

**5.1**  
**YEAR 2010-OPTION 1 : with the Elevated Tank**

**NODES**



## 2010 Option 1

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
N1	641	1027	10	9.25	53.47
N2	646	700	10	10.22	53.43
SW4	811	649	10	0.00	47.10
SW5	739	592	10	0.00	36.01
SW6	691	535	9	0.00	23.00
SW7	625	507	8	0.00	27.95
SW8	596	472	8	0.00	34.33
SW9	565	299	8	0.00	40.70
C447	447	250	10	29.31	20.26
C807	807	298	6	13.69	28.33
C875	875	298	7	6.56	29.51
C877	877	280	7	9.89	33.17
C895	895	289	7	7.11	29.17
C928	928	296	9	14.83	28.26
C934	934	264	11	281.25	26.10
C944	944	264	11	0.00	26.46
C946	946	243	11	0.00	26.10
C948	948	334	10	0.00	26.60
D440	440	355	10	0.00	23.75
D446	446	360	10	58.61	25.88
D754	754	389	8	20.72	26.09
D755	754	315	8	11.25	26.72
D756	758	395	7	13.69	26.58
D768	768	445	10	4.67	28.05
D835	849	442	8	0.00	38.60
D837	847	447	8	0.00	38.59
D838	846	439	8	0.00	39.32
D840	850	416	8	0.00	38.58
D845	853	373	8	0.00	38.23
D854	854	379	8	13.33	35.72
D855	857	373	8	14.83	38.34
D856	856	318	8	9.89	35.78
D860	860	318	7	13.69	30.21
D862	862	375	7	29.67	34.97
D880	880	380	8	-227.00	35.32
D909	909	358	11	19.78	30.30
D912	912	303	11	24.72	29.06
D970	970	453	10		26.60
E295	295	432	10	0.00	34.33
E524	539	476	10	117.25	27.55
E576	576	488	10	90.19	21.87
E632	632	476	9	4.97	20.88
E645	645	456	8	5.42	21.78
E668	668	483	7	8.14	22.76
E681	681	415	8	7.22	29.98
E703	703	453	8	6.44	23.10

NODE	X	Y	Z	CS (l/s)	Pressure Head (m)
E715	715	458	7	5.53	31.94
E717	718	494	7	5.89	19.76
E729	729	415	7	5.89	13.24
E732	732	482	7	2.97	26.03
E740	740	438	7	8.19	18.80
E747	747	443	7	4.44	33.15
E748	749	420	7	0.00	39.04
E754	754	420	8	9.25	27.82
E768	768	414	8	0.00	29.45
E769	768	438	8	6.67	29.80
E770	768	482	7	3.33	34.04
E777	777	444	8	10.50	30.03
E799	797	439	8	5.25	38.04
E805	805	482	8	6.67	36.38
E815	815	448	7	10.50	30.66
E816	816	486	6	0.00	31.56
E839	837	492	8	2.64	36.95
E841	846	444	8	3.31	39.76
E845	844	439	8	5.14	38.59
E846	845	414	8	18.17	38.59
E849	849	495	8	6.67	36.16
E865	865	479	7	0.83	36.01
E867	867	439	7	2.08	35.95
E871	871	441	8	4.94	37.17
E872	872	411	8	11.97	37.22
E873	873	499	8	49.42	15.57
E897	897	476	8	1.25	33.16
E900	900	441	8	0.83	32.98
E904	904	412	11	9.08	33.32
E905	905	441	10	14.83	33.22
E908	908	486	11	44.47	33.24
E910	910	463	11	0.83	31.60
E937	937	582	11	34.58	30.32
F286	286	601	10	15.92	34.33
F468	481	555	10	0.00	41.51
F627	626	528	7	119.03	25.38
F629	629	528	8	0.00	27.95
F630	633	524	8	0.00	27.95
F631	633	532	8	2.25	27.95
F632	633	528	8	110.14	7.00
F633	637	599	8	4.44	19.08
F649	649	510	7	3.81	9.91
F650	650	551	8	19.22	26.07
F653	653	531	9	3.81	11.30
F667	667	573	9	7.39	8.85
F678	678	569	9	6.47	17.64

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
F679	680	559	9	11.14	20.72
F691	691	585	9	17.03	18.19
F695	695	587	9	0.00	22.90
F696	694	591	9	0.00	22.88
F697	697	588	9	7.19	22.85
F698	699	588	9	0.00	38.07
F699	696	568	9	0.00	23.00
F720	720	572	9	5.64	22.93
F721	722	521	9	0.00	39.65
F736	736	568	8	11.53	18.59
F739	739	541	9	0.00	23.31
F740	739	514	8	7.50	23.64
F757	757	572	9	0.00	29.54
F761	762	568	9	3.58	41.87
F775	776	541	9	10.22	35.73
F776	776	514	7	16.67	33.15
F777	776	595	7	15.47	31.54
F788	788	568	9	13.83	31.96
F813	813	542	10	4.58	39.74
F814	814	515	7	9.17	33.85
F815	815	595	7	9.83	31.51
F826	826	544	11	13.83	33.40
F830	830	573	8	4.58	36.15
F831	831	569	10	10.17	41.93
F832	832	515	10	3.53	41.85
F836	832	516	8	7.53	36.26
F838	843	595	8	3.31	40.78
F853	853	571	11	7.17	36.17
F856	856	569	10	5.06	36.83
F858	858	518	10	2.50	41.03
F863	863	540	8	3.31	35.77
F864	864	569	8	0.00	32.89
F890	890	571	11	2.08	39.65
F891	891	544	11	6.31	37.62
F893	893	523	8	2.08	32.59
F895	895	571	8	2.92	32.81
F908	908	569	10	0.00	31.21
F909	909	577	10	16.08	39.34
F911	911	501	11	5.67	31.11
F912	912	526	10	1.25	31.37
F913	913	548	10	1.25	30.57
F919	919	579	10	46.14	29.27
F940	940	550	11	5.06	31.08
F945	945	508	10	14.83	29.61
F947	947	531	10	34.58	30.38
F953	953	578	10	34.58	31.00

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
F955	955	569	11	2.53	30.45
F964	964	507	11	14.83	37.73
F967	967	574	10	14.83	30.35
F968	968	679	11	3.78	30.52
G103	103	638	10	0.00	28.09
G128	128	659	10	0.00	28.09
G129	129	678	10	0.00	28.09
G134	134	660	10	0.00	28.09
G144	144	670	10	0.00	28.09
G145	145	676	10	330.00	28.09
G166	155	631	10	0.00	28.98
G235	252	665	10	15.92	30.25
G257	257	616	10	0.00	30.54
G284	284	633	10	0.00	34.14
G287	287	662	10	0.00	34.11
G292	292	670	10	15.92	34.06
G293	294	658	10	15.92	34.11
G334	334	663	10	0.00	37.65
G376	375	655	10	15.90	38.09
G377	377	689	10	31.86	38.09
G483	466	683	9	20.08	45.37
G485	489	637	9	24.89	45.22
G507	507	699	10	43.19	42.57
G508	508	688	10	14.22	44.49
G511	511	638	10	6.69	41.21
G515	515	671	10	4.81	41.14
G565	565	695	8	1.61	37.01
G585	585	674	8	4.17	39.34
G591	591	644	8	1.61	37.12
G593	593	701	8	16.33	35.85
G610	611	694	8	0.00	39.50
G611	612	700	8	0.00	39.37
G612	613	694	8	0.00	39.25
G613	614	697	8	13.86	38.97
G614	612	676	8	10.53	39.08
G615	615	677	8	6.39	37.46
G616	613	694	8	0.00	37.56
G617	618	646	8	0.00	38.42
G618	616	676	8	14.72	34.89
G619	619	647	8	19.86	38.55
G621	621	621	8	26.81	10.25
G622	622	624	7	0.00	35.99
G653	653	682	8	3.81	18.97
G685	685	652	9	29.14	34.29
G688	688	627	8	10.17	16.57
G692	692	640	9	19.50	20.09

NODE	X	Y	Z	CS (l/s)	Pressure Head (m)
G736	736	643	10	26.11	16.89
G742	742	665	10	41.92	36.01
G768	772	679	10	0.00	39.67
G771	771	613	9	18.94	22.01
G774	774	617	9	3.58	36.27
G777	777	628	9	7.69	36.13
G788	788	680	9	7.69	35.01
G793	794	662	10	0.00	43.12
G812	817	654	11	8.39	35.76
G813	818	695	11	8.39	35.32
G814	814	642	10	40.25	46.15
G815	815	686	11	36.08	30.88
G816	815	698	11	22.44	36.97
G817	816	639	10	0.00	47.10
G820	820	629	11	5.06	34.51
G821	821	617	11	2.56	34.01
G823	823	612	11	5.11	34.11
G826	826	692	11	3.39	42.93
G842	842	661	10	12.81	37.12
G845	845	658	11	5.14	36.75
G846	846	641	11	4.97	36.56
G848	848	620	11	8.53	36.15
G850	850	697	11	6.75	35.84
G863	863	665	10	19.25	41.50
G867	867	647	11	13.72	39.28
G872	872	623	11	4.72	38.73
G877	877	699	11	1.69	38.20
G881	881	603	10	17.42	41.36
G883	883	670	10	5.06	38.26
G888	888	653	11	7.44	38.86
G893	893	629	10	9.36	38.23
G898	898	608	10	8.11	36.51
G902	902	659	10	12.19	31.66
G910	910	658	10	5.31	39.19
G912	912	637	10	0.00	36.64
G918	918	669	10	4.72	36.14
G932	932	627	10	0.00	40.61
G949	949	635	10	5.67	30.33
G967	967	633	10	3.14	33.78
G987	987	724	10	2.53	33.79
H108	108	745	10	0.00	28.09
H480	480	745	10	10.81	44.04
H482	482	791	10	10.81	46.54
H521	521	790	9	54.08	46.06
H522	522	720	9	0.00	50.34
H565	565	719	9	12.53	47.61

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
H587	589	702	8	12.53	44.21
H589	589	755	8	12.53	44.87
H599	599	725	9	36.78	44.87
H609	607	723	9	0.00	48.21
H610	610	722	11	12.56	45.73
H640	640	731	8	6.31	48.22
H680	680	704	11	15.36	46.58
H682	682	702	10	14.53	34.63
H683	683	700	10	15.36	34.61
H684	683	702	10	0.00	34.59
H687	694	735	10	0.00	33.71
H727	727	708	11	7.25	48.08
H728	728	710	10	7.25	33.11
H729	728	705	10	0.00	34.67
H732	729	738	10	14.44	33.11
H761	761	712	11	4.83	48.40
H765	765	709	10	3.86	29.12
H766	766	768	10	6.97	27.95
H785	785	762	11	0.00	49.80
H795	795	768	11	0.00	49.47
H796	796	758	11	0.00	49.63
H797	797	743	11	0.00	49.38
H798	798	799	11	16.81	49.02
H799	799	716	11	17.31	51.29
H803	804	712	10	0.00	22.71
H804	804	759	10	50.97	21.03
H805	805	759	11	0.00	49.34
H807	807	733	11	14.75	49.26
H809	809	724	11	9.53	47.34
H810	810	719	10	14.28	46.26
H811	811	747	10	0.00	44.66
H836	836	737	11	4.28	48.86
H837	837	728	11	6.44	48.58
H839	839	709	11	6.44	48.50
H842	842	723	10	6.44	37.12
H850	850	710	11	5.33	44.97
H852	852	750	10	0.00	44.84
H856	856	740	11	0.00	47.34
H857	857	726	11	6.44	46.35
H860	860	765	11	10.69	44.64
H865	865	754	12	5.00	46.34
H866	866	741	11	14.83	47.50
H870	870	730	11	0.00	46.16
H873	873	702	11	34.67	43.51
H895	895	759	10	18.78	42.26
H903	903	740	11	34.64	46.26



NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
H908	908	765	10	33.47	45.51
H915	915	707	11	17.33	24.20
H919	919	712	10	21.64	44.20
H939	939	868	11	17.33	33.79
I479	479	876	10	36.78	34.13
I518	518	886	10	32.58	34.21
I520	520	824	10	17.19	34.21
I550	550	887	9	40.75	45.07
I560	560	897	10	15.28	42.18
I561	561	856	10	3.83	41.46
I578	578	855	9	9.56	50.40
I580	580	895	9	9.56	54.00
I590	590	895	10	0.00	54.07
I593	593	880	10	3.83	54.09
I599	599	879	10	0.00	53.91
I601	601	881	10	0.00	54.15
I603	603	801	10	3.83	54.15
I604	604	842	9	40.22	44.91
I609	609	873	8	22.92	48.52
I613	613	876	10	0.00	54.05
I614	614	892	10	3.83	54.53
I639	639	891	10	16.11	55.87
I643	643	811	10	0.00	56.03
I650	650	876	6	28.00	45.75
I683	683	892	10	8.47	56.93
I757	757	890	10	0.00	59.27
I767	767	826	10	15.78	58.73
I774	774	894	9	5.47	59.62
I785	785	879	10	20.03	59.27
I786	786	810	10	7.31	57.63
I797	797	882	11	7.31	51.95
I805	805	817	10	13.69	54.59
I846	846	806	11	13.69	52.47
I853	853	832	11	7.31	51.92
I862	862	817	11	7.31	52.34
I874	874	921	11	17.31	51.77
J562	562	912	10	15.28	43.13
J592	592	917	10	12.31	53.64
J764	764	957	10	0.00	58.73
J812	804	910	10	26.19	59.13
J821	821	998	11	33.50	59.53
J900	960	998	10	-1505.00	56.76
J901	960	1010	10	139.90	64.89
K816	814	998	10	26.19	58.02
K818	798	1046	10	35.83	55.18
L812	811	1118	10	23.50	51.82

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
M738	779	1233	10	41.83	41.39
M739	732	1281	10	19.36	37.81
M740	714	1358	10	38.69	35.81
M741	647	1382	10	19.36	33.90
M760	770	1155	10	22.47	49.36
SW10	529	432	8	0.00	33.93
SW11	494	404	8	0.00	31.15
SW12	442	368	8	0.00	28.36
SW13	304	341	8	0.00	28.36
SW14	308	438	10		26.76
SW15	317	354	10		26.76
SW16	422	315	10	0.00	26.76
SW17	446	232	10	0.00	26.76
SW20	624	405	10	35.25	37.01
SW21	670	382	10	35.25	34.60
SW22	707	324	10	35.25	32.77
SW23	747	251	10	35.25	31.88
SW24	787	224	10	35.25	30.59
SW25	748	165	10	35.25	28.44
SW26	670	182	10	23.50	28.10
SW27	572	211	10	0.00	28.10
D1015	1015	306	10	0.00	26.60
H8081	808	746	11	0.00	49.07
H8082	808	744	11	0.00	49.05
H8083	810	744	11	0.00	48.94
H8084	806	747	11	0.00	49.07

**5.1**  
**YEAR 2010-OPTION 1 : with the Elevated Tank**

**BRANCHES**



## 2010 Option 1

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
604	N1	N2	500	300	0.28
603	J522	N1	500	300	0.28
457	SW7	SW8	540	300	-1.63
456	F630	SW7	20	1000	-0.15
458	SW8	SW9	540	300	-1.63
463	WS1	SW9	1000	800	1.1
459	SW9	SW10	540	400	2.02
490	SW9	SW20	1000	500	0.95
611	D912	C934	660	400	1.23
10	C934	D912	660	250	-0.75
14	D440	D446	220	200	-0.93
15	D446	E524	1070	200	-0.37
448	SW12	D446	20	200	1.82
664	D755	D754	300	200	0.53
17	D754	D755	300	150	-0.36
16	D756	D754	450	150	-0.03
665	D754	D756	450	200	0.05
18	D755	E754	300	150	-0.53
663	E754	D755	300	200	0.79
19	D768	E769	180	200	-0.15
485	D835	D837	20	250	0.21
476	D835	D840	190	250	0.1
423	D835	E841	390	250	-0.55
468	E845	D835	20	250	-0.23
497	D837	D838	20	500	-1.84
620	D837	D840	20	700	0.5
650	D837	D856	690	500	1.37
618	E845	D837	20	700	-0.23
619	E846	D837	20	700	-0.3
621	F832	D838	1140	700	1.7
422	D845	D840	200	250	-0.3
477	D840	E846	20	250	-0.17
633	D840	E872	250	400	1.23
75	D840	E872	250	250	0.75
26	D855	D845	390	250	-0.3
22	D854	D856	30	250	-0.5
20	D860	D854	560	200	-0.97
21	D854	E849	420	250	-0.39
651	D856	D862	560	500	0.97
23	D862	D856	560	250	-0.51
24	D856	D880	370	250	0.39
649	D862	SW24	800	300	0.69
28	D880	D909	300	250	0.93
529	D880	D909	300	400	1.51
27	D880	E873	360	100	1.38
29	D909	D912	210	250	0.85

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
541	D909	D912	210	400	1.39
32	E524	E576	710	250	0.99
447	E524	SW10	20	200	-5.65
33	E576	F629	750	250	-0.85
35	E632	E645	170	100	0.15
34	E632	F650	270	100	-0.78
36	E645	E668	300	150	-0.24
40	E668	E681	350	100	-0.9
37	E668	E703	550	150	-0.3
39	E681	E715	460	250	-0.55
38	E681	F650	410	150	0.73
41	E703	E732	290	150	-0.67
49	E747	E715	360	250	0.67
54	E717	E729	410	100	0.75
50	E717	F633	1110	250	-0.24
42	E732	E754	250	150	-0.84
55	E740	E777	370	100	-1.04
48	E770	E747	210	250	0.76
662	E768	E754	150	200	1.34
43	E754	E768	150	150	-0.9
44	E768	E769	60	200	-0.48
45	E768	E770	180	200	-1.38
46	E769	E849	790	200	-0.84
47	E770	E805	360	300	-1.18
56	E777	E815	360	100	0.08
57	E777	F777	320	100	-0.28
657	F777	E777	320	200	0.55
53	E799	E845	460	200	-0.17
74	E805	E846	390	350	-0.94
72	E815	E839	250	100	-0.97
71	E815	F815	320	100	-0.28
59	E845	E839	420	250	0.73
60	E839	F836	310	250	0.52
62	E841	E865	250	100	0.75
61	E841	F838	230	250	-0.74
58	E849	E845	270	250	-1.07
67	E865	E867	160	100	0.12
63	E865	E897	330	100	0.45
70	E865	F863	240	100	0.08
69	E867	E872	380	100	-0.43
68	E867	E910	430	100	0.29
646	E872	E871	20	300	0.73
77	E873	E871	280	150	-2.19
78	E871	E904	420	150	0.44
76	E872	E904	340	300	0.8
634	E872	E904	340	300	0.96

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
66	E897	E900	240	100	0.11
64	E897	F895	240	100	0.22
65	E897	F912	140	100	-0.04
80	E904	E908	30	300	0.66
645	E904	E908	20	300	0.97
83	E904	E910	450	150	0.48
79	E905	E908	290	250	-0.3
81	E908	E937	400	250	0.96
85	E908	F919	1080	150	0.48
84	E910	F912	160	150	0.56
82	E937	F947	460	250	0.25
489	F286	F468	1800	200	-0.73
184	G284	F286	340	200	-0.22
87	F468	G507	640	250	-0.45
629	G507	F468	640	800	1.14
673	F627	F629	310	200	-1.36
88	F629	F627	310	150	0.91
89	F627	G618	870	250	-1.23
479	F629	F630	20	1000	-0.13
482	F630	F631	20	1000	0.02
108	F631	F650	240	150	0.71
91	F632	F653	290	200	-1.19
672	F632	F653	290	200	-1.45
100	F632	G621	1150	250	-0.55
95	F633	F679	620	200	-0.52
101	F653	F649	480	100	0.49
671	F678	F653	330	200	1.59
92	F653	F678	330	200	-1.3
107	F667	F691	370	100	-0.94
93	F678	F696	260	200	-1.4
670	F696	F678	260	200	1.7
105	F679	F691	160	200	1.14
96	F679	F695	280	200	-0.91
659	F695	F679	280	200	1.11
106	F691	F736	600	200	0.37
431	F695	F696	10	200	0.42
433	F695	F699	10	300	-1.27
104	F695	F720	310	300	0.19
430	F696	F697	10	200	0.45
434	F696	F699	10	300	-1.39
435	F697	F699	10	300	-1.51
669	G692	F697	350	200	-1.11
98	F697	G692	350	250	1.06
99	F697	G736	620	200	0.83
103	F698	F721	300	200	-0.6
97	F698	G742	700	250	0.39

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
114	F720	F739	180	250	0.09
658	F720	F739	180	200	0.1
118	F721	F761	390	200	-0.6
115	F739	F740	270	200	0.24
119	F761	F831	710	250	-0.56
120	F761	G774	440	100	0.65
112	F776	F775	270	100	-0.73
655	F775	F776	270	200	1.44
117	F775	F813	370	250	-1.24
656	F776	F777	270	200	1
111	F777	F776	270	100	-0.51
113	F776	F814	370	100	-0.14
110	F777	F815	370	100	0.06
121	F788	F826	350	150	-0.78
125	F814	F813	260	100	-1.07
128	F813	F832	150	250	-1.51
122	F815	F814	270	100	-0.53
124	F814	F830	180	100	-0.77
123	F815	F836	210	100	-0.94
135	F831	F826	250	120	1.07
136	F826	F853	270	150	-0.66
225	F826	G823	180	120	-0.35
126	F836	F830	280	250	0.22
505	F831	F832	40	900	1.37
133	F832	F831	40	250	-0.5
145	F831	F856	240	120	0.88
512	G826	F831	390	700	1.59
134	F831	G826	390	600	-1.22
132	F838	F832	520	250	-0.94
503	F832	F858	250	300	0.91
142	F832	F858	250	300	0.75
129	F838	F863	250	100	0.85
148	F856	F853	240	200	0.38
149	F853	G850	240	200	0.09
137	F853	G883	290	150	-0.55
146	F856	F891	340	150	-0.4
504	F858	F890	310	300	0.89
143	F858	F890	310	300	0.74
130	F863	F895	310	100	0.5
139	F893	F890	240	100	-1.17
144	F890	F909	180	300	0.66
624	F890	F909	180	300	0.8
147	F891	F908	180	150	1.35
150	F891	G883	300	350	-0.39
138	F895	F893	290	100	0.19
141	F893	F919	260	150	0.49



BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
131	F895	F913	190	100	0.16
154	F908	F911	100	150	0.0014
152	F919	F908	260	150	-0.67
153	F919	F908	260	150	-0.67
630	F909	F964	550	300	0.67
189	F909	F964	550	300	0.56
156	F911	F940	300	150	0.06
155	F911	G898	540	120	-0.59
151	F912	F919	460	150	0.47
163	F919	F945	300	150	0.18
157	F940	F955	130	150	0.3
160	F940	G918	840	150	-0.52
164	F945	F953	220	150	-0.66
165	F947	F953	220	250	-0.53
167	F947	F967	190	200	0.13
166	F953	F964	420	250	-1.48
158	F955	F968	110	150	-0.17
161	F955	G949	490	150	0.32
168	F967	F968	660	200	-0.34
162	F968	G967	560	200	-0.56
640	G145	G166	220	500	-1.32
176	G145	G166	220	300	-0.79
175	G145	G257	1120	200	-0.44
639	G166	G293	1260	500	-1.32
177	G166	G293	1260	300	-0.79
180	G257	G235	340	250	0.32
181	G257	G292	350	200	-0.95
183	G284	G287	170	250	0.14
182	G292	G287	290	250	-0.14
179	G293	G292	30	200	0.36
185	G292	G334	420	200	-0.88
638	G293	G376	830	500	-1.44
178	G293	G376	830	300	-0.86
186	G334	G377	450	300	-0.39
636	G376	G377	30	300	-0.04
187	G376	G483	1120	300	-0.9
637	G376	G483	1120	500	-1.49
188	G377	G485	1120	300	-0.88
635	G483	G485	100	800	1.08
644	G483	G508	300	900	-1.36
191	G483	G508	300	300	-0.57
189	G483	H480	620	300	-0.21
628	G485	G507	510	800	1.32
193	G485	G507	510	150	0.37
192	G485	G511	280	200	0.9
465	H482	G485	620	400	1.22

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
190	G485	H482	620	350	-0.93
194	G507	G515	110	200	1.08
198	G508	H565	750	300	-0.58
642	G508	H565	750	900	-1.39
199	G508	H589	810	150	0.4
197	G515	G511	500	100	-0.07
200	G511	G585	740	200	0.67
195	G515	G593	750	200	0.95
203	G591	G565	250	100	0.2
205	G591	G585	210	100	-0.66
201	G585	G614	240	200	0.37
202	G593	G591	290	100	-0.39
204	G591	G615	250	100	-0.14
196	G593	G618	250	200	0.52
442	G610	G611	20	150	0.61
443	G610	G614	10	150	0.85
441	H609	G610	270	150	1.45
444	G611	G614	10	150	-0.14
215	G611	G616	220	150	0.74
208	G613	G612	30	250	-1.06
410	G612	G614	30	250	0.84
224	G612	H610	210	250	-1.9
210	G612	H682	670	200	0.66
429	G614	G613	10	250	1.12
207	G615	G613	210	250	-1.08
209	G613	G617	30	200	1.29
437	G616	G615	10	150	0.74
214	G618	G615	300	150	-0.66
206	G618	G615	290	250	-0.96
217	G619	G617	210	250	-0.46
212	G617	H683	670	200	0.57
222	G619	G685	680	100	0.36
218	G621	G688	680	250	-1.1
219	G653	G692	310	100	-0.49
223	G685	H684	210	250	-0.54
220	G692	G688	260	250	1.3
231	G742	G768	290	250	-1.2
667	G742	G815	650	200	0.93
232	G742	G815	650	125	0.55
424	G768	G793	290	250	-1.2
230	G771	H766	360	150	-1.07
226	G823	G774	470	150	-0.09
227	G777	G823	430	250	-0.16
228	G788	G821	320	150	-0.44
425	G793	G814	280	250	-1.2
237	G812	G813	90	150	0.43

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
238	G812	G816	240	150	-0.54
263	G812	G845	280	150	-0.37
256	G820	G813	150	150	-0.41
261	G813	G846	280	150	-0.45
239	G816	G814	100	150	-1.76
241	G814	G817	80	350	-1.51
240	G814	H811	240	150	0.53
267	G816	G842	280	150	0.25
243	G817	G826	870	700	1.4
501	G817	G826	870	600	1.49
500	H8081	470	470	600	1.72
242	G817	470	470	700	-1.61
236	G821	G820	100	150	-0.59
257	G820	G848	280	150	-0.47
235	G823	G821	120	150	0.007
234	G823	G850	280	150	-0.55
233	G823	G850	280	120	-0.47
262	G845	G842	260	200	-0.28
268	G842	G863	220	150	-0.98
274	G842	H842	170	150	0.01
255	G846	G845	90	200	0.1
254	G848	G846	180	200	-0.41
264	G846	G867	220	200	-0.92
253	G850	G848	220	200	-0.26
258	G848	G872	250	150	-0.69
250	G850	G877	280	150	-0.6
249	G867	G863	330	160	-0.57
248	G867	G863	330	400	-1.18
271	G863	G881	180	250	0.13
269	G863	H860	300	400	-1.62
247	G872	G867	180	400	-0.83
265	G867	G888	220	200	0.41
246	G877	G872	250	400	-0.7
245	G883	G877	210	400	-0.51
251	G877	G898	220	150	0.63
270	G888	G881	310	160	-0.65
273	G881	H873	310	150	-0.6
272	G881	H895	140	250	-0.27
244	G883	G902	200	120	1.08
266	G893	G888	180	200	-0.59
259	G898	G893	220	150	-0.6
260	G893	G910	190	100	-0.2
252	G898	G918	210	150	0.4
275	G918	G910	240	120	-0.62
278	G910	G932	240	100	-0.46
277	G910	H895	450	150	-0.58

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
279	G932	H919	410	100	-0.46
280	G967	G987	200	200	-0.06
281	G967	H939	840	250	-0.38
282	G987	H939	920	150	-0.25
283	H480	H521	610	300	-0.36
464	H522	H482	620	400	1.1
284	H482	H522	620	400	-0.92
291	H521	H522	20	200	-1.88
294	H521	I479	870	200	1.04
292	H521	I550	440	250	0.52
289	H599	H522	810	200	-0.78
293	H522	I580	860	400	-1.05
632	I580	H522	860	500	1.44
285	H565	H609	270	300	-0.59
641	H565	H609	270	900	-1.41
286	H589	H587	150	150	-0.31
287	H587	H610	240	150	-1.02
290	H599	I604	430	350	-0.13
440	H609	H610	20	450	-0.57
643	H609	H610	20	1000	-1.11
295	H610	H640	290	150	0.36
509	H610	H680	680	1000	-1.32
296	H610	H680	680	410	-0.63
297	H682	H680	280	150	-1.72
508	H727	H680	490	1000	1.37
301	H680	H727	490	410	-0.66
300	H682	H683	10	250	0.49
299	H682	H728	500	200	0.41
445	H683	H684	10	250	0.54
304	H729	H727	270	150	-1.77
307	H727	H761	320	410	-0.68
507	H761	H727	320	1000	1.42
427	H728	H732	20	150	0.02
438	H728	H765	320	100	0.65
446	H729	H732	30	150	1.77
302	H732	H766	320	150	0.98
305	H765	H761	280	150	-1.68
308	H761	H798	360	450	-0.73
506	H798	H761	360	1000	1.43
306	H765	H766	30	150	1.54
439	H765	H803	370	125	0.89
303	H766	H804	370	150	1.05
310	H795	H785	120	600	-1.03
320	H785	H795	120	1000	1.68
312	H785	H796	70	800	1.17
474	H785	H796	70	700	1.27

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
321	H795	H798	200	1000	1.68
309	H798	H795	200	600	-1.03
487	H796	H797	100	700	1.27
313	H796	H797	100	800	1.17
314	H797	H805	100	800	1.17
488	H797	H805	100	700	1.27
502	H798	120	120	600	0.88
311	H798	120	120	450	0.62
316	H799	H805	400	300	0.85
419	H805	H799	400	60	-0.24
420	H799	H797	110	60	-0.3
317	H799	H797	110	300	-1.04
318	H799	H853	540	160	-0.18
451	H804	H803	30	150	-1.84
322	H803	H811	100	100	-1.74
315	H805	H807	30	800	1.24
498	H805	H807	30	700	1.34
418	H8084	140	140	100	-0.27
499	H807	110	110	700	1.32
351	H807	110	110	800	1.22
325	H810	H809	90	150	-0.84
345	H809	H837	280	150	-0.47
326	H809	120	120	150	-0.91
324	H811	H810	50	120	-1.07
327	H810	H839	280	150	-0.65
337	H836	H837	100	350	0.68
346	H836	H856	200	500	1.42
323	H8083	310	310	500	0.61
511	H8083	310	310	600	0.81
336	H839	H837	90	350	-0.38
338	H837	H857	200	150	0.76
331	H839	H850	150	150	1.08
328	H842	H852	100	80	-1.23
330	H852	H850	120	150	-0.37
332	H850	H860	100	150	0.41
329	H852	H860	240	150	0.02
343	H856	H857	100	400	1.72
347	H856	H866	110	500	0.32
341	H857	H860	140	150	0.83
342	H857	H860	140	400	1.62
339	H857	H870	120	150	0.27
333	H860	H873	140	150	0.66
349	H866	H865	120	150	0.28
344	H866	H870	120	150	0.77
350	H866	H903	370	260	0.62
348	H8084	590	590	110	0.32

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
340	H873	H870	120	150	-1.04
334	H873	H908	380	200	-0.48
335	H895	H919	250	250	-0.86
354	H903	H908	180	410	1.31
421	H903	H915	100	40	1.2
355	H903	I874	650	410	-1.33
353	H908	H919	340	410	0.94
356	H939	H915	590	150	0.89
352	H919	H939	200	200	1.79
357	I479	I518	380	200	-0.13
359	I518	I520	90	150	-0.05
358	I550	I518	600	150	0.97
360	I518	I560	430	150	-1.06
364	I520	I561	420	150	-1.02
366	I550	I578	430	200	-1.1
365	I550	I604	590	150	0.13
362	I560	I561	90	150	0.69
371	I560	I578	350	150	-1.12
361	I560	I590	320	150	-1.5
363	I561	J562	340	150	-0.55
368	I578	I580	30	150	-1.7
367	I578	I599	320	150	-0.92
370	I580	I603	340	400	-0.88
631	I603	I580	340	600	1.35
369	I580	I609	320	150	1.09
373	I590	I593	30	150	-0.16
623	I590	I593	30	500	-0.43
374	I590	I599	170	150	0.24
627	J592	I590	140	300	-0.69
372	I590	J592	140	150	0.43
376	I593	I603	180	300	-0.23
622	I593	I603	180	500	-0.38
375	I599	I601	30	150	-0.68
381	I601	I603	30	400	-0.13
380	I601	I613	140	150	0.2
382	I603	I614	120	300	-0.7
648	I603	I614	120	700	-1.44
378	I609	I604	420	300	1.11
377	I604	I650	460	100	0.4
668	I604	I650	460	200	0.79
379	I613	I609	320	250	1.67
383	I613	I614	30	250	-1.39
384	I613	I643	370	150	-0.57
385	I614	I639	340	300	-0.78
625	I614	I639	340	700	-1.61
626	I639	I643	40	700	-1.65

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
386	I643	1639	40	300	0.8
615	I643	1683	430	800	-1.27
387	I643	1683	430	350	-0.63
614	I683	1767	840	800	-1.29
388	I683	1767	840	350	-0.64
389	I767	1774	650	350	0.06
613	I767	1785	200	800	-1.45
414	I786	1785	150	100	-0.55
393	I786	1785	150	300	-1.3
612	I785	J821	390	800	-1.58
395	I785	J821	390	300	-0.71
415	I785	J821	390	100	-0.3
391	I797	1786	700	300	-1.02
413	I797	1786	700	60	-0.29
392	I786	1805	180	150	0.91
390	I797	1846	490	360	-0.08
401	I846	1805	770	110	-0.26
398	I853	1846	130	110	-0.37
400	I846	1862	220	360	-0.23
397	I853	1874	240	260	-0.14
617	I862	1874	200	400	0.88
399	I874	1862	200	410	-0.68
616	J821	1862	900	400	1.64
402	I862	J821	900	200	-0.78
403	J562	J592	320	150	-1.41
404	J821	J812	360	500	1.29
405	J812	K816	360	500	1.16
647	J821	J900	2000	800	-1.36
455	J900	J821	2000	800	1.36
661	J900	J901	100	400	1.11
406	K816	K818	360	400	1.6
407	K818	L812	630	400	1.31
408	L812	M760	630	400	1.13
452	M738	M739	670	300	1.1
409	M760	M738	630	300	1.69
453	M739	M740	670	300	0.82
454	M740	M741	670	200	0.62
460	SW10	SW11	540	300	1.08
461	SW11	SW12	540	300	1.08
470	SW20	SW21	540	400	1.2
491	SW21	SW22	700	400	0.92
492	SW22	SW23	700	400	0.64
493	SW23	SW24	700	300	0.64
494	SW24	SW25	700	300	0.83
495	SW25	SW26	700	300	0.33
411	H8081	30	30	800	0.03

<b>BRANCH</b>	<b>Initial Node</b>	<b>Final Node</b>	<b>Length (m)</b>	<b>Diameter (mm)</b>	<b>Flow Velocity (m/s)</b>
510	H8082	50	50	600	1.09
412	H8082	50	50	300	0.58



**5.2**

**YEAR 2010-OPTION 2 : without the Elevated Tank**

**NODES**



2010 Option 2

NODE	X	Y	Z	CS (l/s)	Pressure Head (m)
N1	641	1027	10	9.25	42
N2	646	700	10	10.22	42.34
SW4	811	649	10	0	48.63
SW5	739	592	10	0	46.66
SW6	691	535	9	0	45.44
SW7	625	507	8	0	43.9
SW8	596	472	8	0	042.07
SW9	565	299	8	0	040.25
WS1	504	472	10	17	38
WS2	449	520	10	0	38
WS3	396	516	10	0	38
C447	447	250	10	29.31	21.77
C807	807	298	6	13.69	26.03
C875	875	298	7	6.56	26.87
C877	877	280	7	9.89	30.46
C895	895	289	7	7.11	26.56
C928	928	296	9	14.83	25.57
C934	934	264	11	281.25	23.4
C944	944	264	11	0	23.77
C946	946	243	11	0	23.4
C948	948	334	10	0	23.9
D440	440	355	10	0	25.26
D446	446	360	10	58.61	27.39
D754	754	389	8	20.72	24.05
D755	754	315	8	11.25	24.79
D756	758	395	7	13.69	24.52
D768	768	445	10	4.67	26.22
D835	849	442	8	0	35.52
D837	847	447	8	0	35.52
D838	846	439	8	0	36.06
D840	850	416	8	0	35.51
D845	853	373	8	0	35.16
D854	854	379	8	13.33	32.9
D855	857	373	8	14.83	35.26
D856	856	318	8	9.89	32.96
D860	860	318	7	13.69	27.54
D862	862	375	7	29.67	32.25
D880	880	380	8	-227	32.54
D909	909	358	11	19.78	27.55
D912	912	303	11	24.72	26.32
D970	970	453	10		23.9
E295	295	432	10	0	32.45
E524	539	476	10	117.25	29.95
E576	576	488	10	90.19	29.12
E632	632	476	9	4.97	22.29
E645	645	456	8	5.42	22.45

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
E668	668	483	7	8.14	23.22
E681	681	415	8	7.22	31.19
E703	703	453	8	6.44	22.98
E715	715	458	7	5.53	32.16
E717	718	494	7	5.89	40.01
E729	729	415	7	5.89	33.49
E732	732	482	7	2.97	25.13
E740	740	438	7	8.19	16.24
E747	747	443	7	4.44	32.37
E748	749	420	7	0	39.19
E754	754	420	8	9.25	26.05
E768	768	414	8	0	27.65
E769	768	438	8	6.67	27.96
E770	768	482	7	3.33	32.57
E777	777	444	8	10.5	27.47
E799	797	439	8	5.25	37.11
E805	805	482	8	6.67	33.86
E815	815	448	7	10.5	28.18
E816	816	486	6	0	29.08
E839	837	492	8	2.64	35.88
E841	846	444	8	3.31	36.35
E845	844	439	8	5.14	35.52
E846	845	414	8	18.17	35.51
E849	849	495	8	6.67	33.32
E865	865	479	7	0.83	32.66
E867	867	439	7	2.08	32.62
E871	871	441	8	4.94	34.01
E872	872	411	8	11.97	34.06
E873	873	499	8	49.42	12.5
E897	897	476	8	1.25	29.88
E900	900	441	8	0.83	29.7
E904	904	412	11	9.08	30.01
E905	905	441	10	14.83	29.9
E908	908	486	11	44.47	29.92
E910	910	463	11	0.83	28.32
E937	937	582	11	34.58	26.02
F286	286	601	10	15.92	32.45
F468	481	555	10	0	36.2
F627	626	528	7	119.03	12.3
F629	629	528	8	0	43.9
F630	633	524	8	0	43.9
F631	633	532	8	2.25	43.9
F632	633	528	8	110.14	43.9
F633	637	599	8	4.44	43.9
F649	649	510	7	3.81	42.27
F650	650	551	8	19.22	31.28

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
F653	653	531	9	3.81	43.66
F667	667	573	9	7.39	30.39
F678	678	569	9	6.47	44
F679	680	559	9	11.14	42.27
F691	691	585	9	17.03	39.74
F695	695	587	9	0	45.27
F696	694	591	9	0	45.29
F697	697	588	9	7.19	45.44
F698	699	588	9	0	45.39
F699	696	568	9	0	23
F720	720	572	9	5.64	45.3
F721	722	521	9	0	43.28
F736	736	568	8	11.53	40.14
F739	739	541	9	0	45.69
F740	739	514	8	7.5	46.02
F757	757	572	9	0	26.92
F761	762	568	9	3.58	40.07
F775	776	541	9	10.22	32.18
F776	776	514	7	16.67	30.24
F777	776	595	7	15.47	28.92
F788	788	568	9	13.83	32.8
F813	813	542	10	4.58	35.6
F814	814	515	7	9.17	31.85
F815	815	595	7	9.83	29.16
F826	826	544	11	13.83	34.24
F830	830	573	8	4.58	37.76
F831	831	569	10	10.17	37.4
F832	832	515	10	3.53	37.33
F836	832	516	8	7.53	36.37
F838	843	595	8	3.31	37.1
F853	853	571	11	7.17	38.22
F856	856	569	10	5.06	38.44
F858	858	518	10	2.5	34.69
F863	863	540	8	3.31	32.39
F864	864	569	8	0	29.33
F890	890	571	11	2.08	31.17
F891	891	544	11	6.31	41.02
F893	893	523	8	2.08	29.03
F895	895	571	8	2.92	29.4
F908	908	569	10	0	29.75
F909	909	577	10	16.08	29.84
F911	911	501	11	5.67	29.66
F912	912	526	10	1.25	28.11
F913	913	548	10	1.25	27.16
F919	919	579	10	46.14	26.2
F940	940	550	11	5.06	29.54

NODE	X	Y	Z	CS (l/s)	Pressure Head (m)
F945	945	508	10	14.83	25.6
F947	947	531	10	34.58	25.73
F953	953	578	10	34.58	25.89
F955	955	569	11	2.53	28.3
F964	964	507	11	14.83	28.72
F967	967	574	10	14.83	25.8
F968	968	679	11	3.78	28.27
G103	103	638	10	0	20.7
G128	128	659	10	0	20.7
G129	129	678	10	0	20.7
G134	134	660	10	0	20.7
G144	144	670	10	0	20.7
G145	145	676	10	330	20.7
G166	155	631	10	0	21.6
G235	252	665	10	15.92	22.92
G257	257	616	10	0	23.21
G284	284	633	10	0	28.42
G287	287	662	10	0	27.81
G292	292	670	10	15.92	26.77
G293	294	658	10	15.92	26.72
G334	334	663	10	0	29.81
G376	375	655	10	15.9	30.18
G377	377	689	10	31.86	30.18
G483	466	683	9	20.08	36.71
G485	489	637	9	24.89	37.02
G507	507	699	10	43.19	35.53
G508	508	688	10	14.22	35.06
G511	511	638	10	6.69	33.86
G515	515	671	10	4.81	33.95
G565	565	695	8	1.61	30.31
G585	585	674	8	4.17	33.27
G591	591	644	8	1.61	30.42
G593	593	701	8	16.33	28.36
G610	611	694	8	0	33.58
G611	612	700	8	0	33.51
G612	613	694	8	0	33.34
G613	614	697	8	13.86	33.21
G614	612	676	8	10.53	33.24
G615	615	677	8	6.39	30.84
G616	613	694	8	0	30.97
G617	618	646	8	0	33.26
G618	616	676	8	14.72	27.26
G619	619	647	8	19.86	33.89
G621	621	621	8	26.81	34.66
G622	622	624	7	0	28.36
G653	653	682	8	3.81	36.52

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
G685	685	652	9	29.14	32.11
G688	688	627	8	10.17	34.55
G692	692	640	9	19.5	37.64
G736	736	643	10	26.11	34.88
G742	742	665	10	41.92	46.66
G768	772	679	10	0	47.38
G771	771	613	9	18.94	19.67
G774	774	617	9	3.58	38.05
G777	777	628	9	7.69	37.97
G788	788	680	9	7.69	36.94
G793	794	662	10	0	47.91
G812	817	654	11	8.39	38.62
G813	818	695	11	8.39	38.08
G814	814	642	10	40.25	48.12
G815	815	686	11	36.08	41.52
G816	815	698	11	22.44	39.87
G817	816	639	10	0	48.68
G820	820	629	11	5.06	36.92
G821	821	617	11	2.56	35.94
G823	823	612	11	5.11	35.96
G826	826	692	11	3.39	39.71
G842	842	661	10	12.81	40.28
G845	845	658	11	5.14	39.85
G846	846	641	11	4.97	39.66
G848	848	620	11	8.53	38.85
G850	850	697	11	6.75	38.04
G863	863	665	10	19.25	46.74
G867	867	647	11	13.72	43.55
G872	872	623	11	4.72	42.72
G877	877	699	11	1.69	41.9
G881	881	603	10	17.42	45.01
G883	883	670	10	5.06	41.83
G888	888	653	11	7.44	42.79
G893	893	629	10	9.36	41.77
G898	898	608	10	8.11	39.36
G902	902	659	10	12.19	35.23
G910	910	658	10	5.31	42.46
G912	912	637	10	0	39.02
G918	918	669	10	4.72	38.52
G932	932	627	10	0	43.25
G949	949	635	10	5.67	28.17
G967	967	633	10	3.14	33.11
G987	987	724	10	2.53	33.14
H108	108	745	10	0	20.7
H480	480	745	10	10.81	35.24
H482	482	791	10	10.81	37.66

NODE	X	Y	Z	CS (1/s)	Pressure Head (m)
H521	521	790	9	54.08	36.96
H522	522	720	9	0	41.1
H565	565	719	9	12.53	36.57
H587	589	702	8	12.53	33.41
H589	589	755	8	12.53	34.2
H599	599	725	9	36.78	34.89
H609	607	723	9	0	36.65
H610	610	722	11	12.56	34.15
H640	640	731	8	6.31	36.64
H680	680	704	11	15.36	37.04
H682	682	702	10	14.53	31.83
H683	683	700	10	15.36	31.83
H684	683	702	10	0	31.83
H687	694	735	10	0	31.53
H727	727	708	11	7.25	41.34
H728	728	710	10	7.25	30.9
H729	728	705	10	0	32.03
H732	729	738	10	14.44	30.93
H761	761	712	11	4.83	44.47
H765	765	709	10	3.86	26.71
H766	766	768	10	6.97	25.61
H785	785	762	11	0	49.8
H795	795	768	11	0	48.98
H796	796	758	11	0	49.65
H797	797	743	11	0	49.42
H798	798	799	11	16.81	47.7
H799	799	716	11	17.31	48.95
H803	804	712	10	0	20.82
H804	804	759	10	50.97	19.09
H805	805	759	11	0	49.4
H807	807	733	11	14.75	49.34
H809	809	724	11	9.53	46.67
H810	810	719	10	14.28	45.74
H811	811	747	10	0	44.94
H836	836	737	11	4.28	47.12
H837	837	728	11	6.44	47.01
H839	839	709	11	6.44	46.98
H842	842	723	10	6.44	40.27
H850	850	710	11	5.33	46.49
H852	852	750	10	0	46.62
H856	856	740	11	0	46.53
H857	857	726	11	6.44	46.71
H860	860	765	11	10.69	46.51
H865	865	754	12	5	45.49
H866	866	741	11	14.83	46.65
H870	870	730	11	0	46.39



NODE	X	Y	Z	CS (l/s)	Pressure Head (m)
H873	873	702	11	34.67	45.04
H895	895	759	10	18.78	45.58
H903	903	740	11	34.64	46.68
H908	908	765	10	33.47	46.46
H915	915	707	11	17.33	24.14
H919	919	712	10	21.64	45.77
H939	939	868	11	17.33	33.72
I479	479	876	10	36.78	24.3
I518	518	886	10	32.58	24.34
I520	520	824	10	17.19	24.34
I550	550	887	9	40.75	35.52
I560	560	897	10	15.28	31.73
I561	561	856	10	3.83	31.03
I578	578	855	9	9.56	39.87
I580	580	895	9	9.56	43.11
I590	590	895	10	0	42.98
I593	593	880	10	3.83	43
I599	599	879	10	0	42.98
I601	601	881	10	0	43.35
I603	603	801	10	3.83	43.35
I604	604	842	9	40.22	34.92
I609	609	873	8	22.92	38.22
I613	613	876	10	0	43.26
I614	614	892	10	3.83	43.71
I639	639	891	10	16.11	44.92
I643	643	811	10	0	45.07
I650	650	876	6	28	35.76
I683	683	892	10	8.47	46.59
I757	757	890	10	0	50.44
I767	767	826	10	15.78	49.63
I774	774	894	9	5.47	51.38
I785	785	879	10	20.03	50.44
I786	786	810	10	7.31	50.17
I797	797	882	11	7.31	48.83
I805	805	817	10	13.69	48.57
I846	846	806	11	13.69	49.16
I853	853	832	11	7.31	48.86
I862	862	817	11	7.31	48.96
I874	874	921	11	17.31	48.66
J562	562	912	10	15.28	32.51
J592	592	917	10	12.31	42.56
J764	764	957	10	0	49.63
J812	804	910	10	26.19	50.62
J821	821	998	11	33.5	51.01
J900	960	998	10	-1505	57
J901	960	1010	10	139.9	56.38

NODE	X	Y	Z	CS (l/s)	Pressure Head (m)
K816	814	998	10	26.19	49.5
K818	798	1046	10	35.83	46.66
L812	811	1118	10	23.5	43.31
M738	779	1233	10	41.83	32.87
M739	732	1281	10	19.36	29.3
M740	714	1358	10	38.69	27.29
M741	647	1382	10	19.36	25.38
M760	770	1155	10	22.47	40.84
SW10	529	432	8	0	34.98
SW11	494	404	8	0	32.39
SW12	442	368	8	0	29.81
SW13	304	341	8	0	29.81
SW14	308	438	10		28.21
SW15	317	354	10		28.21
SW16	422	315	10	0	28.21
SW17	446	232	10	0	28.21
SW20	624	405	10	35.25	36.33
SW21	670	382	10	35.25	33.61
SW22	707	324	10	35.25	31.46
SW23	747	251	10	35.25	30.35
SW24	787	224	10	35.25	28.47
SW25	748	165	10	35.25	26.32
SW26	670	182	10	23.5	25.97
SW27	572	211	10	0	25.97
D1015	1015	306	10	0	23.9
H8081	808	746	11	0	49.21
H8082	808	744	11	0	47.85
H8083	810	744	11	0	47.81
H8084	806	747	11	0	49.21

**5.2**  
**YEAR 2010-OPTION2 : without the Elevated Tank**

**BRANCHES**



2010 Option 2

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
604	N1	N2	500	300	0.28
603	J592	N1	500	300	0.28
677	SW5	SW4	900	1000	-1.54
449	SW4	G817	20	1000	-1.54
676	SW6	SW5	700	900	-1.76
467	SW5	G742	20	800	0.17
675	SW7	SW6	900	900	-1.46
678	SW6	F697	20	900	0.3
457	SW7	SW8	540	700	1.49
456	F630	SW7	20	1000	-0.45
458	SW8	SW9	540	700	1.49
463	WS1	SW9	1000	500	-0.79
459	SW9	SW10	540	400	1.78
490	SW9	SW20	1000	500	1
581	F468	WS1	500	450	-0.87
1	C447	D440	360	200	-0.93
3	C807	C895	940	250	-0.47
2	C807	D756	950	100	0.14
666	D756	C807	950	200	-0.27
4	C875	C895	280	200	0.32
5	C875	D860	250	200	-0.52
8	C877	C928	540	250	0.87
653	C877	C928	540	300	1.19
7	C877	D862	260	250	-0.94
652	D862	C877	260	300	1.28
6	C895	C928	360	250	-0.42
654	C928	C934	50	300	1.29
611	D912	C934	660	400	1.22
10	C934	D912	660	250	-0.75
14	D440	D446	220	200	-0.93
15	D446	E524	1070	200	-0.46
448	SW12	D446	20	200	1.64
664	D755	D754	300	200	0.57
17	D754	D755	300	150	-0.39
16	D756	D754	450	150	-0.06
665	D754	D756	450	200	0.1
663	E754	D755	300	200	0.83
18	D755	E754	300	150	-0.56
19	D768	E769	180	200	-0.15
485	D835	D837	20	250	0.17
476	D835	D840	190	250	0.09
423	D835	E841	390	250	-0.44
468	E845	D835	20	250	-0.18
497	D837	D838	20	500	-2.89
620	D837	D840	20	700	0.52
650	D837	D856	690	500	1.31

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
618	E845	D837	20	700	-0.04
619	E846	D837	20	700	-0.27
621	F832	D838	1140	700	1.47
422	D845	D840	200	250	-0.3
477	D840	E846	20	250	-0.19
633	D840	E872	250	400	1.27
75	D840	E872	250	250	0.78
26	D855	D845	390	250	-0.3
22	D854	D856	30	250	-0.5
20	D860	D854	560	200	-0.96
21	D854	E849	420	250	-0.39
23	D862	D856	560	250	-0.49
651	D856	D862	560	500	0.92
24	D856	D880	370	250	0.37
649	D862	SW24	800	300	0.55
529	D880	D909	300	400	1.5
28	D880	D909	300	250	0.92
27	D880	E873	360	100	1.39
541	D909	D912	210	400	1.38
29	D909	D912	210	250	0.84
32	E524	E576	710	250	0.38
447	E524	SW10	20	200	-1.78
33	E576	F629	750	250	-1.46
35	E632	E645	170	100	0.41
34	E632	F650	270	100	-1.04
36	E645	E668	300	150	-0.12
40	E668	E681	350	100	-0.94
37	E668	E703	550	150	-0.17
39	E681	E715	460	250	-0.21
38	E681	F650	410	150	-0.24
41	E703	E732	290	150	-0.53
49	E747	E715	360	250	0.32
54	E717	E729	410	100	0.75
51	E717	E748	340	250	0.51
50	E717	F633	1110	250	-0.75
42	E732	E754	250	150	-0.7
55	E740	E777	370	100	-1.04
48	E770	E747	210	250	0.41
52	E748	E799	510	250	0.51
662	E768	E754	150	200	1.33
43	E754	E768	150	150	-0.9
44	E768	E769	60	200	-0.4
45	E768	E770	180	200	-1.43
46	E769	E849	790	200	-0.77
47	E770	E805	360	300	-0.97
56	E777	E815	360	100	-0.04

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
657	F777	E777	320	200	0.52
57	E777	F777	320	100	-0.26
53	E799	E845	460	200	0.62
74	E805	E846	390	350	-0.78
72	E815	E839	250	100	-1.07
71	E815	F815	320	100	-0.31
59	E845	E839	420	250	-0.22
60	E839	F836	310	250	-0.44
62	E841	E865	250	100	0.75
61	E841	F838	230	250	-0.63
58	E849	E845	270	250	-1.02
67	E865	E867	160	100	0.1
63	E865	E897	330	100	0.44
70	E865	F863	240	100	0.1
69	E867	F872	380	100	-0.45
68	E867	E910	430	100	0.28
646	E872	E871	20	300	0.73
77	E873	E871	280	150	-1.68
78	E871	E904	420	150	0.46
76	E872	E904	340	300	0.84
634	E872	E904	340	300	1.01
66	E897	E900	240	100	0.11
64	E897	F895	240	100	0.26
65	E897	F912	140	100	-0.09
80	E904	E908	30	300	0.7
645	E904	E908	20	300	1.03
83	E904	E910	450	150	0.48
79	E905	E908	290	250	-0.3
81	E908	E937	400	250	1.1
85	E908	F919	1080	150	0.47
84	E910	F912	160	150	0.55
82	E937	F947	460	250	0.4
489	F286	F468	1800	300	-0.68
184	G284	F286	340	200	-1.03
629	G507	F468	640	400	-0.58
87	F468	G507	640	250	0.35
88	F629	F627	310	150	1.55
89	F627	G618	870	250	-1.51
479	F629	F630	20	1000	-0.15
90	F629	F632	40	200	0.02
482	F630	F631	20	1000	0.04
480	F632	F630	20	1000	-0.19
481	F630	F633	20	1000	0.07
94	F631	F633	30	200	0.01
108	F631	F650	240	150	1.79
672	F632	F653	290	200	-0.17

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
91	F632	F653	290	200	-0.14
100	F632	G621	1150	250	1.01
95	F633	F679	620	200	0.45
101	F653	F649	480	100	0.49
92	F653	F678	330	200	-0.25
671	F678	F653	330	200	0.31
107	F667	F691	370	100	-0.94
93	F678	F696	260	200	-0.76
105	F679	F691	160	200	1.14
96	F679	F695	280	200	-1.04
106	F691	F736	600	200	0.37
431	F695	F696	10	200	-0.41
432	F695	F698	10	200	-1.05
104	F695	F720	310	300	0.19
430	F696	F697	10	200	-1.17
426	F697	F698	20	250	0.54
98	F697	G692	350	250	1.7
99	F697	G736	620	200	1.16
103	F698	F721	300	200	0.81
97	F698	G742	700	250	-0.65
114	F720	F739	180	250	0.09
658	F720	F739	180	200	0.1
118	F721	F761	390	200	0.81
115	F739	F740	270	200	0.24
119	F761	F831	710	250	0.39
120	F761	G774	440	100	-0.39
655	F775	F776	270	200	1.32
112	F776	F775	270	100	-0.67
117	F775	F813	370	250	-1.16
656	F776	F777	270	200	0.92
111	F777	F776	270	100	-0.47
113	F776	F814	370	100	-0.32
110	F777	F815	370	100	-0.15
121	F788	F826	350	150	-0.78
125	F814	F813	260	100	-0.93
128	F813	F832	150	250	-1.4
122	F815	F814	270	100	-0.57
124	F814	F830	180	100	-1.13
123	F815	F836	210	100	-1.14
135	F831	F826	250	120	0.62
136	F826	F853	270	150	-0.81
225	F826	G823	180	120	-0.57
127	F830	F832	250	250	-1.05
126	F836	F830	280	250	-0.78
505	F831	F832	40	900	1.26
133	F832	F831	40	250	-0.46



BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
145	F831	F856	240	120	-0.37
512	G826	F831	390	500	1.76
134	F831	G826	390	600	-1.67
132	F838	F832	520	250	-0.83
142	F832	F858	250	300	1.3
129	F838	F863	250	100	0.82
148	F856	F853	240	200	0.07
149	F853	G850	240	200	-0.19
137	F853	G883	290	150	-0.75
146	F856	F891	340	150	-0.65
143	F858	F890	310	300	1.27
130	F863	F895	310	100	0.5
139	F893	F890	240	100	-0.82
144	F890	F909	180	300	1.15
147	F891	F908	180	150	1.77
150	F891	G883	300	350	-0.51
138	F895	F893	290	100	0.24
141	F893	F919	260	150	0.35
131	F895	F913	190	100	0.16
154	F908	F911	100	150	-0.05
152	F919	F908	260	150	-0.91
153	F919	F908	260	150	-0.91
159	F909	F964	550	300	0.42
630	F909	F964	550	300	0.5
156	F911	F940	300	150	0.14
155	F911	G898	540	120	-0.8
151	F942	F919	460	150	0.45
163	F919	F945	300	150	0.47
157	F940	F955	130	150	0.56
160	F940	G918	840	150	-0.71
164	F945	F953	220	150	-0.37
165	F947	F953	220	250	-0.19
167	F947	F967	190	200	-0.19
166	F953	F964	420	250	-1.03
158	F955	F968	110	150	0.1
161	F955	G949	490	150	0.32
168	F967	F968	660	200	-0.66
162	F968	G967	560	200	-0.72
176	G145	G166	220	300	-0.79
640	G145	G166	220	500	-1.32
175	G145	G257	1120	200	-0.45
639	G166	G293	1260	500	-1.32
177	G166	G293	1260	300	-0.79
180	G257	G235	340	250	0.32
181	G257	G292	350	200	-0.96
183	G284	G287	170	250	0.66

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
182	G292	G287	290	250	-0.66
179	G293	G292	30	200	-0.38
185	G292	G334	420	200	-0.81
638	G293	G376	830	500	-1.34
178	G293	G376	830	300	-0.8
186	G334	G377	450	300	-0.36
636	G376	G377	30	300	-0.05
637	G376	G483	1120	500	-1.39
187	G376	G483	1120	300	-0.84
188	G377	G485	1120	300	-0.86
635	G483	G485	100	600	-1.3
191	G483	G508	300	300	0.28
189	G483	H480	620	300	-0.08
628	G485	G507	510	400	-0.09
193	G485	G507	510	150	-0.04
192	G485	G511	280	200	0.73
190	G485	H482	620	350	-0.81
465	H482	G485	620	600	1.36
194	G507	G515	110	200	1.14
198	G508	H565	750	300	-0.04
199	G508	H589	810	150	0.5
197	G515	G511	500	100	0.08
200	G511	G585	740	200	0.54
195	G515	G593	750	200	0.97
203	G591	G565	250	100	0.2
205	G591	G585	210	100	-0.73
201	G585	G614	240	200	0.22
202	G593	G591	290	100	-0.49
204	G591	G615	250	100	-0.17
196	G593	G618	250	200	0.57
442	G610	G611	20	150	0.45
443	G610	G614	10	150	0.47
441	H609	G610	270	150	0.92
444	G611	G614	10	150	-0.42
215	G611	G616	220	150	0.87
208	G613	G612	30	250	-0.74
410	G612	G614	30	250	0.65
224	G612	H610	210	250	-1.46
210	G612	H682	670	200	0.12
429	G614	G613	10	250	0.6
207	G615	G613	210	250	-1.29
209	G613	G617	30	200	-0.37
437	G616	G615	10	150	0.87
214	G618	G615	300	150	-0.8
206	G618	G615	290	250	-1.15
217	G619	G617	210	250	0.27

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
212	G617	H683	670	200	0.06
216	G621	G619	300	250	0.69
222	G619	G685	680	100	0.06
218	G621	G688	680	250	-0.23
219	G653	G692	310	100	-0.49
221	G688	G685	300	250	0.79
223	G685	H684	210	250	0.21
220	G692	G688	260	250	1.22
229	G736	H732	700	150	0.59
231	G742	G768	290	250	-0.47
232	G742	G815	650	125	0.55
667	G742	G815	650	200	0.93
424	G768	G793	290	250	-0.47
230	G771	H766	360	150	-1.07
226	G823	G774	470	150	0.03
227	G777	G823	430	250	-0.16
228	G788	G821	320	150	-0.44
425	G793	G814	280	250	-0.47
237	G812	G813	90	150	0.49
238	G812	G816	240	150	-0.54
263	G812	G845	280	150	-0.42
256	G820	G813	150	150	-0.53
261	G813	G846	280	150	-0.51
239	G816	G814	100	150	-1.94
241	G814	G817	80	350	-1.16
240	G814	H811	240	150	0.79
267	G816	G842	280	150	0.13
243	G817	G826	870	700	1.9
679	G817	G863	500	500	1.29
242	G817	H8081	470	700	-1.07
500	H8081	G817	470	1200	1.75
236	G821	G820	100	150	-0.76
257	G820	G848	280	150	-0.52
235	G823	G821	120	150	-0.18
234	G823	G850	280	150	-0.61
233	G823	G850	280	120	-0.52
262	G845	G842	260	200	-0.31
268	G842	G863	220	150	-1.19
274	G842	H842	170	150	0.05
255	G846	G845	90	200	0.09
254	G848	G846	180	200	-0.57
264	G846	G867	220	200	-1.11
253	G850	G848	220	200	-0.49
258	G848	G872	250	150	-0.85
250	G850	G877	280	150	-0.79
248	G867	G863	330	400	-1.44

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
249	G867	G863	330	160	-0.7
271	G863	G881	180	250	0.96
269	G863	H860	300	400	-0.22
247	G872	G867	180	400	-1.02
265	G867	G888	220	200	0.56
246	G877	G872	250	400	-0.87
245	G883	G877	210	400	-0.63
251	G877	G898	220	150	0.77
270	G888	G881	310	160	-0.61
273	G881	H873	310	150	-0.14
272	G881	H895	140	250	0.4
244	G883	G902	200	120	1.08
266	G893	G888	180	200	-0.71
259	G898	G893	220	150	-0.72
260	G893	G910	190	100	0.03
252	G898	G918	210	150	0.52
275	G918	G910	240	120	-0.72
278	G910	G932	240	100	-0.37
277	G910	H895	450	150	-0.58
279	G932	H919	410	100	-0.37
280	G967	G987	200	200	-0.09
281	G967	H939	840	250	-0.47
282	G987	H939	920	150	-0.31
283	H480	H521	610	300	-0.24
284	H482	H522	620	400	-0.84
464	H522	H482	620	600	1.3
291	H521	H522	20	300	-1.31
294	H521	I479	870	200	1.07
292	H521	I550	440	250	0.63
289	H599	H522	810	200	-0.83
293	H522	I580	860	400	-0.82
632	I580	H522	860	700	1.39
285	H565	H609	270	300	-0.22
286	H589	H587	150	150	-0.21
287	H587	H610	240	150	-0.92
290	H599	I604	430	350	-0.11
440	H609	H610	20	450	-0.02
643	H609	H610	20	1000	-0.04
295	H610	H640	290	150	0.36
296	H610	H680	680	410	-1.05
297	H682	H680	280	150	-1.23
301	H680	H727	490	410	-1.33
300	H682	H683	10	250	0.07
299	H682	H728	500	200	0.24
445	H683	H684	10	250	-0.21
304	H729	H727	270	150	-1.49

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
307	H727	H761	320	410	-1.59
427	H728	H732	20	150	-0.27
438	H728	H765	320	100	0.66
446	H729	H732	30	150	1.49
302	H732	H766	320	150	0.99
305	H765	H761	280	150	-2
308	H761	H798	360	450	-1.57
306	H765	H766	30	150	1.49
439	H765	H803	370	125	0.85
303	H766	H804	370	150	1.02
310	H795	H785	120	600	-1.63
312	H785	H796	70	800	1.11
474	H785	H796	70	1200	1.68
319	H785	H774	660	400	0.43
309	H798	H795	200	600	-1.63
487	H796	H797	100	1200	1.68
313	H796	H797	100	800	1.11
488	H797	H805	100	1200	1.68
314	H797	H805	100	800	1.11
311	H798	H8082	120	450	0.35
502	H798	H8082	120	600	0.49
419	H805	H799	400	60	0.13
316	H799	H805	400	300	-0.46
317	H799	H797	110	300	0.17
420	H799	H797	110	60	0.85
318	H799	H853	540	160	0.2
451	H804	H803	30	150	-1.87
322	H803	H811	100	100	-2.88
498	H805	H807	30	1200	1.66
315	H805	H807	30	800	1.1
418	H8084	H805	140	100	-0.24
499	H807	H8081	110	1200	1.65
351	H807	H8081	110	800	1.09
325	H810	H809	90	150	-0.79
345	H809	H837	280	150	-0.25
326	H809	H8084	120	150	-1.08
324	H811	H810	50	120	-0.76
327	H810	H839	280	150	-0.5
337	H836	H837	100	350	0.4
346	H836	H856	200	500	0.77
323	H8083	H836	310	500	0.99
336	H839	H837	90	350	-0.23
338	H837	H857	200	150	0.31
331	H839	H850	150	150	0.4
328	H842	H852	100	80	-1.12
330	H852	H850	120	150	-0.18

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
332	H850	H860	100	150	-0.08
329	H852	H860	240	150	-0.14
343	H856	H857	100	400	0.5
347	H856	H866	110	500	0.45
342	H857	H860	140	400	0.42
341	H857	H860	140	150	0.21
339	H857	H870	120	150	0.36
333	H860	H873	140	150	0.74
349	H866	H865	120	150	0.28
344	H866	H870	120	150	0.38
350	H866	H903	370	260	0.15
680	H866	H903	370	500	0.29
348	H8084	H866	590	110	0.39
340	H873	H870	120	150	-0.75
334	H873	H908	380	200	-0.35
335	H895	H919	250	250	-0.19
354	H903	H908	180	410	1.06
421	H903	H915	100	40	1.22
355	H903	I874	650	410	-0.83
353	H908	H919	340	410	0.72
356	H939	H915	590	150	0.89
352	H919	H939	200	200	1.96
357	I479	I518	380	200	-0.1
359	I518	I520	90	150	-0.09
358	I550	I518	600	150	0.99
360	I518	I560	430	150	-1.02
364	I520	I561	420	150	-0.98
366	I550	I578	430	200	-1.01
365	I550	I604	590	150	0.25
362	I560	I561	90	150	0.69
371	I560	I578	350	150	-1.11
361	I560	I590	320	150	-1.46
363	I561	J562	340	150	-0.51
368	I578	I580	30	150	-1.56
367	I578	I599	320	150	-0.88
370	I580	I603	340	400	-0.91
631	I603	I580	340	700	1.55
369	I580	I609	320	150	1.04
623	I590	I593	30	500	-0.41
373	I590	I593	30	150	-0.15
374	I590	I599	170	150	0.02
627	J592	I590	140	300	-0.69
372	I590	J592	140	150	0.43
622	I593	I603	180	300	-0.67
376	I593	I603	180	300	-0.55
375	I599	I601	30	150	-0.86

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
381	I601	I603	30	400	-0.15
380	I601	I613	140	150	0.19
382	I603	I614	120	300	-0.68
648	I603	I614	120	800	-1.53
378	I609	I604	420	300	1.05
668	I604	I650	460	200	0.79
377	I604	I650	460	100	0.4
379	I613	I609	320	250	1.61
383	I613	I614	30	250	-1.35
384	I613	I643	370	150	-0.54
625	I614	I639	340	800	-1.66
385	I614	I639	340	300	-0.74
626	I639	I643	40	800	-1.69
386	I643	I639	40	300	0.76
615	I643	I683	430	800	-1.66
387	I643	I683	430	350	-0.82
388	I683	I767	840	350	-0.83
614	I683	I767	840	800	-1.68
389	I767	I774	650	350	-0.5
613	I767	I785	200	800	-1.77
414	I786	I785	150	100	-0.22
393	I786	I785	150	300	-0.52
415	I785	J821	390	100	-0.33
395	I785	J821	390	300	-0.79
612	I785	J821	390	800	-1.77
413	I797	I786	700	60	-0.08
391	I797	I786	700	300	-0.28
392	I786	I805	180	150	0.66
390	I797	I846	490	360	0.24
401	I846	I805	770	110	0.21
398	I853	I846	130	110	-0.25
400	I846	I862	220	360	0.06
397	I853	I874	240	260	-0.02
399	I874	I862	200	410	-0.44
617	I862	I874	200	400	0.56
402	I862	J821	900	200	-0.44
616	J821	I862	900	400	0.92
403	J562	J592	320	150	-1.38
404	J821	J812	360	500	1.29
405	J812	K816	360	500	1.16
455	J900	J821	2000	800	1.36
647	J821	J900	2000	800	-1.36
661	J900	J901	100	400	1.11
406	K816	K818	360	400	1.6
407	K818	L812	630	400	1.31
408	L812	M760	630	400	1.13

BRANCH	Initial Node	Final Node	Length (m)	Diameter (mm)	Flow Velocity (m/s)
452	M738	M739	670	300	1.1
409	M760	M738	630	300	1.69
453	M739	M740	670	300	0.82
454	M740	M741	670	200	0.62
460	SW10	SW11	540	300	1.04
461	SW11	SW12	540	300	1.04
470	SW20	SW21	540	400	1.28
491	SW21	SW22	700	400	1
492	SW22	SW23	700	400	0.72
493	SW23	SW24	700	300	0.78
494	SW24	SW25	700	300	0.83
495	SW25	SW26	700	300	0.33
411	H8081	H8084	30	800	0.04
412	H8082	H8083	50	300	0.33
510	H8082	H8083	50	600	0.61



## **APPENDIX G**

### **FRAMEWORK OF EXTENSION OF TREATMENT PLANT IN URGENT REHABILITATION WORKS**



## APPENDIX G

### EXPANSION OF TREATMENT PLANT IN URGENT REHABILITATION WORKS

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## 1. BASIC CONCEPT OF THE PLANNING

The size and location to be constructed are of 50,000 m<sup>3</sup>/day capacity treatment plant beside the existing Phum Prek Treatment Plant, as studied in Section 5.3.3 of the Main Report.

The treatment system of the newly constructed Plant in the stage of Urgent Rehabilitation Works is employed as the same system of the existing one from the following matters:

- a) Local staff already familiarize themselves with the present system,
- b) Spare parts can be used in common with the existing facilities in the Plant, and
- c) Existing civil structures and buildings can be utilized.

Furthermore, in case of planning the detail, the following are thoroughly considered as well as the above matters.

As the intake tower is constructed with the space necessary for the expansion works, the Intake Pumps to be set in this stage are fully utilized the existing structures.

The structure of the Receiving Well and Mixing Chamber is planned with the existing plant mixing purposes. Because the function of the existing mixing system does not necessarily look work sufficiently and the spare parts of the mechanical facilities are not in hand. Considering the present local condition, a hydraulic mixing system will be planned not only for the new Plant but for the existing plant. No machinery will be used for the mixing work.

For the Flocculation and Sedimentation Basins, the same system as the existings is employed for the Plant, from the following reasons:

- a) It is desirable that the water level of the new Plant at Flocculation and Sedimentation is same as the existing one,
- b) According to the Study on Function of Phum Prek Treatment Plant conducted by the Study Team, the activities/functions of the existing flocculation and sedimentation basins were fully acceptable, and
- c) Manual flushing-out system of sedimented sludge employed in the present flocculation and sedimentation basins is fit for the present condition.

As for the filter media, under drain and filtered water control system for the existing filters, necessary repair works will be carried out soon as one of French ODA's. Considering the convenience of the operation and maintenance, the newly constructed filter system will be same as the repaired.

Taking into consideration the matters stated above, the succeeding facilities for the newly constructed Treatment Plant in the Urgent Rehabilitation Works stage are planned, and the layout of the extended Phum Prek Treatment Plant is shown in Fig-5.4.

## **2. FRAMEWORK OF THE SYSTEM**

The extended Plant system consists of a) Intake Facilities and Raw Water Main, b) Treatment Facilities, and c) Distribution Facilities. All of them are stated below:

### **2.1 Intake Facilities and Raw Water Main**

#### a) Intake Pump

Pump Type	Vertical Mixed-Flow type
Capacity	Ø500 x Q36.7 m <sup>3</sup> /min x H24.0 m x 210 kw x 3,000 v/50 Hz x 6p 2 units
Description	Both pumps are installed into existing house.

b) Raw Water Main

Size & No.	Ø700 DIP x 1.4 km
Appurtenances	Line valves, air release valves and drain.
Description	Main is installed along existing pipelines.

2.2 Treatment Facilities

a) Receiving Well

Size & No.	W5.0 m x L6.5 m x D5.4 m x 1 well
Capacity	175 m <sup>3</sup>
Detention Time	1.6 min
Description	Raw water is received by the new Well for divided into 50,000 m <sup>3</sup> and 100,000 m <sup>3</sup> by means of weir measuring.

b) Mixing Chamber

Size & No.	W5.0 m x L5.0 m x D5.0 m x 1 chamber
Capacity	125 m <sup>3</sup>
Detention Time	1.2 min
Chemicals	Alum., Lime and chlorine
Flash Mixer	37.0 kw x 1 unit
Description	Receiving Well and Mixing Chamber are connected by Ø1,000 (existing) and Ø800 (expanded) pipes.

c) Flocculation Basin

Size & No.	W11.8 m x L10.8 m x D3.2 m x 3 basins
Capacity	407 m <sup>3</sup>
Detention Time	33 min
Flocculator	2 units/partition x 2 partition x 3 basins = 12 units
Description	1.5 ~ 0.4 kw x variable speed 3 stages Every basin is split into 2 by partition.

d) Sedimentation Basin

Size & No. W12.0 m x L52.0 m x D2.8 m x 3 basins  
Capacity 1,747 m<sup>3</sup>  
Overflow Rate 51 mm/min  
Detention Time 2.4 hr  
Appurtenances Drain valves, overflow troughs and  
sedimented sludge wash-out system

e) Filter

Size & No. W4.5 m x L11.9 m x 6 filters  
Filter Area 53.6 m<sup>2</sup>/filter  
Filter Speed 164.2 m/day  
Backwash By air and water  
Filter Control Control system x 6 units  
Valve Type Pneumatic type butterfly valve  
Description Present washing condition is employed to use  
existing machinery for backwash.

f) Clear Water Reservoir

Size & No. W31.4 m x L31.4 m x D5.13 m x 2 units  
Capacity 10,000 m<sup>3</sup>  
Detention Time 1.6 hr  
Appurtenances Water level meters, and ventilators  
Description Reservoir is separated into 2 with partition  
wall, and constructed at the site of exist-  
ing excavated area by USSR to utilize the  
existing piles.

g) Distribution Pump and Pump House

Size & No. Ø350 x Q17.5 m<sup>3</sup>/min x H42 m  
x 180 kw x 5 units (including 2 sets of  
transmission pumps)

Type of Pump Double Suction Horizontal Volute type  
Pump House W8.0 m x L18.0 m x H6.0 m x 1 house  
Appurtenances Overhead traveling crane  
Description Pump house is set beside the existing house.  
Transmission pumps for elevated tank are in-  
stalled together with new pumps.



h) Chemical Building

Size & No.	1st Floor - 360 m <sup>2</sup> ; 2nd Floor - 264 m <sup>2</sup> ; Total 624 m <sup>2</sup>
Chemicals	Alum., lime and chlorine
Dissolved	
Solution Tank	Alum. W2.0 m x L2.0 m x 4 tanks Lime W2.0 m x L3.0 m x 2 tanks
Appurtenances	Overhead traveling crane, control equipment, water supply equipment, and others.

### 3. Capacity of Reservoirs

Nowadays the operation condition and combination of pumps at Phum Prek Treatment Plant is as follows:

a) Daytime (at Present)

Operating Hours : 5 a.m. - 6 p.m. (13 hours)

Combination of Pumps :

Raw Water Pump @2,200 m<sup>3</sup>/hr x 2 sets = 4,400 m<sup>3</sup>/hr

Distribution Pump @2,100 m<sup>3</sup>/hr x 1 set = 2,100 m<sup>3</sup>/hr

@ 900 m<sup>3</sup>/hr x 2 sets = 1,800 m<sup>3</sup>/hr

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Total 3,900 m<sup>3</sup>/hr

b) Night Time (at Present)

Operating Hours : 6 p.m. - 5 a.m. (11 hours)

Combination of Pumps :

Raw Water Pump @2,200 m<sup>3</sup>/hr x 1 set = 2,200 m<sup>3</sup>/hr

Distribution Pump @ 900 m<sup>3</sup>/hr x 1 set = 900 m<sup>3</sup>/hr

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Total 900 m<sup>3</sup>/hr

The night time surplus water 1,300 m<sup>3</sup>/hr (2,200 - 900 = 1,300) can be reserved in the Reservoir constructed in the Rehabilitation stage. The reservable capacity will be: 1,300 m<sup>3</sup>/hr x 11 hr = 14,300 m<sup>3</sup>

After the Rehabilitation Works, as the transmission pumps will be set, the following pump combination will become possible:

c) Daytime after Rehabilitation Works

Operating Hours : 5 a.m. - 6 p.m. (13 hours)

Combination of Pumps :

Raw Water Pump @2,200 m<sup>3</sup>/hr x 2 sets = 4,400 m<sup>3</sup>/hr

Distribution Pump @2,100 m<sup>3</sup>/hr x 1 set = 2,100 m<sup>3</sup>/hr

@ 900 m<sup>3</sup>/hr x 2 set = 1,800 m<sup>3</sup>/hr

Transmission Pump @1,000 m<sup>3</sup>/hr x 1 set = 1,000 m<sup>3</sup>/hr

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Total 4,900 m<sup>3</sup>/hr

d) Night Time after Rehabilitation Works

Same as item b) above.

The combination of the pumps after the Rehabilitation Works is possible, and 500 m<sup>3</sup>/hr (4,900 - 4,400 = 500) capacity can be supplied to the service area as far as being reservoirs.

During the operation hours in the daytime, some 6,500 m<sup>3</sup> treated water will be able to supply additionally (500 m<sup>3</sup>/hr x 13 hr = 6,500 m<sup>3</sup>/hr). For the filter wash water, 2,000 to 3,500 m<sup>3</sup> will become necessary (@53.6 m<sup>2</sup>/filter x 0.9 m<sup>3</sup>/min x 6 min x 12 filters = 3,500). Considering these additionally suppliable capacity and water necessary for the plant operation, the capacity of the reservoirs will be shown below:

Capacity of Reservoirs

to be constructed : 6,500 + 3,500 = 10,000 m<sup>3</sup>



**APPENDIX H**  
**PRESENT CONDITION OF ELECTRIC FACILITIES**  
**ON TREATMENT PLANTS**



## APPENDIX H

### PRESENT CONDITION OF ELECTRIC FACILITIES ON TREATMENT PLANTS

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## PRESENT CONDITION OF ELECTRIC FACILITIES ON TREATMENT PLANTS

### 1. PHUM PREK TREATMENT PLANT

#### 1.1 Outline Of Facilities

##### 1.1.1 Power Receiving System

The Plant receives dual power sources consisting of extra-high tension and low tension supplies. The extra-high tension is supplied from No.1 and No.4 Power Stations, and the supply from the No.1 Power Station is through an exclusive supply cable. Low tension power source is supplied to the Treatment Plant through a transformer (15 KV/380 & 220 V) belonging to Electricite du Phnom Penh (EDP) and being set in the Treatment Plant premises. Low tension power source for Intake Facilities (380 & 220 V) is supplied from EDP transformer separated from the transformer stated above.

##### 1.1.2 Distribution System

The Treatment Plant receives 15 KV for the power source and transforms to 3 KV by a transformer (15 KV/3 KV - 3,150 KVA) to supply high tension motors. The control and instrumental circuits for high tension system are operated by both of direct current and alternating current transformed by a transformer (3 KV/220 V).

Low tension power source is receiving through low tension panels. The low tension system does not equip with relay panels and control center at present, and all of power supply system of low tension motors and control circuit of the motors are installed into low tension panels and/or local control boxes. Almost cables are set directly into concrete or surfaces of concrete without any guard pipes like conduit tubes.