

APPENDIX L
FORCE MAIN CALCULATIONS

Pipeline Velocity and Head Loss and Corresponding Pump Horsepower

Years when Flowrate Occurs: Average Flowrate	Flow, mg	Dia Area, in sq	One 12"		One 14"		One 16"		Dual 12"		Dual -12" & 14"	
			Flow, gp	head loss	Vel, fps	head loss	Vel, fps	head loss	Vel, fps	head loss	Vel, fps	head loss
	0.25	174	0.49	36	0.36	35	0.28	35	0.25	35		
1998	0.50	347	0.99	41	0.72	37	0.55	36	0.49	36	0.50	36
	0.75	521	1.48	49	1.09	41	0.83	38	0.74	38		
2020	1.00	694	1.97	60	1.45	46	1.11	41	0.99	41		
	1.25	868	2.46	74	1.81	53	1.39	44	1.23	45	1.00	41
	1.50	1,042	2.96	90	2.17	61	1.66	48	1.48	49		
	1.75	1,215	3.45	108	2.53	69	1.94	53	1.72	55		
	2.00	1,389	3.94	129	2.89	79	2.22	58	1.97	60	1.60	50
	2.25	1,563	4.43	153	3.26	90	2.49	64	2.22	67		
1998=2.4	2.50	1,736	4.93	178	3.62	103	2.77	70	2.46	74	2.00	60
	2.75	1,910	5.42	206	3.98	116	3.05	77	2.71	81		
	3.00	2,083	5.91	236	4.34	130	3.32	85	2.96	90		
	3.25	2,257	6.40	269	4.70	146	3.60	93	3.20	99	2.80	80
	3.50	2,431	6.90	303	5.07	162	3.88	101	3.45	108		
	3.75	2,604	7.39	340	5.43	179	4.16	110	3.69	118		
	4.00	2,778	7.88	379	5.79	198	4.43	120	3.94	129		
2020=4.2	4.25	2,951	8.37	420	6.15	218	4.71	131	4.19	141	3.30	100

Assumptions

- 1 Assumes a tri-plex pump station - two pumps handle entire flow, one standby.
- 2 Assume 3@90 elbow, 4@45 elbow, 1@tee thru, 1@tee branch, 1 exit, 1 entrance, 5 gate valves, 1 plug valve, 1 increaser for total K=16.96
- 3 Assume 10 @ 45 elbow, 2@ thru tees, 2@ gate valve total K= 4.4
- 4 Physical Features

Pipeline length, ft = 16,760 Static Head, ft = 34
 Pipeline friction factor, C = 120 Fittings, K= 17 Note 2