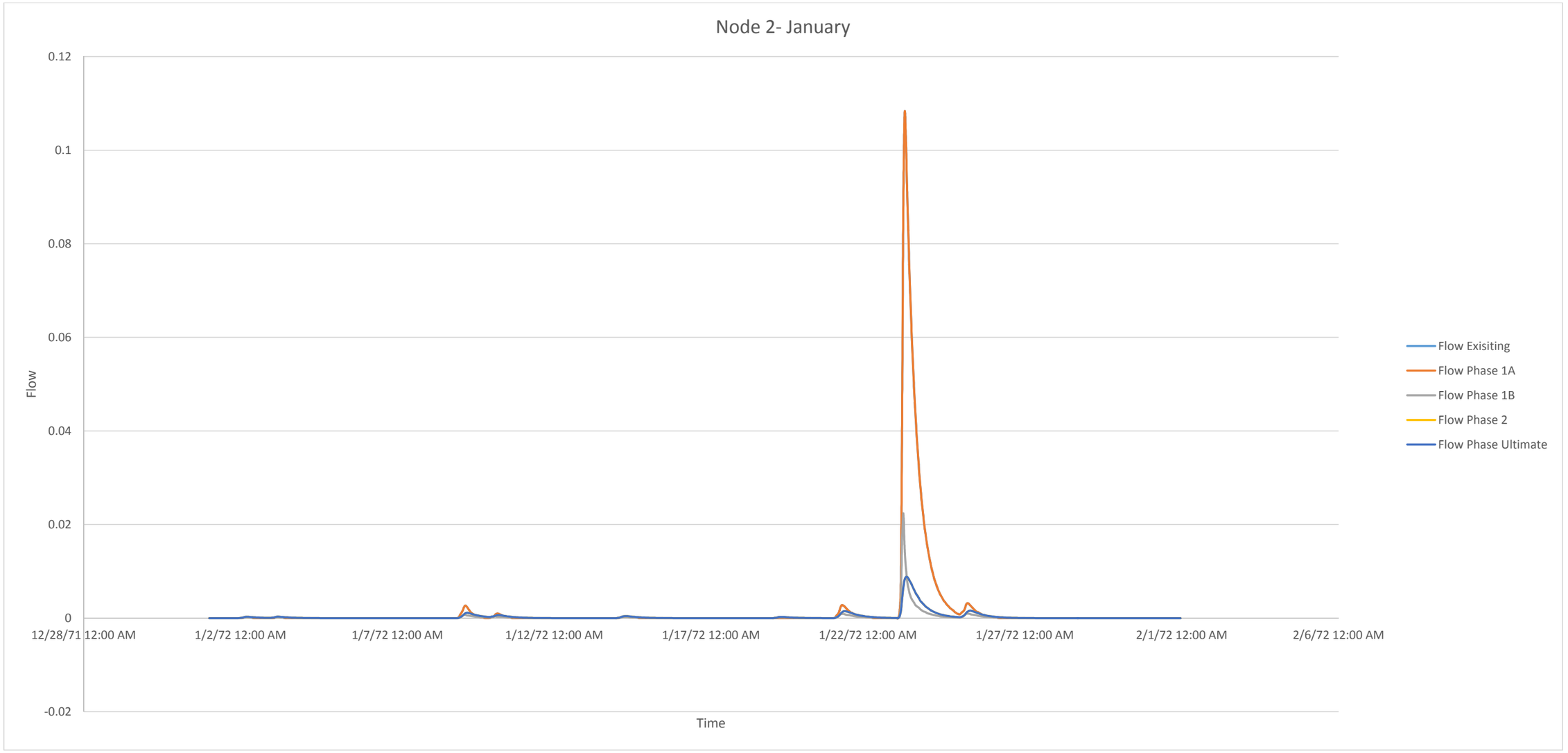
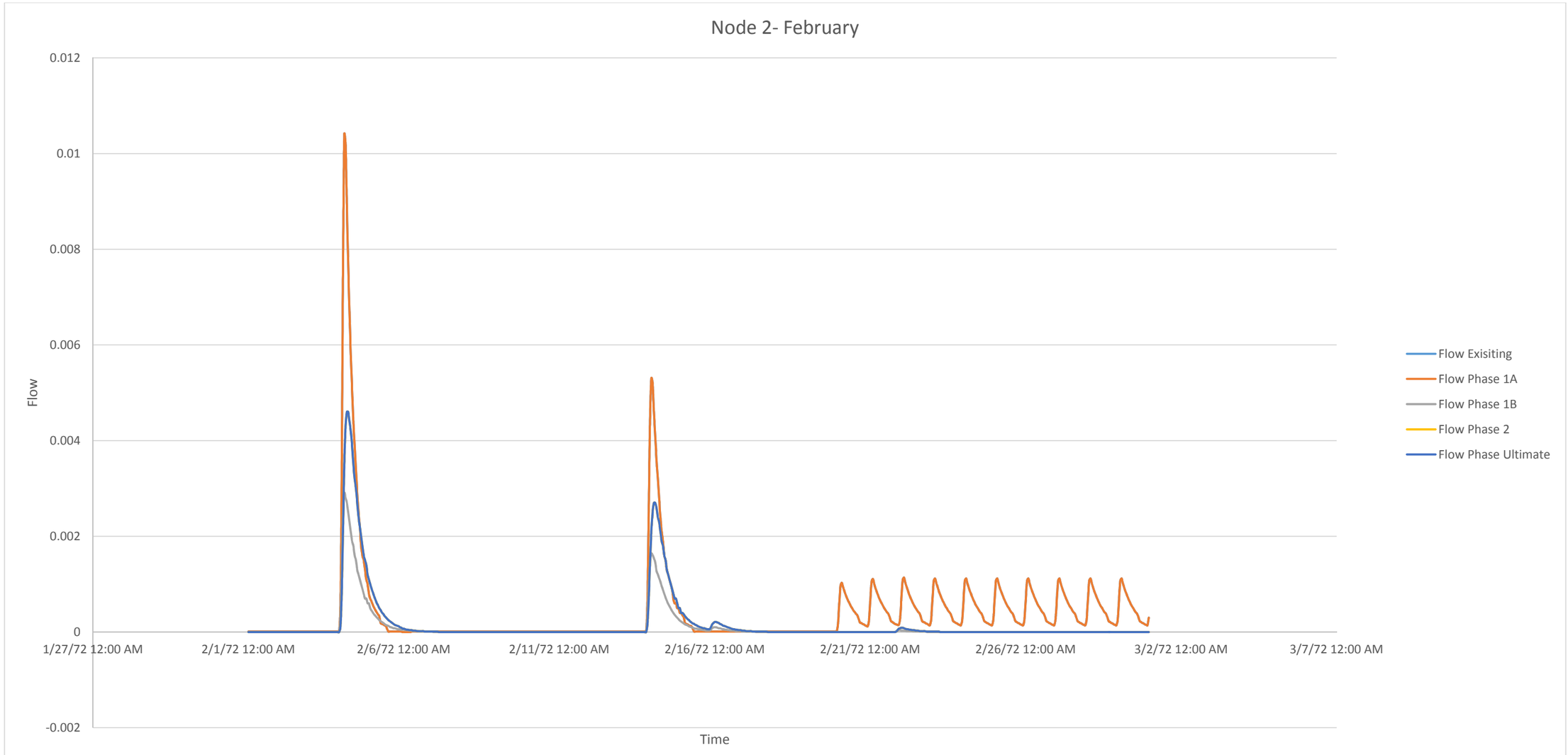
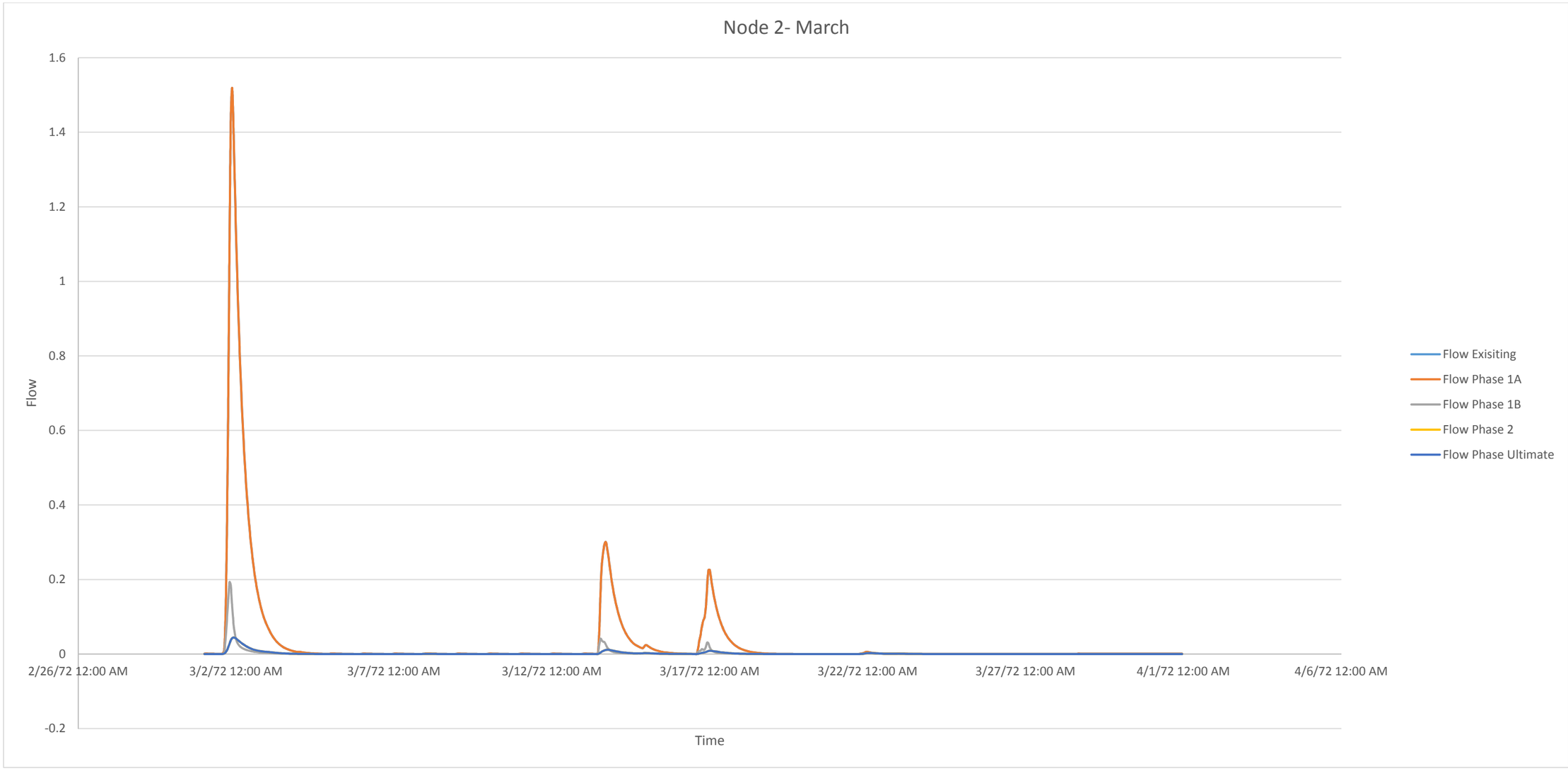
Average Year-1972



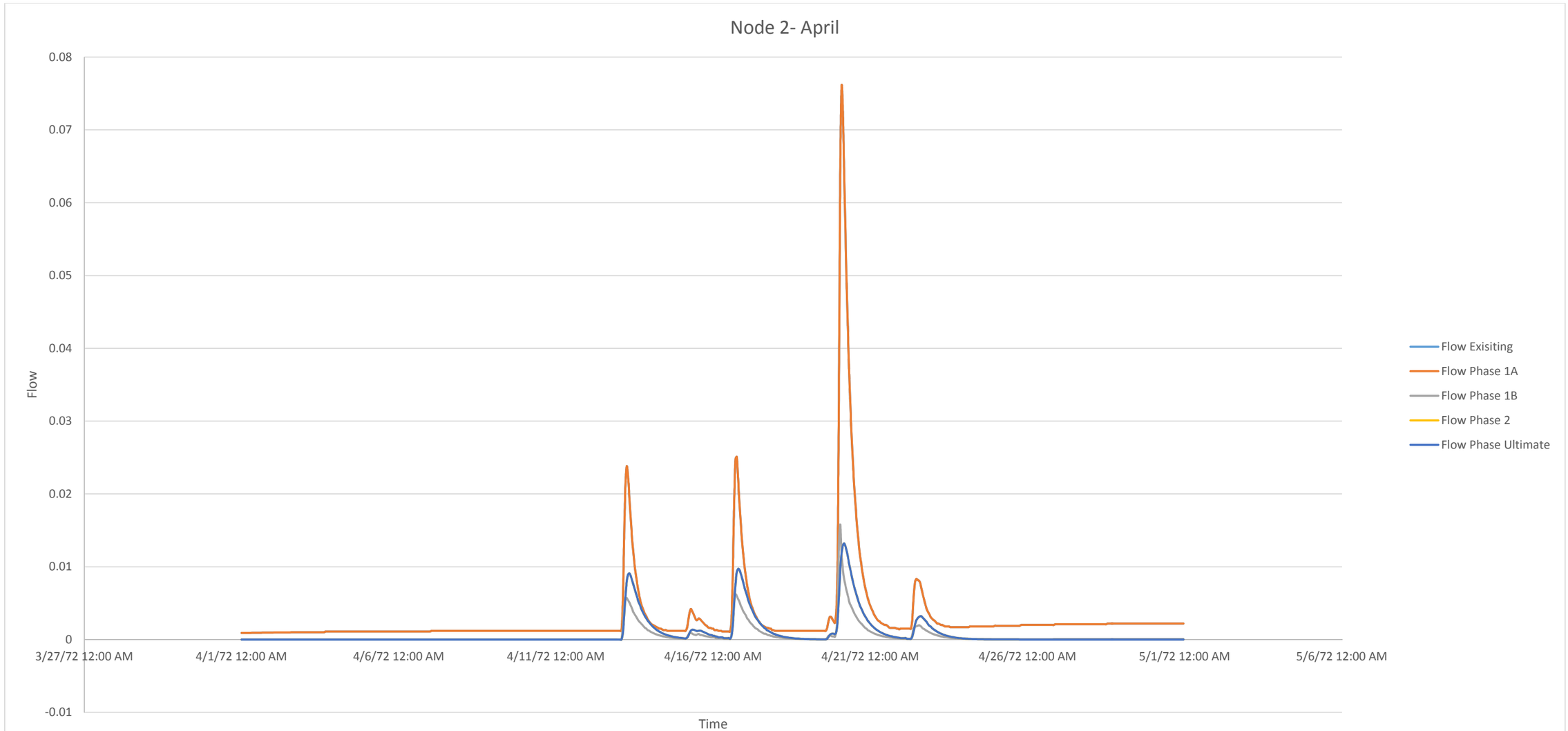
January						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		8	8	9	9	9
Magnitudes (cm/s)	Max.	0.1079	0.1079	0.0224	0.0088	0.0088
	Min.	0.00027	0.00027	0.00013	0.00027	0.00027
Duration (h)	Max.	76	76	97	104	104
	Min.	8	8	30	38	38



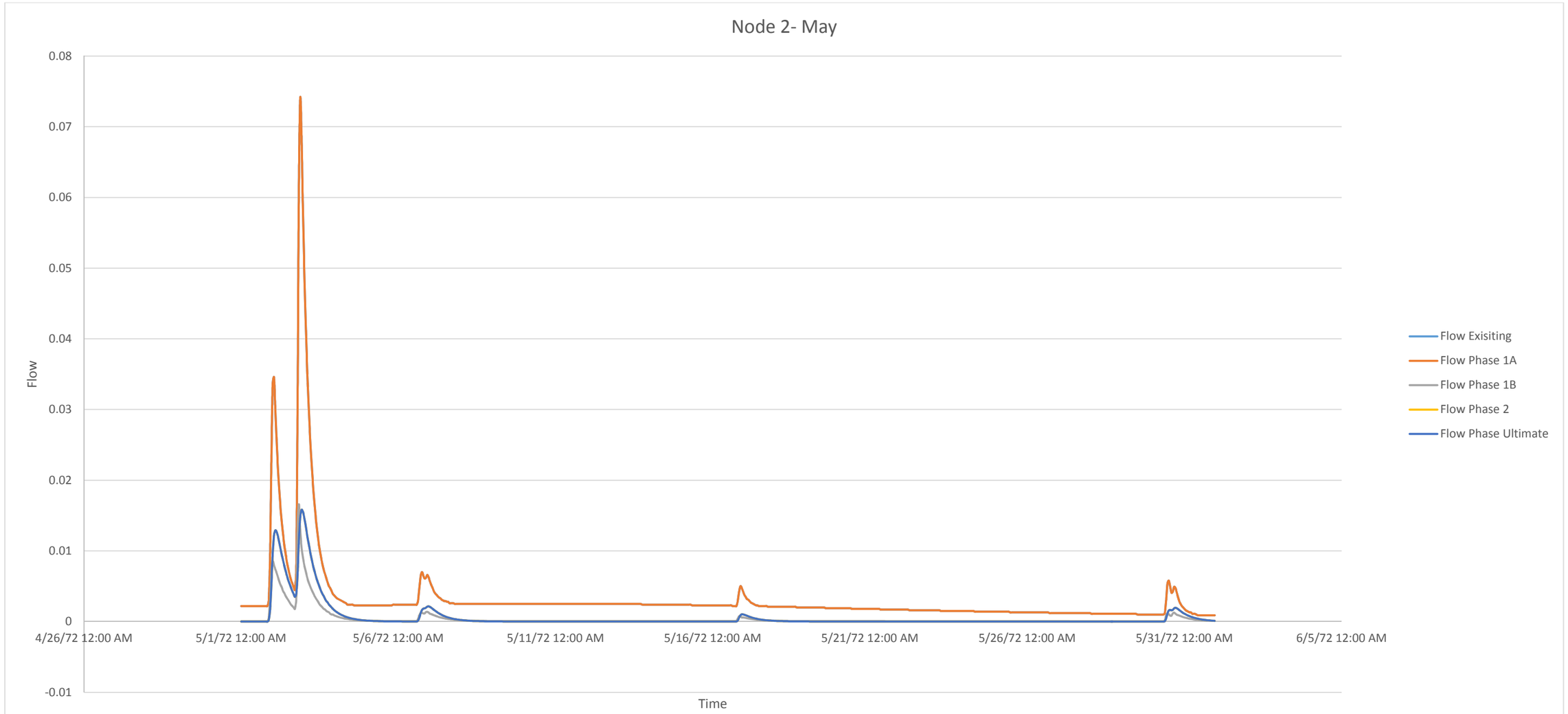
February						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		12	12	4	4	4
Magnitudes (cm/s)	Max.	0.0104	0.0104	0.0029	0.0046	0.0046
	Min.	0.00103	0.00103	0.00004	0.00009	0.00009
Duration (h)	Max.	48	48	71	76	76
	Min.	23	23	24	34	34



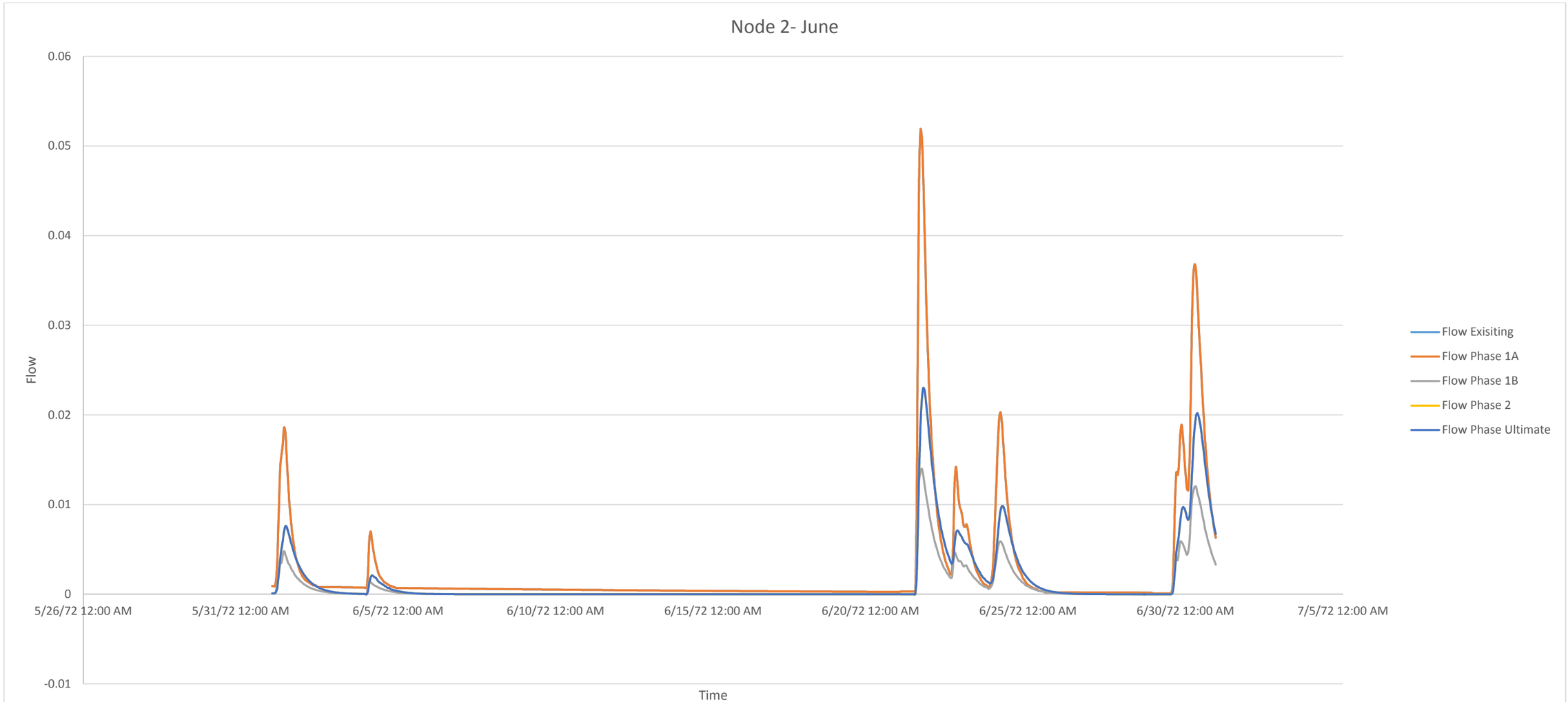
March						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitudes (cm/s)	Max.	1.5191	1.5191	0.1927	0.0443	0.0443
	Min.	0.00158	0.00158	0.00016	0.00033	0.00033
Duration (h)	Max.	79	79	100	107	107
	Min.	25	25	46	54	54



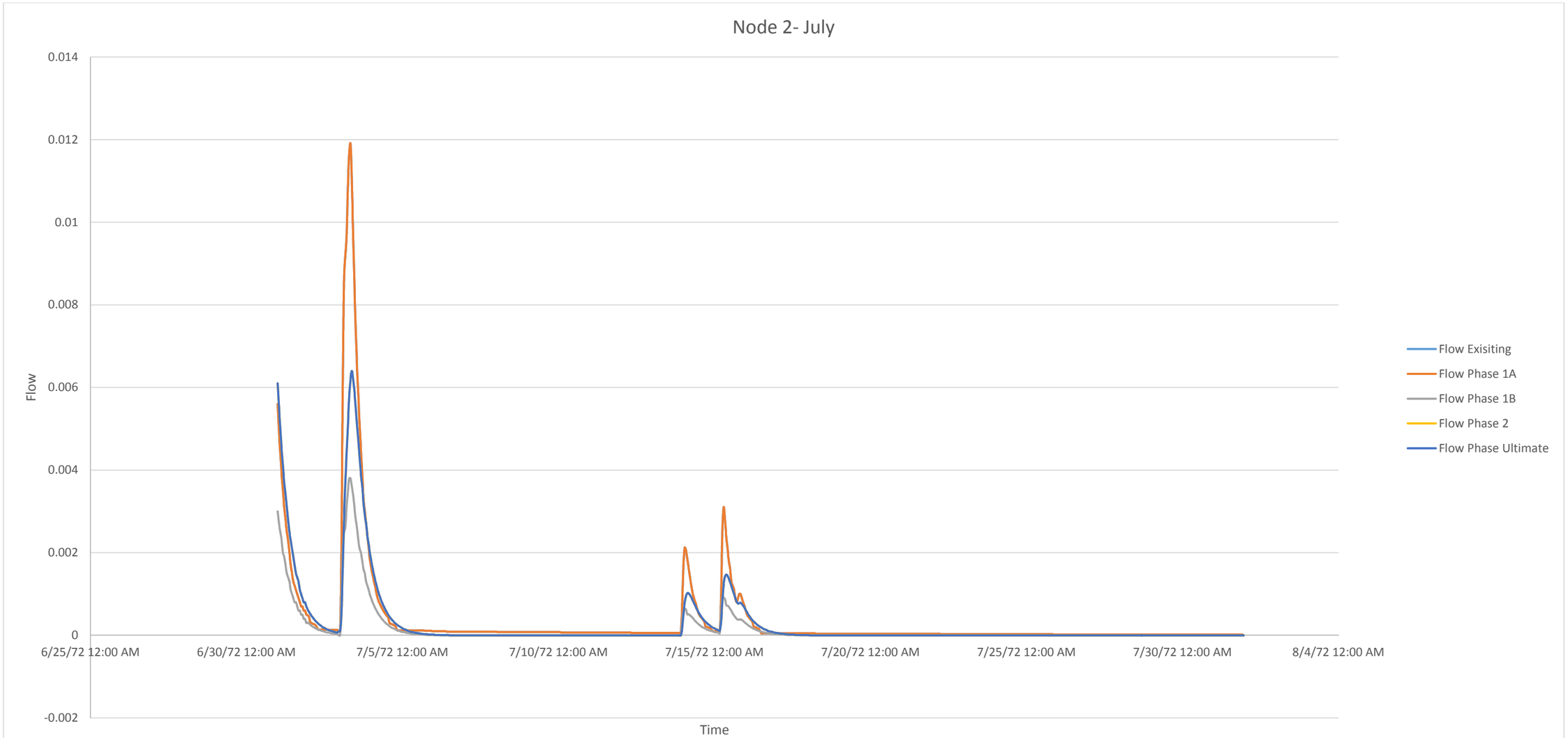
April						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitudes (cm/s)	Max.	0.0759	0.0759	0.0158	0.0132	0.0132
	Min.	0.0042	0.0042	0.00089	0.00135	0.00135
Duration (h)	Max.	55	55	65	64	64
	Min.	27	27	28	33	33



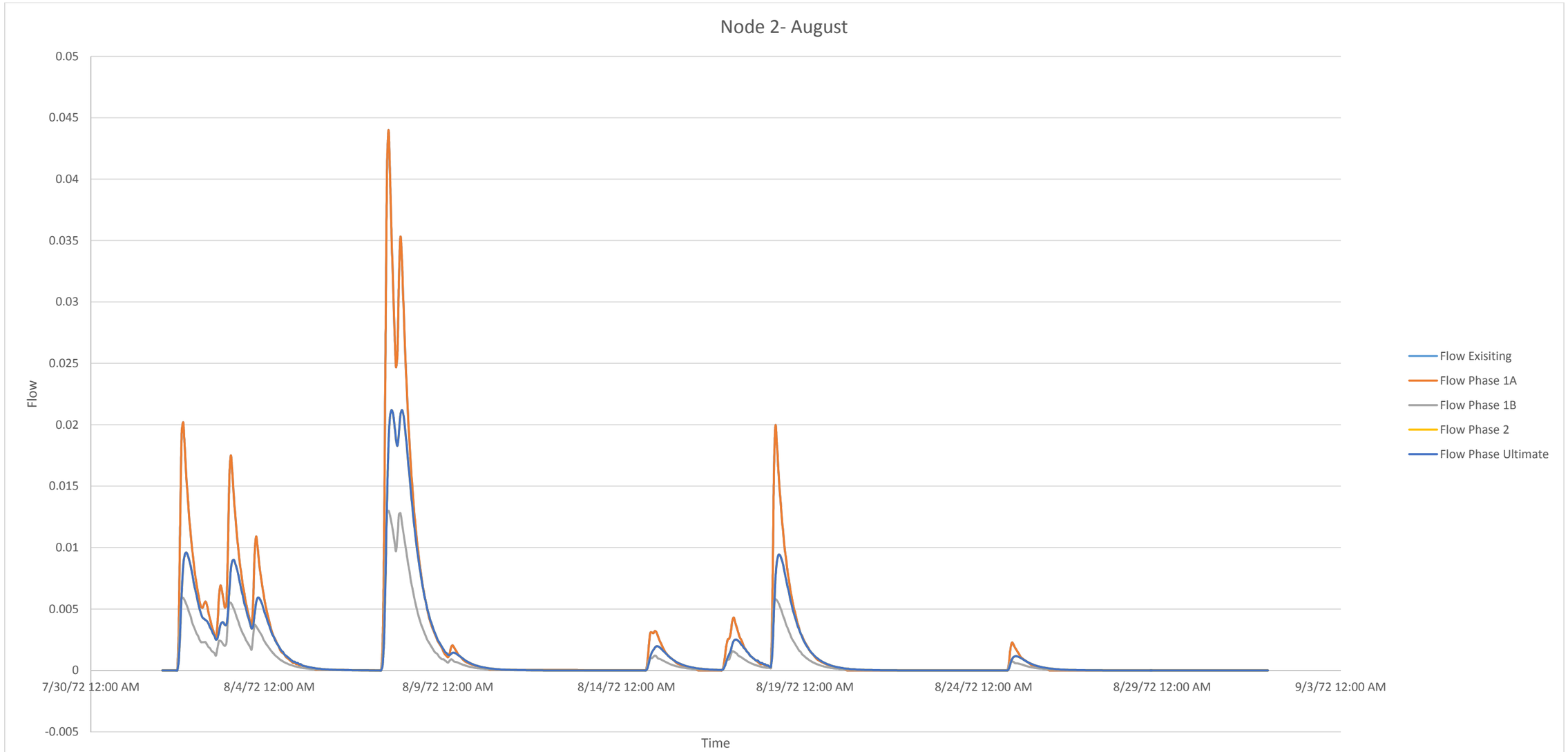
May						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitudes (cm/s)	Max.	0.074	0.074	0.0166	0.0158	0.0158
	Min.	0.005	0.005	0.00076	0.00102	0.00102
Duration (h)	Max.	45	45	71	93	93
	Min.	23	23	47	55	55



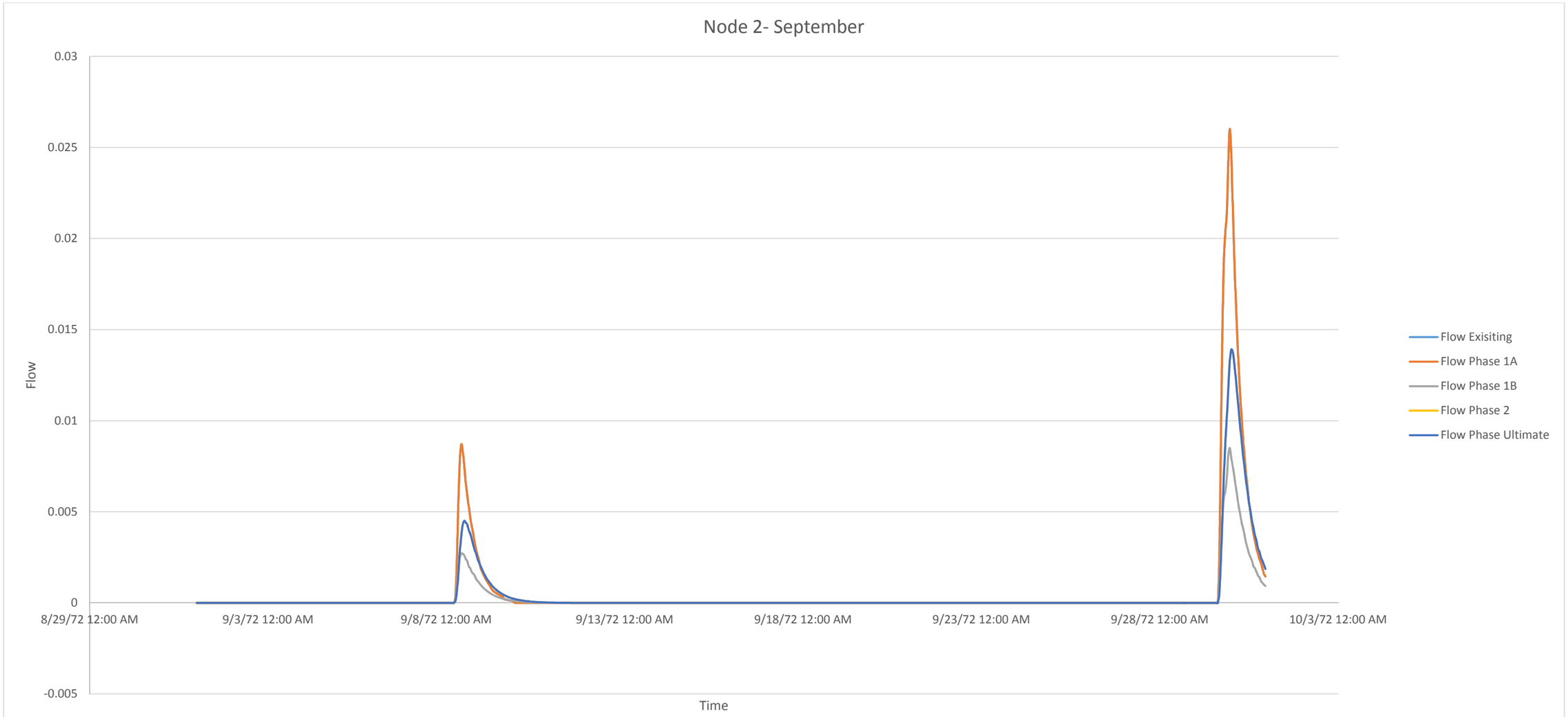
June						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitudes (cm/s)	Max.	0.0518	0.0518	0.014	0.023	0.023
	Min.	0.0062	0.0062	0.00153	0.0021	0.0021
Duration (h)	Max.	26	26	26	27	27
	Min.	36	36	56	66	66



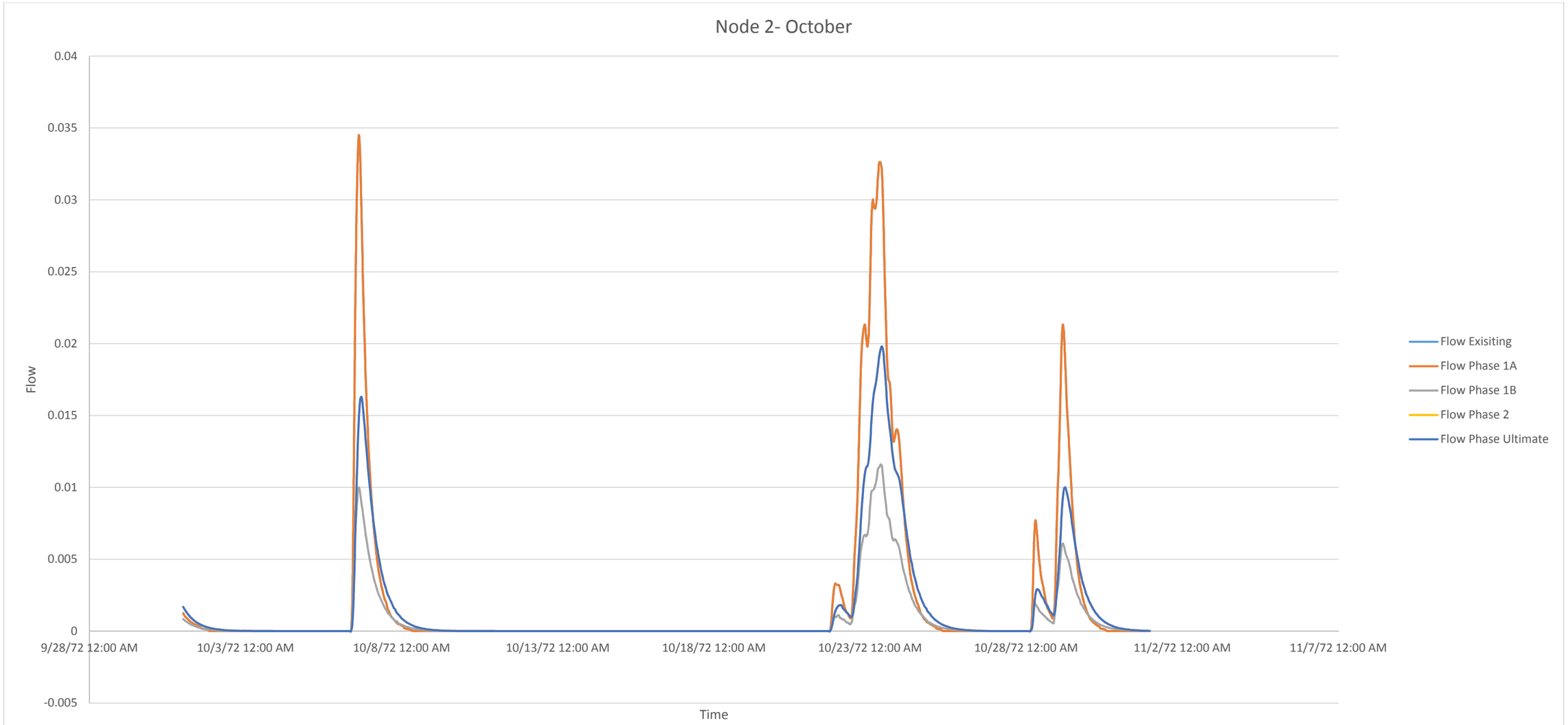
July						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		3	3	3	3	3
Magnitudes (cm/s)	Max.	0.0119	0.0119	0.0038	0.0064	0.0064
	Min.	0.00212	0.00212	0.00063	0.00102	0.00102
Duration (h)	Max.	70	70	76	83	83
	Min.	25	25	29	29	29



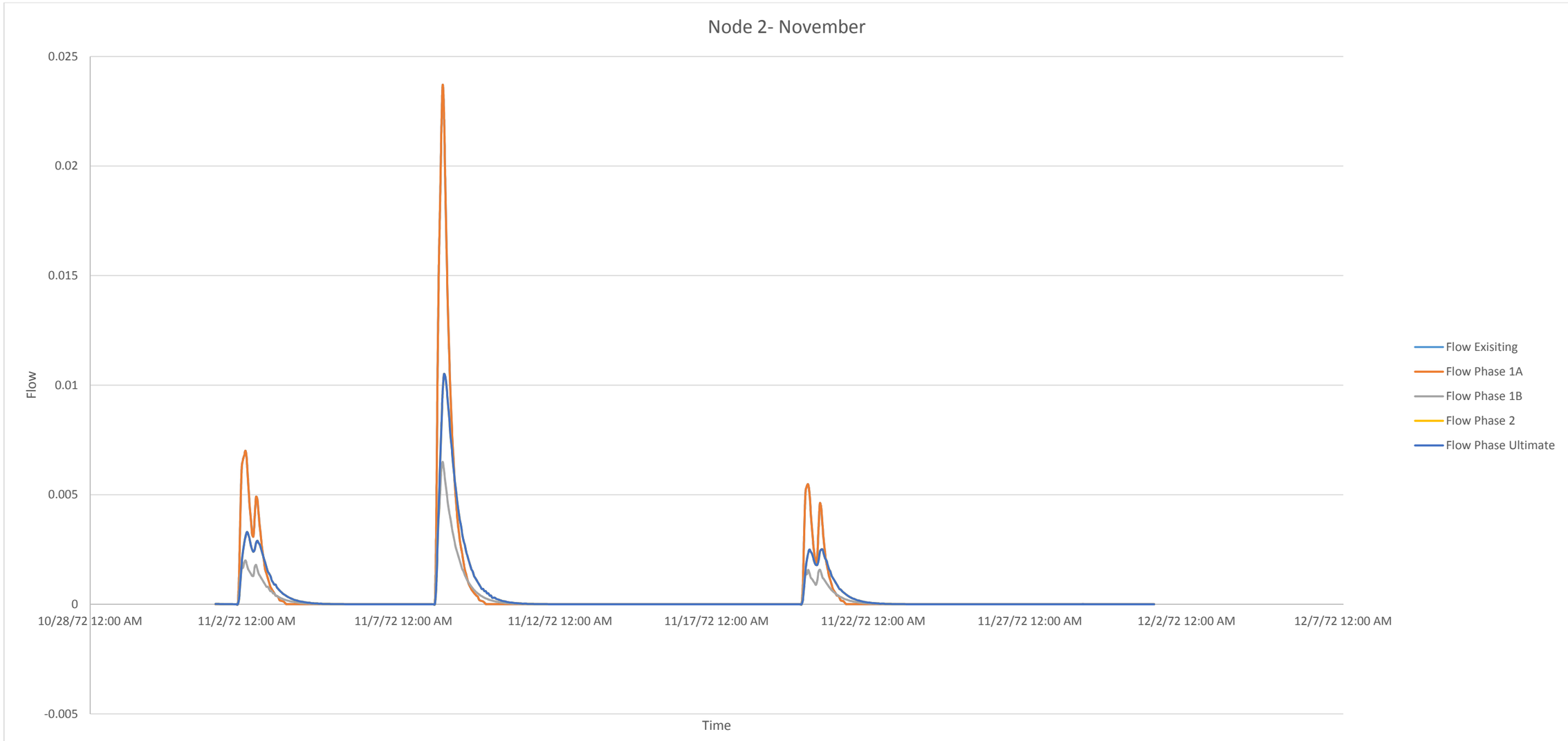
August						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		11	11	11	11	11
Magnitudes (cm/s)	Max.	0.044	0.044	0.013	0.0212	0.0212
	Min.	0.00226	0.00226	0.00071	0.00116	0.00116
Duration (h)	Max.	72	72	100	108	108
	Min.	27	27	55	63	63



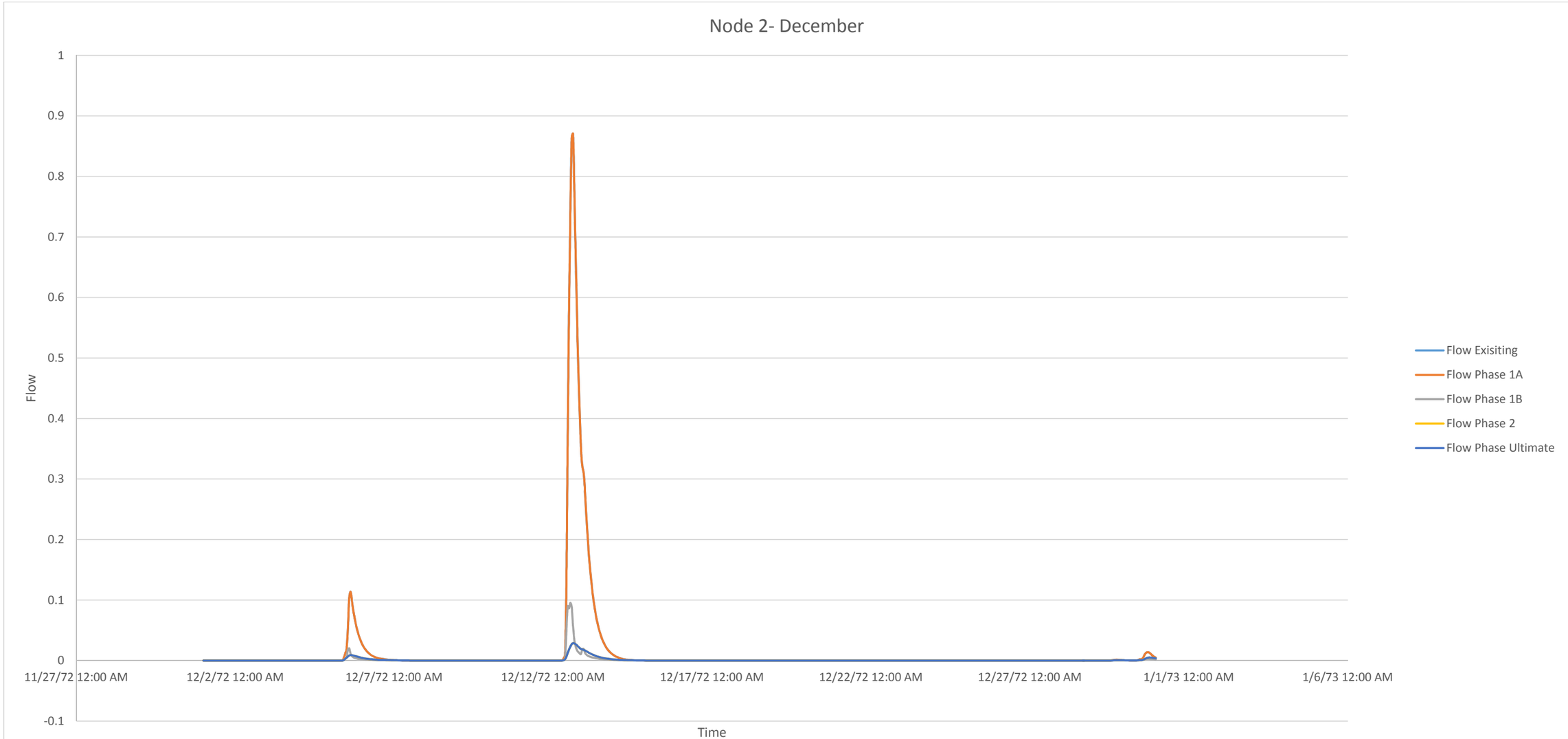
September						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		2	2	2	2	2
Magnitudes (cm/s)	Max.	Not Finish within August				
	Min.	0.0087	0.0087	0.0027	0.0045	0.0045
Duration (h)	Max.					
	Min.	40	40	71	71	78



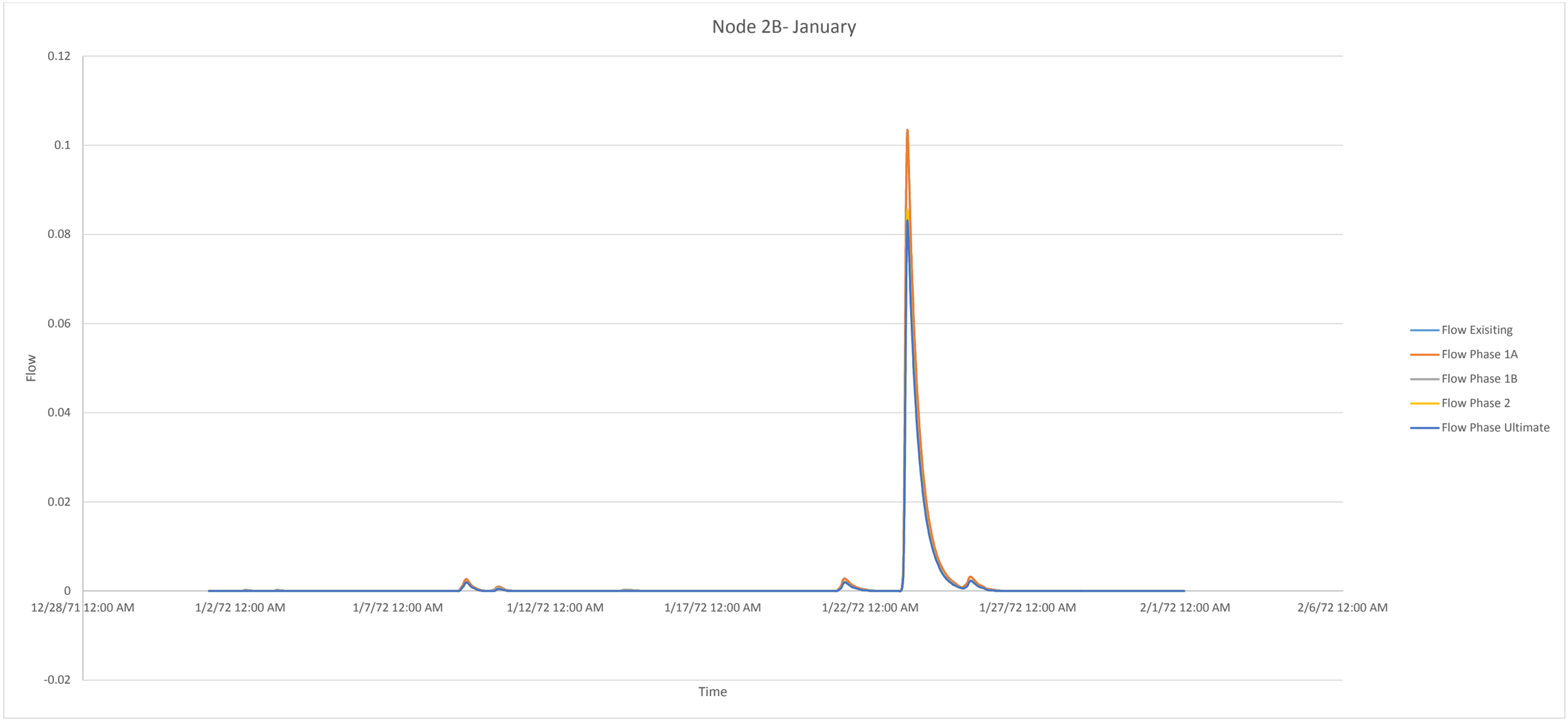
October						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitudes (cm/s)	Max.	0.0345	0.0345	0.0116	0.0198	0.0198
	Min.	0.00326	0.00326	0.0011	0.0018	0.0018
Duration (h)	Max.	46	46	52	61	61
	Min.	15	15	14	15	15



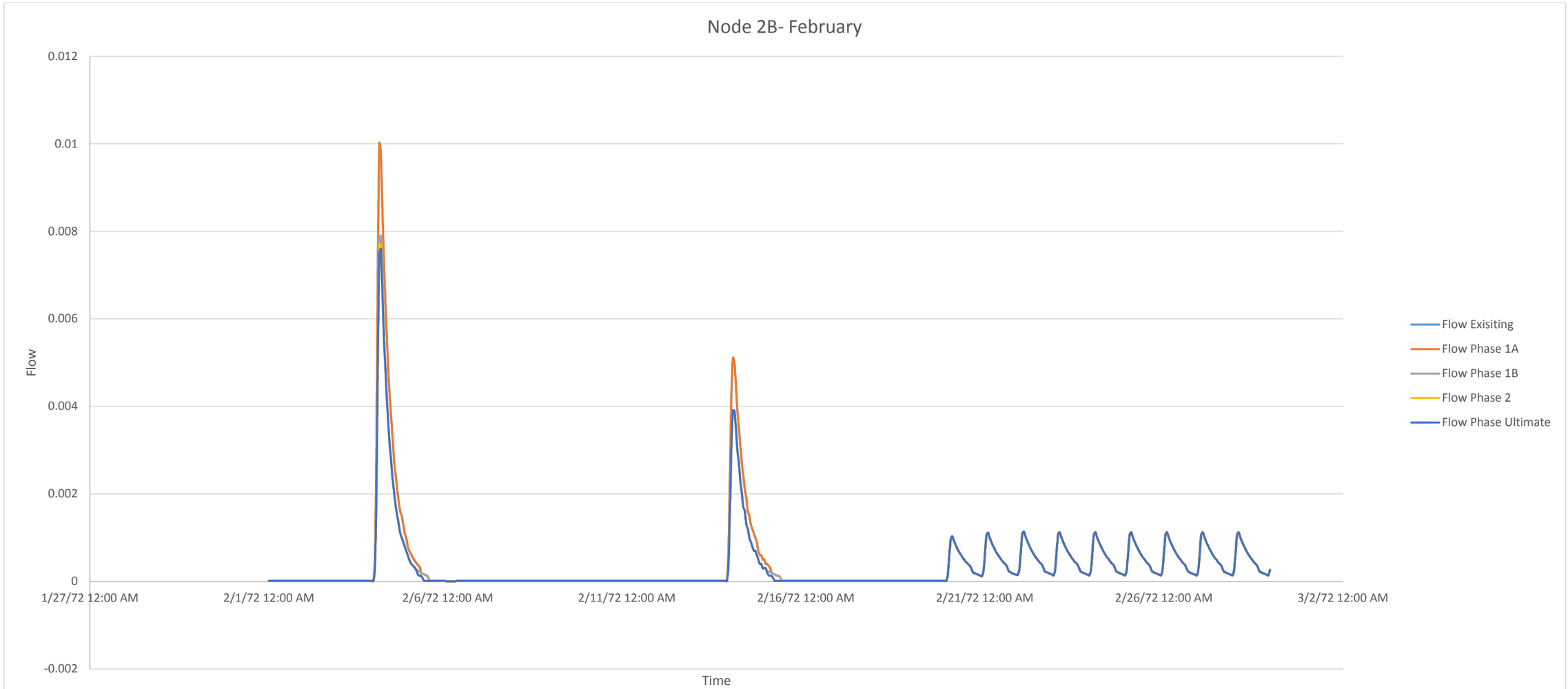
November						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitudes (cm/s)	Max.	0.0237	0.0237	0.0065	0.0105	0.0105
	Min.	0.00547	0.00547	0.00157	0.0025	0.0025
Duration (h)	Max.	38	38	68	87	87
	Min.					



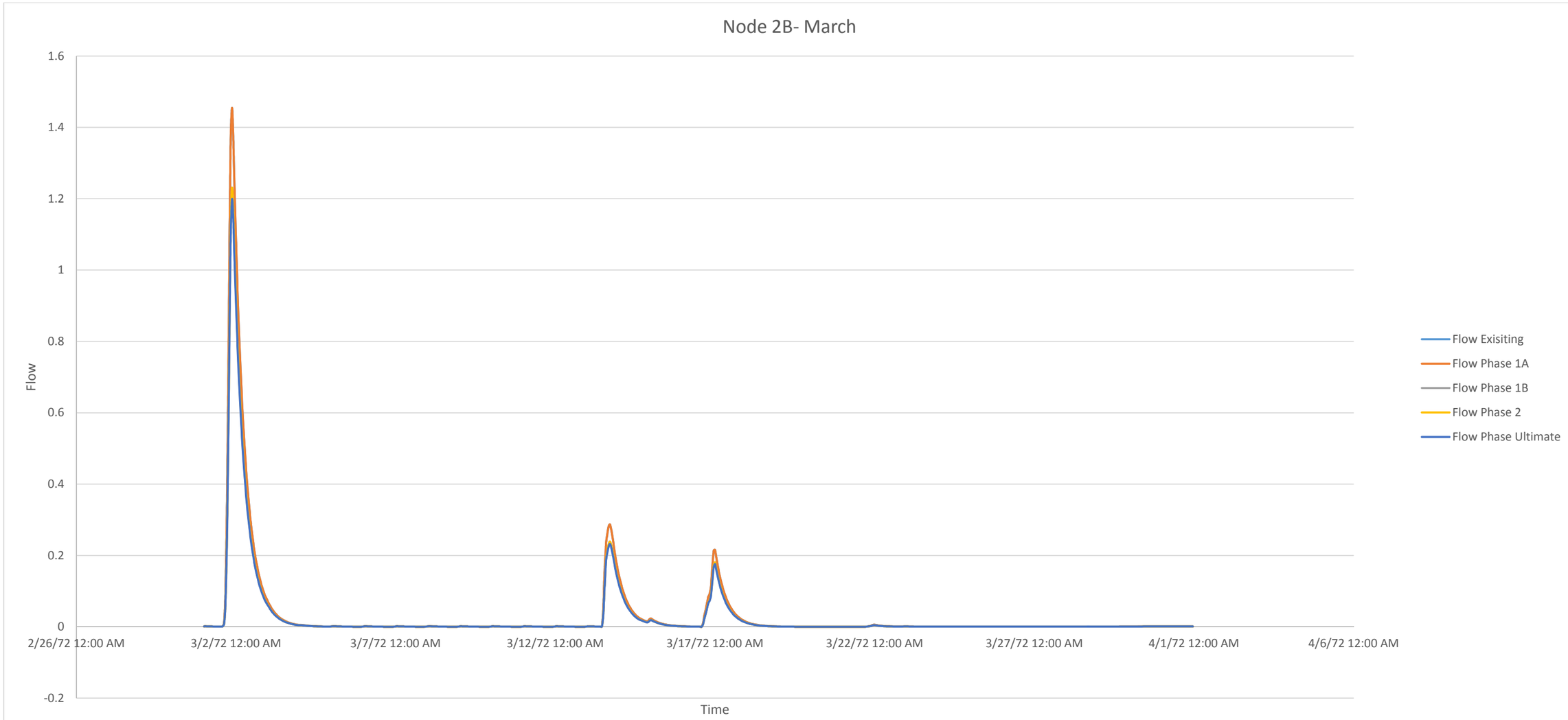
December						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		4	4	5	4	4
Magnitudes (cm/s)	Max.	0.8704	0.8704	0.0954	0.0288	0.0288
	Min.	0.00143	0.00143	0.00041	0.00066	0.00066
Duration (h)	Max.	65	65	82	89	89
	Min.	14	14	15	17	17



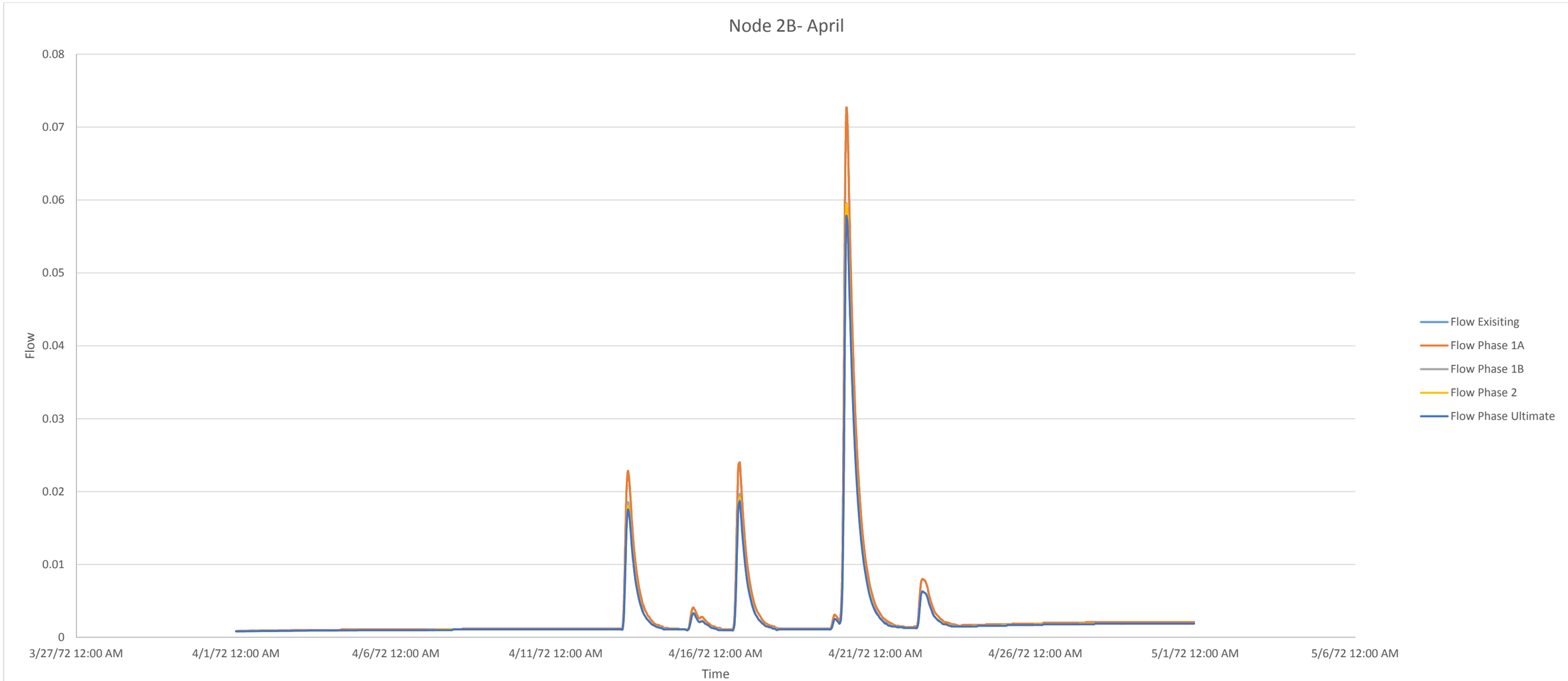
January						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		8	8	8	8	8
Magnitude (cm/s)	Max.	0.1029	0.1029	0.0851	0.0852	0.0827
	Min.	0.00027	0.00027	0.00027	0.00045	0.00045
Duration (h)	Max.	46	46	46	46	46
	Min.	8	8	8	10	10



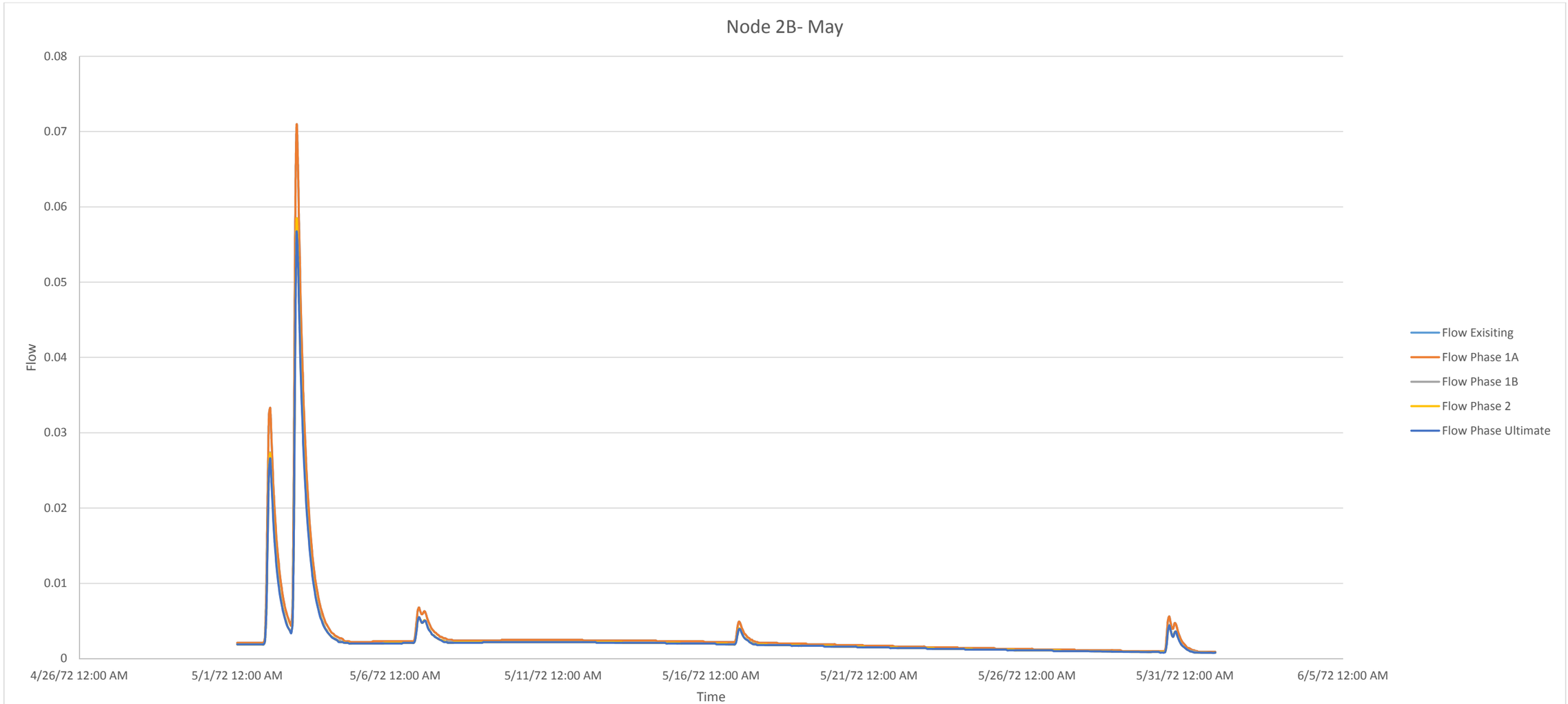
February						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		11	11	11	11	11
Magnitude (cm/s)	Max.	0.01	0.01	0.0079	0.0077	0.0076
	Min.	0.00103	0.00103	0.00103	0.00103	0.00103
Duration (h)	Max.	37	37	37	33	33
	Min.	46	46	46	46	46



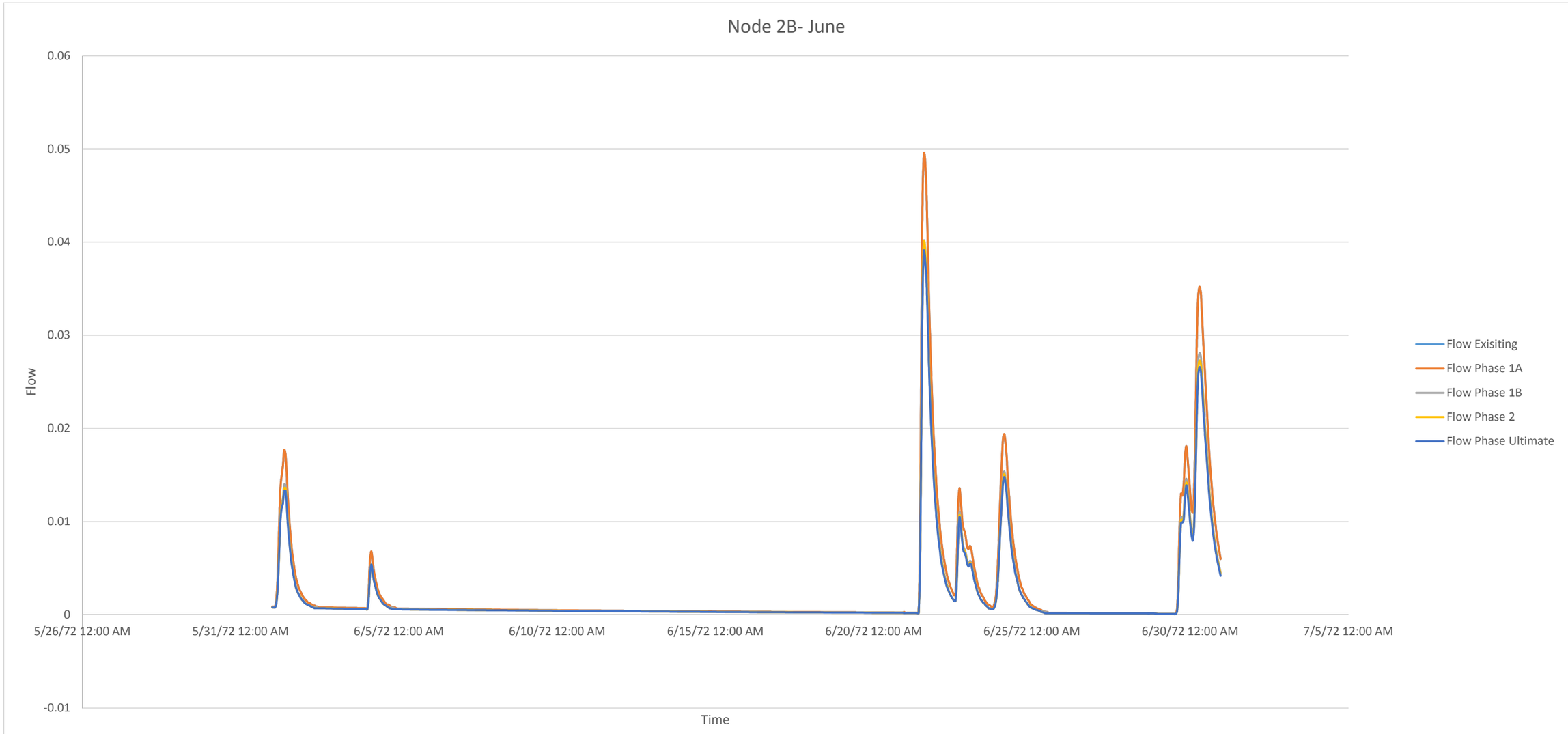
March						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitude (cm/s)	Max.	1.4546	1.4546	1.2305	1.2305	1.1991
	Min.	0.00121	0.00121	0.00084	0.00084	0.00084
Duration (h)	Max.	79	79	79	79	79
	Min.	21	21	22	30	30



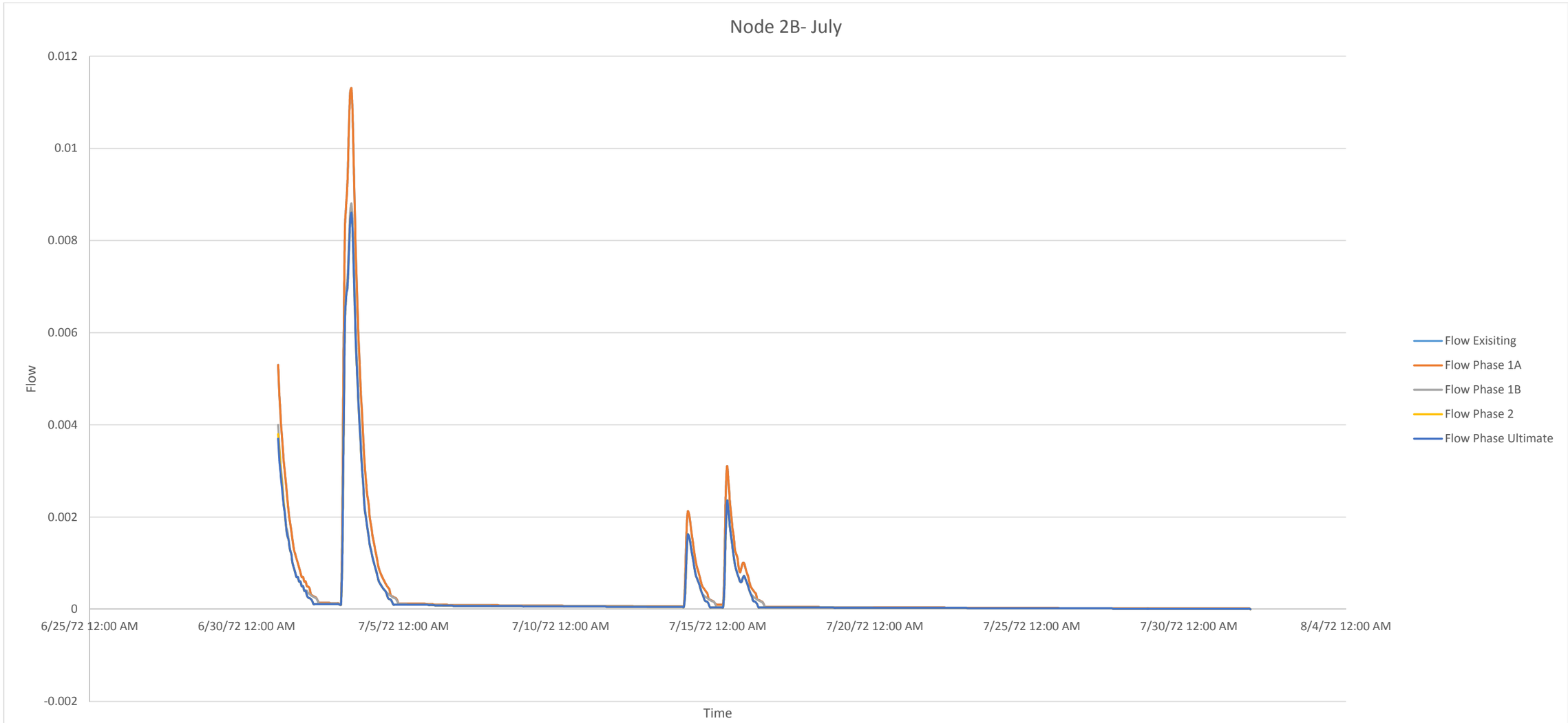
April						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitude (cm/s)	Max.	0.0724	0.0724	0.0594	0.0593	0.0577
	Min.	0.0041	0.0041	0.0033	0.0033	0.0033
Duration (h)	Max.	55	55	55	55	55
	Min.	25	25	25	22	22



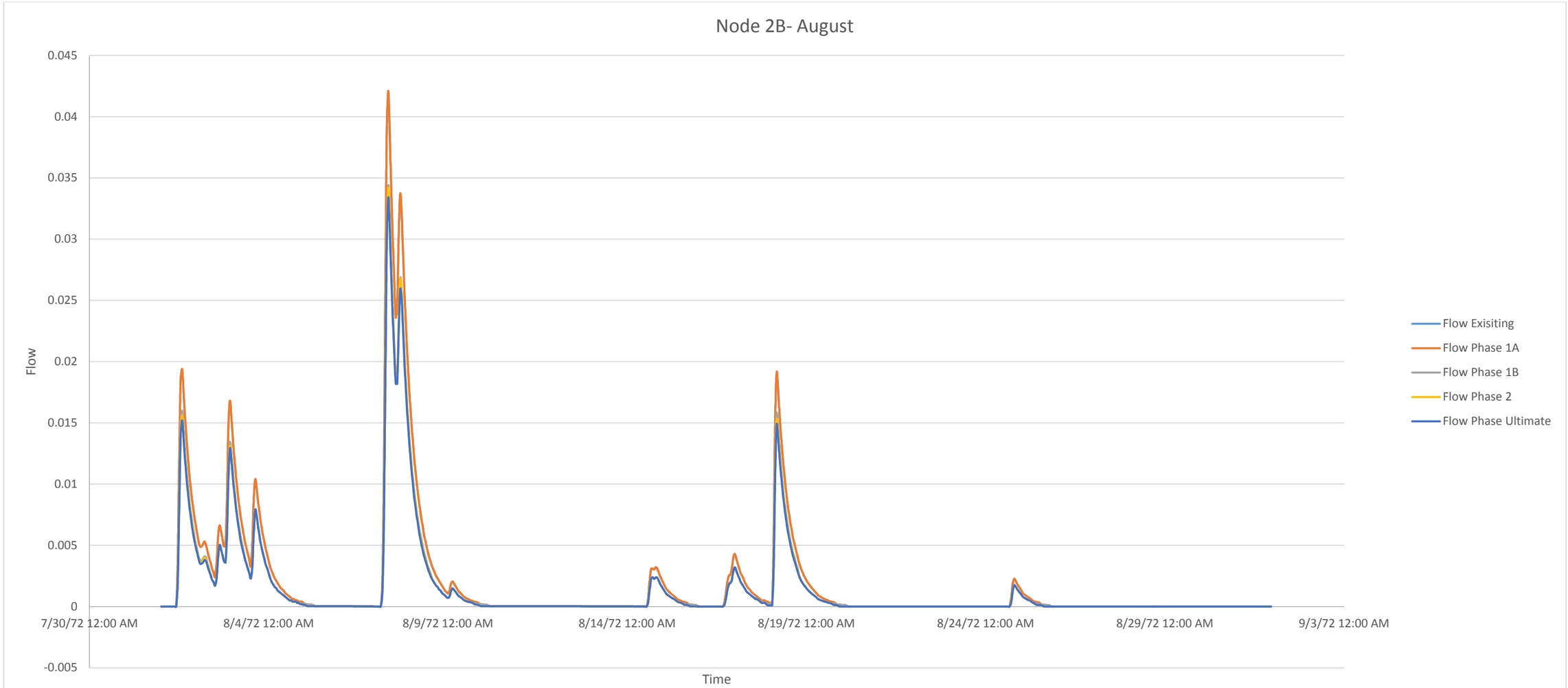
May						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitude (cm/s)	Max.	0.0707	0.0707	0.0581	0.0581	0.0564
	Min.	0.0049	0.0049	0.004	0.004	0.0039
Duration (h)	Max.	27	27	27	27	27
	Min.	15	15	16	14	13



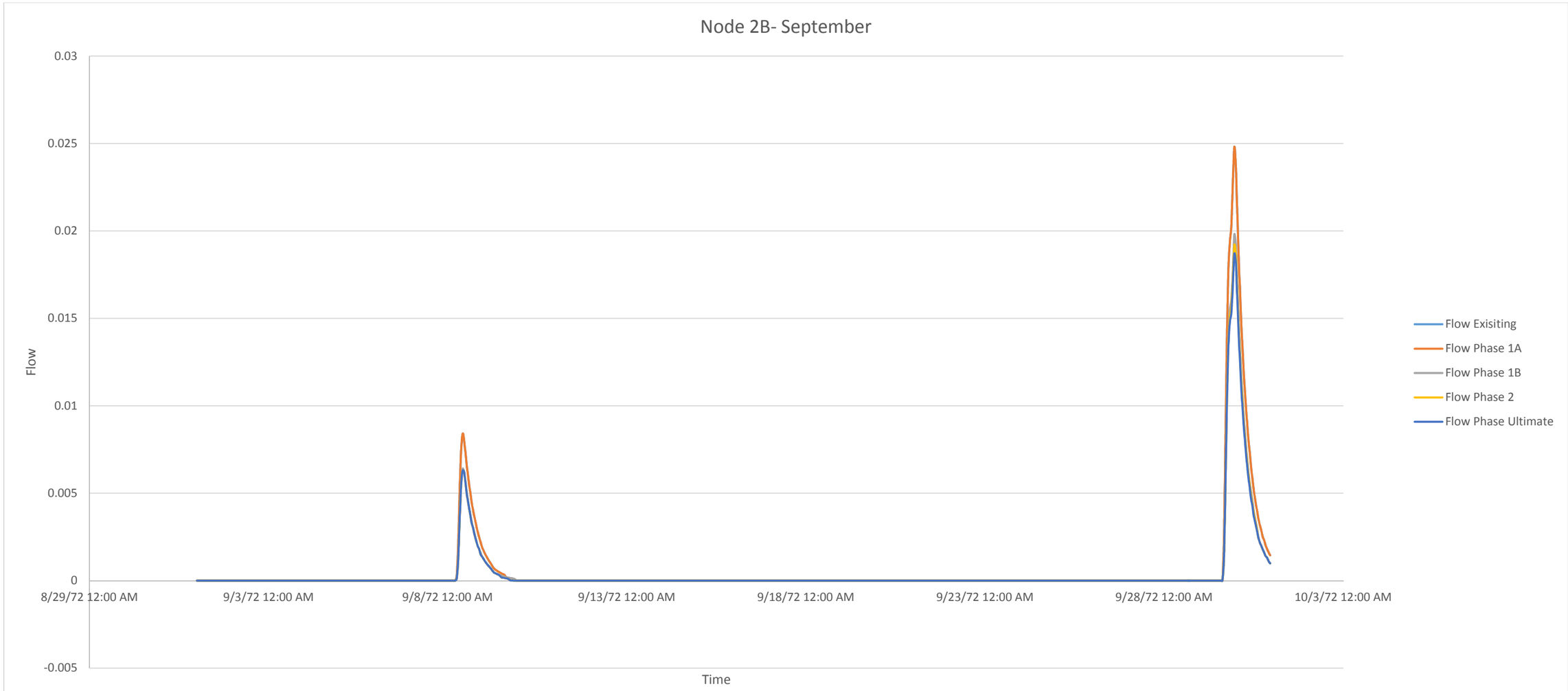
June						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.0495	0.0495	0.0401	0.04	0.039
	Min.	0.0068	0.0068	0.0054	0.0054	0.0054
Duration (h)	Max.	55	55	54	54	54
	Min.	21	21	21	18	18



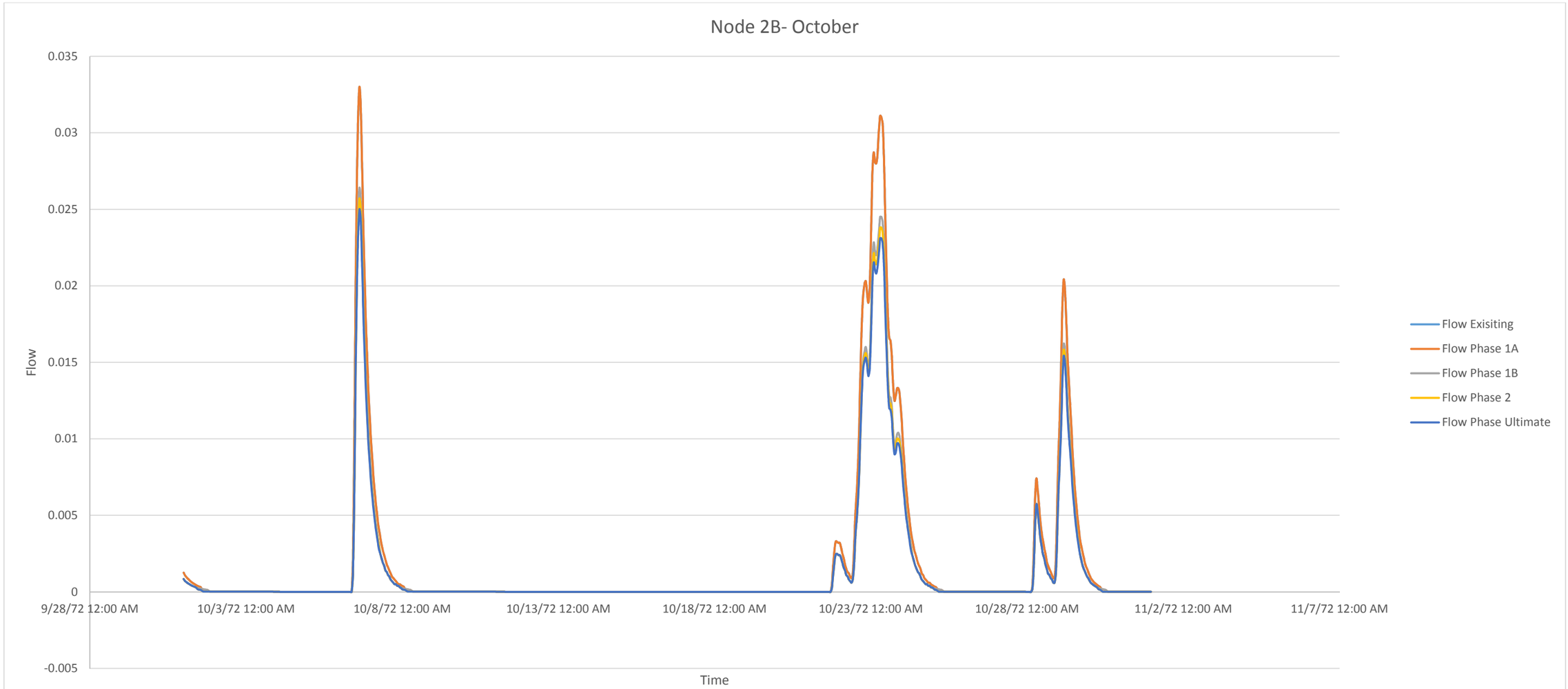
July						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		3	3	3	3	3
Magnitude (cm/s)	Max.	0.0113	0.0113	0.0088	0.0086	0.0086
	Min.	0.00212	0.00212	0.00162	0.00162	0.00162
Duration (h)	Max.	43	43	43	39	39
	Min.	24	24	24	19	19



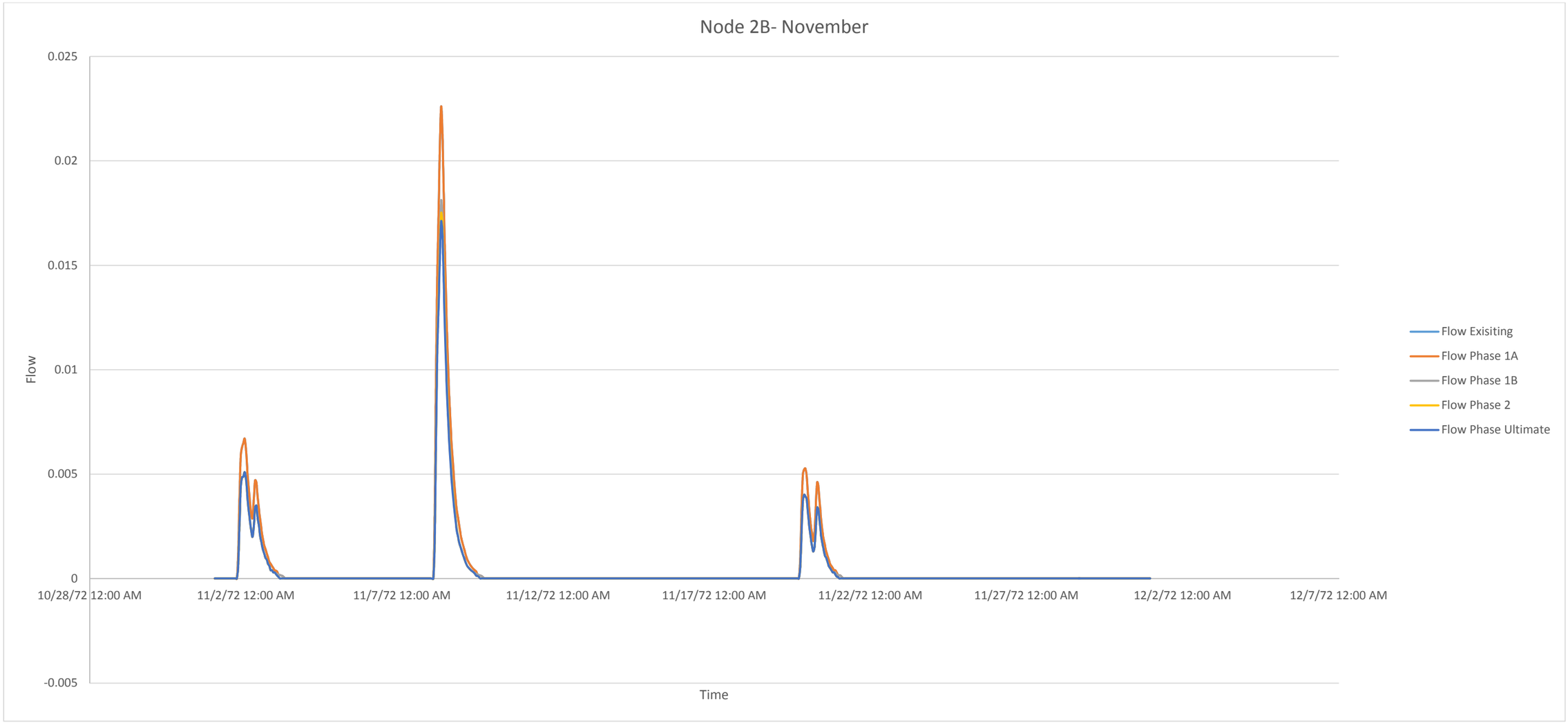
August						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		11	11	11	11	11
Magnitude (cm/s)	Max.	0.0421	0.0421	0.0344	0.0342	0.0334
	Min.	0.00226	0.00226	0.00173	0.00173	0.00173
Duration (h)	Max.	72	72	72	66	66
	Min.	27	27	27	22	22



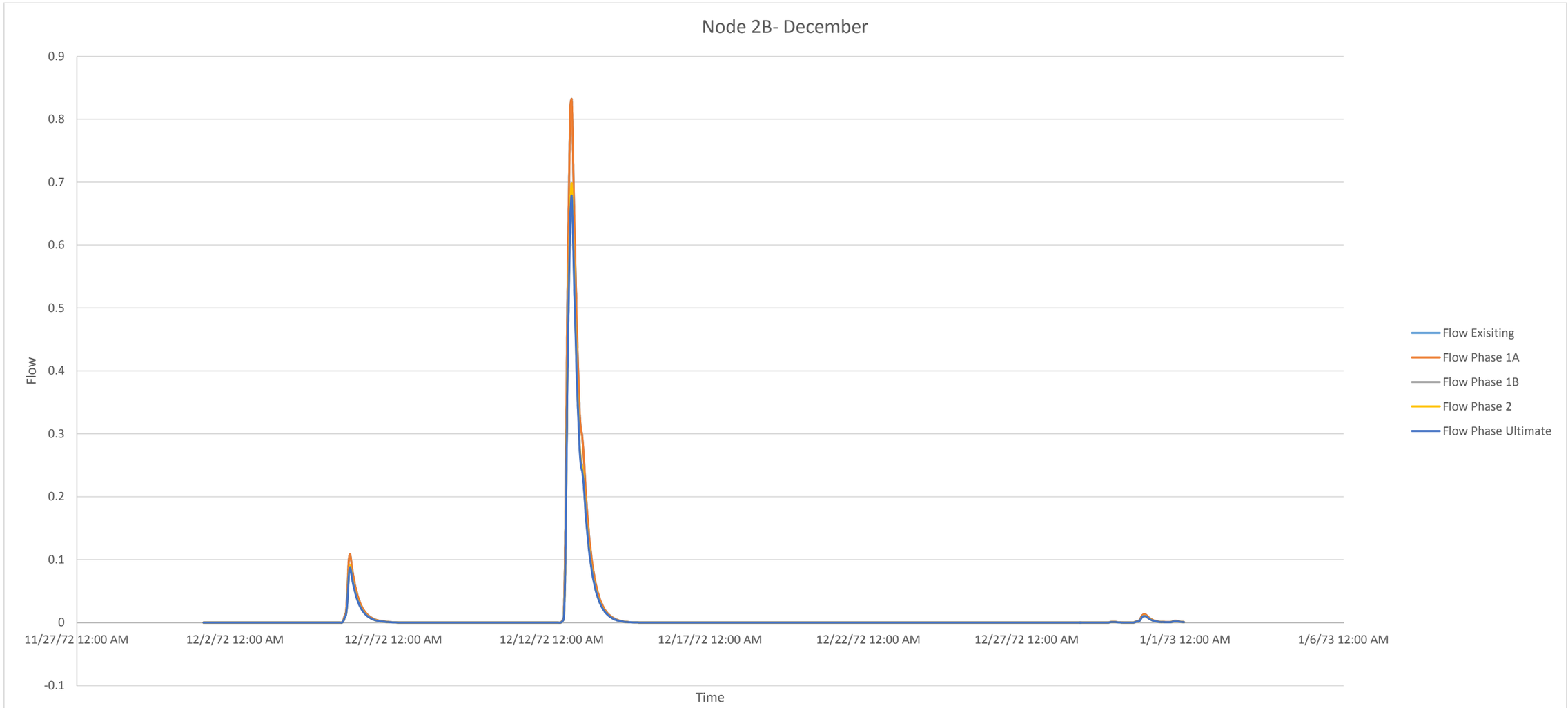
September						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		2	2	2	2	2
Magnitude (cm/s)	Max.	Not finished within this month				
	Min.	0.0084	0.0084	0.0064	0.0063	0.0063
Duration (h)	Max.					
	Min.	40	40	40	38	38



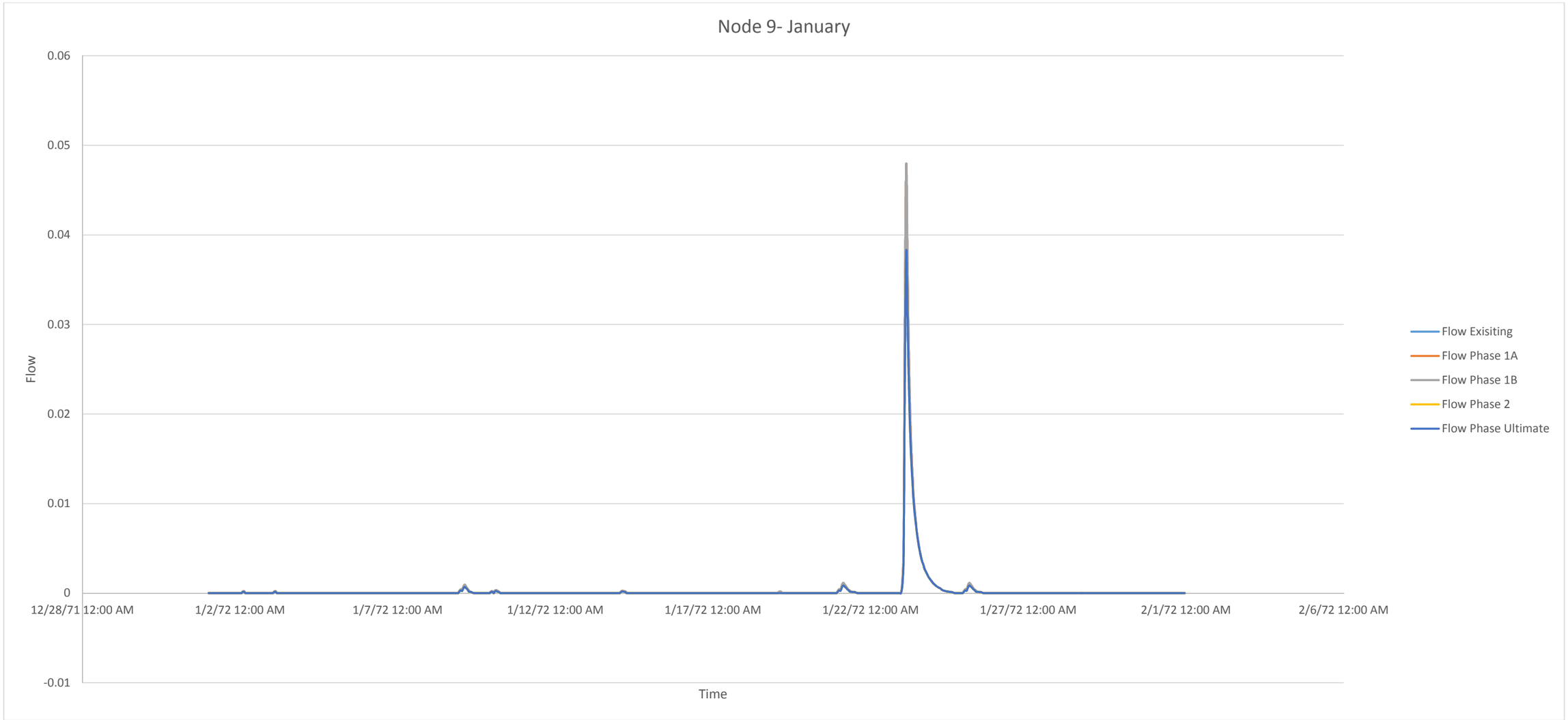
October						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitude (cm/s)	Max.	0.033	0.033	0.0264	0.0257	0.025
	Min.	0.0033	0.0033	0.00248	0.00248	0.00248
Duration (h)	Max.	46	46	46	42	42
	Min.	15	15	15	15	15



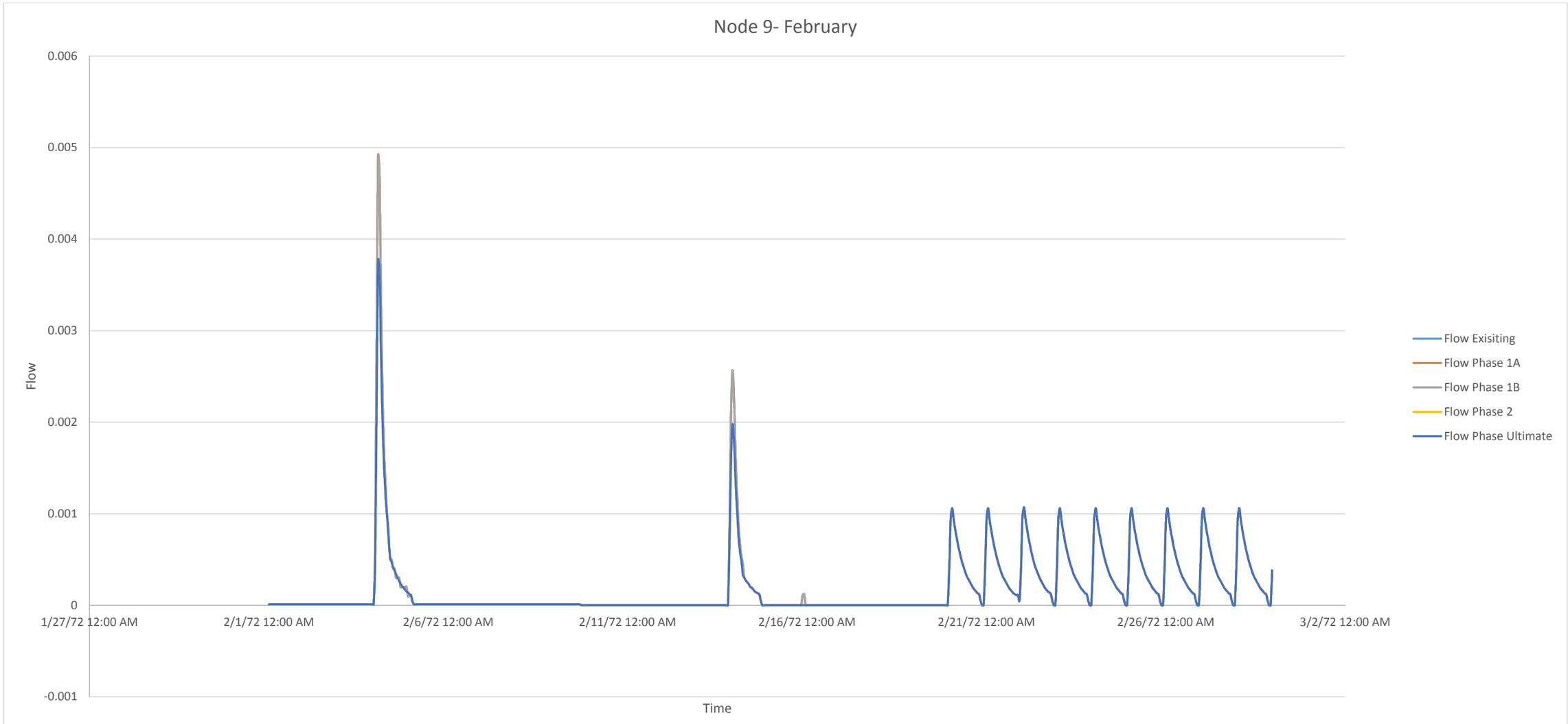
November						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitude (cm/s)	Max.	0.0226	0.0226	0.0181	0.0175	0.0171
	Min.	0.0046	0.0046	0.0034	0.0034	0.0034
Duration (h)	Max.	38	38	38	35	35
	Min.	22	22	22	19	19



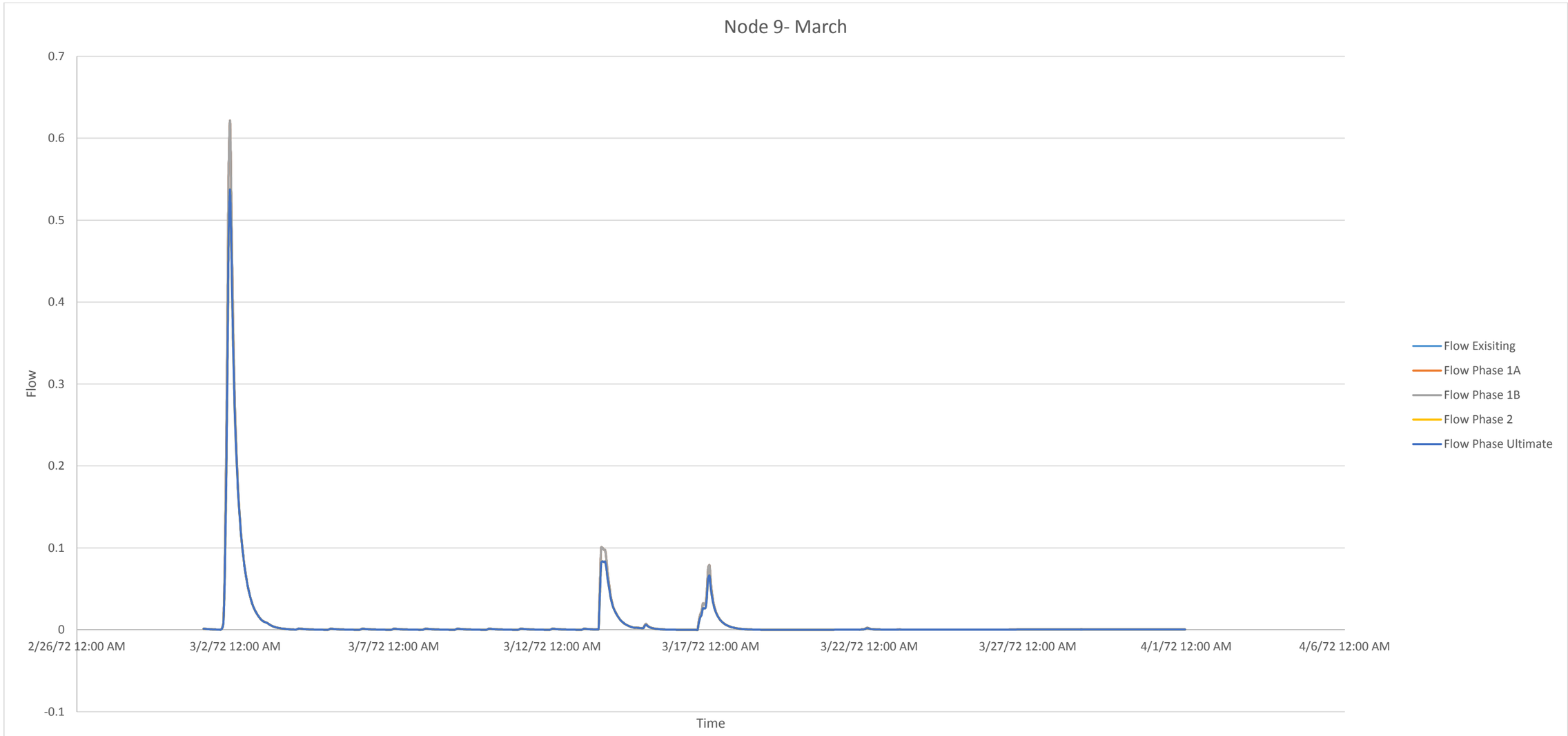
December						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		3	3	3	3	3
Magnitude (cm/s)	Max.	0.8316	0.8316	0.6973	0.6977	0.6783
	Min.	0.0134	0.0134	0.011	0.0107	0.0105
Duration (h)	Max.	65	65	65	65	65
	Min.	27	27	27	27	27



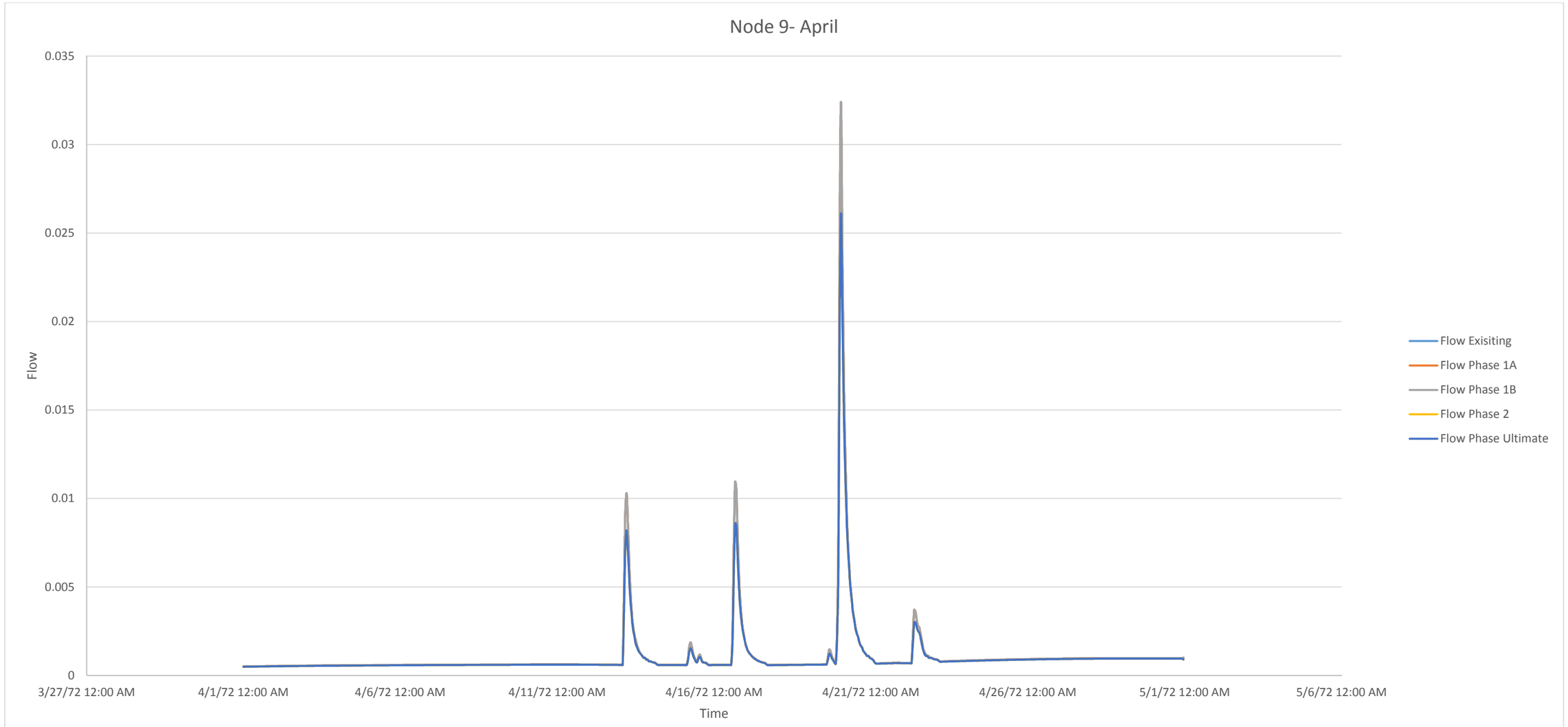
January						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		9	9	9	8	8
Magnitude (cm/s)	Max.	0.0479	0.0479	0.0479	0.0382	0.0382
	Min.	0.00019	0.00019	0.00019	0.00016	0.00016
Duration (h)	Max.	40	40	40	40	40
	Min.	3	3	3	2	2



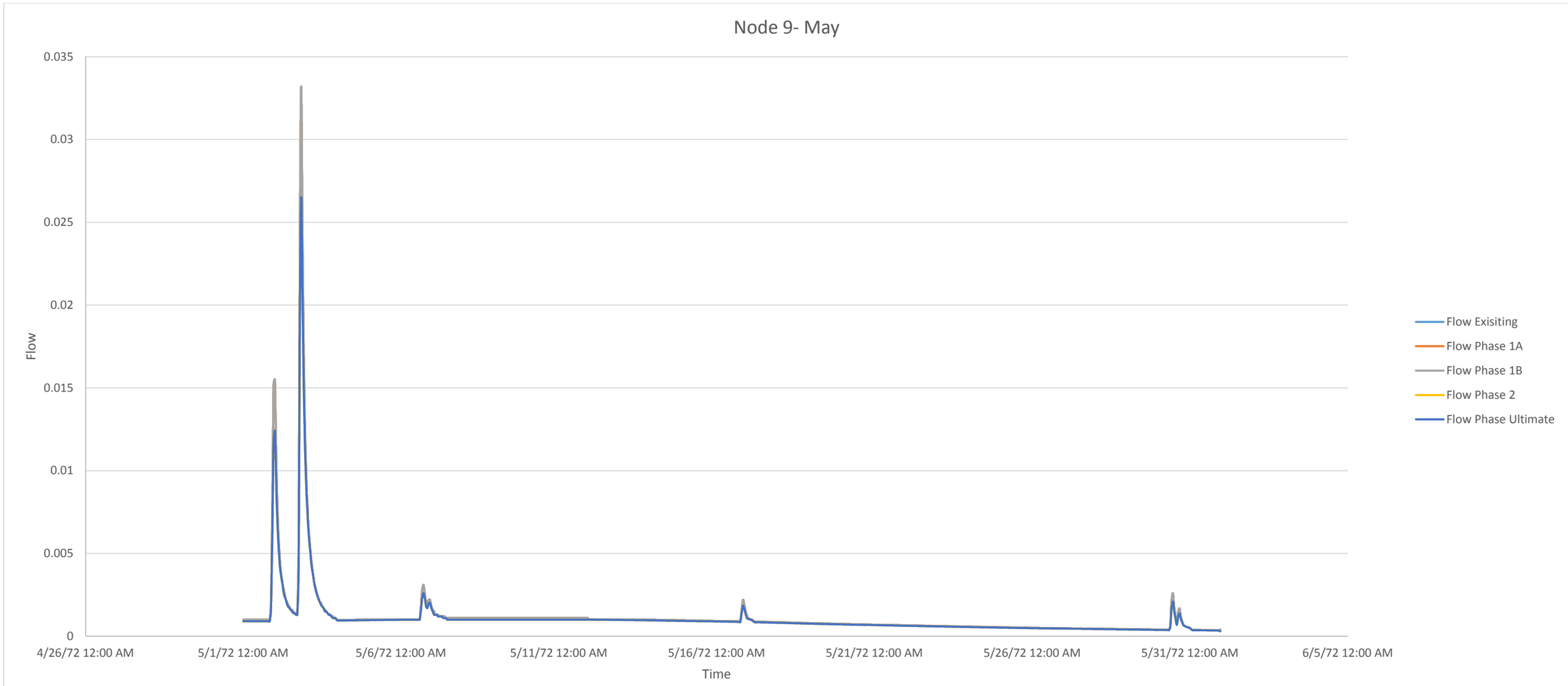
February						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		13	13	13	12	12
Magnitude (cm/s)	Max.	0.0049	0.0049	0.0049	0.00377	0.00377
	Min.	0.00012	0.00012	0.00012	0.00106	0.00106
Duration (h)	Max.	26	26	26	26	26
	Min.	2	2	2	22	22



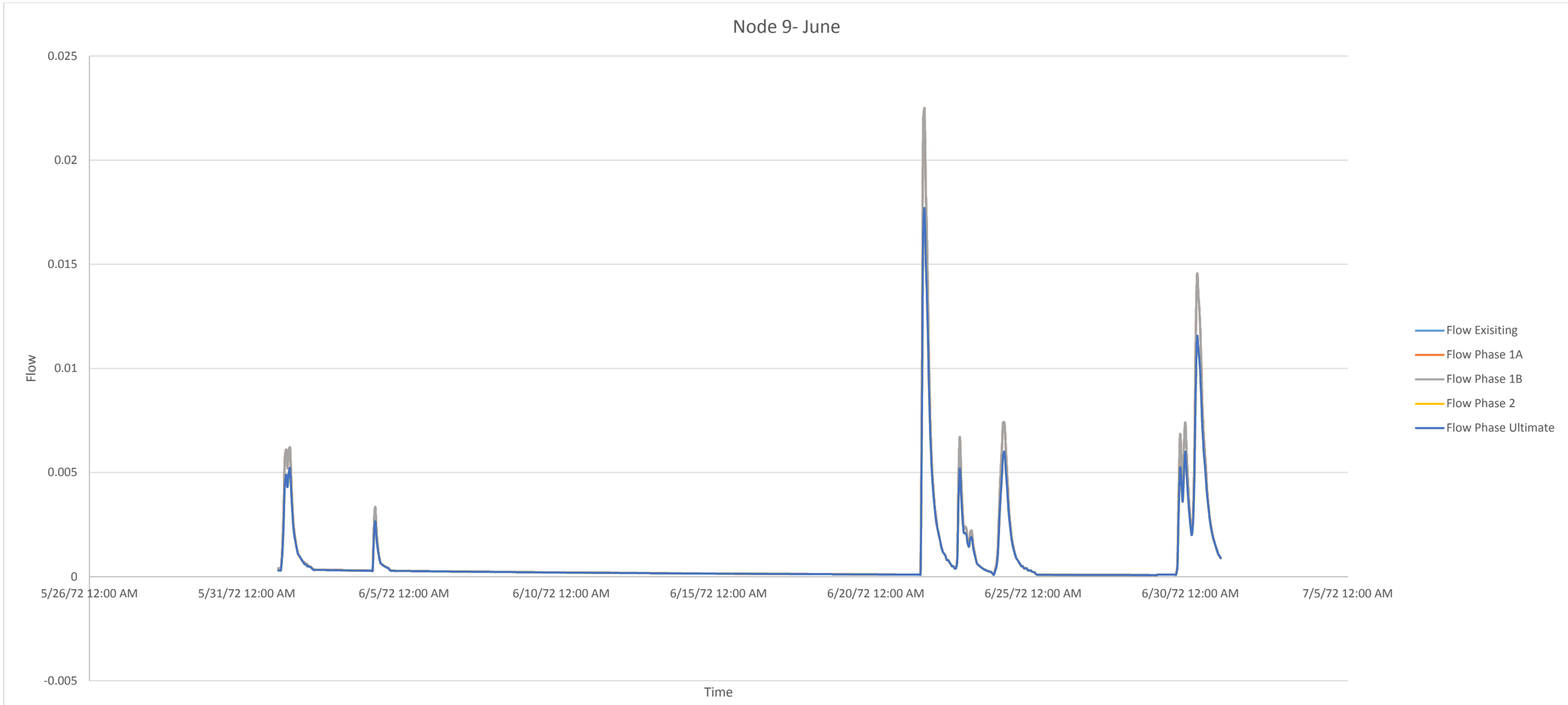
March						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		15	15	15	15	15
Magnitude (cm/s)	Max.	0.6211	0.6211	0.6211	0.5374	0.5374
	Min.	0.00125	0.00125	0.00125	0.00125	0.00125
Duration (h)	Max.	42	42	42	42	42
	Min.	20	20	20	20	20



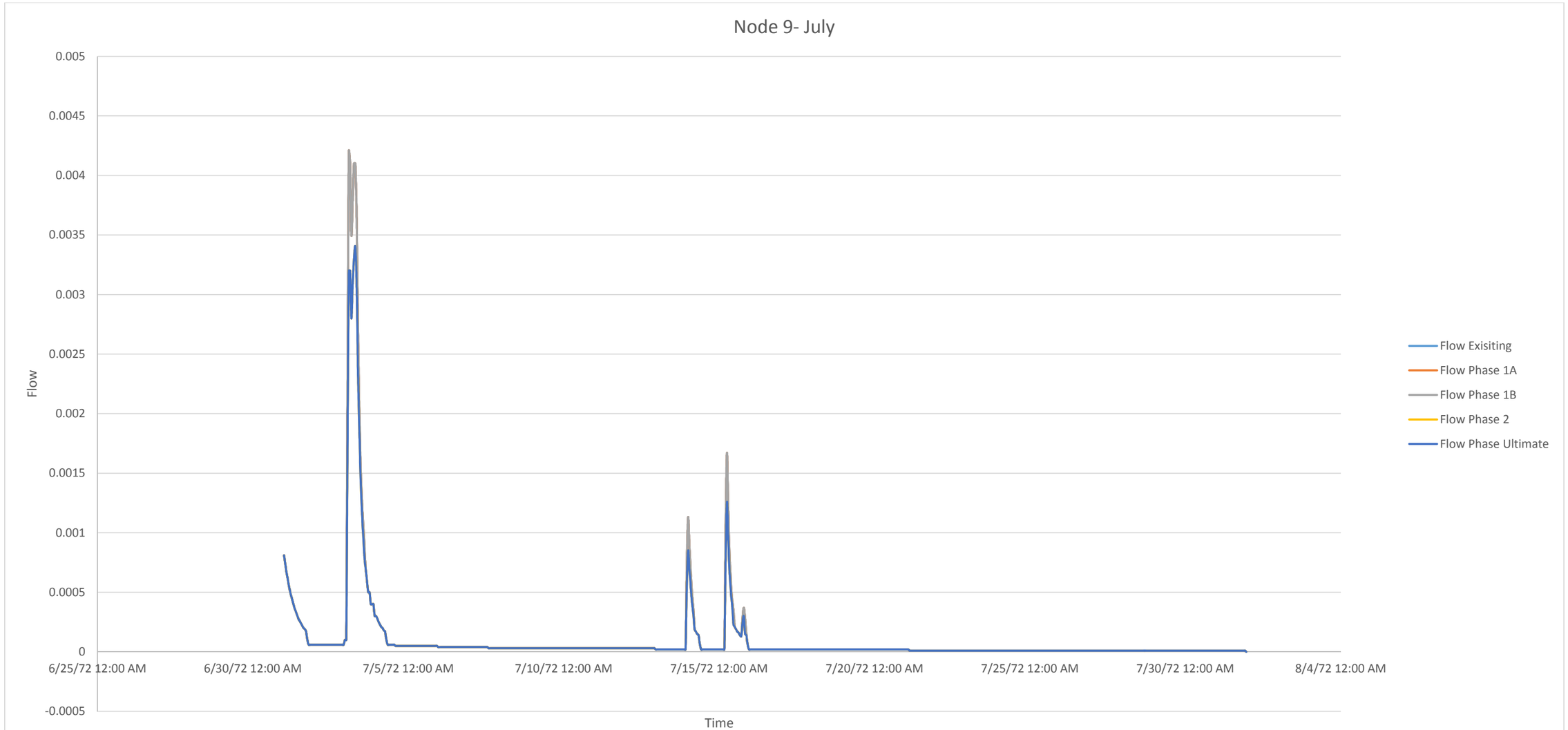
April						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.0324	0.0324	0.0324	0.0261	0.0261
	Min.	0.00118	0.00118	0.00118	0.00105	0.00105
Duration (h)	Max.	30	30	30	30	30
	Min.	8	8	8	8	8



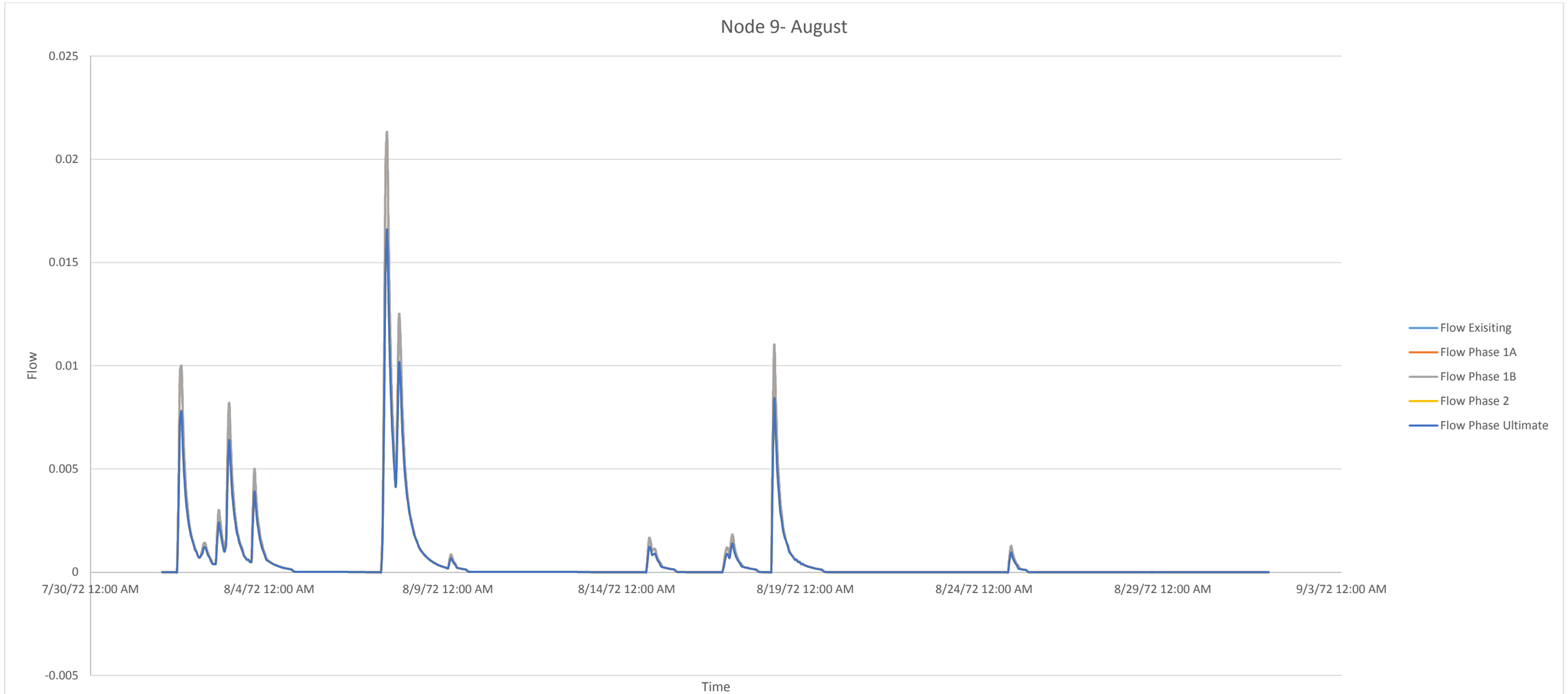
May						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.0332	0.0332	0.0332	0.0265	0.0265
	Min.	0.0022	0.0022	0.0022	0.00184	0.00184
Duration (h)	Max.	23	23	23	23	23
	Min.	10	10	10	9	9



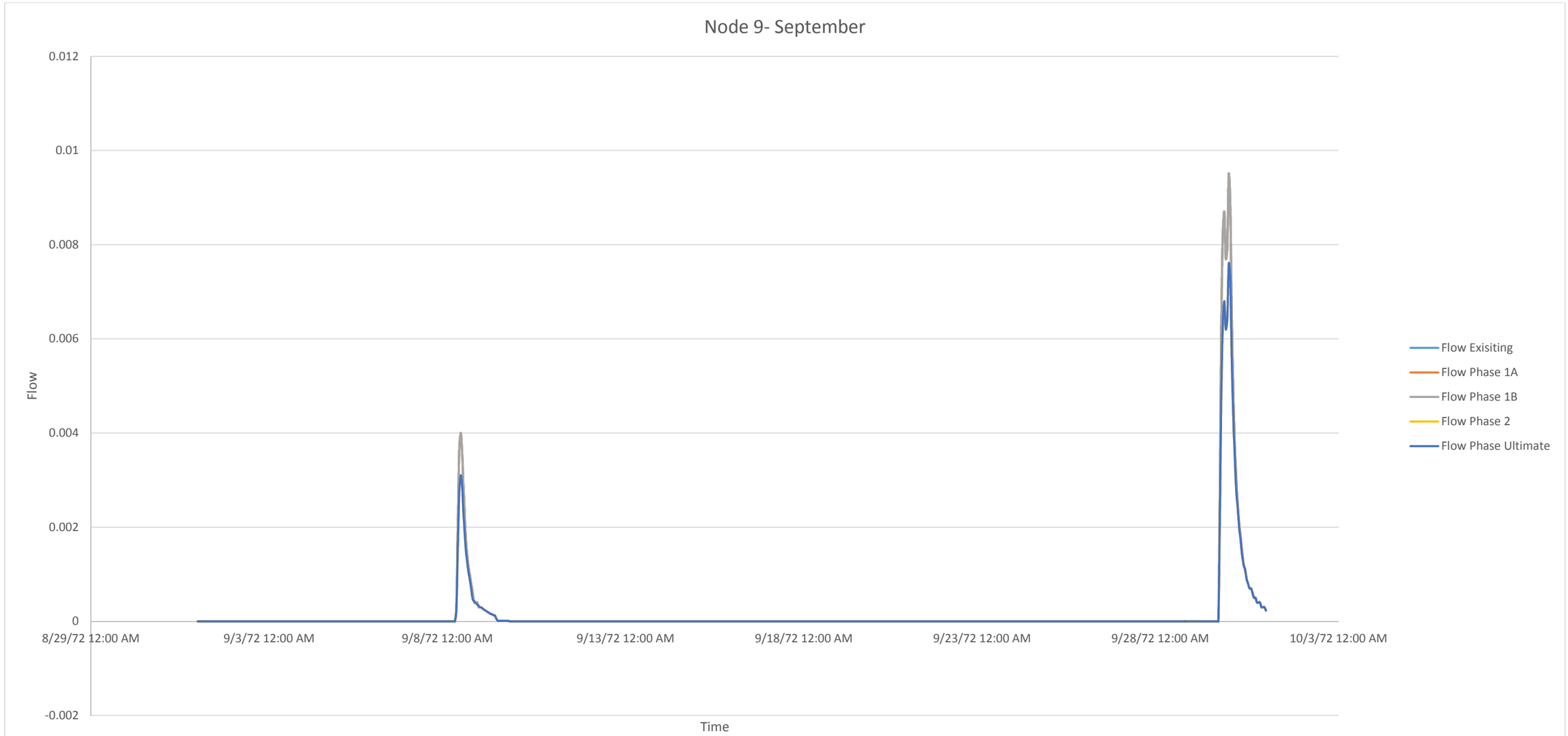
June						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		8	8	8	8	8
Magnitude (cm/s)	Max.	0.0225	0.0225	0.0225	0.0177	0.0177
	Min.	0.00335	0.00335	0.00335	0.00266	0.00266
Duration (h)	Max.	25	25	25	25	25
	Min.	13	13	13	13	13



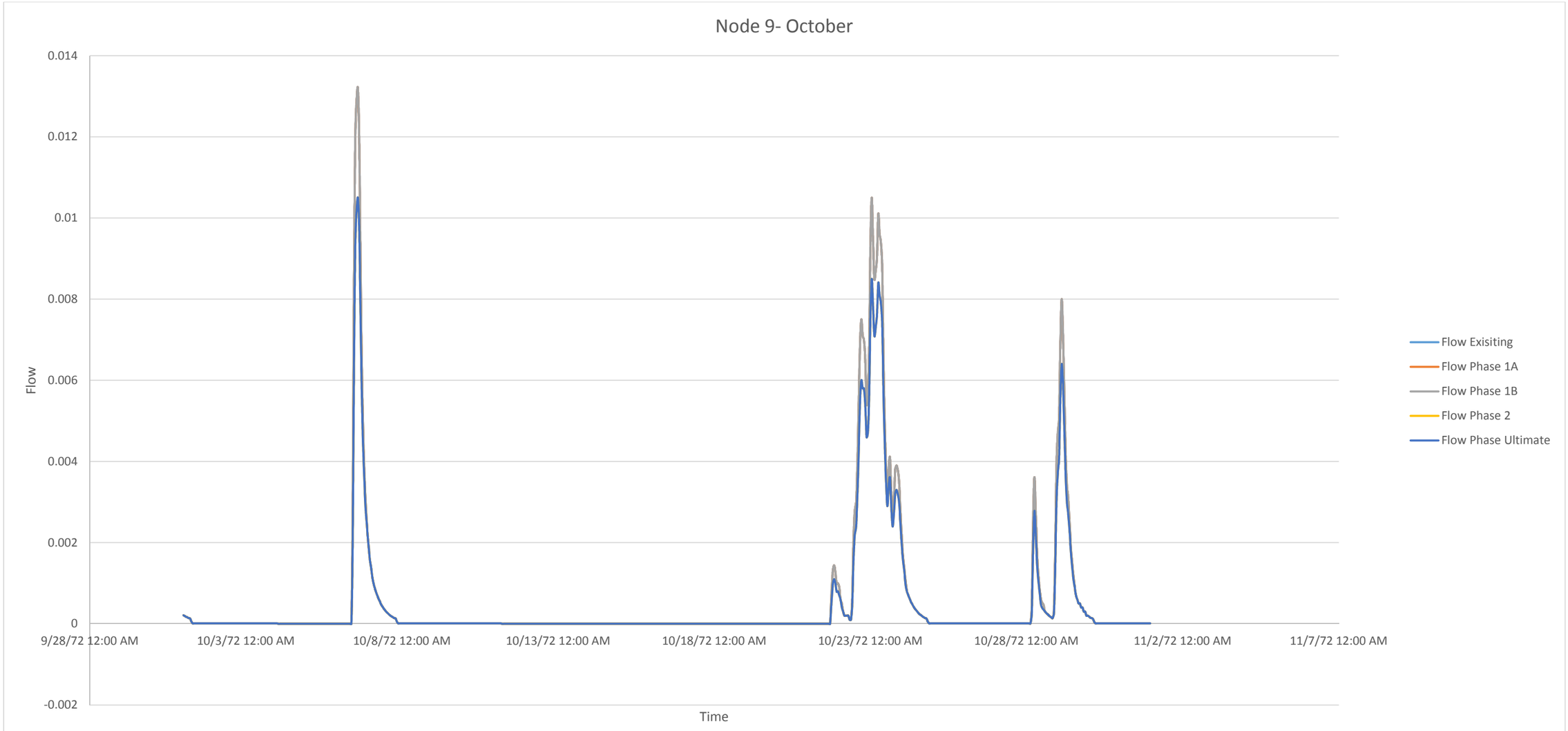
July						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		4	4	4	4	4
Magnitude (cm/s)	Max.	0.0042	0.0042	0.0042	0.0034	0.0034
	Min.	0.00037	0.00037	0.00037	0.0003	0.0003
Duration (h)	Max.	33	33	33	33	33
	Min.	5	5	5	5	5



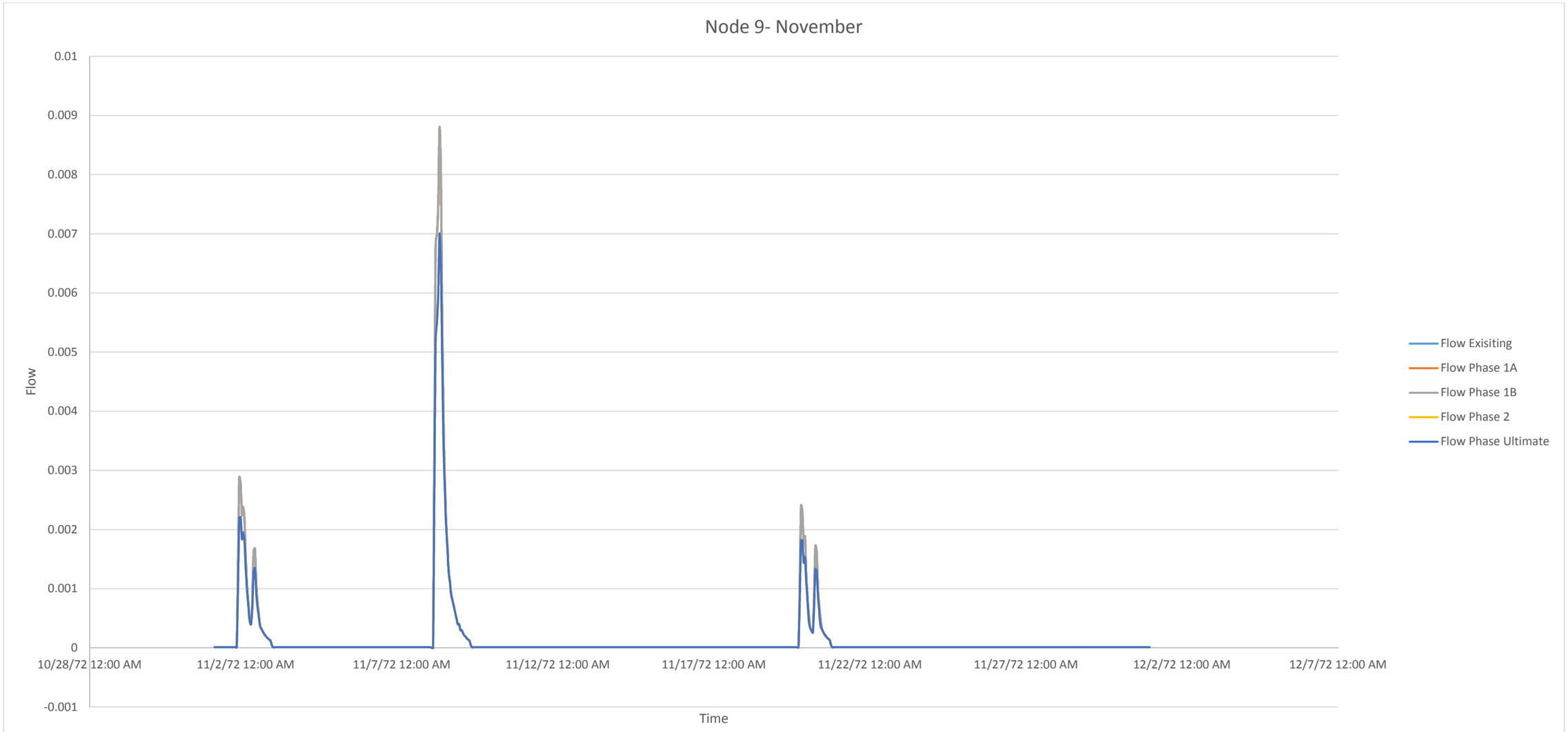
August						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		12	12	12	12	12
Magnitude (cm/s)	Max.	0.0213	0.0213	0.0213	0.0166	0.0166
	Min.	0.00086	0.00086	0.00086	0.00068	0.00068
Duration (h)	Max.	44	44	44	44	44
	Min.	13	13	13	13	13



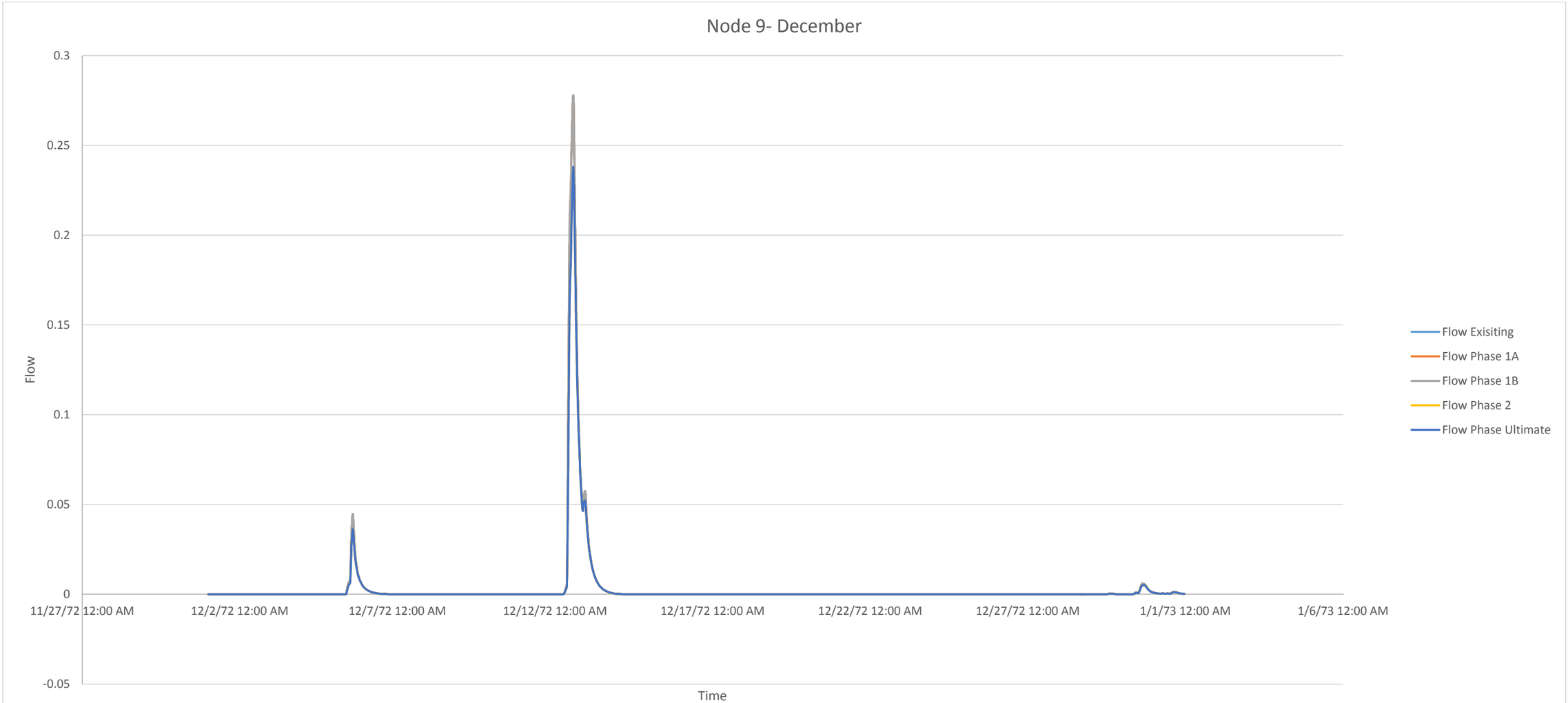
September						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		2	2	2	2	2
Magnitude (cm/s)	Max.	Not finished within this month				
	Min.	0.004	0.004	0.004	0.0031	0.0031
Duration (h)	Max.					
	Min.	36	36	36	36	36



October						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		9	9	9	9	9
Magnitude (cm/s)	Max.	0.0132	0.0132	0.0132	0.0105	0.0105
	Min.	0.00144	0.00144	0.00144	0.0011	0.0011
Duration (h)	Max.	35	35	35	35	35
	Min.	10	10	10	10	10

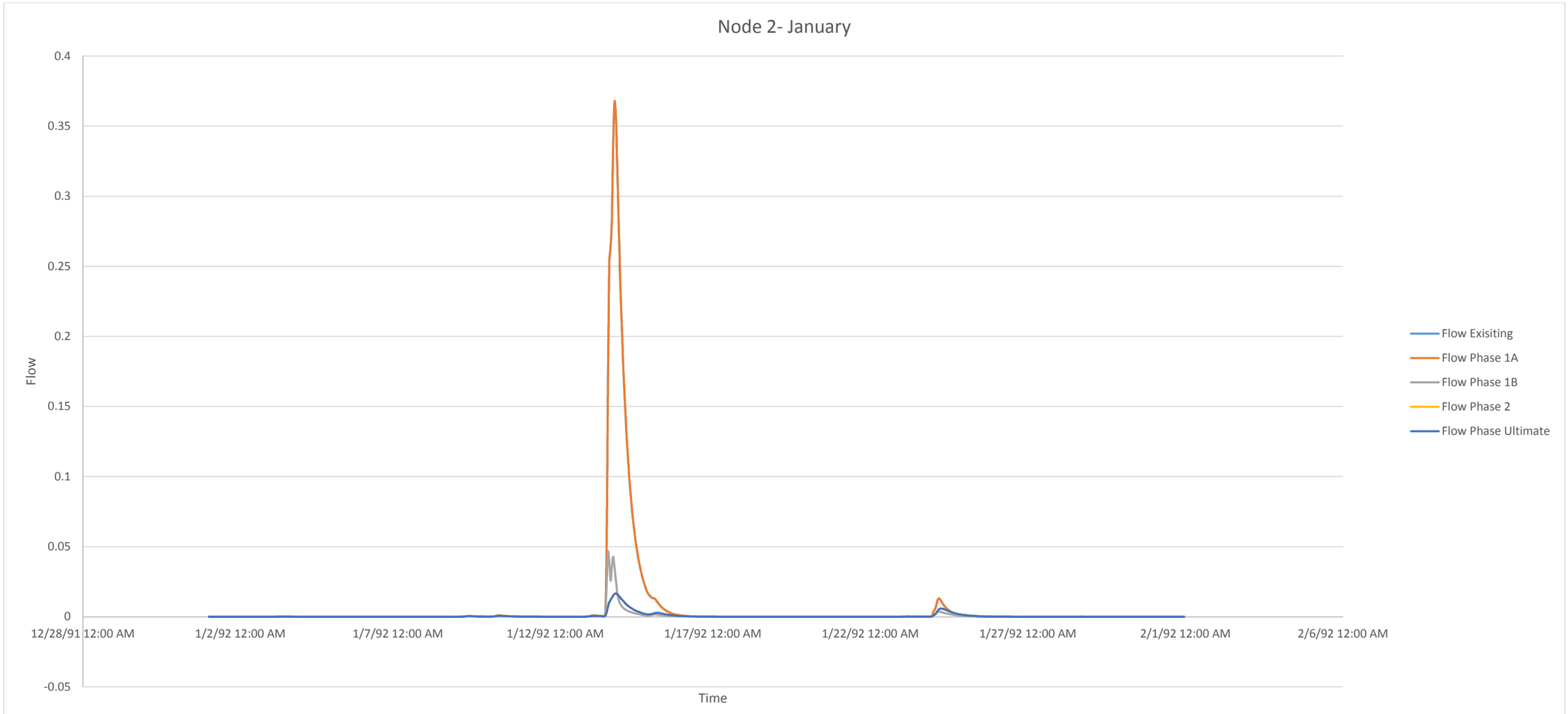


November						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitude (cm/s)	Max.	0.0088	0.0088	0.0088	0.007	0.007
	Min.	0.00172	0.00172	0.00172	0.00133	0.00133
Duration (h)	Max.	29	29	29	29	29
	Min.	14	14	14	14	14

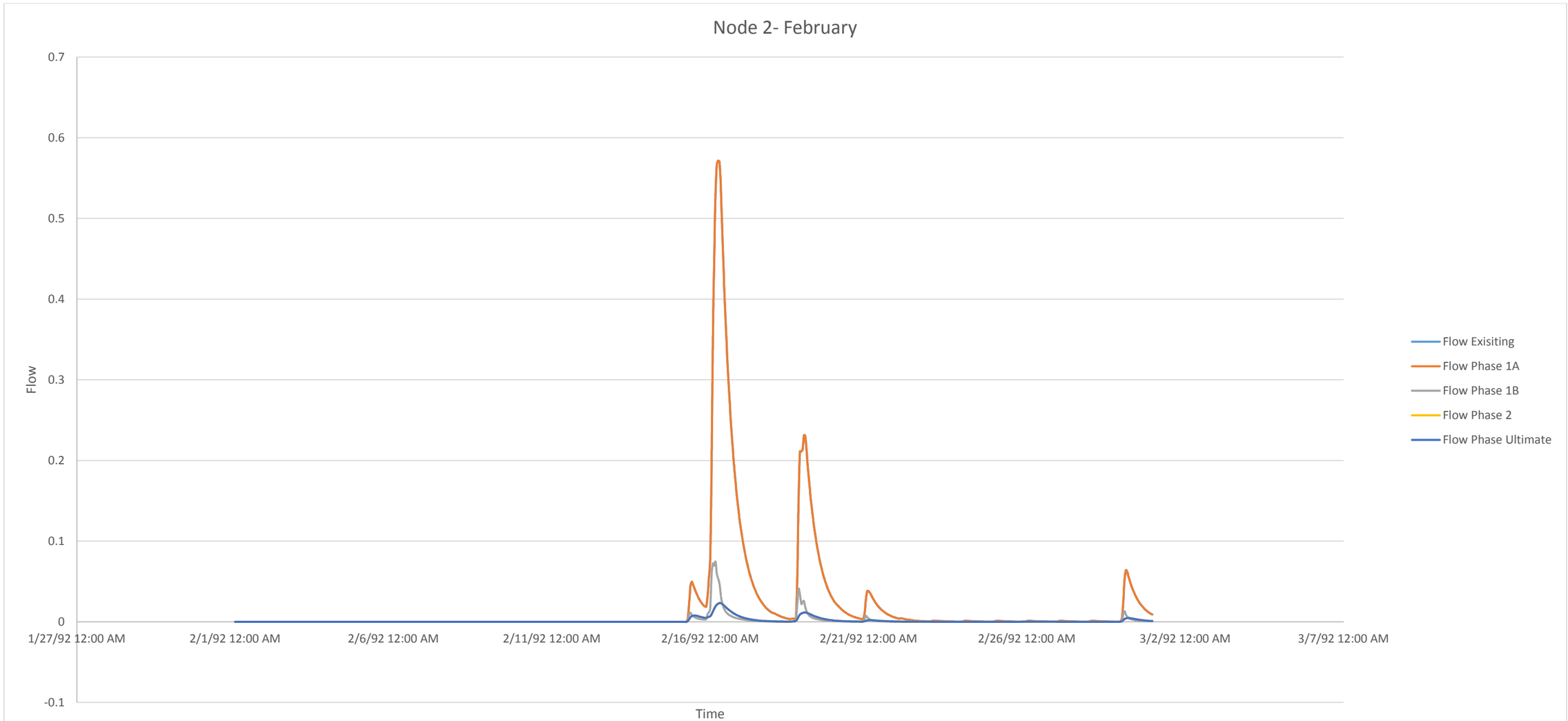


December						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		3	3	3	3	3
Magnitude (cm/s)	Max.	0.2764	0.2764	0.2764	0.2373	0.2373
	Min.	0.00105	0.00105	0.00105	0.00105	0.00105
Duration (h)	Max.	45	45	45	45	45
	Min.	7	7	7	7	7

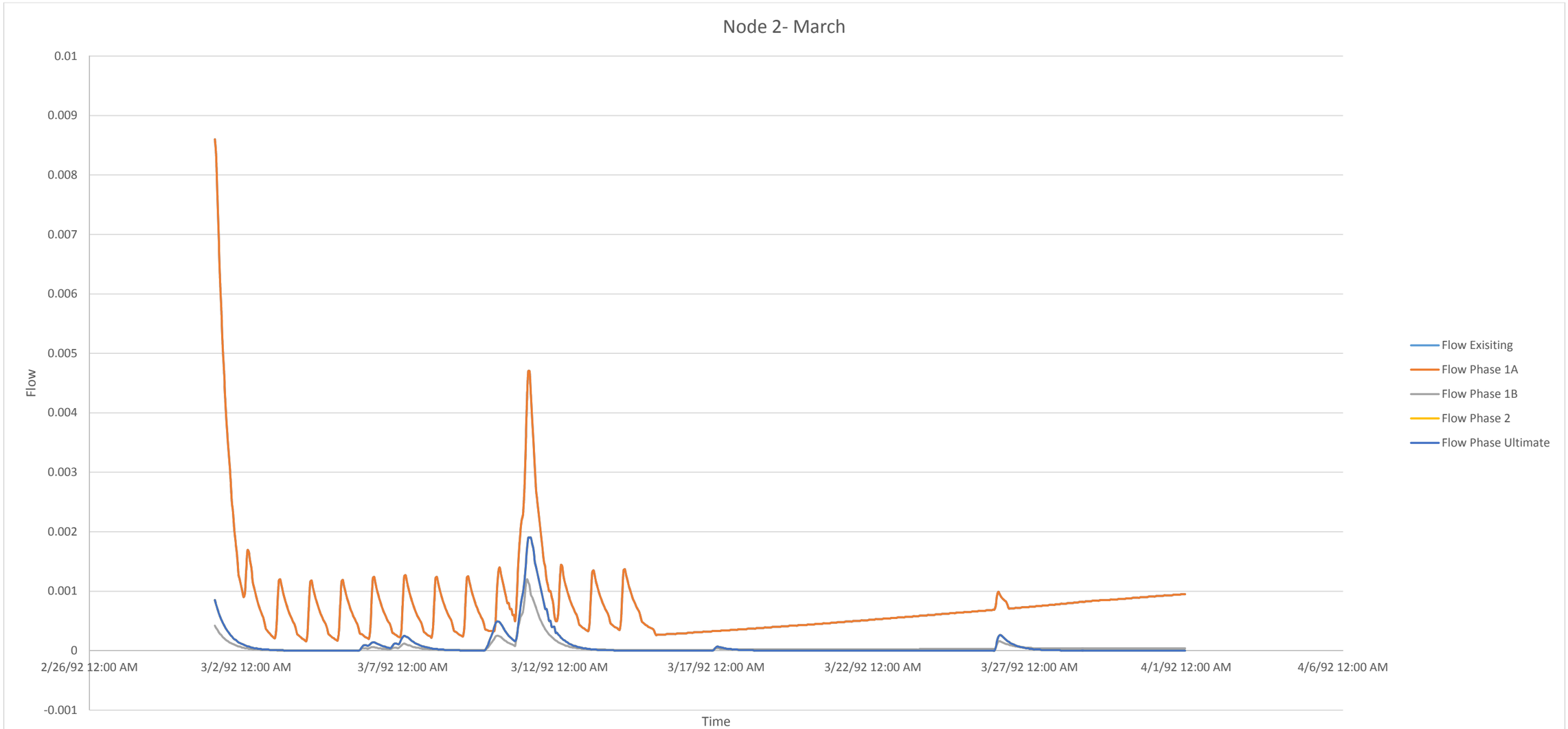
Wet Year-1992



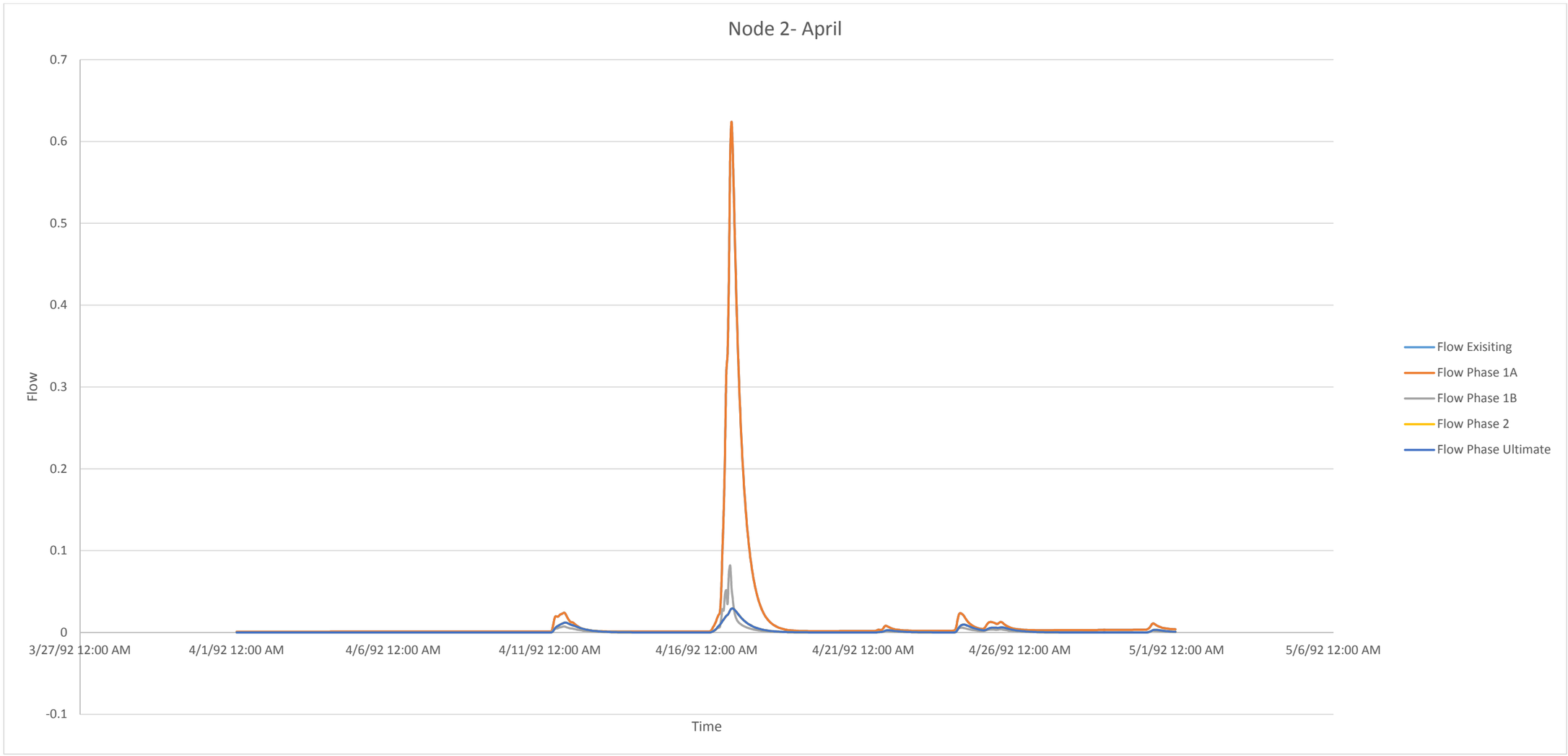
January						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		4	4	8	8	8
Magnitudes (cm/s)	Max.	0.3675	0.3675	0.0461	0.0166	0.0166
	Min.	0.00034	0.00034	0.00005	0.0001	0.0001
Duration (h)	Max.	87	87	101	109	109
	Min.	14	14	21	38	38



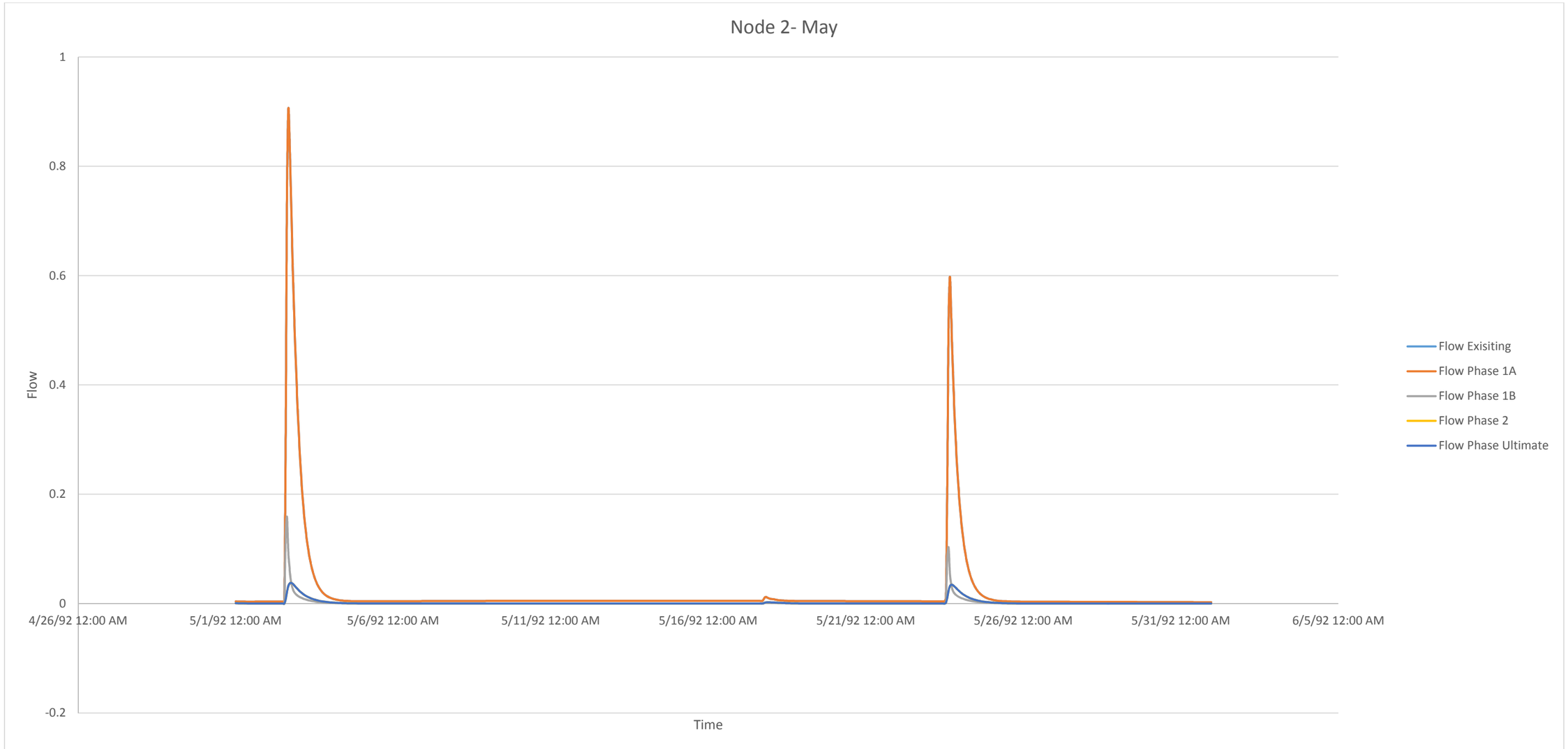
February						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitudes (cm/s)	Max.	0.5716	0.5716	0.0744	0.0232	0.0232
	Min.	0.00118	0.00118	0.00009	0.00018	0.00018
Duration (h)	Max.	65	65	71	74	74
	Min.	23	23	34	43	43



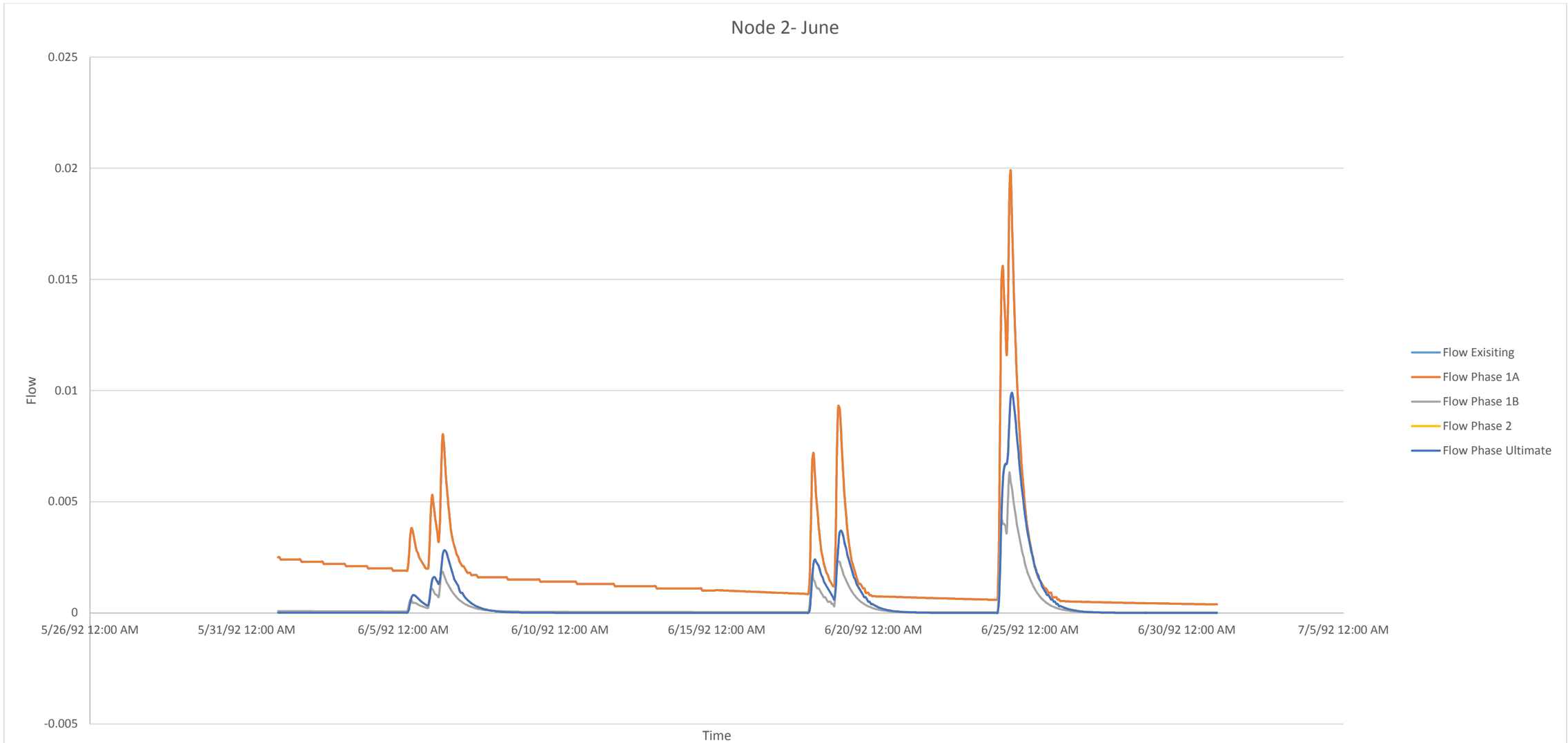
March						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		14	14	6	6	6
Magnitudes (cm/s)	Max.	0.0047	0.0047	0.0012	0.0019	0.0019
	Min.	0.00099	0.00099	0.00004	0.00007	0.00007
Duration (h)	Max.	30	30	38	38	38
	Min.	14	14	11	31	31



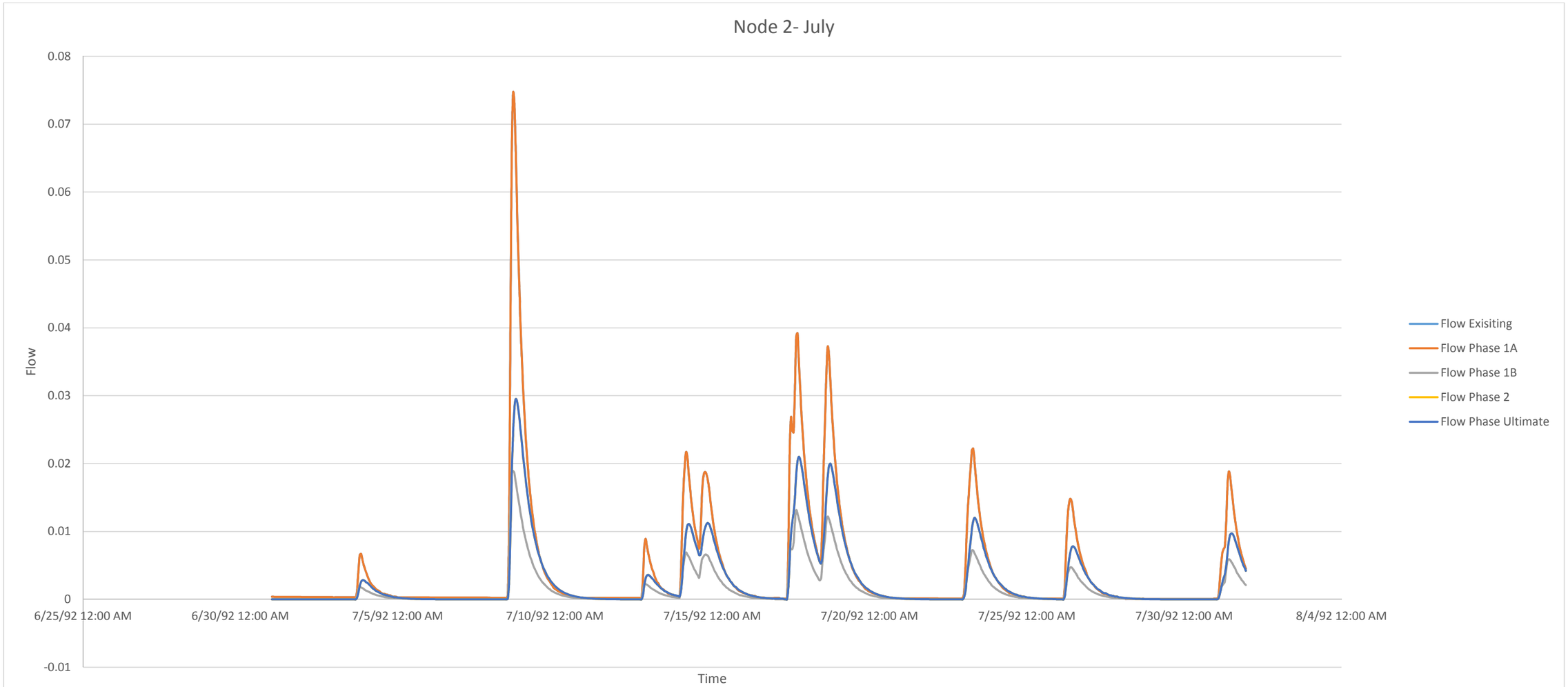
April						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitudes (cm/s)	Max.	0.624	0.624	0.0817	0.0293	0.0293
	Min.	0.0082	0.0082	0.00179	0.00267	0.00267
Duration (h)	Max.	79	79	94	98	98
	Min.	33	33	44	57	57



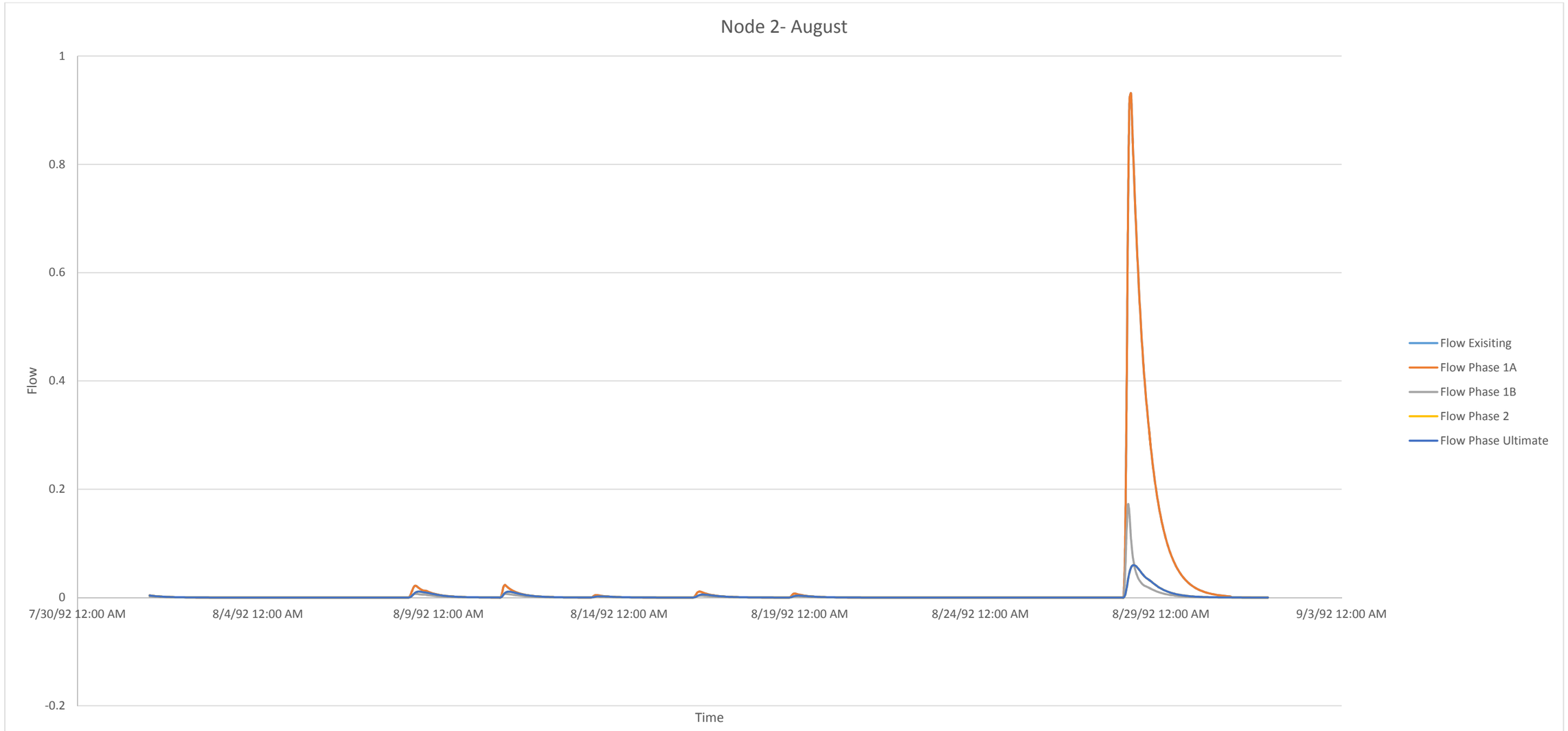
May						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		4	4	4	4	4
Magnitudes (cm/s)	Max.	0.9027	0.9027	0.1589	0.038	0.038
	Min.	0.0051	0.0051	0.00027	0.00021	0.00021
Duration (h)	Max.	60	60	77	66	66
	Min.	7	7	22	21	21



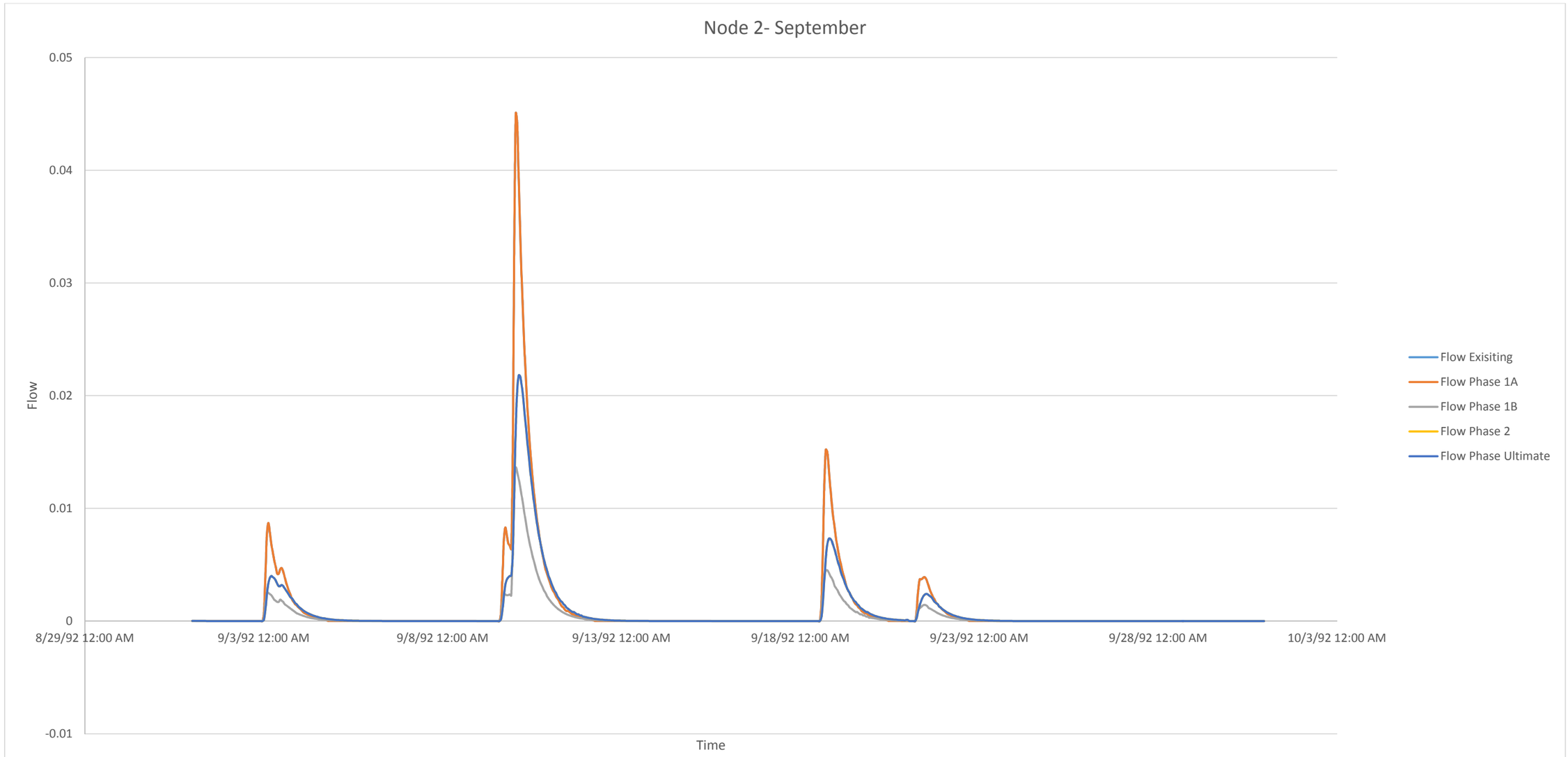
June						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	6	6
Magnitudes (cm/s)	Max.	0.0199	0.0199	0.0063	0.0099	0.0099
	Min.	0.0038	0.0038	0.00058	0.0008	0.0008
Duration (h)	Max.	46	46	89	89	89
	Min.	13	13	14	14	14



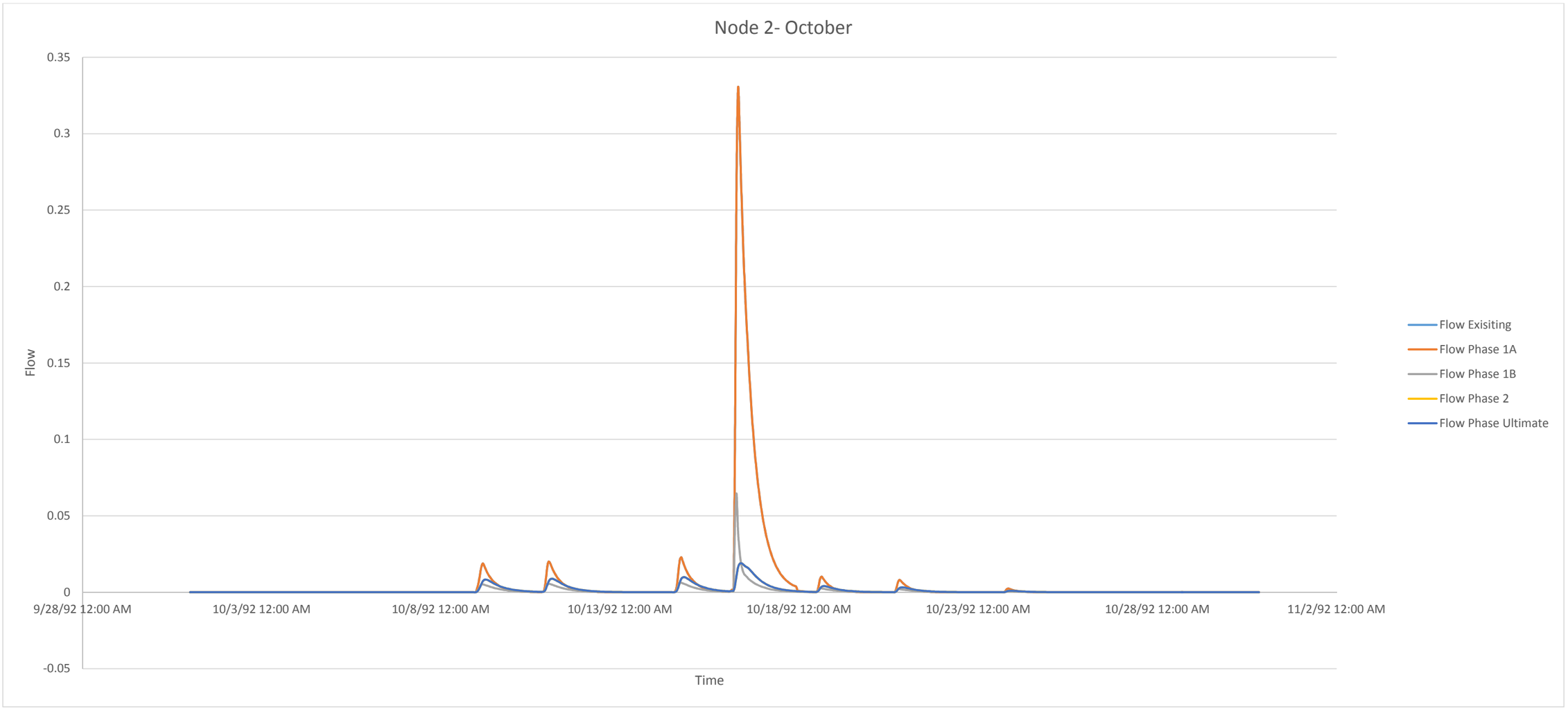
July						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		10	10	10	10	10
Magnitudes (cm/s)	Max.	0.0746	0.0746	0.0189	0.0295	0.0295
	Min.	0.0067	0.0067	0.00182	0.00281	0.00281
Duration (h)	Max.	95	95	98	98	98
	Min.	31	31	34	40	40



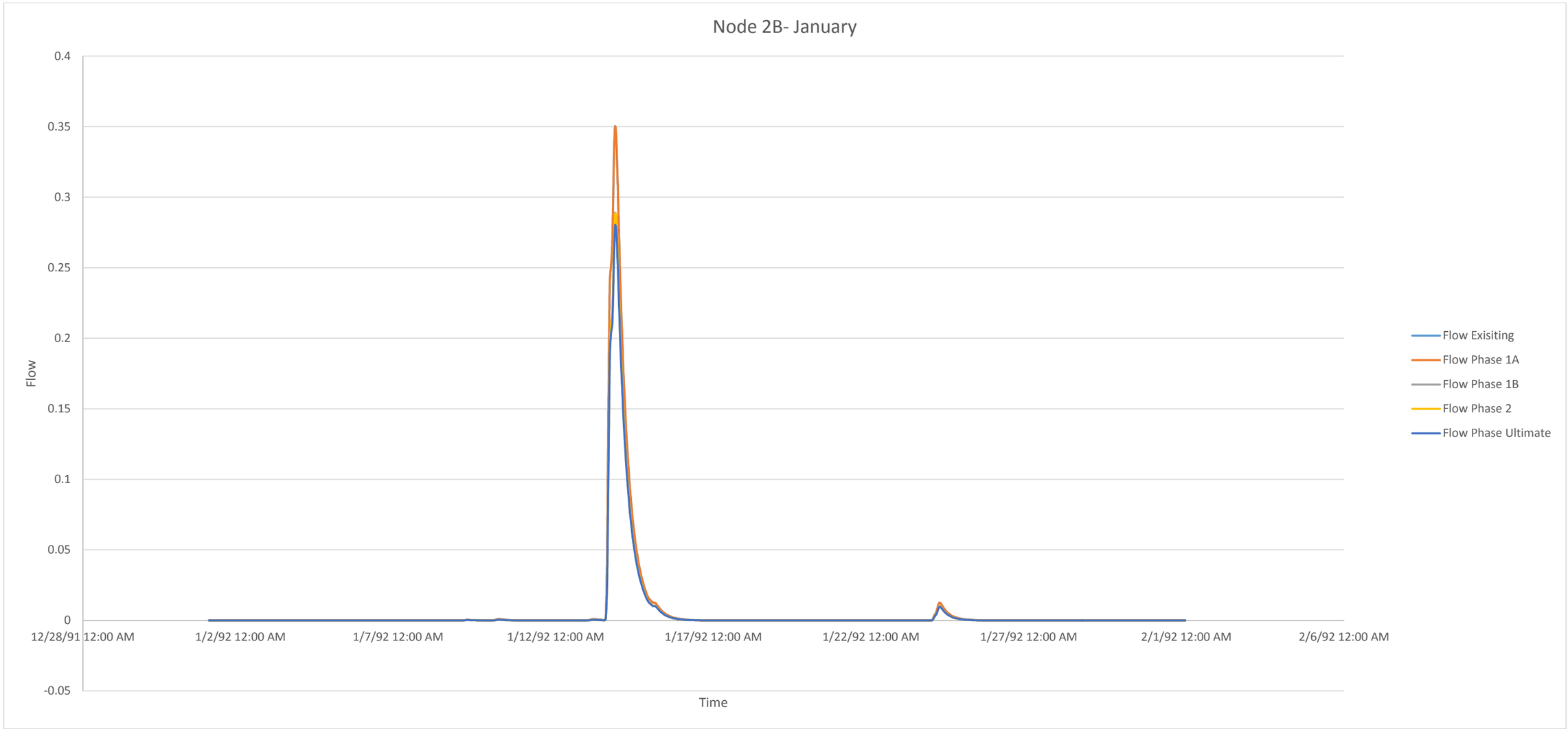
August						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitudes (cm/s)	Max.	0.9313	0.9313	0.1716	0.0598	0.0598
	Min.	0.0045	0.0045	0.00143	0.0023	0.0023
Duration (h)	Max.	84	84	82	89	89
	Min.	35	35	52	59	59



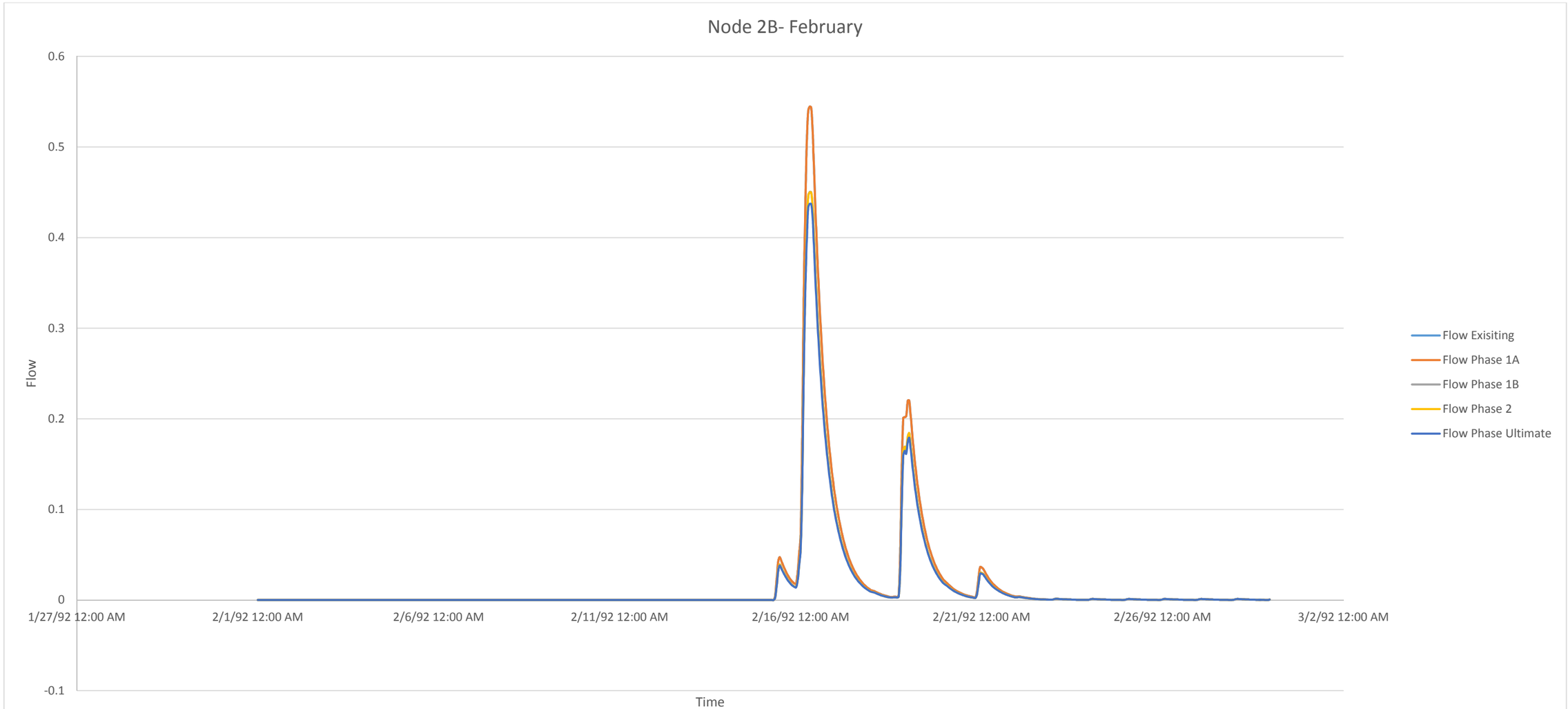
September						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		4	4	4	4	4
Magnitudes (cm/s)	Max.	0.045	0.045	0.0136	0.0218	0.0218
	Min.	0.0039	0.0039	0.00144	0.0024	0.0024
Duration (h)	Max.	63	63	77	84	84
	Min.	35	35	49	56	56



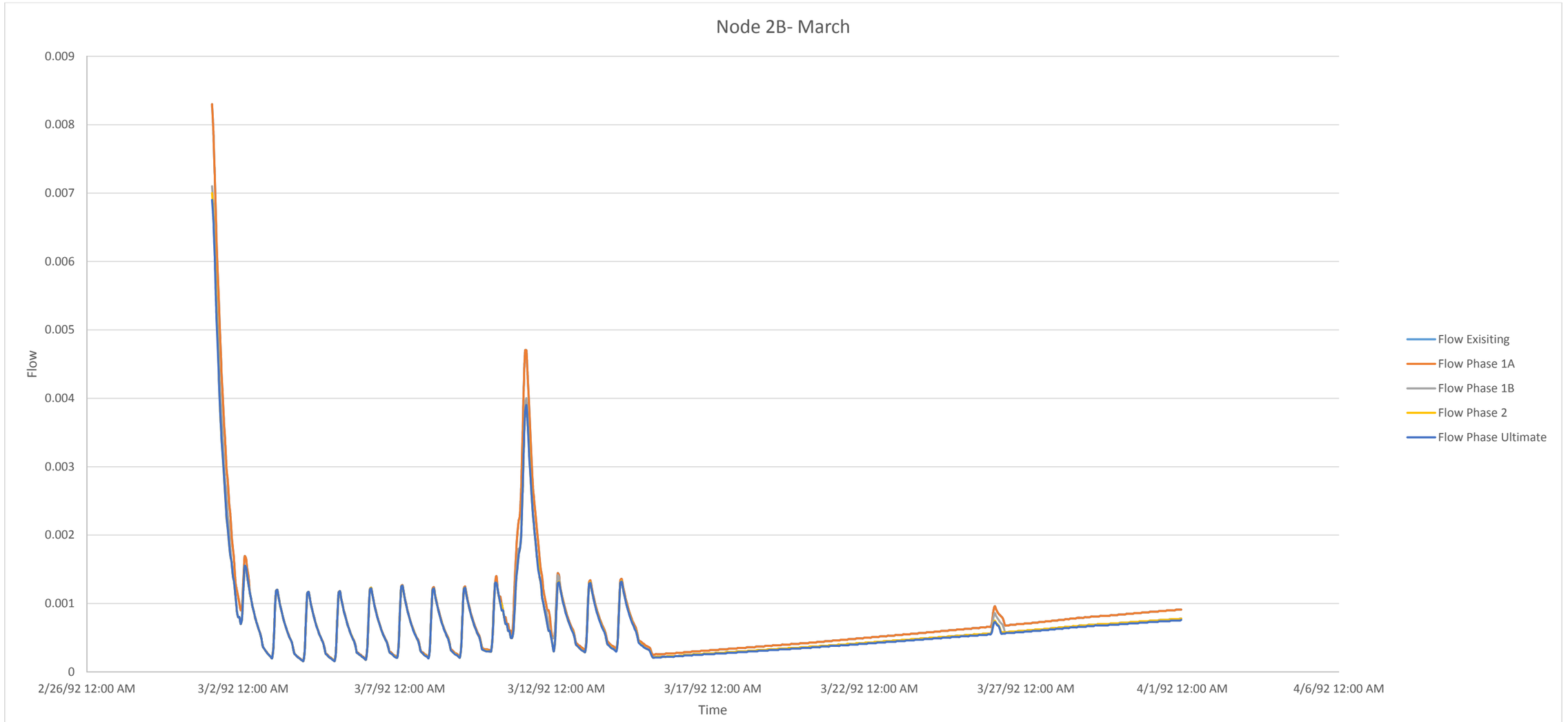
October						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitudes (cm/s)	Max.	0.3294	0.3294	0.0646	0.019	0.019
	Min.	0.00242	0.00242	0.00067	0.00097	0.00097
Duration (h)	Max.	87	87	97	104	104
	Min.	20	20	41	48	48



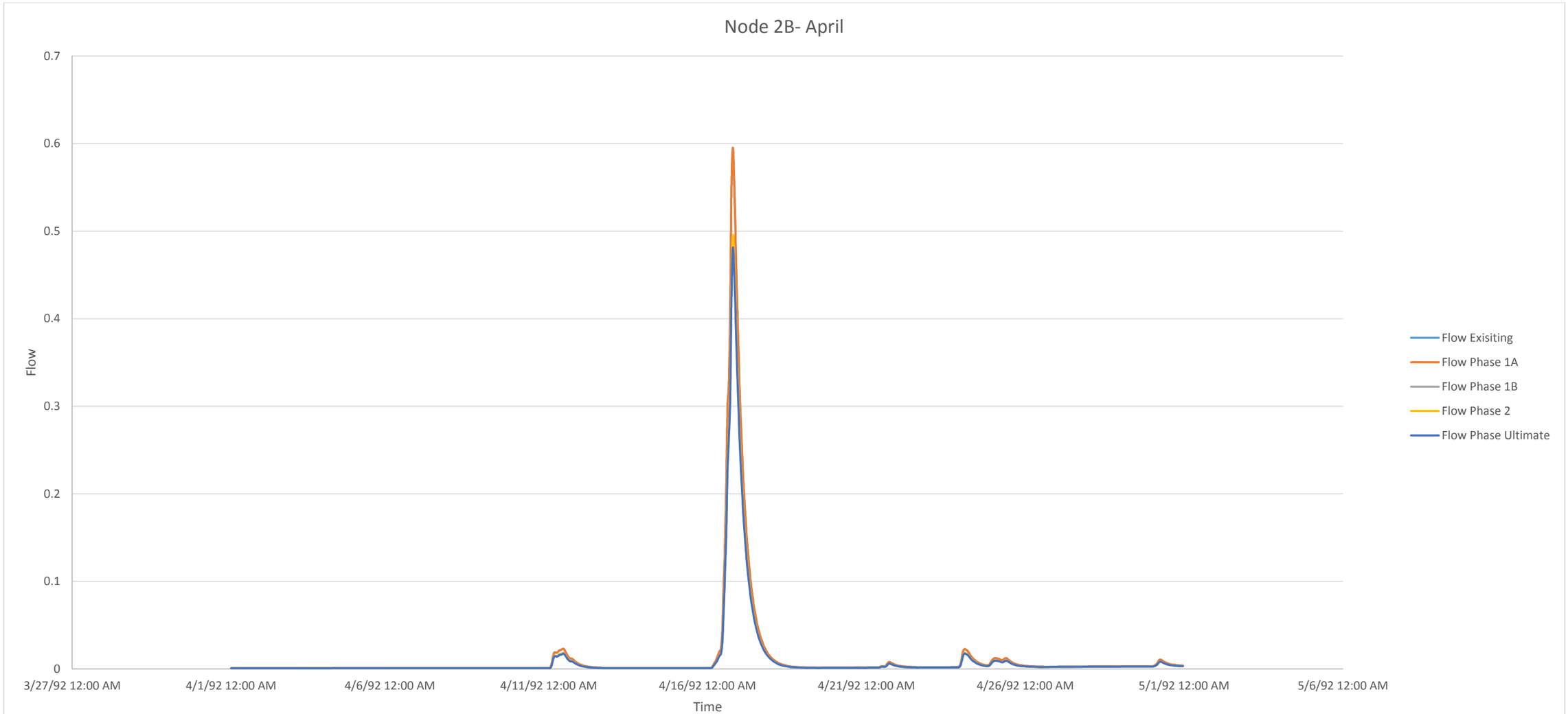
January						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		5	5	5	5	5
Magnitude (cm/s)	Max.	0.3499	0.3499	0.2885	0.2882	0.2799
	Min.	0.00034	0.00034	0.00034	0.00021	0.00021
Duration (h)	Max.	73	73	73	73	73
	Min.	14	14	14	10	10



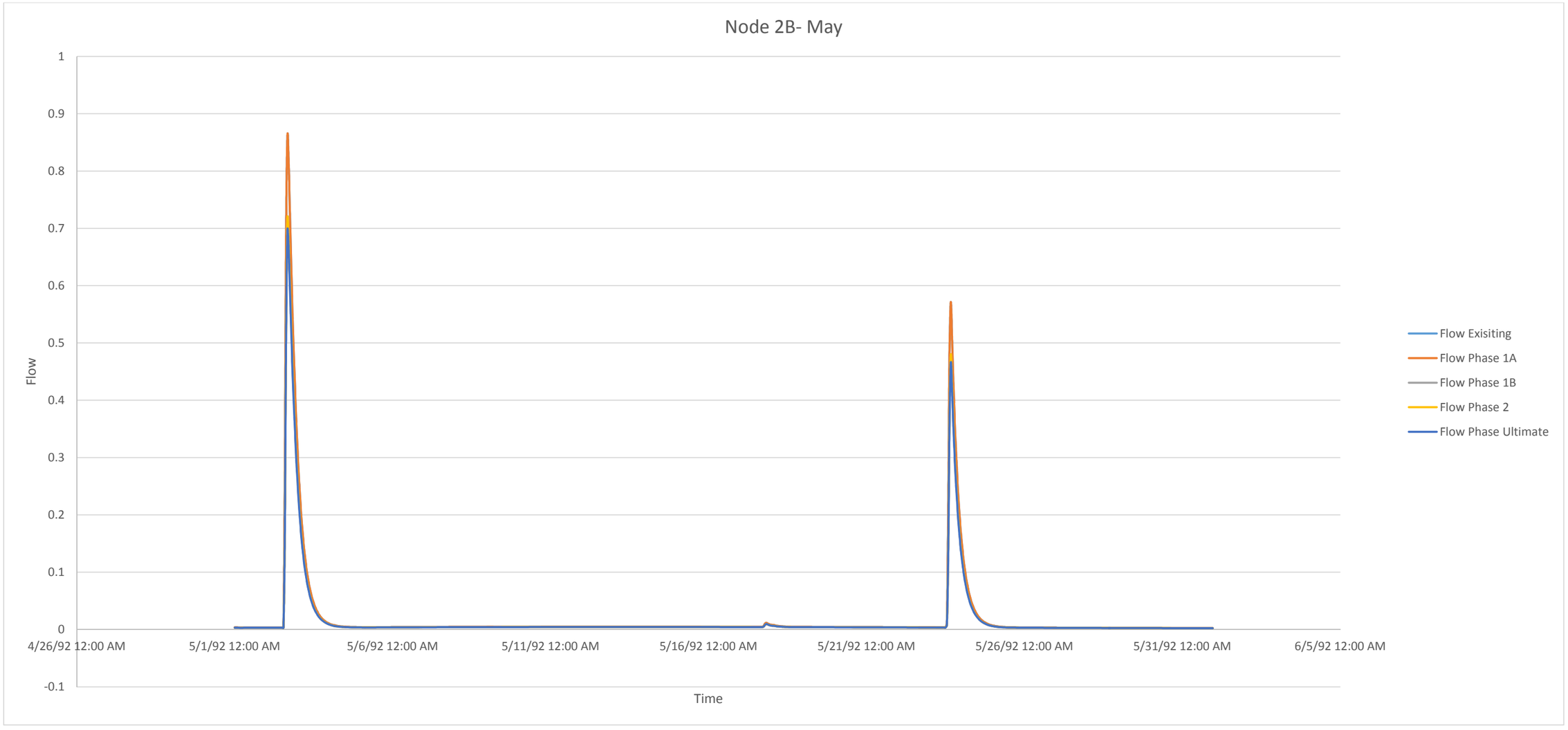
February						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		11	11	11	11	11
Magnitude (cm/s)	Max.	0.5446	0.5446	0.4504	0.4499	0.4372
	Min.	0.00114	0.00114	0.00114	0.00114	0.00114
Duration (h)	Max.	44	44	44	44	44
	Min.	20	20	20	20	20



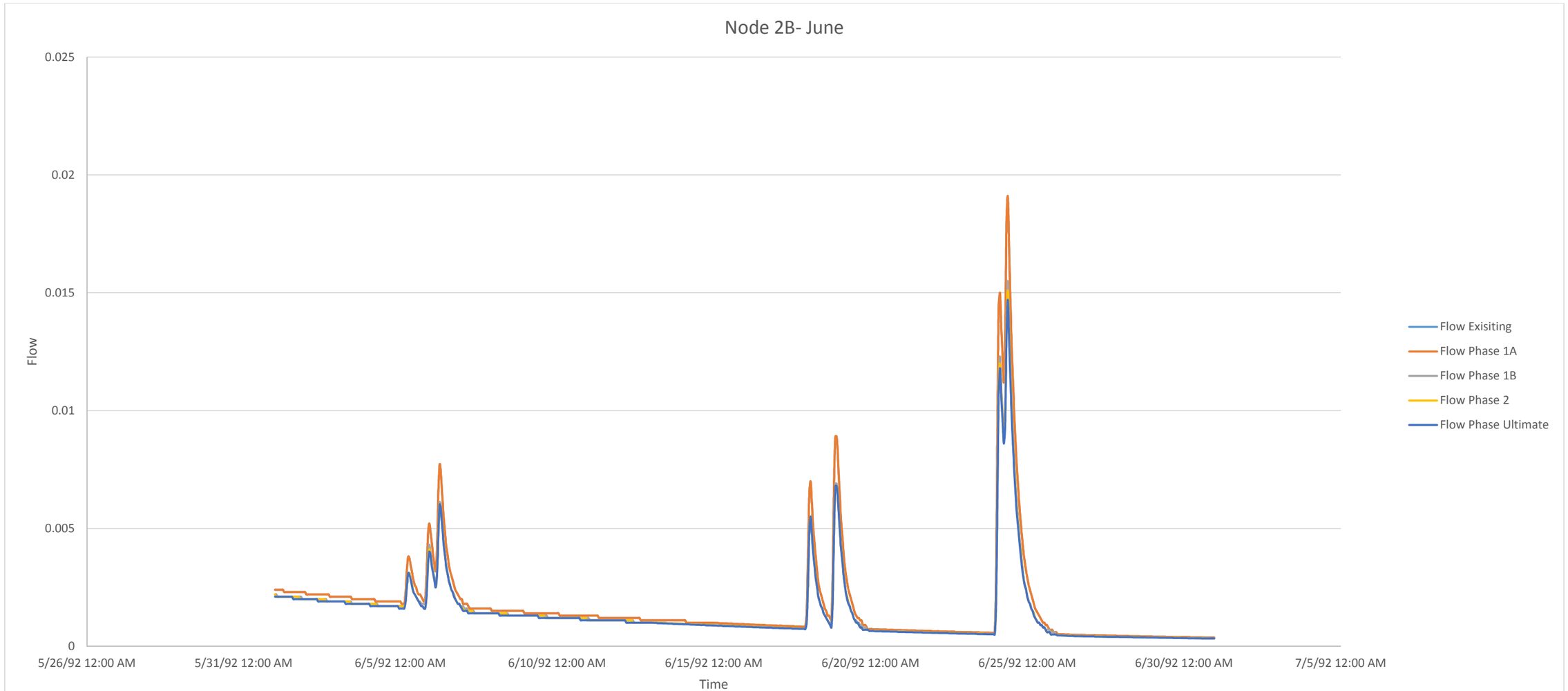
March						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		14	14	14	14	14
Magnitude (cm/s)	Max.	0.0047	0.0047	0.004	0.0039	0.0039
	Min.	0.00096	0.00096	0.00086	0.00075	0.00073
Duration (h)	Max.	30	30	29	29	29
	Min.	10	10	10	10	7



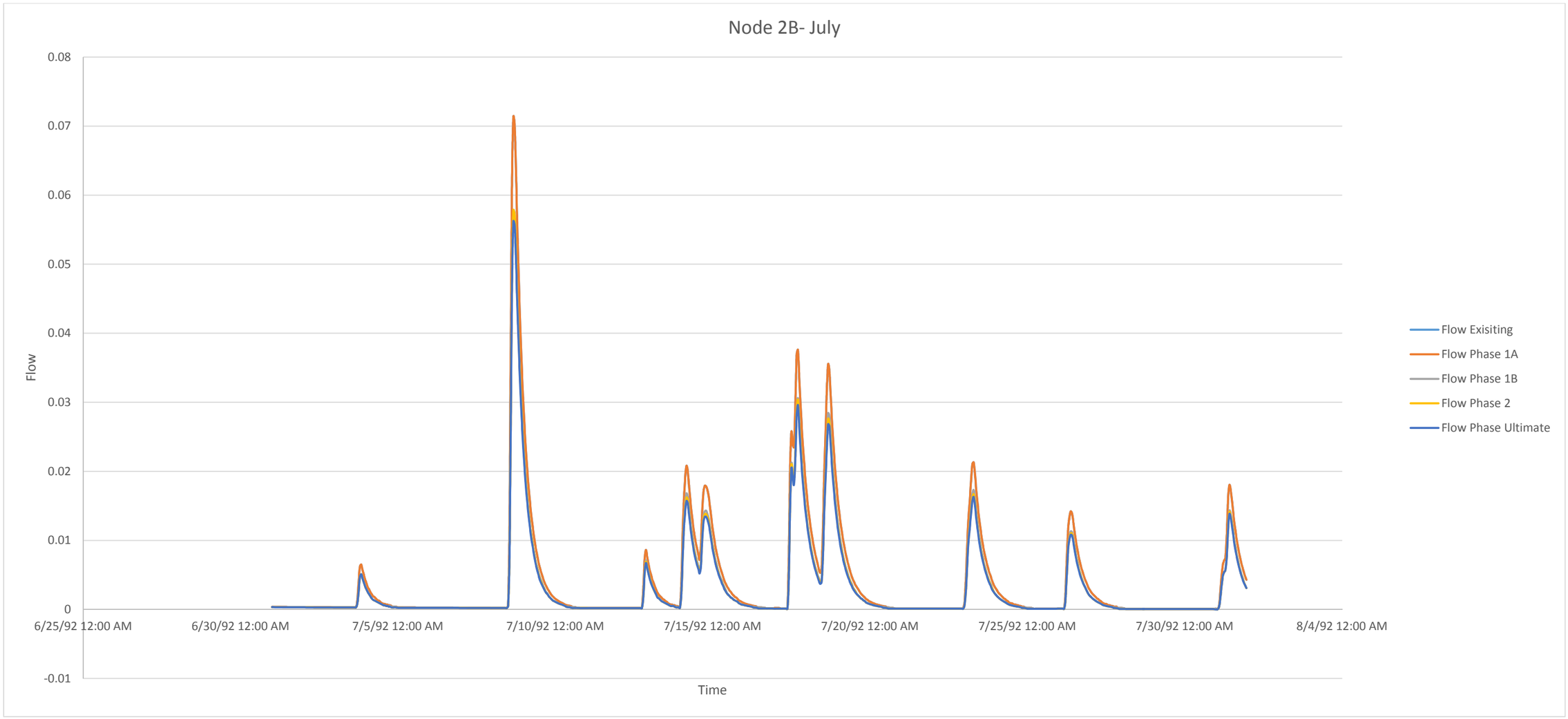
April						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitude (cm/s)	Max.	0.5952	0.5952	0.495	0.4952	0.4809
	Min.	0.0079	0.0079	0.0062	0.0062	0.0062
Duration (h)	Max.	69	69	65	65	65
	Min.	24	24	16	16	16



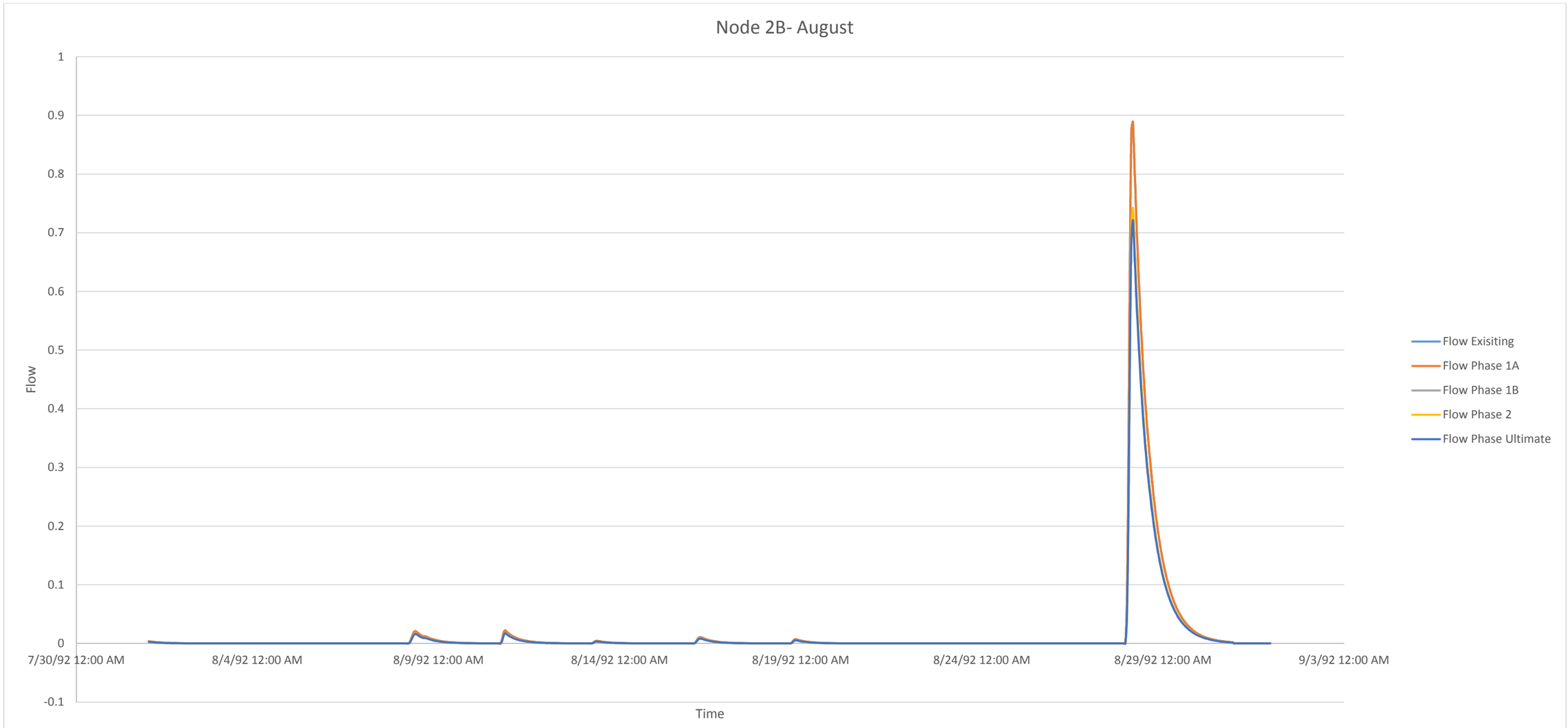
May						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		3	3	3	3	3
Magnitude (cm/s)	Max.	0.861	0.861	0.7158	0.7164	0.6955
	Min.	0.0116	0.0116	0.0096	0.0096	0.0096
Duration (h)	Max.	41	41	39	39	38
	Min.	23	23	15	15	14



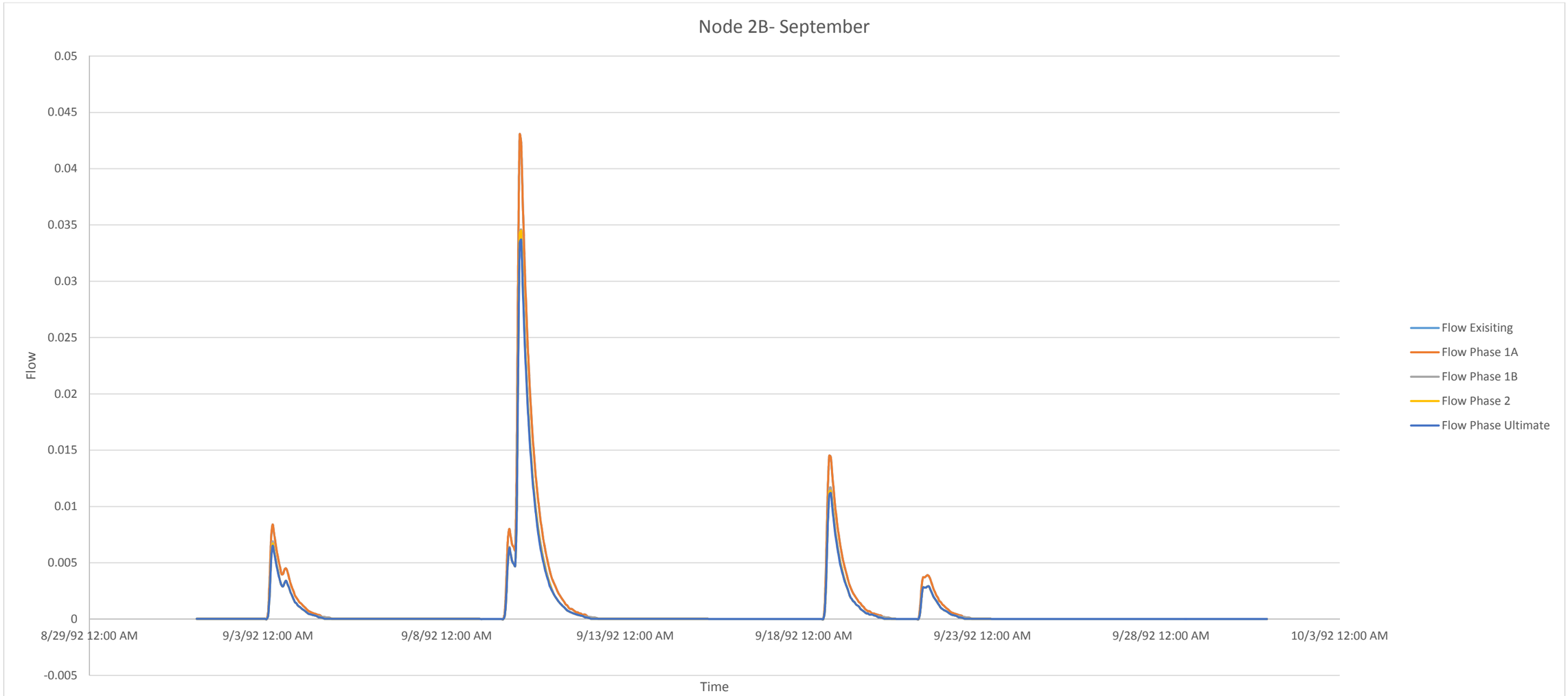
June						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.0191	0.0191	0.0155	0.0151	0.0147
	Min.	0.0038	0.0038	0.0031	0.0031	0.0031
Duration (h)	Max.	48	48	48	48	48
	Min.	14	14	12	14	14



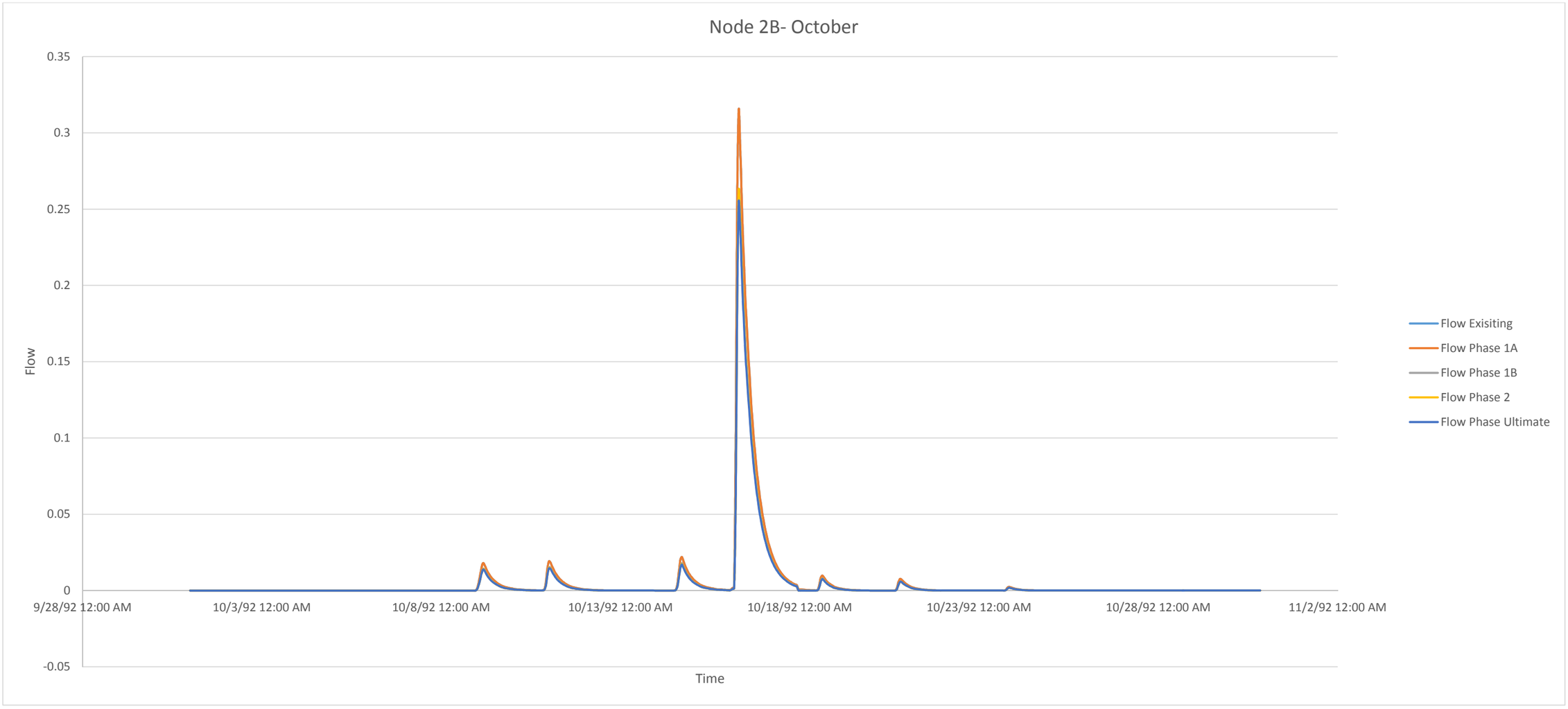
July						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		10	10	10	10	10
Magnitude (cm/s)	Max.	0.0713	0.0713	0.0578	0.0578	0.0562
	Min.	0.0065	0.0065	0.0051	0.0051	0.0051
Duration (h)	Max.	53	53	53	49	49
	Min.	27	27	26	24	24



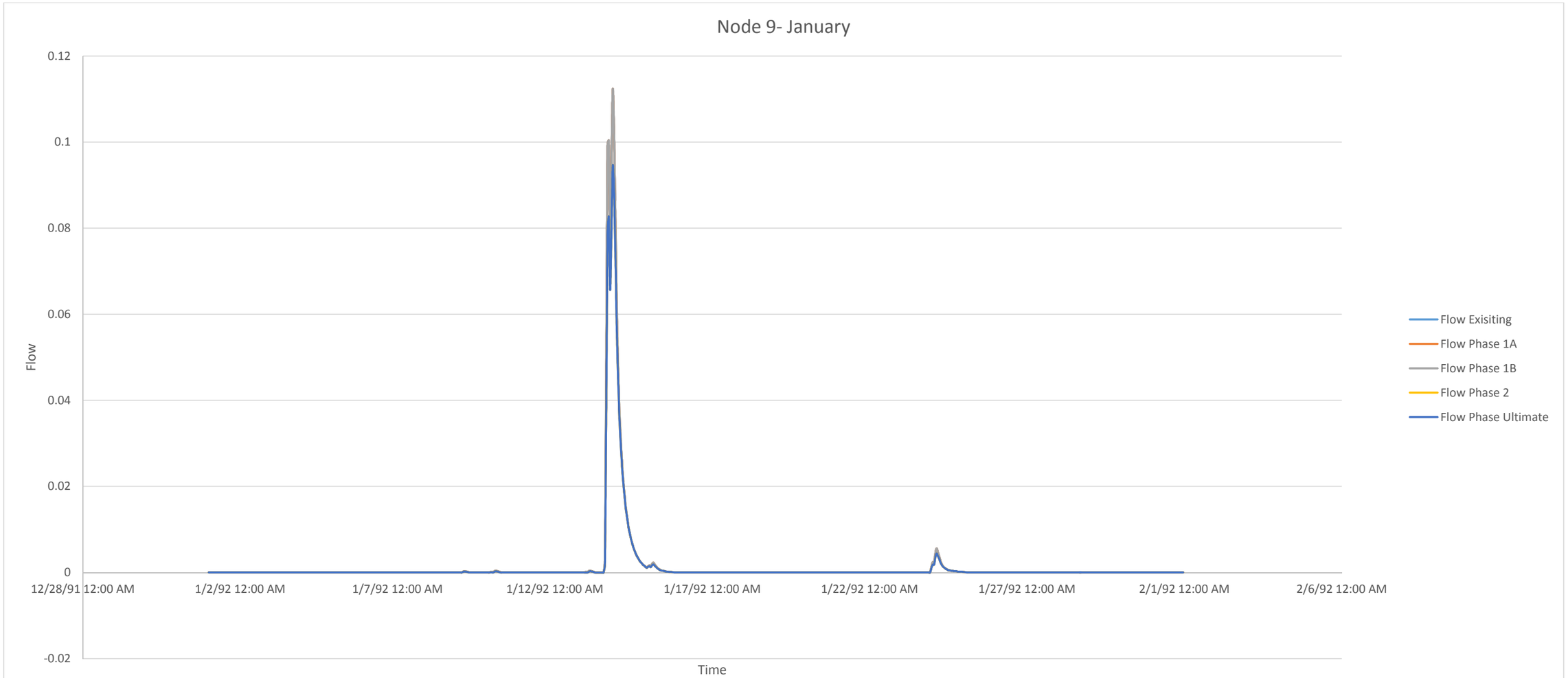
August						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitude (cm/s)	Max.	0.8893	0.8893	0.742	0.7425	0.7215
	Min.	0.0044	0.0044	0.0034	0.0034	0.0034
Duration (h)	Max.	84	84	72	71	71
	Min.	19	19	16	16	16



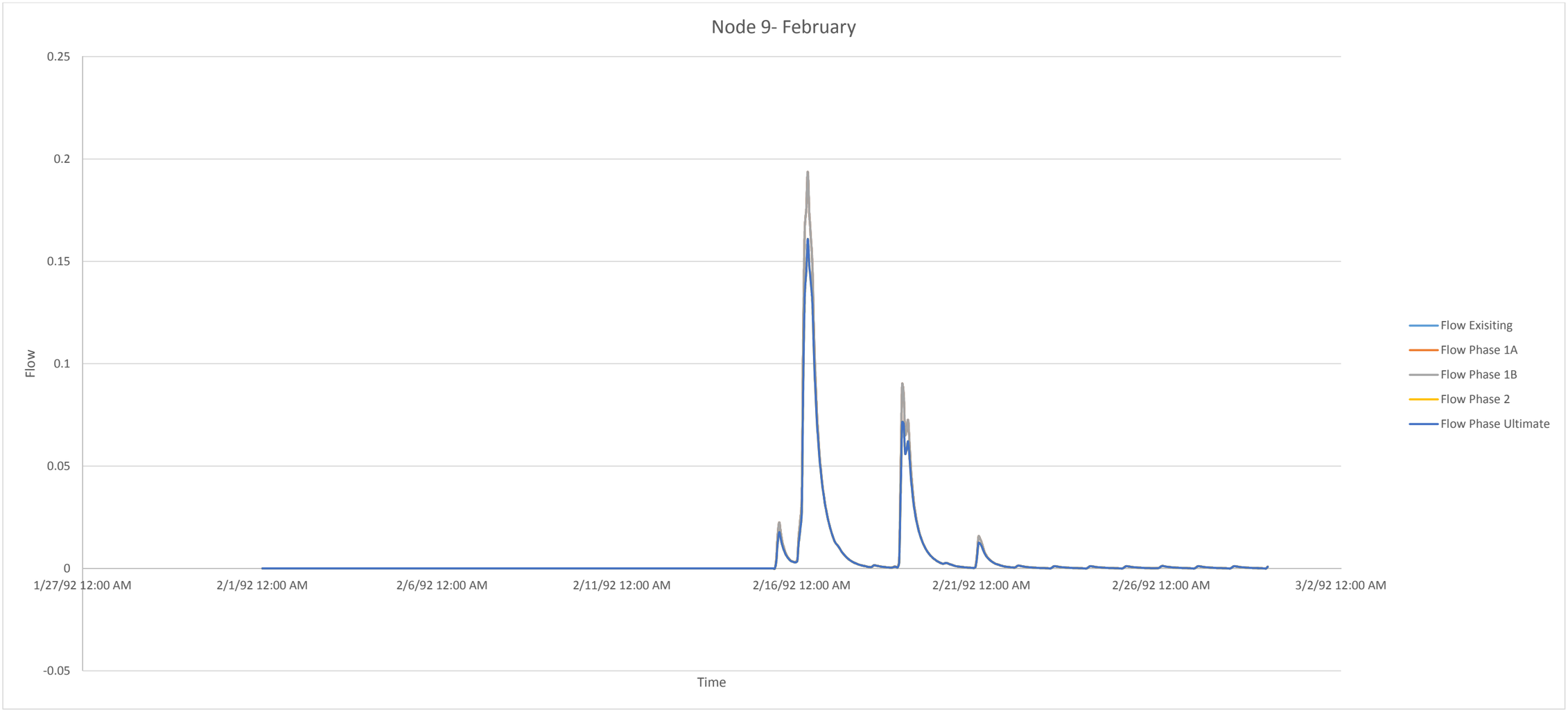
September						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		4	4	4	4	4
Magnitude (cm/s)	Max.	0.043	0.043	0.0346	0.0345	0.0337
	Min.	0.0039	0.0039	0.0029	0.0029	0.0029
Duration (h)	Max.	63	63	63	58	58
	Min.	35	35	35	30	30



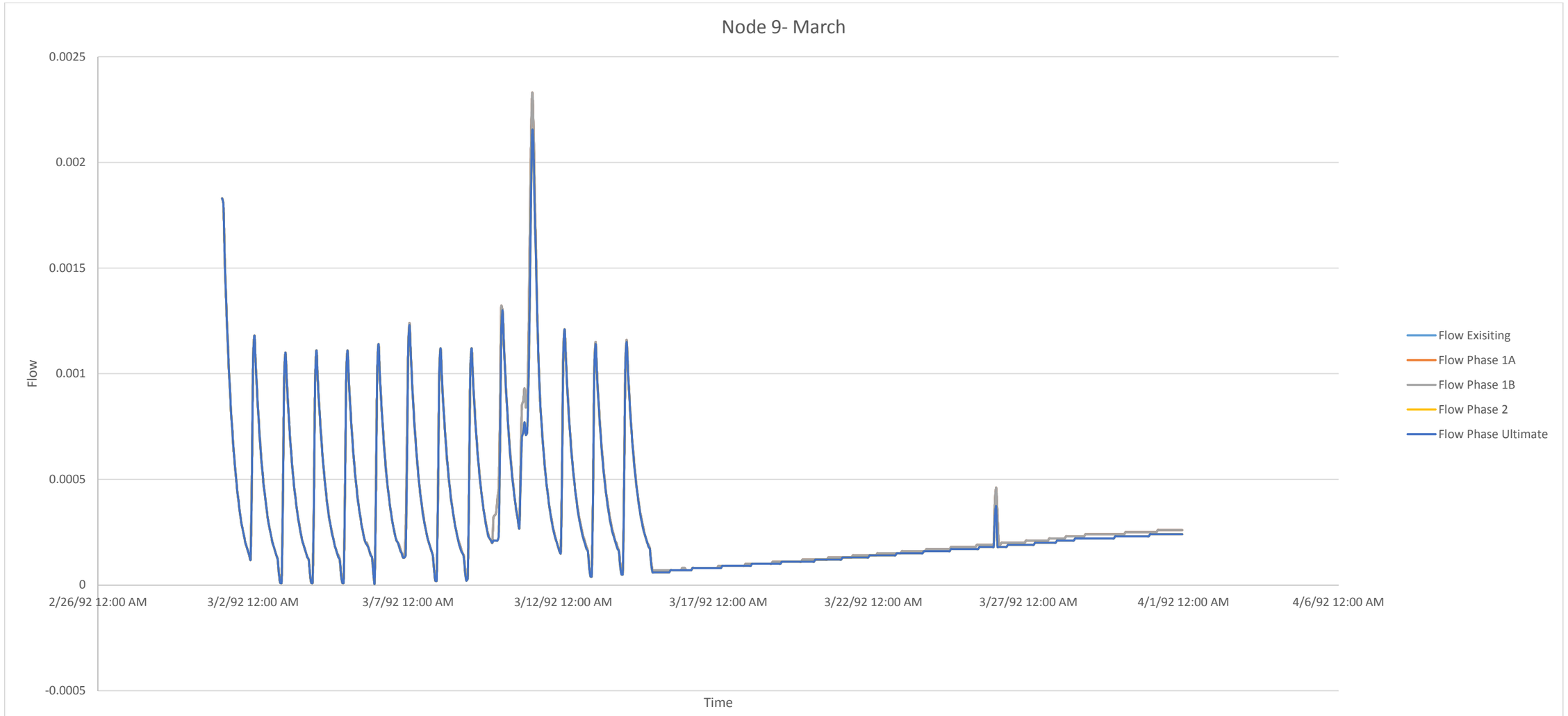
October						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.3143	0.3143	0.2613	0.2615	0.2539
	Min.	0.00242	0.00242	0.00187	0.00187	0.00187
Duration (h)	Max.	45	45	45	45	45
	Min.	20	20	20	16	16



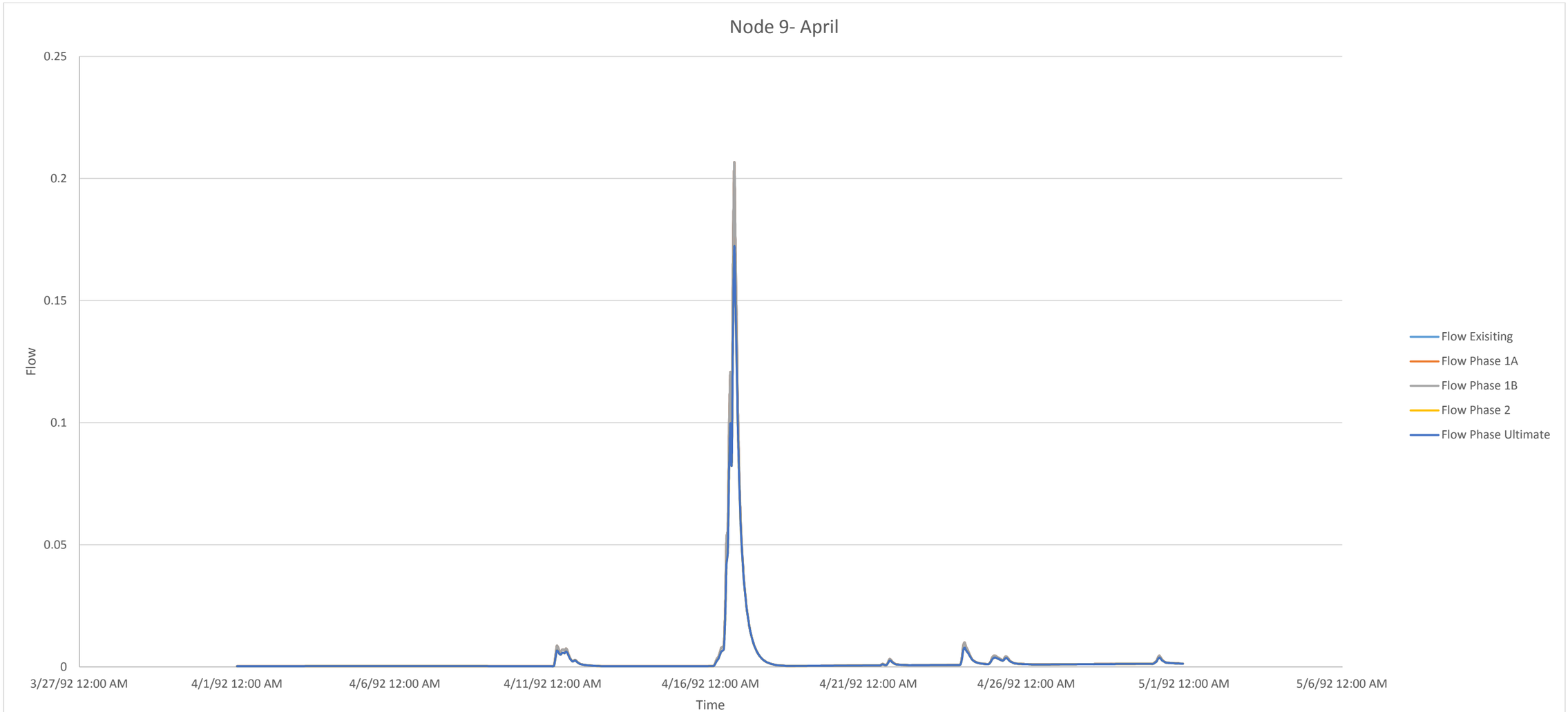
January						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitude (cm/s)	Max.	0.11220	0.11220	0.11220	0.09440	0.09440
	Min.	0.0003	0.0003	0.0003	0.00021	0.00021
Duration (h)	Max.	53	53	53	53	53
	Min.	4	4	4	4	4



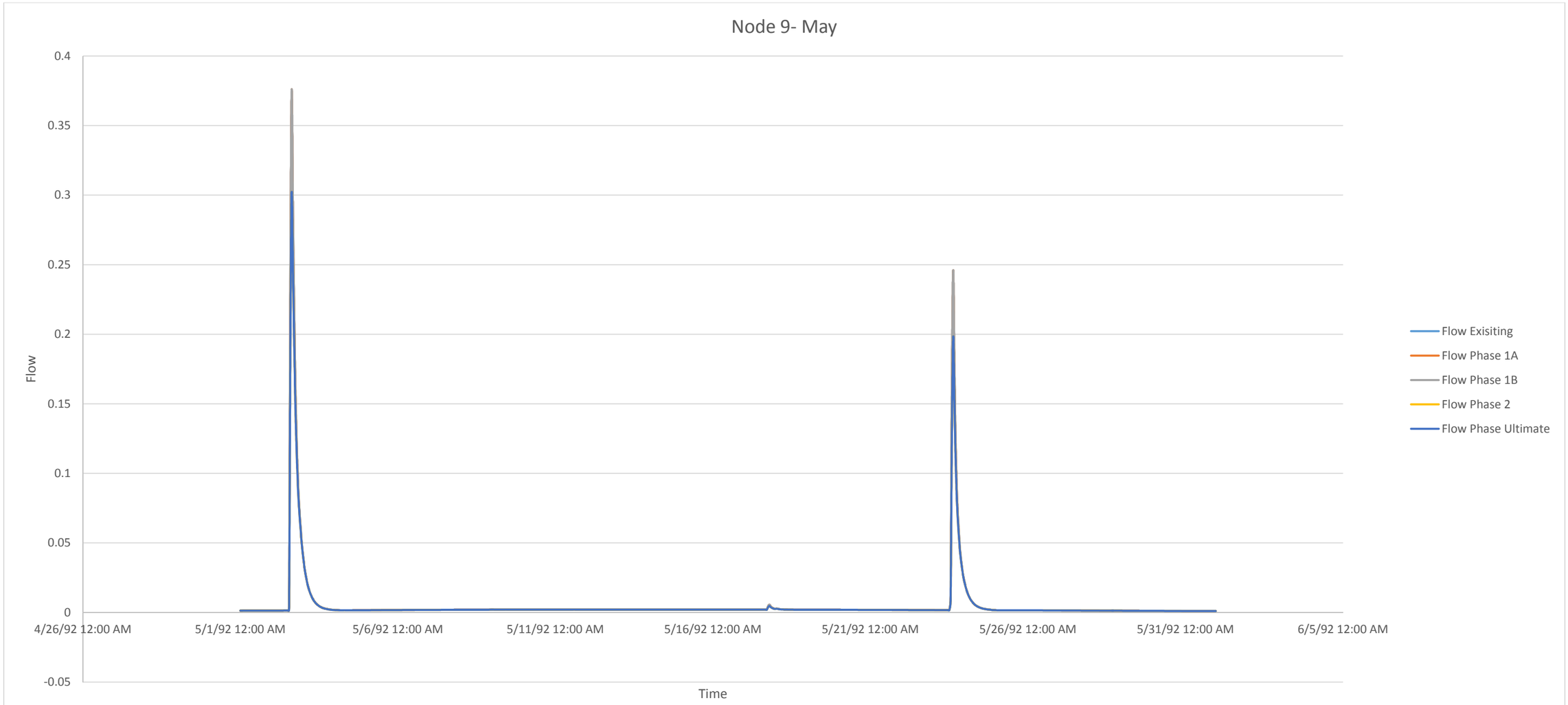
February						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		12	12	12	12	12
Magnitude (cm/s)	Max.	0.19370	0.19370	0.19370	0.16090	0.16090
	Min.	0.0011	0.0011	0.0011	0.0011	0.0011
Duration (h)	Max.	76	76	76	76	76
	Min.	22	22	22	22	22



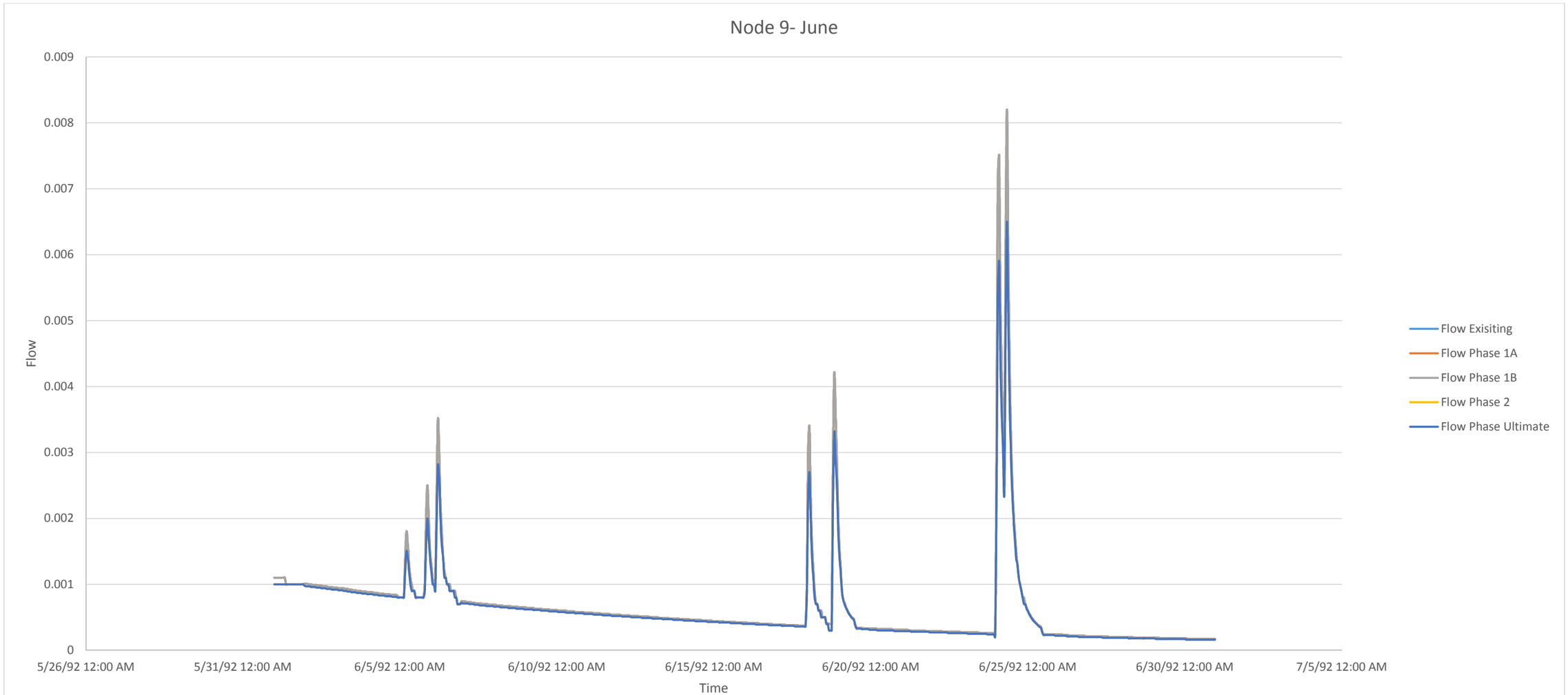
March						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		14	14	14	14	14
Magnitude (cm/s)	Max.	0.00233	0.00233	0.00233	0.00215	0.00215
	Min.	0.00046	0.00046	0.00046	0.00037	0.00037
Duration (h)	Max.	25	25	25	25	25
	Min.	3	3	3	2	2



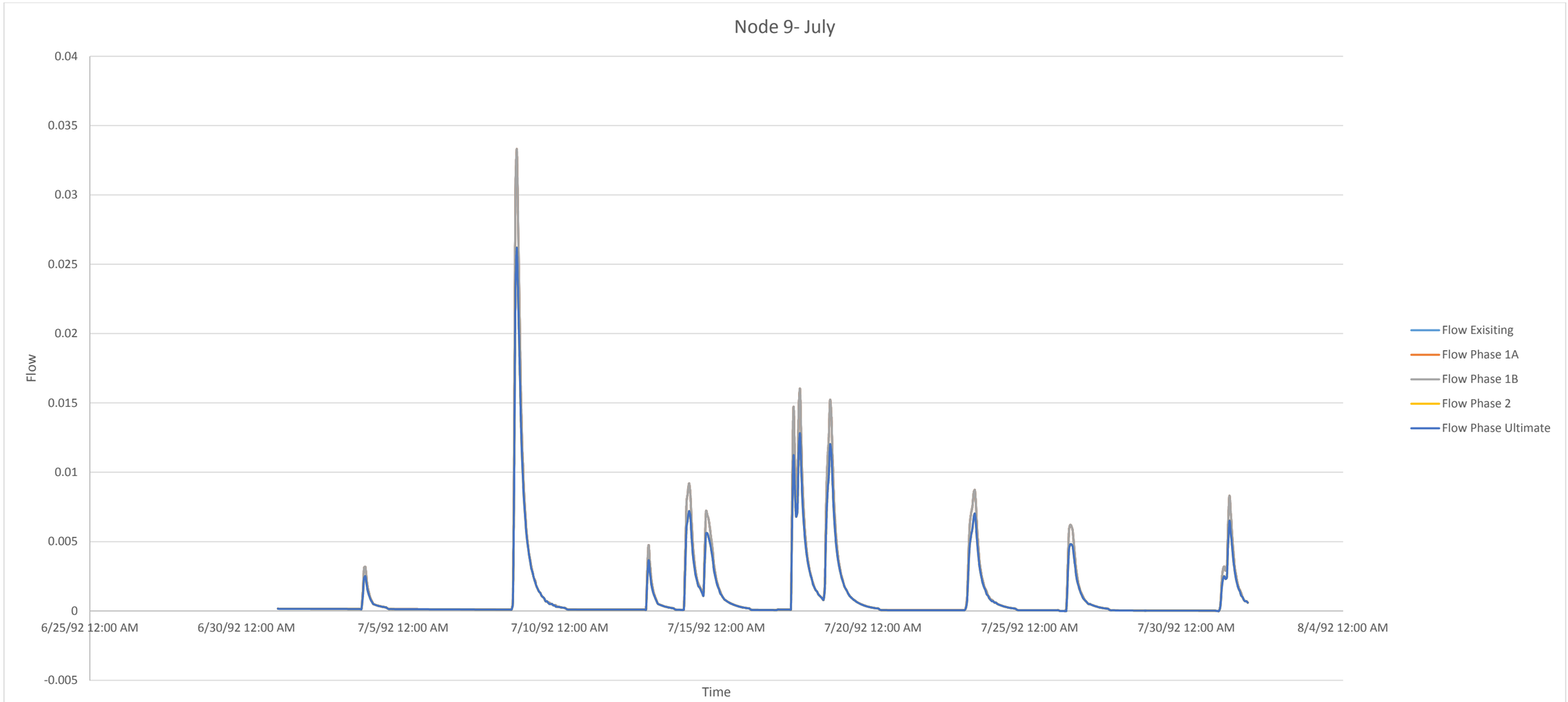
April						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.20670	0.20670	0.20670	0.17230	0.17230
	Min.	0.0032	0.0032	0.0032	0.00256	0.00256
Duration (h)	Max.	55	55	55	55	55
	Min.	14	14	14	16	16



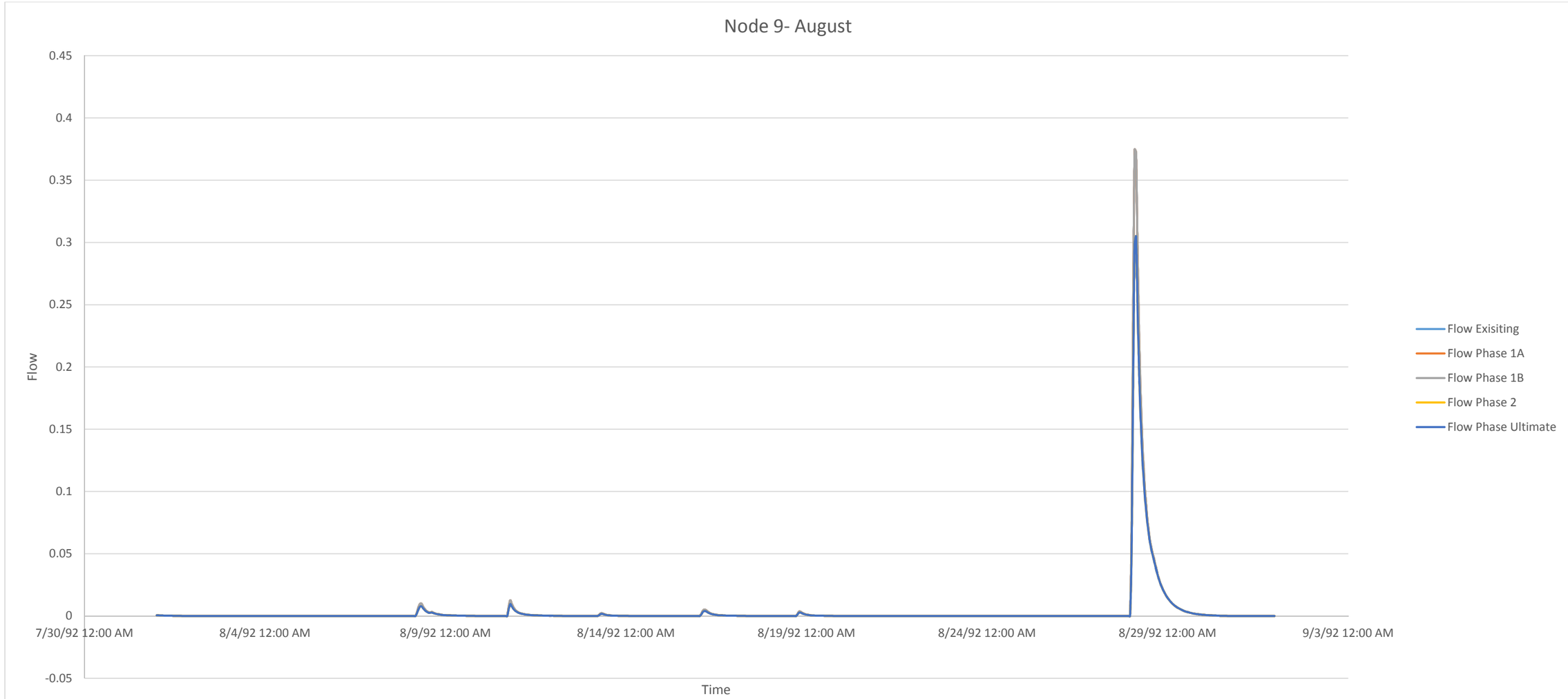
May						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		3	3	3	3	3
Magnitude (cm/s)	Max.	0.37530	0.37530	0.37530	0.30080	0.30080
	Min.	0.0056	0.0056	0.0056	0.0047	0.0047
Duration (h)	Max.	38	38	38	39	39
	Min.	15	15	15	12	12



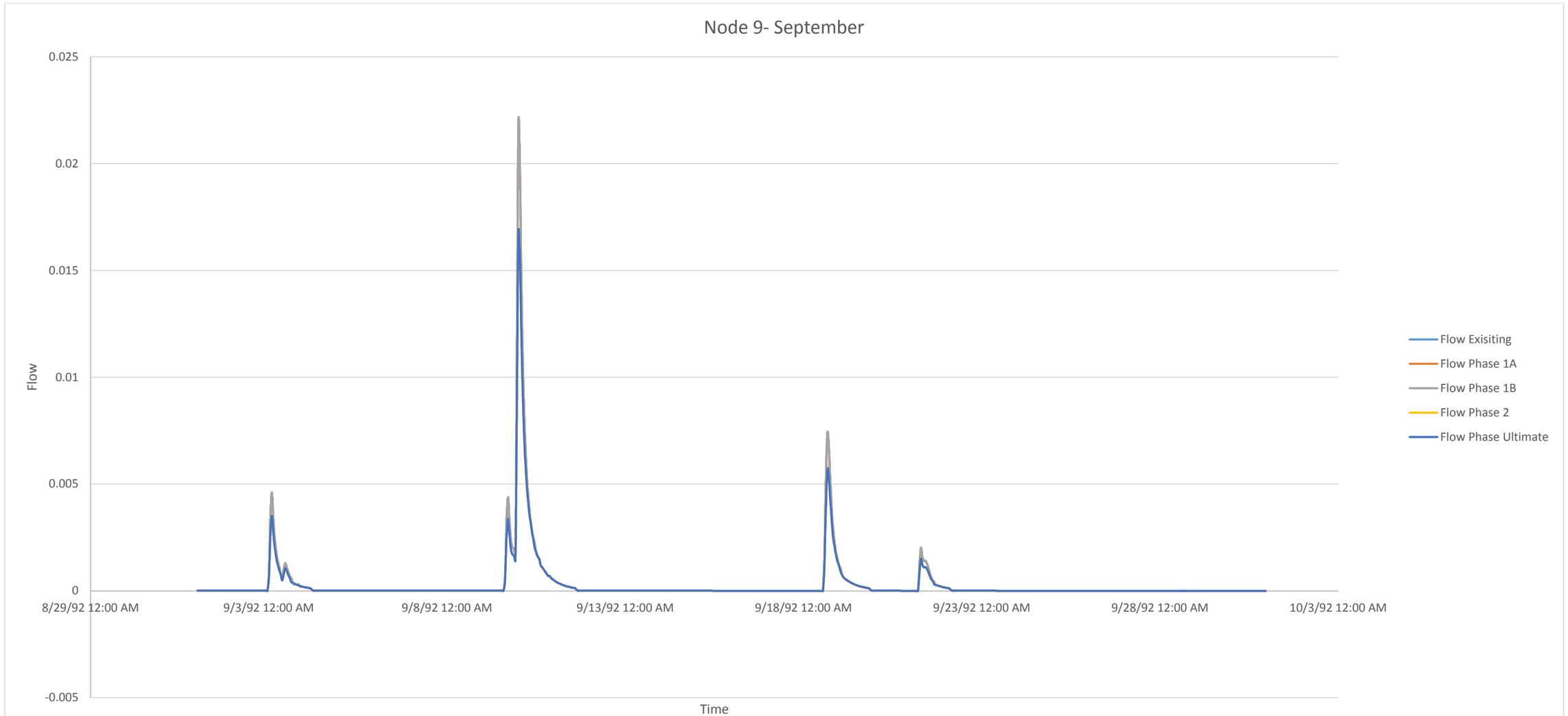
June						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.00820	0.00820	0.00820	0.00650	0.00650
	Min.	0.0018	0.0018	0.0018	0.0015	0.0015
Duration (h)	Max.	37	37	37	37	37
	Min.	8	8	8	8	8



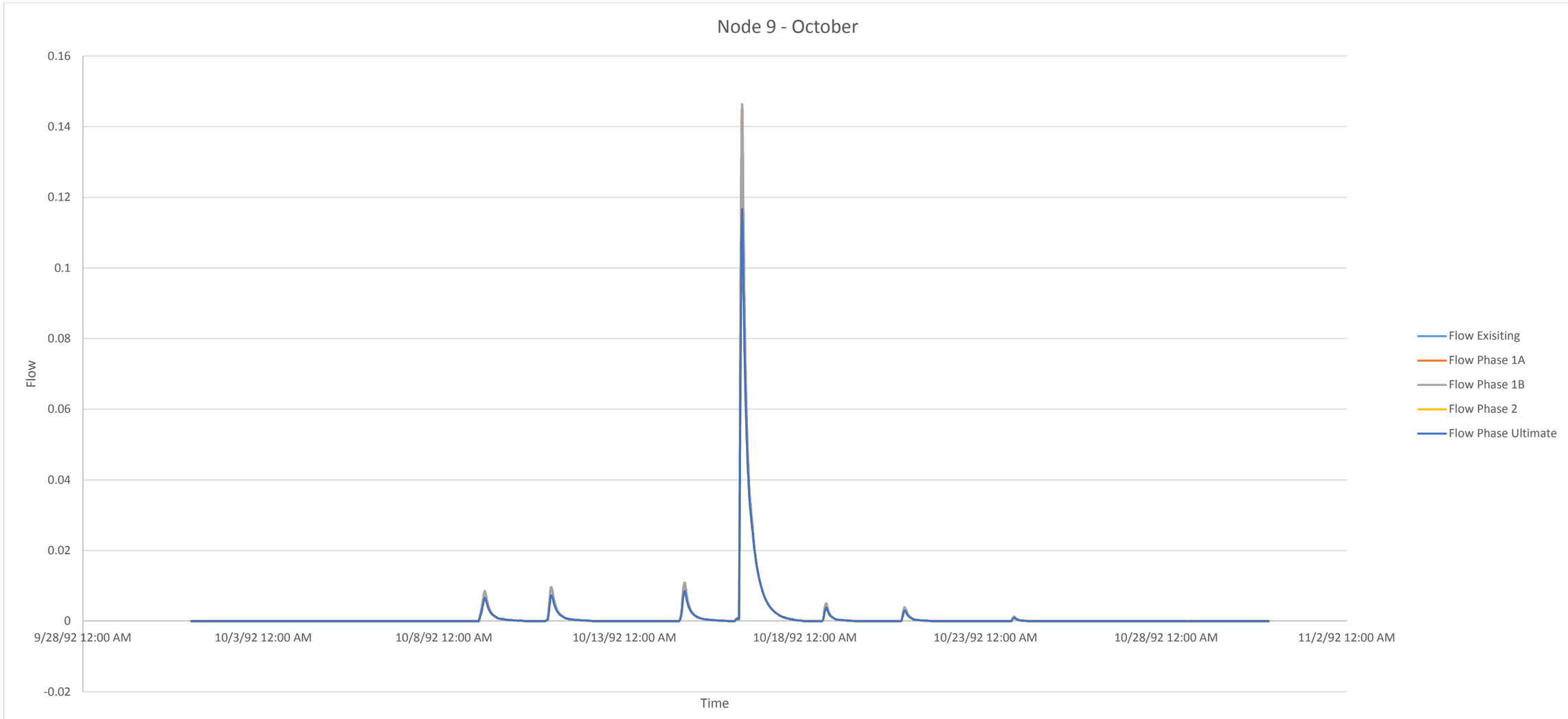
July						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		11	11	11	11	11
Magnitude (cm/s)	Max.	0.03330	0.03330	0.03330	0.02620	0.02620
	Min.	0.00318	0.00318	0.00318	0.00251	0.00251
Duration (h)	Max.	25	25	25	25	25
	Min.	20	20	20	20	20



August						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitude (cm/s)	Max.	0.37450	0.37450	0.37450	0.30490	0.30490
	Min.	0.00223	0.00223	0.00223	0.00172	0.00172
Duration (h)	Max.	64	64	64	64	64
	Min.	21	21	21	21	21



September						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		6	6	6	6	6
Magnitude (cm/s)	Max.	0.02190	0.02190	0.02190	0.01680	0.01680
	Min.	0.00201	0.00201	0.00201	0.0015	0.0015
Duration (h)	Max.	49	49	49	49	49
	Min.	22	22	22	22	22



October						
Conditions		Existing	Phase 1A	Phase 1B	Phase 2	Ultimate
Frequency		7	7	7	7	7
Magnitude (cm/s)	Max.	0.14590	0.14590	0.14590	0.11600	0.11600
	Min.	0.00127	0.00127	0.00127	0.00096	0.00096
Duration (h)	Max.	37	37	37	37	37
	Min.	10	10	10	10	10

Appendix 7.5 – Dandas Street Expansion Supporting Documents

ESR - Catchment #	GAWSER - Catchment #	ESR - Culvert #	NOCSS - Culvert #	Area (ha)	Existing Imp (%)	Proposed (%)	GAWSER - Existing 100-Year Flow (cms)	GAWSER - Proposed Uncontrolled 100-Year Flow (cms)	GAWSER - Proposed Controlled 100-Year Flow (cms)	Storage Available for 100-Year Event (m3)	Storage Provided by	Control Level
D21A	1501	C21A	FM-D2	1.23	40	85	0.073	0.100	0.067	**370**	On-site Control	100-Year
D21B	1502	C21B	FM-D3	2.24	31	82	0.125	0.182	-	**670**	SWM Pond 2	Regional
D22	1503	C22	FM-D4	1.82	38	80	0.107	0.147	0.096	**550**	On-site Control	100-Year
D22A	1504	C22A	FM-D4A	1.33	51	89	0.085	0.109	0.076	**400**	On-site Control	100-Year
D22B	1505	C22B	FM-D5	0.56	39	80	0.033	0.045	0.029	**170**	On-site Control	100-Year
D23	1506	C23	FM-D6	1.17	42	77	0.070	0.094	0.062	**350**	On-site Control	100-Year

Sources:
Environmental Study Report (ESR) - Dundas Street Class EA Study Brant Street to Bronte Road, MMM Group, May 2015
Section 6.1.6.6
Exhibits 6-17 through 6-20
Table 6-2

Dundas Expansion SWM Pond Flows
ULTIMATE CONDITIONS
MAR 11 2016, MMM, AZZ

Onsite Control 4501
ULTIMATE Drainage Area 1.23 ha
Imperviousness 85 %
Rating Curve

OUTFLOW	STORAGE
(cms)	(ha*m)
0.0000	0.0000
0.0010	0.0261
0.0730	0.0370

Return Period	Inflow (cms)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	1501	4501	4501	
25 mm 24 hr	0.017	0.0203	0.001	
2-Yr	0.041	0.0284	0.016	
5-Yr	0.058	0.0304	0.030	
10-Yr	0.068	0.0317	0.038	
25-Yr	0.081	0.0336	0.050	
50-Yr	0.090	0.0348	0.059	
100-Yr	0.100	0.0361	0.067	
Regional	0.118	0.0432	0.114	Beyond Available Storage - Regional Control Not Provided

Onsite Control 4503
ULTIMATE Drainage Area 1.82 ha
Imperviousness 80 %
Rating Curve

OUTFLOW	STORAGE
(cms)	(ha*m)
0.0000	0.0000
0.0010	0.0364
0.1068	0.0550

Return Period	Inflow (cms)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	1503	4503	4503	
25 mm 24 hr	0.025	0.0296	0.001	
2-Yr	0.060	0.0404	0.024	
5-Yr	0.084	0.0438	0.043	
10-Yr	0.099	0.0458	0.055	
25-Yr	0.119	0.0490	0.073	
50-Yr	0.133	0.0510	0.084	
100-Yr	0.147	0.0532	0.096	
Regional	0.175	0.0656	0.167	Beyond Available Storage - Regional Control Not Provided

Onsite Control 4504
ULTIMATE Drainage Area 1.33 ha
Imperviousness 89 %
Rating Curve

OUTFLOW	STORAGE
(cms)	(ha*m)
0.0000	0.0000
0.0010	0.0296
0.0848	0.0400

Return Period	Inflow (cms)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	1504	4504	4504	
25 mm 24 hr	0.019	0.0230	0.001	
2-Yr	0.045	0.0317	0.018	
5-Yr	0.063	0.0336	0.033	
10-Yr	0.074	0.0347	0.042	
25-Yr	0.088	0.0365	0.057	
50-Yr	0.098	0.0376	0.066	
100-Yr	0.109	0.0389	0.076	
Regional	0.128	0.0449	0.125	Beyond Available Storage - Regional Control Not Provided

Onsite Control 4505

ULTIMATE Drainage Area 0.56 ha

Imperviousness 80 %

Rating Curve

OUTFLOW	STORAGE
(cms)	(ha*m)
0.0000	0.0000
0.0010	0.0112
0.0327	0.0170

Return Period	Inflow (cms)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	1505	4505	4505	
25 mm 24 hr	0.008	0.0078	0.001	
2-Yr	0.018	0.0122	0.007	
5-Yr	0.026	0.0133	0.013	
10-Yr	0.030	0.0140	0.016	
25-Yr	0.036	0.0149	0.021	
50-Yr	0.041	0.0156	0.025	
100-Yr	0.045	0.0163	0.029	
Regional	0.054	0.0204	0.051	Beyond Available Storage - Regional Control Not Provided

Onsite Control 4506

ULTIMATE Drainage Area 1.17 ha

Imperviousness 77 %

Rating Curve

OUTFLOW	STORAGE
(cms)	(ha*m)
0.0000	0.0000
0.0010	0.0225
0.0704	0.0350

Return Period	Inflow (cms)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	1506	4506	4506	
25 mm 24 hr	0.015	0.0175	0.001	
2-Yr	0.038	0.0250	0.015	
5-Yr	0.054	0.0273	0.028	
10-Yr	0.063	0.0286	0.035	
25-Yr	0.076	0.0307	0.047	
50-Yr	0.085	0.0320	0.054	
100-Yr	0.094	0.0334	0.062	
Regional	0.112	0.0416	0.107	Beyond Available Storage - Regional Control Not Provided

The design of quality and quantity control measures, and storm sewer outlet details, if required, will be finalized during detailed design.

6.1.6.6 Fourteen Mile Creek Tributary Catchment

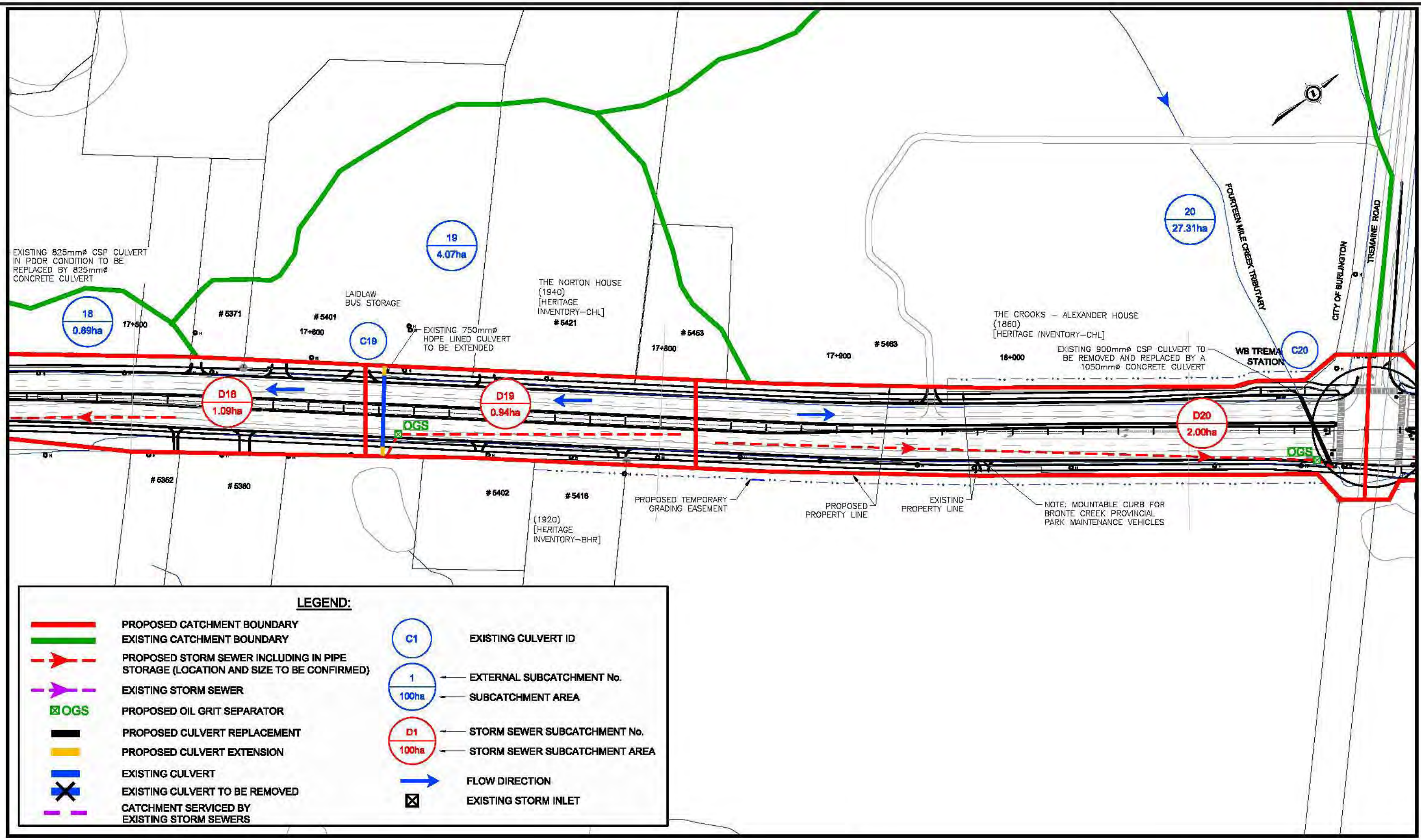
Fourteen Mile Creek and its tributaries cross Dundas Street through eight culverts as shown in **Exhibits 6-17**, **6-18**, **6-19** and **6-20**. This portion of Dundas Street is located between approximately 710 m east of Sutton Drive and approximately 90 m west of Valleyridge Drive. This Dundas Street catchment is divided in eight different sub-catchments as follows:

1. Approximately 710 m east of Sutton Drive to approximately 380 m West of Tremaine Road, draining to Culvert C19.
2. Approximately 380 m West of Tremaine Road to Tremaine Road, draining to Culvert C20.
3. Tremaine Road to approximately 220 m East of Tremaine Road, draining to Culvert C21A.
4. Approximately 220 m East of Tremaine Road to approximately 650 m East of Tremaine Road, draining to Culvert C21B.
5. Approximately 650 m East of Tremaine Road to approximately 140 m west of Colonel William Parkway, draining to Culvert C22
6. Approximately 140 m west of Colonel William Parkway to approximately 100 m east of Colonel William Parkway, draining to Culvert C22A.
7. Approximately 100 m east of Colonel William Parkway to approximately 210 m east of Colonel William Parkway, draining to Culvert C22B.
8. Approximately 210 m East of Colonel William Parkway to approximately 330 m west of Bronte Road, draining to Culvert C23.

Stormwater management (SWM) requirements for the Fourteen Mile Creek and its tributaries are as per the NOCSS for the quality treatment and quantity control, which includes:

- Quality control of runoff to Enhanced level of treatment in accordance with the Ministry of the Environment and Climate Change's Stormwater Management Planning and Design Manual, 2003.
- Quantity control of runoff such that the post-development flows do not exceed the pre-development flows.

Due to space constraints within the road right-of-way, no erosion control is proposed for runoff from widened portion of Dundas Street. However, it is anticipated that when the upstream areas are developed, stormwater management and erosion control strategies will be reviewed and explored; there may be opportunities to accommodate runoff from Dundas Street.



Halton Region

MMM GROUP

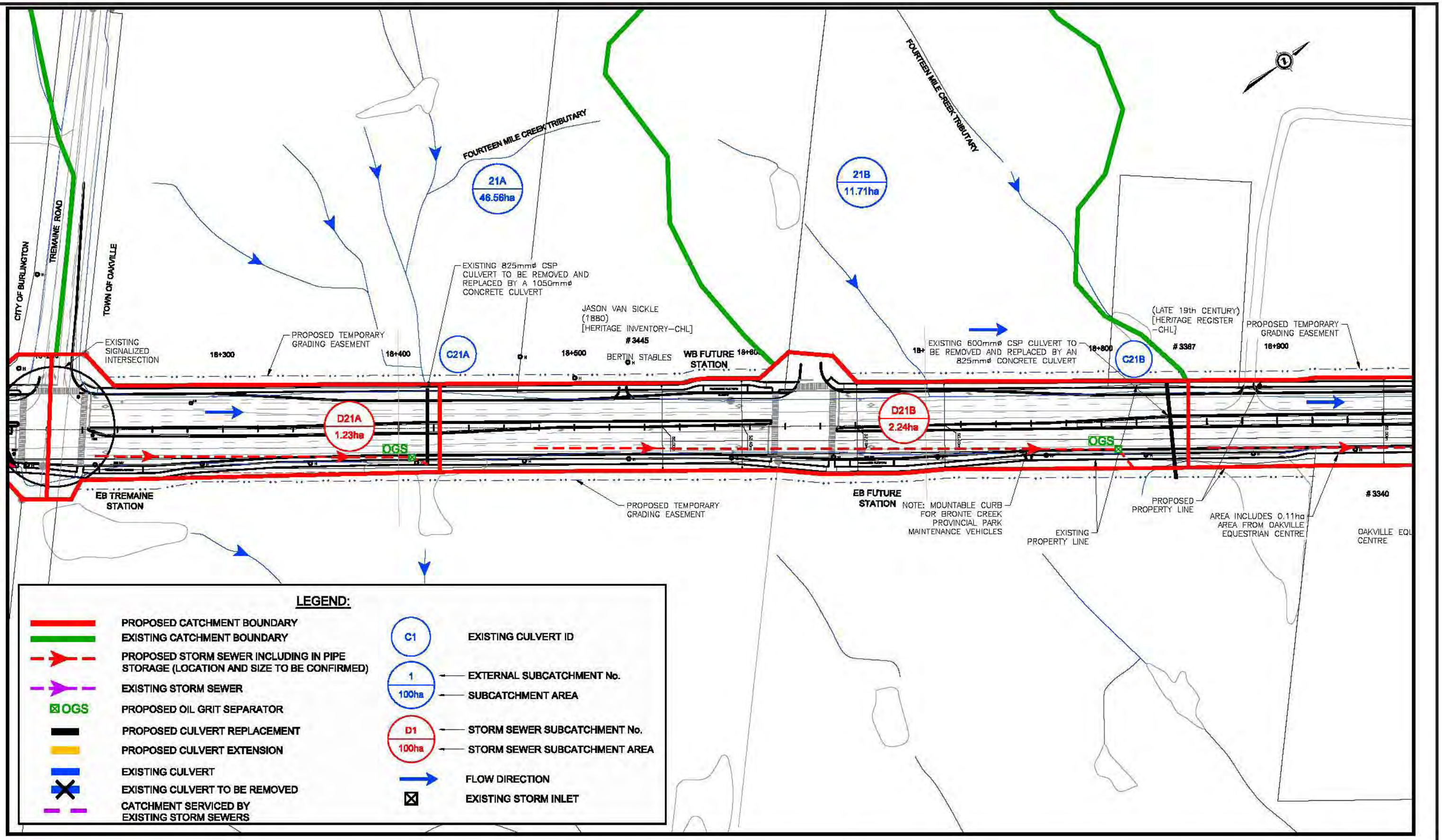
DUNDAS STREET CLASS EA STUDY
Brant Street to Bronte Road

NOTE:
THE LOCATION AND LENGTHS OF CULVERTS SHOWN SCHEMATICALLY ONLY (NOT TO SCALE)

Metric Scale
25m 0 50m
Horizontal

Future Drainage Mosaic
Fourteen Mile Creek Tributary Catchment

Exhibit
6-17



Halton Region

MMM GROUP

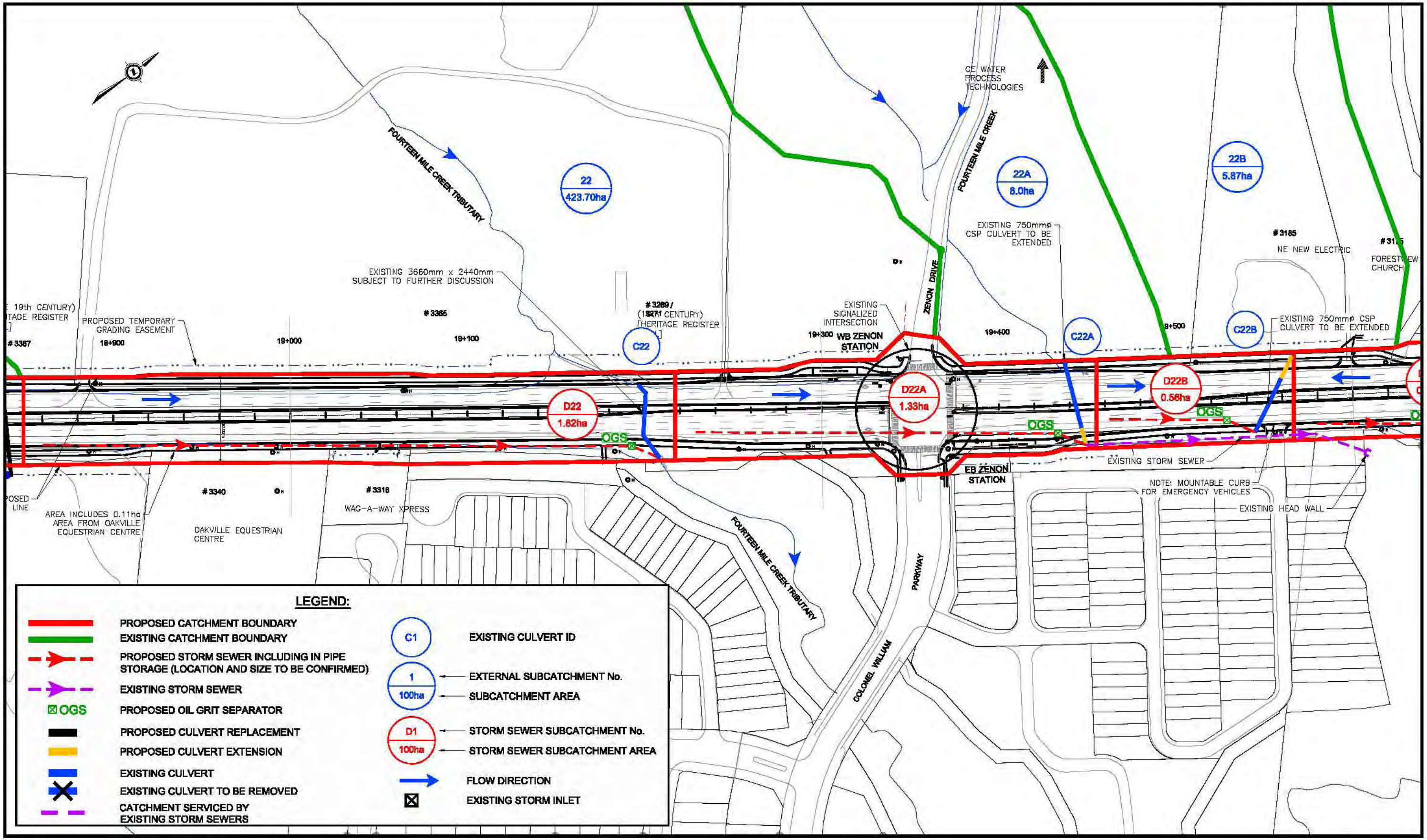
DUNDAS STREET CLASS EA STUDY
Brant Street to Bronte Road

NOTE:
THE LOCATION AND LENGTHS OF CULVERTS SHOWN SCHEMATICALLY ONLY (NOT TO SCALE)

Metric Scale
25m 0 50m
Horizontal

Future Drainage Mosaic
Fourteen Mile Creek Tributary Catchment

Exhibit
6-18



Halton REGION | MMM GROUP

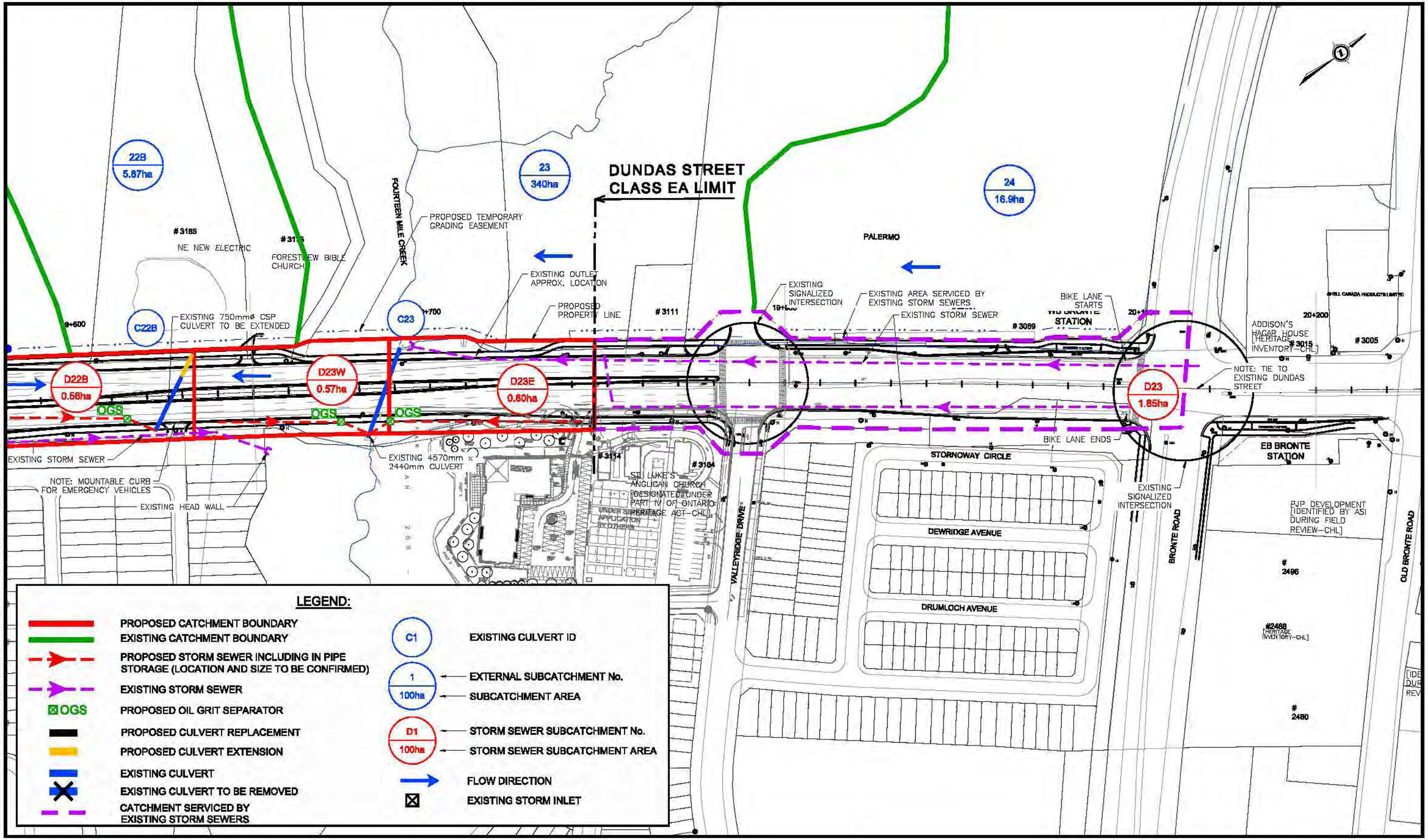
DUNDAS STREET CLASS EA STUDY
Brant Street to Bronte Road

NOTE:
THE LOCATION AND LENGTHS OF CULVERTS SHOWN SCHEMATICALLY ONLY (NOT TO SCALE)

Metric Scale
25m 0 50m
Horizontal

Future Drainage Mosaic
Fourteen Mile Creek Tributary Catchment

Exhibit
6-19



Halton Region | MMM GROUP

DUNDAS STREET CLASS EA STUDY
Brant Street to Bronte Road

NOTE:
THE LOCATION AND LENGTHS OF CULVERTS SHOWN SCHEMATICALLY ONLY (NOT TO SCALE)

Metric Scale
25m 0 50m
Horizontal

Future Drainage Mosaic
Fourteen Mile Creek Catchment

Exhibit
6-20

order to achieve no overtopping of Dundas Street during a Regional Storm event, the existing 825 mm diameter CSP culvert will be replaced by a 1050 mm diameter concrete culvert. The proposed sizing is tabulated in **Table 6-3**.

For quantity control, underground storage in oversized storm sewers will be provided to control the post-development flows to pre-development flows for all storms from 2 year to 100 year storm events. About 310 m^3 to 370 m^3 of storage volume will be required to provide peak flow control.

In terms of quality control of storm runoff from Dundas Street, the most feasible method to obtain Enhanced level water quality treatment will be through an OGS at the outlet of the storm sewer system. Given the proposed urban cross-section of future Dundas Street, other methodologies are not easily implemented. The proposed location of the OGS is indicated in **Exhibit 6-18**.

The design of quality and quantity control measures will be finalized during detailed design.

Culvert 21B: Approximately 220 m East of Tremaine Road to approximately 650 m East of Tremaine Road

The existing ditch system drains a portion (2.24 ha) of Dundas Street and will be replaced by a storm sewer system which is generally shown in **Exhibit 6-18**. As indicated in **Section 3.5.4.6**, Culvert C21B can convey the 50 year and 100 year flows without overtopping Dundas Street, but the Regional Storm flow will overtop Dundas Street. In order to achieve no overtopping of Dundas Street during a Regional Storm event, the existing 600 mm diameter CSP culvert will be replaced by an 825 mm diameter concrete culvert. The proposed sizing is tabulated in **Table 6-3**.

For quantity control, underground storage in oversized storm sewers will be provided to control the post-development flows to pre-development flows for all storms from 2 year to 100 year storm events. About 560 m^3 to 670 m^3 of storage volume will be required to provide peak flow control.

In terms of quality control of storm runoff from Dundas Street, the most feasible method to obtain Enhanced level water quality treatment will be through an oil-grit separator (OGS) at the outlet of the storm sewer system. Given the proposed urban cross-section of future Dundas Street, other methodologies are not easily implemented. The proposed location of the OGS is indicated in **Exhibit 6-18**.

The design of quality and quantity control measures will be finalized during detailed design.

It is noted that the Environmental Implementation Report / Functional Servicing Study (EIR/FSS) for the Lazy Pat Farm Development, under review by various approval agencies, indicates that the flows from this portion of Dundas Street can be treated in the proposed SWM Pond 2 (as noted in the EIR/FSS) for the proposed development. Depending on the schedule of the Lazy Pat Farm Development and Dundas Street Widening projects, the runoff from this portion of Dundas Street can be managed within the proposed SWM Pond 2. If the Dundas Street widening proceeds in advance of the Lazy Pat Farm development, the runoff from Dundas Street will be managed within underground pipe storage and treated by OGS.

Table 6-2: Summary of Existing and Post Development Flows and the Required Storage Volumes

Road Catchment ID*	Catchment	Drainage Area (ha)*	Existing Road Area (ha)	% Imp.	Proposed Road Area (ha)	% Imp.	Existing Flows (m^3/s)*							Post Development Uncontrolled Flows (m^3/s)*							Max Storage Volume Required to Attenuate 100 Year Flow (m^3)
							2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	Reg.	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	Reg.	
D1	Tuck Creek Tributary	1.33	0.45	34	0.94	71	0.097	0.141	0.187	0.236	0.271	0.31	0.181	0.191	0.267	0.325	0.395	0.441	0.495	0.19	400
D2	Tuck Creek Tributary	0.92	0.35	38	0.66	72	0.076	0.116	0.142	0.177	0.202	0.230	0.126	0.138	0.196	0.232	0.280	0.312	0.350	0.131	280
D3	Tuck Creek Tributary	2.27	0.87	38	1.71	75	0.161	0.240	0.292	0.398	0.457	0.522	0.308	0.307	0.435	0.519	0.631	0.706	0.816	0.325	680
D4	Tuck Creek Tributary	0.79	0.31	39	0.59	75	0.064	0.092	0.120	0.150	0.172	0.196	0.108	0.118	0.164	0.199	0.240	0.268	0.301	0.113	240
D5	Tuck Creek Tributary	1.19	0.44	37	0.94	79	0.090	0.130	0.171	0.215	0.246	0.281	0.162	0.179	0.251	0.297	0.366	0.408	0.457	0.171	360
D6	Tuck Creek Tributary	1.07	0.36	34	0.70	65	0.080	0.125	0.153	0.193	0.221	0.253	0.146	0.146	0.211	0.252	0.307	0.343	0.386	0.152	320
D7	Tuck Creek Tributary	2.06	0.97	47	1.73	84	0.173	0.254	0.306	0.404	0.461	0.524	0.283	0.298	0.424	0.504	0.610	0.681	0.764	0.298	620
D8	Tuck Creek Tributary	3.03	1.55	52	2.70	89	0.237	0.397	0.480	0.592	0.671	0.795	0.418	0.342	0.556	0.666	0.812	0.911	1.026	0.432	910
D9	Shoreacres Creek	1.18	0.77	65	1.00	85	0.142	0.201	0.239	0.301	0.337	0.380	0.166	0.185	0.258	0.306	0.368	0.415	0.465	0.171	360
D10	Shoreacres Creek	0.66	0.32	48	0.46	70	0.067	0.098	0.118	0.146	0.165	0.187	0.092	0.096	0.137	0.163	0.197	0.220	0.247	0.094	200
D11	Shoreacres Creek	5.18	2.56	49	4.39	85	0.383	0.618	0.749	0.926	1.050	1.279	0.708	0.626	1.004	1.200	1.459	1.632	1.835	0.748	1550
D12	Appleby Creek	3.05	1.49	48	2.63	86	0.275	0.397	0.488	0.602	0.711	0.807	0.420	0.467	0.656	0.777	0.943	1.050	1.176	0.442	920
D13	Sheldon Creek	4.18	1.93	46	3.5	83	0.284	0.414	0.527	0.727	0.827	0.940	0.567	0.493	0.701	0.849	1.165	1.304	1.468	0.602	1250
D17	Sheldon Creek	1.69	0.75	44	1.41	83	0.134	0.197	0.239	0.318	0.364	0.414	0.231	0.242	0.344	0.410	0.496	0.554	0.622	0.244	Se Note **
DB1	Bronte Creek	1.59	0.96	60	1.98	88	0.172	0.246	0.295	0.375	0.422	0.477	0.222	0.310	0.434	0.514	0.62	0.689	0.781	0.288	480
D18	Bronte Creek	1.09	0.39	36	1.15	77	0.077	0.115	0.152	0.192	0.221	0.252	0.148	0.167	0.235	0.279	0.345	0.385	0.432	0.165	330
D19	Fourteen Mile Creek Tributary	0.94	0.36	38	0.71	76	0.074	0.107	0.139	0.175	0.2	0.228	0.129	0.140	0.195	0.232	0.286	0.319	0.358	0.135	280
D20	Fourteen Mile Creek Tributary	2.00	0.78	39	1.58	79	0.150	0.222	0.269	0.365	0.418	0.477	0.272	0.293	0.412	0.489	0.591	0.673	0.755	0.288	600
D21A***	Fourteen Mile Creek Tributary	1.23	0.49	40	1.05	85	0.101	0.145	0.174	0.213	0.241	0.267	0.112	0.209	0.301	0.362	0.451	0.512	0.571	0.178	370
D21B***	Fourteen Mile Creek Tributary	2.24	0.70	31	1.83	82	0.135	0.200	0.242	0.297	0.337	0.378	0.203	0.321	0.474	0.576	0.714	0.816	0.914	0.323	670
D22***	Fourteen Mile Creek Tributary	1.82	0.69	38	1.45	80	0.129	0.188	0.227	0.279	0.318	0.355	0.156	0.263	0.388	0.470	0.583	0.665	0.745	0.262	550
D22A***	Fourteen Mile Creek Tributary	1.33	0.68	51	1.18	89	0.136	0.196	0.234	0.286	0.325	0.36	0.132	0.234	0.337	0.405	0.501	0.568	0.633	0.193	400
D22B***	Fourteen Mile Creek Tributary	0.56	0.22	39	0.45	80	0.049	0.069	0.082	0.099	0.112	0.124	0.049	0.100	0.143	0.171	0.209	0.237	0.264	0.081	170
D23***	Fourteen Mile Creek Tributary	1.17	0.49	42	0.90	77	0.107	0.153	0.182	0.221	0.248	0.275	0.109	0.198	0.287	0.344	0.422	0.479	0.534	0.168	350

* *Roadway runoff from Dundas Street only - does not include external area flows to culvert*

** *The existing storm sewers on Sutton Drive are designed to convey flows from 1.05 ha area of Dundas Street. The storm sewers drain to a downstream SWM pond located beyond the cul-de-sac of Dutchess Court. During detailed design, the capacity of the storm sewers will be assessed to accommodate the flows from the widened Dundas Street and if required, quality and quantity controls for the storm runoff from Dundas Street (1.69 ha) will be finalised at that time.*

*** *Including NOCSS Flows for the Adjacent Pervious Areas*

Appendix 7.6 – Stormwater Management Pond Calculations

MMM GROUP	Project	Bentall 407 West	No.	14-09222-001-SW1	
	By	AZZ	Date	2018.01.22	Page 1
	Checked		Checked		

Subject: **POND 1 - SWM Pond Design (1)**

Updated 2018.01.22

SWM Pond Stage-Storage Relationship:

Elevation (m)	Cumulative Storage (m^3)				
	Forebay	Main Cell	Total PP	Active Storage	
149.00			0	-	*Bottom of pond*
150.00			3,716	-	
151.00			8,529	-	
152.00			14,564	0	*Permanent pool*
153.00	-	-	-	7,552	*Extended Detention*
154.00	-	-	-	16,915	
155.00	-	-	-	28,257	
156.00	-	-	-	41,743	*Top of pond (max. 100-year)*
156.75	-	-	-	53,117	*Buffer (including Freeboard)*

Permanent Pool Area (m^2) : 6,730
Extended Detention Pond Area (m^2) : 8,725 est.

All stage-storage volumes based on measurements from proposed grading model in Civil 3D.

SWM Pond Storage Requirements:

Drainage Area		23.55	ha
Imperviousness		88.0	%
Storage Criteria for Enhanced Level Quality Control (Wet Pond)		255.0	m^3/ha
Storage for Enhanced Level Quality Control (Wet Pond)		6,005	m^3
Required Permanent Pool Storage		5,063	m^3
Extended Detention Storage for Water Quality Control (40m^3/ha)		942	m^3
25 mm Runoff Depth		19.70	mm
Required Extended Detention Storage for Erosion Control		4,639	m^3
Provided Storage for Proposed Stormwater Management Wet Pond	Permanent Pool Storage	14,564	m^3
	Active Storage for Water Quantity Control (100-Year)	41,743	m^3
	Active Storage for Water Quantity Control (Regional Storm)	48,568	m^3
	Max. Storage including Freeboard	53,117	m^3
	Total	67,681	m^3

Forebay Length Sizing Calculation

Settling Calculation

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Dist - Forebay Length	22.54	m	
Q - Peak Design Flowrate (25mm - Pond Outflow)	0.051	m3/s	
r - Length to width ratio	3		
V_s - Settling Velocity	0.0003	m/s	for 0.15mm diameter particle size

Dispersion Length Calculation

$$Dist = \frac{8Q}{dV_f};\ Width = \frac{Dist}{8}$$

Dist - Forebay Length		5.92	m	
Q - Inlet Flowrate	5-Year STM inflow to Forebay	1.11	m3/s	
d - Depth of Permanent Pool		3.00	m	
V_f - Desired Velocity in Forebay		0.5	m/s	max. permissible velocity in the forebay

Required Minimum Forebay Length **22.54 m**
Requred Minimum Bottom Width **2.82 m**

Pond Outlet Design - Erosion Control Orifice:

Provided Extended Detention Storage (m^3) :	7,552
Extended Detention Elevation (m) :	153.00
Permanent Pool Elevation (m)	152.00
Max. Extended Detention Depth (m) :	1.00
Permanent Pool Area (m^2) :	6,730
Extended Detention Pond Area (m^2) :	8,725
Orifice Flow Coefficient :	0.6
Diameter of Orifice Used (mm):	215
Area of Orifice Used (m^2) :	0.0363
Peak Flow (m^3/s) :	0.0957

Detention Time:

The falling head orifice equation is used to calculate the detention time:

$$t = \frac{2A_p}{CA_0(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

Where,

t = Drawdown Time in Seconds; *(target 72 hours)*
A_p = Surface Area of the Pond (m^2);
C = Orifice Flow Coefficient;
A_0 = Cross-sectional Area of the Orifice (m^2);
g = Gravitational Acceleration Constant (9.81 m/s^2);
h_1 = Starting Water Elevation above the orifice (m);
h_2 = Ending Water Elevation above the orifice (m).

Description	Elevation (m)	Surface Area (m^2)		Volume (m^3)	h_1 (m)	h_2 (m)	Maximum Flow (m^3/s)	Drawdown Time (hours)
Extended Detention	153.00	8,725	7,727	7,727	1.00	0.00	0.096	42.4
Permanent Pool	152.00	6,730						
							Total Drawdown Time (hours):	42.4

Updated 2018.01.19

Outlet Configuration:

	Orifice at Reversed Pipe to Control MH	Control MH		Emergency Spill
		Weir	Orifice at Outlet Pipe of Control MH (D/S)	
Ori. dia (mm) / Weir Length (m):	215	2.00	350	15.00
Invert Elevation:	152.00	153.00	152.00	156.10
Orifice/Weir Flow Coefficient:	0.61	1.84	0.61	1.84

Emergency Spillway design target:
To pass full Regional incoming flow within freeboard allowance (0.30 m maximum head)

Description	Elevation (m)	Depth to PP (m)	Active Storage (m3)	Controlled Flow (m3/s)					
				Reversed Pipe to Control MH[1]	Control MH			Emergency Spill [3]	Total
					Weir[2]	Outlet Pipe from Control MH (D/S) [1]	Restricted Flow from Control MH		
Permanent Pool	**152.00**	0.000	**0**	0.000	0.000	0.000	0.000	0.000	0.000
	152.50	0.500	3,776	0.061	0.000	0.000	0.061	0.000	0.061
Extended Detention	**153.00**	1.000	**7,552**	0.093	0.000	0.000	0.093	0.000	0.093
	153.50	1.500	12,234	0.116	1.301	0.299	0.299	0.000	0.299
	154.00	2.000	**16,915**	0.135	3.680	0.351	0.351	0.000	0.351
	154.50	2.500	22,586	0.152	6.761	0.396	0.396	0.000	0.396
	155.00	3.000	**28,257**	0.167	10.409	0.437	0.437	0.000	0.437
	155.50	3.500	35,000	0.181	14.546	0.474	0.474	0.000	0.474
Top of Pond (Flood Control Up to Regional)	**156.00**	**4.000**	**41,743**	**0.194**	**19.122**	**0.508**	**0.508**	**0.000**	**0.508**
0.3 m Freeboard	**156.30**	**4.300**	**46,293**	**0.201**	**22.061**	**0.528**	**0.528**	**2.469**	**2.997**
	156.45	4.450	48,568	0.204	23.582	0.537	0.537	5.715	6.252
Freeboard	**156.75**	**4.750**	**53,117**	**0.211**	**26.724**	**0.556**	**0.556**	**14.464**	**15.020**

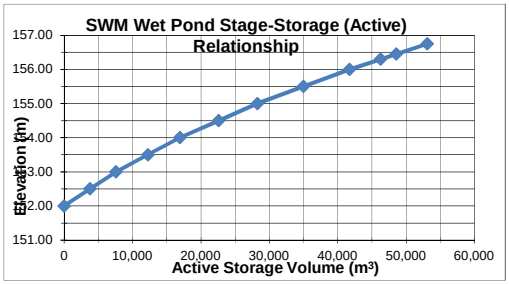
1) Orifice Equation: $Q = C\ A\ (2gh)^{1/2}$
2) Broad-Crested Weir Equation: $Q = C\ L\ H^{3/2}$
3) Emergency Spill to pass uncontrolled Regional Flows

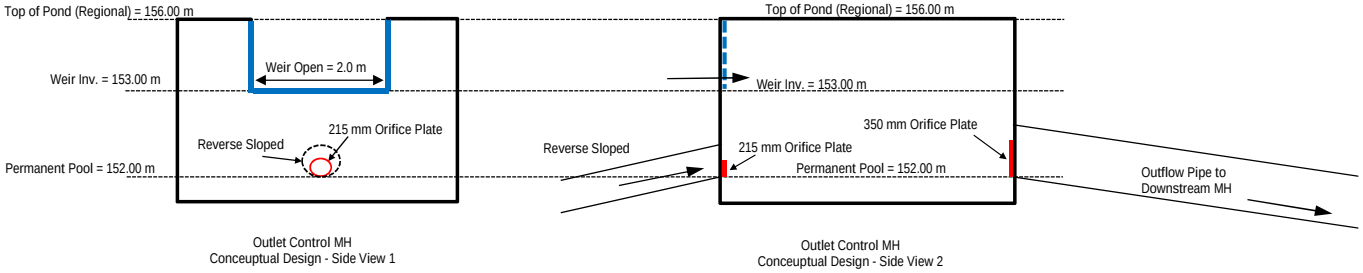
Storage - Discharge Relationship

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)
152.000	0.0000	0.0000
152.500	0.0615	0.3776
153.000	0.0927	0.7552
153.500	0.2992	1.2234
154.000	0.3512	1.6915
154.500	0.3964	2.2586
155.000	0.4369	2.8257
155.500	0.4740	3.5000
156.000	0.5084	4.1743
156.300	2.9966	4.6293
156.450	6.2524	4.8568
156.750	15.0197	5.3117

Water Elevation vs Return Periods

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)	Return Period
152.41	0.05	0.3120	25 mm 24 hr
152.90	0.09	0.6808	2-Yr
153.14	0.15	0.8843	5-Yr
153.25	0.20	0.9930	10-Yr
153.43	0.27	1.1543	25-Yr
153.53	0.30	1.2553	50-Yr
153.68	0.32	1.3884	100-Yr
155.84	0.50	3.9624	Regional





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Subject: **POND 2 - SWM Pond Design (1)**

Updated 2018.01.22

SWM Pond Stage-Storage Relationship:

Elevation (m)	Cumulative Storage (m^3)				
	Forebay	Main Cell	Total PP	Active Storage	
142.75	0	0	0	-	*Bottom of pond*
143.50	0	1,153	1,153	-	
144.50	0	3,363	3,363	-	
145.32	1,208	5,835	7,044	-	
145.75	1,804	7,693	9,497	0	*Permanent pool*
146.18	-	-	-	2,879	
146.70	-	-	-	7,051	*Extended Detention*
146.75	-	-	-	7,452	
147.50	-	-	-	14,379	
148.50	-	-	-	25,167	
149.80	-	-	-	41,884	*Top of pond (max. 100-year)*
150.50	-	-	-	52,859	*Buffer (including Freeboard)*

Permanent Pool Area (m^2) : 6,264
Extended Detention Pond Area (m^2) : 8,584 est.

All stage-storage volumes based on measurements from proposed grading model in Civil 3D.

SWM Pond Storage Requirements:

Drainage Area		20.75	ha
Imperviousness		89.1	%
Storage Criteria for Enhanced Level Quality Control (Wet Pond)		256.9	m^3/ha
Storage for Enhanced Level Quality Control (Wet Pond)		5,331	m^3
Required Permanent Pool Storage		4,501	m^3
Extended Detention Storage for Water Quality Control (40m^3/ha)		830	m^3
25 mm Runoff Depth		20.06	mm
Required Extended Detention Storage for Erosion Control		4,162	m^3
Provided Storage for Proposed Stormwater Management Wet Pond	Permanent Pool Storage	9,497	m^3
	Active Storage for Water Quantity Control (100-Year)	41,884	m^3
	Active Storage for Water Quantity Control (Regional Storm)	48,155	m^3
	Max. Storage including Freeboard	52,859	m^3
	Total	62,357	m^3

Forebay Length Sizing Calculation

Settling Calculation

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Dist - Forebay Length	21.68	m	
Q - Peak Design Flowrate (25mm - Pond Outflow)	0.047	m3/s	
r - Length to width ratio	3		
V_s - Settling Velocity	0.0003	m/s	for 0.15mm diameter particle size

Dispersion Length Calculation

$$Dist = \frac{8Q}{dV_f};\ Width = \frac{Dist}{8}$$

Dist - Forebay Length		5.19	m	
Q - Inlet Flowrate	5-Year STM inflow to Forebay	0.97	m3/s	
d - Depth of Permanent Pool		3.00	m	
V_f - Desired Velocity in Forebay		0.5	m/s	max. permissible velocity in the forebay

Required Minimum Forebay Length 21.68 m
Requred Minimum Bottom Width 2.71 m

Pond Outlet Design - Erosion Control Orifice:

Provided Extended Detention Storage (m^3) :	7,051
Extended Detention Elevation (m) :	146.70
Permanent Pool Elevation (m)	145.75
Max. Extended Detention Depth (m) :	0.95
Permanent Pool Area (m^2) :	6,264
Extended Detention Pond Area (m^2) :	8,584
Orifice Flow Coefficient :	0.6
Diameter of Orifice Used (mm):	**200**
Area of Orifice Used (m^2) :	0.0314
Peak Flow (m^3/s) :	0.0783

Detention Time:

The falling head orifice equation is used to calculate the detention time:

$$t = \frac{2A_p}{CA_0(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

Where,

t = Drawdown Time in Seconds; *(target 72 hours)*
A_p = Surface Area of the Pond (m^2);
C = Orifice Flow Coefficient;
A_0 = Cross-sectional Area of the Orifice (m^2);
g = Gravitational Acceleration Constant (9.81 m/s^2);
h_1 = Starting Water Elevation above the orifice (m);
h_2 = Ending Water Elevation above the orifice (m).

Description	Elevation (m)	Surface Area (m^2)		Volume (m^3)	h_1 (m)	h_2 (m)	Maximum Flow (m^3/s)	Drawdown Time (hours)
Extended Detention	146.70	8,584	7,424	7,053	0.95	0.00	0.078	**47.4**
Permanent Pool	145.75	6,264						
							Total Drawdown Time (hours):	47.4

Updated 2018.01.19

Outlet Configuration:

	Orifice at Reversed Pipe to Control MH	Control MH		Emergency Spill
		Weir	Orifice at Outlet Pipe of Control MH (D/S)	
Ori. dia (mm) / Weir Length (m):	200	2.00	270	15.00
Invert Elevation:	145.75	146.70	145.75	149.90
Orifice/Weir Flow Coefficient:	0.61	1.84	0.61	1.84

Emergency Spillway design target:
To pass full Regional incoming flow within freeboard allowance (0.30 m maximum head)

Description	Elevation (m)	Depth to PP (m)	Active Storage (m3)	Controlled Flow (m3/s)					
				Reversed Pipe to Control MH[1]	Control MH			Emergency Spill [3]	Total
					Weir[2]	Outlet Pipe from Control MH (D/S) [1]	Restricted Flow from Control MH		
Permanent Pool	**145.75**	0.000	**0**	0.000	0.000	0.000	0.000	0.000	0.000
	145.97	0.215	1,439	0.029	0.000	0.000	0.029	0.000	0.029
	146.18	0.430	**2,879**	0.049	0.000	0.000	0.049	0.000	0.049
Extended Detention	146.70	0.950	7,051	0.078	0.000	0.000	0.078	0.000	0.078
	146.75	1.000	**7,452**	0.081	0.041	0.144	0.041	0.000	0.041
	147.13	1.375	10,915	0.096	1.020	0.172	0.172	0.000	0.172
	147.50	1.750	**14,379**	0.109	2.633	0.197	0.197	0.000	0.197
	148.00	2.250	19,773	0.124	5.455	0.225	0.225	0.000	0.225
	148.50	2.750	**25,167**	0.138	8.887	0.250	0.250	0.000	0.250
	149.15	3.400	33,525	0.154	14.112	0.280	0.280	0.000	0.280
Top of Pond (Flood Control Up to Regional)	**149.80**	**4.050**	**41,884**	**0.169**	**20.086**	**0.306**	**0.306**	**0.000**	**0.306**
0.3 m Freeboard	**150.10**	**4.350**	**46,588**	**0.175**	**23.071**	**0.318**	**0.318**	**2.469**	**2.786**
	150.20	4.450	48,155	0.177	24.096	0.321	0.321	4.535	4.856
Top of Pond (All)	**150.50**	**4.750**	**52,859**	**0.183**	**27.260**	**0.332**	**0.332**	**12.827**	**13.160**

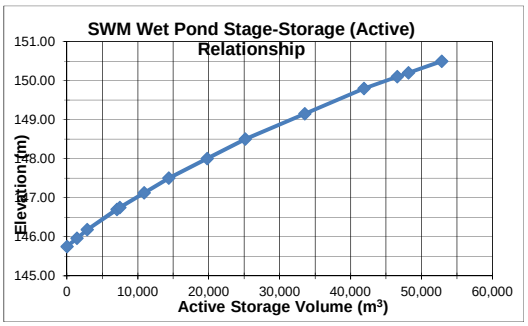
1) Orifice Equation: $Q = C\ A\ (2gh)^{1/2}$
2) Broad-Crested Weir Equation: $Q = C\ L\ H^{3/2}$
3) Emergency Spill to pass uncontrolled Regional Flows

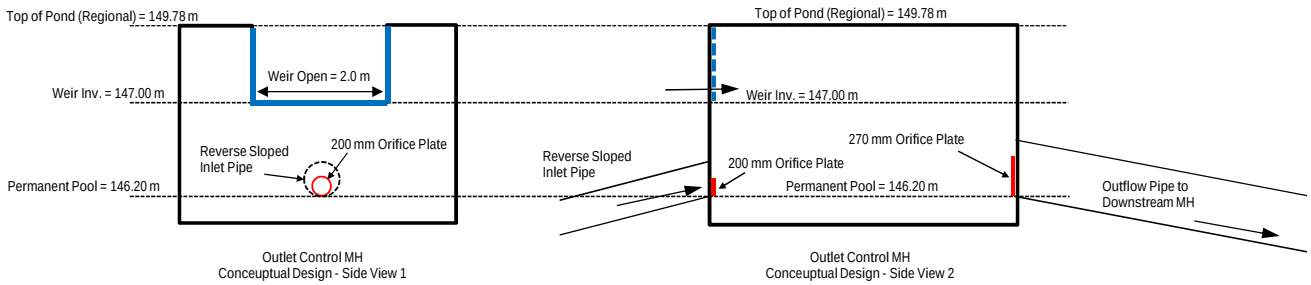
Storage - Discharge Relationship

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)
145.750	0.0000	0.0000
145.965	0.0288	0.1439
146.180	0.0488	0.2879
146.700	0.0783	0.7051
146.750	0.0411	0.7452
147.125	0.1723	1.0915
147.500	0.1966	1.4379
148.000	0.2250	1.9773
148.500	0.2502	2.5167
149.150	0.2795	3.3525
149.800	0.3061	4.1884
150.100	2.7862	4.6588
150.200	4.8565	4.8155
150.500	13.1597	5.2859

Water Elevation vs Return Periods

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)	Return Period
146.78	0.05	0.2750	25 mm 24 hr
146.90	0.07	0.6154	2-Yr
147.26	0.15	0.7805	5-Yr
147.30	0.16	0.8967	10-Yr
147.37	0.17	1.0881	25-Yr
147.42	0.18	1.2088	50-Yr
147.47	0.19	1.3490	100-Yr
149.61	0.30	3.9439	Regional





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Subject: **POND 3 - SWM Pond Design (1)**

Phase 2

Updated 2018.01.19

SWM Pond Stage-Storage Relationship:

Elevation (m)	Cumulative Storage (m^3)				
	Forebay	Main Cell	Total PP	Active Storage	
143.20	0	0	0	-	*Bottom of pond*
145.00	0	9,544	9,544	-	
145.77	3,132	14,983	18,116	-	
146.20	5,173	18,505	23,678	0	*Permanent pool*
146.63	-	-	-	6,284	
146.95	-	-	-	11,708	
147.00	-	-	-	12,555	*Extended Detention*
147.50	-	-	-	21,030	
148.20	-	-	-	34,535	
149.25	-	-	-	57,314	
150.30	-	-	-	82,949	*Top of pond (max. 100-year)*
151.00	-	-	-	102,826	*Buffer (including Freeboard)*

Permanent Pool Area (m^2) : 13,826

Extended Detention Pond Area (m^2) : 16,822 est.

All stage-storage volumes based on measurements from proposed grading model in Civil 3D.

SWM Pond Storage Requirements:

Drainage Area		36.99	ha
Imperviousness		90.0	%
Storage Criteria for Enhanced Level Quality Control (Wet Pond)		258.3	m^3/ha
Storage for Enhanced Level Quality Control (Wet Pond)		9,556	m^3
Required Permanent Pool Storage		8,076	m^3
Extended Detention Storage for Water Quality Control (40m^3/ha)		1,480	m^3
25 mm Runoff Depth		20.06	mm
Required Extended Detention Storage for Erosion Control		7,420	m^3
Provided Storage for Proposed Stormwater Management Wet Pond	Permanent Pool Storage	23,678	m^3
	Active Storage for Water Quantity Control (100-Year)	82,949	m^3
	Active Storage for Water Quantity Control (Regional Storm)	96,379	m^3
	Max. Storage including Freeboard	102,826	m^3
	Total	126,504	m^3

Forebay Length Sizing Calculation

Settling Calculation

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Dist - Forebay Length	25.28	m	
Q - Peak Design Flowrate (25mm - Pond Outflow)	0.064	m3/s	
r - Length to width ratio	3		
V_s - Settling Velocity	0.0003	m/s	for 0.15mm diameter particle size

Dispersion Length Calculation

$$Dist = \frac{8Q}{dV_f};\ Width = \frac{Dist}{8}$$

Dist - Forebay Length		8.89	m	
Q - Inlet Flowrate	5-Year STM inflow to Forebay	1.67	m3/s	
d - Depth of Permanent Pool		3.00	m	
V_f - Desired Velocity in Forebay		0.5	m/s	max. permissible velocity in the forebay

Required Minimum Forebay Length 25.28 m

Requred Minimum Bottom Width 3.16 m

For Phase 2 Only. 27.91 m and 3.49 m for Ultimate Conditions.

Pond Outlet Design - Erosion Control Orifice:

Provided Extended Detention Storage (m^3) :	12,555
Extended Detention Elevation (m) :	147.00
Permanent Pool Elevation (m)	146.20
Max. Extended Detention Depth (m) :	0.80
Permanent Pool Area (m^2) :	13,826
Extended Detention Pond Area (m^2) :	16,822
Orifice Flow Coefficient :	0.6
Diameter of Orifice Used (mm):	**255**
Area of Orifice Used (m^2) :	0.0511
Peak Flow (m^3/s) :	0.1169

For Phase 2 Only. 290 mm Dia for Ultimate Conditions.

Detention Time:

The falling head orifice equation is used to calculate the detention time:

$$t = \frac{2A_p}{CA_0(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

Where,

t = Drawdown Time in Seconds; *(target 72 hours)*
A_p = Surface Area of the Pond (m^2);
C = Orifice Flow Coefficient;
A_0 = Cross-sectional Area of the Orifice (m^2);
g = Gravitational Acceleration Constant (9.81 m/s^2);
h_1 = Starting Water Elevation above the orifice (m);
h_2 = Ending Water Elevation above the orifice (m).

Description	Elevation (m)	Surface Area (m^2)		Volume (m^3)	h_1 (m)	h_2 (m)	Maximum Flow (m^3/s)	Drawdown Time (hours)
Extended Detention	147.00	16,822	15,324	12,259	0.80	0.00	0.117	53.4
Permanent Pool	146.20	13,826						
						Total Drawdown Time (hours):		53.4

Updated 2018.01.19

Outlet Configuration:

For Phase 2 Only. 290 mm Dia for Ultimate Conditions.

	Orifice at Reversed Pipe to Control MH	Control MH		Emergency Spill
		Weir	Orifice at Outlet Pipe of Control MH (D/S)	
Ori. dia (mm) / Weir Length (m):	255	2.00	400	20.00
Invert Elevation:	146.20	147.00	146.20	149.88
Orifice/Weir Flow Coefficient:	0.61	1.84	0.61	1.84

Emergency Spillway design target:
To pass full Regional incoming flow within freeboard allowance (0.30 m maximum head)

Description	Elevation (m)	Depth to PP (m)	Active Storage (m3)	Controlled Flow (m3/s)					
				Reversed Pipe to Control MH[1]	Control MH			Emergency Spill [3]	Total
					Weir[2]	Outlet Pipe from Control MH (D/S) [1]	Restricted Flow from Control MH		
Permanent Pool	**146.20**	0.000	**0**	0.000	0.000	0.000	0.000	0.000	0.000
	146.42	0.215	3,142	0.041	0.000	0.000	0.041	0.000	0.041
	146.63	0.430	**6,284**	0.076	0.000	0.000	0.076	0.000	0.076
	146.95	0.750	**11,708**	0.109	0.000	0.000	0.109	0.000	0.109
Extended Detention	147.00	0.800	12,555	0.113	0.000	0.000	0.113	0.000	0.113
	147.50	1.300	**21,030**	0.149	1.301	0.356	0.356	0.000	0.356
	147.85	1.650	27,782	0.170	2.884	0.409	0.409	0.000	0.409
	148.20	2.000	**34,535**	0.189	4.837	0.456	0.456	0.000	0.456
	148.73	2.525	45,924	0.214	8.337	0.518	0.518	0.000	0.518
	149.25	3.050	**57,314**	0.236	12.420	0.573	0.573	0.000	0.573
Top of Pond (Flood Control Up to Regional)	**149.78**	**3.575**	**73,627**	**0.256**	**17.011**	**0.624**	**0.624**	**0.000**	**0.624**
0.3 m Freeboard	**150.08**	**3.875**	**82,949**	**0.267**	**19.843**	**0.651**	**0.651**	**3.291**	**3.942**
	150.30	4.100	87,784	0.275	22.061	0.671	0.671	10.196	10.867
	150.70	4.500	96,379	0.289	26.191	0.704	0.704	27.576	28.280
Top of Pond (All)	**151.00**	**4.800**	**102,826**	**0.298**	**29.440**	**0.728**	**0.728**	**43.911**	**44.640**

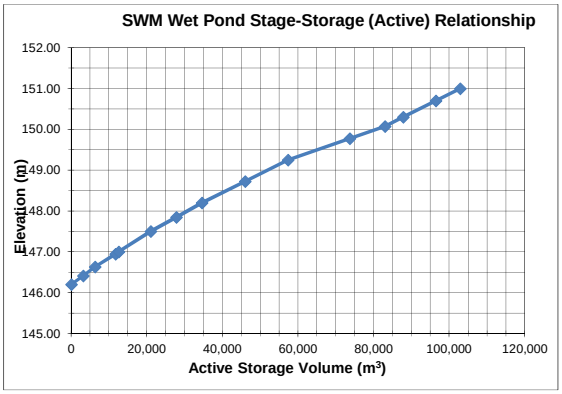
1) Orifice Equation: $Q = C\ A\ (2gh)^{1/2}$
2) Broad-Crested Weir Equation: $Q = C\ L\ H^{3/2}$
3) Emergency Spill to pass uncontrolled Regional Flows

Storage - Discharge Relationship

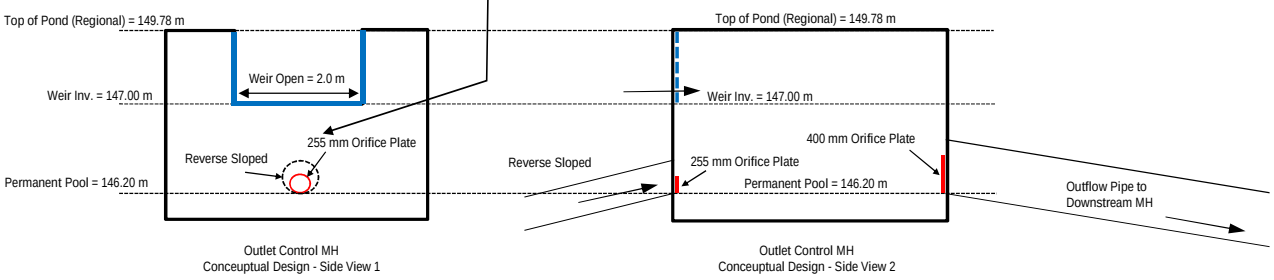
Elevation (m)	Discharge (m^3/s)	Storage (ha-m)
146.200	0.0000	0.0000
146.415	0.0408	0.3142
146.630	0.0759	0.6284
146.950	0.1089	1.1708
147.000	0.1132	1.2555
147.500	0.3561	2.1030
147.850	0.4089	2.7782
148.200	0.4555	3.4535
148.725	0.5177	4.5924
149.250	0.5732	5.7314
149.775	0.6238	7.3627
150.075	3.9424	8.2949
150.300	10.8666	8.7784
150.700	28.2799	9.6379
151.000	44.6396	10.2826

Water Elevation vs Return Periods

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)	Return Period
146.49	0.06	0.5290	25 mm 24 hr
146.72	0.11	1.1421	2-Yr
147.08	0.18	1.4816	5-Yr
147.21	0.23	1.6721	10-Yr
147.40	0.31	1.9550	25-Yr
147.51	0.36	2.1276	50-Yr
147.62	0.37	2.3555	100-Yr
149.26	0.62	6.9048	Regional



For Phase 2 Only. 290 mm Dia for Ultimate Conditions.



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Subject: **POND 3 - SWM Pond Design (1)**

Ultimate Condition

Updated 2018.01.19

SWM Pond Stage-Storage Relationship:

Elevation (m)	Cumulative Storage (m^3)				
	Forebay	Main Cell	Total PP	Active Storage	
143.20	0	0	0	-	*Bottom of pond*
145.00	0	9,544	9,544	-	
145.77	3,132	14,983	18,116	-	
146.20	5,173	18,505	23,678	0	*Permanent pool*
146.63	-	-	-	6,284	
146.95	-	-	-	11,708	
147.00	-	-	-	12,555	*Extended Detention*
147.50	-	-	-	21,030	
148.20	-	-	-	34,535	
149.25	-	-	-	57,314	
150.30	-	-	-	82,949	*Top of pond (max. 100-year)*
151.00	-	-	-	102,826	*Buffer (including Freeboard)*

Permanent Pool Area (m^2) : 13,826

Extended Detention Pond Area (m^2) : 16,822 est.

All stage-storage volumes based on measurements from proposed grading model in Civil 3D.

SWM Pond Storage Requirements:

Drainage Area		39.85	ha
Imperviousness		90.0	%
Storage Criteria for Enhanced Level Quality Control (Wet Pond)		258.3	m^3/ha
Storage for Enhanced Level Quality Control (Wet Pond)		10,295	m^3
Required Permanent Pool Storage		8,701	m^3
Extended Detention Storage for Water Quality Control (40m^3/ha)		1,594	m^3
25 mm Runoff Depth		20.06	mm
Required Extended Detention Storage for Erosion Control		7,994	m^3
Provided Storage for Proposed Stormwater Management Wet Pond	Permanent Pool Storage	23,678	m^3
	Active Storage for Water Quantity Control (100-Year)	82,949	m^3
	Active Storage for Water Quantity Control (Regional Storm)	96,379	m^3
	Max. Storage including Freeboard	102,826	m^3
	Total	126,504	m^3

Forebay Length Sizing Calculation

Settling Calculation

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Dist - Forebay Length	27.91	m	
Q - Peak Design Flowrate (25mm - Pond Outflow)	0.078	m3/s	
r - Length to width ratio	3		
V_s - Settling Velocity	0.0003	m/s	for 0.15mm diameter particle size

Dispersion Length Calculation

$$Dist = \frac{8Q}{dV_f};\ Width = \frac{Dist}{8}$$

Dist - Forebay Length		6.83	m	
Q - Inlet Flowrate	5-Year STM inflow to Forebay	1.28	m3/s	
d - Depth of Permanent Pool		3.00	m	
V_f - Desired Velocity in Forebay		0.5	m/s	max. permissible velocity in the forebay

Required Minimum Forebay Length 27.91 m

Requred Minimum Bottom Width 3.49 m

Pond Outlet Design - Erosion Control Orifice:

Provided Extended Detention Storage (m^3) :	12,555
Extended Detention Elevation (m) :	147.00
Permanent Pool Elevation (m)	146.20
Max. Extended Detention Depth (m) :	0.80
Permanent Pool Area (m^2) :	13,826
Extended Detention Pond Area (m^2) :	16,822
Orifice Flow Coefficient :	0.6
Diameter of Orifice Used (mm):	**290**
Area of Orifice Used (m^2) :	0.0661
Peak Flow (m^3/s) :	0.1492

Detention Time:

The falling head orifice equation is used to calculate the detention time:

$$t = \frac{2A_p}{CA_0(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

Where,

t = Drawdown Time in Seconds; *(target 72 hours)*
A_p = Surface Area of the Pond (m^2);
C = Orifice Flow Coefficient;
A_0 = Cross-sectional Area of the Orifice (m^2);
g = Gravitational Acceleration Constant (9.81 m/s^2);
h_1 = Starting Water Elevation above the orifice (m);
h_2 = Ending Water Elevation above the orifice (m).

Description	Elevation (m)	Surface Area (m^2)		Volume (m^3)	h_1 (m)	h_2 (m)	Maximum Flow (m^3/s)	Drawdown Time (hours)
Extended Detention	147.00	16,822	15,324	12,259	0.80	0.00	0.149	41.3
Permanent Pool	146.20	13,826						
							Total Drawdown Time (hours):	41.3

Subject: **POND 3 - SWM Pond Design (3)**

Updated 2018.01.19

Outlet Configuration:

	Orifice at Reversed Pipe to Control MH	Control MH		Emergency Spill
		Weir	Orifice at Outlet Pipe of Control MH (D/S)	
Ori. dia (mm) / Weir Length (m):	290	2.00	400	20.00
Invert Elevation:	146.20	147.00	146.20	149.88
Orifice/Weir Flow Coefficient:	0.61	1.84	0.61	1.84

Emergency Spillway design target:
To pass full Regional incoming flow within freeboard allowance (0.30 m maximum head)

Description	Elevation (m)	Depth to PP (m)	Active Storage (m3)	Controlled Flow (m3/s)					
				Reversed Pipe to Control MH[1]	Control MH			Emergency Spill [3]	Total
					Weir[2]	Outlet Pipe from Control MH (D/S) [1]	Restricted Flow from Control MH		
Permanent Pool	**146.20**	0.000	**0**	0.000	0.000	0.000	0.000	0.000	0.000
	146.42	0.215	3,142	0.047	0.000	0.000	0.047	0.000	0.047
	146.63	0.430	**6,284**	0.095	0.000	0.000	0.095	0.000	0.095
	146.95	0.750	**11,708**	0.139	0.000	0.000	0.139	0.000	0.139
Extended Detention	147.00	0.800	12,555	0.144	0.000	0.000	0.144	0.000	0.144
	147.50	1.300	**21,030**	0.192	1.301	0.356	0.356	0.000	0.356
	147.85	1.650	27,782	0.219	2.884	0.409	0.409	0.000	0.409
	148.20	2.000	**34,535**	0.243	4.837	0.456	0.456	0.000	0.456
	148.73	2.525	45,924	0.275	8.337	0.518	0.518	0.000	0.518
	149.25	3.050	**57,314**	0.304	12.420	0.573	0.573	0.000	0.573
Top of Pond (Flood Control Up to Regional)	**149.78**	**3.575**	**73,627**	**0.331**	**17.011**	**0.624**	**0.624**	**0.000**	**0.624**
0.3 m Freeboard	**150.08**	**3.875**	**82,949**	**0.345**	**19.843**	**0.651**	**0.651**	**3.291**	**3.942**
	150.30	4.100	87,784	0.355	22.061	0.671	0.671	10.196	10.867
	150.70	4.500	96,379	0.372	26.191	0.704	0.704	27.576	28.280
Top of Pond (All)	**151.00**	**4.800**	**102,826**	**0.385**	**29.440**	**0.728**	**0.728**	**43.911**	**44.640**

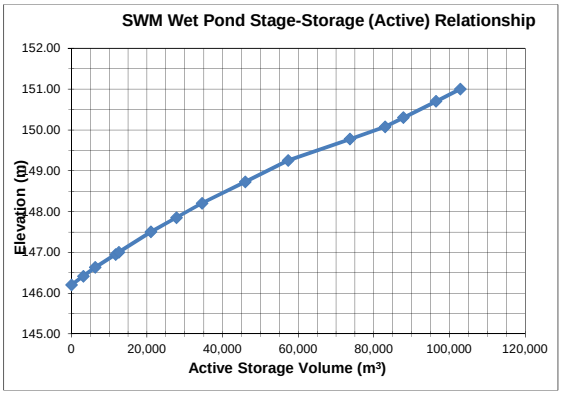
1) Orifice Equation: $Q = C\ A\ (2gh)^{1/2}$
2) Broad-Crested Weir Equation: $Q = C\ L\ H^{3/2}$
3) Emergency Spill to pass uncontrolled Regional Flows

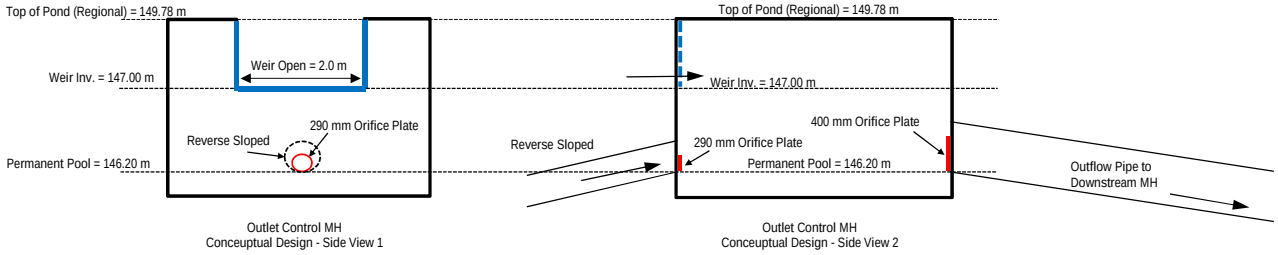
Storage - Discharge Relationship

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)
146.200	0.0000	0.0000
146.415	0.0472	0.3142
146.630	0.0953	0.6284
146.950	0.1388	1.1708
147.000	0.1444	1.2555
147.500	0.3561	2.1030
147.850	0.4089	2.7782
148.200	0.4555	3.4535
148.725	0.5177	4.5924
149.250	0.5732	5.7314
149.775	0.6238	7.3627
150.075	3.9424	8.2949
150.300	10.8666	8.7784
150.700	28.2799	9.6379
151.000	44.6396	10.2826

Water Elevation vs Return Periods

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)	Return Period
146.55	0.08	0.5134	25 mm 24 hr
146.92	0.13	1.1173	2-Yr
147.12	0.20	1.4668	5-Yr
147.24	0.25	1.6636	10-Yr
147.41	0.32	1.9534	25-Yr
147.51	0.36	2.1272	50-Yr
147.62	0.37	2.3621	100-Yr
149.26	0.62	6.9985	Regional





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Subject: **POND 5 - SWM Pond Design (1)**

Updated 2018.01.22

SWM Pond Stage-Storage Relationship:

Elevation (m)	Cumulative Storage (m^3)				
	Forebay	Main Cell	Total PP	Active Storage	
150.00	0	0	0	-	*Bottom of pond*
151.50	0	773	773	-	
152.57	687	1,900	2,588	-	
153.00	1,121	2,558	3,679	0	*Permanent pool*
153.43	-	-	-	1,360	
154.20	-	-	-	4,708	*Extended Detention*
154.25	-	-	-	4,926	
155.00	-	-	-	8,980	
156.00	-	-	-	15,524	
157.10	-	-	-	24,190	*Top of pond*
157.80	-	-	-	31,175	*Freeboard*

Permanent Pool Area (m^2) : 2,925
Extended Detention Pond Area (m^2) : 4,927 est.

All stage-storage volumes based on measurements from proposed grading model in Civil 3D.

SWM Pond Storage Requirements:

Drainage Area		14.40	ha
Imperviousness		88.0	%
Storage Criteria for Enhanced Level Quality Control (Wet Pond)		255.0	m^3/ha
Storage for Enhanced Level Quality Control (Wet Pond)		3,672	m^3
Required Permanent Pool Storage		3,096	m^3
Extended Detention Storage for Water Quality Control (40m^3/ha)		576	m^3
25 mm Runoff Depth		19.70	mm
Required Extended Detention Storage for Erosion Control		2,837	m^3
Provided Storage for Proposed Stormwater Management Wet Pond	Permanent Pool Storage	3,679	m^3
	Active Storage for Water Quantity Control (100-Year)	24,190	m^3
	Active Storage for Water Quantity Control (Regional Storm)	28,381	m^3
	Max. Storage including Freeboard	31,175	m^3
	Total	34,854	m^3

Forebay Length Sizing Calculation

Settling Calculation

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

Dist - Forebay Length	15.36	m	
Q - Peak Design Flowrate (25mm - Pond Outflow)	0.024	m3/s	
r - Length to width ratio	3		
V_s - Settling Velocity	0.0003	m/s	for 0.15mm diameter particle size

Dispersion Length Calculation

$$Dist = \frac{8Q}{dV_f};\ Width = \frac{Dist}{8}$$

Dist - Forebay Length		3.62	m	
Q - Inlet Flowrate	5-Year STM inflow to Forebay	0.68	m3/s	
d - Depth of Permanent Pool		3.00	m	
V_f - Desired Velocity in Forebay		0.5	m/s	max. permissible velocity in the forebay

Required Minimum Forebay Length 15.36 m
Requred Minimum Bottom Width 1.92 m

Pond Outlet Design - Erosion Control Orifice:

Extended Detention Storage (m^3) :	4,926
Extended Detention Elevation (m) :	154.20
Permanent Pool Elevation (m)	153.00
Max. Extended Detention Depth (m) :	1.20
Permanent Pool Area (m^2) :	2,925
Extended Detention Pond Area (m^2) :	4,927
Orifice Flow Coefficient :	0.6
Diameter of Orifice Used (mm):	**155**
Area of Orifice Used (m^2) :	0.0189
Peak Flow (m^3/s) :	0.0540

Detention Time:

The falling head orifice equation is used to calculate the detention time:

$$t = \frac{2A_p}{CA_0(2g)^{0.5}}\left(h_1^{0.5} - h_2^{0.5}\right)$$

Where,

t = Drawdown Time in Seconds; *(target 72 hours)*
A_p = Surface Area of the Pond (m^2);
C = Orifice Flow Coefficient;
A_0 = Cross-sectional Area of the Orifice (m^2);
g = Gravitational Acceleration Constant (9.81 m/s^2);
h_1 = Starting Water Elevation above the orifice (m);
h_2 = Ending Water Elevation above the orifice (m).

Description	Elevation (m)	Surface Area (m^2)		Volume (m^3)	h_1 (m)	h_2 (m)	Maximum Flow (m^3/s)	Drawdown Time (hours)
Extended Detention	154.20	4,927	3,926	4,711	1.20	0.00	0.054	46.9
Permanent Pool	153.00	2,925						
							Total Drawdown Time (hours):	46.9

Updated 2018.01.19

Outlet Configuration:

	Orifice at Reversed Pipe to Control MH	Control MH		High Flow Weir	Emergency Spill
		Weir	Orifice at Outlet Pipe of Control MH (D/S)		
Ori. dia (mm) / Weir Length (m):	155	2.00	240	0.80	10.00
Invert Elevation:	153.00	154.20	153.00	157.10	157.32
Orifice/Weir Flow Coefficient:	0.61	1.84	0.61	1.84	1.84

Emergency Spillway design target:
To pass full Regional incoming flow within freeboard allowance (0.30 m maximum head)

Description	Elevation (m)	Depth to PP (m)	Active Storage (m3)	Controlled Flow (m3/s)						
				Reversed Pipe to Control MH[1]	Control MH			High Flow Weir [3]	Emergency Spill [4]	Total
					Weir[2]	Outlet Pipe from Control MH (D/S) [1]	Restricted Flow from Control MH			
Permanent Pool	**153.00**	0.000	**0**	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	153.22	0.215	680	0.019	0.000	0.000	0.019	0.000	0.000	0.019
	153.43	0.430	**1,360**	0.030	0.000	0.000	0.030	0.000	0.000	0.030
Extended Detention	154.20	1.200	4,708	0.054	0.000	0.000	0.054	0.000	0.000	0.054
	154.25	1.250	**4,926**	0.055	0.041	0.130	0.041	0.000	0.000	0.041
	154.63	1.625	6,953	0.063	1.020	0.150	0.150	0.000	0.000	0.150
	155.00	2.000	**8,980**	0.071	2.633	0.168	0.168	0.000	0.000	0.168
	155.50	2.500	12,252	0.079	5.455	0.189	0.189	0.000	0.000	0.189
	156.00	3.000	**15,524**	0.087	8.887	0.207	0.207	0.000	0.000	0.207
	156.55	3.550	19,857	0.095	13.257	0.226	0.226	0.000	0.000	0.226
	157.10	4.100	**24,190**	0.102	18.174	0.244	0.244	0.000	0.000	0.244
Top of Pond (Flood Control Up to Regional)	**157.22**	**4.220**	**25,744**	**0.104**	**19.313**	**0.248**	**0.248**	**0.061**	**0.000**	**0.309**
	157.30	4.300	26,185	0.105	20.086	0.250	0.250	0.132	0.000	0.382
0.3 m Freeboard	**157.52**	**4.520**	**28,381**	**0.107**	**22.262**	**0.256**	**0.256**	**0.401**	**1.646**	**2.303**
Top of Pond (All)	**157.80**	**4.800**	**31,175**	**0.111**	**25.136**	**0.264**	**0.264**	**0.862**	**6.119**	**7.246**

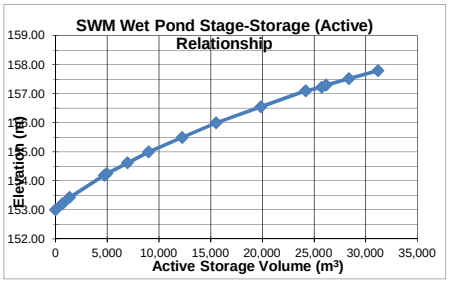
1) Orifice Equation: $Q = C\ A\ (2gh)^{1/2}$
2) Broad-Crested Weir Equation: $Q = C\ L\ H^{3/2}$
3) Broad-Crested Weir Equation: $Q = C\ L\ H^{3/2}$; **High Flow Weir could be intergrated with Control MH (as shown below) or Constructed Separately**
4) Emergency Spill to pass uncontrolled Regional Flows

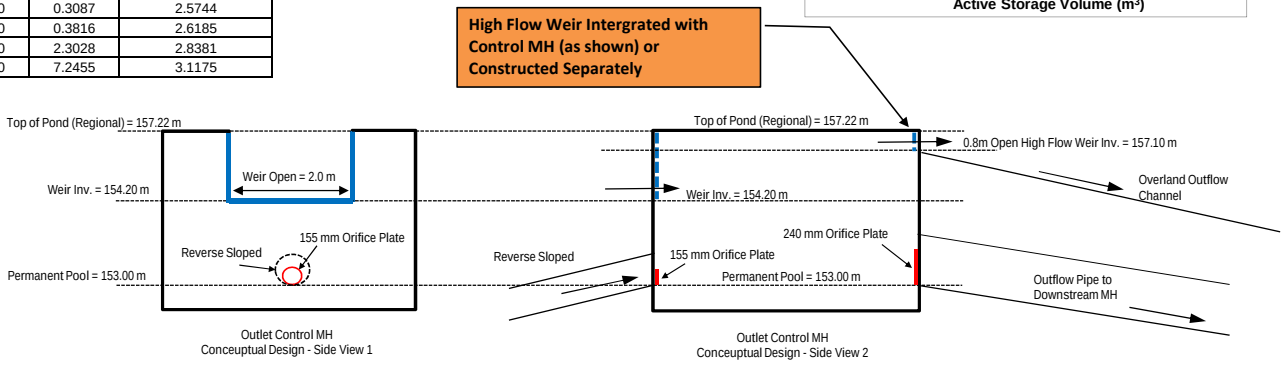
Storage - Discharge Relationship

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)
153.000	0.0000	0.0000
153.215	0.0189	0.0680
153.430	0.0303	0.1360
154.200	0.0540	0.4708
154.250	0.0411	0.4926
154.625	0.1500	0.6953
155.000	0.1676	0.8980
155.500	0.1886	1.2252
156.000	0.2074	1.5524
156.550	0.2264	1.9857
157.100	0.2439	2.4190
157.220	0.3087	2.5744
157.300	0.3816	2.6185
157.520	2.3028	2.8381
157.800	7.2455	3.1175

Water Elevation vs Return Periods

Elevation (m)	Discharge (m^3/s)	Storage (ha-m)	Return Period
153.52	0.02	0.2054	25 mm 24 hr
154.10	0.05	0.4302	2-Yr
154.79	0.13	0.5128	5-Yr
154.83	0.14	0.5821	10-Yr
154.89	0.15	0.7034	25-Yr
154.94	0.16	0.7816	50-Yr
154.99	0.17	0.8731	100-Yr
157.21	0.31	2.5087	Regional





Updated 2018.01.22

Proposed SWM Pond Summary

Pond #	Phase 1A		Phase 1B		Phase 2		Ultimate	
	Drainage Area (ha)	Imperviousness (%)	Drainage Area (ha)	Imperviousness (%)	Drainage Area (ha)	Imperviousness (%)	Drainage Area (ha)	Imperviousness (%)
Pond 2	17.8	89	17.8	89	17.8	89	20.8	89
Pond 3	-	-	24.6	50	37.0	90	39.9	90
Pond 1	-	-	-	-	-	-	23.6	88
Pond 5	-	-	-	-	-	-	14.4	88

Summary of SWM Pond Permanent Pool Requirements under Ultimate Development Conditions

Element	Pond 2	Pond 3	Pond 1	Pond 5
Drainage Area (ha)	20.8	39.9	23.6	14.4
Imperviousness (%)	89	90	88	88
Storage Criteria for Enhanced Level Treatment (m^3/ha)	257	258	255	255
Storage Required for Enhanced Level Treatment (m^3)	5,331	10,295	6,005	3,672
Permanent Pool Storage Required (m^3)	4,501	8,701	5,063	3,096
Water Quality Extended Detention (m^3)	830	1,594	942	576
Permanent Pool Volume Provided (m^3)	9,497	23,678	14,564	3,679

Summary of SWM Pond Erosion Control (Drawdown Time)

Element	Pond 2	Pond 3		Pond 1	Pond 5
Required Extended Detention Storage for Erosion Control (m^3)	4,162	7,994		4,639	2,837
Provided Extended Detention Storage for Erosion Control (m^3)	7,051	12,555		7,552	4,926
Permanent Pool Elevation (m)	145.75	146.20		152.00	153.00
Extended Detention Elevation (m)	146.70	147.00		153.00	154.20
Max. Extended Detention Depth (m)	0.95	0.80		1.00	1.20
Development Phases	Ultimate Conditions	Phase 1A, Phase 1B and Phase 2	Ultimate Conditions	Ultimate Conditions	Ultimate Conditions
Orifice Diameter (mm)	200	255	290	215	155
Peak Outflow Rate (m3/s)	0.078	0.117	0.149	0.096	0.054
Drawdown Time (hours)	47.4	53.4	41.3	42.4	46.9

Summary of SWM Pond Forebay Design

Element		Pond 2	Pond 3	Pond 1	Pond 5
Forebay Design	Required Minimum Forebay Length (m)	21.68	27.91	22.54	15.36
	Required Minimum Bottom Width (m)	2.71	3.49	2.82	1.92

Summary of SWM Pond Flood Control MH

Element		Pond 2	Pond 3	Pond 1	Pond 5
Low Flow Control	Reversed Pipe Orifice Invert - Permanent Pool Elevation (masl)	145.75	146.20	152.00	153.00
	Reversed Pipe Orifice Diameter (mm)	200	290 (Ultimate) 255 (All Interim)	215	155
Flow Control MH (Flood Control up to Regional Event)	Weir Invert - Erosion Control Extended Detention - (masl)	146.70	147.00	153.00	154.20
	Weir Width/Opening (m)	2.00	2.00	2.00	2.00
	Invert of a Pipe Connecting the Control MH to D/S	145.75	146.20	152.00	153.00
	D/S Pipe Orifice Diameter (mm)	270	400	350	240
	High Flow Weir (2nd Weir) - Wdith/Opening (m)	Not required	Not required	Not required	0.80
	High Flow Weir (2nd Weir) - Invert (masl)	Not required	Not required	Not required	157.10
Emergency Spill (to pass uncontrolled Regional Flows)	Spillway Invert - (masl)	149.90	149.88	156.10	157.32
	Spillway Width (m)	15.00	20.00	15.00	10.00
Freeboard	Top of Regional Storm Storage Elevation (masl)	149.80	149.78	156.00	157.22
	Top of Pond Elevation including Freeboard (masl)	150.50	151.00	156.75	157.80
	Freeboard Depth (m)	0.70	1.22	0.75	0.58

Summary of Simulated SWM Pond Design Events Elevation (Ultimate Conditions)

Return Period	Pond 2	Pond 3	Pond 1	Pond 5
25 mm 24 hr	146.78	146.55	152.41	153.52
2-Yr	146.90	146.92	152.90	154.10
5-Yr	147.26	147.12	153.14	154.79
10-Yr	147.30	147.24	153.25	154.83
25-Yr	147.37	147.41	153.43	154.89
50-Yr	147.42	147.51	153.53	154.94
100-Yr	147.47	147.62	153.68	154.99
Regional	149.61	149.26	155.84	157.21

Rooftop Control

FOR PH1B

Catchment GAWSER ID	2309
Area (ha)	2.56
Imperviousness	100
Rooftop Control GAWSER ID	1020

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)
160	0	0
160.15	0.1050	0.3840
	↑	↑
Assume:	41 L/s/ha	0.15 m Depth

REVISED FOR PH2 AND ULT

Catchment GAWSER ID	2309
Area (ha)	5.12
Imperviousness	100
Rooftop Control GAWSER ID	1020

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)
160	0	0
160.15	0.2099	0.7680
	↑	↑
Assume:	41 L/s/ha	0.15 m Depth

Typical Roof Drain Design
Zurn Control-Flow Roof Drains

Area per Drain (sq. m.)	Drain Rise (mm)	Max. Discharge per Drain (L/min)	Unit Controlled Flow Rate (L/s/ha)
518	150	127.5	41

SWM Pond Flows

PH1A CONDITIONS

QUANTITY CONTROL UP TO REGIONAL STORM EVENT

FINAL, JAN 2018, MMM, AZZ

POND 2

PH1A Drainage Area	15.58	ha	Plus Dundas Street	2.24	ha
Imperviousness	90	%		82	%
Total Drainage Area	17.82	ha			
Imperviousness	89	%			
Detention Time	47	Hr			

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
145.75	0.0000	0.0000	Permanent Pool
145.97	0.0288	0.1439	
146.18	0.0488	0.2879	
146.70	0.0783	0.7051	
146.75	0.0411	0.7452	Extended Detention
147.50	0.1966	1.4379	
148.50	0.2502	2.5167	Top of Pond (max. 100-Year)
149.80	0.3061	4.1884	
150.20	4.8565	4.8155	Top of Pond (max. Regional) - Below Freeboard
150.50	13.1597	5.2859	Freeboard

Return Period	POST POND 2			
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)
Gawser ID	**3090**		**4500**	**4500**
25 mm 24 hr	0.244	146.76	0.252	0.044
2-Yr	0.587	146.90	0.625	0.073
5-Yr	0.819	147.26	0.795	0.148
10-Yr	0.964	147.31	0.924	0.158
25-Yr	1.146	147.39	1.139	0.174
50-Yr	1.282	147.44	1.274	0.184
100-Yr	1.417	147.50	1.433	0.196
Regional	1.550	149.82	4.420	0.483

SWM Pond Flows

PH1B CONDITIONS

QUANTITY CONTROL UP TO REGIONAL STORM EVENT

FINAL, JAN 2018, MMM, AZZ

POND 2

PH1B Drainage Area	15.57	ha	Plus Dundas Street	2.24	ha
Imperviousness	90	%		82	%
Total Drainage Area	17.81	ha			
Imperviousness	89	%			
Detention Time	47	Hr			

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
145.75	0.0000	0.0000	Permanent Pool
145.97	0.0288	0.1439	
146.18	0.0488	0.2879	
146.70	0.0783	0.7051	
146.75	0.0411	0.7452	Extended Detention
147.50	0.1966	1.4379	
148.50	0.2502	2.5167	Top of Pond (max. 100-Year)
149.80	0.3061	4.1884	
150.20	4.8565	4.8155	Top of Pond (max. Regional) - Below Freeboard
150.50	13.1597	5.2859	Freeboard

Return Period	POST POND 2			
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)
Gawser ID	3090		4500	4500
25 mm 24 hr	0.244	146.76	0.252	0.044
2-Yr	0.587	146.90	0.625	0.073
5-Yr	0.819	147.26	0.795	0.148
10-Yr	0.964	147.31	0.924	0.158
25-Yr	1.146	147.39	1.139	0.174
50-Yr	1.282	147.44	1.274	0.184
100-Yr	1.417	147.50	1.433	0.196
Regional	1.550	149.82	4.420	0.483

POND 3

PH1B Drainage Area	24.57	ha
Imperviousness	50	%
Detention Time	41	Hr

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
146.20	0.0000	0.0000	Permanent Pool
146.63	0.0953	0.6284	
146.95	0.1388	1.1708	
147.00	0.1444	1.2555	Extended Detention
147.50	0.3561	2.1030	
149.25	0.5732	5.7314	
150.08	3.9424	8.2949	Top of Pond (max. 100-Year)
150.30	10.8666	8.7784	
150.70	28.2799	9.6379	Top of Pond (max. Regional) - Below Freeboard
151.00	44.6396	10.2826	Freeboard

Return Period	POST POND 3			
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)
Gawser ID	2140		1000	1000
25 mm 24 hr	0.241	146.33	0.229	0.028
2-Yr	0.678	146.52	0.586	0.071
5-Yr	0.984	146.60	0.834	0.088
10-Yr	1.175	146.65	0.995	0.098
25-Yr	1.419	146.76	1.242	0.113
50-Yr	1.599	147.00	1.371	0.146
100-Yr	1.779	147.10	1.509	0.186
Regional	2.246	148.56	4.303	0.488

SWM Pond Flows

PH2 CONDITIONS

QUANTITY CONTROL UP TO REGIONAL STORM EVENT

FINAL, JAN 2018, MMM, AZZ

POND 2

PH2 Drainage Area	15.57 ha	Plus Dundas Street	2.24	ha
Imperviousness	90 %		82	%
Total Drainage Area	17.81 ha			
Imperviousness	89 %			
Detention Time	47 Hr			

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
145.75	0.0000	0.0000	Permanent Pool
145.97	0.0288	0.1439	
146.18	0.0488	0.2879	
146.70	0.0783	0.7051	
146.75	0.0411	0.7452	Extended Detention
147.50	0.1966	1.4379	
148.50	0.2502	2.5167	Top of Pond (max. 100-Year)
149.80	0.3061	4.1884	
150.20	4.8565	4.8155	Top of Pond (max. Regional) - Below Freeboard
150.50	13.1597	5.2859	Freeboard

Return Period	POST POND 2			
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)
Gawser ID	3090		4500	4500
25 mm 24 hr	0.244	146.76	0.252	0.044
2-Yr	0.587	146.90	0.625	0.073
5-Yr	0.819	147.26	0.795	0.148
10-Yr	0.964	147.31	0.924	0.158
25-Yr	1.146	147.39	1.139	0.174
50-Yr	1.282	147.44	1.274	0.184
100-Yr	1.417	147.50	1.433	0.196
Regional	1.550	149.82	4.420	0.483

POND 3

PH2 Drainage Area	36.99 ha
Imperviousness	90 %
Detention Time	53 Hr

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
146.20	0.0000	0.0000	Permanent Pool
146.63	0.0953	0.6284	
146.95	0.1388	1.1708	
147.00	0.1444	1.2555	Extended Detention
147.50	0.3561	2.1030	
149.25	0.5732	5.7314	
150.08	3.9424	8.2949	Top of Pond (max. 100-Year)
150.30	10.8666	8.7784	
150.70	28.2799	9.6379	Top of Pond (max. Regional) - Below Freeboard
151.00	44.6396	10.2826	Freeboard

Return Period	POST POND 3			
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)
Gawser ID	2140		1000	1000
25 mm 24 hr	0.517	146.49	0.529	0.064
2-Yr	1.197	146.72	1.142	0.107
5-Yr	1.666	147.08	1.482	0.178
10-Yr	1.959	147.21	1.672	0.233
25-Yr	2.329	147.40	1.955	0.314
50-Yr	2.604	147.51	2.128	0.358
100-Yr	2.879	147.62	2.356	0.371
Regional	3.494	149.26	6.905	0.618

SWM Pond Flows
ULTIMATE CONDITIONS
QUANTITY CONTROL UP TO REGIONAL STORM EVENT
FINAL, JAN 2018, MMM, AZZ

POND 2

ULTIMATE Drainage Area	18.51 ha	Plus Dundas Street	2.24	ha
Imperviousness	90 %		82	%
Total Drainage Area	20.75 ha			
Imperviousness	89 %			
Detention Time	47 Hr			

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
145.75	0.0000	0.0000	Permanent Pool
145.97	0.0288	0.1439	
146.18	0.0488	0.2879	
146.70	0.0783	0.7051	
146.75	0.0411	0.7452	Extended Detention
147.50	0.1966	1.4379	
148.50	0.2502	2.5167	Top of Pond (max. 100-Year)
149.80	0.3061	4.1884	
150.20	4.8565	4.8155	Top of Pond (max. Regional) - Below Freeboard
150.50	13.1597	5.2859	Freeboard

Return Period	POST POND 2				TARGET FLOW - EXISTING FLOW AT COMPARIABLE LOCATION
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	**3090**		**4500**	**4500**	**1203**
25 mm 24 hr	0.290	146.78	0.2750	0.047	0.025
2-Yr	0.698	146.90	0.6154	0.072	0.107
5-Yr	0.974	147.26	0.7805	0.147	0.165
10-Yr	1.146	147.30	0.8967	0.155	0.198
25-Yr	1.361	147.37	1.0881	0.170	0.250
50-Yr	1.523	147.42	1.2088	0.179	0.284
100-Yr	1.683	147.47	1.3490	0.190	0.319
Regional	1.842	149.61	3.9439	0.298	0.787

POND 3

ULTIMATE Drainage Area	39.85 ha
Imperviousness	90 %
Detention Time	41 Hr

Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
146.20	0.0000	0.0000	Permanent Pool
146.63	0.0953	0.6284	
146.95	0.1388	1.1708	
147.00	0.1444	1.2555	Extended Detention
147.50	0.3561	2.1030	
149.25	0.5732	5.7314	
150.08	3.9424	8.2949	Top of Pond (max. 100-Year)
150.30	10.8666	8.7784	
150.70	28.2799	9.6379	Top of Pond (max. Regional) - Below Freeboard
151.00	44.6396	10.2826	Freeboard

Return Period	POST POND 3				EXISTING FLOW AT COMPARIABLE LOCATION
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	**2140**		**1000**	**1000**	**1105**
25 mm 24 hr	0.431	146.55	0.5134	0.078	0.057
2-Yr	0.925	146.92	1.1173	0.135	0.253
5-Yr	1.281	147.12	1.4668	0.197	0.390
10-Yr	1.492	147.24	1.6636	0.246	0.467
25-Yr	1.788	147.41	1.9534	0.319	0.590
50-Yr	1.996	147.51	2.1272	0.358	0.670
100-Yr	2.207	147.62	2.3621	0.372	0.754
Regional	3.233	149.26	6.9985	0.621	1.857

POND 5

ULTIMATE Drainage Area 14.40 ha
Imperviousness 88 %
Detention Time 47 Hr
Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
153.00	0.0000	0.0000	Permanent Pool
154.20	0.0540	0.4708	Extended Detention
154.25	0.0411	0.4926	
155.00	0.1676	0.8980	
156.00	0.2074	1.5524	
156.55	0.2264	1.9857	
157.10	0.2439	2.4190	Top of Pond (max. 100-Year)
157.22	0.3087	2.5744	
157.30	0.3816	2.6185	Top of Pond (max. Regional) - Below Freeboard
157.52	2.3028	2.8381	Freeboard

Return Period	POST POND 5				TARGET FLOW - Based on Existing Flows from Existing Catchment 1202 (ID 2501) in Proportion to Drainage Area
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	3060		4510	4510	N/A
25 mm 24 hr	0.206	153.52	0.2054	0.024	0.024
2-Yr	0.487	154.10	0.4302	0.049	0.100
5-Yr	0.679	154.79	0.5128	0.132	0.153
10-Yr	0.799	154.83	0.5821	0.138	0.182
25-Yr	0.951	154.89	0.7034	0.150	0.229
50-Yr	1.063	154.94	0.7816	0.157	0.260
100-Yr	1.176	154.99	0.8731	0.165	0.292
Regional	1.385	157.21	2.5087	0.306	0.715

POND 1

ULTIMATE Drainage Area 23.55 ha
Imperviousness 88 %
Detention Time 42 Hr
Rating Curve

ELEVATION (m)	OUTFLOW (cms)	STORAGE (ha*m)	
152.00	0.0000	0.0000	Permanent Pool
152.50	0.0615	0.3776	
153.00	0.0927	0.7552	Extended Detention
153.50	0.2992	1.2234	
154.00	0.3512	1.6915	
155.00	0.4369	2.8257	
156.00	0.5084	4.1743	Top of Pond (max. 100-Year)
156.30	2.9966	4.6293	
156.45	6.2524	4.8568	Top of Pond (max. Regional) - Below Freeboard
156.75	15.0197	5.3117	Freeboard

Return Period	POST POND 1				TARGET FLOW - Based on Existing Flows to Culvert FM-D2 in Proportion to Drainage Area
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	3000		4000	4000	
25 mm 24 hr	0.337	152.41	0.3120	0.051	0.042
2-Yr	0.796	152.90	0.6808	0.087	0.165
5-Yr	1.111	153.14	0.8843	0.150	0.269
10-Yr	1.306	153.25	0.9930	0.198	0.332
25-Yr	1.555	153.43	1.1543	0.269	0.426
50-Yr	1.739	153.53	1.2553	0.303	0.490
100-Yr	1.923	153.68	1.3884	0.318	0.557
Regional	2.266	155.84	3.9624	0.497	1.299

POND WEST OF TREMAINE

- ORIGINAL STAGE STORAGE -REGIONAL CONTROL NOT PROVIDED

- UPDATED STAGE STORAGE -REGIONAL CONTROL PROVIDED (Preliminary)

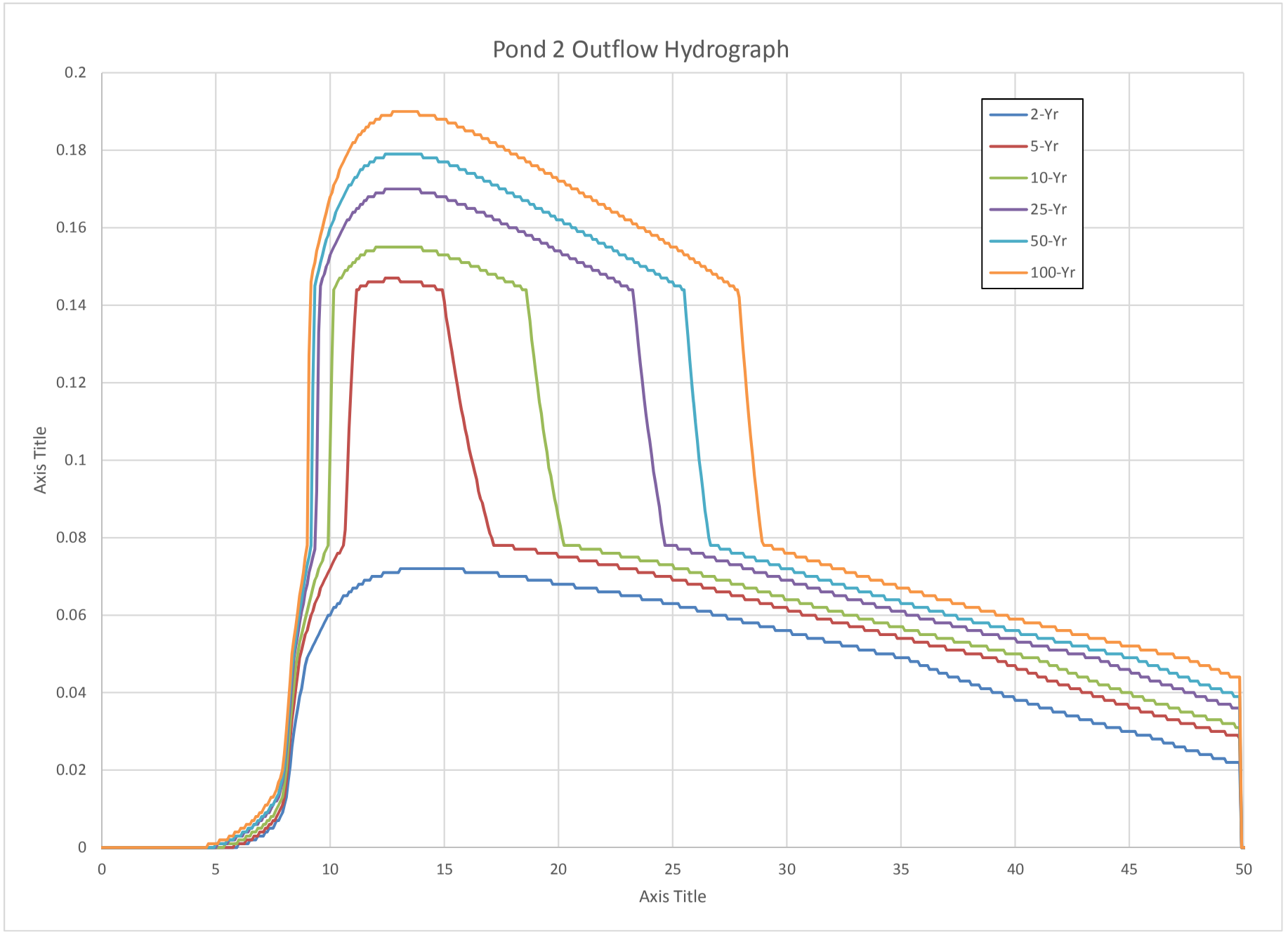
ULTIMATE Drainage Area 21.05 ha

Imperviousness 20 %

Rating Curve

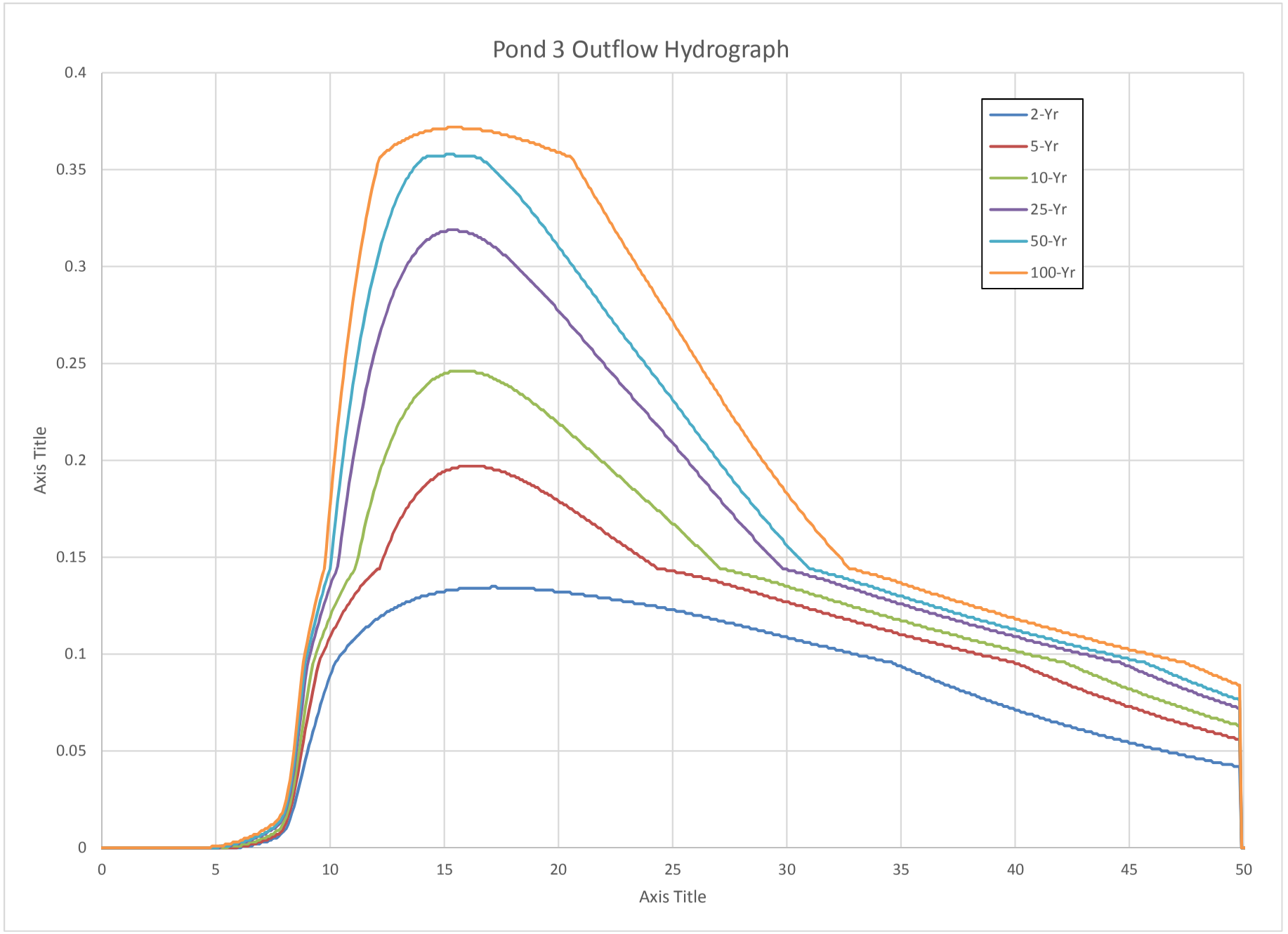
ELEVATION	OUTFLOW	STORAGE
(m)	(cms)	(ha*m)
156.10	0.0000	0.0000
156.50	0.1661	0.3000
156.80	0.2706	0.4000
157.10	0.3229	0.5000
157.40	0.4106	0.6000
157.70	0.4890	0.7000
158.00	0.5413	0.7500
158.10	1.1000	1.9000

Return Period	POST POND 5				TARGET FLOW - Based on Existing Flows from Existing Catchment 1202 (ID 2501) in Proportion to Drainage Area
	Inflow (cms)	Water Elevation (m)	Utilized Storage (ha*m)	Outflow (cms)	
Gawser ID	3050		500	500	N/A
25 mm 24 hr	0.145	156.21	0.080	0.044	0.035
2-Yr	0.545	156.48	0.286	0.158	0.146
5-Yr	0.828	156.82	0.406	0.274	0.223
10-Yr	1.006	157.05	0.484	0.314	0.266
25-Yr	1.232	157.39	0.598	0.408	0.335
50-Yr	1.399	157.61	0.669	0.465	0.380
100-Yr	1.568	157.97	0.744	0.535	0.428
Regional	2.007	158.10	1.869	1.085	1.045


Pond 2 Outflow Hydrograph
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
Axis Title
0
5
10
15
20
25
30
35
40
45
50
Axis Title
2-Yr
5-Yr
10-Yr
25-Yr
50-Yr
100-Yr

POND 2	**OUTFLOW**
Weir Empty - Flow Limit	**0.078**

Return Period	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
DT (HR)	0.08	0.08	0.08	0.08	0.08	0.08
DT (MIN)	5.00	5.00	5.00	5.00	5.00	5.00
PEAK (CMS)	0.072	0.147	0.155	0.170	0.179	0.190
PEAK - TIME (HR)	13.08	12.42	12.00	12.42	12.42	12.75
WEIR EMPTY - TIME (HR)	0.00	17.17	20.25	24.67	26.67	29.00
TIME TO DRAIN FLOW FROM WEIR AND SPILLWAY (HR)	0.00	4.75	8.25	12.25	14.25	16.25
Calculated 25 mm Detention Time (hr) for Erosion Control - Ultimate Development	47.36	47.36	47.36	47.36	47.36	47.36
Pond Drawdown Time (hr)	**47.36**	**52.11**	**55.61**	**59.61**	**61.61**	**63.61**

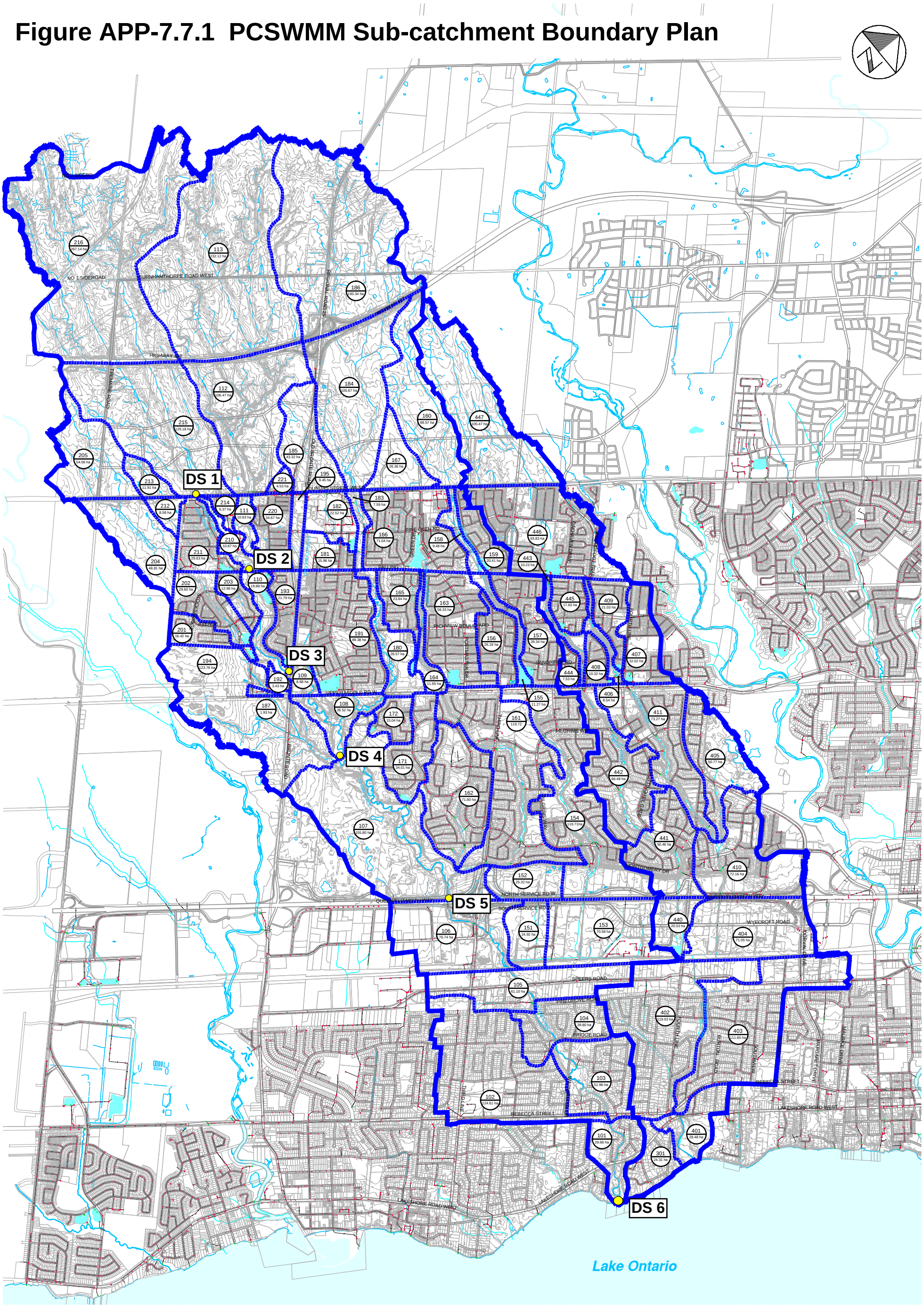

Pond 3 Outflow Hydrograph
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Axis Title
0
5
10
15
20
25
30
35
40
45
50
Axis Title
2-Yr
5-Yr
10-Yr
25-Yr
50-Yr
100-Yr

POND 3	OUTFLOW
Weir Empty - Flow Limit	0.144

Return Period	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
DT (HR)	0.08	0.08	0.08	0.08	0.08	0.08
DT (MIN)	5.00	5.00	5.00	5.00	5.00	5.00
PEAK (CMS)	0.135	0.197	0.246	0.319	0.358	0.372
PEAK - TIME (HR)	17.08	15.67	15.25	15.17	15.08	15.17
WEIR EMPTY - TIME (HR)	0.00	24.33	27.08	29.83	31.00	32.75
TIME TO DRAIN FLOW FROM WEIR AND SPILLWAY (HR)	0.00	8.67	11.83	14.67	15.92	17.58
Calculated 25 mm Detention Time (hr) for Erosion Control - Ultimate Development	41.31	41.31	41.31	41.31	41.31	41.31
Pond Drawdown Time (hr)	**41.31**	**49.98**	**53.14**	**55.98**	**57.23**	**58.89**

Appendix 7.7 – Regional Flow Downstream Impact

Figure APP-7.7.1 PCSWMM Sub-catchment Boundary Plan



LEGEND

- WATERSHED BOUNDARY
- SUBCATCHMENT BOUNDARY
- 101 / 29.66 ha — SUBCATCHMENT NUMBER / SUBCATCHMENT AREA

SCALE VALID ONLY FOR 24"x36" VERSION

FOURTEEN MILE CREEK
McCRANEY CREEK SYSTEM FLOOD MITIGATION OPPORTUNITIES STUDY
TOWN OF OAKVILLE

SUBCATCHMENT BOUNDARY PLAN

amec

Scale 1:17500 (0 200 400 800)

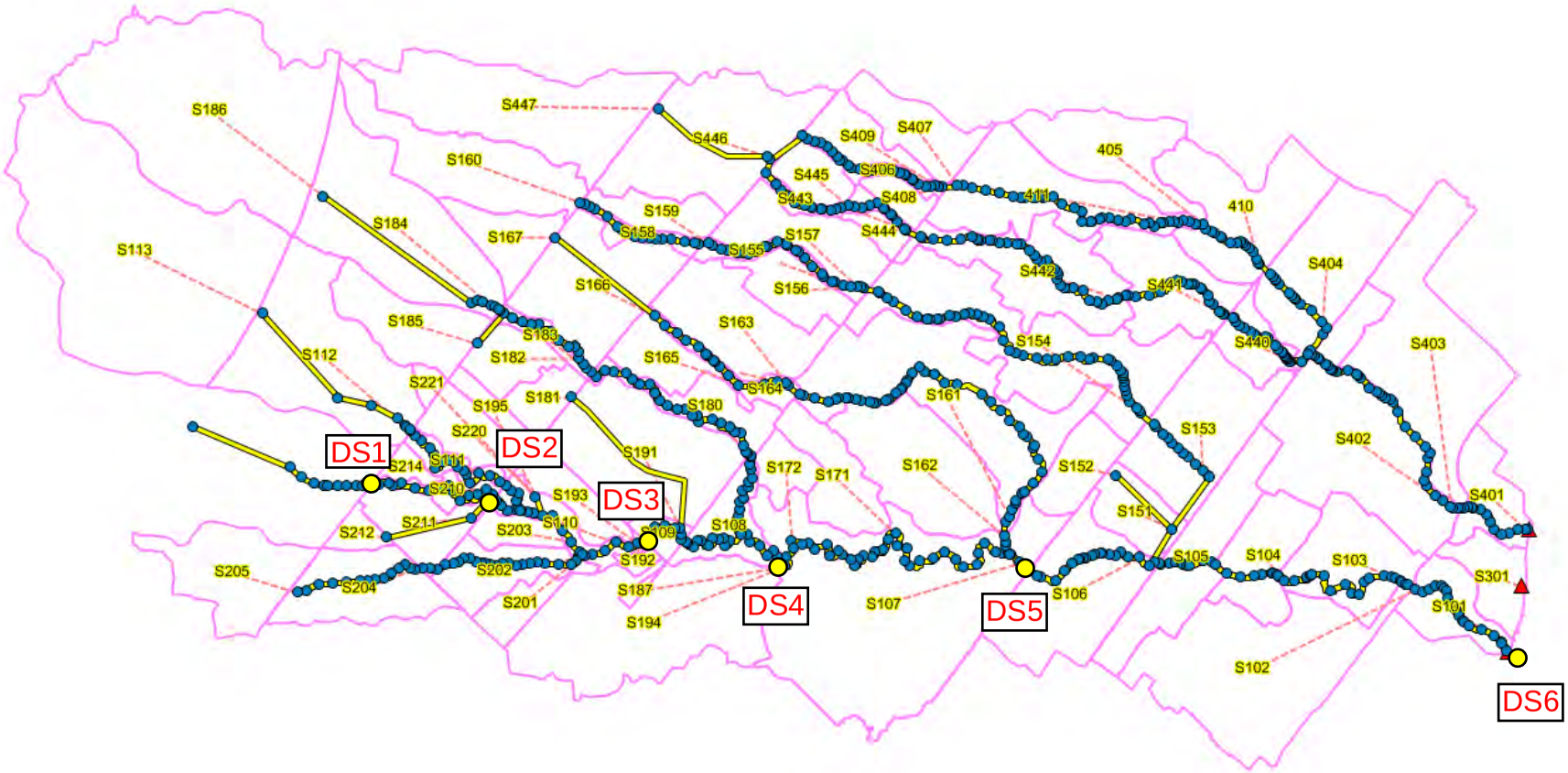
Consultant File No. TP111031

Drawing No. 1

P:\Work\111031\water\dwg\July2013\Dwg-1 Sub-Catch.dwg

Jul 17/13 – richard.bartolo

Figure APP-7.7.2 PCSWMM Schematic



PCSWMM Conduit	Schematic Node Name	PCSWMM Catchment	Location	Area (ha)	Original Reg. Flows	Existing	Interim 1a Uncontrolled		Interim 1a Controlled		Interim 1b Uncontrolled		Interim 1b Controlled		Interim 2 Uncontrolled		Interim 2 Controlled		Ultimate Uncontrolled		Ultimate Controlled	
					AMEC Model	Flow (m3/s)	Flow (m3/s)	% difference	Flow (m3/s)	% difference	Flow (m3/s)	% difference	Flow (m3/s)	% difference	Flow (m3/s)	% difference	Flow (m3/s)	% difference	Flow (m3/s)	% difference	Flow (m3/s)	% difference
3660.527	DS1	215	Dundas Rd	408.23	48.226	20.344	20.599	1%	19.135	-6%	20.46	1%	18.495	-9%	22.14	9%	18.153	-11%	23.19	14%	17.402	-14%
2528.637	DS2	210	Richview Blvd	457.31	53.573	23.191	23.826	3%	21.854	-6%	23.89	3%	21.488	-7%	26.18	13%	20.876	-10%	27.48	18%	20.131	-13%
1130.117	DS3	110	Bronte Rd	1062.95	122.589	89.9	90.524	1%	88.732	-1%	90.64	1%	88.491	-2%	92.89	3%	87.869	-2%	94.25	5%	87.181	-3%
7322.142	DS4	108	Fourteen Mile Creek Lands	1604.5	170.839	139.782	140.419	0%	138.579	-1%	140.50	1%	138.343	-1%	142.76	2%	137.743	-1%	144.15	3%	137.032	-2%
4232.339	DS5	107	HW 403	2317.58	222.989	192.612	193.2	0%	191.483	-1%	193.34	0%	191.324	-1%	195.35	1%	190.763	-1%	196.57	2%	190.241	-1%
OF100	DS6	101	Lake Ontario	3118.23	270.239	243.229	243.72	0%	242.173	0%	243.80	0%	241.986	-1%	245.76	1%	241.536	-1%	246.78	1%	241.083	-1%

Appendix 7.8 – Monitoring Program

Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

Proposed Monitoring Stations Baseline Condition

Legend

- Existing Watercourse
- Subject Property
- Existing Groundwater Monitoring Wells
- Mini-Piezometer
- Staff Gauge
- Pond Logger
- Existing Surface Water / Water Quality Monitoring Station

Proposed Monitoring Stations

- Proposed Mini Piezometer
- Proposed Monitoring Well
- Stream Flow/Temperature Monitoring Point
- Baseline Amphibian Survey Station
- Post Channel Realignment Amphibian Survey Station
- Baseline Bird Sampling Station
- Post Channel Realignment Bird Sampling Station
- Baseline Stream Temperature & Dissolved Oxygen Station
- Baseline Benthic Macroinvertebrate Station
- Post Channel Realignment Benthic Macroinvertebrate Station
- Baseline Fish Habitat and Community Station
- Post Channel Realignment Fish Habitat and Community Station
- Watercourse Cross Section Annual Measurement

Note: Locations shown are proposed and subject to revision pending final design.

Scale 0 100 200 400 Metres

Client: QuadReal

Prepared By: wsp

Date: June 2017

Project No.: 09M-00013-01

Scale as Shown

Appendix: 7.8.1

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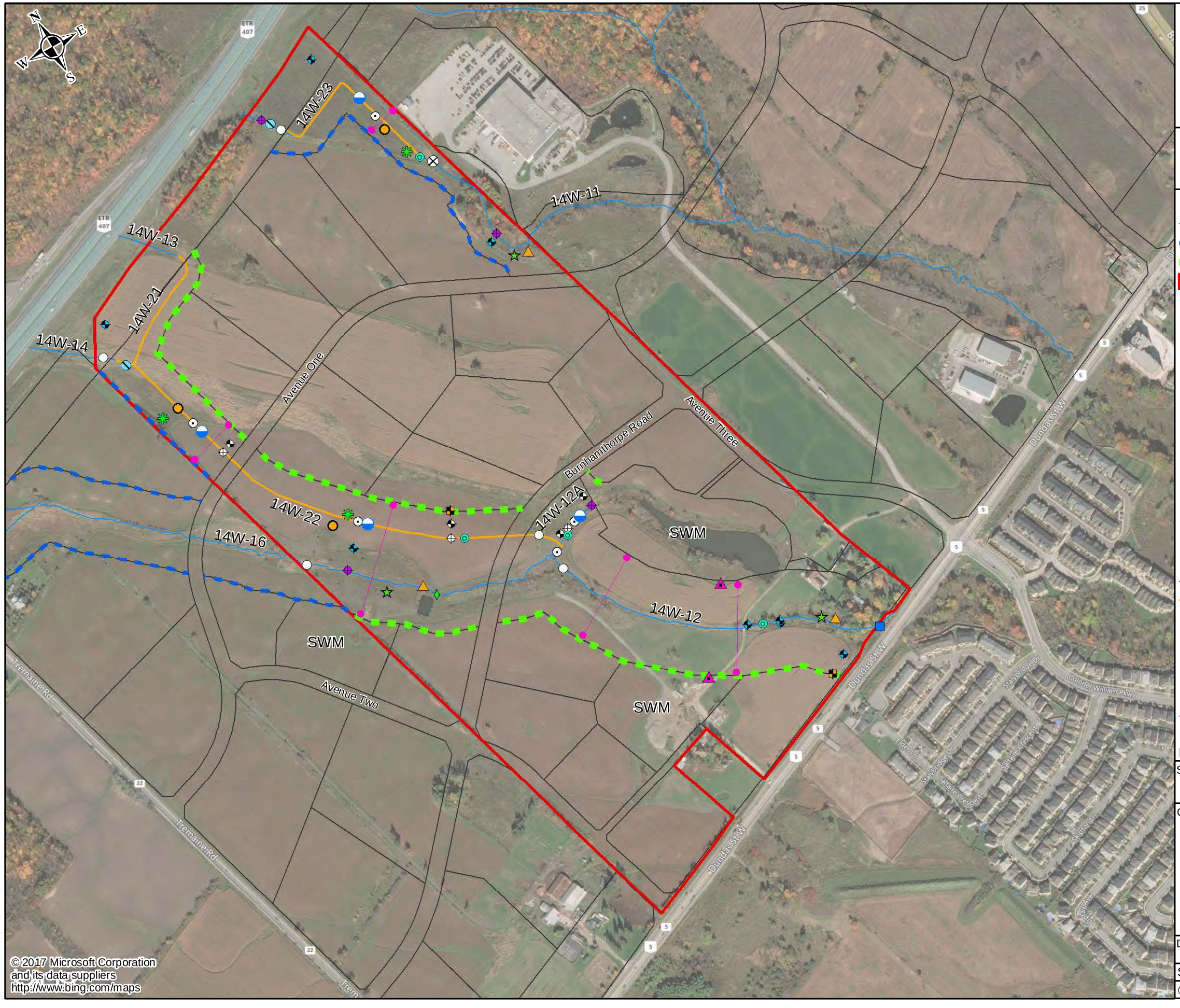
J:\1442 Projects by Job Number\2009\14-09222-001-HG1 Bentall Lands\050 Mapping\MXD\Report\Appendix 7.8.1 Proposed Monitoring Stations Baseline Condition.mxd

Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

Proposed Monitoring Stations Post Construction Condition



Legend

- Existing Watercourse
- 1.10m Infiltration Swale
- 1.3m Infiltration Swale
- Subject Property
- Existing Groundwater Monitoring Wells
- Existing Mini-Piezometer
- Existing Staff Gauge
- Existing Surface Water / Water Quality Monitoring Station

Proposed Monitoring Stations

- Proposed Infiltration Trench Monitor
- Proposed Mini Piezometer
- Proposed Monitoring Well
- Stream Flow/Temperature Monitoring Point
- Baseline Amphibian Survey Station
- Post Channel Realignment Amphibian Survey Station
- Baseline Bird Sampling Station
- Post Channel Realignment Bird Sampling Station
- Baseline Stream Temperature & Dissolved Oxygen Station
- Development Plan
- Proposed Channel Diversions
- Baseline Benthic Macroinvertebrate Station
- Post Channel Realignment Benthic Macroinvertebrate Station
- Baseline Fish Habitat and Community Station
- Post Channel Realignment Fish Habitat and Community Station
- SWM Facility Quality Sampling Station
- Watercourse Cross Section Annual Measurement

Note: Locations shown are proposed and subject to revision pending final design.

Scale 0 100 200 400 Metres

Client: QuadReal	Prepared By: wsp
Date: June 2017	Project No.: 09M-00013-01
Scale as Shown	**Appendix: 7.8.2**
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J:\1442 Projects by Job Number\2009\14-09222-001-HG1 Bentall Lands\050 Mapping\MXD\Report\Appendix 7.8.2 Proposed Monitoring Stations Post Construction.mxd

Appendix 7.8 – Monitoring Program

1.1 OPA 289 Monitoring Requirements

Policy 8.9.5.2 of OPA 289 (North Oakville West Secondary Plan) specifies that monitoring be completed as dictated below, on an annual basis:

> "*A program shall be established by the Town in consultation with the Region of Halton and Conservation Halton to monitor the development in the Planning Area on an annual basis. The monitoring program shall be in accordance with directions established in the North Oakville Creeks Subwatershed Study and shall also consider such factors as:*
>
> *a) relationship and level of population and employment growth in North Oakville;*
> *b) supply of existing lots and number of building permits granted;*
> *c) the general achievement of housing mix targets in North Oakville;*
> *d) the functioning of stormwater management facilities to ensure they are constructed and operate as designed,*
> *e) stream alterations/relocations to ensure that natural channel designs were implemented and operate as designed;*
> *f) erosion and operation of sediment controls during construction;*
> *g) utilization of wastewater treatment and water supply system capacity; and,*
> h) *development application status.*"

1.2 NOCSS Monitoring Requirements

Monitoring Requirements were specified in the NOCSS and include the following requirements as agreed to in the Ontario Municipal Board (OMB) Mediation Item: Stormwater Management – Temperature and Dissolved Oxygen Targets dated July 12, 2007 and incorporated into Appendix KK of the NOCSS:

1) Erosion and sediment control plans;
2) Stormwater management facility monitoring;
3) Modified streams monitoring; and,
4) Monitoring in relation to stormwater management works, municipal services and trails installed by an owner within the Natural Heritage System.

1.3 Monitoring Approach

The proposed monitoring plan will be based on the Adaptive Environmental Monitoring (AEM) approach for the management of the NHS in accordance with the recommendations of NOCSS. The AEM approach will allow for a flexible monitoring plan that will use real-time monitoring results to revise and update, as required, the monitoring plan to ensure the anticipated results are achieved. By applying AEM, undesirable environmental effects/results can potentially be identified early in the monitoring program and corrected through management interventions to avoid major problems before they occur, as well as, maximize the fulfillment of the monitoring objectives. Details of the AEM approach, including the determination of the monitoring parameters will developed at the detail design stage in discussion with Conservation Halton (CH).

Erosion and Sediment Control (ESC)

1) An ESC plan will be submitted to the Town of Oakville (Town). The plan must be reviewed and approved by the Town prior to the start of any clearing and grading;
2) The ESC requirements will follow the applicable approved guidelines and by-laws in effect at the time of development. Deliverables will include a site alteration design report, an existing site conditions survey plan, an ESC plan, and a schedule of monitoring and reporting;
3) The ESC plan will include inspection, sampling for total suspended solids at all outlets from the site, and reporting of results; and,
4) Remedial action to correct deficiencies of erosion and sediment control practices and facilities may be required based on either inspection or sampling results.

Stormwater Management Facility Monitoring

1) Stormwater management (SWM) facilities constructed in the conveyance system and at the end-of-pipe will be included in the monitoring program, which applies to the period prior to the assumption of the facilities by the Town. The monitoring plan will include monitoring of the receiving system for the effectiveness of the stormwater management facilities at the location of the outfall for the purpose of water quality monitoring, and at a location or locations to be determined through the EIR for the purpose of erosion control. Monitoring will follow applicable approved guidelines in effect at the time of development (e.g., Town of Oakville's "*Stormwater Monitoring Guideline North of Dundas Street. Operation, Maintenance and Monitoring of Stormwater Management Ponds*", January 2012). These guidelines will replace Appendix KK - Stormwater Pond Monitoring Protocol from the Subwatershed Study. The Town of Oakville and Conservation Authority will consult with the North Oakville landowners in the preparation of such guidelines. Monitoring requirements will be reflected in subdivision agreements;
2) Privately owned SWM facilities are not included in this mediation document and will be subject to site specific requirements at the time of application;
3) All SWM facilities to be assumed by the Town will be monitored by the owner for design conformance, maintenance of function and hydraulic performance. Monitoring and reporting plans are to be reviewed and approved by the Town;
4) Facilities with water quality function(s) will be monitored by the owner for performance in meeting the specific pond design target for total suspended solids (80% removal). Total phosphorus and temperature sampling will also be required. Temperature monitoring should be according to the OMB mediation dated July 12, 2007, as well as any other commitments/criteria required through permits and/or approvals obtained during detail design (e.g., *Guidance for Development Activities in Redside Dace Protected Habitat,* 2016); and,
5) Facilities subject to *Ontario Water Resources Act* approval may be required to do additional monitoring as a condition of the Certificate of Approval.

Monitoring of Modified Streams

1) A multidisciplinary monitoring program approved by the Town and CH will be implemented for all stream modifications. The monitoring program will be implemented by the proponent of the stream modification; and,

2) Notwithstanding Principle 1 immediately above, additional monitoring associated with Fisheries and Oceans Canada (DFO) approvals under the federal *Fisheries Act* may be required and shall be the responsibility of the proponent.

Monitoring in Relation to Stormwater Management Works, Municipal Services and Trails Installed by an Owner within the Natural Heritage System

In addition to items identified in the three sub-sections above:

1) A monitoring program will be implemented for all municipal services such as roads, watermains, sanitary sewers, SWM works or trails within the Natural Heritage System;
2) A monitoring program approved by the Town and CH is to be developed based on the natural features and functions potentially affected by the specific works noted above;
3) The details of the monitoring program are to be included in the EIR; and,
4) The monitoring program will be implemented by the landowners installing the stormwater management works, municipal services and trails.

1.4 Proposed Monitoring

Monitoring programs that meet the requirements above will be carried out by the landowner. The monitoring plan will be developed as the plan is advanced in the detailed design stage. The parameters and locations for monitoring shall be developed during the detailed design of the proposed watercourse realignments and SWM facilities. Given the outstanding review of the project under other legislation (e.g., Endangered Species Act (2007), Fisheries Act (1985)) and the potential for specific monitoring requirements that may arise, the finalization of the monitoring plan will be specified as a condition of Draft Plan Approval. This will provide an opportunity to develop a comprehensive monitoring program that will include the various legislative requirements, minimize duplication of effort and avoid proposing monitoring events/parameters that may not be permitted (i.e., fish community sampling in Redside Dace habitat). Furthermore, it will allow for greater certainty as it relates to necessary monitoring as the detail design works progress.

Figures A7.8.1 and A7.8.2 present the proposed monitoring locations under the baseline (pre-construction) and ultimate development conditions.

Erosion and Sediment Control

The Erosion and Sediment Control Plan (ESC Plan) will be developed in advance of any site alteration work and will follow the requirements set out in the "*Site Alteration: Erosion and Sediment Controls. Permit Procedures and Guidelines*" (Town of Oakville, February 2013) and the "*Erosion & Sediment Control Guidelines for Urban Construction*" (Greater Golden Horseshoe Conservation Authorities, December 2006). The ESC Plan will include the following elements:

- ESC measures to be implanted at the site including types of measures with construction details, their locations, timing of installation of these measures;
- Spill Control and Response Plan;
- Inspections and Performance Monitoring Plan, including identifying responsibilities for inspections, maintenance and repair of the ESC measures, and for taking remedial actions if ESC measures are found to be not working as planned; and,

- Reporting requirements.

Stormwater Management Facilities

Two SWM facilities (SWM facilities 2 & 3) are proposed between Dundas Street and the Burnhamthorpe Road Extension to control post-development peak flows to prescribed rates, as well as, provide water quality treatment and erosion control in the receiving watercourses. The Town has issued monitoring guidelines for stormwater management facilities north of Dundas Street (January 2012) including details on operation, maintenance and monitoring. SWM facilities 2 & 3 have been designed to allow for monitoring, inspection and maintenance according to the Town guidelines, including design conformance, inspection, functionality and sediment accumulation. Full access is available from public rights of way to the applicable sampling locations.

A detailed sampling and monitoring program will be developed at the time of detailed design and will include an estimate of costs, as well as, defining the frequency and duration of the monitoring.

Note that as indicated in the OMB mediation dated July 12, 2007, discharge temperatures for stormwater management facilities connected to coldwater streams should be below 20°C and have dissolved oxygen concentrations of at least six milligrams per litre. These thresholds represent temperature and oxygen conditions suitable to support for Redside Dace. Therefore, temperature monitoring will also be incorporated in the detailed monitoring program.

Modified Stream Monitoring, Reach 14W-22, Reach 14W-23 and Reach 14W-12A

Reach 14W-22 and Reach 14W-23 are proposed to be realigned using natural channel design principles. These realigned reaches will be monitored from a hydraulic, as well as, an ecological perspective following the completion of construction. Given that Reach 14W-12A will be maintained, it will only be monitored from an ecological perspective. The following provides a conceptual approach to the monitoring program that will apply to the realigned reaches and Reach 14W-12A. The final details of the plan will be developed as the design progresses and as other agencies (i.e., Ministry of Natural Resources and Forestry (MNRF), DFO) provide input in order that the program is comprehensive and adheres to potential restriction associated with other legislation (i.e., *Endangered Species Act* (2007)) while avoiding duplicated efforts.

Monitoring will be initiated within a Baseline Monitoring period with a minimum of one monitoring event within two years of the realignment works. The baseline data will be combined with all previous data collected during previous site investigations. Post-construction Monitoring of the realigned reaches will commence once the channel diversions are completed for a period of three years. Annual reports will be filed in tabular and graphical form with remedial measures or additional enhancements recommended to address deficiencies (if any) provided.

Specifically related to Reach 14W-22, a commitment will be made to ensure the desired ecological function has been obtained and that if this reach is not functioning as intended, the reach will be revisited to undertake the necessary remedial measures required to ensure the desired function.

Hydraulic Monitoring

For the hydraulic component, the Baseline Monitoring period consists of the period immediately prior to/after connection of the realigned channel to the active upstream and downstream reaches; however, prior to the first spring freshet. Post-construction Monitoring will continue once per year for three years following Baseline Monitoring. The intent of the Post-construction Monitoring is to provide annual comparisons and inspections of the affected reaches. This will provide a determination of stream widening, aggradation or erosion processes have been accelerated by development.

The proposed monitoring of the hydraulic function of these systems will examine the channel cross-section in the area beneath a standard elevation (to be determined at detailed design). Cross-sections will be established at 2 set locations within Reach 14W-22 (upstream and downstream of Avenue One) and 1 set location within Reach 14W-23. Baseline monitoring is also proposed within Reaches 14W-12 and 14W-16 to establish a pre-development rate of stream widening, if any. Any evidence of erosive stress including downcutting, slumping or other soil failures, exposed vegetation root mass, and channel bar formation will also be documented during monitoring.

Ecology Monitoring

The timing of monitoring events will be set by acceptable protocols (e.g., Marsh Monitoring Protocol). Set Baseline Monitoring stations will be located at/in close proximity to stations established in support of the EIR (where possible). This will provide the opportunity to build upon existing data thereby providing greater context to the post-construction monitoring results.

In general, the proposed monitoring program will examine the function of the realigned reaches as fish habitat, benthic macroinvertebrate habitat, examination of the vegetation community within the riparian habitat (specimen survival and ground cover establishment), as well as, the function of the floodplain as habitat for anurans. There will also be specific temperature monitoring related to the discharging of flows from SMW facilities to Reach 14W-12 with the outflow temperature target being 20^{o}C.

The extent of the owners' participation in the monitoring of the aquatic habitat and community is currently unclear given the classification of Reach 14W-11A, Reach 14W-12A and Reach 14W-14 as Redside Dace Contributing habitat. Typically the MNRF will restrict in-water sampling within Redside Dace habitat and will often not issue the required licence(s). The outcome of post-construction monitoring requires further discussion with the MNRF given the habitat classification and the additional approvals that are anticipated as part of the *Endangered Species Act* (2007) review process.

Based on previous discussions with the DFO related to the proposed watercourse realignment, a *Fisheries Act* (1985) Authorization is not anticipated, and as such, additional monitoring as a requirement of the Act is unlikely. As the design progresses, the DFO will be consulted and in the event that additional monitoring is required, it will be undertaken by the owners.

Subject to the agency approvals and requirements as indicated above, the proposed ecological monitoring is anticipated to generally consist of the following components as identified in Table A7.8.1 below, with potential monitoring locations shown on Figures A7.8.1 and A7.8.2.

Table A7.8.1 - Anticipated Ecological Monitoring Components

Monitoring Event	Protocol	Spring	Summer	Fall	Reach
Vegetation	Ecological Land Classification (ELC)	*	*		14W-22 14W-23
Birds	Breeding Bird Survey (BBS)	*			14W-22 14W-23
Anurans	Marsh Monitoring Protocol (MMP)	*			14W-22 14W-23
Fish Habitat and Community	Ontario Stream Assessment Protocol (select module(s))	*			14W-12A 14W-22 14W-23
Benthic Macroinvertebrates	Ontario Benthos Biomonitoring Network (OBBN)	*			14W-12A 14W-22 14W-23

The ecological component of the Monitoring Report will generally consist of the following based on agency approval:

- Description of the existing conditions documented in accordance with the aforementioned protocols.
- Photographic record, with photos taken from the same location and vantage point year after year.
- Assessment of the current year's results with previous years/baseline.
- Recommendations for adjustments to mitigation measures and/or remedial works to address efficiencies (if any). Recommendations to the monitoring measure and/or remedial works will be forwarded to the landowner following the monitoring events in the event that these works must be undertaken during specific timing windows (e.g., fisheries in-water timing windows).

Additional monitoring parameters and/or reporting schedule may be required following the review of the proposed works by the regulatory agencies and if required will be undertaken by the owners. For instance, CH has indicated that benthic macroinvertebrate sampling be undertaken in the spring, a minimum of two weeks before the fish community surveys are undertaken. This monitoring parameter will be included into the final monitoring plan.

Groundwater Monitoring

A groundwater monitoring program will be undertaken using a well network constructed within the Natural Heritage System Lands as shown on Figures A7.8.1 and A7.8.2. Existing monitoring wells and mini-piezometers constructed for use with the EIR/FSS studies and located within the NHS will be retained (eight monitoring well locations, four mini-piezometer locations). It is also proposed to construct monitoring wells at four additional locations as shown on the figure, with two monitoring well nests to be constructed within the proposed diversion Reach 14W-22, and two monitoring well nests at Reach 14W-12A. Stream channel mini-piezometers are also proposed nearby the proposed monitoring well locations along the proposed

diversion Reach 14W-22 and at Reach 14W-12A. The monitoring wells and mini-piezometers proposed along the diversion reaches would be constructed in coordination with the channel re-alignment construction.

Three channel monitoring points are proposed in the area of Reach 14W-12A that will monitor watercourse levels and temperatures. They will be located next to existing or proposed monitoring stations, with one to be located next to mini-piezometer MP-24 in the small channel leading to the existing Farm Pond, one to be located along Reach 14W-12A at the proposed monitoring station, upstream of the proposed confluence with Reach 14W-22, and one along Reach 14W-14 next to monitoring well nest MMM-09-10S/D (Figure A7.8.1). This latter channel monitor would be moved into Reach 14W-22 after completion of the channel realignments in the future (see Figure A7.8.2).

Monitoring of the infiltration trenches is also proposed at two locations (see Figure A7.8.2). The locations for the trench monitors have been selected to coincide with groundwater monitoring stations downslope (i.e., downgradient) of the infiltration trenches to monitor the effectiveness of these mitigative measures in maintaining shallow overburden groundwater contributions to the watercourses.

Monitoring is proposed at quarterly intervals (spring, summer, fall, winter) with manual measurements recorded at each monitoring location. Data loggers will be installed at selected wells and at the infiltration trenches set to record at hourly intervals and these units will be uploaded at the time of the quarterly events. The groundwater monitoring data will be used to support the other monitoring data collected at the Subject Property and the groundwater monitoring program would continue for up to 3 years following the construction of the realigned channels.

In addition, monitoring of the effectiveness of the infiltration trenches will be performed after major rain events, after a rainfall event of 30 mm or greater. A data logger will be installed at the inlet pipe to each of the monitored infiltration trenches, and at the outlet to the trench, and will be set to monitor temperature and water level fluctuations on an hourly interval and uploaded at the time of quarterly monitoring visits and after significant rainfall events. Water quality samples will also be obtained from the infiltration trenches after significant rainfall events. Total Suspended Solids, Nitrogen, and Phosphorous will be sampled at both the inlet and outlet pipes of the infiltration trenches. As it is not proposed to direct pavement runoff to the infiltration trenches, sampling for salts, and oil and grease is not planned. The configuration of the infiltration trench monitoring and sampling ports would be defined at the time of the detailed design.

Monitoring in Relation to Stormwater Management Works, Municipal Services and Trails Installed within the Natural Heritage System

Reach 14W-16 and Reach 14W-22 will be subject to crossings by roads and municipal servicing (i.e., water mains and sewers). In an effort to minimize encroachments, the municipal servicing has been located within the road right-of-ways.

The proposed road/municipal services crossing of Reach 14W-22 will occur in a realigned reach and is anticipated to be constructed at the same time as the channel works (prior to "tie-in" to the existing watercourse). As a result, the final monitoring program associated with the watercourse realignment (previous section) will include monitoring of this road crossing. Monitoring information prepared for the MNRF (if required) will also be forwarded to the Town and CH for their files.

The proposed road/municipal services crossing of Reach 14W-16 will occur within Redside Dace Occupied habitat and, as a result, it is anticipated that there will be specific monitoring requirements for this crossing issued by the MNRF as part of their review and approval process under the ESA (2007). This will likely include monitoring vegetation survival, as well as, aquatic community and habitat monitoring. Furthermore, permission to undertake in-water monitoring works (e.g., fish community, aquatic habitat, etc.) in Redside Dace Occupied habitat is typically restricted. It is anticipated that the monitoring required by MNRF for the aforementioned parameters will be sufficient to address the Town and CH requirements. Monitoring information prepared for the MNRF will also be forwarded to the Town and CH for their files. As the interests of MNRF required monitoring will likely focus on Redside Dace habitat, additional monitoring for this road crossing will be consistent (where applicable) to the monitoring associated with the reach realignments.

As identified on Figure 5.8, the proposed trail corridors have limited interaction with naturalized areas within the NHS. Monitoring is only necessary in those areas where there are encroachments into these naturalized areas of the NHS. Proposed reach/riparian habitat crossings have been consolidated onto the proposed road/municipal services crossings of Reach 14W-16 and Reach 14W-22 thereby limiting interactions with the NHS. In those limited instance where the trail does encroach into the NHS (principally cultural meadow habitat), the trail alignments have not been finalized. Finalization of the trail alignment will occur once the limits of the NHS have been agreed to by the Town, CH and proponent. The monitoring requirements associated with the trail will be developed as the trail design is complete and is proposed to be undertaken as a condition of Draft Plan approval.

Appendix 8.0

Appendix 8.1 – Wastewater/Sanitary Design Sheets

Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

WASTEWATER ANALYSIS PLAN

HIGHWAY 407

PLANNED 407 TRANSITWAY

TREMAINE ROAD

BRONTE ROAD

EXTERNAL BY OTHERS

DUNDAS STREET

BURNHAMTHORPE ROAD

STREET FOUR

AVENUE ONE

AVENUE TWO

AVENUE THREE

AVENUE FIVE

Block G1-1 5.26 ha
Block G1-2 3.43 ha
Block G2-1 4.76 ha
Block G2-2 3.59 ha
Block G2-3 3.54 ha
Block P1 2.72 ha
Block P2-1 2.61 ha
Block P2-2 3.00 ha
Block P2-3 3.07 ha
Block P2-4 3.54 ha
Block G3-1 1.68 ha
Block G3-1 1.60 ha
Block G3-2 1.33 ha
Block G3 4.01 ha
Block G4 1.82 ha
Block G5-1 2.12 ha
Block G5-2 2.84 ha
Block G5-5 2.69 ha
Block G5-6 2.79 ha
Block C1 3.23 ha
Block C2-1 0.63 ha
Block C2-2 1.06 ha
Block C3-3 1.85 ha
Block C3-4 0.87 ha
Block C3-5 1.96 ha
Block C4-1 1.51 ha
Block C4-2 1.24 ha
Block C4-3 1.56 ha
Block C5-1 1.71 ha
Block C5-2 2.53 ha
Block C6 2.91 ha
Block C7 0.31 ha
Block C8 2.18 ha
Block G6 4.29 ha
Block G7 3.34 ha
Block G8 3.70 ha
Block G9 7.31 ha
Block G10 3.42 ha
Block P3 (E) 7.55 ha
Block P4 11.64 ha
Block P5 3.89 ha
Block P6 3.87 ha
Block P7 (E) 2.43 ha
Block P8 2.79 ha
SWM 1.15 ha
SWM 0.20 ha
SWM 2.49 ha
SWM 3.60 ha
SWM 2.10 ha
SWM 2.37 ha
SWM 1.61 ha
SWM 2.70 ha
NATURAL HERITAGE AREA
NATURAL HERITAGE AREA
NATURAL HERITAGE AREA
NATURAL HERITAGE AREA

MHA1 MHA2 MHA3 MHA4 MHA5 MHA6 MHA7 MHA8
MHB1 MHB2 MHB3 MHB4 MHB5 MHB6 MHB7 MHB8 MHB9 MHB10
MHC1 MHC2 MHC3 MHC4 MHC5
MHD1 MHD2 MHD3 MHD4 MHD6
MHE1 MHE2

300Ø SAN @ 1.0%
300Ø SAN @ 0.7%
300Ø SAN @ 1.4%
300Ø SAN @ 1.2%
300Ø SAN @ 0.5%
300Ø SAN @ 0.8%
300Ø SAN @ 2.5%
375Ø SAN @ 0.5%
375Ø SAN @ 0.7%
600Ø SAN @ 0.5%
450Ø SAN @ 0.5%
450Ø SAN @ 1.25%
300Ø SAN @ 0.5% (IF REQUIRED)
200Ø SAN @ 1.0%
EX 825Ø SAN

50.44 / 5424
56.78 / 6524
2.43 / 304
39.42 / 4540
56.0 / 2170
13.0 / 715

CONNECT TO EXISTING 600Ø ON COLONEL WILLIAM PARKWAY

SAN SEWER FROM MHD4 TO MHD6 NOT REQUIRED FOR OPTION 2.

SERVICING OPTION 2: CONNECT TO EXISTING 300Ø ON VALLEYRIDGE DRIVE.

EX. MH9

LEGEND

- SANITARY SEWER
- SANITARY MANHOLE
- SANITARY DRAINAGE BOUNDARY
- ALTERNATIVE SANITARY SEWER ALIGNMENT
- EXTERNAL SANITARY SEWER (B.O.)
- EXISTING SANITARY SEWER
- 39.40 / 4533 — TRIBUTARY AREA (Ha) / TRIBUTARY POPULATION
- 13.0 / 715 — EXTERNAL TRIBUTARY AREA (Ha) / EXTERNAL TRIBUTARY POPULATION
- FUTURE CULVERT CROSSING
- 407 WEST EMPLOYMENT AREA
- PROPERTY BOUNDARIES

NOTES:

- For the purposes of the analysis land use, natural heritage and storm water sizing and location assumptions have been made for the entire 407 West Employment Area
- Right-of-way requirements for future 407 Transitway to be determined
- The Natural Heritage System on lands owned by others is conceptual, as shown in the North Oakville West Secondary Plan, and is subject to further study.

Scale: 0 100 200 300 400 500m

Client: QuadReal

Prepared by: wsp

Date: AUGUST 2018

Project No.: 1409222.001

FIGURE A-8.1

FILE NAME: X:\DIV10\14-09222\MUN\ASP-FSS Exhibits\APP B1-8.1_Wastewater Analysis Plan.dwg_Fig A-8.1

THE REGIONAL MUNICIPALITY OF HALTON

SANITARY DESIGN SHEET

PROJECT No.: 14-09222
PROJECT NAME: 407 West Employment Area
CONSULTANT: WSP

DATE PRINTED: 24-Aug-18
DATE REVISED: 26-Jul-18
DESIGNED BY: SW
CHECKED BY: AW

Street	Manhole From	Manhole To	Length in metres	Tributary Area (Hectares) Increment Res.	Comm.	Ind.	Inst.	Road	Total	Accumulated Res.	Comm.	Ind.	Inst.	Road	Total	Tributary Population Increment Res.	Comm.	Ind.	Inst.	Total	Accumulated Res.	Comm.	Ind.	Inst.	Total	Q Average L/s	K Average	Peaking Factor M	Q Peak Dry L/s	Total Infil-tration L/s	Q Total L/s	SEWER Size (mm)	Slope (m/m)	Q (L/s)	V (m/s) Full Flow	V (m/s) Act. Flow	REMARKS
Avenue 3-Avenue 2-Burnhamthorpe Road-Dundas Street																																				
Block G1-2	PLUG	A1				3.43			3.43			3.43			3.43			429		429			429		429												
Avenue 3	A1	A2	50			0.00		0.11	0.11			3.43		0.11	3.54			0		0			429		429	1.365	0.80	4.008	4.38	1.01	5.39	300	0.010	96.701	1.37	0.71	
Block G1-1	PLUG	A3				5.26			5.26			5.26			5.26			658		658			658		658												
Avenue 3	A3	A2	150			0.00		0.33	0.33			5.26		0.33	5.59			0		0			658		658	2.093	0.80	3.910	6.55	1.60	8.14	300	0.010	96.701	1.37	0.75	
Block G2-1	PLUG	A2				4.76			4.76			4.76			4.76			595		595			595		595												
Block G3-1	PLUG	A2				1.60			1.60			1.60			1.60			200		200			200		200												
Block C2-1	PLUG	A2				0.63			0.63			0.63			0.63			79		79			79		79												
Avenue 2	A2	A4	380			0.00		0.84	0.84			15.68		1.28	16.96			0		0			1960		1960	6.238	0.80	3.593	17.93	4.85	22.78	300	0.010	96.701	1.37	1.12	
Block G2-2	PLUG	A5				3.59			3.59			3.59			3.59			449		449			449		449												
Block C1	PLUG	A5				3.23			3.23			3.23			3.23			404		404			404		404												
Burnhamthorpe Road	A5	A6	82			0.00		0.47	0.47			6.82		0.47	7.29			0		0			853		853	2.713	0.80	3.844	8.34	2.09	10.43	300	0.010	96.701	1.37	0.86	
Block G2-3	PLUG	A6				3.54			3.54			3.54			3.54			443		443			443		443												
Burnhamthorpe Road	A6	A4	225			0.00		0.59	0.59			10.36		1.06	11.42			0		0			1295		1295	4.122	0.80	3.725	12.28	3.27	15.55	300	0.007	80.906	1.14	0.86	
Block C2-2	PLUG	A7				1.06			1.06			1.06			1.06			133		133			133		133												
Block G4	PLUG	A7				1.80			1.80			1.80			1.80			225		225			225		225												
Burnhamthorpe Road	A7	A4	130			0.00		0.34	0.34			2.86		0.34	3.20			0		0			358		358	1.138	0.80	4.045	3.68	0.91	4.60	300	0.007	80.906	1.14	0.60	
Block G3-1	PLUG	A4				1.68			1.68			1.68			1.68			210		210			210		210												
Block G3-2	PLUG	A4				1.33			1.33			1.33			1.33			166		166			166		166												
Avenue 2	A4	A8	260			0.00		0.57	0.57			31.91		3.24	35.15			0		0			3989		3989	12.696	0.80	3.334	33.87	10.05	43.92	300	0.008	86.492	1.22	1.24	
Block G3	PLUG	A8				4.01			4.01			4.01			4.01			501		501			501		501												
Block C3-3	PLUG	A8				1.85			1.85			1.85			1.85			231		231			231		231												
Block P8	PLUG	A8				2.79			2.79			2.79			2.79			349		349			349		349												
Avenue 2	A8	D2	160			0.00		0.35	0.35			40.56		3.60	44.16			0		0			5070		5070	16.137	0.80	3.239	41.82	12.63	54.45	375	0.005	123.977	1.12	1.08	
External 1	TO	D1		56.00		0.00			56.00	56.00					56.00	2170				2170	2170				2170												
Dundads Street	D1	D2	430			0.00		1.29	1.29	56.00		0.00		1.29	57.29			0		0	2170		0		2170	6.907	1.00	3.558	24.57	16.38	40.96	450	0.005	201.600	1.27	0.96	
															0.00																						
Block C3-4	PLUG	D2				0.87			0.87			0.87			0.87			109		109			109		109												
Block C3-5	PLUG	D2				1.96			1.96			1.96			1.96			245		245			245		245												
Dundas Street	D2	D3	720			0.00		2.16	2.16	56.00		43.39		7.05	106.44			0		0	2170		5424		7594	24.170	0.91	3.072	67.77	30.44	98.22	600	0.005	434.172	1.54	1.24	
															0.00																						

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Street	Manhole From	Manhole To	Length in metres	Tributary Area (Hectares) Increment Res.	Comm.	Ind.	Inst.	Road	Total	Accumulated Res.	Comm.	Ind.	Inst.	Road	Total	Tributary Population Increment Res.	Comm.	Ind.	Inst.	Total	Accumulated Res.	Comm.	Ind.	Inst.	Total	Q Average L/s	K Average	Peaking Factor M	Q Peak Dry L/s	Total Infil-tration L/s	Q Total L/s	SEWER Size (mm)	Slope (m/m)	Q (L/s)	V (m/s) Full Flow	V (m/s) Act. Flow	REMARKS
Avenue 3-Avenue 3-Burnhamthorpe Road																																				
Block P1	PLUG	B1				2.72			2.72			2.72			2.72			340		340			340		340												
Avenue 3	B1	B2	90			0.00		0.20	0.20			2.72		0.20	2.92			0		0			340		340	1.082	0.80	4.055	3.51	0.83	4.34	300	0.007	80.906	1.14	0.55	
Avenue 3	B2	B3	90			0.00		0.20	0.20			2.72		0.40	3.12			0		0			340		340	1.082	0.80	4.055	3.51	0.89	4.40	300	0.020	136.756	1.93	0.79	
Block P2-1	PLUG	B3				2.61			2.61			2.61			2.61			326		326			326		326											
Block P2-2	PLUG	B3				3.00			3.00			3.00			3.00			375		375			375		375											
Block P2-3	PLUG	B3				3.07			3.07			3.07			3.07			384		384			384		384											
Block P2-4	PLUG	B3				3.54			3.54			3.54			3.54			443		443			443		443											
Block G5-5	PLUG	B3				2.69			2.69			2.69			2.69			336		336			336		336											
Block G5-6	PLUG	B3				2.79			2.79			2.79			2.79			349		349			349		349											
Avenue 3	B3	B4	555			0.00		1.22	1.22			20.42		1.62	22.04			0		0			2553		2553	8.124	0.80	3.501	22.75	6.30	29.06	300	0.007	80.906	1.14	1.05	
Block P3	PLUG	B5				7.55			7.55			7.55			7.55			944		944			944		944											
Avenue 1	B5	B4	220			0.00		0.48	0.48			7.55		0.48	8.03			0		0			944		944	3.004	0.80	3.816	9.17	2.30	11.47	300	0.010	96.701	1.37	0.88	
Block C5-2	PLUG	B4				2.53			2.53			2.53			2.53			316		316			316		316											
Block G7	PLUG	B4				3.51			3.51			3.51			3.51			439		439			439		439											
Avenue 3	B4	B6	225			0.00		0.50	0.50			34.01		2.60	36.61			0		0			4251		4251	13.531	0.80	3.310	35.83	10.47	46.29	300	0.007	80.906	1.14	1.19	
Block G5-1	PLUG	B7				2.12			2.12			2.12			2.12			265		265			265		265											
Burnhamthorpe Road	B7	B8	150			0.00		0.39	0.39			2.12		0.39	2.51			0		0			265		265	0.843	0.80	4.101	2.77	0.72	3.49	300	0.012	105.930	1.50	0.61	
Block G5-2	PLUG	B8				2.84			2.84			2.84			2.84			355		355			355		355											
Block C5-1	PLUG	B8				1.71			1.71			1.71			1.71			214		214			214		214											
Burnhamthorpe Road	B8	B6	195			0.00		0.51	0.51			6.67		0.90	7.57			0		0			834		834	2.654	0.80	3.850	8.17	2.16	10.34	300	0.005	68.378	0.97	0.68	
Block C4-1	PLUG	B6				1.51			1.51			1.51			1.51			189		189			189		189											
Avenue 3	B6	B10	135			0.00		0.30	0.30			42.19		3.79	45.98			0		0			5274		5274	16.786	0.80	3.223	43.29	13.15	56.44	375	0.005	123.977	1.12	1.10	
Block C4-2	PLUG	B10				1.24			1.24			1.24			1.24			155		155			155		155											
Block G6	PLUG	B10				4.29			4.29			4.29			4.29			536		536			536		536											
Block C4-3	PLUG	B10				1.56			1.56			1.56			1.56			195		195			195		195											
Block C6	PLUG	B10				2.91			2.91			2.91			2.91			364		364			364		364											
Avenue 3	B10	D3	365			0.00		0.80	0.80			52.19		4.59	56.78			0		0	0		6524		6524	20.764	0.80	3.136	52.09	16.24	68.33	375	0.005	123.977	1.12	1.16	
Avenue One-Avenue Five-Burnhamthorpe Road-Dundas Street																																				
Block P4	PLUG	C1				11.64			11.64			11.64			11.64			1455		1455			1455		1455											
Avenue 1	C1	C2	150			0.00		0.33	0.33			11.64		0.33	11.97			0		0			1455		1455	4.631	0.80	3.689	13.67	3.42	17.09	300	0.025	152.897	2.16	1.36	
Avenue 1	C2	C3	95			0.00		0.21	0.21			11.64		0.54	12.18			0		0			1455		1455	4.631	0.80	3.689	13.67	3.48	17.15	300	0.005	68.378	0.97	0.80	
Block G8	PLUG	C3				3.70			3.70			3.70			3.70			463		463			463		463											
Block G9	PLUG	C3				7.31			7.31			7.31			7.31			914		914			914		914											
Avenue 5	C3	C4	330			0.00		0.86	0.86			22.65		1.40	24.05			0		0			2831		2831	9.012	0.80	3.464	24.97	6.88	31.85	300	0.005	68.378	0.97	0.95	
Block P5	PLUG	C5				3.89			3.89			3.89			3.89			486		486			486		486											
Block P6	PLUG	C5				3.87			3.87			3.87			3.87			484		484			484		484											
Burnhamthorpe Road	C5	C4	235			0.00		0.61	0.61			7.76		0.61	8.37			0		0			970		970	3.087	0.80	3.808	9.41	2.39	11.80	300	0.010	96.701	1.37	0.88	
Block G10	PLUG	C4				3.42			3.42			3.42			3.42			428		428			428		428											
Block C7	PLUG	C4				0.31			0.31			0.31			0.31			39		39			39		39											
Block C8	PLUG	C4				2.18			2.18			2.18			2.18			273		273			273		273											
Avenue 5	C4	D4	420			0.00		1.09	1.09			36.32		3.10	39.42			0		0			4540		4540	14.450	0.80	3.284	37.96	11.27	49.23	300	0.005	68.378	0.97	1.06	
Dundas Street	D4	D6	315			0.00		0.95	0.95			36.32	0.00	4.05	40.37			0		0			4540		4540	14.450	0.80	3.284	37.96	11.54	49.50	450	0.013	318.758	2.00	1.42	
Block P7	PLUG	D6				2.43			2.43			2.43			2.43			304		304			304		304											
Dundas Street	D6	D3	210			0.00		0.63	0.63			38.75	0.00	4.68	43.43			0		0			4844		4844	15.417	0.80	3.258	40.18	12.42	52.60	450	0.005	201.600	1.27	1.06	
Colonel William Parkway	D3	E1	55			0.00		0.14	0.14	56.00	0.00	134.33	0.00	16.46	206.79			0		0	2170	0	16791	0	18961	60.351	0.86	2.676	138.69	59.14	197.83	600	0.005	434.172	1.54	1.50	

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Street	Manhole From	Manhole To	Length in metres	Tributary Area (Hectares) Increment Res.	Comm.	Ind.	Inst.	Road	Total	Accumulated Res.	Comm.	Ind.	Inst.	Road	Total	Tributary Population Increment Res.	Comm.	Ind.	Inst.	Total	Accumulated Res.	Comm.	Ind.	Inst.	Total	Q Average L/s	K Average	Peaking Factor M	Q Peak Dry L/s	Total Infil-tration L/s	Q Total L/s	SEWER Size (mm)	Slope (m/m)	Q (L/s)	V (m/s) Full Flow	V (m/s) Act. Flow	REMARKS
Existing - By Others																																				
Colonel William Parkway	*E1*	*23A*		*0.00*					*0.00*	*56.00*	*0.00*	*134.33*	*0.00*	*16.46*	*206.79*	*0*				*0*	*2170*	*0*	*16791*	*0*	*18961*	*60.351*	*0.86*	*2.676*	*138.69*	*59.14*	*197.83*	*600*	*0.017*	*800.573*	*2.83*	*2.35*	
Colonel William Parkway	*23A*	*22A*		*0.09*					*0.09*	*56.09*	*0.00*	*134.33*	*0.00*	*16.46*	*206.88*	*0*				*0*	*2170*	*0*	*16791*	*0*	*18961*	*60.351*	*0.86*	*2.676*	*138.70*	*59.17*	*197.87*	*600*	*0.017*	*800.573*	*2.83*	*2.35*	
Colonel William Parkway	*22A*	*21A*		*0.11*					*0.11*	*56.20*	*0.00*	*134.33*	*0.00*	*16.46*	*206.99*	*0*				*0*	*2170*	*0*	*16791*	*0*	*18961*	*60.351*	*0.86*	*2.676*	*138.71*	*59.20*	*197.91*	*600*	*0.017*	*800.573*	*2.83*	*2.35*	
Fut. Phase 6	*Plug 4*	*20A*		*4.88*					*4.88*	*4.88*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*659*				*659*	*659*	*0*	*0*	*0*	*659*	*2.098*	*1.00*	*3.910*	*8.20*	*1.40*	*9.60*	*200*	*0.005*	*23.192*	*0.74*	*0.70*	
Colonel William Parkway	*21A*	*20A*		*0.08*					*0.08*	*56.28*	*0.00*	*134.33*	*0.00*	*16.46*	*207.07*	*0*				*0*	*2170*	*0*	*16791*	*0*	*18961*	*60.351*	*0.86*	*2.676*	*138.72*	*59.22*	*197.95*	*600*	*0.017*	*800.573*	*2.83*	*2.35*	
Colonel William Parkway	*20A*	*19A*		*0.00*					*0.00*	*61.16*	*0.00*	*134.33*	*0.00*	*16.46*	*211.95*	*0*				*0*	*2829*	*0*	*16791*	*0*	*19620*	*62.449*	*0.86*	*2.661*	*143.33*	*60.62*	*203.95*	*600*	*0.004*	*363.254*	*1.28*	*1.32*	
Colonel William Parkway	*19A*	*18A*		*0.00*					*0.00*	*61.16*	*0.00*	*134.33*	*0.00*	*16.46*	*211.95*	*0*				*0*	*2829*	*0*	*16791*	*0*	*19620*	*62.449*	*0.86*	*2.661*	*143.33*	*60.62*	*203.95*	*600*	*0.004*	*363.254*	*1.28*	*1.32*	
Colonel William Parkway	*18A*	*17A*		*0.00*					*0.00*	*61.16*	*0.00*	*134.33*	*0.00*	*16.46*	*211.95*	*0*				*0*	*2829*	*0*	*16791*	*0*	*19620*	*62.449*	*0.86*	*2.661*	*143.33*	*60.62*	*203.95*	*600*	*0.004*	*363.254*	*1.28*	*1.32*	
Colonel William Parkway	*17A*	*16A*		*0.00*					*0.00*	*61.16*	*0.00*	*134.33*	*0.00*	*16.46*	*211.95*	*0*				*0*	*2829*	*0*	*16791*	*0*	*19620*	*62.449*	*0.86*	*2.661*	*143.33*	*60.62*	*203.95*	*600*	*0.004*	*363.254*	*1.28*	*1.32*	
Fut. Phase 5B	*Plug 3*	*148A*		*8.84*					*8.84*	*8.84*	*0.00*	*0.00*	*0.00*	*0.00*	*8.84*	*796*				*796*	*796*	*0*	*0*	*0*	*796*	*2.534*	*1.00*	*3.862*	*9.78*	*2.53*	*12.31*	*200*	*0.005*	*23.192*	*0.74*	*0.75*	
Colonel William Parkway	*148A*	*147A*		*0.59*					*0.59*	*9.43*	*0.00*	*0.00*	*0.00*	*0.00*	*9.43*	*32*				*32*	*828*	*0*	*0*	*0*	*828*	*2.635*	*1.00*	*3.851*	*10.15*	*2.70*	*12.85*	*200*	*0.005*	*23.192*	*0.74*	*0.76*	
Colonel William Parkway	*147A*	*141A*		*0.34*					*0.34*	*9.77*	*0.00*	*0.00*	*0.00*	*0.00*	*9.77*	*19*				*19*	*847*	*0*	*0*	*0*	*847*	*2.696*	*1.00*	*3.845*	*10.37*	*2.79*	*13.16*	*200*	*0.005*	*23.192*	*0.74*	*0.77*	
Street A	*145A*	*144A*		*0.76*					*0.76*	*0.76*	*0.00*	*0.00*	*0.00*	*0.00*	*0.76*	*42*				*42*	*42*	*0*	*0*	*0*	*42*	*0.134*	*1.00*	*4.329*	*0.58*	*0.22*	*0.80*	*200*	*0.012*	*35.929*	*1.14*	*0.43*	
Street A	*144A*	*143A*		*0.73*					*0.73*	*1.49*	*0.00*	*0.00*	*0.00*	*0.00*	*1.49*	*40*				*40*	*82*	*0*	*0*	*0*	*82*	*0.261*	*1.00*	*4.266*	*1.11*	*0.43*	*1.54*	*200*	*0.014*	*38.808*	*1.24*	*0.54*	
Street A	*143A*	*142A*		*0.19*					*0.19*	*1.68*	*0.00*	*0.00*	*0.00*	*0.00*	*1.68*	*10*				*10*	*92*	*0*	*0*	*0*	*92*	*0.293*	*1.00*	*4.253*	*1.25*	*0.48*	*1.73*	*200*	*0.015*	*40.170*	*1.28*	*0.56*	
Street A	*142A*	*141A*		*0.37*					*0.37*	*2.05*	*0.00*	*0.00*	*0.00*	*0.00*	*2.05*	*20*				*20*	*112*	*0*	*0*	*0*	*112*	*0.356*	*1.00*	*4.230*	*1.51*	*0.59*	*2.09*	*200*	*0.030*	*56.809*	*1.81*	*0.80*	
Colonel William Parkway	*141A*	*16A*		*0.00*					*0.00*	*11.82*	*0.00*	*0.00*	*0.00*	*0.00*	*11.82*	*0*				*0*	*959*	*0*	*0*	*0*	*959*	*3.052*	*1.00*	*3.812*	*11.63*	*3.38*	*15.02*	*250*	*0.005*	*42.050*	*0.86*	*0.79*	
Colonel William Parkway	*16A*	*15A*		*0.00*					*0.00*	*72.98*	*0.00*	*134.33*	*0.00*	*16.46*	*223.77*	*0*				*0*	*3788*	*0*	*16791*	*0*	*20579*	*65.501*	*0.87*	*2.640*	*150.51*	*64.00*	*214.51*	*600*	*0.004*	*363.254*	*1.28*	*1.35*	
Colonel William Parkway	*15A*	*14A*		*0.00*					*0.00*	*72.98*	*0.00*	*134.33*	*0.00*	*16.46*	*223.77*	*0*				*0*	*3788*	*0*	*16791*	*0*	*20579*	*65.501*	*0.87*	*2.640*	*150.51*	*64.00*	*214.51*	*600*	*0.004*	*363.254*	*1.28*	*1.35*	
Colonel William Parkway	*14A*	*13A*		*0.00*					*0.00*	*72.98*	*0.00*	*134.33*	*0.00*	*16.46*	*223.77*	*0*				*0*	*3788*	*0*	*16791*	*0*	*20579*	*65.501*	*0.87*	*2.640*	*150.51*	*64.00*	*214.51*	*600*	*0.004*	*363.254*	*1.28*	*1.35*	
Colonel William Parkway	*13A*	*Ex. 11A*		*0.00*					*0.00*	*72.98*	*0.00*	*134.33*	*0.00*	*16.46*	*223.77*	*0*				*0*	*3788*	*0*	*16791*	*0*	*20579*	*65.501*	*0.87*	*2.640*	*150.51*	*64.00*	*214.51*	*600*	*0.003*	*341.867*	*1.21*	*1.28*	
Fut. Phase 5A	*Plug 2*	*106A*		*7.30*					*7.30*	*7.30*	*0.00*	*0.00*	*0.00*	*0.00*	*7.30*	*548*				*548*	*548*	*0*	*0*	*0*	*548*	*1.744*	*1.00*	*3.953*	*6.90*	*2.09*	*8.98*	*200*	*0.004*	*20.744*	*0.66*	*0.63*	
Street A	*118A*	*117A*		*0.34*					*0.34*	*0.34*	*0.00*	*0.00*	*0.00*	*0.00*	*0.34*	*19*				*19*	*19*	*0*	*0*	*0*	*19*	*0.060*	*1.00*	*4.383*	*0.27*	*0.10*	*0.36*	*200*	*0.018*	*44.004*	*1.40*	*0.42*	
Street A	*117A*	*116A*		*0.23*					*0.23*	*0.57*	*0.00*	*0.00*	*0.00*	*0.00*	*0.57*	*13*				*13*	*32*	*0*	*0*	*0*	*32*	*0.102*	*1.00*	*4.350*	*0.44*	*0.16*	*0.61*	*200*	*0.011*	*34.399*	*1.09*	*0.42*	
Street A	*116A*	*115A*		*0.75*					*0.75*	*1.32*	*0.00*	*0.00*	*0.00*	*0.00*	*1.32*	*41*				*41*	*73*	*0*	*0*	*0*	*73*	*0.232*	*1.00*	*4.279*	*0.99*	*0.38*	*1.37*	*200*	*0.012*	*35.929*	*1.14*	*0.50*	
Street A	*115A*	*114A*		*0.65*					*0.65*	*1.97*	*0.00*	*0.00*	*0.00*	*0.00*	*1.97*	*36*				*36*	*109*	*0*	*0*	*0*	*109*	*0.347*	*1.00*	*4.233*	*1.47*	*0.56*	*2.03*	*200*	*0.013*	*37.396*	*1.19*	*0.57*	
Street A	*114A*	*113A*		*0.47*					*0.47*	*2.44*	*0.00*	*0.00*	*0.00*	*0.00*	*2.44*	*26*				*26*	*135*	*0*	*0*	*0*	*135*	*0.430*	*1.00*	*4.206*	*1.81*	*0.70*	*2.50*	*200*	*0.011*	*34.399*	*1.09*	*0.59*	
Street A	*113A*	*112A*		*0.24*					*0.24*	*2.68*	*0.00*	*0.00*	*0.00*	*0.00*	*2.68*	*13*				*13*	*148*	*0*	*0*	*0*	*148*	*0.471*	*1.00*	*4.193*	*1.98*	*0.77*	*2.74*	*200*	*0.012*	*35.929*	*1.14*	*0.63*	
Street A	*112A*	*111A*		*0.18*					*0.18*	*2.86*	*0.00*	*0.00*	*0.00*	*0.00*	*2.86*	*10*				*10*	*158*	*0*	*0*	*0*	*158*	*0.503*	*1.00*	*4.184*	*2.10*	*0.82*	*2.92*	*200*	*0.010*	*32.798*	*1.04*	*0.61*	
Street A	*111A*	*106A*		*0.22*					*0.22*	*3.08*	*0.00*	*0.00*	*0.00*	*0.00*	*3.08*	*12*				*12*	*170*	*0*	*0*	*0*	*170*	*0.541*	*1.00*	*4.173*	*2.26*	*0.88*	*3.14*	*200*	*0.025*	*51.859*	*1.65*	*0.86*	
Fut. Phase 5A	*Plug 1*	*106A*		*1.97*					*1.97*	*1.97*	*0.00*	*0.00*	*0.00*	*0.00*	*1.97*	*108*				*108*	*108*	*0*	*0*	*0*	*108*	*0.344*	*1.00*	*4.234*	*1.46*	*0.56*	*2.02*	*200*	*0.032*	*58.672*	*1.87*	*0.77*	
Street B	*106A*	*101A*		*0.18*					*0.18*	*12.53*	*0.00*	*0.00*	*0.00*	*0.00*	*12.53*	*0*				*0*	*826*	*0*	*0*	*0*	*826*	*2.629*	*1.00*	*3.852*	*10.13*	*3.58*	*13.71*	*200*	*0.004*	*20.744*	*0.66*	*0.71*	
Colonel William Parkway	*104A*	*103A*		*0.98*					*0.98*	*0.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.98*	*54*				*54*	*54*	*0*	*0*	*0*	*54*	*0.172*	*1.00*	*4.308*	*0.74*	*0.28*	*1.02*	*200*	*0.011*	*34.399*	*1.09*	*0.45*	
Colonel William Parkway	*103A*	*102A*		*0.33*					*0.33*	*1.31*	*0.00*	*0.00*	*0.00*	*0.00*	*1.31*	*18*				*18*	*72*	*0*	*0*	*0*	*72*	*0.229*	*1.00*	*4.280*	*0.98*	*0.37*	*1.36*	*200*	*0.010*	*32.798*	*1.04*	*0.46*	
Colonel William Parkway	*102A*	*101A*		*0.15*					*0.15*	*1.46*	*0.00*	*0.00*	*0.00*	*0.00*	*1.46*	*8*				*8*	*80*	*0*	*0*	*0*	*80*	*0.255*	*1.00*	*4.269*	*1.09*	*0.42*	*1.50*	*200*	*0.010*	*32.798*	*1.04*	*0.50*	
Colonel William Parkway	*101A*	*100A*		*0.19*					*0.19*	*14.18*	*0.00*	*0.00*	*0.00*	*0.00*	*14.18*	*10*				*10*	*916*	*0*	*0*	*0*	*916*	*2.916*	*1.00*	*3.824*	*11.15*	*4.06*	*15.21*	*200*	*0.004*	*20.744*	*0.66*	*0.73*	
Colonel William Parkway	*100A*	*Ex. 12A*		*0.41*					*0.41*	*14.59*	*0.00*	*0.00*	*0.00*	*0.00*	*14.59*	*23*				*23*	*939*	*0*	*0*	*0*	*939*	*2.989*	*1.00*	*3.817*	*11.41*	*4.17*	*15.58*	*200*	*0.005*	*22.959*	*0.73*	*0.79*	
Colonel William Parkway	*Ex. 12A*	*Ex. 11A*		*0.00*					*0.00*	*14.59*	*0.00*	*0.00*	*0.00*	*0.00*	*14.59*	*0*				*0*	*939*	*0*	*0*	*0*	*939*	*2.989*	*1.00*	*3.817*	*11.41*	*4.17*	*15.58*	*200*	*0.009*	*31.288*	*1.00*	*1.00*	
Colonel William Parkway	*Ex. 11A*	*Ex. 10A*		*0.00*					*0.00*	*87.57*	*0.00*	*134.33*	*0.00*	*16.46*	*238.36*	*0*				*0*	*4727*	*0*	*16791*	*0*	*21518*	*68.490*	*0.88*	*2.621*	*157.75*	*68.17*	*225.92*	*600*	*0.006*	*455.363*	*1.61*	*1.61*	
Old Bronte Road External - By Others																																				
External 2	TO	E2		13.00					13.00	13.00					13.00	715				1635	715				715												
Old Bronte Road	E2	EX. MH9	415			0.00		1.25	1.25	13.00		0.00	0.00	1.25	14.25				0	0	715				715	2.276	1.00	3.889	8.85	4.07	12.93	200	0.010	32.798	1.04		

Existing Sewer built by others
External Sewer to be built by others

THE REGIONAL MUNICIPALITY OF HALTON

SANITARY DESIGN SHEET

OPTION 2

PROJECT No.: 14-09222

PROJECT NAME: 407 West Employment Area

CONSULTANT: WSP

DATE PRINTED: 24-Aug-18

DATE REVISED: 26-Jul-18

DESIGNED BY: SW

CHECKED BY: AW

Street	Manhole From	Manhole To	Length in metres	Tributary Area (Hectares) Increment Res.	Comm.	Ind.	Inst.	Road	Total	Accumulated Res.	Comm.	Ind.	Inst.	Road	Total	Tributary Population Increment Res.	Comm.	Ind.	Inst.	Total	Accumulated Res.	Comm.	Ind.	Inst.	Total	Q Average L/s	K Average	Peaking Factor M	Q Peak Dry L/s	Total Infil-tration L/s	Q Total L/s	SEWER Size (mm)	Slope (m/m)	Q (L/s)	V (m/s) Full Flow	V (m/s) Act. Flow	REMARKS
Avenue 3-Avenue 2-Burnhamthorpe Road-Dundas Street																																				
Block G1-2	PLUG	A1				3.43			3.43			3.43			3.43			429		429			429		429												
Avenue 3	A1	A2	50			0.00		0.11	0.11			3.43		0.11	3.54			0		0			429		429	1.365	0.80	4.008	4.38	1.01	5.39	300	0.010	96.701	1.37	0.71	
Block G1-1	PLUG	A3				5.26			5.26			5.26			5.26			658		658			658		658												
Avenue 3	A3	A2	150			0.00		0.33	0.33			5.26		0.33	5.59			0		0			658		658	2.093	0.80	3.910	6.55	1.60	8.14	300	0.010	96.701	1.37	0.75	
Block G2-1	PLUG	A2				4.76			4.76			4.76			4.76			595		595			595		595												
Block G3-1	PLUG	A2				1.60			1.60			1.60			1.60			200		200			200		200												
Block C2-1	PLUG	A2				0.63			0.63			0.63			0.63			79		79			79		79												
Avenue 2	A2	A4	380			0.00		0.84	0.84			15.68		1.28	16.96			0		0			1960		1960	6.238	0.80	3.593	17.93	4.85	22.78	300	0.010	96.701	1.37	1.12	
Block G2-2	PLUG	A5				3.59			3.59			3.59			3.59			449		449			449		449												
Block C1	PLUG	A5				3.23			3.23			3.23			3.23			404		404			404		404												
Burnhamthorpe Road	A5	A6	82			0.00		0.47	0.47			6.82		0.47	7.29			0		0			853		853	2.713	0.80	3.844	8.34	2.09	10.43	300	0.010	96.701	1.37	0.86	
Block G2-3	PLUG	A6				3.54			3.54			3.54			3.54			443		443			443		443												
Burnhamthorpe Road	A6	A4	225			0.00		0.59	0.59			10.36		1.06	11.42			0		0			1295		1295	4.122	0.80	3.725	12.28	3.27	15.55	300	0.007	80.906	1.14	0.86	
Block C2-2	PLUG	A7				1.06			1.06			1.06			1.06			133		133			133		133												
Block G4	PLUG	A7				1.82			1.82			1.82			1.82			228		228			228		228												
Burnhamthorpe Road	A7	A4	130			0.00		0.34	0.34			2.88		0.34	3.22			0		0			360		360	1.146	0.80	4.043	3.71	0.92	4.63	300	0.007	80.906	1.14	0.60	
Block G3-1	PLUG	A4				1.68			1.68			1.68			1.68			210		210			210		210												
Block G3-2	PLUG	A4				1.33			1.33			1.33			1.33			166		166			166		166												
Avenue 2	A4	A8	260			0.00		0.57	0.57			31.93		3.24	35.17			0		0			3991		3991	12.704	0.80	3.334	33.89	10.06	43.94	300	0.008	86.492	1.22	1.24	
Block G3	PLUG	A8				4.01			4.01			4.01			4.01			501		501			501		501												
Block C3-3	PLUG	A8				1.85			1.85			1.85			1.85			231		231			231		231												
Block P8	PLUG	A8				2.79			2.79			2.79			2.79			349		349			349		349												
Avenue 2	A8	D2	160			0.00		0.35	0.35			40.58		3.60	44.18			0		0			5073		5073	16.145	0.80	3.239	41.84	12.63	54.47	375	0.005	123.977	1.12	1.08	
External 1	TO	D1		56.00		0.00			56.00	56.00					56.00	2170				2170	2170				2170												
Dundas Street	D1	D2	430			0.00		1.29	1.29	56.00		0.00		1.29	57.29			0		0	2170		0		2170	6.907	1.00	3.558	24.57	16.38	40.96	450	0.005	201.600	1.27	0.96	
															0.00																						
Block C3-4	PLUG	D2				0.87			0.87			0.87			0.87			109		109			109		109												
Block C3-5	PLUG	D2				1.96			1.96			1.96			1.96			245		245			245		245												
Dundas Street	D2	D3	720			0.00		2.16	2.16	56.00		43.41		7.05	106.46			0		0	2170		5426		7596	24.178	0.91	3.072	67.79	30.45	98.24	600	0.005	434.172	1.54	1.24	
															0.00																						

THE REGIONAL MUNICIPALITY OF HALTON

SANITARY DESIGN SHEET

OPTION 2

PROJECT No.: 14-09222

PROJECT NAME: 407 West Employment Area

CONSULTANT: WSP

DATE PRINTED: 24-Aug-18

DATE REVISED: 26-Jul-18

DESIGNED BY: SW

CHECKED BY: AW

Street	Manhole From	Manhole To	Length in metres	Tributary Area (Hectares) Increment Res.	Comm.	Ind.	Inst.	Road	Total	Accumulated Res.	Comm.	Ind.	Inst.	Road	Total	Tributary Population Increment Res.	Comm.	Ind.	Inst.	Total	Accumulated Res.	Comm.	Ind.	Inst.	Total	Q Average L/s	K Average	Peaking Factor M	Q Peak Dry L/s	Total Infil-tration L/s	Q Total L/s	SEWER Size (mm)	Slope (m/m)	Q (L/s)	V (m/s) Full Flow	V (m/s) Act. Flow	REMARKS
Avenue 3-Avenue 3-Burnhamthorpe Road																																				
Block P1	PLUG	B1				2.72			2.72			2.72			2.72			340		340			340		340												
Avenue 3	B1	B2	90			0.00		0.20	0.20			2.72		0.20	2.92			0		0			340		340	1.082	0.80	4.055	3.51	0.83	4.34	300	0.007	80.906	1.14	0.55	
Avenue 3	B2	B3	90			0.00		0.20	0.20			2.72		0.40	3.12			0		0			340		340	1.082	0.80	4.055	3.51	0.89	4.40	300	0.020	136.756	1.93	0.79	
Block P2-1	PLUG	B3				2.61			2.41			2.61			2.61			326		326			326		326											
Block P2-2	PLUG	B3				3.00			3.06			3.00			3.00			375		375			375		375											
Block P2-3	PLUG	B3				3.07			3.11			3.07			3.07			384		384			384		384											
Block P2-4	PLUG	B3				3.54			3.58			3.54			3.54			443		443			443		443											
Block G5-5	PLUG	B3				2.69			2.69			2.69			2.69			336		336			336		336											
Block G5-6	PLUG	B3				2.79			2.79			2.79			2.79			349		349			349		349											
Avenue 3	B3	B4	555			0.00		1.22	1.22			20.42		1.62	22.04			0		0			2553		2553	8.124	0.80	3.501	22.75	6.30	29.06	300	0.007	80.906	1.14	1.05	
Block P3	PLUG	B5				7.55			7.55			7.55			7.55			944		944			944		944											
Avenue 1	B5	B4	220			0.00		0.48	0.48			7.55		0.48	8.03			0		0			944		944	3.004	0.80	3.816	9.17	2.30	11.47	300	0.005	68.378	0.97	0.70	
Block C5-2	PLUG	B4				2.53			2.53			2.53			2.53			316		316			316		316											
Block G7	PLUG	B4				3.51			3.51			3.51			3.51			439		439			439		439											
Avenue 3	B4	B6	225			0.00		0.50	0.50			34.01		2.60	36.61			0		0			4251		4251	13.531	0.80	3.310	35.83	10.47	46.29	300	0.005	68.378	0.97	1.04	
Block G5-1	PLUG	B7				2.12			2.12			2.12			2.12			265		265			265		265											
Burnhamthorpe Road	B7	B8	150			0.00		0.39	0.39			2.12		0.39	2.51			0		0			265		265	0.843	0.80	4.101	2.77	0.72	3.49	300	0.012	105.930	1.50	0.61	
Block G5-2	PLUG	B8				2.84			2.84			2.84			2.84			355		355			355		355											
Block C5-1	PLUG	B8				1.71			1.71			1.71			1.71			214		214			214		214											
Burnhamthorpe Road	B8	B6	195			0.00		0.51	0.51			6.67		0.90	7.57			0		0			834		834	2.654	0.80	3.850	8.17	2.16	10.34	300	0.005	68.378	0.97	0.68	
Block C4-1	PLUG	B6				1.51			1.51			1.51			1.51			189		189			189		189											
Avenue 3	B6	B10	135			0.00		0.30	0.30			42.19		3.79	45.98			0		0			5274		5274	16.786	0.80	3.223	43.29	13.15	56.44	375	0.005	123.977	1.12	1.10	
Block C4-2	PLUG	B10				1.24			1.24			1.24			1.24			155		155			155		155											
Block G6	PLUG	B10				4.29			4.29			4.29			4.29			536		536			536		536											
Block C4-3	PLUG	B10				1.56			1.56			1.56			1.56			195		195			195		195											
Block C6	PLUG	B10				2.91			2.91			2.91			2.91			364		364			364		364											
Avenue 3	B10	D3	365			0.00		0.80	0.80			52.19		4.59	56.78			0		0	0		6524		6524	20.764	0.80	3.136	52.09	16.24	68.33	375	0.005	123.977	1.12	1.16	
Block P7	PLUG	D6				2.43			2.43			2.43			2.43			304		304			304		304											
Dundas Street	D6	D3	210			0.00		0.63	0.63			2.43	0.00	0.63	3.06			0		0			304		304	0.967	0.80	4.076	3.15	0.88	4.03	450	0.005	201.600	1.27	0.48	
Colonel William Parkway	D3	E1	55			0.00		0.14	0.14	56.00	0.00	98.03	0.00	12.41	166.44			0		0	2170	0	12254	0	14424	45.909	0.87	2.795	112.00	47.60	159.60	600	0.005	434.172	1.54	1.43	
Avenue One-Avenue Five-Burnhamthorpe Road-Dundas Street																																				
Block P4	PLUG	C1				11.64			11.64			11.64			11.64			1455		1455			1455		1455											
Avenue 1	C1	C2	150			0.00		0.33	0.33			11.64		0.33	11.97			0		0			1455		1455	4.631	0.80	3.689	13.67	3.42	17.09	300	0.025	152.897	2.16	1.36	
Avenue 1	C2	C3	95			0.00		0.21	0.21			11.64		0.54	12.18			0		0			1455		1455	4.631	0.80	3.689	13.67	3.48	17.15	300	0.005	68.378	0.97	0.80	
Block G8	PLUG	C3				3.70			3.70			3.70			3.70			463		463			463		463											
Block G9	PLUG	C3				7.31			7.31			7.31			7.31			914		914			914		914											
Avenue 5	C3	C4	330			0.00		0.86	0.86			22.65		1.40	24.05			0		0			2831		2831	9.012	0.80	3.464	24.97	6.88	31.85	300	0.005	68.378	0.97	0.95	
Block P5	PLUG	C5				3.89			3.89			3.89			3.89			486		486			486		486											
Block P6	PLUG	C5				3.87			3.87			3.87			3.87			484		484			484		484											
Burnhamthorpe Road	C5	C4	235			0.00		0.61	0.61			7.76		0.61	8.37			0		0			970		970	3.087	0.80	3.808	9.41	2.39	11.80	300	0.010	96.701	1.37	0.88	
Block G10	PLUG	C4				3.42			3.42			3.42			3.42			428		428			428		428											
Block C7	PLUG	C4				0.31			0.31			0.31			0.31			39		39			39		39											
Block C8	PLUG	C4				2.18			2.18			2.18			2.18			273		273			273		273											
Avenue 5	C4	D4	420			0.00		1.09	1.09			36.32		3.10	39.42			0		0			4540		4540	14.450	0.80	3.284	37.96	11.27	49.23	300	0.005	68.378	0.97	1.06	
Dundas Street	D4	EX. VALLEY-RIDGE	50			0.00		0.15	0.15			36.32	0.00	3.25	39.57			0		0			4540		4540	14.450	0.80	3.284	37.96	11.32	49.28	450	0.013	318.758	2.00	1.40	

THE REGIONAL MUNICIPALITY OF HALTON

SANITARY DESIGN SHEET

OPTION 2

PROJECT No.: 14-09222
PROJECT NAME: 407 West Employment Area
CONSULTANT: WSP

DATE PRINTED: 24-Aug-18
DATE REVISED: 26-Jul-18
DESIGNED BY: SW
CHECKED BY: AW

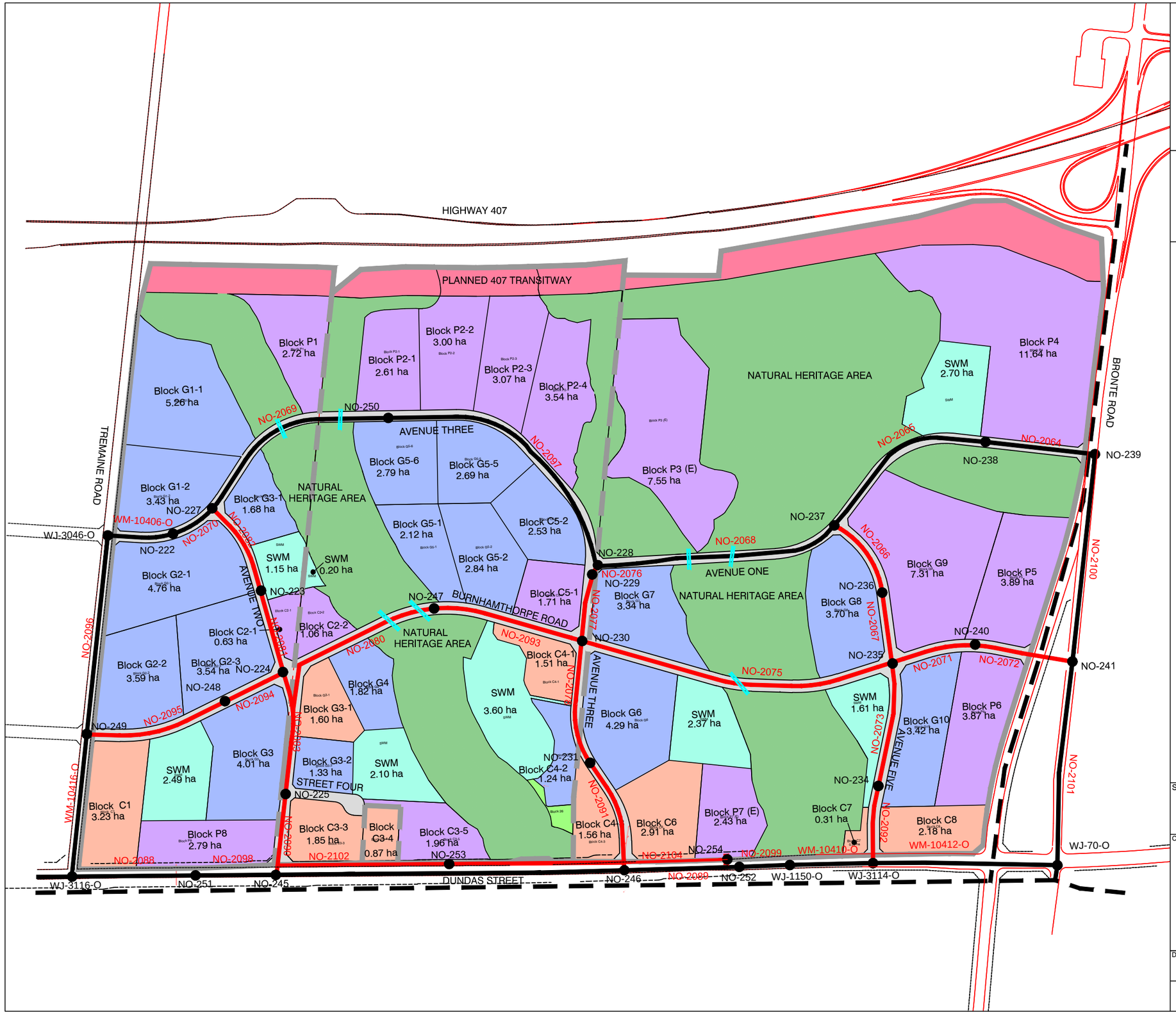
Street	Manhole From	Manhole To	Length in metres	Tributary Area (Hectares) Increment Res.	Comm.	Ind.	Inst.	Road	Total	Accumulated Res.	Comm.	Ind.	Inst.	Road	Total	Tributary Population Increment Res.	Comm.	Ind.	Inst.	Total	Accumulated Res.	Comm.	Ind.	Inst.	Total	Q Average L/s	K Average	Peaking Factor M	Q Peak Dry L/s	Total Infil-tration L/s	Q Total L/s	SEWER Size (mm)	Slope (m/m)	Q (L/s)	V (m/s) Full Flow	V (m/s) Act. Flow	REMARKS
Existing - By Others																																				
Colonel William Parkway	E1	23A		0.00					0.00	56.00	0.00	98.03	0.00	12.41	166.44	0				0	2170	0	12254	0	14424	45.909	0.87	2.795	112.00	47.60	159.60	600	0.017	800.573	2.83	2.15	
Colonel William Parkway	23A	22A		0.09					0.09	56.09	0.00	98.03	0.00	12.41	166.53	0				0	2170	0	12254	0	14424	45.909	0.87	2.795	112.01	47.63	159.63	600	0.017	800.573	2.83	2.15	
Colonel William Parkway	22A	21A		0.11					0.11	56.20	0.00	98.03	0.00	12.41	166.64	0				0	2170	0	12254	0	14424	45.909	0.87	2.795	112.02	47.66	159.68	600	0.017	800.573	2.83	2.15	
Fut. Phase 6	Plug 4	20A		4.88					4.88	4.88	0.00	0.00	0.00	0.00	4.88	659				659	659	0	0	0	659	2.098	1.00	3.910	8.20	1.40	9.60	200	0.005	23.192	0.74	0.70	
Colonel William Parkway	21A	20A		0.08					0.08	56.28	0.00	98.03	0.00	12.41	166.72	0				0	2170	0	12254	0	14424	45.909	0.87	2.795	112.03	47.68	159.71	600	0.017	800.573	2.83	2.15	
Colonel William Parkway	20A	19A		0.00					0.00	61.16	0.00	98.03	0.00	12.41	171.60	0				0	2829	0	12254	0	15083	48.006	0.88	2.776	116.85	49.08	165.92	600	0.004	363.254	1.28	1.26	
Colonel William Parkway	19A	18A		0.00					0.00	61.16	0.00	98.03	0.00	12.41	171.60	0				0	2829	0	12254	0	15083	48.006	0.88	2.776	116.85	49.08	165.92	600	0.004	363.254	1.28	1.26	
Colonel William Parkway	18A	17A		0.00					0.00	61.16	0.00	98.03	0.00	12.41	171.60	0				0	2829	0	12254	0	15083	48.006	0.88	2.776	116.85	49.08	165.92	600	0.004	363.254	1.28	1.26	
Colonel William Parkway	17A	16A		0.00					0.00	61.16	0.00	98.03	0.00	12.41	171.60	0				0	2829	0	12254	0	15083	48.006	0.88	2.776	116.85	49.08	165.92	600	0.004	363.254	1.28	1.26	
Fut. Phase 5B	Plug 3	148A		8.84					8.84	8.84	0.00	0.00	0.00	0.00	8.84	796				796	796	0	0	0	796	2.534	1.00	3.862	9.78	2.53	12.31	200	0.005	23.192	0.74	0.75	
Colonel William Parkway	148A	147A		0.59					0.59	9.43	0.00	0.00	0.00	0.00	9.43	32				32	828	0	0	0	828	2.635	1.00	3.851	10.15	2.70	12.85	200	0.005	23.192	0.74	0.76	
Colonel William Parkway	147A	141A		0.34					0.34	9.77	0.00	0.00	0.00	0.00	9.77	19				19	847	0	0	0	847	2.696	1.00	3.845	10.37	2.79	13.16	200	0.005	23.192	0.74	0.77	
Street A	145A	144A		0.76					0.76	0.76	0.00	0.00	0.00	0.00	0.76	42				42	42	0	0	0	42	0.134	1.00	4.329	0.58	0.22	0.80	200	0.012	35.929	1.14	0.43	
Street A	144A	143A		0.73					0.73	1.49	0.00	0.00	0.00	0.00	1.49	40				40	82	0	0	0	82	0.261	1.00	4.266	1.11	0.43	1.54	200	0.014	38.808	1.24	0.54	
Street A	143A	142A		0.19					0.19	1.68	0.00	0.00	0.00	0.00	1.68	10				10	92	0	0	0	92	0.293	1.00	4.253	1.25	0.48	1.73	200	0.015	40.170	1.28	0.56	
Street A	142A	141A		0.37					0.37	2.05	0.00	0.00	0.00	0.00	2.05	20				20	112	0	0	0	112	0.356	1.00	4.230	1.51	0.59	2.09	200	0.030	56.809	1.81	0.80	
Colonel William Parkway	141A	16A		0.00					0.00	11.82	0.00	0.00	0.00	0.00	11.82	0				0	959	0	0	0	959	3.052	1.00	3.812	11.63	3.38	15.02	250	0.005	42.050	0.86	0.79	
Colonel William Parkway	16A	15A		0.00					0.00	72.98	0.00	98.03	0.00	12.41	183.42	0				0	3788	0	12254	0	16042	51.059	0.89	2.749	124.26	52.46	176.72	600	0.004	363.254	1.28	1.27	
Colonel William Parkway	15A	14A		0.00					0.00	72.98	0.00	98.03	0.00	12.41	183.42	0				0	3788	0	12254	0	16042	51.059	0.89	2.749	124.26	52.46	176.72	600	0.004	363.254	1.28	1.27	
Colonel William Parkway	14A	13A		0.00					0.00	72.98	0.00	98.03	0.00	12.41	183.42	0				0	3788	0	12254	0	16042	51.059	0.89	2.749	124.26	52.46	176.72	600	0.004	363.254	1.28	1.27	
Colonel William Parkway	13A	Ex. 11A		0.00					0.00	72.98	0.00	98.03	0.00	12.41	183.42	0				0	3788	0	12254	0	16042	51.059	0.89	2.749	124.26	52.46	176.72	600	0.003	341.867	1.21	1.23	
Fut. Phase 5A	Plug 2	106A		7.30					7.30	7.30	0.00	0.00	0.00	0.00	7.30	548				548	548	0	0	0	548	1.744	1.00	3.953	6.90	2.09	8.98	200	0.004	20.744	0.66	0.63	
Street A	118A	117A		0.34					0.34	0.34	0.00	0.00	0.00	0.00	0.34	19				19	19	0	0	0	19	0.060	1.00	4.383	0.27	0.10	0.36	200	0.018	44.004	1.40	0.42	
Street A	117A	116A		0.23					0.23	0.57	0.00	0.00	0.00	0.00	0.57	13				13	32	0	0	0	32	0.102	1.00	4.350	0.44	0.16	0.61	200	0.011	34.399	1.09	0.42	
Street A	116A	115A		0.75					0.75	1.32	0.00	0.00	0.00	0.00	1.32	41				41	73	0	0	0	73	0.232	1.00	4.279	0.99	0.38	1.37	200	0.012	35.929	1.14	0.50	
Street A	115A	114A		0.65					0.65	1.97	0.00	0.00	0.00	0.00	1.97	36				36	109	0	0	0	109	0.347	1.00	4.233	1.47	0.56	2.03	200	0.013	37.396	1.19	0.57	
Street A	114A	113A		0.47					0.47	2.44	0.00	0.00	0.00	0.00	2.44	26				26	135	0	0	0	135	0.430	1.00	4.206	1.81	0.70	2.50	200	0.011	34.399	1.09	0.59	
Street A	113A	112A		0.24					0.24	2.68	0.00	0.00	0.00	0.00	2.68	13				13	148	0	0	0	148	0.471	1.00	4.193	1.98	0.77	2.74	200	0.012	35.929	1.14	0.63	
Street A	112A	111A		0.18					0.18	2.86	0.00	0.00	0.00	0.00	2.86	10				10	158	0	0	0	158	0.503	1.00	4.184	2.10	0.82	2.92	200	0.010	32.798	1.04	0.61	
Street A	111A	106A		0.22					0.22	3.08	0.00	0.00	0.00	0.00	3.08	12				12	170	0	0	0	170	0.541	1.00	4.173	2.26	0.88	3.14	200	0.025	51.859	1.65	0.86	
Fut. Phase 5A	Plug 1	106A		1.97					1.97	1.97	0.00	0.00	0.00	0.00	1.97	108				108	108	0	0	0	108	0.344	1.00	4.234	1.46	0.56	2.02	200	0.032	58.672	1.87	0.77	
Street B	106A	101A		0.18					0.18	12.53	0.00	0.00	0.00	0.00	12.53	0				0	826	0	0	0	826	2.629	1.00	3.852	10.13	3.58	13.71	200	0.004	20.744	0.66	0.71	
Colonel William Parkway	104A	103A		0.98					0.98	0.98	0.00	0.00	0.00	0.00	0.98	54				54	54	0	0	0	54	0.172	1.00	4.308	0.74	0.28	1.02	200	0.011	34.399	1.09	0.45	
Colonel William Parkway	103A	102A		0.33					0.33	1.31	0.00	0.00	0.00	0.00	1.31	18				18	72	0	0	0	72	0.229	1.00	4.280	0.98	0.37	1.36	200	0.010	32.798	1.04	0.46	
Colonel William Parkway	102A	101A		0.15					0.15	1.46	0.00	0.00	0.00	0.00	1.46	8				8	80	0	0	0	80	0.255	1.00	4.269	1.09	0.42	1.50	200	0.010	32.798	1.04	0.50	
Colonel William Parkway	101A	100A		0.19					0.19	14.18	0.00	0.00	0.00	0.00	14.18	10				10	916	0	0	0	916	2.916	1.00	3.824	11.15	4.06	15.21	200	0.004	20.744	0.66	0.73	
Colonel William Parkway	100A	Ex. 12A		0.41					0.41	14.59	0.00	0.00	0.00	0.00	14.59	23				23	939	0	0	0	939	2.989	1.00	3.817	11.41	4.17	15.58	200	0.005	22.959	0.73	0.79	
Colonel William Parkway	Ex. 12A	Ex. 11A		0.00					0.00	14.59	0.00	0.00	0.00	0.00	14.59	0				0	939	0	0	0	939	2.989	1.00	3.817	11.41	4.17	15.58	200	0.009	31.288	1.00	1.00	
Colonel William Parkway	Ex. 11A	Ex. 10A		0.00					0.00	87.57	0.00	98.03	0.00	12.41	198.01	0				0	4727	0	12254	0	16981	54.048	0.89	2.724	131.67	56.63	188.30	600	0.006	455.363	1.61	1.53	
Old Bronte Road External - By Others																																				
External 2	TO	E2		13.00					13.00	13.00					13.00	715				1635	715				715												
Old Bronte Road	E2	EX. MH9	415			0.00		1.25	1.25	13.00		0.00	0.00	1.25	14.25			0		0	715				715	2.276	1.00	3.889	8.85	4.07	12.93	200	0.010	32.798	1.04		

Existing Sewer built by others
External Sewer to be built by others

Appendix 8.2 – Water Analysis

Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

WATER ANALYSIS PLAN



LEGEND

- EXISTING REGIONAL WATERMAIN
- PROPOSED REGIONAL WATERMAIN
- PROPOSED LOCAL WATERMAIN
- WATER ANALYSIS NODE
- FUTURE CULVERT CROSSING
- 407 WEST EMPLOYMENT AREA
- PROPERTY BOUNDARIES

NOTES:

- For the purposes of the analysis land use, natural heritage and storm water sizing and location assumptions have been made for the entire 407 West Employment Area
- Right-of-way requirements for future 407 Transitway to be determined
- The Natural Heritage System on lands owned by others is conceptual, as shown in the North Oakville West Secondary Plan, and is subject to further study.

Scale

0 100 200 300 400 500m

Client: QuadReal

Prepared by: wsp

Date: AUGUST 2018

Project No.: 1409222.001

FIGURE A-8.2

407 West Employment Lands
14-09222
Water Analysis
Maximum Daily Flow - Pipe Report

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)	Status	Total Forward Flow (ML)	Total Reverse Flow (ML)	Total Net Flow (ML)	Flow Reversal Count
NO-2064	NO-239	NO-238	201.06	600	120	14.87	0.05	0	0.01	Open				0
NO-2065	NO-238	NO-237	397.08	600	120	5.2	0.02	0	0	Open				0
NO-2066	NO-237	NO-236	177.95	300	120	5.2	0.07	0.01	0.03	Open				0
NO-2067	NO-236	NO-235	149.93	300	120	-3.94	0.06	0	0.02	Open				0
NO-2068	NO-237	NO-228	538.90	600	120	0	0	0	0	Closed				0
NO-2069	NO-227	NO-250	454.68	600	120	0	0	0	0	Closed				0
NO-2070	NO-222	NO-227	91.03	600	120	7.77	0.03	0	0	Open				0
NO-2071	NO-235	NO-240	179	300	120	-0.72	0.01	0	0	Open				0
NO-2072	NO-240	NO-241	137.52	300	120	-7.16	0.1	0.01	0.06	Open				0
NO-2073	NO-235	NO-234	259.63	300	120	-3.22	0.05	0	0.01	Open				0
NO-2075	NO-235	NO-230	667.9	300	120	0	0	0	0	Closed				0
NO-2076	NO-228	NO-229	8.23	300	120	-6.27	0.09	0	0.04	Open				0
NO-2077	NO-229	NO-230	145.77	300	120	-10.64	0.15	0.02	0.12	Open				0
NO-2078	NO-230	NO-231	261.63	300	120	-8.22	0.12	0.02	0.07	Open				0
NO-2080	NO-247	NO-224	357.76	300	120	-8.77	0.12	0.03	0.08	Open				0
NO-2081	NO-223	NO-224	197.08	300	120	0	0	0	0	Closed				0
NO-2082	NO-227	NO-223	180.27	300	120	7.77	0.11	0.01	0.07	Open				0
NO-2083	NO-224	NO-225	253.2	300	120	-8.77	0.12	0.02	0.08	Open				0
NO-2088	WJ-3116-O	NO-251	257.6	1,200.00	130	-11.75	0.01	0	0	Open				0
NO-2089	NO-246	NO-252	239.94	1,200.00	130	-49.2	0.04	0	0	Open				0
NO-2090	NO-225	NO-245	162.33	300	120	-15.36	0.22	0.04	0.23	Open				0
NO-2091	NO-231	NO-246	235.73	300	120	-17.78	0.25	0.07	0.3	Open				0
NO-2092	NO-234	WJ-3114-O	155.42	300	120	-8.12	0.11	0.01	0.07	Open				0
NO-2093	NO-230	NO-247	318.32	300	120	-2.42	0.03	0	0.01	Open				0
NO-2094	NO-224	NO-248	122.04	300	120	0	0	0	0	Closed				0
NO-2095	NO-249	NO-248	302.87	300	120	28.75	0.41	0.22	0.74	Open				0
NO-2096	NO-249	WJ-3046-O	417.52	600	120	14.57	0.05	0	0.01	Open				0
NO-2097	NO-250	NO-228	595.06	600	120	0	0	0	0	Open				0
NO-2098	NO-251	NO-245	164.44	1,200.00	130	-11.75	0.01	0	0	Open				0
NO-2099	NO-252	WJ-1150-O	144.25	1,200.00	130	-49.2	0.04	0	0	Open				0
NO-2100	NO-239	NO-241	433.99	600.00	120	-14.87	0.05	0	0.01	Open				0
NO-2101	NO-241	WJ-70-O	444.61	600.00	120	-22.03	0.08	0.01	0.02	Open				0
NO-2102	NO-245	NO-253	370.30	300.00	120	0.91	0.01	0	0	Open				0
NO-2103	NO-253	NO-246	365.89	300.00	120	-1.38	0.02	0	0	Open				0
NO-2104	NO-246	NO-254	241.64	150.00	120	2.01	0.11	0.04	0.16	Open				0
WM-10406-O	WJ-3046-O	NO-222	137.39	600	120	14.57	0.05	0	0.01	Open				0
WM-10408-O	NO-245	NO-246	733.46	1,200.00	130	-28.03	0.02	0	0	Open				0
WM-10410-O	WJ-3114-O	WJ-1150-O	139.97	1,200.00	130	59.02	0.05	0	0	Open				0
WM-10416-O	WJ-3116-O	NO-249	294.55	600	120	43.32	0.15	0.02	0.05	Open				0

407 West Employment Lands
14-09222
Water Analysis
Maximum Daily Flow - Junction Report

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
NO-222	6.8	160	196.22	51.49
NO-223	8.19	159	196.21	52.89
NO-224	0	157.8	196.18	54.56
NO-225	6.29	152	196.2	62.84
NO-227	0	159.7	196.22	51.92
NO-228	6.27	152.4	196.13	62.17
NO-229	4.2	152	196.13	62.74
NO-230	0	151.3	196.15	63.76
NO-231	9.56	149	196.17	67.05
NO-234	4.9	153	196.23	61.46
NO-235	0	153.5	196.23	60.74
NO-236	9.14	155	196.22	58.6
NO-237	0	156	196.23	57.19
NO-238	9.67	157	196.23	55.77
NO-239	0	162	196.23	48.66
NO-240	6.44	155	196.23	58.61
NO-241	0	156	196.24	57.2
NO-245	0	153.8	196.24	60.33
NO-246	0	148	196.24	68.58
NO-247	6.52	153	196.15	61.34
NO-248	29.09	157	196	55.44
NO-249	0	158	196.22	54.34
NO-250	0	155	196.13	58.47
NO-251	0	154	196.24	60.05
NO-252	0	147	196.24	70
NO-253	2.36	151	196.24	64.31
NO-254	2.01	147	196.2	69.95
WJ-1150-O	0	152	196.24	62.89
WJ-3046-O	0	159	196.22	52.91
WJ-3114-O	0	152	196.24	62.89
WJ-3116-O	0	157	196.24	55.78

407 West Employment Lands
14-09222
Water Analysis
Peak Daily Flow - Pipe Report

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)	Status	Total Forward Flow (ML)	Total Reverse Flow (ML)	Total Net Flow (ML)	Flow Reversal Count
NO-2064	NO-239	NO-238	201.06	600	120	23.51	0.08	0	0.02	Open				0
NO-2065	NO-238	NO-237	397.08	600	120	8.24	0.03	0	0	Open				0
NO-2066	NO-237	NO-236	177.95	300	120	8.24	0.12	0.01	0.07	Open				0
NO-2067	NO-236	NO-235	149.93	300	120	-6.19	0.09	0.01	0.04	Open				0
NO-2068	NO-237	NO-228	538.90	600	120	0	0	0	0	Closed				0
NO-2069	NO-227	NO-250	454.68	600	120	0	0	0	0	Closed				0
NO-2070	NO-222	NO-227	91.03	600	120	12.27	0.04	0	0.01	Open				0
NO-2071	NO-235	NO-240	179	300	120	-1.19	0.02	0	0	Open				0
NO-2072	NO-240	NO-241	137.52	300	120	-11.36	0.16	0.02	0.13	Open				0
NO-2073	NO-235	NO-234	259.63	300	120	-5	0.07	0.01	0.03	Open				0
NO-2075	NO-235	NO-230	667.9	300	120	0	0	0	0	Closed				0
NO-2076	NO-228	NO-229	8.23	300	120	-9.9	0.14	0.01	0.1	Open				0
NO-2077	NO-229	NO-230	145.77	300	120	-16.8	0.24	0.04	0.27	Open				0
NO-2078	NO-230	NO-231	261.63	300	120	-13.01	0.18	0.04	0.17	Open				0
NO-2080	NO-247	NO-224	357.76	300	120	-13.81	0.2	0.07	0.19	Open				0
NO-2081	NO-223	NO-224	197.08	300	120	0	0	0	0	Closed				0
NO-2082	NO-227	NO-223	180.27	300	120	12.27	0.17	0.03	0.15	Open				0
NO-2083	NO-224	NO-225	253.2	300	120	-13.81	0.2	0.05	0.19	Open				0
NO-2088	WJ-3116-O	NO-251	257.6	1,200.00	130	-39.54	0.03	0	0	Open				0
NO-2089	NO-246	NO-252	239.94	1,200.00	130	-98.67	0.09	0	0.01	Open				0
NO-2090	NO-225	NO-245	162.33	300	120	-24.22	0.34	0.09	0.54	Open				0
NO-2091	NO-231	NO-246	235.73	300	120	-28.1	0.4	0.17	0.71	Open				0
NO-2092	NO-234	WJ-3114-O	155.42	300	120	-12.74	0.18	0.03	0.16	Open				0
NO-2093	NO-230	NO-247	318.32	300	120	-3.79	0.05	0.01	0.02	Open				0
NO-2094	NO-224	NO-248	122.04	300	120	0	0	0	0	Closed				0
NO-2095	NO-249	NO-248	302.87	300	120	45.39	0.64	0.52	1.73	Open				0
NO-2096	NO-249	WJ-3046-O	417.52	600	120	23.01	0.08	0.01	0.02	Open				0
NO-2097	NO-250	NO-228	595.06	600	120	0	0	0	0	Open				0
NO-2098	NO-251	NO-245	164.44	1,200.00	130	-39.54	0.03	0	0	Open				0
NO-2099	NO-252	WJ-1150-O	144.25	1,200.00	130	-98.67	0.09	0	0.01	Open				0
NO-2100	NO-239	NO-241	433.99	600.00	120	-23.51	0.08	0.01	0.02	Open				0
NO-2101	NO-241	WJ-70-O	444.61	600.00	120	-34.87	0.12	0.02	0.04	Open				0
NO-2102	NO-245	NO-253	370.30	300.00	120	1.07	0.02	0	0	Open				0
NO-2103	NO-253	NO-246	365.89	300.00	120	-2.56	0.04	0	0.01	Open				0
NO-2104	NO-246	NO-254	241.64	150.00	120	3.18	0.18	0.09	0.37	Open				0
WM-10406-O	WJ-3046-O	NO-222	137.39	600	120	23.01	0.08	0	0.02	Open				0
WM-10408-O	NO-245	NO-246	733.46	1,200.00	130	-64.83	0.06	0	0	Open				0
WM-10410-O	WJ-3114-O	WJ-1150-O	139.97	1,200.00	130	135.36	0.12	0	0.01	Open				0
WM-10416-O	WJ-3116-O	NO-249	294.55	600	120	68.4	0.24	0.04	0.13	Open				0

407 West Employment Lands
14-09222
Water Analysis
Peak Daily Flow - Junction Report

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
NO-222	10.74	160	190.92	43.96
NO-223	12.93	159	190.89	45.34
NO-224	0	157.8	190.83	46.96
NO-225	9.93	152	190.88	55.27
NO-227	0	159.7	190.92	44.38
NO-228	9.9	152.4	190.71	54.46
NO-229	6.63	152	190.72	55.04
NO-230	0	151.3	190.76	56.09
NO-231	15.09	149	190.8	59.43
NO-234	7.74	153	190.95	53.95
NO-235	0	153.5	190.94	53.23
NO-236	14.43	155	190.94	51.08
NO-237	0	156	190.95	49.68
NO-238	15.27	157	190.95	48.26
NO-239	0	162	190.95	41.16
NO-240	10.17	155	190.94	51.09
NO-241	0	156	190.96	49.7
NO-245	0	153.8	190.97	52.84
NO-246	0	148	190.97	61.09
NO-247	10.29	153	190.76	53.68
NO-248	45.93	157	190.41	47.49
NO-249	0	158	190.93	46.81
NO-250	0	155	190.71	50.77
NO-251	0	154	190.97	52.55
NO-252	0	147	190.97	62.51
NO-253	3.72	151	190.97	56.82
NO-254	3.18	147	190.88	62.38
WJ-1152-O	0	152	190.27	54.4
WJ-3046-O	0	159	190.92	45.38
WJ-3114-O	0	152	190.97	55.41
WJ-3116-O	0	157	190.97	48.29

407 West Employment Lands
14-09222
Water Analysis
Fire Flow Report

ID	Static Demand (L/s)	Static Pressure (psi)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (psi)	Available Flow @Hydrant (L/s)	Available Flow Pressure (psi)
NO-222	6.8	51.49	196.22	250	46.96	954.72	20
NO-223	8.19	52.89	196.21	250	37.16	394.19	20
NO-224	0	54.56	196.18	250	40.64	430.62	20
NO-225	6.29	62.84	196.2	250	53.98	665.6	20
NO-227	0	51.92	196.22	250	47.2	916.73	20
NO-228	6.27	62.17	196.13	250	32.95	316.07	20
NO-229	4.2	62.74	196.13	250	38.17	350.74	20
NO-230	0	63.76	196.15	250	48.27	467.15	20
NO-231	9.56	67.05	196.17	250	55.95	614.62	20
NO-234	4.9	61.46	196.23	250	55.14	819.94	20
NO-235	0	60.74	196.23	250	54.98	877.51	20
NO-236	9.14	58.6	196.22	250	51.65	742.5	20
NO-237	0	57.19	196.23	250	52.59	1,019.99	20
NO-238	9.67	55.77	196.23	250	51.58	1,112.43	20
NO-239	0	48.66	196.23	250	44.74	1,024.89	20
NO-240	6.44	58.61	196.23	250	52.35	798.2	20
NO-241	0	57.2	196.24	205	54.63	1,592.04	20
NO-245	0	60.33	196.24	250	57.8	2,376.18	20
NO-246	0	68.58	196.24	250	66.09	2,694.72	20
NO-247	6.52	61.34	196.15	250	44.59	434.61	20
NO-248	29.09	55.44	196	250	31.02	342.64	20
NO-249	0	54.34	196.22	250	51.03	1,498.52	20
NO-250	0	58.47	196.13	250	28.11	287.10	20
NO-251	0	60.05	196.24	250	57.51	2,352.33	20
NO-252	0	70	196.24	250	67.53	2,765.65	20
NO-253	2.36	64.31	196.24	250	55.82	675.71	20
NO-254	2.01	69.95	196.2	250	-347.47	79.74	20
WJ-1150-O	0	62.89	196.24	250	60.43	2,566.58	20
WJ-3046-O	0	52.91	196.22	250	48.69	1,048.24	20
WJ-3114-O	0	62.89	196.24	250	60.44	2,581.93	20
WJ-3116-O	0	55.78	196.24	250	53.23	2,198.68	20

407 West Employment Lands
14-09222
Water Analysis
Average Daily Flow - Junction Demands

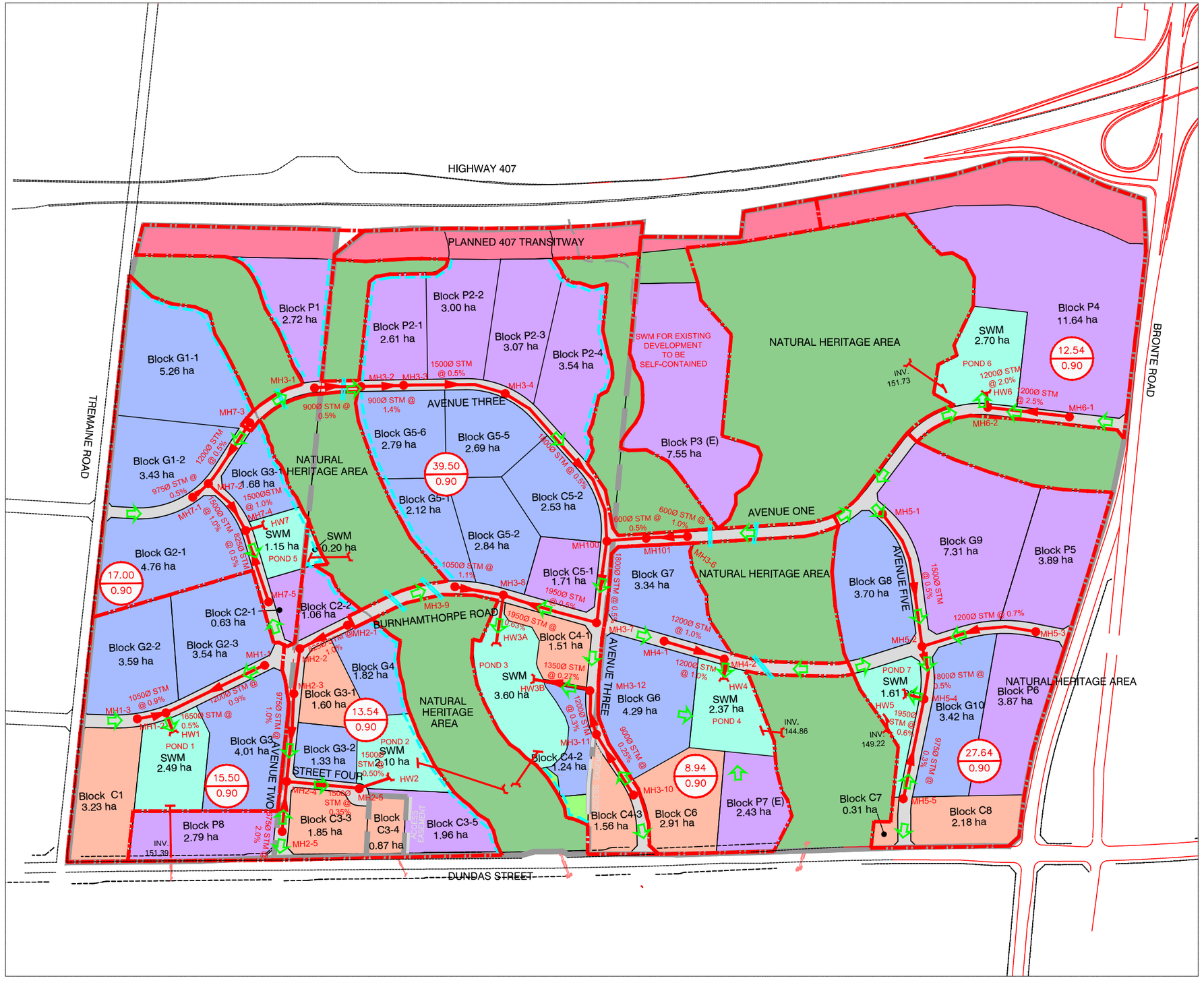
ID	Area (ha)	Demand (L/s)	Elevation (m)
NO-222	8.19	3.58	160.0
NO-223	9.86	4.31	159.0
NO-224	0.00	0.00	157.8
NO-225	7.57	3.31	152.0
NO-227	0.00	0.00	159.7
NO-228	7.55	3.30	152.4
NO-229	5.05	2.21	152.0
NO-230	0.00	0.00	151.3
NO-231	11.52	5.03	149.0
NO-234	5.91	2.58	153.0
NO-235	0.00	0.00	153.5
NO-236	11.01	4.81	155.0
NO-237	0.00	0.00	156.0
NO-238	11.64	5.09	157.0
NO-239	0.00	0.00	162.0
NO-240	7.76	3.39	155.0
NO-241	0.00	0.00	156.0
NO-245	0.00	0.00	153.8
NO-246	0.00	0.00	148.0
NO-247	7.84	3.43	153.0
NO-248	35.03	15.31	157.0
NO-249	0.00	0.00	158.0
NO-250	0.00	0.00	155.0
NO-251	0.00	0.00	154.0
NO-252	0.00	0.00	147.0
NO-253	2.83	1.24	151.0
NO-254	2.43	1.06	147.0
WJ-1150-O	0.00	0.00	152.0
WJ-3046-O	0.00	0.00	159.0
WJ-3114-O	0.00	0.00	151.5
WJ-3116-O	0.00	0.00	156.5

Demand Rate: 302 l/cap/day

Appendix 8.3 – Stormwater Design Sheets

Environmental Implementation Report / Functional Servicing Study for 14 Mile Creek West and the Lazy Pat Farm Property

STORMWATER ANALYSIS PLAN



LEGEND

- STORM SEWER
- STORM MANHOLE
- STORM DRAINAGE BOUNDARY
- OVERLAND FLOW ROUTE
- TRIBUTARY AREA (Ha)
- RUN-OFF CO-EFFICIENT
- FUTURE CULVERT CROSSING
- PROPOSED INFILTRATION SWALE
- 407 WEST EMPLOYMENT AREA
- PROPERTY BOUNDARIES

NOTES:

- For the purposes of the analysis land use, natural heritage and storm water sizing and location assumptions have been made for the entire 407 West Employment Area
- Right-of-way requirements for future 407 Transitway to be determined
- The Natural Heritage System on lands owned by others is conceptual, as shown in the North Oakville West Secondary Plan, and is subject to further study.

Scale

0 100 200 300 400 500m

Client: QuadReal

Prepared by: wsp

Date: AUGUST 2018

Project No.: 1409222.001

FIGURE A-8.3

FILE NAME: X:\DIV\O\14-09222\MUN\ASP-FSS Exhibits\APP 8.3_Stormwater Analysis.dwg_Fig A-8.3

SUBDIVISION: 407 West Employment Area

I= 1170
(tc+5.8)^0.843

TOWN OF OAKVILLE

STORM SEWER DESIGN SHEET

SHEET NO.: 1 OF 1

PROJECT NO.: 14-09222 n= 0.013

CONSULTANT : WSP

DESIGNED BY: SW

DRAINAGE AREA PLAN NO.:

CHECKED BY: AW DATE REVISED: 18-Jul-18

LOCATION	FROM MH	TO MH	AREA (ha)	ACCUM AREA (ha)	RUNOFF CO-EFFICIENT	AxR	ACCUM. AxR	Tc minutes	INTENSITY (mm/hr)	EXPECTED FLOW (m³/s)	FALL (m)	LENGTH (m)	GRADIENT (%)	PIPE SIZE (mm)	CAPACITY (m³/s)	VELOCITY (m/s)	TIME OF FLOW (min)	DROP IN LOWER MH
Pond One																		
Block G2-3	PLUG	1-1	3.54		0.90	3.19												
Block G3	PLUG	1-1	4.01		0.90	3.61												
Burnhamthorpe Road	1-1	1-2	0.69	8.24	0.85	0.59	7.3807	10.00	114.21	2.342	1.980	220.0	0.9	1200	3.699	3.27	1.12	0.08
Block G2-2	PLUG	1-3	3.59		0.90	3.23												
Block C1	PLUG	1-3	3.23		0.90	2.91												
Burnhamthorpe Road	1-3	1-2	0.44	7.26	0.85	0.38	6.51	10.00	114.21	2.067	0.540	60.0	0.9	1050	2.591	2.99	0.33	0.08
Outlet	1-2	HW1	0.00	15.50	0.00	0.00	13.89	11.12	107.80	4.161	0.300	60.0	0.5	1650	6.445	3.01	0.33	0
Pond Two																		
Block C2-2	PLUG	2-1	1.06		0.90	0.95												
Block G4	PLUG	2-1	1.82		0.90	1.64												
Burnhamthorpe Road	2-1	2-2	0.42	3.30	0.85	0.35	2.95	10.00	114.21	0.935	1.600	160.0	1	825	1.435	2.69	0.99	0.03
Block G3-1	PLUG	2-2	1.60		0.90	1.44												
Avenue 2	2-2	2-3	0.50	5.39	0.85	0.42	4.81	10.99	108.49	1.448	2.250	225.0	1	975	2.241	3.00	1.25	0.03
Block P8	PLUG	2-4	2.79		0.90	2.51												
Avenue 2	2-4	2-3	0.22	3.01	0.85	0.19	2.70	10.00	114.21	0.856	2.000	100.0	2	675	1.189	3.32	0.50	0.05
Block G3-2	PLUG	2-3	1.33		0.90	1.20												
Block C3-3	PLUG	2-3	1.85		0.90	1.67												
Block C3-4	PLUG	2-3	0.87		0.90	0.78												
Block C3-5	PLUG	2-3	1.96		0.90	1.76												
Outlet	2-3	2-4	0.00	13.54	0.85	0.00	12.1304	12.24	102.12	3.441	0.490	140.0	0.35	1500	4.182	2.37	0.99	0
Outlet	2-4	HW2	0.00	13.54	0.85	0.00	12.1304	13.23	97.65	3.290	0.300	60.0	0.5	1500	4.998	2.83	0.35	0

SUBDIVISION: 407 West Employment Area

$I = \frac{1170}{(tc+5.8)^{0.843}}$

TOWN OF OAKVILLE

STORM SEWER DESIGN SHEET

SHEET NO.: 1 OF 1

CONSULTANT : WSP

DRAINAGE AREA PLAN NO.:

PROJECT NO.: 14-09222 n= 0.013

DESIGNED BY: SW

CHECKED BY: AW DATE REVISED: 18-Jul-18

LOCATION	FROM MH	TO MH	AREA (ha)	ACCUM AREA (ha)	RUNOFF CO-EFFICIENT	AxR	ACCUM. AxR	Tc minutes	INTENSITY (mm/hr)	EXPECTED FLOW (m³/s)	FALL (m)	LENGTH (m)	GRADIENT (%)	PIPE SIZE (mm)	CAPACITY (m³/s)	VELOCITY (m/s)	TIME OF FLOW (min)	DROP IN LOWER MH
Pond Three A (WEST)																		
Block P1	Plug	3-1	2.72		0.90	2.45												
Avenue 3	3-1	3-2	0.53	3.25	0.85	0.45	2.90	10.00	114.21	0.919	0.450	90.0	0.5	900	1.280	2.01	0.75	0.05
Avenue 3	3-2	3-3	0.19	3.44	0.85	0.16	3.06	10.75	109.86	0.933	1.190	85.0	1.4	900	2.142	3.37	0.42	0.05
Block P2-1	PLUG	3-3	2.61		0.90	2.35												
Block P2-2	PLUG	3-3	3.00		0.90	2.70												
Block G5-6	PLUG	3-3	2.79		0.90	2.51												
Avenue 3	3-3	3-4	0.45	12.29	0.85	0.38	11.00	11.17	107.56	3.286	1.025	205.0	0.5	1500	4.998	2.83	1.21	0.03
Block P2-3	PLUG	3-4	3.07		0.90	2.76												
Block P2-4	PLUG	3-4	3.54		0.90	3.19												
Block G5-5	PLUG	3-4	2.69		0.90	2.42												
Avenue 3	3-4	100	0.83	22.41	0.85	0.70	20.07035	12.37	101.50	5.659	1.875	375.0	0.5	1800	8.128	3.19	1.96	0.03
Avenue 1	3-6	101	0.85	0.85	0.85	0.72		10.00	114.21	0.000	0.600	60.0	1	600	0.614	2.17	0.46	0.03
Avenue 1	101	100	0.18	0.18	0.85	0.15	0.86955	10.46	111.48	0.269	0.400	80.0	0.5	600	0.434	1.54	0.87	0.03
Block C5-2	PLUG	100	2.84		0.90	2.56												
Avenue 3	100	3-7	0.35	26.45	0.85	0.30	22.93	14.33	93.12	5.930	0.800	160.0	0.5	1800	8.128	3.19	0.83	0.05
Block C5-1	PLUG	3-7	1.71		0.90	1.54												
Burnhamthorpe Road	3-7	3-8	0.51	28.67	0.85	0.43	24.90	15.17	89.98	6.223	0.975	195.0	0.5	1950	10.062	3.37	0.96	0.05
Block G5-1	PLUG	3-9	2.12		0.90	1.91												
Block G5-2	PLUG	3-9	2.84		0.90	2.56												
Burnhamthorpe Road	3-9	3-8	0.85	5.81	0.85	0.72	5.18	10.00	114.21	1.644	1.100	100.0	1.1	1050	2.864	3.31	0.50	0.03
Outlet	3-8	HW3A	0.00	34.47	0.85	0.00	30.08	16.13	86.63	7.238	0.536	85.0	0.63	1950	11.295	3.78	0.37	0
														*Install equivalent horizontal elliptical pipe (1750x2700)				
Pond Three B (EAST)																		
Block C4-3	PLUG	3-10	1.56		0.90	1.40												
Avenue 3	3-10	3-11	0.31	1.87	0.85	0.26	1.67	10.00	114.21	0.591	0.350	140.0	0.25	900	0.905	1.42	1.64	0.05
										*Pipe to convey 100-year flow from road area								
Block C4-2	PLUG	3-11	1.24		0.90	1.12												
Avenue 3	3-11	3-12	0.20	3.31	0.85	0.17	2.95	11.64	105.09	0.956	0.270	90.0	0.3	1200	2.135	1.89	0.79	0.05
										*Pipe to convey 100-year flow from road area								
Block C4-1	PLUG	3-12	1.51		0.90	1.36												
Outlet	3-12	HW3B	0.21	5.03	0.85	0.18	4.49	12.43	101.22	1.390	0.365	135.0	0.27	1350	2.773	1.94	1.16	0
										*Pipe to convey 100-year flow from road area				*Install equivalent horizontal elliptical pipe (1100x1750)				

SUBDIVISION: 407 West Employment Area

$I = \frac{1170}{(tc+5.8)^{0.843}}$

TOWN OF OAKVILLE

STORM SEWER DESIGN SHEET

SHEET NO.: 1 OF 1

CONSULTANT : WSP

DRAINAGE AREA PLAN NO.:

PROJECT NO.: 14-09222 n= 0.013

DESIGNED BY: SW

CHECKED BY: AW DATE REVISED: 18-Jul-18

LOCATION	FROM MH	TO MH	AREA (ha)	ACCUM AREA (ha)	RUNOFF CO-EFFICIENT	AxR	ACCUM. AxR	Tc minutes	INTENSITY (mm/hr)	EXPECTED FLOW (m³/s)	FALL (m)	LENGTH (m)	GRADIENT (%)	PIPE SIZE (mm)	CAPACITY (m³/s)	VELOCITY (m/s)	TIME OF FLOW (min)	DROP IN LOWER MH
Pond Four																		
Block G7	PLUG	4-1	3.34		0.90	3.01												
Block G6	PLUG	4-1	4.29		0.90	3.86												
Burnhamthorpe Road	4-1	4-2	0.66	8.29	0.85	0.56	7.43	10.00	114.21	2.357	1.300	130.0	1	1200	3.899	3.45	0.63	0.08
Outlet	4-2	HW4	0.65	8.94	0.85	0.55	7.98	10.63	110.52	2.451	0.400	40.0	1	1200	3.899	3.45	0.19	0
Pond Five																		
Block G1-2	PLUG	7-1	3.43		0.90	3.09												
Avenue 3	7-1	7-2	0.33	3.76	0.85	0.28	3.37	10.00	114.21	1.068	0.200	40.0	0.5	975	1.585	2.12	0.31	0.08
Block G1-1	PLUG	7-3	5.26		0.90	4.73												
Avenue 3	7-3	7-2	0.32	5.58	0.85	0.27	5.01	10.00	114.21	1.588	0.725	145.0	0.5	1200	2.757	2.44	0.99	0.08
Block G2-1	PLUG	7-2	4.76		0.90	4.28												
Block G3-1	PLUG	7-2	1.68		0.90	1.51												
Avenue 2	7-2	7-4	0.24	16.02	0.85	0.21	14.3744	10.99	108.50	4.332	1.100	110.0	1	1500	7.069	4.00	0.46	0.08
Block C2-1	PLUG	7-5	0.63		0.90	0.57												
Avenue 2	7-5	7-4	0.35	0.98	0.85	0.30	0.8662	10.00	114.21	0.275	0.800	160.0	0.5	825	1.015	1.90	1.40	0.08
Outlet	7-4	HW7	0.00	17.00	0.85	0.00	15.24055	11.45	106.07	4.536	0.450	45.0	1	1500	7.069	4.00	0.19	0.00
Pond Six																		
Block P4	PLUG	6-1	11.64		0.90	10.48												
Avenue 1	6-1	6-2	0.54	12.18	0.85	0.46	10.934	10.00	114.21	3.469	3.250	130.0	2.5	1200	6.164	5.45	0.40	0.03
Outlet	6-2	HW6	0.36	12.54	0.85	0.31	11.24	10.40	111.85	3.493	0.600	30.0	2	1200	5.514	4.88	0.10	0
Pond Seven																		
Block G8	Plug	5-1	3.70		0.90	3.33												
Block G9	Plug	5-1	7.31		0.90	6.58												
Avenue 5	5-1	5-2	1.31	12.32	0.85	1.11	11.02	10.00	114.21	3.497	1.400	280.0	0.5	1500	4.998	2.83	1.65	0.05
Block P5	PLUG	5-3	3.89		0.90	3.50												
Block P6	PLUG	5-3	3.87		0.90	3.48												
Burnhamthorpe Road	5-3	5-2	0.77	8.53	0.85	0.65	7.64	10.00	114.21	2.423	1.575	225.0	0.7	1200	3.262	2.88	1.30	0.05
Avenue 5	5-2	5-4	0.66	21.51	0.85	0.56	19.22	11.65	105.04	5.609	0.525	105.0	0.5	1800	8.128	3.19	0.55	0.08
Block C8	Plug	5-5	2.18		0.90	1.96												
Avenue 5	5-5	5-4	0.53	2.71	0.85	0.45	2.42	10.00	114.21	0.875	0.615	205.0	0.3	975	1.227	1.64	2.08	0.05
										*Pipe to convey 100-year flow from road area								
Block G10	Plug	5-4	3.42		0.90	3.08												
Outlet	5-4	HW5	0.00	27.64	0.85	0.00	24.71590	12.20	102.34	7.123	0.240	40.0	0.6	1950	11.022	3.69	0.18	0.00
										*Pipe to convey 100-year flow from road area								

Appendix 8.4 – Conceptual Plan Profiles

Appendix 8.5 – Conceptual Grading Plan