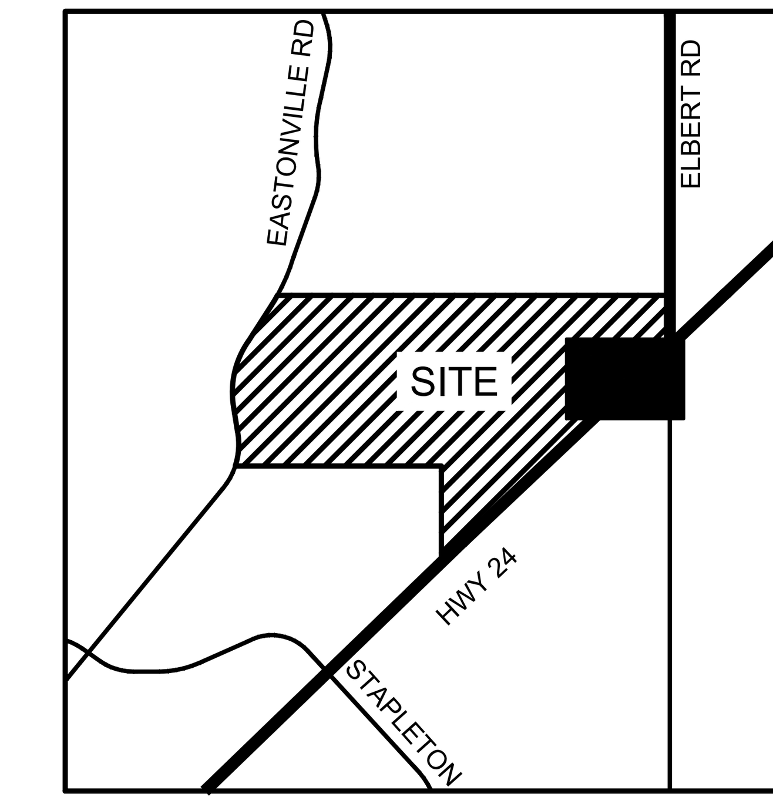

VICINITY MAP

LEGEND:

PROPOSED MAJOR CONTOUR — 5250
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR — 5250
EXISTING MINOR CONTOUR
PROPOSED STORM DRAIN PIPE
EXISTING STORM DRAIN PIPE
PROPOSED DRAINAGE CHANNEL
PROPOSED ROAD
PROPERTY LINE
DIRECTIONAL FLOW ARROW
EMERGENCY OVERFLOW ARROW
EXISTING 100-YR FLOODWAY
EXISTING 100-YR FLOODPLAIN
PROPOSED 100-YR FLOODPLAIN
WATERSHED BOUNDARY
MAJOR BASIN LINE
100YR ZONE A FLOODPLAIN
PROPOSED DETENTION LOCATION (A)
POTENTIAL WATER QUALITY LOCATION (WQ)
SWMM CONVEYANCE ELEMENT (SWMM)
PROPOSED PEAK FLOW RATE (CFS) (850)
DESIGN POINT (X)
PROPOSED BASIN LABEL — XX BASIN DESIGNATION; AREA (AC.) XX; XX % IMPERVIOUSNESS

LAND USE
LOW DENSITY
MEDIUM DENSITY
HIGH/MED DENSITY
HIGH DENSITY
CHURCH
COMMERCIAL
ELEMENTARY SCHOOL
COMMUNITY PARK

NOTES:

NORTH 0 50 100

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR8

FIG.DR8

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

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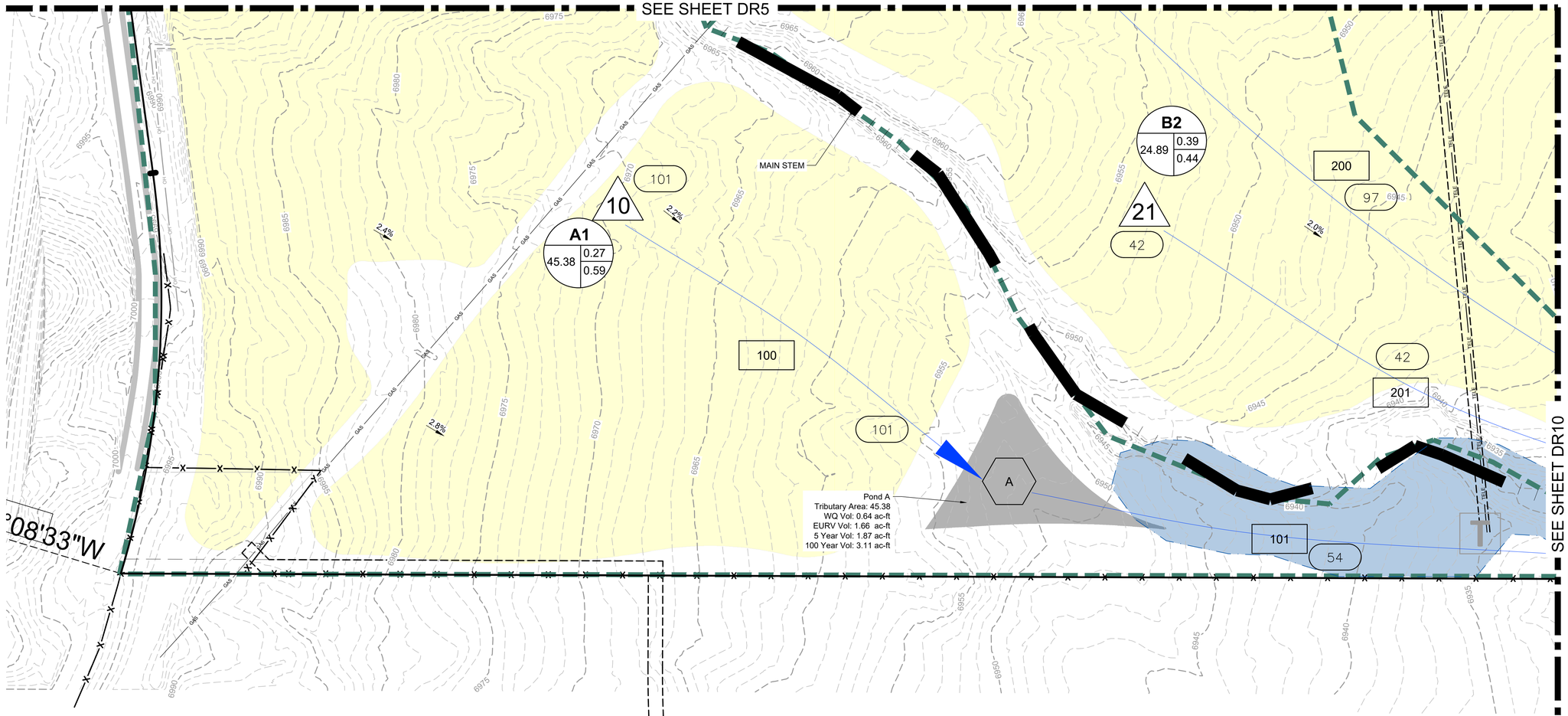
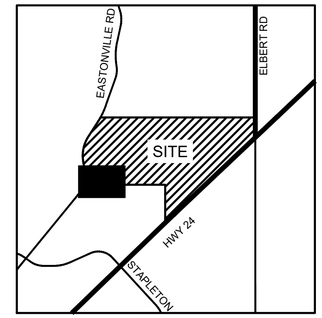
SEE SHEET DR5

SEE SHEET DR10





VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100–YR FLOODWAY
- EXISTING 100–YR FLOODPLAIN
- PROPOSED 100–YR FLOODPLAIN
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- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX) BASIN DESIGNATION; AREA (AC.) XX | XX % IMPERVIOUSNESS

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 100

50

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR9

FIG.DR9

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

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SEE SHEET DR6

SEE SHEET DR9

SEE SHEET DR11

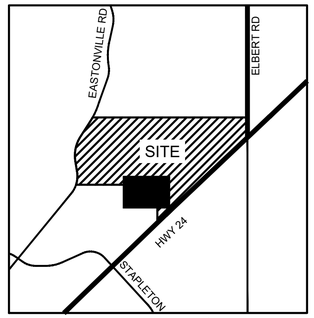
MAIN STEM TRIBUTARY NUMBER 2

Pond B
Tributary Area: 180.79
WQ Vol: 2.41 ac-ft
EURV Vol: 5.73 ac-ft
5 Year Vol: 6.04 ac-ft
100 Year Vol: 15.28 ac-ft

205
267
200
42
97
201
54
23
O1
202
136
B
164
206
O2
101
401
69
402
252

1.5%
2.2%
1.8%
1.7%

6935 6930 6925 6920 6915 6910 6905 6900 6895 6890 6885



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION — A
- POTENTIAL WATER QUALITY LOCATION — WQ
- SWMM CONVEYANCE ELEMENT — SWMM
- PROPOSED PEAK FLOW RATE (CFS) — 850
- DESIGN POINT — A
- PROPOSED BASIN LABEL — XX (BASIN DESIGNATION); AREA (AC.) XX; XX % IMPERVIOUSNESS

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH

0 100
50

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR10

FIG.DR10

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CADDwgs\Exhibits\00-Drainage Basins.dwg

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SEE SHEET DR8

SEE SHEET DR10

STATE HIGHWAY 24

D2
77.90 | 0.47 | 0.60

41
252

402
252

401
69

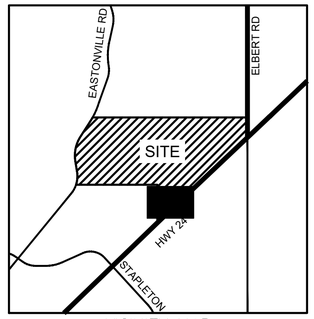
Pond D
Tributary Area: 102.23
WQ Vol: 1.96 ac-ft
EURV Vol: 6.56 ac-ft
5 Year Vol: 6.59 ac-ft
100 Year Vol: 10.13 ac-ft

D

161
403

O3
161

1.7%
1.9%
1.8%
1.7%
1.8%



VICINITY MAP

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPOSED DRAINAGE CHANNEL
- PROPOSED ROAD
- PROPERTY LINE
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW ARROW
- EXISTING 100-YR FLOODWAY
- EXISTING 100-YR FLOODPLAIN
- PROPOSED 100-YR FLOODPLAIN
- WATERSHED BOUNDARY
- MAJOR BASIN LINE
- 100YR ZONE A FLOODPLAIN
- PROPOSED DETENTION LOCATION (A)
- POTENTIAL WATER QUALITY LOCATION (WQ)
- SWMM CONVEYANCE ELEMENT (SWMM)
- PROPOSED PEAK FLOW RATE (CFS) (850)
- DESIGN POINT (X)
- PROPOSED BASIN LABEL (XX / AREA (AC.) XX XX / BASIN DESIGNATION / % IMPERVIOUSNESS)

LAND USE

- LOW DENSITY
- MEDIUM DENSITY
- HIGH/MED DENSITY
- HIGH DENSITY
- CHURCH
- COMMERCIAL
- ELEMENTARY SCHOOL
- COMMUNITY PARK

NOTES:

NORTH
0 100
50

HRGreen

Job No.:	191897.01
Prepared By:	TBI
Date:	04/14/2020

PROPOSED DR11

FIG.DR11

HRGreen DRAWING PATH:\\hrgreen.com\HRG\Data\2019\191897.01\CAD\Dwgs\Exhibits\00-Drainage Basins.dwg

EXHIBIT M: FEMA FLOODPLAIN MAPPING

possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

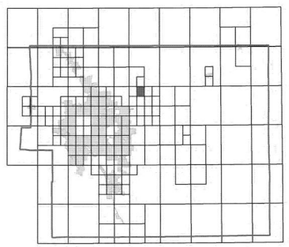
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

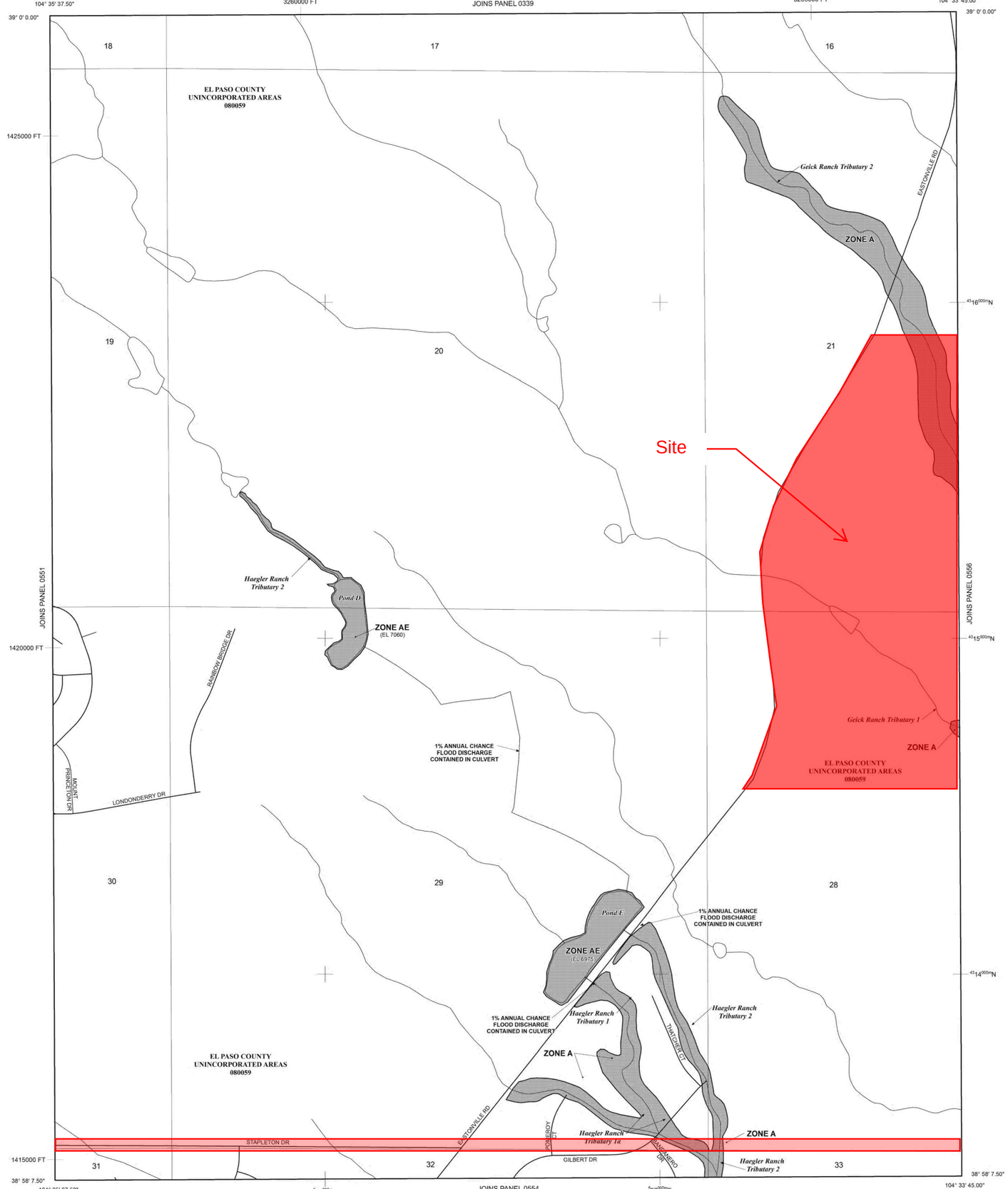
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 — 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4276000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0552G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 552 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0552	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0552G

MAP REVISED

possible updated or additional flood hazard information.

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Silver Spring, MD 20910-3282

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Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

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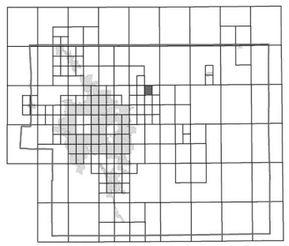
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

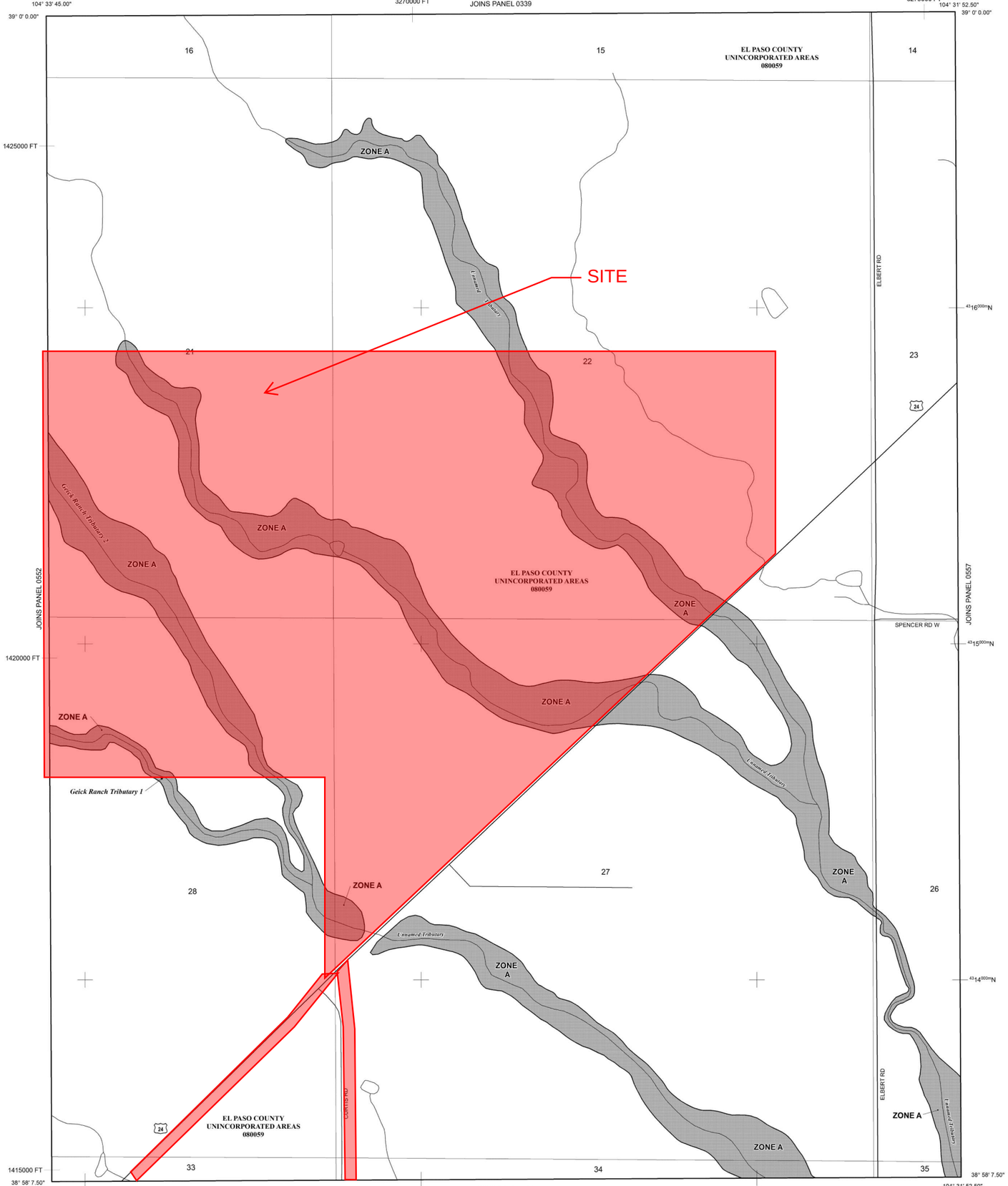
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A — Cross section line

23 — 23 — Transect line

97° 07' 30.00"
32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13

6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0556G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 556 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0556	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0556G

MAP REVISED

possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

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Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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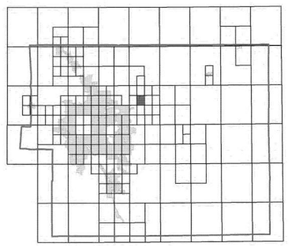
El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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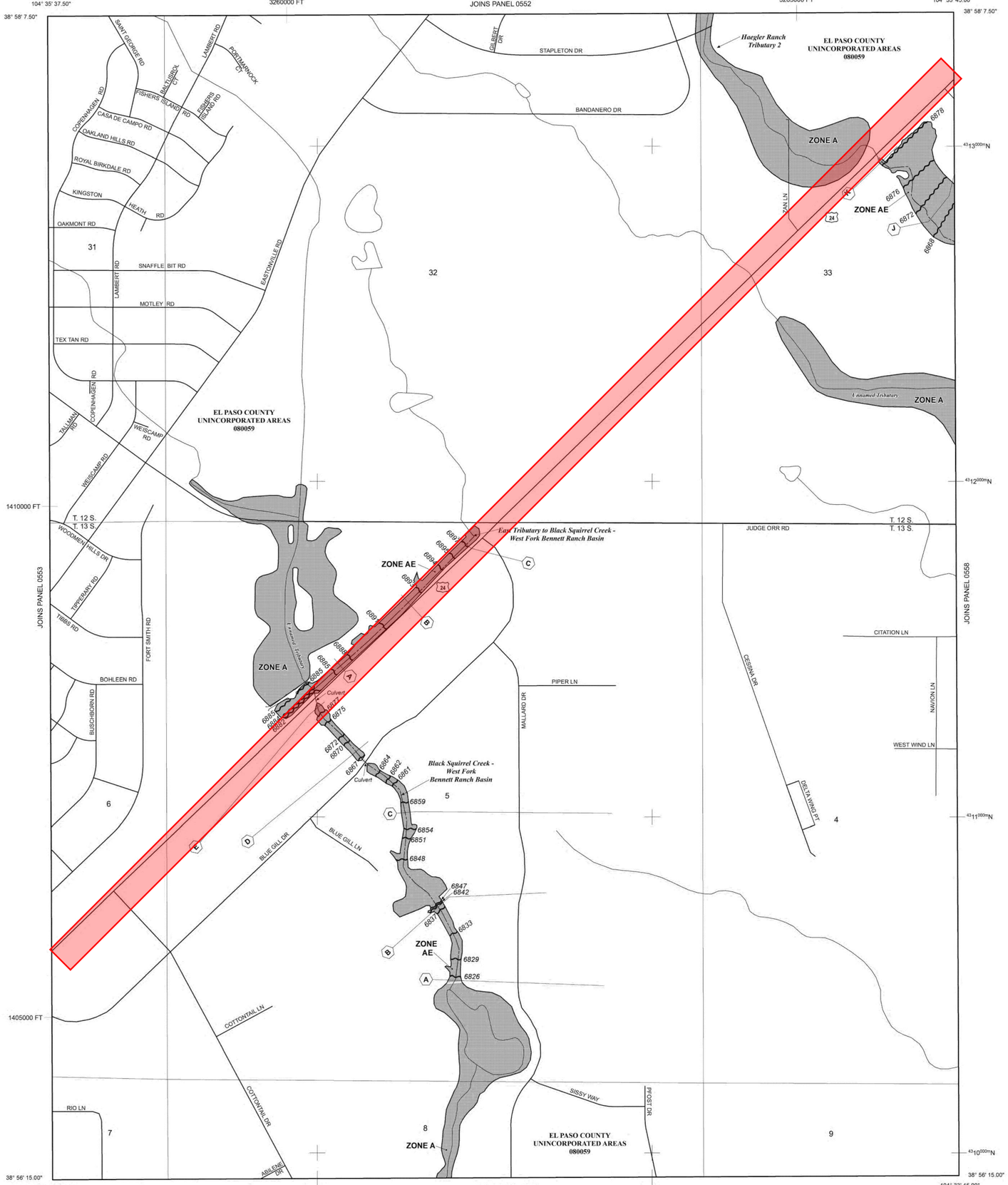

Flood Zone Descriptions

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A Cross section line
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97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
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DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

MAP REPOSITORIES
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EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0554G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 554 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0554	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0554G

MAP REVISED

possible updated or additional flood hazard information.

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1315 East-West Highway
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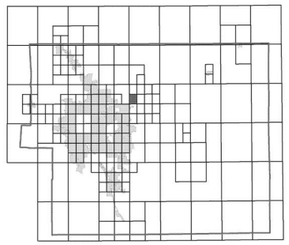
El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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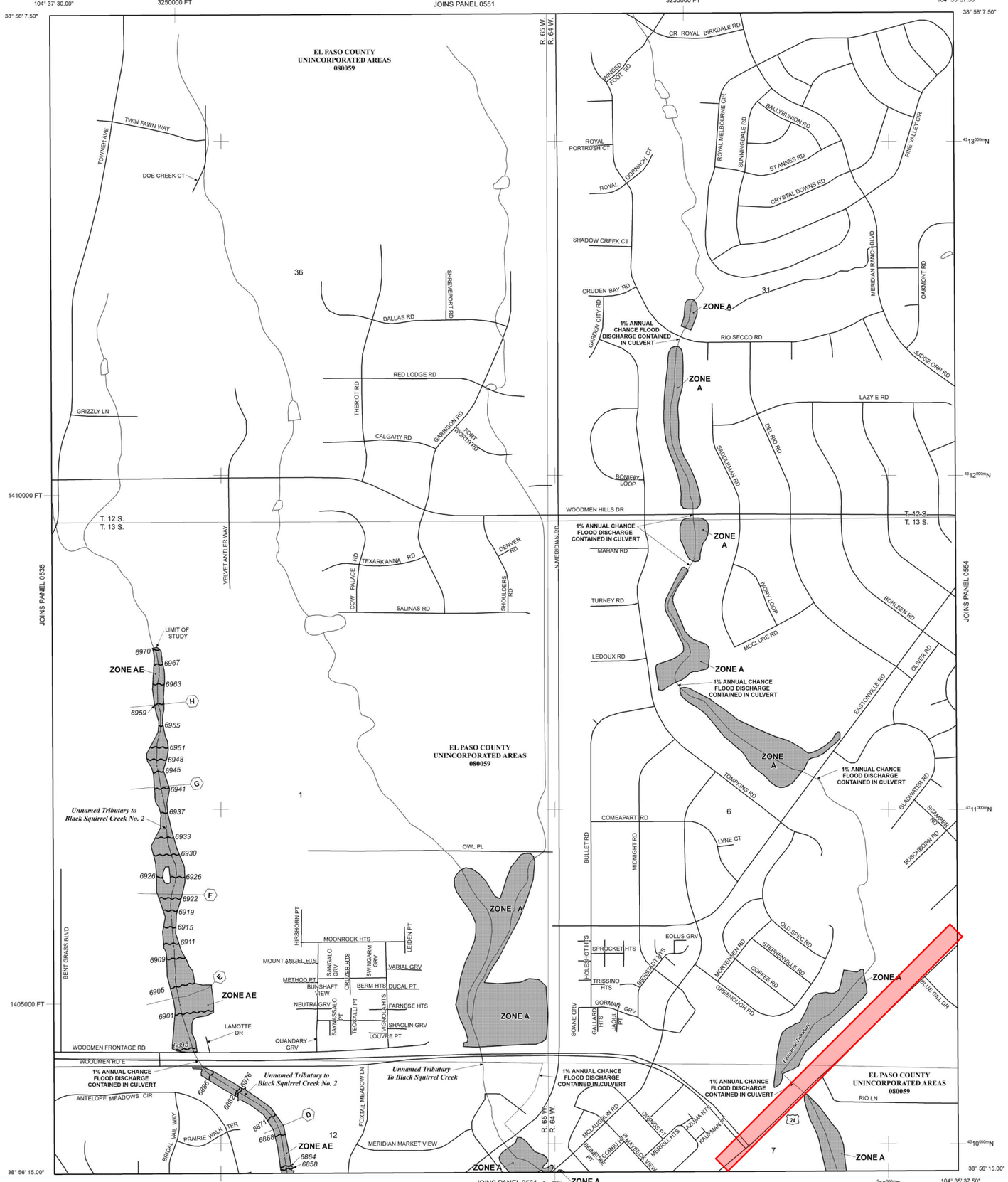

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

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ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

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COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

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Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

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A — A — Cross section line

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M1.5 — River Mile

MAP REPOSITORIES
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EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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MAP SCALE 1" = 500'

250 0 500 1000 FEET

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NFIP

PANEL 0553G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 553 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0553	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0553G

MAP REVISED

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

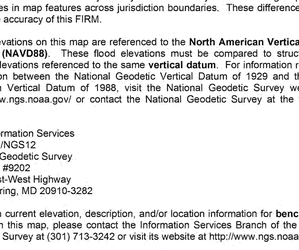
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

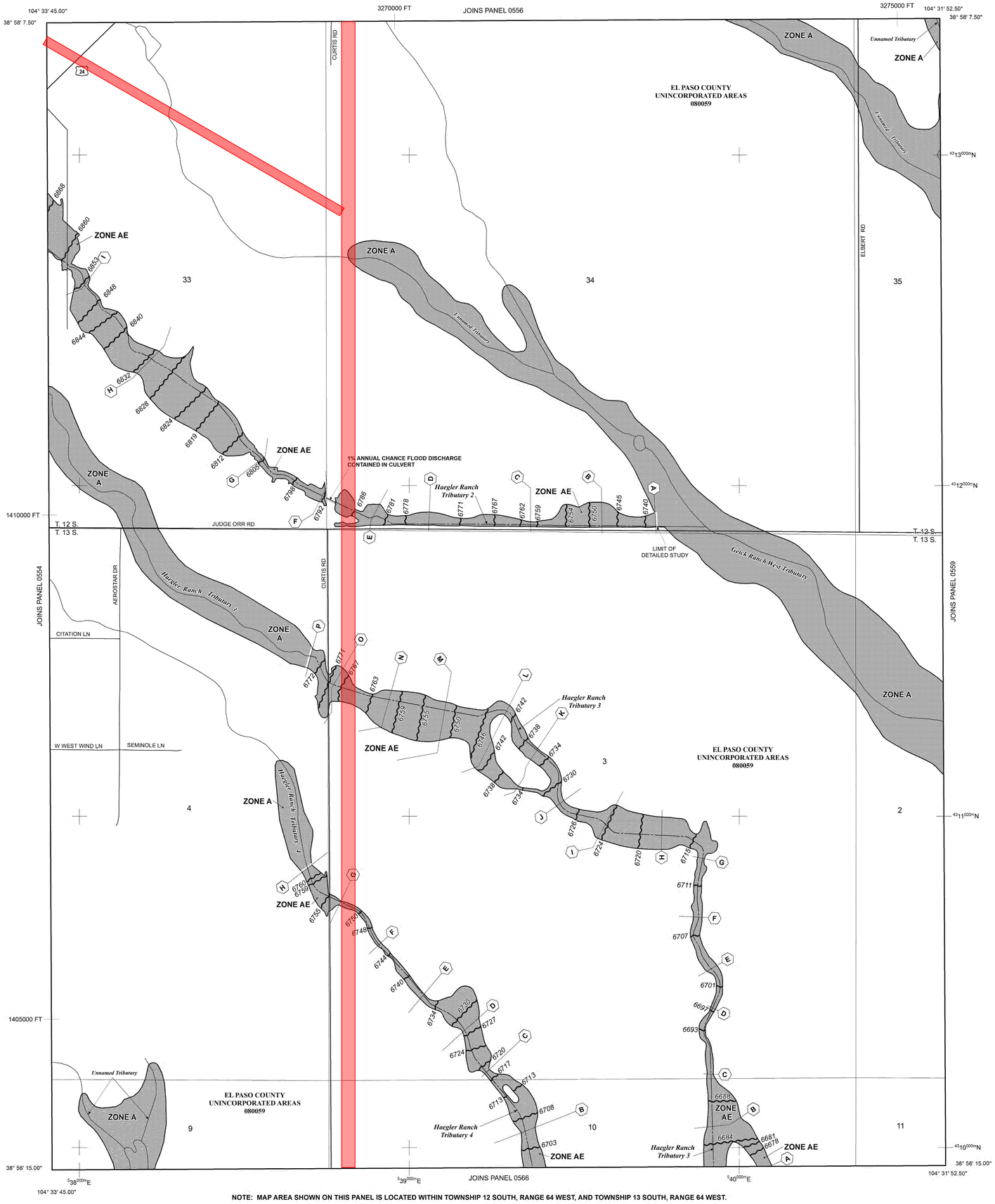
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST, AND TOWNSHIP 13 SOUTH, RANGE 64 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 — 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0558G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 558 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0558	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0558G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

EXHIBIT N: COLORADO PARKS & WILDLIFE CORRESPONDENCE

MEMO

To:	El Paso County
From:	HR Green
Subject:	Colorado Parks and Wildlife Exhibit
Project Number:	201662
Date:	August 4, 2021

Regarding Exhibit N of the 1041 Permit, please consult the following document as evidence of Correspondence with Colorado Parks and Wildlife. HR Green is in communication with Wildlife Manager, Aaron Berscheid. Based on discussions with Aaron Berscheid, further comments regarding Grandview Development will be provided upon referral of the PUD/PD from El Paso County to Colorado Parks and Wildlife, but the general recommendations contained withing the following documents for Waterbury (the property directly south of Grandview Reserve) also apply to the Grandview Reserve property. Thank you for your consideration.

COLORADO
Parks and Wildlife
Department of Natural Resources

Area 14, Southeast Region
4255 Sinton Road
Colorado Springs, CO 80907
P 719.227.5200 | F 719.227.5264

August 12, 2020

El Paso County
ATTN: Kari Parsons
2880 International Circle,
Colorado Springs, CO 80910

Re: Grandview Reserve Sketch Plan

Dear Ms. Parsons,

Colorado Parks and Wildlife (CPW) has reviewed the plans for the Grandview Reserve Sketch Plan in El Paso County, Colorado in the northwest corner of the intersection of Elbert Road and Colorado Highway 24. Colorado Parks and Wildlife (CPW) is in receipt of the above referenced permit application and is familiar with the site. CPW offers the following comments for your consideration.

CPW recommends crossing any riparian corridors and streams at a perpendicular angle, in order to reduce impacts to natural resources, as well as spanning the corridors with structures located outside the riparian and stream zone. During construction, stream crossing by construction vehicles should be avoided. CPW requests that any new service roads that are proposed for construction in conjunction with the project avoid crossing creeks or stream beds to avoid impacts to wildlife and habitat. If any new access or maintenance roads will be constructed that cross stream habitat, CPW would like to be consulted on best management practices and options for construction to minimize impacts. A construction design for any new or reconstructed riparian crossing that actively minimizes barriers to fish passage at all water levels and mitigates any existing barriers where possible would minimize the negative impact of the project on native fish species.

CPW recommends a 100 foot buffer zone be permanently placed around the creeks and ponds. If a trail is constructed near the creek or ponds, it should be a minimum of 100 feet from the edge. This buffer zone will offer wildlife utilizing the creek and ponds less disturbance by development and decrease the likelihood of human and wildlife encounters. The existing native riparian vegetation around the creeks, the ponds and in the drainage ways should be kept intact for wildlife habitat and to increase ground stabilization.

Trails would provide excellent opportunities for wildlife viewing. However, if trails are placed too close to areas utilized by wildlife it creates disturbances resulting in reduced wildlife

Dan Prenzlow, Director, Colorado Parks and Wildlife • Parks and Wildlife Commission: Marvin McDaniel, Chair • Carrie Besnette Hauser, Vice-Chair
Marie Haskett, Secretary • Taishya Adams • Betsy Blecha • Charles Garcia • Dallas May • Duke Phillips, IV • Luke B. Schafer • Jay Tutchton • Eden Vardy

viewing opportunities. CPW recommends constructing trails on the outer edges of open space areas. This minimizes wildlife disturbance and creates increased wildlife viewing opportunities. Trails near creeks and drainage areas should cross perpendicular rather than run parallel to these critical wildlife habitat areas. Crossings should occur in areas that have the least usage by wildlife in order to have minimal impacts on wildlife.
CPW recommends the development and implementation of a noxious weed control plan for the site. All disturbed soils should be monitored for noxious weeds and noxious weeds should be actively controlled until native plant revegetation and reclamation is achieved. Care should be taken to avoid the spread of noxious weeds, and all construction equipment should be cleaned prior to leaving the site. A noxious weed management plan should be developed prior to any disturbance of the site. ACPW recommends that all landscaping in the developed area should be comprised of native species. Using native species with high food and cover values in an open space area is beneficial to wildlife. This can encourage wildlife to concentrate in areas that minimize human conflicts and optimize wildlife watching opportunities. Native plant species can also provide an aesthetically pleasing landscape that requires little maintenance, and are frequently more drought-tolerant than non-native species

CPW also recommends that all areas of disturbance and exposed soils above the ordinary high water mark be re-vegetated with a native seed mix. This will contribute to the replacement of lost riparian vegetation values and minimize establishment of noxious weeds. The placement of willow sprigs or bare root stock should also be considered along the banks, especially in those areas which have been disturbed. We recommend planting of vegetation along the bank to help reduce and control erosion and contribute to bank stability over the long term. The site should be monitored for a period of at least two growing seasons. Any stands of noxious weeds that become established should be controlled with appropriate mechanical and/or chemical methods suitable for the proposed location. CPW recommends using a clean fill material, if needed, that would be conducive to growing native vegetation that will help stabilize the banks. Non-native vegetation can overrun native vegetation and can become problematic. A seed mixture of native grasses is also recommended to provide a good support system in the soil.

We appreciate being given the opportunity to comment. Please feel free to contact District Wildlife Manager, Aaron Berscheid, should you have any questions or require additional information at 719-439-9601 or via email at aaron.berscheid@state.co.us

Sincerely,

Frank McGee
Area Wildlife Manager

Cc: SE regional files
Area 14 files
Aaron Berscheid, DWM

EXHIBIT O: ECOS REPORT

Natural Features and Wetland Report for the Grandview Reserve Project in El Paso County, Colorado

August 12, 2020

Prepared for:

4 Site Investments
1271 Kelly Johnson Blvd., Ste. 100
Colorado Springs, CO 80920

Prepared by:

ecosystem services LLC

1455 Washburn Street
Erie, Colorado 80516
(p): 970-812-3267

Project Number: 2018-15-1

Ecosystem Services, LLC
Response to El Paso County Comments
Regarding The
Natural Features and Wetland Report (Report) for the
Grandview Reserve Project
in El Paso County, Colorado

Responses to County Comments RE: April 10, 2020 Report:

1) The County comments were inserted as text boxes in the April 10, 2020 Report (please refer to the County's internal copy of this marked up Report). Ecos resubmitted the Report with a revision date of July 10, 2020 in response to County comments (refer to 7/10/20 Report on file with the County).

General Response:

Ecos stated in several sections of the Report "…the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500-foot elevation limits documented for the species and recommended for conducting surveys by the USFWS." We did not insert ULTO references and requirements, write up an action plan and mitigation recommendations, etc. per County comments, as these actions are not required by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA). In the 7/10/20 report we have attached the 2020 ESA Clearance from USFWS for this Site which states, " Ute ladies-tresses orchid and Preble's meadow jumping mouse are not likely to occupy the project site. Project is still consistent with the section 7 conclusions from 2019." Ecos also attached our request for said 2020 ESA Clearance which was mandated by the County due to a site plan change, noting that an ESA Clearance applies to a Site regardless of site plan.

Detailed Responses to each comments inserted into the April 10, 2020 Report with references to page and section:

Based on the explanation above Ecos did not make any revisions regarding ULTO, however we did insert the new Figure 2 Sketch Plan HR Green prepared that better illustrates topography (per other County comments). Our detailed response to each of the County comments are below:

- Page iii, Acronyms and Abbreviations – Ecos has not inserted the acronym "ULTO" as we do not use said acronym in our Report. The County had inserted this acronym in their comments.
- Page 1, 1.1 Purpose – We assume the notes "ULTO" (pointing at the Vegetation bullet) and "USFW survey required for a recommended 3 years for ULTO" (pointing at the Federal and State Listed, Candidate, Threatened and Endangered Species bullet) are for the County's reference as they do not belong or need to be inserted in a general "bullet" listing of resources reviewed in the Report.
- Page 9, 3.3 Vegetation – A text box stating, "Address action plan for ULTO" is pointing at an excerpt taken from the USFWS March 25, 2019 response to our 2019 ESA Clearance Request (Appendix F of April 10, 2020 Report) in which the USFWS states that, "…the project area has not yet been surveyed for ULTO…" and "The Grandview Reserve subdivision would be located between 7020 and 6860 feet above mean sea level, which is higher than the 6500-foot elevation recommended for conducting ULTO surveys." No action plan for ULTO is required under the law as the USFWS has issued a legal document in response to our 2020 Endangered Species Act (ESA) Clearance Request that states, "Ute ladies-tresses orchid and Preble's mouse are not likely to occupy the project site. Project is still consistent with the section 7 conclusions from 2019." The Agency has indicated that they have "No Concern" with our findings under the ESA. We also made sure to clarify 2 items in our 2020 Revised Report:
    - The recommendation for a ULTO survey was removed from Table 3 of the report as it prompted the USFWS to provide Survey Guidelines in their response to our 2019 ESA Clearance Request; and
    - We stated in Table 3 that "…the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500-foot elevation limits documented for the species and recommended for

conducting surveys by the USFWS." This fact was presented in the USFWS 2019 response to Ecos' 2019 ESA Clearance Request that the County is referencing and inserting in their comments (refer to USFWS March 25, 2019 response to Ecos 2019 ESA Clearance Request in Appendix F of April 10, 2020 Report as cited in the USFWS March 25, 2019 response excerpt referenced above).

- Page 12, Section 3.4 Wetland Habitat and Waters of the U.S., Sub-section 3.4.2 Field Assessment Findings, items 1) Jurisdictional wetland habitat and waters of the U.S. and 2) Non-Jurisdictional, Isolated Wetlands –Label each on figures". The County has requested that we label the applicable figures to indicate which Drainages are Jurisdictional and Non-Jurisdictional. Figure 6 on page 15 is the only Figure referenced in this section and the only one that represents the content of the County comments; and Figure 6 clearly labels each Drainage by alpha designation (A – D) and Jurisdictional and Non-Jurisdictional status.
- Page 28, Table 3 – A text box stating, "address mitigation, protection" is pointing at the Ute ladies tresses box in the table. No mitigation plan for ULTO is required under the law as the USFWS has issued a legal document in response to our 2020 ESA Clearance Request that states, ""Ute ladies-tresses orchid and Preble's mouse are not likely to occupy the project site. Project is still consistent with the section 7 conclusions from 2019." The Agency has indicated that they have "No Concern" with our findings under the ESA. We also made sure to clarify 2 items in our 2020 Revised Report:
    - The recommendation for a ULTO survey was removed as it prompted the USFWS to provide Survey Guidelines in their response to our 2019 ESA Clearance Request; and
    - We stated in Table 3 that "…the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500-foot elevation limits documented for the species and recommended for conducting surveys by the USFWS." This fact was presented in the USFWS 2019 response to Ecos' 2019 ESA Clearance Request that the County is referencing and inserting in their comments (refer to USFWS March 25, 2019 response to Ecos 2019 ESA Clearance Request in Appendix F of April 10, 2020 Report as cited in the USFWS March 25, 2019 response excerpt referenced above).

2) 6/30/20 EDARP Review; PCD Manager Comments – These comments are still referencing the March 25, 2109 letter from USFWS and as such are not applicable. As explained in our detailed response to the comments on our Report (above), we will not be implementing any of the recommendation regarding Ute-ladies-tresses orchid as they are not likely to occupy the project site as confirmed by the USFWS.

3) 4/27/20 Community Services Department, Environmental Division comments –

- Wetland habitat: The Applicant will apply for and provide a Clean Water Act Section 404 Permit to the Planning and Community Development Department prior to undertaking ground-disturbing activities if the onsite wetland areas are proposed to be impacted. Ecos has addressed this issue in 7.1 of all previous versions of the Report and again in the 7/10/20 Report.
- Wildlife Habitat: The Applicant will prepare a fencing plan to avoid negative conflicts with pronghorn in accordance with CPW guidelines. The Applicant will perform two surveys for migratory birds and their nests approximately 1 – 2 months prior to 1 week prior to construction to ensure compliance with the MBTA. Avoidance of nest take or harm is typically feasible and if not, then a permit will be processed with the USFWS. These comments are addressed below in Ecos' response to the County comments received for the 7/10/20 report.

4) 4/22/19 Community Services Department, Environmental Division comments –

- Comment 1: "Two jurisdictional wetlands have been identified on the property. A completed U.S. Army Corps of Engineers (USCOE) permit shall be provided to the Planning and Community Development Department prior to undertaking ground-disturbing activities in these jurisdictional wetland areas. The applicant is hereby on notice that the USCOE has regulatory jurisdiction over wetlands. It is the applicant's responsibility, and not El Paso County's, to ensure compliance with all applicable laws and regulations, including, but not limited to, the Clean Water Act." Ecos has addressed this issue in 7.1 of all previous versions of the Report and again in the 7/10/20 Report.

- Comment 2: “Documentation from the U.S. Fish and Wildlife Service (USFWS) shall be provided to the Planning and Community Development Department prior to project commencement where the project will result in ground disturbing activity in habitat occupied or potentially occupied by threatened or endangered species and/or where development will occur within 300 feet of the centerline of a stream or within 300 feet of the 100 year floodplain, whichever is greater.“ Ecos has provided USFWS ESA Site Clearance concurrence responses dated March 25, 2019 response to our 2019 ESA Clearance Request (Appendix F of April 10, 2020 Report) and April 29, 2020 (Appendix F of July 10, 2020 Report).
- Comment 3: “ The project will interfere with wildlife habitat. Information regarding wildlife protection measures shall be provided including fencing requirements, garbage containment, and riparian/wetland protection/buffer zones, as appropriate. Information can be obtained from Colorado Parks and Wildlife.” Fencing requirements are addressed below in Ecos’ response to the County comments received for the 7/10/20 report. Garbage containment will be addressed by the Grandview Reserve HOA. Riparian/wetland protection/buffer zones have been incorporated into the Sketch Plan by design.
- General Comment: “ It is strongly recommended that the applicant obtain the necessary approvals from all federal, state and county agencies as a part of their planning process.” Ecos references obtaining permits for all applicable environmental issues in Section 7.0 of all previous versions of the Report and again in the 7/10/20 Report.

Responses to County Comments RE: July 10, 2020 Report:

The El Paso County, Community Services Department, Environmental Division provided a comment letter dated 7/17/20. Ecos has incorporated applicable revision into this August 12, 2020 revision of the Report, as summarized below:

- Comment 1: “Two jurisdictional wetlands have been identified on the property. A completed U.S. Army Corps of Engineers (USCOE) permit shall be provided to the Planning and Community Development Department prior to undertaking ground-disturbing activities in these jurisdictional wetland areas. The applicant is hereby on notice that the USCOE has regulatory jurisdiction over wetlands. It is the applicant’s responsibility, and not El Paso County’s, to ensure compliance with all applicable laws and regulations, including, but not limited to, the Clean Water Act.” Ecos has addressed this issue in 7.1 of all previous versions of the Report and again in the 8/12/20 Report.

- Comment 2: “2. The project will interfere with wildlife habitat including pronghorn range. In accordance with Colorado Parks and Wildlife guidelines, the applicant will prepare a fencing plan to avoid negative conflicts with pronghorn.” Ecos revised Section 6.6 of the 8/12/20 Report to acknowledge this request, noting our intention to discuss this with the county, as follows: “2. Ecos has recommended that the Project minimize the installation of fencing to avoid injury to wildlife. When fencing is needed, we have specified the use of wildlife friendly fences or the inclusion of specific wildlife crossings along fence lines. Pronghorn are of particular concern because they do not jump over fences and can be injured by barbed-wire fences. The El Paso County, Community Services Department, Environmental Division has requested that fencing be installed to “avoid negative conflicts with pronghorn”. Therefore, <u>ecos will discuss this with the County and if deemed to be in the best interest of pronghorn protection</u>, work with the Applicant to prepare a fencing plan in accordance with Colorado Parks and Wildlife guidelines.

  Ecos’ recommendation is that fencing is not required to avoid impacts with pronghorn as they are a timid and non-confrontational species that avoids interaction with humans as a regular course of their survival. The County Environmental Divisions references fencing be installed, “In accordance with Colorado Parks and Wildlife guidelines…”, however pursuant to the CPW publication *Fencing with Wildlife in Mind* CPW does NOT advocate for the use of fences; rather they try to rationalize that fencing may not be required at all, and only provides guidelines for the portion of the public that feels they need fences for other reasons such as privacy and security.

The CPW guidance publication *Fencing with Wildlife in Mind* correctly states on page 5 in the section titled *Do You Really Need a Fence?* That, "…the best fence for wildlife is no fence at all…In some cases, though, there are good alternatives to fences. People, especially those new to mountain and foothill communities, tend to put up fencing along their property lines. If the property contains important habitat and the fence excludes wildlife, the animals lose food, water, resting areas, and travel corridors." and "There are many creative ways to define boundaries, discourage trespass, or maintain privacy. A line of trees, shrubs, and other vegetation can be used to mark a boundary, screen for privacy, beautify your landscape, and provide additional food and cover for wildlife. The areas that wildlife choose as travel corridors are often the same places that you would want to preserve in a natural state to retain the scenic amenities and aesthetic value of your property. You could also consider marking property boundaries with signs, flexible fiberglass or plastic boundary posts, or fence posts spaced at intervals without cross-wires. If you only fence the portions of your property that you need to protect, you'll be saving time, money, and wildlife."

Furthermore, in the section titled *Considerations for Fence Design* CPW states, "If a fence is needed, please consider fence placement and designs that minimize the impact on wildlife." And "Wherever possible, design your fence to provide wildlife free travel to important habitats and corridors, as well as access to water. Wetlands and riparian habitats are especially important for all wildlife." Please refer to the CPW manual at: https://cpw.state.co.us/Documents/LandWater/PrivateLandPrograms/FencingWithWildlifeInMind.pdf

- Comment 3: "3. The project will interfere with wildlife habitat including potentially nesting migratory birds. The applicant will perform two surveys for migratory birds and their nests approximately one to two months prior to one week prior to construction. The take of migratory birds and their nests will be avoided. The applicant is hereby on notice that the U.S. Fish and Wildlife Service has regulatory jurisdiction over migratory birds. It is the applicant's responsibility, and not El Paso County's, to ensure compliance with all applicable laws and regulations, including but not limited to, the Migratory Bird Treaty Act." Ecos has revised Section 7.3 of the 8/12/20 Report to specify that 2 surveys will be performed prior to construction pursuant to the wording recommended by the County. However, as Wildlife Biologists our typical approach includes formulating site-specific migratory bird/raptor impact avoidance recommendations by discussing the proposed Construction Start Date with the Applicant well in advance to recommend the best start date and work timeframe to avoid and/or minimize migratory bird/raptor impact. At this phase of the Project it was not yet appropriate to insert this specific language, but ecos intends to work with the Applicant as outlined in the following text. We will wait until the Construction Start Date is first proposed, make our site-specific recommendations (outlined above) and once the Construction Start Date is finalized, we then set the date for the first survey based on seasonal conditions that make nest identification most effective such that the field surveyor may have maximum opportunity to identify all potential nests. The second survey is always set one week or less prior to construction to ensure no new nest have been established.

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LIST OF ACROYNMS AND ABBREVIATIONS

AMSL	above mean sea level
Applicant	4 Site Investments
CCRs	Codes, Covenants and Restrictions
CDA	Colorado Department of Agriculture
CNHP	Colorado Natural Heritage Program
COGCC	Colorado Oil and Gas Conservation Commission
CPW	Colorado Parks and Wildlife
CWA	Clean Water Act
Ecos or ecos	Ecosystem Services, LLC
JD	Jurisdictional under the Clean Water Act
Non-JD	Non- jurisdictional under the Clean Water Act
PMJM	Preble's meadow jumping mouse
Report	Natural Features and Wetland Report
Site	Grandview Reserve
NRCS	Natural Resource Conservation Service
NTCHS	National Technical Committee for Hydric Soils
NWI	National Wetland Inventory
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WOUS	Waters of the United States

1.0 INTRODUCTION

Ecosystem Services, LLC (Ecos or ecos) was retained by 4 Site Investments (Applicant) to perform a natural resource assessment for the proposed Grandview Reserve project (Project) and to prepare this Natural Features and Wetland Report (Report).

The contact information for the Applicant and ecos representatives for this Report is provided below:

Applicant

Peter Martz
4 Site Investments
1271 Kelly Johnson Blvd., Ste. 100
Colorado Springs, Colorado 80920
Phone: 719-492-1993
pmartzlrg@comcast.net

Agent

Grant E. Gurnée, P.W.S.
Ecosystem Services, LLC
1455 Washburn Street
Erie, Colorado 80516
Phone: (970) 812-6167
grant@ecologicalbenefits.com

1.1 Purpose

The purpose of this Report is to identify and document the natural resources, ecological characteristics and existing conditions of the Project site (Site); identify potential ecological impacts associated with Site development; and provide current regulatory guidance related to potential development-related impacts to natural resources. The specific resources and issues of concern addressed in this Report are in conformance with the El Paso County requirements (refer to Section 2.0), and include:

- Mineral and Natural Resource Extraction;
- Vegetation;
- Wetland Habitat and Waters of the U.S.
- Weeds;
- Wildfire Hazard;
- Wildlife;
- Federal and State Listed, Candidate, Threatened and Endangered Species; and
- Raptors and Migratory Birds.

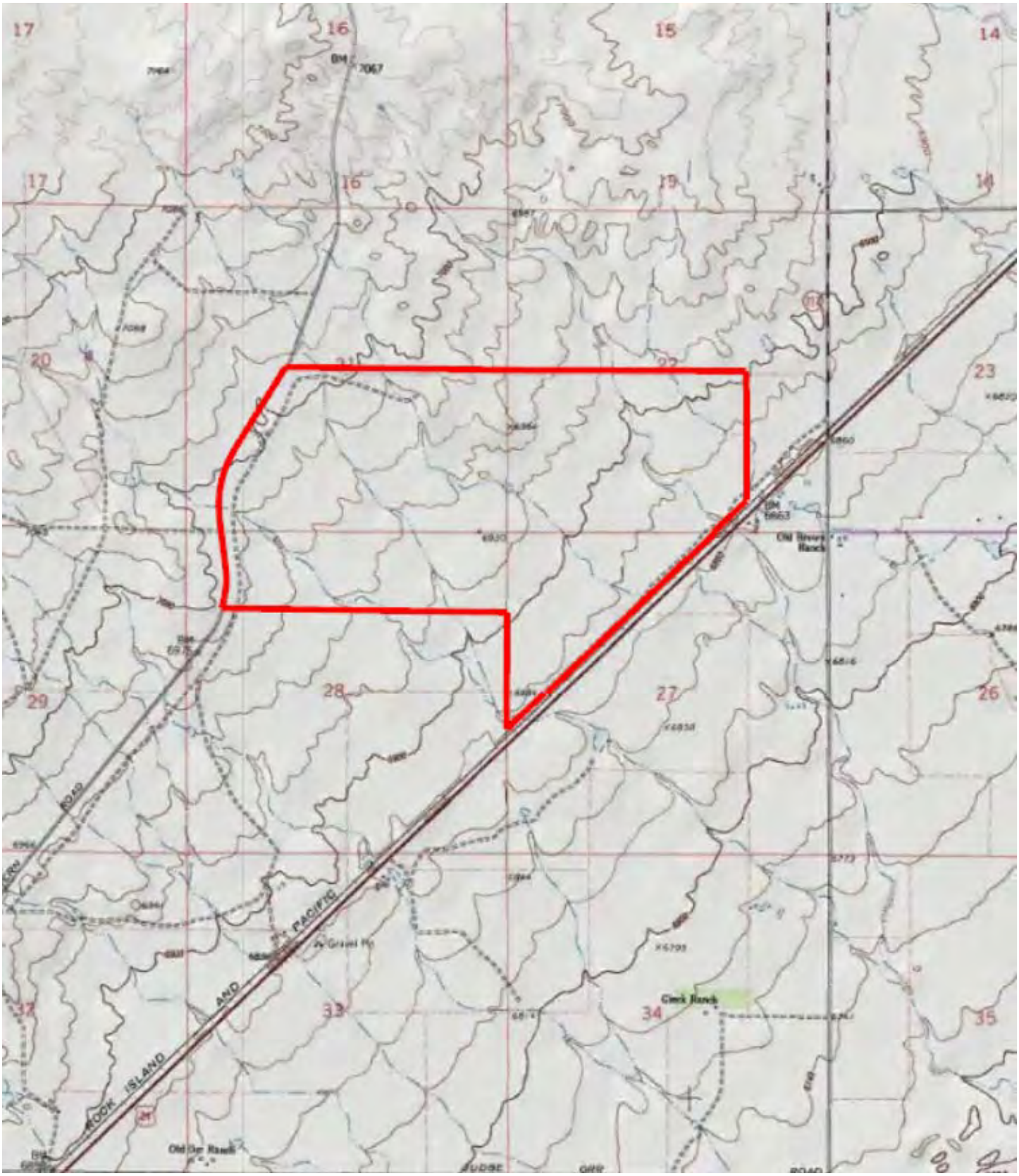
1.2 Site Location and Project Description

The Site is located in the Falcon/Peyton area of El Paso County and is bounded along the north by 4 Way Ranch Phase I, along the south by Waterbury, along the southeast by Highway 24, and along the west by Eastonville Road. There are no existing structures, roads, or other infrastructure on the Site. The Site is located approximately 4.14 miles southwest of Peyton, 4.16 miles northeast of Falcon and 4.66 miles south of Eastonville, in El Paso County, Colorado. The Site is generally located within the south ½ of Section 21, south ½ of Section 22, the north ½ of Section 27, and the north ½ of Section 28, Township 12 South, Range 64 West in El Paso County, Colorado. The center of the Site is situated at approximately Latitude 38.98541389 north, -104.55472222 east (refer to Figure 1).

The Applicant proposes to develop the 768.2-acre Site as a mixed use residential and commercial community consisting of the following:

Table 1 – Land Use Summary				
Land Use Category	**Acreage**	**Acreage %**	**Density Units/Acre**	**Units**
School	10.9 acres	1.4%	NA	NA
Church	6.1 acres	0.8%	NA	NA
Low Density Residential	134.1 acres	17.5%	2	268
Medium Density Residential	272.5 acres	35.5%	4	1090
Medium-High Density Residential	65.6 acres	8.5	8	524
High Density Residential	114.9 acres	15.0%	12	1378
Commercial	16.4 acres	2.1%	NA	NA
Open Space[1]	127.1 acres	16.5%	NA	NA
Rex Road Collector	20.6 acres	2.7%	NA	NA
TOTAL	**768.2 acres**	**100%**	**-**	**3260**
Note 1: Open Space includes: Detention, Drainage Corridors, General Open Space & Easements and R.O.W. Buffer of Eastonville Road and Highway 24				

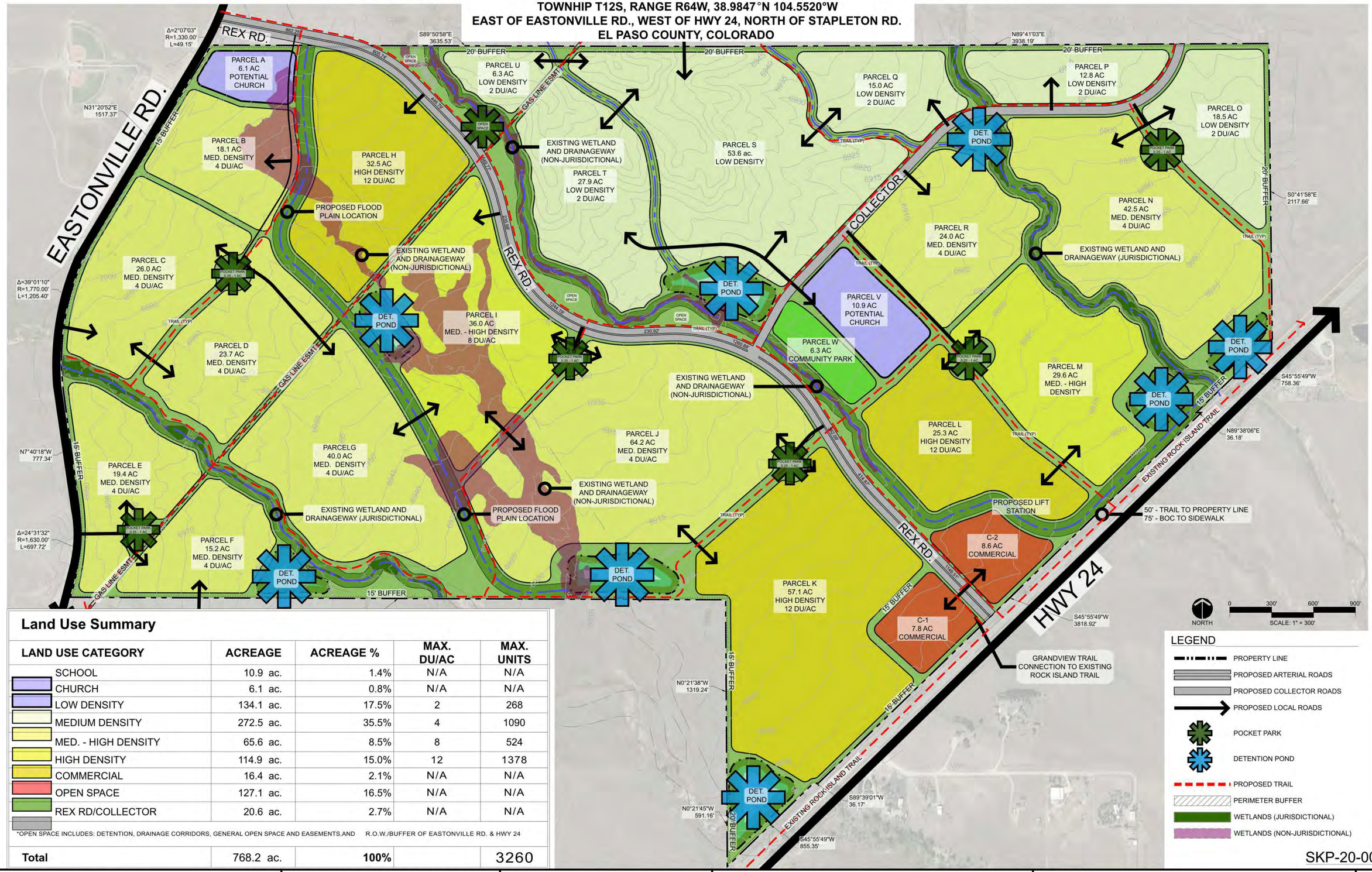
Please refer to Figure 2.



USGS 7.5 min. Quad: Falcon
Latitude: 38.985713°N
Longitude: -104.552854°W
Section 21, 22, 27 & 28, Township 12 South, Range 64 West

GRANDVIEW RESERVE SKETCH PLAN

TOWNHIP T12S, RANGE R64W, 38.9847°N 104.5520°W
EAST OF EASTONVILLE RD., WEST OF HWY 24, NORTH OF STAPLETON RD.
EL PASO COUNTY, COLORADO



Land Use Summary

LAND USE CATEGORY	ACREAGE	ACREAGE %	MAX. DU/AC	MAX. UNITS
SCHOOL	10.9 ac.	1.4%	N/A	N/A
CHURCH	6.1 ac.	0.8%	N/A	N/A
LOW DENSITY	134.1 ac.	17.5%	2	268
MEDIUM DENSITY	272.5 ac.	35.5%	4	1090
MED. - HIGH DENSITY	65.6 ac.	8.5%	8	524
HIGH DENSITY	114.9 ac.	15.0%	12	1378
COMMERCIAL	16.4 ac.	2.1%	N/A	N/A
OPEN SPACE	127.1 ac.	16.5%	N/A	N/A
REX RD/COLLECTOR	20.6 ac.	2.7%	N/A	N/A
Total	768.2 ac.	**100%**		3260

*OPEN SPACE INCLUDES: DETENTION, DRAINAGE CORRIDORS, GENERAL OPEN SPACE AND EASEMENTS,AND R.O.W./BUFFER OF EASTONVILLE RD. & HWY 24

LEGEND

- PROPERTY LINE
- PROPOSED ARTERIAL ROADS
- PROPOSED COLLECTOR ROADS
- PROPOSED LOCAL ROADS
- POCKET PARK
- DETENTION POND
- PROPOSED TRAIL
- PERIMETER BUFFER
- WETLANDS (JURISDICTIONAL)
- WETLANDS (NON-JURISDICTIONAL)

SKP-20-001

HR GREEN Xrefs: 01-DV-OSCN_sgt-1-ARCH DH01: 01-VICINITY MAP- 01-XL-CONCEPT: 01-DV-SURF

DRAWN BY: JAG JOB DATE: 7/6/2020
APPROVED: PLS JOB NUMBER: 191897
CAD DATE: ----
CAD FILE: J:\2019\191897\CAD\Dwgs\L\01-L-SHEETS
BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1" IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen HRGreen.com

GRANDVIEW RESERVE
4 SITE INVESTMENT, LLC
FALCON, COLORADO

GRANDVIEW RESERVE SKETCH PLAN
SKETCH PLAN

SHEET SP1.2

2.0 METHODOLOGY

Ecos performed an office assessment in which available databases, resources, literature and field guides on local flora and fauna were reviewed to gather background information on the environmental setting of the Site. We consulted several organizations, agencies, and their databases, including:

- Colorado Department of Agriculture (CDA) Noxious Weed List;
- Colorado Natural Heritage Program (CNHP);
- Colorado Oil and Gas Conservation Commission (COGCC) GIS Online;
- Colorado Parks and Wildlife (CPW);
- El Paso County Master Plan;
- El Paso County, Sub-Area Plan (provided by Client);
- Federal Emergency Management Agency (FEMA);
- Google Earth current and historic aerial imagery;
- Survey of Critical Biological Resources, El Paso County, Colorado;
- Survey of Critical Wetlands and Riparian Areas in EI Paso and Pueblo Counties, Colorado;
- U.S. Army Corps of Engineers (USACE) 1987 Corps of Engineers Wetlands Delineation Manual;
- USACE 2010 Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Great Plains Region;
- U.S. Department of Agriculture (USDA) PLANTS Database;
- U.S. Fish and Wildlife Service (USFWS) Region 6;
- USFWS National Wetland Inventory (NWI);
- USFWS IPaC database search; and
- U.S. Geological Survey (USGS).

Ecos also reviewed pertinent, site-specific background data provided by 4 Site Investments and their consulting Team, including: topographic base mapping, site development plans, and other data pertinent to the assessment.

Ecos reviewed, and incorporated the requirements of the following regulations into, this Report:

1) Chapter IV. Zoning Regulations, Section 35.13 – Development Requirements for Mineral and Natural Resource Extraction Operations;
2) Chapter V. Subdivision Regulations:
    a. Section 51.5 – Wildlife Hazard and Vegetation Reports; and
    b. Section 51.6 – Streams, Lakes, Physical Features and Wildlife Habitats.
3) Chapter 6 - General Development Standards:
    a. Section 6.3.3 - Wildfire Protection and Wildfire Mitigation;
    b. Section 6.3.7 - Noxious Weeds;

c. Section 6.3.8 – Wetlands; and
d. Section 6.3.9 – Wildlife.

4) Chapter 8 - Subdivision Design, Improvements and Dedications:
    a. Section 8.4.2 Environmental Considerations:
        i. Item A.4. – Threatened and Endangered Species Compliance; and
        ii. Item B.1. - Hazards
            1. l00-year floodplain as identified by the applicant, review agency, or the Floodplain Administrator; and
            2. Wildfire hazards as identified on the County and State wildfire hazard inventory or maps.
5) El Paso County Master Plan: Pertinent Maps and descriptors to append all of the topics, regulations and guidance referenced above, including:
    a. Wetland Habitat Maps and descriptors; and
    b. Wildlife Habitat Maps and descriptors.

Following the collection and review of existing data and background information, ecos conducted a field assessment of the Site to identify any potential impacts to natural resources associated with the Project. Field reconnaissance concentrated on identification of wetland habitat, waters of the U.S., wildlife habitat (including habitat suitable to support threatened and endangered wildlife) significant topographic features, noxious weeds and vegetation. Wetland habitat and waters of the U.S. boundaries, wildlife habitat, major vegetation communities, and significant weed stands were sketched on topographic and aerial base maps and located using a hand-held Global Positioning System as deemed necessary. Representative photographs were taken to assist in describing and documenting Site conditions and potential ecological impacts.

The office and onsite assessment data, the pertinent El Paso County regulations outlined above, and Natural Resource Assessment and Wetland report examples used in previous County land development review submittals (provided by El Paso County) were used in the preparation of the Report.

3.0 ENVIRONMENTAL SETTING

The Site is located in the Southwestern Tablelands Ecological Region (Chapman et al, 2006), which is primarily comprised of sub-humid grassland and semiarid rangeland. More specifically, the Site is located in the Foothills Grassland sub-region (26j) which contains a mix of grassland types with some small areas of isolated tallgrass prairie species that are more common much farther east. The proximity to runoff and moisture from the Front Range and the more loamy, gravelly, and deeper soils are able to support more tallgrass and midgrass species than neighboring ecoregions. Big and little bluestem, yellow indiangrass and switchgrass occur, along with foothill grassland communities. The annual precipitation of 14 to 20 inches tends to be greater than in regions farther east. Soils are loamy, gravelly, moderately deep, and mesic. Rangeland and pasture are common , with small areas of cropland. Urban and suburban

development has increased in recent years, expanding out from Colorado Springs and the greater Denver area.

3.1 Topography

The Site is generally characterized as gently sloping from northwest to southeast with four ephemeral drainages (prairie sloughs) present, two of which are discontinuous and two are tributary to Black Squirrel Creek offsite. Naturally undulating swales drain toward the sloughs, which contain wetlands in low areas and dry areas where alluvial deposits have formed. Site topography ranges from a high elevation of 7020 feet above mean sea level (AMSL) in the northwestern corner to a low elevation of 6860 feet above AMSL where the northeastern tributary exits the Site on the southeast boundary along Highway 24; for a total elevation drop of 160 feet. An ill-defined and undulating hill, which is likely an eroded remnant bluff, is present in the north-central portion of the Site. Refer to Figure 3 for the Topographic Map.

3.2 Soils

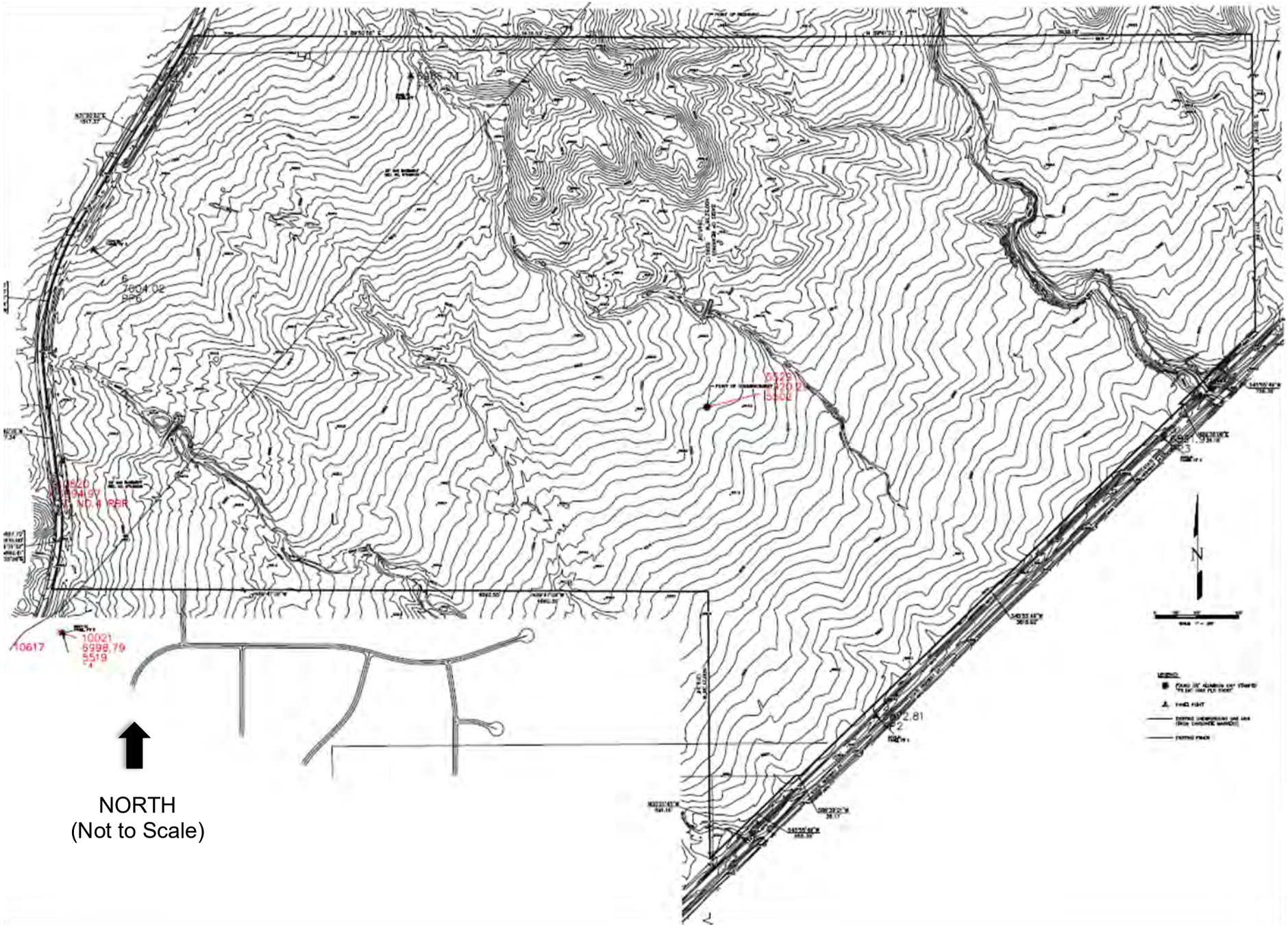
Ecos utilized the U.S. Department of Agriculture, Natural Resource Conservation Service Web Soil Survey (USDA, NRCS, 2020) to determine if hydric soils are present within the Site, as this data assist in informing the presence/absence of potential wetland habitat regulated under the Clean Water Act. The soils data were also utilized to supplement the field observations of vegetation, as the USDA provides correlation of native vegetation species by soils types. Please refer to Appendix A for the USDA Soil Map and additional information.

Blakeland loamy sand (Map Unit #8), Columbine gravelly sandy loam (Map Unit #19) and Stapleton sandy loam (Map Unit #83) are listed by the NRCS as hydric soils that are found in swales and depressions. Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS, 1994) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in *Field Indicators of Hydric Soils in the United States* (USDA, NRCS, 2010).

Additional, detailed soil data for the Project are presented in the Soils & Geology Report that will be included in the Project submittal.

Figure 3



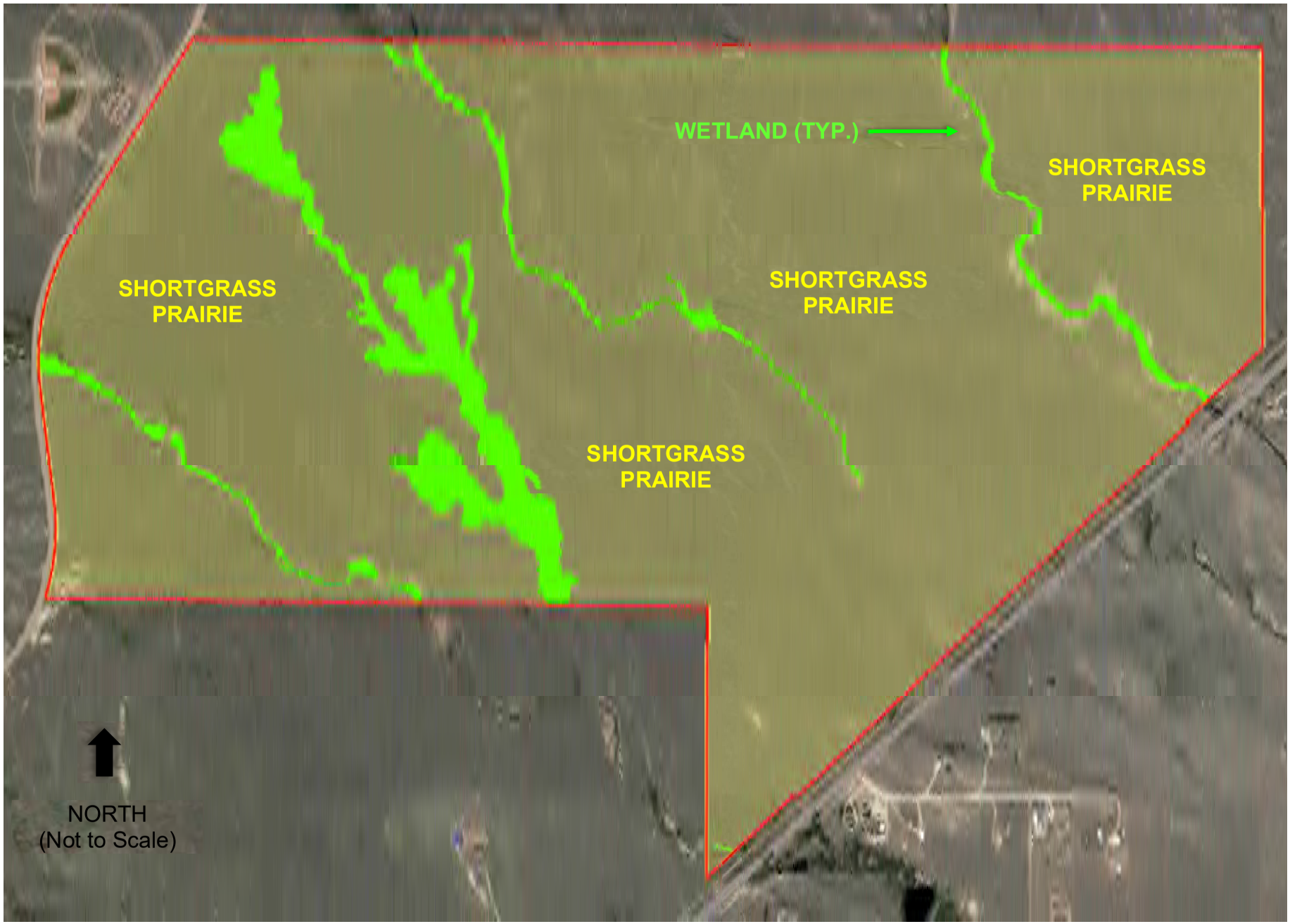
TOPOGRAPHIC MAP

3.3 Vegetation

The vegetation within the Site is primarily comprised of shortgrass prairie with wetland vegetation in the swales and sloughs (Figure 4). The shortgrass prairie is dominated by little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*), and buffalograss (*Bouteloua dactyloides*) with occasional associative grass and forb species including western wheatgrass (*Pascopyrum smithii*), yellow Indiangrass (*Sorghastrum nutans*), Canada wildrye (*Elymus canadensis*), needle and thread (*Hesperostipa comata*), switchgrass (*Panicum virgatum*), Western yarrow (*Achillea millefolium*), broom snakeweed (*Gutierrezia sarothrae*), fringed sage (*Artemisia frigida*), Prickly pear (*Opuntia* spp.), and prairie aster spp. (*Symphyotrichum* spp.). Occasional patches of snowberry (*Symphoricarpos albus*) and Wood's rose (*Rosa woodsii*) occupy the transitional areas between uplands and wetlands. A few, single plains cottonwood (*Populus deltoides*) occur along the drainages. The Site is heavily grazed and there are weeds scattered throughout, including Canada thistle (*Cirsium arvense*), Scotch thistle (*Onopordum acanthium*), Russian thistle (*Salsola kali*), common mullein (*Verbascum thapsus*), and yellow toadflax spp. (*Linaria vulgaris*).

Hydrophytic vegetation (wetland vegetation) is present within the swales and sloughs (refer to Section 3.4.2).

Figure 4



VEGETATION COMMUNITY MAP

3.4 Wetland Habitat and Waters of the U.S.

3.4.1 Methodology

Ecos utilized the National Wetland Inventory (NWI) Wetlands Mapper (USFWS 2020a); Colorado Wetland Inventory Mapping Tool (CNHP, 2018); historic and current Google Earth aerial photography; USGS 7.5-minute topographic mapping; and detailed Project topographic mapping to screen the Site for potential wetland habitat and waters of the U.S. Additionally, ecos performed a jurisdictional delineation to identify the Waters of the United States (WOUS), including wetlands.

The mapping data above were proofed during the filed assessment and a wetland delineation was conducted to determine the presence/absence of potential WOUS, including wetland habitat. Once a feature was verified to be present, ecos determined whether it is a jurisdictional wetland/waters under the Clean Water Act. The USACE, wetland delineation methodology was employed to document the 3 field indicators (parameters) of wetland habitat (i.e., wetland hydrology, hydric soils and a predominance of hydrophytic vegetation as explained in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and supplemented by the Regional Supplement to the *Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys and Coast Region (Version 2)* (USACE, 2010). The wetland delineation was surveyed by the project team surveyor

Consistent with the NWI and Colorado Wetland Inventory Mapping Tool (Figure 5) and topographic mapping, the wetland/waters delineation revealed the presence of four drainages with the potential to support wetland habitat (Figure 6). Two of the drainages (i.e. northeast Drainage D and southwest Drainage A) were determined to be jurisdictional, and support predominantly palustrine emergent wetland (PEMC1) habitat with minor occurrences of palustrine scrub-shrub (PSS) and palustrine forested (PFO) species along their fringes. The central Drainage C and south-central Drainage B were investigated found to be discontinuous, prairie sloughs that are non-jurisdictional, "isolated" features, as verified by the USACE (Appendix B). Please refer to Figure 5 for a composite of the NWI and CNHP Wetland and Riparian Areas mapping, to Figure 6 for the ECOS Wetland and Waters Sketch Map, and to Appendix B for the USACE Non-Jurisdictional Verification email.

3.4.2 Field Assessment Findings

The results of the onsite assessment for each of the four onsite drainages is summarized below, with an explanation of the field indicators (parameters) of wetland habitat/waters that were observed, and an explanation as to whether ecos determined each feature was jurisdictional or non- jurisdictional under Section 404 of the Clean Water Act (as verified by the USACE). Jurisdictional features are mapped on Figure 6.

1) Jurisdictional wetland habitat and waters of the U.S.
    a. PEMC1 Wetland Habitat – Northeast Drainage D is classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetland (PEMC1). Wetland Area A is tributary to Black Squirrel Creek off of the Site to the southeast. It is dominated by Nebraska sedge, redtop, clustered field sedge, three-square bulrush, swordleaf rush, soft-stem bulrush, poverty rush, Baltic rush, and watercress. Other species were present, including water mint, sporadic patches of sandbar willow, cutleaf evening primrose, fireweed, curly dock, and water milfoil, and snowberry, wild licorice and Wood's rose along the high banks. Soil samples indicate the presence of field indicators of hydric soils (organic horizon from 0-2 inches, 10YR4/2 clay loam from 2-9 inches, 10YR4/1 clay loam from 9-14 inches, and 10YR5/1 sandy clay from 14-18+ inches). Sustaining hydrology was evident as flowing water is present within a defined channel and saturated soils are present at the surface and throughout the floodplain, including groundwater driven side-slope seepage. This area meets all 3 parameters for jurisdictional wetland habitat.
    b. PEMC1 Wetland Habitat – Southwest Drainage A is classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetlands (PEMC1 Wetland Area D is tributary to Black Squirrel Creek off of the Site to the southeast. It is dominated by Nebraska sedge, clustered field sedge, swordleaf rush, redtop, poverty rush, Baltic rush, and pussytoes. Other species were present, including soft-stem bulrush, three-square bulrush, smartweed, saltgrass, foxtail barley, water mint, scouring rush, wild geranium, watercress, narrowleaf cattail, and snowberry, wild licorice and Wood's rose along the high banks. Sporadic occurrences of sandbar willow, crack willow and plains cottonwood were present. Soil samples indicate the presence of field indicators of hydric soils (10YR2/2 loamy clay from 0-6 inches, 10YR4/2 sand from 6-12 inches, 10YR4/1 sand from 12-16 inches, and 10YR4/1 clayey sand from 16-18+ inches). Sustaining hydrology from groundwater seepage was evident as saturated soil is present at or within 8-12 inches of the ground surface. These areas meet all 3 parameters for jurisdictional wetland habitat.
2) Non-Jurisdictional, Isolated Wetlands - The central Drainage C and south-central Drainage B were investigated found to be discontinuous, prairie sloughs with reaches that are upland swales; they exhibited upland "breaks" in which they did not exhibit defined bed or bank (Figure 6); and they were also found to be "isolated" as they did not connect with downstream WOUS. Patches of PEMC1 Wetland exists in these drainages that exhibits the same characteristics of other wetlands on site and meets all 3 parameters for jurisdictional wetland habitat. However, they are clearly disconnected from Black Squirrel Creek by uplands that do not exhibit a defined bed or bank. Therefore, these drainages are isolated, non-jurisdictional features and as such were not delineated.

3.4.3 Summary of Jurisdictional and Non-Jurisdictional Wetlands and Waters

Jurisdictional Habitat – Northeast Drainage D and southwest Drainage A (refer to Figure 6) are jurisdictional wetland habitat and WOUS as they are tributary to the jurisdictional habitat in Black Squirrel Creek. These natural features meet the criteria that the USACE uses to assert jurisdiction, as they are:

- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

Non-Jurisdictional Areas – The central Drainage C and south-central Drainage B are considered non-jurisdictional. They do not meet the criteria that the Corps uses to assert jurisdiction, as they are not:

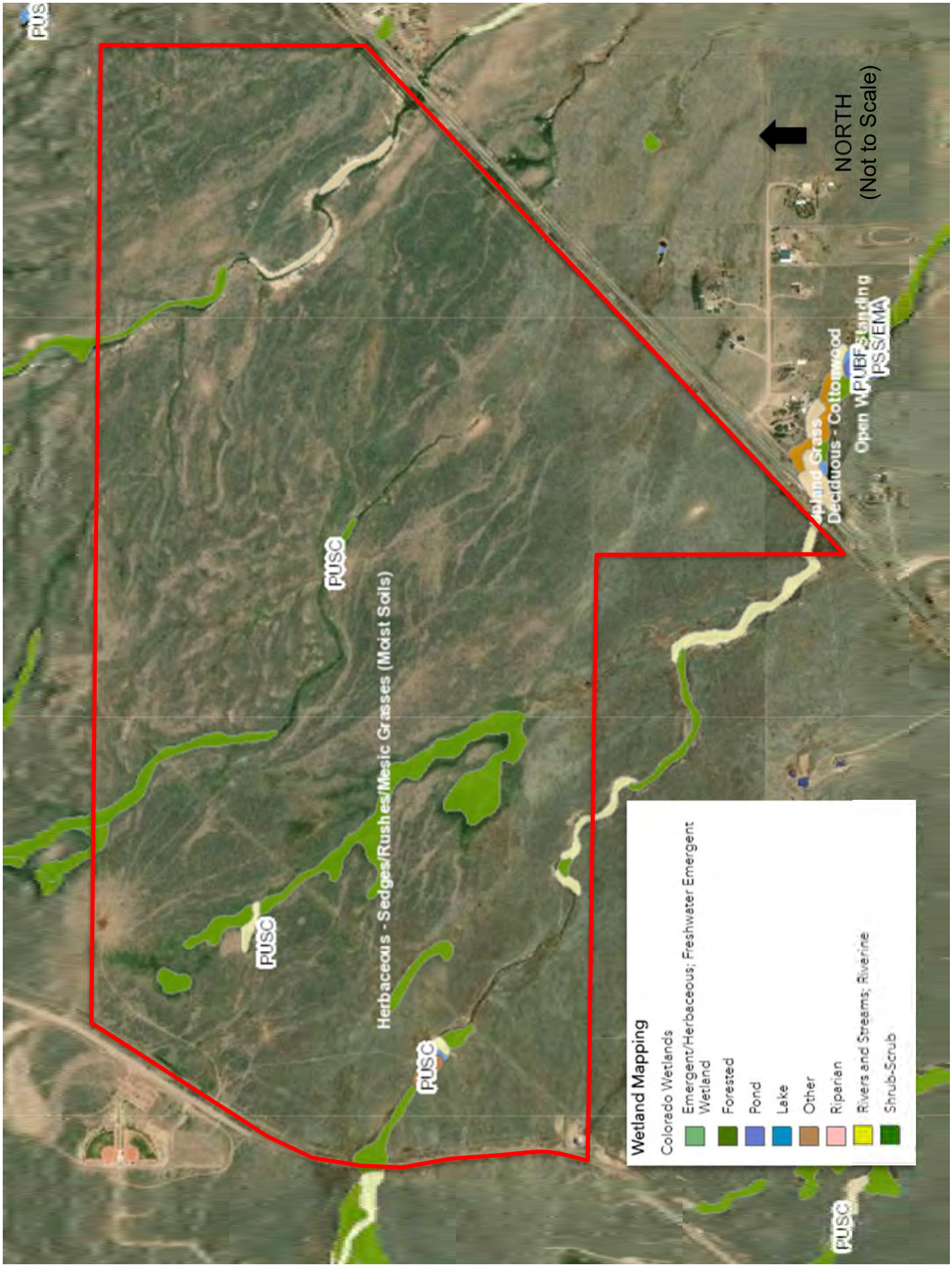
- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

Furthermore, Drainages B and C are not considered "tributaries", as "a tributary includes natural, man-altered, or man-made water bodies that carry flow directly or indirectly into a traditional navigable water." These drainages are ephemeral swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) over which the Corps does not assert jurisdiction.

3.4.4 Verification by the U.S. Army Corps of Engineers

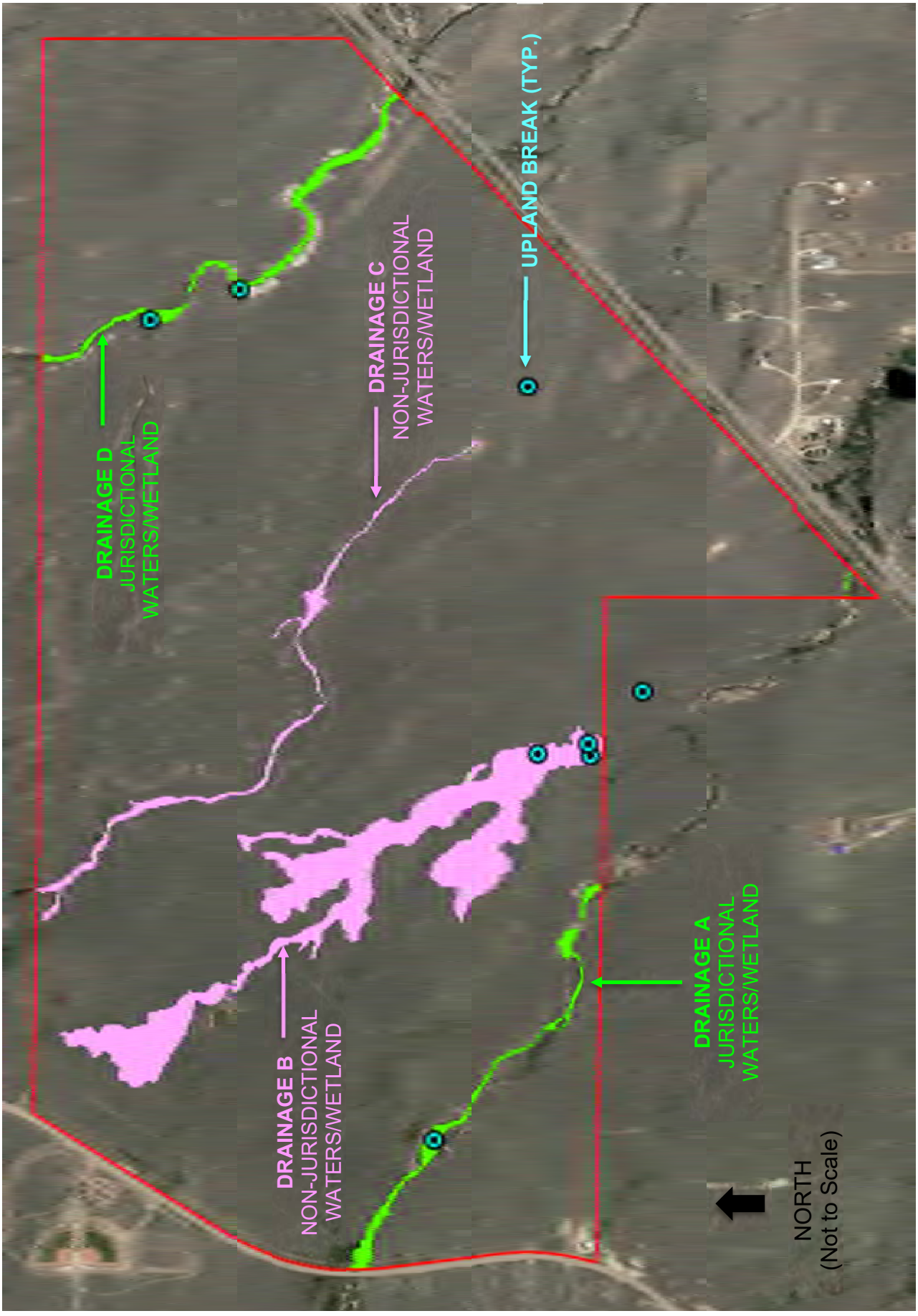
On July 5, 2019, the USACE provided an email to Ecos to confirm our findings of non-jurisdiction for Drainages B and C. Note that we did not request a jurisdictional determination of Drainages A and D as we have documented them to be jurisdictional. An excerpt of the USACE response from Tony Martinez, Regulatory Program Manager for the Albuquerque District, Southern Colorado Regulatory Branch of the USACE is copied below, and the original email is contained in Appendix B.

"Based on the information provided in the attached email and our site visit on June 21, 2019 our office concurs with your observations that central Drainage C and south-central Drainage B are isolated and are located entirely upland therefore, we conclude that No permit is required."



SOURCE: USFWS, National Wetland Inventory & CNHP, Colorado Wetland Inventory

Figure 5 NATIONAL WETLAND INVENTORY & CNHP WETLAND & RIPARIAN AREAS MAP



SOURCE: Ecosystem Services, LLC On-site Delineation, 10-11-18

Figure 6 ECOS WETLAND & WATERS SKETCH MAP

3.5 Weeds

3.5.1 Regulatory Background

The Colorado Department of Agriculture maintains a list of noxious weed species (CDA, 2020a) and works with counties to manage noxious weeds. Weed management on Site must follow County requirements, including the "El Paso County Noxious Weeds and Control Methods" report (El Paso County, 2015b).

There are four CDA categories of noxious weeds:

- List A: Rare noxious that are designated for eradication statewide.
- List B: Discretely distributed noxious weeds that must be eradicated, contained, or suppressed, depending on their location, to stop their continued spread.
- List C. These species are well-established in Colorado. Species management plans are designed to support the efforts of local governing bodies to facilitate more effective integrated weed management. The goal of such plans is not to stop the continued spread of these species, but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species.
- Watch List Species are those may pose a potential threat to the agricultural productivity and environmental values. The Watch List is intended to serve advisory and educational purposes only. Its purpose is to encourage the identification and reporting of these species to the Commissioner in order to assist in determining which species should be designated as noxious weeds.

3.5.2 Noxious Weed Survey Results

Weed species on the Site were very limited, sporadic and dispersed; and as such, no large patches were identified or mapped by ecos.

No noxious weed species on the Colorado Department of Agriculture List A or the Watch List (CDA, 2020a) were observed on the Site.

Three List B noxious weed species (CDA, 2020a) were observed on the Site:

- Canada thistle (*Cirsium arvense*);
- Scotch thistle (*Onopordum acanthium*)
- yellow toadflax (*Linaria vulgaris*).

One List C noxious weed species (CDA, 2020a) were observed on Site:

- common mullein (*Verbascum thapsus*).

3.5.3 Noxious Weed Management Plan

All of the List B species on the Site are designated for suppression (CDA, 2018a). The Colorado Noxious Weed Act defines suppression as "*reducing the vigor of noxious weed populations within an infested region, decreasing the propensity of noxious weed species*

to spread to surrounding lands, and mitigating the negative effects of noxious weed populations on infested lands." Suppression efforts may employ a wide variety of integrated management techniques. Per the El Paso County Noxious Weed and Control Methods document (El Paso County, 2018a): "*The most effective way to control noxious weeds is through Integrated Pest Management (IPM). IPM incorporates weed biology, environmental information, and available management techniques to create a management plan that prevents unacceptable damage from pests, such as weeds, and poses the least risk to people and the environment. IPM is a combination of treatment options that, when used together, provide optimum control for noxious weeds; however, IPM does not necessarily imply that multiple control techniques have to be used or that chemical control options should be avoided.*

- *Prevention: The most effective, economical, and ecologically sound management technique. The spread of noxious weeds can be prevented by cleaning equipment, vehicles, clothing, and shoes before moving to weed free areas; using weed-free sand, soil, and gravel; and using certified weed free seed and feed.*
- *Cultural: Promoting and maintaining healthy native or other desirable vegetation. Methods include proper grazing management (prevention of overgrazing), re-vegetating or re-seeding, fertilizing, and irrigation.*
- *Biological: The use of an organism such as insects, diseases, and grazing animals to control noxious weeds; useful for large, heavily infested areas. Not an effective method when eradication is the objective but can be used to reduce the impact and dominance of noxious weeds.*
- *Mechanical: Manual or mechanical means to remove, kill, injure, or alter growing conditions of unwanted plants. Methods include mowing, hand pulling, tilling, mulching, cutting, and clipping seed heads.*
- *Chemical: The use of herbicides to suppress or kill noxious weeds by disrupting biochemical processes unique to plants."*

The following information provides general measures to prevent introducing new weeds and spreading existing weeds during construction:

<u>Prior to Construction</u>:

1. Create a native habitat restoration and weed control plan for the Open Space areas. Since there is such dense knapweed mixed with other weeds along the Creek, total re-vegetation of some areas may be necessary. One option in the weediest areas would be to remove the top three to six inches of topsoil and replace it with topsoil from the non-weedy short grass prairie north of the Creek that will be developed. If topsoil can be transferred directly, or is only briefly stockpiled, then re-seeding may not be needed. Planning topsoil management ahead of construction may decrease costs for weed control, restoration, and grading.

2. Biological control is a low cost and non-invasive way to begin controlling weeds. Optimum results take 3-5 years. Contact the Colorado Department of Agriculture Request-A-Bug program at 970-464-7916 to reserve insects, determine the species/quantity needed, and discuss release schedules (CDA, 2020b). At a minimum, species should be introduced to control the knapweed. Biological control may also be available for yellow toadflax, musk thistle, and Canada thistle; with the dense patches of yellow toadflax in the northwest corner of the Site being the highest priority of these three.
3. Reduce grazing overall. Eliminate cattle grazing in knapweed-infested areas, unless using grazing for weed control. Cattle will eat young knapweed prior to bolting but avoid it once the plant matures and develops spines. Thus, targeted grazing can reduce knapweed, but prolonged heavy grazing increases it. Cattle grazing in areas of diffuse knapweed twice in spring may decrease seed by 50%. If cattle are being used for weed control, grazing should consist of two, 10-day intervals in the spring when diffuse knapweed is bolting and about 6 to 12 inches tall (see CSU, 2013). Grazing may reduce the efficacy of biological control.
4. Develop a mowing program to control weeds. This will be most effective for the large areas of common mullein, but may also be used for Canada thistle, musk thistle, and cheatgrass. Mowing in the knapweed areas may reduce the efficacy of biological control for this species.

<u>During construction staging</u>:

1. Fence off all the open space areas to prevent vehicles from driving through them and spreading knapweed, etc. to new areas (Note: fencing will also prevent unpermitted wetland impacts and likely be required by the stormwater management plan).
2. Designate a minimal number of vehicle crossings of the Open Space areas. Construct crossings with weed free soil so that noxious weed seeds are not tracked into new areas.

<u>During construction</u>:

1. Prior to any grading of the non-weedy areas on the slopes north of the Creek, salvage the top six inches of topsoil so that it can be used to construct vehicle crossings and for re-vegetation of natural areas. If possible, immediately move soil to re-vegetation areas. If soil must be stockpiled, minimize the time in order to maintain native seed viability. Excess topsoil may be used for development areas.
2. Do not move weedy soil to new areas within the Site or import weedy soil from other Sites.
3. Control weeds within staging areas and along construction access roads on an ongoing basis.

4. Noxious weeds are most likely to become established in areas where the native vegetation and soil have been disturbed by construction. Thus, maintaining and then quickly re-establishing desirable vegetation post-construction will minimize weed infestations. Desirable vegetation may consist of native plant communities or landscaped areas.

The Site development plan should include measures to prevent introducing new weeds and spreading existing weeds during construction (including prevention measures above). Following construction, the Homeowner's Association (HOA) will be responsible for weed control. Weed management recommendations for the species observed on the Site are summarized in Table 2. Refer to the El Paso County "Noxious Weed and Control Methods" booklet for additional detail (El Paso County, 2018a).

TABLE 2 – NOXIOUS WEED MANAGEMENT SUMMARY

Species	Occurrence	Management[1,2,3]
LIST B[4]		
Canada thistle (*Cirsium arvense*)	Uncommon and dispersed.	Mowing combined with herbicide treatment. Mow every 10 to 21 days during the growing season to prevent seeding. Spot treatment with herbicide will likely be needed in open space areas.
Scotch thistle (*Onopordum acanthium*)	Uncommon and dispersed.	No known biological control agents effective against Scotch thistle. Any physical method that severs the root below the soil surface prior to seed production will kill the plant. Properly dispose of flowering cut plants, as seeds can mature and become viable. Spot treatment with herbicide will likely be needed in open space areas.
Yellow toadflax (*Linaria vulgaris*)	Uncommon and dispersed.	Difficult to control; control when infestations are small. Biological control is available and recommended, particularly in the northwest corner where this species is most abundant. Spot treatment with herbicide will likely be needed in open space areas.
LIST C		

TABLE 2 – NOXIOUS WEED MANAGEMENT SUMMARY		
Species	**Occurrence**	**Management[1,2,3]**
Common mullein (*Verbascum thapsus*)	Uncommon and dispersed.	Reduce grazing to increase density of other vegetation. Mow in the bolting to early flowering stage to reduce seed production. Use herbicide to kill existing rosettes. Hand-pulling is effective, but likely not feasible for such large areas. Establish other vegetation and minimize disturbance to prevent existing seeds from sprouting in bare soil.

[1]Refer to the El Paso County "Noxious Weed and Control Methods" booklet for additional detail (El Paso County, 2018a).

[2]When using herbicides, always read and follow the product label to ensure proper use and application.

[3]If near water or wetlands, only use herbicides and formulations approved for use near water.

[4]All of the List B species on the Site are designated for suppression (Colorado Code of regulations, 2018).

3.6 Wildfire Hazard

The stated purpose and intent of the 2018 El Paso County Development Standards" for "Fire Protection and Wildfire Mitigation" is to ensure that proposed development is reviewed for wildfire risks and adequate fire protection. No permit or approval associated with development, construction or occupancy shall be approved or issued until the provisions of these standards are satisfied.

The El Paso County Wildfire Hazard Map is based on the existing vegetation and classifies the grassland areas that comprise the Site as "Low Hazard – Non Forested". [Note: the Vegetation Map required to be referenced in the current Land Development Code is not available, therefore we used the most current map (Figure 7).] "Wildland areas" include land shown as "High Hazard – Forested" or areas identified as such in the "Wildland Fire Risk and Hazard Mitigation Plan." Since the Site does not include forested (high hazard) areas, it is not subject to the wildland areas requirements and does not requires the preparation of a Wildland Fire and Hazard Mitigation Plan.

3.6.1 Fire Protection

Falcon Fire Protection District

A portion of the Site is located within the jurisdiction and boundaries of the Falcon Fire Protection District (FFPD). The portion of the Site within the boundaries of the Falcon Fire Protection District is that portion west of the North/South section line beginning at the intersection of Highway 24 and Curtis Road. The Falcon Fire Department (Fire Department) has provided a letter for the previous iteration of this Project dated October 15, 2018 (Appendix C) to confirm its commitment to provide fire suppression, fire prevention, emergency rescue, ambulance, hazardous materials and emergency medical services (collectively, "Emergency Services") to the applicable portion of the Site, subject to the following conditions:

- All new construction, renovations or developments within the Fire Department's jurisdiction must comply with the applicable fire code and nationally recognized life-safety standards adopted by the El Paso County Board of County Commissioners and the FFPD's Board of Directors, as amended from time to time;
- All development, water and construction plans must be reviewed and approved by the Fire Department for compliance with the applicable fire code and nationally recognized life-safety standards prior to final plat or construction permit being issued; and,
- All development or construction projects shall meet the fire code and nationally recognized standards' pertaining to fire protection water. Please note that approved and inspected fire cisterns are permitted by the Fire Department in an attempt to help the property owner/developer meet these requirements.

Note: A new letter from FFPD will be obtained for the current iteration of this Project prior to Preliminary Plan submittal.

The three staffed FFPD stations are located as follows:

- Station 1, 12072 Royal County Down Road, Peyton (1.94 miles from Site)
- Station 3, 7030 Old Meridian Road, Peyton (4.21 miles from Site)
- Station 4, 2710 Capital Drive, Colorado Springs, CO (9.95 miles from Site)

One unstaffed station is located as follows:

- Station 2 located at 14450 Meridian Road (4.16 miles from the Site.

The closest station to the Site entrance is Station 1. Equipment at Station 1 includes an engine, a water tender (water truck), a brush truck, an AMR ambulance, a utility truck, and a command vehicle (FFPD, 2018). Equipment at the second closest station, Station 2, includes a 4-wheel drive engine, a water tender, and a brush truck.

Peyton Fire Protection District

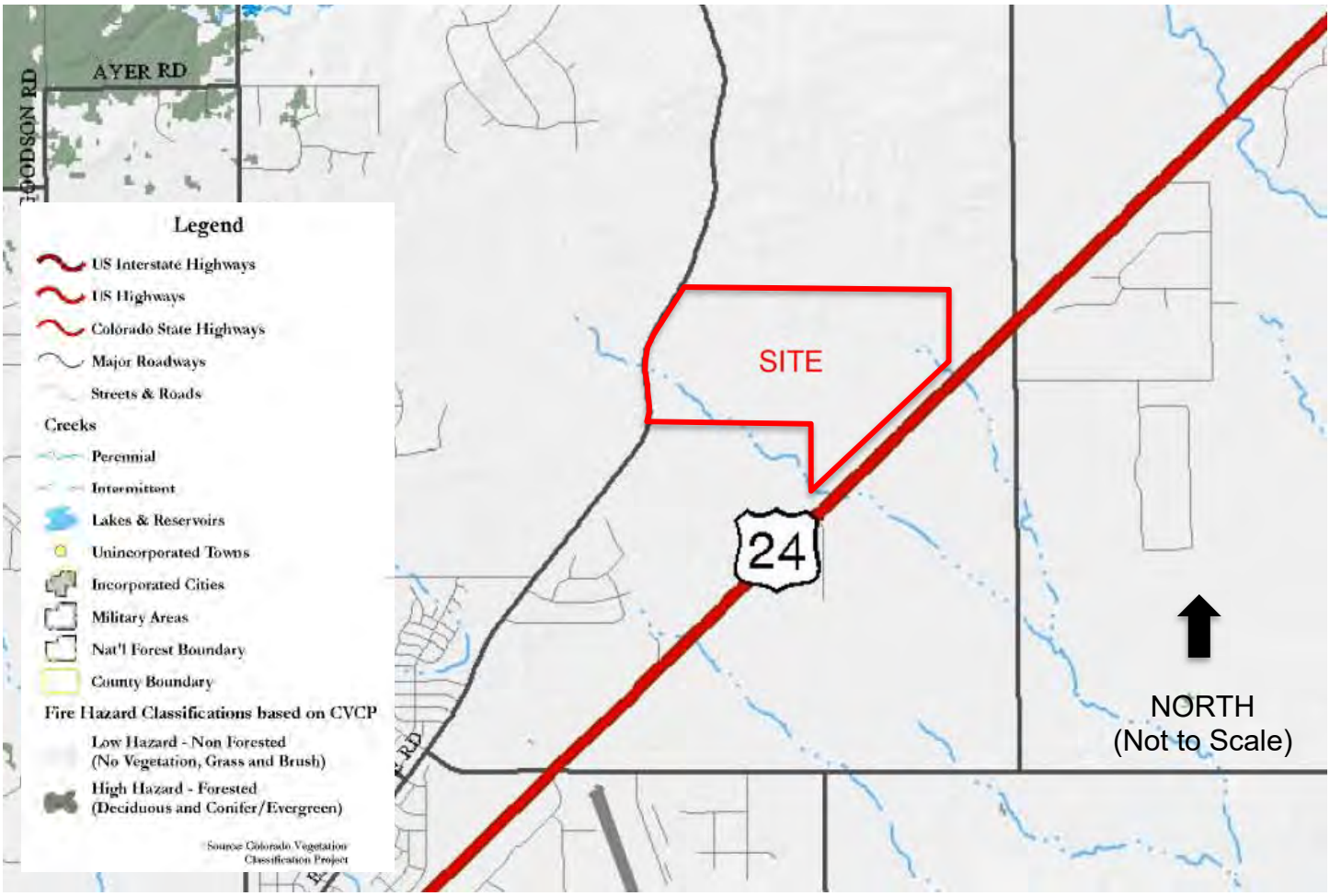
Peyton Fire Protection District (PFPD) will serve that potion of the Site east of the North/South section line beginning at the intersection of Highway 24 and Curtis Road.

The PFPD has provided a letter for the previous iteration of this Project dated October 30, 2018 (Appendix C) to confirm its commitment to provide fire prevention and suppression, emergency rescue, emergency medical and emergency hazardous materials response services (collectively, "Emergency Services") to the applicable portion of the Site, subject to the following conditions:

- All new construction, renovations or developments within the Fire Department's jurisdiction must comply with the applicable fire code and nationally recognized life-safety standards adopted by the El Paso County Board of County Commissioners and the PFPD's Board of Directors, as amended from time to time;
- All development, water and construction plans must be reviewed and approved by the PFPD for compliance with the applicable fire code and nationally recognized life-safety standards prior to final plat or construction permit being issued; and,
- All development or construction projects shall meet the fire code and nationally recognized standards' pertaining to fire protection water. Approved and inspected fire cisterns are permitted by the PFPD in an attempt to help the property owner/developer meet these requirements .

Note: A new letter from PFPD will be obtained for the current iteration of this Project prior to Preliminary Plan submittal.

PFPD is a paid/volunteer fire department located at 13665 Railroad Street, Peyton, Colorado, which is 4.26 miles from the Site. PFPD covers 110 square miles and has an ISO rating of 8B.



SOURCE: El Paso County, Colorado Wildfire Hazards (Based on CVCP Indicators), Map, 2007

Colorado Vegetation Classification Project (CVCP) Indicator Groupings

Low Hazard - Non Forested

No Vegetation:
(1) Urban/Built Up
(6) Barren Land
(8) Riparian
(9) Water
(11) Residential
(12) Commercial
(61) Rock
(6101) Talus Slopes & Rock Outcroppings
(62) Soil

Grass:
(21) Dryland Agriculture
(22) Irrigated Agriculture
(3102) Grassland
(3104) Grass/Forb Mix
(3111) Sparse Grass/Blowouts
(3304) Grass/Misc. Cactus Mix
(3307) Grass/Yucca Mix
(7102) Alpine Grass Dominated
(7103) Alpine Grass/Forb Mix
(7401) Subalpine Grass/Forb Mix
(83) Herbaceous Riparian

Brush:
(3201) Sagebrush Community
(3202) Slatbrush Community
(3203) Greasewood
(33) Shrub/Grass/Forb Mix
(3301) Sagebrush/Grass Mix
(3302) Rabbitbrush/Grass Mix
(4202) Xeric Mountain Shrub Mix
(4203) Mesic Mountain Shrub Mix
(4205) Upland Willow/Shrub Mix
(72) Subalpine Shrub Community
(82) Shrub Riparian
(8201) Willow

High Hazard - Forested

Deciduous:
(4201) Gambel Oak
(5101) Aspen
(5102) Aspen/Mesic Mountain Shrub Mix
(81) Forested Riparian
(8101) Cottonwood

Conifer/Evergreen:
(4101) Pinyon-Juniper
(4102) Juniper
(4301) PJ-Oak Mix
(4303) PJ-MNT Shrub Mix
(4304) Sparse PJ/Shrub/Rock Mix
(4305) Sparse Juniper/Shrub/Rock Mix
(5201) Ponderosa Pine
(5202) Engelmann Spruce/Fir Mix
(5203) Douglas Fir
(5204) Lodgepole Pine
(5207) Spruce/Lodgepole Pine Mix
(5208) Bristlecone Pine
(5209) Ponderosa Pine/Douglas Fir Mix
(5211) Limber Pine
(5213) Lodgepole/Spruce/Fir Mix
(5214) Fir/Lodgepole Pine Mix
(5215) Douglas Fir/Engelmann Spruce Mix
(5301) Spruce/Fir/Aspen Mix
(5302) P. Pine/Gambel Oak Mix
(5303) Ponderosa Pine/Aspen Mix
(5304) Douglas Fir/Aspen Mix
(5306)Lodgepole Pine/Aspen Mix
(5307) Spruce/Fir/Lodgepole/Aspen Mix
(5308) P. Pine/Mountain Shrub Mix
(5309) P. Pine/Aspen/Mesic Mountain Shrub Mix

3.7 Wildlife Communities

The stated purpose and intent of the "El Paso County Development Standards" section on wildlife is to ensure that proposed development is reviewed in consideration of the impacts on wildlife and wildlife habitat, and to implement the provisions of the Master Plan (El Paso County, 2018b). Ecos has determined that the wildlife impact potential for development of the Site is expected to be low.

The Site currently provides poor to moderate habitat for wildlife. There are two primary vegetation types on the Site, including shortgrass prairie and wetlands.

The project would develop most of the shortgrass prairie, however the drainages and adjacent short grass prairie would be preserved as Open Space. A noxious weed management plan will be implemented per State and County requirements to improve wildlife habitat; and a native plant re-vegetation plan for the Open Space is recommended to provide additional benefit to wildlife habitat.

The habitat preferences of the observed species are reflective of the habitat on Site. Two species of raptors were observed and appear to either be residents or frequent hunters to this Site: ferruginous hawk (*Buteo regalis*) and great horned owl (*Bubo virginianus*). Sandhill crane (*Grus canadensis*) were observed flying over during their migration, although they are not likely to utilize the Site. Prairie species such as jackrabbit (*Lepus townsendii*), pronghorn (*Antilocapra americana*), black-tailed prairie dog (*Cynomys ludovicianus*) and thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*) were present. The remaining species are considered generalists and included mourning doves (*Zenaida macroura*) and American crows (*Corvus brachyrhynchos*). The Site provides very limited tree nesting habitat for raptors; however, ferruginous hawks may also use ground nests. No existing nest sites for any raptors were noted during the Site visit.

The Site provides habitat for mammals including rodents, antelope, and carnivores. The site provides foraging and breeding habitat for predators such as coyote and fox. The Site also provides good habitat for reptiles but limited habitat for amphibians due to the lack of persistent standing and flowing water. No other species were observed by ecos during our field assessment.

The Site contains no Wildlife Refuges or Hatcheries according to the USFWS IPaC Trust Resources Report (USFWS, 2020b) (Appendix D).

4.0 FEDERAL LISTED SPECIES

A number of species that occur in El Paso County are listed as candidate, threatened or endangered by the USFWS (USFWS, 2020b) under the Endangered Species Act (ESA). Ecos compiled the Federally-listed species for the Site in Table 3 based on the Site-specific, USFWS IPaC Trust Resources Report we ran for the Project (Appendix D); and our onsite assessment. Ecos has provided our professional opinion regarding the

probability that these species may occur within the Site and their probability of being impacted by the Project.

The likelihood that the Project would impact any of the species listed below is very low to none. Most are not expected occur in the Project area or on the Site; nor will they be affected by the indirect effects of the project. The Preble's meadow jumping mouse is discussed in more detail below because there is USFWS designated Critical Habitat in the County.

TABLE 3 - FEDERAL LISTED SPECIES ASSESSED FOR THE PROJECT

Species	Status	Habitat Requirements and Presence	Probability of Impact by Project
FISH			
Greenback cutthroat trout (*Oncorhynchus clarki stomias*)	Threatened	Cold, clear, gravely headwater streams and mountain lakes that provide an abundant food supply of insects.	None. Suitable habitat does not exist on the Site.
Pallid sturgeon (*Scaphirhynchus albus*)	Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
BIRDS			
Least tern (*Sternula antillarum*)	Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
Mexican spotted owl (*Strix occidentalis lucida*)	Threatened	Mature, old-growth forests of white pine, Douglas fir, and ponderosa pine; steep slopes and canyons with rocky cliffs. The closest USFWS designated Critical habitat is over 15 miles southwest of the Site in mountainous terrain.	None. Suitable habitat does not exist on the Site.

TABLE 3 - FEDERAL LISTED SPECIES ASSESSED FOR THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Piping plover (*Charadrius melodus*)	Threatened	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
Whooping crane (*Grus americana*)	Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
MAMMALS			

TABLE 3 - FEDERAL LISTED SPECIES ASSESSED FOR THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Preble's meadow jumping mouse (*Zapus hudsonius preblei*)	Threatened	Inhabits well-developed riparian habitat with adjacent, relatively undisturbed grassland communities, and a nearby water source. Well-developed riparian habitat includes a dense combination of grasses, forbs and shrubs; a taller shrub and tree canopy may be present. Has been found to regularly use uplands at least as far out as 100 meters beyond the 100-year floodplain.	None. Unlikely to occur on Site due to: 1) the absence of habitat required to support the life requisites of the species; 2) negative trapping results reported by USFWS adjacent to the Site; 3) 10.22-mile distance from closest CPW "Potential" Occupied Habitat (west/northwest of the Site in Colorado Springs); 4) 6.5-mile distance from closest USFWS Critical Habitat (southwest of the Site along Black Squirrel Creek in Colorado Springs); and 5) lack of habitat connection corridor from known habitat to the Site.
PLANTS			

TABLE 3 - FEDERAL LISTED SPECIES ASSESSED FOR THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	Threatened	Primarily occurs along seasonally flooded river terraces, sub-irrigated or spring-fed abandoned stream channels or valleys, and lakeshores. May also occur along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside borrow pits, reservoirs, and other human-modified wetlands.	Very Low. Unlikely to occur as the Site is situated between 6,860 and 7,020 feet above mean sea level, which is higher than the 6,500-foot elevation limits documented for the species and recommended for conducting surveys by the USFWS.
Western prairie fringed orchid (*Platanthera praeclara*)	Threatened	Occurs in tallgrass prairie in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Oklahoma. Upstream depletions to the Platte River system in Colorado and Wyoming may affect the species in Nebraska.	None. The proposed project will not alter or deplete flows to the South Platte.

4.1 Preble's meadow jumping mouse

4.1.1 Natural History

The Preble's meadow jumping mouse (PMJM) is a small mammal approximately 9-inches in length with large hind feet adapted for jumping, a long bicolor tail (which accounts for 60% of its length), and a distinct dark stripe down the middle of its back, bordered on either side by gray to orange-brown fur (USFWS, 2016). This largely nocturnal mouse lives primarily in the foothills of southeastern Wyoming, and south to Colorado Springs, along the eastern edge of the Front Range of Colorado. PMJM are true hibernators. They usually enter into hibernation in September or October and emerge in May of the following spring.

PMJM typically inhabits areas characterized by well-developed plains riparian vegetation with relatively undisturbed grassland and a water source in close proximity (Armstrong et al. 1997). PMJM regularly range into adjacent uplands to feed, hibernate, and avoid flooding. Radio-tracking studies conducted by CPW have documented PMJM using upland habitat adjacent to wetlands and riparian areas (Shenk and Sivert 1999).

4.1.2 Threats

Threats to PMJM and their habitat include habitat alteration, degradation, loss, and fragmentation resulting from human land uses including urban development, flood control, water development, and agriculture. Habitat destruction may impact individual PMJM directly or by destroying nest sites, food resources, and hibernation sites; by disrupting behavior; or by forming a barrier to movement. Invasive non-native and noxious weeds can alter habitat and decrease its value.

4.1.3 Critical Habitat

Critical habitat is specific areas identified by the USFWS as being essential to the conservation of PMJM (USFWS, 2016). In determining which areas to designate as critical habitat, the USFWS must use the best scientific and commercial data available and consider physical and biological features (primary, constituent elements) that are essential to conservation of the species, and that may require special management consideration and protection. The primary constituent elements for the PMJM include those habitat components essential for the biological needs of reproducing, rearing of young, foraging, sheltering, hibernation, dispersal, and genetic exchange. Thus, critical habitat includes riparian areas located within grassland, shrub land, forest, and mixed vegetation types where dense herbaceous or woody vegetation occurs near the ground level, where available open water exists during their active season, and where there are ample upland habitats of sufficient width and quality for foraging, hibernation, and refugia from catastrophic flooding events. Section 7 of the Endangered Species Act prohibits destruction or adverse modification of a critical habitat by any activity funded, authorized, or carried out by any Federal agency, and Federal Agencies proposing actions affecting areas designated as critical habitat must consult with the USFWS on the effects of their proposed actions, pursuant to Section 7(a)(2) of the Act.

4.1.4 Potentially Occupied Range

Colorado Parks and Wildlife (CPW) mapped areas of “potential” PMJM occupied range (CPW, 2005). The occupied range mapping is based on known occurrences of PMJM (i.e., trapping data) and mapped riparian vegetation (i.e., potential habitat that was not necessarily trapped or verified). For each known PMJM location, a one-mile buffer is applied to riparian areas both upstream and downstream. This includes both the main channel and side channels. Additionally, a 100-meter lateral buffer is applied which, in general, represents foraging and hibernaculum habitat. This buffer serves as a general guideline. Site specific topographic and vegetative features may increase or decrease the area considered locally as foraging and hibernaculum habitat. Where riparian vegetation maps don't exist, the stream centerline is buffered laterally by 100 meters.

4.1.5 Summary

PMJM are very unlikely to occur on the Site or be affected by the Project due to:

1) the absence of onsite habitat required to support the life requisites of the species;

2) negative trapping results reported by USFWS adjacent to the Site;

3) 10.22-mile distance from closest CPW "Potential" Occupied Range (west/northwest of the Site in Colorado Springs);

4) 6.5-mile distance from closest USFWS Critical Habitat (southwest of the Site along Black Squirrel Creek in Colorado Springs); and

5) lack of a habitat connection corridor from known habitat to the Site.

Refer to Figure 8 – USFWS PMJM Trapping Map and Figure 9 – PMJM Habitat Map.

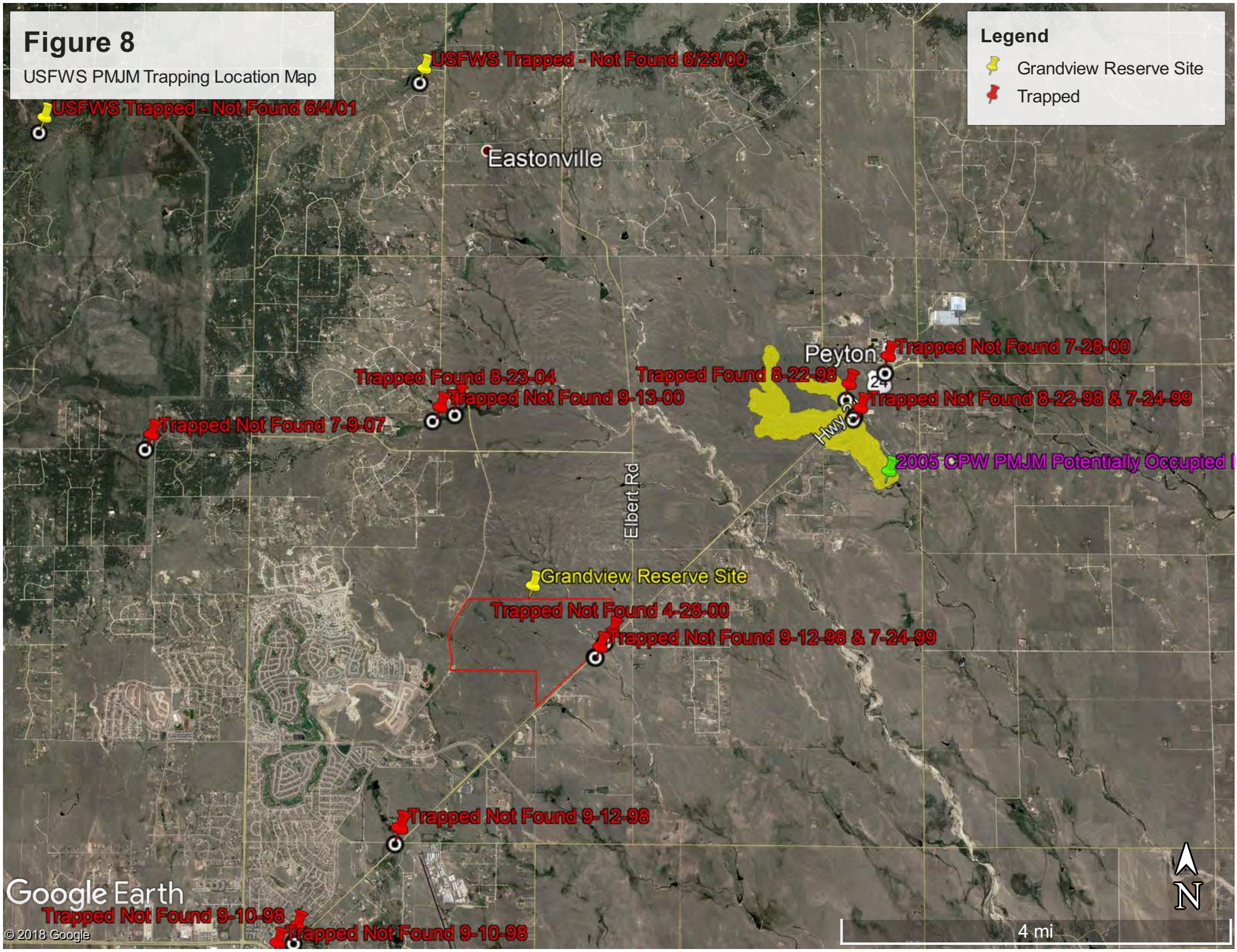


Figure 8
USFWS PMJM Trapping Location Map
Legend
Grandview Reserve Site
Trapped
USFWS Trapped - Not Found 6/23/00
USFWS Trapped - Not Found 6/4/01
Eastonville
Peyton
Trapped Not Found 7-28-00
Trapped Found 8-22-98
Trapped Found 8-23-04
Trapped Not Found 9-13-00
Trapped Not Found 8-22-98 & 7-24-99
Trapped Not Found 7-9-07
Hwy 24
2005 CPW PMJM Potentially Occupied
Elbert Rd
Grandview Reserve Site
Trapped Not Found 4-28-00
Trapped Not Found 9-12-98 & 7-24-99
Trapped Not Found 9-12-98
Google Earth
Trapped Not Found 9-10-98
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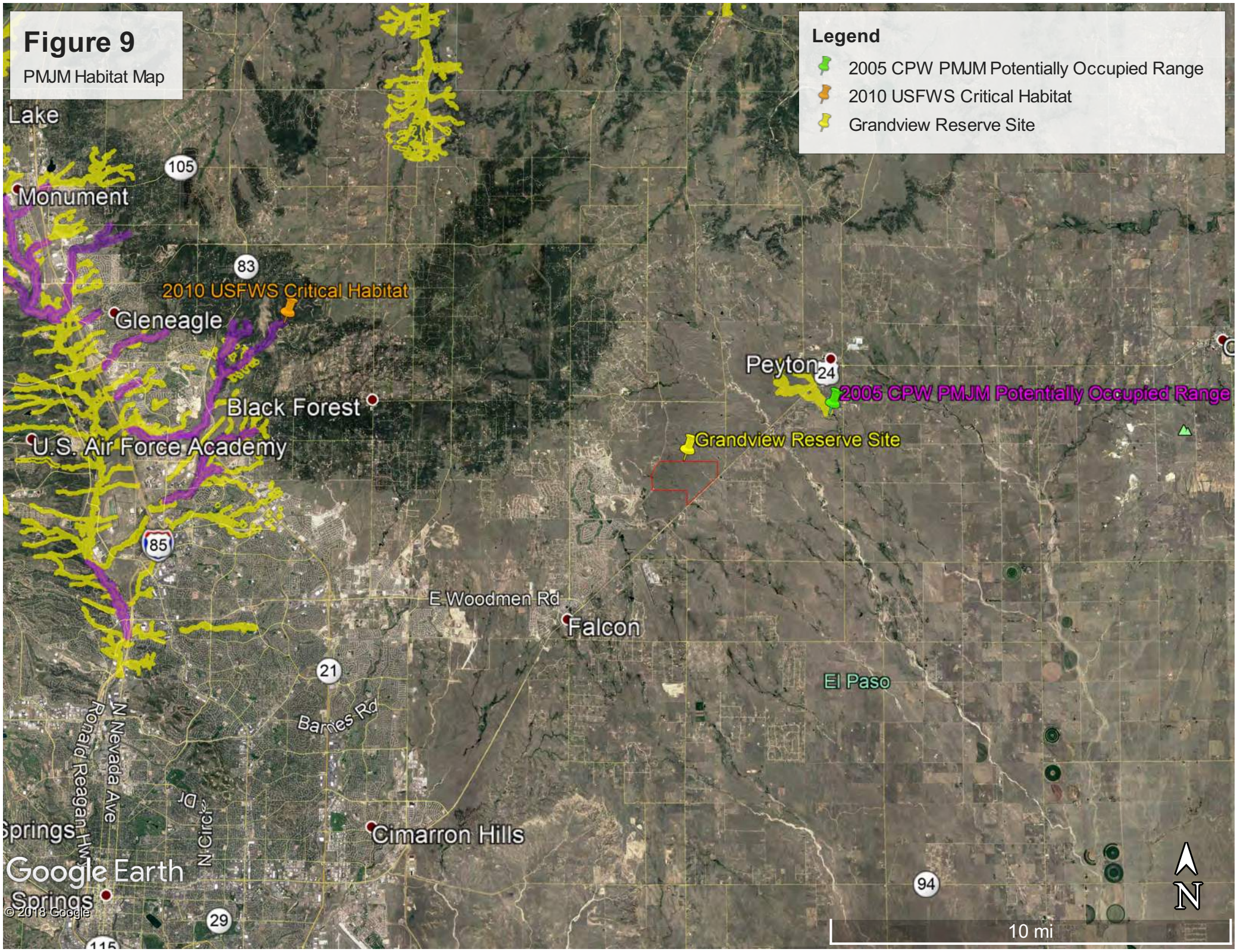
Figure 9
PMJM Habitat Map
Legend
2005 CPW PMJM Potentially Occupied Range
2010 USFWS Critical Habitat
Grandview Reserve Site
Lake
105
Monument
83
2010 USFWS Critical Habitat
Gleneagle
Peyton
24
2005 CPW PMJM Potentially Occupied Range
Black Forest
U.S. Air Force Academy
Grandview Reserve Site
85
E Woodmen Rd
Falcon
21
El Paso
Barnes Rd
N Nevada Ave
Ronald Reagan Hwy
N Circle Dr
Springs
Cimarron Hills
Google Earth
Springs
© 2018 Google
29
94
N
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5.0 RAPTORS AND MIGRATORY BIRDS

Raptors and most birds are protected by the Colorado Nongame Wildlife Regulations, as well as by the federal Migratory Bird Treaty Act and/or the Bald and Golden Eagle Protection Act. No raptor nests have been mapped within one mile of the Site (COGCC, 2020). No raptors nests were observed during the site visit. However, the short grass prairie and wetland habitats are valuable nesting and foraging habitat for birds.

6.0 SUMMARY OF POTENTIAL IMPACTS

6.1 Mineral and Natural Resource Extraction

The previous project engineer researched the records of the El Paso County Clerk and Recorder and established that there is not a mineral estate owner on the Site (Appendix E). This research will be replicated for this current iteration of the Project and provided prior to Preliminary Plan submittal. However, Mineral or Natural Resource Extraction will not occur as a part of this Project, and no associated impacts to habitat will occur.

6.2 Vegetation

There are two main types of vegetation on Site; wetlands and short-grass prairie. Long-term cattle grazing has degraded vegetation by increasing weeds (although mild) in many areas and severely reducing woody riparian vegetation along the drainages. Direct negative impacts to vegetation will result from the construction of roads, trails, and homes; and indirect negative impacts will result such as spreading weeds to new areas or alteration of wetland hydrology. Since the project will preserve the onsite drainages and an open space area, there is good potential to improve vegetation in these areas. The following recommendations are intended to minimize negative impacts and increase positive impacts:

1. Create a habitat restoration and management plan for the drainages and Open Space areas that begins as soon as possible, continues through construction, and is taken over and implemented by the Metropolitan District following construction.
2. Increase native vegetation in the disturbed shortgrass prairie areas by seeding with native species. Another option would be to spread ~1” of salvaged topsoil obtained/stockpiled from any non-weedy shortgrass prairie area that would be impacted by infrastructure construction, such as roads and associated disturbances, and use it in undisturbed areas.
3. Include requirements in the Codes, Covenants and Restrictions (CCRs) to preserve native vegetation and minimize non-native landscaping and irrigation.
4. Implement a stormwater management system that does not significantly increase flows into the drainages and prepare a natural channel stabilization plan for all drainages.

6.3 Wetland Habitat and Waters of the U.S.

Drainages A and D are both jurisdictional WOUS, including adjacent wetlands; therefore, potential regulatory impacts to these drainages are discussed below:

Drainage A is the western-most drainage located between Parcels E and F (Medium Density) along the west side; and Parcels C, D and G (Medium Density) along the east side. The Sketch Plan (Figure 2) illustrates an Open Space buffer along both sides of the drainage that will assist in ameliorating the effects of residential runoff. This buffer area should be planted with multi-story palette of native upland and riparian species to supplement the regrowth and regeneration of previous woody vegetation (now that grazing has been removed), provide shading to regulate pH and water quality, and assist in stabilizing the streambanks. Given that Parcels E and F are proposed to be accessed via Eastonville Road to the west and the Waterbury project to the south, it does not appear that a road crossing of Drainage A will be necessary. Utility lines will need to cross Drainage A to get service to all lots; however, this impact may be avoided by boring beneath the drainage. A Detention Pond is proposed along the downstream, west side of the drainage that will require an outfall into the drainage. However, with proper location and alignment, impacts for this outfall should be minimal and primarily restored in-place.

Drainage D is the eastern-most drainage located between Parcels M (Medium-High Density), R (Medium Density) and Q (Low Density) along the west side; and Parcels N (Medium Density) and P (Low Density) along the east side. The Sketch Plan (Figure 2) illustrates an Open Space buffer along both sides of the drainage that will assist in ameliorating the effects of residential runoff. This buffer area should be planted with multi-story palette of native upland and riparian species to supplement the regrowth and regeneration of previous woody vegetation (now that grazing has been removed), provide shading to regulate pH and water quality, and assist in stabilizing the streambanks. A road crossing is proposed over the upstream reach of Drainage D that may cause impacts to WOUS and wetlands; however, these impacts may be significantly reduced if a free-span bridge is used. Utility lines will need to cross Drainage D to get service to all lots; however, this impact may be avoided by boring beneath the drainage or minimized by including them in the road crossing ROW. Three Detention Ponds are proposed along the drainage, one upstream and two downstream, all of which will require outfalls into the drainage. However, with proper location and alignment, impacts for these outfalls should be minimal and primarily restored in-place.

All Drainages: Project phasing should be used to avoid Site-wide, over-lot grading and related impacts from runoff, erosion and pollutant discharge into the drainages. Given the proposed density of development, strategic stormwater control before, during and after construction will be required to avoid these impacts and the associated channel incision and streambank degradation. Stormwater runoff from streets and impervious surfaces should be treated via vegetated swales, separators, (e.g., “Stormceptors” or similar oil and sediment separators) and/or the proposed detention basins prior to discharge into the drainages.

6.4 Weeds

Weeds observed on Site included three List B noxious weed species and one List C noxious weed species (CDA, 2018a). Suppression is required for all List B species. Site development typically causes weeds to increase due to increased earth disturbance and new weeds being brought in (on vehicles and shoes, in soil and fill material, in landscaping supplies, etc.). The following recommendations are intended to minimize negative impacts and increase positive impacts:

1. Introduce biological control agents for weed control as soon as possible.
2. Implement an integrated noxious weed management plan that begins as soon as possible, continues through construction, and is taken over and implemented by the Metropolitan District following construction. Control of List B species should be the highest priority, particularly knapweed.
3. Include requirements in the CCRs that landowners manage weeds on their property per the Colorado Noxious Weed Act and El Paso County guidelines.
4. Prohibit importation of fill dirt and landscaping material from other locations unless it is certified as weed free.

6.5 Wildfire Hazard

The Site is comprised entirely of herbaceous prairie and wetland vegetation designated as "Low Hazard – Non Forested" and has no forested (high hazard) areas (Figure 7). Therefore, it is not subject to the wildland areas requirements and does not require the preparation of a Wildland Fire and Hazard Mitigation Plan.

6.6 Wildlife Communities

The impact to wildlife is similar to that for vegetation. Species that occur in wetland and riparian habitat are expected to benefit from Open Space protection. Implementation of the stormwater management plan will assist in protecting water quality in the drainages, to ameliorate development impacts on aquatic wildlife species. Many shortgrass prairie specialist species avoid areas with buildings, overhead powerlines, and trees; thus, the project is expected to have the most significant negative impact on these species. The following, additional recommendations are intended to reduce impacts to wildlife:

1. Limit the use of herbicides, pesticides, and fertilizers as they can negatively impact aquatic wildlife species.
2. Ecos has recommended that the Project minimize the installation of fencing to avoid injury to wildlife. When fencing is needed, we have specified the use of wildlife friendly fences or the inclusion of specific wildlife crossings along fence lines. Pronghorn are of particular concern because they do not jump over fences and can be injured by barbed-wire fences. The El Paso County, Community Services Department, Environmental Division has requested that fencing be installed to "avoid negative conflicts with pronghorn". Therefore, ecos will

discuss this with the County and if deemed to be in the best interest of pronghorn protection, work with the Applicant to prepare a fencing plan in accordance with Colorado Parks and Wildlife guidelines.

3. Road crossings over the drainages should be designed to enable wildlife underpass and allow use of the drainages as movement corridors to reduce collisions with vehicles.
4. Dogs should be kept in fenced pens and be leashed when on walks. At least one designated off-leash area for dogs should be provided, as this will increase compliance with leash rules in other areas.
5. Cats should no be allowed outdoors because they kill birds and native rodents. Cats may also be eaten by foxes and coyotes.

6.7 Federal Listed Species

The Site is not located within any USFWS designated critical habitat or known occupied habitat for federally designated threatened or endangered species, including the Preble's meadow jumping mouse. Therefore, no direct or indirect impacts to federally designated threatened or endangered species are expected to occur from the Project.

6.8 Raptors and Migratory Birds

The Project is expected to have minimal impacts on raptors and migratory birds. Preservation of Open Space along the drainages will likely have a positive impact on the birds that use this habitat. The project is expected to have slight negative impact on shortgrass prairie birds due to habitat alteration and increased disturbance by people, dogs, and cats. Negative impacts can be minimized by following the recommendations in the vegetation and wildlife sections.

7.0 REGULATIONS AND RECOMMENDATIONS

7.1 Clean Water Act

Section 404 of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the U.S. (including wetland habitat) without a valid permit. Ecos identified jurisdictional wetland habitat and WOUS along Drainages A and D. However, the majority of the WOUS and wetlands on the Site will be set aside and included in Open Space with buffers; and no jurisdictional wetlands or waters will occur within private lots. Therefore, it is evident that impact minimization has been incorporated since the early stages of the design process. Any proposed impacts to WOUS or wetlands resulting from road or utility crossings, stormwater outfalls, channel stabilization, grading operations or other associated development disturbances should be avoided or minimized to the extent feasible. 4 Site Investments will need to obtain Clean Water Act (CWA) Section 404 Permit authorization from the USACE prior to construction to authorize development-related impacts. At the Sketch Plan phase, detailed data are not available to assess cumulative impacts and assign the type of 404 Permit that may be

applicable. However, if feasible, the cost and timeframe associated with the Project may be minimized if cumulative impacts are avoided and minimized to the extent that they meet the requirements for Nationwide Permit 29 for Residential Developments.

7.2 Endangered Species Act

The Site is not located within any USFWS designated critical habitat or known occupied habitat for federally designated threatened or endangered species, including the Preble's meadow jumping mouse. Therefore, no direct or indirect impacts to federally designated threatened or endangered species are expected to occur from the Project. Therefore, 4 Site Investments is not required to initiate consultation with the USFWS under the ESA. A "Clearance Letter" dated May 25, 2019 was obtained from the USFWS for the previous iteration of this Project that concurred with ecos' findings and "cleared" the entire Site. Ecos requested an updated, 2020 Endangered Species Act (ESA) Clearance Letter from USFWS. The USFWS issued a Concurrence response to our 2020 ESA Clearance Request that states, ""Ute ladies-tresses orchid and Preble's mouse are not likely to occupy the project site. Project is still consistent with the section 7 conclusions from 2019." The Agency has indicated that they have "No Concern" with our findings under the ESA and therefore no further action is required under the ESA (refer to Appendix F)

7.3 Migratory Bird Treaty Act & Bald and Golden Eagle Protection Act

No raptor nests have been mapped within one mile of the Site (COGCC, 2020) and no migratory bird nests were observed within the Site during ecos' assessment. However, given the transitory nature of these species ecos recommends a nesting bird inventory immediately prior to construction to identify any new nests within the Site or within the CPW recommended buffers of the Site. Therefore, the Applicant will perform two surveys for migratory birds and their nests: 1) approximately one to two months prior to construction; and 2) one week prior to construction. If these species are found to be present, construction activities will be restricted during the breeding season near any newly identified nests to ensure the avoidance of take.

7.4 Colorado Noxious Weed Act

In order to ensure Project compliance with the Act, the Noxious Weed Management Plan referenced in Section 3.5.3 of this Report should be implemented, and further site-specific weed management should be implemented on an ongoing basis, starting as soon as feasible.

8.0 REFERENCES

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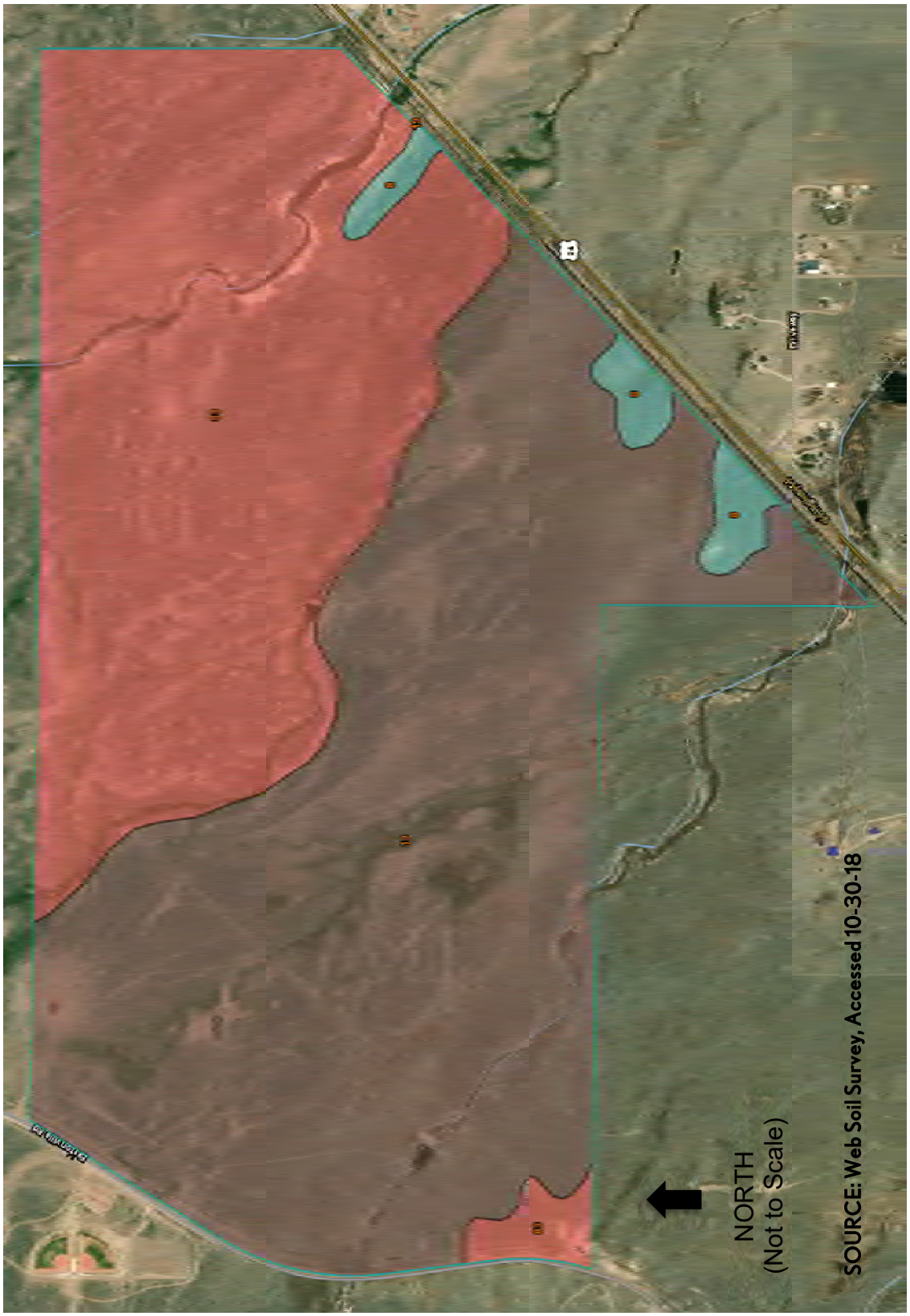
Appendix A

USDA Soil Data



Summary by Map Unit — El Paso County Area, Colorado (CO625)

Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
8	Blakeland loamy sand, 1 to 9 percent slopes	Blakeland loamy sand, 1 to 9 percent slopes	17.5	2.3%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	Columbine gravelly sandy loam, 0 to 3 percent slopes	428.6	55.8%
83	Stapleton sandy loam, 3 to 8 percent slopes	Stapleton sandy loam, 3 to 8 percent slopes	322.2	41.9%
Totals for Area of Interest			**768.3**	**100.0%**

Appendix B

USACE Verification Email

From:	Martinez, Joseph A CIV USARMY CESPA (US)
To:	Grant Gurnee
Subject:	RE: [Non-DoD Source] FW: Grandview Reserve Project - Request for Verification of Non-JD Drainages (UNCLASSIFIED)
Date:	Friday, July 5, 2019 1:58:43 PM

CLASSIFICATION: UNCLASSIFIED

Mr. Gurnee,

Based on the information provided in the attached email and our site visit on June 21, 2019 our office concurs with your observations that central Drainage C and south-central Drainage B are isolated and are located entirely upland therefore, we conclude that No permit is required.

If you should have any questions, please contact me at (719).600.8641.

Respectfully,

Tony Martinez, R.E.M.

Regulatory Program Manager| U.S. Army Corps Of Engineers | Office: (719) 600.8641 | Email: joseph.a.martinez@usace.army.mil|

Albuquerque District
Southern Colorado Regulatory Branch
201 West 8th Street, Suite 350, Pueblo Colorado 81003

Visit our Web Site at: http://www.spa.usace.army.mil/Missions/Regulatory-Program-and-Permits/

-----Original Message-----
From: Grant Gurnee [mailto:grant@ecologicalbenefits.com]
Sent: Tuesday, June 18, 2019 2:21 PM
To: Martinez, Joseph A CIV USARMY CESPA (US) <Joseph.A.Martinez@usace.army.mil>
Subject: [Non-DoD Source] FW: Grandview Reserve Project - Request for Verification of Non-JD Drainages

Hi Tony –

Here is the email I sent Van on May 20, 2019.

I hope you received my calendar invitation to meet at 10:30 this Friday (June 21) at the intersection of Stapleton Road and Hwy. 24.

Thank you,

Grant

From: Grant Gurnee <grant@ecologicalbenefits.com <mailto:grant@ecologicalbenefits.com> >
Sent: Monday, May 20, 2019 10:23 AM
To: Truan, Van A SPA <van.a.truan@usace.army.mil <mailto:van.a.truan@usace.army.mil> >
Cc: Peter Martz <pmartzlrg@comcast.net <mailto:pmartzlrg@comcast.net> >; Mike Bramlett <mbramlett@jrengineering.com <mailto:mbramlett@jrengineering.com> >; Jon Dauzvardis <jon@ecologicalbenefits.com <mailto:jon@ecologicalbenefits.com> >

Subject: Grandview Reserve Project - Request for Verification of Non-JD Drainages
Importance: High

Hello Van –

Ecos would like to request the Corps' formal concurrence regarding the non-jurisdictional status of Drainages B and C on the Grandview Reserve Site in El Paso County (refer to Section 3.4 and additional information in the attached report). Please let us know if you would like to schedule a site visit to review these drainages with us.

Summary:

The central Drainage C and south-central Drainage B were investigated found to be discontinuous, prairie sloughs with reaches that are upland swales; they exhibited upland "breaks" in which they did not exhibit defined bed or bank (Figure 6 in attached report); and they were also found to be "isolated" as they did not connect with downstream WOUS. Patches of PEMC1 Wetland exists in these drainages that exhibits the 3 parameters for jurisdictional wetland habitat. However, they are clearly disconnected from Black Squirrel Creek by uplands that do not exhibit a defined bed or bank. Therefore, ecos determined that these drainages are isolated, non-jurisdictional features – pending Corps verification.

Thank you,

Grant

Grant Gurnée, P.W.S.

Owner – Restoration Ecologist

ecosystem services LLC

(o): 970-812-ECOS (3267)

(c): 303-746-0091

(w): Blockedwww.ecologicalbenefits.com <Blockedhttp://www.ecologicalbenefits.com/>

(e): grant@ecologicalbenefits.com <mailto:grant@ecologicalbenefits.com>

P Life is like a river…we all must learn to adapt to the challenges of dynamic equilibrium

Appendix C

Commitment Letters to Provide Fire and Emergency Services

FALCON FIRE PROTECTION DISTRICT

Administration Office
7030 Old Meridian Road
Falcon, Colorado 80831
Business Number: 719-495-4050 Business Fax: 719-495-3112

October 15, 2018

4 Site Investments, LLC
1271 Kelly Johnson Blvd, Suite 100
Colorado Springs, CO 80920

Re: Conditional Commitment to Provide Emergency Services
Property: A portion of 4 Way Ranch- Phase 2

Based upon the information you have provided, a portion of the above-referenced real property is located within the jurisdiction and boundaries of the Falcon Fire Protection District ("Fire Department"). The portion within the boundaries of the Falcon Fire Protection District is that portion west of the North/South section line beginning at the intersection of Highway 24 and Curtis By this letter, the Fire Department confirms its commitment to provide fire suppression, fire prevention, emergency rescue, ambulance, hazardous materials and emergency medical services (collectively, "Emergency Services") to the property within the District boundaries, subject to the following conditions:

- ☒ All new construction, renovations or developments within the Fire Department's jurisdiction must comply with the applicable fire code and nationally recognized life-safety standards adopted by the El Paso County Board of County Commissioners and the Fire Department's Board of Directors, as amended from time to time;
- ☒ All development, water and construction plans must be reviewed and approved by the Fire Department for compliance with the applicable fire code and nationally recognized life-safety standards prior to final plat or construction permit being issued; and,
- ☒ All development or construction projects shall meet the fire code and nationally recognized standards' pertaining to fire protection water. Please note that approved and inspected fire cisterns are permitted by the Fire Department in an attempt to help the property owner/developer meet these requirements.

Please do not hesitate to call the fire administration office or me for further information between 9:00 am and 4:00 pm, Monday through Friday.

Sincerely,
Trent Harwig
Fire Chief/Administrator

PEYTON FIRE PROTECTION DISTRICT
Administrative Offices
141 Union Boulevard, Suite 150
Lakewood, Colorado 80228-1898
Tel: 303-987-0835 800-741-3254
Fax: 303-987-2032

October 30, 2018

4 Site Investments, LLC
1274 Kelly Johnson Blvd., Suite 100
Colorado Springs, CO 80923

Re: A portion of 4 Way Ranch – Phase 2 (the "Project") – Fire Protection to Serve Letter

To Whom It May Concern:

Based upon the provided information, a portion of the above-referenced Project is located within the jurisdiction and boundaries of the Peyton Fire Protection District (the "District"). The portion within the boundaries of the District is that portion east of the North/South section line beginning at the intersection of Highway 24 and Curtis Road.

The District is able to provide fire prevention and suppression, emergency rescue, emergency medical, and emergency hazardous materials response to the portion of the Project that is within the District service area, subject to the following conditions:

- All new construction, renovations, or developments within the District's jurisdiction must comply with the applicable fire code and nationally recognized life-safety standards adopted by the El Paso County Board of County Commissioners and the District's Board of Directors, as amended from time to time;
- All development, water, and construction plans must be reviewed and approved by the District for compliance with the applicable fire code and nationally recognized life-safety standards prior to final plat or construction permit being issued; and
- All development or construction projects shall meet the fire code and nationally recognized standards pertaining to fire protection water. Approved and inspected fire cisterns are permitted by the District in an attempt to help the property owner/developer meet these requirements.

If additional information is required, please contact our administrative office at 303-987-0835. Thank you.

Sincerely,

Ashley B. Frisbie
District Manager

cc: Patrick Palacol, District President
Jeffery Turner, Fire Chief

Appendix D

USFWS IPaC Trust Resources Report