APPENDIX R:

Calculations

Alternative 1 - Plains Sewer Collection System Capacity Calculations

Capacity Evaluation for Plains Township Sewer Authority - EXISTING CONDITIONS
assumes Manning's n = 0.015 for VCP
0.015 for DIP
0.015 for RCP

Pipe Material	STREET NAME	UPSTREAM MANHOLE #	UPSTREAM MANHOLE ELEV.	DOWNSTREAM MANHOLE #	DOWNSTREAM MANHOLE ELEV	PIPE DIAM. IN.	LENGTH (FT)	SLOPE (FT/FT)	X-SECT AREA (FT2)	VELOCITY (Ft/s)	FULL PIPE CAPACITY (cfs)	FULL PIPE CAPACITY (MGD)	(A) DESIGN AVG CAPACITY (MGD)	(B) Est Existing AVG Flow (MGD)	(C) Est. Prop. AVG Flow (MGD)	(D) Excess Capacity AVG Flow (MGD)
DIP	E.MT.RD.	3	1024.5	2	1020.2	10	215	0.02	0.55	4.9	2.69	1.74	0.580	0.01	0.191	0.389
DIP	E.MT.RD.	2	1020.1	1	1016.1	10	200	0.02	0.55	4.9	2.69	1.74	0.580	0.01	0.191	0.389
DIP	E.MT.RD.	1	1016	29	1010.9	10	200	0.02	0.55	4.9	2.69	1.74	0.580	0.01	0.191	0.389
DIP	E.MT.RD.	29	1010.98	28	1006.84	10	255	0.0162	0.55	4.4	2.42	1.57	0.522	0.01	0.191	0.331
DIP	E.MT.RD.	28	1006.84	27	1005	10	244	0.0075	0.55	3.0	1.65	1.07	0.355	0.01	0.191	0.164
DIP	E.MT.RD.	27	999.86	26	998.46	10	148	0.0095	0.55	3.4	1.85	1.20	0.400	0.132	0.313	0.087
DIP	E.MT.RD.	26	998.46	25	996.93	10	138	0.0111	0.55	3.7	2.00	1.30	0.432	0.132	0.313	0.119
DIP	E.MT.RD.	25	996.93	24	995.74	10	149	0.008	0.55	3.1	1.70	1.10	0.367	0.132	0.313	0.054
DIP	E.MT.RD.	24	995.74	23	994.13	10	149.5	0.0108	0.55	3.6	1.98	1.28	0.426	0.132	0.313	0.113
DIP	E.MT.RD.	23	994.13	22	988.17	10	150	0.04	0.55	7.0	3.81	2.46	0.820	0.132	0.313	0.507
DIP	E.MT.RD.	22	988.17	21	985.91	10	152.5	0.0148	0.55	4.2	2.32	1.50	0.499	0.132	0.313	0.186
DIP	E.MT.RD.	21	985.91	20	979.55	10	343.5	0.0185	0.55	4.7	2.59	1.67	0.558	0.132	0.313	0.245
DIP	E.MT.RD.	20	979.55	20A	969.01	10	162.5	0.0649	0.55	8.9	4.85	3.13	1.045	0.132	0.313	0.732
DIP	E.MT.RD.	20A	969.01	19	957.28	10	240	0.0488	0.55	7.7	4.20	2.72	0.906	0.132	0.313	0.593
DIP	E.MT.RD.	19	957.28	18	942.74	10	239.2	0.0608	0.55	8.6	4.69	3.03	1.011	0.132	0.313	0.698
DIP	E.MT.RD.	18	942.74	17	917.32	10	385.3	0.066	0.55	9.0	4.89	3.16	1.053	0.132	0.313	0.740
DIP	E.MT.RD.	17	917.32	16	890.98	12	414.8	0.0635	0.79	9.9	7.80	5.04	1.680	0.22	0.401	1.279
DIP	E.MT.RD.	16	890.98	15	882.97	12	172.7	0.0464	0.79	8.5	6.67	4.31	1.436	0.22	0.401	1.035
DIP	E.MT.RD.	15	882.97	14	873.6	12	169	0.0554	0.79	9.3	7.28	4.71	1.570	0.22	0.401	1.169
DIP	E.MT.RD.	14	873.6	13	864.51	12	120	0.0758	0.79	10.8	8.52	5.51	1.836	0.22	0.401	1.435
DIP	E.MT.RD.	13	864.51	12	856.24	12	140	0.0591	0.79	9.6	7.52	4.86	1.621	0.22	0.401	1.220
DIP	E.MT.RD.	12	856.24	11	848.2	12	159.5	0.0504	0.79	8.8	6.95	4.49	1.497	0.22	0.401	1.096
DIP	E.MT.RD.	11	848.2	10	839.14	12	152.5	0.0594	0.79	9.6	7.54	4.88	1.625	0.22	0.401	1.224
DIP	E.MT.RD.	10	839.14	9	813.99	12	400.3	0.0628	0.79	9.9	7.76	5.01	1.671	0.22	0.401	1.270
DIP	E.MT.RD.	9	813.99	8	805.98	12	133.4	0.06	0.79	9.7	7.58	4.90	1.633	0.22	0.401	1.232
DIP	E.MT.RD.	8	805.98	7	799.52	12	119.3	0.0541	0.79	9.2	7.20	4.65	1.551	0.22	0.401	1.150
DIP	E.MT.RD.	7	799.52	6	794.26	12	124	0.0424	0.79	8.1	6.37	4.12	1.373	0.22	0.401	0.972
DIP	E.MT.RD.	6	794.26	5	788.47	12	119	0.0487	0.79	8.7	6.83	4.41	1.472	0.22	0.401	1.071
DIP	E.MT.RD.	5	788.47	4	786.83	12	132.57	0.0124	0.79	4.4	3.45	2.23	0.743	0.22	0.401	0.342
VCP	Jumper RD.	4	786.83	3A	777.65	12	114.36	0.0531	0.79	9.1	7.13	4.61	1.537	0.22	0.401	1.136
VCP	Jumper RD.	3A	777.65	3	754.03	12	285.08	0.0829	0.79	11.3	8.91	5.76	1.920	0.22	0.401	1.519
VCP	Jumper RD.	3	754.03	2A	728.89	12	320.36	0.0785	0.79	11.0	8.67	5.60	1.868	0.22	0.401	1.467
VCP	Jumper RD.	2A	728.89	2	719.84	12	136.13	0.0594	0.79	9.6	7.54	4.88	1.625	0.22	0.401	1.224
VCP	Jumper RD.	2	719.84	1	705.88	12	199.09	0.0701	0.79	10.4	8.19	5.30	1.765	0.22	0.401	1.364
VCP	Jumper RD.	1	705.88	1A	702.62	12	48.45	0.0673	0.79	10.2	8.03	5.19	1.730	0.22	0.401	1.329
VCP	SR 315	1A(D155)	700.19	D-154	698.92	12	77.4	0.02	0.79	5.6	4.38	2.83	0.943	0.35	0.531	0.412
VCP	SR 315	D-154	698.92	D-153	695.17	12	133.9	0.02	0.79	5.6	4.38	2.83	0.943	0.35	0.531	0.412
VCP	SR 315	D-153	695.17	D-152	684.93	12	400	0.03	0.79	6.8	5.36	3.46	1.155	0.35	0.531	0.624
VCP	SR 315	D-152	684.93	D-32	679.53	12	270	0.02	0.79	5.6	4.38	2.83	0.943	0.35	0.531	0.412
VCP	ROW	D-32	673.94	D-31	671.11	21	132.2	0.0214	2.41	8.4	20.14	13.02	5.207	0.909	1.09	4.117
VCP	ROW	D-31	671.11	D-=30	668.37	21	235.4	0.0116	2.41	6.2	14.83	9.58	3.834	0.909	1.09	2.744
VCP	ROW	D-30	668.37	D-29	665.09	21	234.6	0.014	2.41	6.8	16.29	10.53	4.211	0.909	1.09	3.121
newPVC	ROW	D-29	665.09	D-27	661.66	21	340+/-	0.01	2.41	5.7	13.77	8.90	3.559	0.909	1.09	2.469
VCP	ROW	D-27	661.66	D-26	661.34	21	147.3	0.0022	2.41	2.7	6.46	4.17	1.669	0.909	1.09	0.579
VCP	ROW	D-26	661.34	D-25	660.85	21	318.7	0.0015	2.41	2.2	5.33	3.45	1.379	0.909	1.09	0.289

Pipe Material	STREET NAME	UPSTREAM MANHOLE #	UPSTREAM MANHOLE ELEV.	DOWNSTREAM MANHOLE #	DOWNSTREAM MANHOLE ELEV	PIPE DIAM. IN.	LENGTH (FT)	SLOPE (FT/FT)	X-SECT AREA (FT2)	VELOCITY (Ft/s)	FULL PIPE CAPACITY (cfs)	FULL PIPE CAPACITY (MGD)	DESIGN AVG CAPACITY (MGD)	Est Existing AVG Flow (MGD)	Est. Prop. AVG Flow (MGD)	Capacity AVG Flow (MGD)
VCP	ROW	D-25	660.85	D-24	659.46	21	385	0.0036	2.41	3.4	8.26	5.34	2.136	0.909	1.09	1.046
VCP	ROW	D24	659.46	D-23	658.71	21	154.5	0.0048	2.41	4.0	9.54	6.16	2.466	0.909	1.09	1.376
VCP	ROW	D-23	658.71	D-22	657.86	21	190.2	0.0045	2.41	3.8	9.23	5.97	2.388	0.909	1.09	1.298
VCP	ROW	D-22	657.86	D-21	656.57	21	326	0.004	2.41	3.6	8.71	5.63	2.251	0.909	1.09	1.161
VCP	ROW	D-21	656.57	D-20	651.73	21	407	0.0119	2.41	6.2	15.02	9.71	3.883	0.909	1.09	2.793
VCP	ROW	D-20	651.73	D-19	650.59	21	311.5	0.0037	2.41	3.5	8.37	5.41	2.165	0.909	1.09	1.075
VCP	ROW	D-19	650.59	D-18	649.79	21	106	0.0075	2.41	5.0	11.92	7.71	3.082	0.909	1.09	1.992
VCP	ROW	D-18	649.79	D-17	648.39	21	327	0.0043	2.41	3.8	9.03	5.84	2.334	0.909	1.09	1.244
VCP	ROW	D-17	648.39	D-16	647.04	21	328.7	0.0041	2.41	3.7	8.81	5.70	2.279	0.909	1.09	1.189
VCP	ROW	D-16	647.04	D-15	645.25	21	297	0.006	2.41	4.4	10.66	6.89	2.757	0.909	1.09	1.667
VCP	ROW	D-15	645.25	D-14	639.65	21	312	0.0179	2.41	7.7	18.42	11.91	4.762	0.909	1.09	3.672
VCP	ROW	D-14	639.65	D-13	634.02	21	261	0.0216	2.41	8.4	20.23	13.08	5.231	0.909	1.09	4.141
VCP	ROW	D-13	634.02	D-12	631.51	21	190	0.0132	2.41	6.6	15.82	10.22	4.089	0.909	1.09	2.999
VCP	ROW	D-12	631.51	D-11	630.54	21	262	0.007	2.41	4.8	11.52	7.44	2.978	1.48	1.661	1.317
VCP	ROW	D-11	630.54	D-10	629.04	21	213.3	0.007	2.41	4.8	11.52	7.44	2.978	1.48	1.661	1.317
VCP	ROW	D-10	629.04	D-9	627.12	21	381	0.005	2.41	4.0	9.73	6.29	2.517	1.48	1.661	0.856
VCP	ROW	D-9	627.12	D-8	624.87	21	344	0.0065	2.41	4.6	11.10	7.17	2.870	1.48	1.661	1.209
VCP	ROW	D-8	624.87	D-7	615.81	21	230	0.0394	2.41	11.4	27.32	17.66	7.065	1.48	1.661	5.404
VCP	ROW	D-7	615.81	D-6	615.26	21	116	0.0047	2.41	3.9	9.44	6.10	2.440	1.48	1.661	0.779
VCP	ROW	D-6	615.26	D-5	613.14	21	393	0.0054	2.41	4.2	10.12	6.54	2.616	1.48	1.661	0.955
VCP	ROW	D-5	613.14	D-4	610.19	21	409	0.0072	2.41	4.9	11.68	7.55	3.020	1.48	1.661	1.359
VCP	ROW	D-4	610.19	D-3	607.74	21	410.8	0.006	2.41	4.4	10.66	6.89	2.757	1.48	1.661	1.096
VCP	ROW	D-3	607.74	D-2	606.41	21	313	0.0043	2.41	3.8	9.03	5.84	2.334	1.48	1.661	0.673
VCP	ROW	D-2	606.41	D-1	605.28	21	244.5	0.0046	2.41	3.9	9.34	6.04	2.414	1.48	1.661	0.753
VCP	ROW	D-1	605.28	56+30	602.11	21	150	0.02	2.41	8.1	19.47	12.58	5.034	1.48	1.661	3.373
VCP	ROW	56+30	602.11	42+10	587.94	21	1420	0.01	2.41	5.7	13.77	8.90	3.559	1.48	1.661	1.898
VCP	Cleveland St	42+10	587.94	37+03	584.87	21	507	0.006	2.41	4.4	10.66	6.89	2.757	1.48	1.661	1.096
VCP	Cleveland St	37+03	584.87	36+85	584.73	21	18	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	North St.	36+85	583.9	34+92	582.36	21	193	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	Center St.	34+92	582.36	33+00	580.82	21	192	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	Center St.	33+00	580.82	30+40	578.74	21	260	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	30+40	578.74	29+05	577.66	21	135	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	29+05	577.66	27+55	576.46	21	150	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	27+55	576.46	25+70	574.98	21	185	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	25+70	574.98	23+30	573.06	21	240	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	23+30	573.06	22+20	572.18	21	110	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	22+20	572.18	20+00	570.42	21	220	0.008	2.41	5.1	12.31	7.96	3.184	1.48	1.661	1.523
VCP	ROW	20+00	570.42	16+30	568.52	24	370	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
VCP	ROW	16+30	568.52	13+00	567.2	24	330	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
VCP	ROW	13+00	567.2	10+50	566.2	24	250	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
VCP	ROW	10+50	566.2	8+50	565	24	200	0.006	3.14	4.8	15.22	9.84	3.937	1.48	1.661	2.276
VCP	ROW	8+50	565	5+10	563.64	24	340	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
VCP	ROW	5+10	563.64	1+70(4+40)	562.28	24	340	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
VCP	ROW	(4+40)	562.28	(1+08)	560.95	24	332	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
RCP	ROW	(1+08)	560.95	28+35	559.64	24	335	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
RCP	ROW	28+35	559.64	25+35	558.41	24	300	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
RCP	ROW	25+35	558.41	21+60	556.91	24	375	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
RCP	ROW	21+60	556.91	17+85	555.41	24	375	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
RCP	ROW	17+85	555.41	15+00	554.27	24	285	0.004	3.14	4.0	12.43	8.04	3.214	1.48	1.661	1.553
RCP	ROW	15+00	554.27	11+55	550.82	24	345	0.01	3.14	6.3	19.65	12.71	5.082	1.48	1.661	3.421
RCP	ROW	11+55	550.82	8+35	547.62	24	320	0.01	3.14	6.3	19.65	12.71	5.082	1.48	1.661	3.421

(A) = Full pipe Capacity / 3 peaking factor (for pipe sizes less than 21")
(A) = Full pipe Capacity / 2.5 peaking factor (for pipe sizes equal to or greater than 21")
(B) - estimated based on EDU information obtained from PTSA for large commercial users; number of residential EDUs connecting into the system were also estimated
(C) = Existing Flow + 150,000 gpd (Proposed BCT Flow)
(D) = Design Capacity - Total Proposed Flow

Alternative 3 - Land Application Calculations

Parcel 6A	Chippewa	Morris	Wellsboro	Oquaga	Chippewa	Chippewa	Oquaga	Wellsboro	Rexford	Wayland	Morris	Lackawanna	Muck	Lackawanna	Oquaga	
Soil Type	CIA	MsB	WmB	OpD	CIB	CnB	OXF	WmD	RdA	Wa	MsB	LcD	Mu	LcB	OpB	
Area (SF)	2,205,401	2,020,149	1,000,285	258,750	188,576	110,746	26,815	27,719	139,453	122,061	35,290	262,695	235,755	101,002	89,878	
	100,646	154,097	1,647,819	205,080		8,666	242,645	191,295		18,790		10,398		129,135		
	247,876		128,229	7,875		299,370		58,249		165,252						
			30,692													
			136,179													
			510,298													
			79,589													
			94,769													
			86,356													
			47,051													
Totals (SF)	2,553,923	2,174,245	3,761,266	471,704	188,576	418,783	269,460	277,263	139,453	306,102	35,290	273,093	235,755	230,136	89,878	
Totals (Acres)	58.63	49.91	86.35	10.83	4.33	9.61	6.19	6.37	3.20	7.03	0.81	6.27	5.41	5.28	2.06	
Total Parcel Area (Acres)	262.28															
% of Total Area	22.35%	19.03%	32.92%	4.13%	1.65%	3.67%	2.36%	2.43%	1.22%	2.68%	0.31%	2.39%	2.06%	2.01%	0.79%	
Spray Irrigation	N	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	
Permeability			0.060	0.080				0.060				0.075		0.075	0.080	
Area			5.18	0.87				0.38				0.47		0.40	0.17	0.06
			86	11				6				6		5	2	115
	Check															
	1.00	ok														
	11,433,242															
	262.47	ok														

Bear Creek
Parcel 6A

Area 115 acres 0.060 in/hr

Month	Forest Adj PE (inches)	Suitable Days	Precipitation (P) 50% Prob inches/month	Precipitation (P) 90% Prob inches/month	Perm (K) 100% inches/month	Perm (K) 10% in/month	WW Load 10% K in/month	WW Load ac-in/month	WW Load gallons/month	WW Load Suitable Day gpd
January	0	0	2.46	2.88	0	0	0	0		
February	0	0	2.08	2.43	0	0	0	0		
March	0.62	8	2.69	3.14	11.52	1.15	0.00	0		
April	1.57	21	3.28	3.83	30.24	3.02	0.76	88	2,381,785	113,418
May	3.60	30	3.69	4.31	43.20	4.32	3.60	415	11,256,574	375,219
June	5.41	30	3.97	4.64	43.20	4.32	5.09	585	15,889,773	529,659
July	6.00	31	3.74	4.37	44.64	4.46	6.09	700	19,018,959	613,515
August	5.15	30	3.1	3.62	43.20	4.32	5.84	672	18,246,472	608,216
September	3.45	30	3.86	4.51	43.20	4.32	3.26	375	10,182,259	339,409
October	1.78	17	3.02	3.53	24.48	2.45	0.70	81	2,195,023	129,119
November	0.62	12	3.12	3.65	17.28	1.73	0	0		
December	0	0	2.55	2.98	0	0	0	0		
	28.20	209	37.56	43.90			25.35			

Sources:
Climatography of the US No. 81 Supplement No. 1
Monthly Precipitation Probabilities 1970 - 2000 Normals, Pennsylvania
WB Scranton Airport
Comparative Climatic Data through 1976, April 1977
Number of Suitable Days - Temperature > 32 C

Avoca, PA

Spray Field Loadings - Parcel 6A

$L_{w(p)} = ET - P + W_p$

$L_{w(p)}$ = wastewater hydraulic loading rate based on soil permeability, in/month
ET = design evapotranspiration rate, in/month
P = design precipitation rate, in/month
W_p = design percolation rate, in/month = Permeability K(100%) x 10%

Soil Permeability based on Hydraulic Conductilivity Tests

k, Permeability (in/hr) = 0.06
Permeability (K) 100% = Operating days x 24 hrs x k

Month	Calendar Days	Operating Days	ET (in/month)	P (in/month)	*Permeability (K) 100%* (in/hr)	W_p (in/month)	$L_{w(p)}$ (in/month)	$L_{w(p)}$ (in/week)
January	31	0	0.00	2.88	0.00	0.00	0.00	0.00
February	28	0	0.00	2.43	0.00	0.00	0.00	0.00
March	31	8	0.62	3.14	11.52	1.15	0.00	0.00
April	30	21	1.57	3.83	30.24	3.02	0.76	0.18
May	31	30	3.60	4.31	43.20	4.32	3.61	0.82
June	30	30	5.41	4.64	43.20	4.32	5.09	1.19
July	31	31	6.00	4.37	44.64	4.46	6.09	1.38
August	31	30	5.15	3.62	43.20	4.32	5.85	1.32
September	30	30	3.45	4.51	43.20	4.32	3.26	0.76
October	31	17	1.78	3.53	24.48	2.45	0.70	0.16
November	30	12	0.62	3.65	17.28	1.73	0.00	0.00
December	31	0	0.00	2.98	0.00	0.00	0.00	0.00
	365	209	28.20	43.89				
						Toal (March - Oct.)	25.37	
						Average (March - Oct.)	3.17	0.72

Partial Yr. Spray

Month	Forest Adj PE (inches)	Precipitation (P) 90% Prob inches/month	Precip - Evap (Gal/Month)
January	0	2.88	220,952
February	0	2.43	186,821
March	0.62	3.14	194,171
April	1.57	3.83	173,771
May	3.60	4.31	54,965
June	5.41	4.64	-59,053
July	6.00	4.37	-124,993
August	5.15	3.62	-117,049
September	3.45	4.51	81,402
October	1.78	3.53	134,103
November	0.62	3.65	232,553
December	0	2.98	229,036
	28.20	43.90	1,206,679

Spray Field Sizing Parcel 6A - Partial Year Spray

Average loading rate (in/ac/week):	0.725	Operating weeks (March - October):	28.14
Annual loading rate (in/ac/yr):	25.37	Annual loading rate (gal/ac/yr) [1]:	688,840
Wastewater flow (gpd):	150,000		
Spray area (acres):	**52.00** [2]		
Spray area (sf):	2,265,120	⟶ Add 100 ft. Buffer:	2,907,132.62
			66.74
		Total Area =	**66.70**

Storage Requirement

Month	Calendar Days	Operating Days	$L_{w(p)}$ (in/ac/mo.)	Available $L_{w(p)}$ (Gal/month)	Wastewater Volume (Gal/month)	Prec - Evapo Volume (Gal/month)	Total Inflow Volume (Gal/month)	Storage (Gallons)	Cumulative Storage (Gallons)	Discharge (Gallons)
January	31	0	0.00	-	4,650,000	220,952	4,870,952	220,952	4,474,037	4,650,000
February	28	0	0.00	-	4,200,000	186,821	4,386,821	186,821	4,660,859	4,200,000
March	31	8	0.00	-	4,650,000	194,171	4,844,171	194,171	4,855,030	4,650,000
April	30	21	0.76	1,077,062	4,500,000	173,771	4,673,771	3,596,709	8,451,738	-
May	31	30	3.60	5,090,310	4,650,000	54,965	4,704,965	(385,345)	8,066,393	-
June	30	30	5.09	7,185,478	4,500,000	-59,053	4,440,947	(2,744,531)	5,321,862	-
July	31	31	6.09	8,600,520	4,650,000	-124,993	4,525,007	(4,075,513)	1,246,349	-
August	31	30	5.84	8,251,195	4,650,000	-117,049	4,532,951	(3,718,244)	(2,471,895)	-
September	30	30	3.26	4,604,496	4,500,000	81,402	4,581,402	(23,093)	-	-
October	31	17	0.70	992,606	4,650,000	134,103	4,784,103	3,791,497	3,791,497	-
November	30	12	0.00	-	4,500,000	232,553	4,732,553	232,553	4,024,050	4,500,000
December	31	0	0.00	-	4,650,000	229,036	4,879,036	229,036	4,253,086	4,650,000
	365	209	25.35	35,801,667	54,750,000	1,206,679	55,956,679			22,650,000

Available $L_{w(p)}$ in gallons each month = $L_{w(p)}$ x (acres) x (1/12) x (43,560) x (7.481)

Storage	8,451,738	gal
	1,129,761	cf

Pond @ 8 ft. deep =	112,976.05	sf ⟶	25 % Buffer:	141,220
				3.24
			Total Area =	**3.24**
		Total Land (Spray and Storage Lagoon) =		**69.94 ac**
			Round to	**70.00 ac**

(1) Annual Loading Rate (gallons/acre/year) = Annual Loading Rate (in/ac/yr) * (1/12) * 43560 * 7.481)
(2) Spray Area = area tested and set asside for spray

Alternative 4 - Land Application Calculations

Parcel 6	Wellsboro	Oquaga	Lackawanna	Oquaga	Morris	Chippewa	Water	Lackawanna	Arnot	Arnot	Chippewa	Oquaga	Wellsboro	Chippewa	Muck	Lackawanna	Morris	Arnot	Morris	Morris	
Soil Type	WmB	OpD	LcB	OpB	MsB	CnB	W	LcD	ArB	ArD	CIA	OXF	WmD	CIB	Mu	LcB	MoB	ASF	MsC	MsB	
Area (SF)	3,907,388	6,066,527	574,302	197,609	196,456	346,417	449,353	770,223	278,152	1,466,717	811,270	274,135	415,404	439,042	763,441	480,267	730,078	196,425	48,796	90,391	
	942,390	2,200,977	761,014	494,224	1,245,296	497,187		370,938			161,716	246,084	215,284					284,269		4,517	
	1,707,178	2,057,285	2,405,831	682,963	1,430,637	325,440						713,637	22,413								
	1,686,563	2,603,401		400,904	350,828	52,273						17,594									
	524,249			1,154,668	1,851,303																
				804,790																	
				290,612																	
				37,176																	
				77,633																	
				57,618																	
Totals (SF)	8,767,769	12,928,190	3,741,147	4,198,196	5,074,520	1,221,317	449,353	1,141,161	278,152	1,466,717	972,986	1,251,451	653,101	439,042	763,441	480,267	730,078	480,694	48,796	94,909	
Totals (Acres)	201.28	296.79	85.88	96.38	116.49	28.04	10.32	26.20	6.39	33.67	22.34	28.73	14.99	10.08	17.53	11.03	16.76	11.04	1.12	2.18	
Total Parcel Area (Acres)	1037.22																				
% of Total Area	19.41%	28.61%	8.28%	9.29%	11.23%	2.70%	0.99%	2.53%	0.62%	3.25%	2.15%	2.77%	1.45%	0.97%	1.69%	1.06%	1.62%	1.06%	0.11%	0.21%	
Spray Irrigation	Y	Y	Y	Y	N	N	N	Y	N	N	N	N	Y	N	N	Y	N	N	N	N	
Permeability	0.06	0.08	0.08	0.08				0.08					0.06			0.08					
	12.076816	23.7432318	6.441368931	7.710184954				1.964808791					0.8995882			0.826906308					0.073
Area	201.28	296.79	85.88	96.38				26.20					14.99			11.03					733
	Check																				
	1.00	ok																			
	45,192,692																				
	1037.48	ok																			

Bear Creek
Parcel 6

0.070 in/hr

Area 733 acres

Month	Forest Adj PE (inches)	Suitable Days	Precipitation (P) 50% Prob inches/month	Precipitation (P) 90% Prob inches/month	Perm (K) 100% inches/month	Perm (K) 10% in/month	WW Load 10% K in/month	WW Load ac-in/month	WW Load gallons/month	WW Load Suitable Day gpd
January	0	0	2.46	2.88	0	0	0	0		
February	0	0	2.08	2.43	0	0	0	0		
March	0.62	8	2.69	3.14	13.44	1.34	0.00	0		
April	1.57	21	3.28	3.83	35.28	3.53	1.27	929	25,212,848	1,200,612
May	3.60	30	3.69	4.31	50.40	5.04	4.32	3,170	86,079,220	2,869,307
June	5.41	30	3.97	4.64	50.40	5.04	5.81	4,258	115,610,825	3,853,694
July	6.00	31	3.74	4.37	52.08	5.21	6.83	5,010	136,033,678	4,388,183
August	5.15	30	3.1	3.62	50.40	5.04	6.56	4,811	130,632,218	4,354,407
September	3.45	30	3.86	4.51	50.40	5.04	3.98	2,918	79,231,627	2,641,054
October	1.78	17	3.02	3.53	28.56	2.86	1.11	814	22,111,670	1,300,686
November	0.62	12	3.12	3.65	20.16	2.02	0	0		
December	0	0	2.55	2.98	0	0	0	0		
	28.20	209	37.56	43.90			29.89			

Sources:
Climatography of the US No. 81 Supplement No. 1
...thly Precipitation Probabilities 1970 - 2000 Normals, Pennsylvania
...ranton Airport
...arative Climatic Data through 1976, April 1977
Number of Suitable Days - Temperature > 32 C Avoca, PA

Spray Field Loadings Parcel 6

$L_{w(p)} = ET - P + W_p$

$L_{w(p)}$ = wastewater hydraulic loading rate based on soil permeability, in/month
ET = design evapotranspiration rate, in/month
P = design precipitation rate, in/month
W_p = design percolation rate, in/month = Permeability K(100%) x 10%

Soil Permeability based on Hydraulic Conductilivity Tests

k, Permeability (in/hr) = 0.07
Permeability (K) 100% = Operating days x 24 hrs x k

Month	Calendar Days	Operating Days	ET (in/month)	P (in/month)	*Permeability (K) 100%* (in/month)	W_p (in/month)	$L_{w(p)}$ (in/month)	$L_{w(p)}$ (in/week)
January	31	0	0.00	2.88	0.00	0.00	0.00	0.00
February	28	0	0.00	2.43	0.00	0.00	0.00	0.00
March	31	8	0.62	3.14	13.44	1.34	0.00	0.00
April	30	21	1.57	3.83	35.28	3.53	1.27	0.30
May	31	30	3.60	4.31	50.40	5.04	4.33	0.98
June	30	30	5.41	4.64	50.40	5.04	5.81	1.36
July	31	31	6.00	4.37	52.08	5.21	6.84	1.54
August	31	30	5.15	3.62	50.40	5.04	6.57	1.48
September	30	30	3.45	4.51	50.40	5.04	3.98	0.93
October	31	17	1.78	3.53	28.56	2.86	1.11	0.25
November	30	12	0.62	3.65	20.16	2.02	0.00	0.00
December	31	0	0.00	2.98	0.00	0.00	0.00	0.00
	365	209		43.89				
						Toal (March - Oct.)	29.90	
						Average (March - Oct.)	3.74	0.85

Full Yr. Spray

Month	Forest Adj PE (inches)	Precipitation (P) 90% Prob inches/month	Precip - Evap (Gal/Month)
January	0	2.88	851,016
February	0	2.43	719,558
March	0.62	3.14	747,867
April	1.57	3.83	669,293
May	3.60	4.31	211,702
June	5.41	4.64	-227,448
July	6.00	4.37	-481,422
August	5.15	3.62	-450,824
September	3.45	4.51	313,529
October	1.78	3.53	516,510
November	0.62	3.65	895,701
December	0	2.98	882,151
	28.20	43.90	4,647,632

Spray Field Sizing Parcel 6

Average loading rate (in/ac/week):	0.854	Operating weeks (March - October):	28.14
Annual loading rate (in/ac/yr):	29.90	Annual loading rate (gal/ac/yr) [1]:	812,020
Wastewater flow (gpd):	150,000		
Spray area (acres):	**75.00** [2]		
Spray area (sf):	3,267,000 →	Add 100 ft. Buffer:	4,029,993.78 sf
			92.52 ac
		Total Area =	**92.50** ac

Storage Requirement

Month	Calendar Days	Operating Days	$L_{w(p)}$ (in/ac/mo.)	*Available* $L_{w(p)}$ (Gal/month)	Wastewater Volume (Gal/month)	Prec - Evapo Volume (Gal/month)	Total Inflow Volume (Gal/month)	Storage (Gallons)	Cumulative Storage (Gallons)	Storage Time (Days)
January	31	0	0.00	-	4,650,000	851,016	5,501,016	5,501,016	19,332,759	129
February	28	0	0.00	-	4,200,000	719,558	4,919,558	4,919,558	24,252,317	162
March	31	8	0.00	-	4,650,000	747,867	5,397,867	5,397,867	29,650,184	198
April	30	21	1.27	2,579,952	4,500,000	669,293	5,169,293	2,589,341	32,239,525	215
May	31	30	4.32	8,808,218	4,650,000	211,702	4,861,702	(3,946,517)	28,293,008	189
June	30	30	5.81	11,830,096	4,500,000	0	4,500,000	(7,330,096)	20,962,913	140
July	31	31	6.83	13,919,903	4,650,000	0	4,650,000	(9,269,903)	11,693,010	78
August	31	30	6.56	13,367,188	4,650,000	0	4,650,000	(8,717,188)	2,975,822	20
September	30	30	3.98	8,107,526	4,500,000	313,529	4,813,529	(3,293,997)	(318,175)	-2
October	31	17	1.11	2,262,618	4,650,000	516,510	5,166,510	2,903,891	2,903,891	19
November	30	12	0.00	-	4,500,000	895,701	5,395,701	5,395,701	8,299,592	55
December	31	0	0.00	-	4,650,000	882,151	5,532,151	5,532,151	13,831,743	92
	365	209	29.89	60,875,501	54,750,000	4,647,632	59,397,632			

Available $L_{w(p)}$ in gallons each month = $L_{w(p)}$ x (acres) x (1/12) x (43,560) x (7.481)

Maximum storage =	32,239,525 gal			
	4,309,521 cf			
Pond @ 10 ft. deep =	430,952.08 sf →	25 % Buffer:	538,690.10 sf	
			12.37 ac	
		Total Area =	**12.40** ac	
		Total Land (Spray and Storage Lagoon) =	**104.90 ac**	
		SAY	**105.00 ac**	

(1) Annual Loading Rate (gallons/acre/year) = Annual Loading Rate (in/ac/yr) * (1/12) * 43560 * 7.481)
(2) Spray Area = daily wastewater flow (gpd) x 365 days / annual spray loading rate (gal/acre/year)

Alternative 5 - On-Lot Sewage Disposal System Calculations

*Community On-Lot Systems per PA Code 73.

Alternative 5 → Community On-Lot System (On Parcel 6)

ADF (SA1 & 2) = 150,000 gpd

Provide Dosing Tanks in series as need:

→ 3,500 gallon tanks [Total cap. = 2 x 225,000 gallons = 450,000 gallons]
Per 73.45(3).

* go with large CIP tanks

Provide Pressurized Distribution – Pump & Pump Tanks

Distribution piping bed > 2,500 SF 73.44 (c)

Max lateral length → 100'
Pipe sizes as needed

Dosing Tanks → 73.45 → Min. 100 gallon capacity

Adsorption Area → 73.55 → Elevated Mounds

Min. 1 ft of sand under aggregate

Aggregate – 6" under pipes; 2" over pipes + pipe dia ~= 12" ±

Adsorption Area

Apprx. # EDU's=470 (S.A.1&2)

Use flow of 400 gpd/EDU per 73.17(a)

So Peak Daily Flow = 400 $\frac{\text{gpd}}{\text{edu}}$ x 470 EDU's= 188,000 gpd

Loading = 2.5 ft²/gpd

Area: 188,000 gpd x 2.5 ft²/gpd = 470,000 ft²

5,000 ft²/bed

$\frac{470{,}000\ \text{ft}^2}{1} \times \frac{1\ \text{bed}}{5{,}000\text{ft}^2} = 94\ \text{beds}$

Estimate Area Needed for Beds, Replacement Area, Tanks, etc. . . .

Say you can place 2 beds/acre under ideal conditions

94 beds x 2 for Replacement Area = 188 Beds

188 beds x $\frac{1 \text{ Acre}}{2 \text{ beds}}$ = 94 acres of disposal area

Need at least 10 acres for pump tanks and access areas, WWTP etc.

→ Need →94 + 10 = 104 acres

From on-lot system analysis map, the southeast portion of parcel 6 would be feasible for purchase (apprx 176 AC)

After further review of this portion of Parcel 6, approximately 213 Acres will need to be purchased due to an abundance of unsuitable soils, slopes, bodies of water, spotty location of suitable soils and buffer requirements.