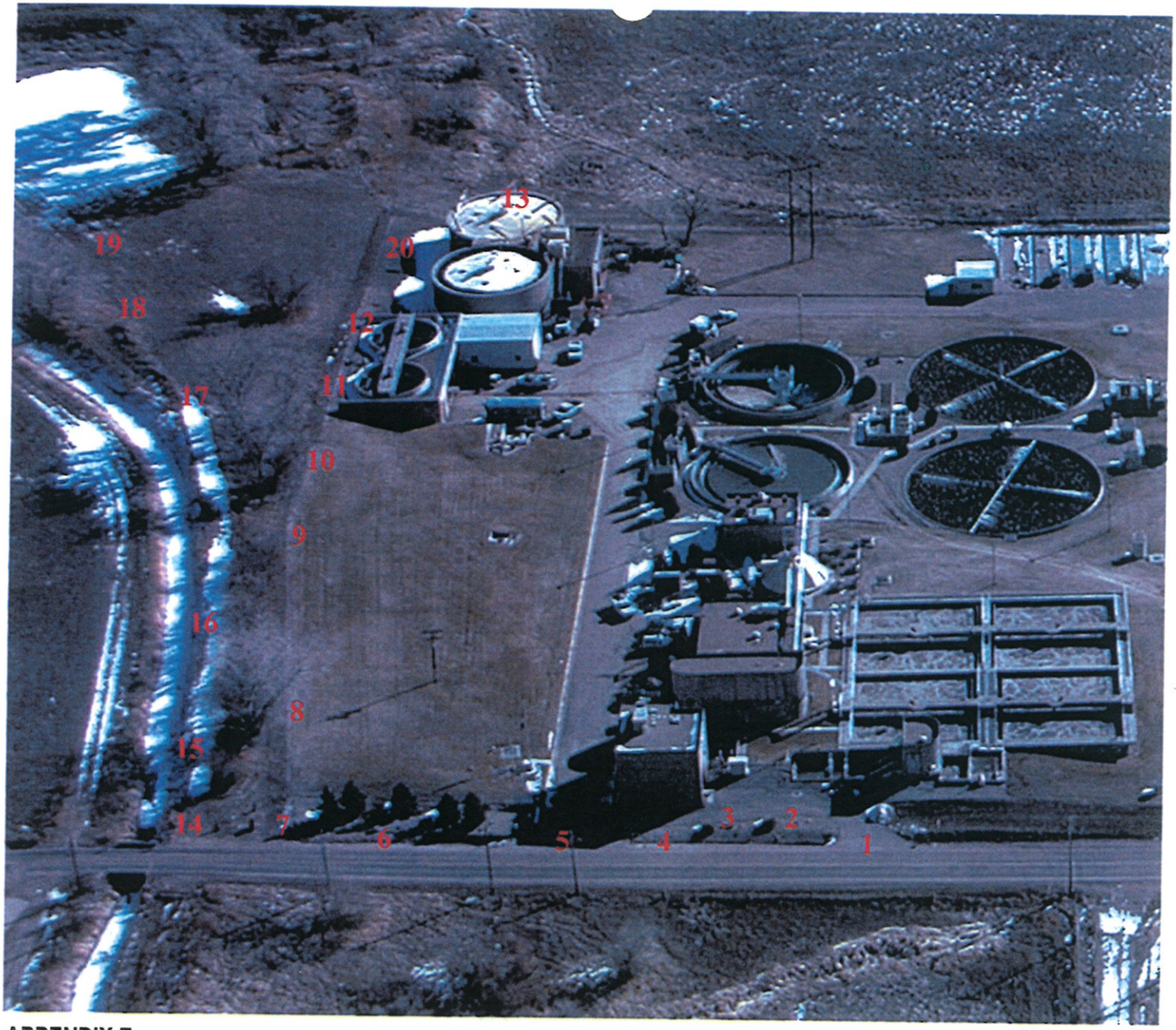
Appendix F – Summary of Fenceline Sampling Results



APPENDIX F

Sampling Locations for the Fenceline Sampling

Appendix F

Summary of Loveland WWTP Fenceline Sampling

Sampling Location	Location Description	10/07/2003 10 to 11 am H2S (ppm)	10/07/2003 2 to 3 pm H2S (ppm)	10/07/2003 4 to 5 pm H2S (ppm)	10/08/2003 10 to 11 am H2S (ppm)	10/08/2003 1 to 2 pm H2S (ppm)	10/08/2003 4 to 5 pm H2S (ppm)	10/11/2003 9 to 10 am H2S (ppm)	10/11/2003 3 to 5 pm H2S (ppm)	10/11/2003 6 to 7 pm H2S (ppm)	10/13/2003 8 to 9 pm H2S (ppm)
1	Fenceline at South Entrance to Headworks	0.21	0.18	0.15	0.16	0.17	0.45	0.002	0.004	0.004	0.070
2	Fenceline at manhole in driveway	0.20	0.55	0.31	0.12	0.085	1.17	0.008	0.15	0.15	0.11
3	Fenceline at rock in driveway	0.01	0.11	0.056	0.17	0.009	0.17	0.012	0.12	0.17	0.021
4	Fenceline at roadsign	0.11	0.12	0.11	0.12	0.005	0.65	0.002	0.091	0.11	0.006
5	Main gate	0.005	0.007	0.040	0.004	0.007	0.045	0.027	0.004	0.15	0.002
6	1/2 way up hill from gate	0.004	0.007	0.026	0.004	0.053	0.012	0.002	0.007	0.094	0.001
7	NW corner of fenceline	0.004	0.004	0.086	0.004	0.008	0.006	0.002	0.074	0.102	0.001
8	Fenceline behind power pole	0.014	0.004	0.006	0.012	0.009	0.002	0.002	0.056	0.030	0.004
9	Fenceline past last tree (from W)	0.007	0.007	0.006	0.008	0.003	0.003	0.002	0.042	0.20	0.003
10	Fenceline 1/2 way b/w tree and sludge tanks	0.008	0.007	0.003	0.007	0.003	0.003	0.002	0.055	0.13	0.003
11	Fenceline behind sludge tanks	0.005	0.006	0.002	0.014	0.005	0.002	0.003	0.035	0.006	0.004
12	Fenceline b/w sludge tanks and digesters	0.005	0.013	0.002	0.030	0.13	0.001	0.004	0.015	0.006	0.004
13	Fenceline due East of digester (north of flare)	0.005	0.003	0.002	0.005	0.003	0.002	0.008	0.004	0.002	0.007
14	Canal at road	0.005	0.003	0.004	0.003	0.029	0.003	0.002	0.033	0.074	0.001
15	Canal at 1st break in trees	0.005	0.004	0.004	0.004	0.033	0.004	0.004	0.020	0.025	0.002
16	Canal just past trees	0.004	0.003	0.003	0.003	0.035	0.002	0.005	0.042	0.119	0.002
17	Canal due N of light at sludge tanks	0.004	0.003	0.002	0.003	0.007	0.001	0.007	0.062	0.008	0.002
18	Canal b/w sludge tanks & digesters	0.005	0.003	0.002	0.003	0.007	0.002	0.003	0.003	0.011	0.001
19	Canal at NE corner of plant	0.005	0.004	0.002	0.003	0.004	0.002	0.006	0.003	0.002	0.003
20	Fenceline behind digesters	0.15	0.004	0.003	0.006	0.005	0.001	0.002	0.048	0.006	0.004

Appendix F
Summary of Loveland WWTP Fenceline Sampling

		10/13/2003	10/13/2003	10/15/2003	10/15/2003	10/15/2003	10/17/2003	10/17/2003	10/17/2003	10/20/2003	10/20/2003
		1 to 2 pm	*4 to 5 pm*	*9 to 10 am*	*3 to 4 pm*	*4 to 5 pm*	*10 to 11 am*	*12 to 1 pm*	*4 to 5 pm*	*10 to 11 am*	*2 to 3 pm*
Sampling Location	Location Description	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)
1	Fenceline at South Entrance to Headworks	0.007	0.005	0.003	0.16	0.62	0.32	0.12	0.003	0.004	0.004
2	Fenceline at manhole in driveway	0.004	0.005	0.004	0.24	0.87	0.65	0.035	0.35	0.016	0.12
3	Fenceline at rock in driveway	0.004	0.003	0.003	0.019	0.39	0.034	0.090	0.068	0.031	0.12
4	Fenceline at roadsign	0.003	0.005	0.003	0.28	0.030	0.051	0.015	0.12	0.004	0.004
5	Main gate	0.004	0.003	0.002	0.022	0.049	0.011	0.009	0.12	0.034	0.006
6	1/2 way up hill from gate	0.006	0.003	0.30	0.005	0.044	0.060	0.011	0.053	0.008	0.004
7	NW corner of fenceline	0.002	0.003	0.16	0.006	0.005	0.005	0.006	0.007	0.027	0.004
8	Fenceline behind power pole	0.003	0.003	0.002	0.004	0.003	0.002	0.003	0.056	0.003	0.004
9	Fenceline past last tree (from W)	0.003	0.003	0.010	0.006	0.002	0.003	0.004	0.083	0.015	0.016
10	Fenceline 1/2 way b/w tree and sludge tanks	0.004	0.003	0.005	0.003	0.002	0.006	0.003	0.009	0.036	0.14
11	Fenceline behind sludge tanks	0.003	0.003	0.015	0.005	0.004	0.003	0.003	0.006	0.022	0.063
12	Fenceline b/w sludge tanks and digesters	0.003	0.003	0.003	0.004	0.005	0.015	0.003	0.009	0.007	0.017
13	Fenceline due East of digester (north of flare)	0.003	0.003	0.016	0.003	0.002	0.003	0.004	0.004	0.004	0.003
14	Canal at road	0.005	0.003	0.14	0.004	0.003	0.003	0.004	0.003	0.038	0.052
15	Canal at 1st break in trees	0.003	0.003	0.030	0.003	0.003	0.002	0.003	0.021	0.004	0.010
16	Canal just past trees	0.003	0.003	0.013	0.005	0.003	0.003	0.003	0.006	0.014	0.037
17	Canal due N of light at sludge tanks	0.003	0.003	0.014	0.004	0.001	0.003	0.003	0.053	0.005	0.12
18	Canal b/w sludge tanks & digesters	0.003	0.003	0.013	0.003	0.002	0.002	0.004	0.007	0.004	0.066
19	Canal at NE corner of plant	0.002	0.002	0.021	0.004	0.002	0.003	0.003	0.013	0.019	0.004
20	Fenceline behind digesters	0.004	0.003	0.007	0.003	0.002	0.004	0.003	0.063	0.014	0.011

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Summary of Loveland WWTP Fenceline Sampling

		10/20/2003	10/22/2003	10/22/2003	10/22/2003	10/23/2003	10/23/2003	10/23/2003		
		7 to 8 pm	*7 to 8 am*	*3 to 4 pm*	*4 to 5 pm*	*9 to 10 am*	*1 to 2 pm*	*3 to 4 pm*		
Sampling Location	Location Description	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	H2S (ppm)	Average (ppm)	Max (ppm)
1	Fenceline at South Entrance to Headworks	0.004	0.040	0.13	0.004	0.013	0.005	0.47	0.12	0.62
2	Fenceline at manhole in driveway	0.006	0.031	0.16	0.011	0.12	0.13	1.5	0.26	1.5
3	Fenceline at rock in driveway	0.002	0.028	0.11	0.018	0.044	0.12	0.14	0.08	0.39
4	Fenceline at roadsign	0.003	0.023	0.014	0.016	0.026	0.15	0.21	0.08	0.28
5	Main gate	0.003	0.023	0.009	0.013	0.059	0.11	0.28	0.04	0.28
6	1/2 way up hill from gate	0.003	0.018	0.042	0.095	0.012	0.062	0.13	0.04	0.3
7	NW corner of fenceline	0.002	0.012	0.14	0.013	0.012	0.12	0.105	0.03	0.16
8	Fenceline behind power pole	0.003	0.003	0.028	0.43	0.006	0.007	0.11	0.03	0.11
9	Fenceline past last tree (from W)	0.002	0.003	0.041	0.45	0.006	0.005	0.035	0.04	0.45
10	Fenceline 1/2 way b/w tree and sludge tanks	0.003	0.003	0.026	0.021	0.006	0.010	0.005	0.02	0.14
11	Fenceline behind sludge tanks	0.003	0.003	0.041	0.016	0.025	0.008	0.009	0.01	0.063
12	Fenceline b/w sludge tanks and digesters	0.003	0.006	0.032	0.011	0.025	0.019	0.013	0.01	0.13
13	Fenceline due East of digester (north of flare)	0.011	0.005	0.005	0.004	0.006	0.008	0.005	0.00	0.079
14	Canal at road	0.003	0.007	0.072	0.014	0.012	0.007	0.12	0.02	0.14
15	Canal at 1st break in trees	0.002	0.006	0.18	0.014	0.011	0.016	0.020	0.02	0.18
16	Canal just past trees	0.009	0.004	0.078	0.084	0.012	0.007	0.042	0.02	0.119
17	Canal due N of light at sludge tanks	0.006	0.008	0.066	0.003	0.012	0.012	0.009	0.02	0.12
18	Canal b/w sludge tanks & digesters	0.008	0.004	0.005	0.003	0.014	0.007	0.005	0.01	0.066
19	Canal at NE corner of plant	0.004	0.002	0.004	0.003	0.007	0.004	0.004	0.01	0.021
20	Fenceline behind digesters	0.003	0.006	0.005	0.004	0.033	0.026	0.005	0.02	0.15

Appendix F
Summary of Loveland WWTP Fenceline Sampling Results

		10/07/2003	10/07/2003	10/07/2003	10/08/2003	10/08/2003	10/08/2003	10/11/2003	10/11/2003	10/11/2003	10/13/2003	10/13/2003
		10 to 11 am	*2 to 3 pm*	*4 to 5 pm*	*10 to 11 am*	*1 to 2 pm*	*4 to 5 pm*	*9 to 10 am*	*3 to 5 pm*	*6 to 7 pm*	*8 to 9 pm*	*1 to 2 pm*
Sampling Location	Location Description	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)
1	Fenceline at South Entrance to Headworks	15.0	2.0	7.0	1.0	1.0	2.0	ND	ND	ND	1.0	ND
2	Fenceline at manhole in driveway	7.0	7.0	7.0	1.0	1.0	7.0	1.0	2.0	7.0	2.0	ND
3	Fenceline at rock in driveway	ND	ND	2.0	1.0	ND	7.0	1.0	1.0	2.0	1.0	ND
4	Fenceline at roadsign	4.0	ND	7.0	1.0	ND	4.0	ND	2.0	1.0	ND	ND
5	Main gate	ND	ND	1.0	ND	ND	2.0	1.0	ND	2.0	ND	ND
6	1/2 way up hill from gate	ND	ND	4.0	ND	1.0	ND	ND	ND	1.0	ND	ND
7	NW corner of fenceline	ND	ND	1.0	ND	ND	ND	ND	1.0	1.0	ND	ND
8	Fenceline behind power pole	ND	ND	ND	1.0	1.0	ND	ND	1.0	1.0	ND	ND
9	Fenceline past last tree (from W)	ND	ND	ND	1.0	ND	ND	ND	1.0	1.0	ND	ND
10	Fenceline 1/2 way b/w tree and sludge tanks	ND	ND	ND	1.0	ND	ND	ND	1.0	1.0	ND	ND
11	Fenceline behind sludge tanks	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND
12	Fenceline b/w sludge tanks and digesters	ND	ND	ND	1.0	1.0	ND	ND	1.0	1.0	ND	ND
13	Fenceline due East of digester (north of flare)	ND	ND	ND	ND	ND	ND	1.0	ND	ND	1.0	ND
14	Canal at road	ND	ND	ND	ND	1.0	ND	ND	2.0	1.0	ND	ND
15	Canal at 1st break in trees	ND	ND	ND	ND	1.0	ND	ND	1.0	1.0	ND	ND
16	Canal just past trees	ND	ND	ND	ND	1.0	ND	1.0	1.0	1.0	ND	ND
17	Canal due N of light at sludge tanks	ND	ND	ND	ND	ND	ND	1.0	2.0	1.0	ND	ND
18	Canal b/w sludge tanks & digesters	ND	ND	ND	ND	ND	ND	1.0	ND	1.0	ND	ND
19	Canal at NE corner of plant	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND
20	Fenceline behind digesters	2.0	ND	ND	ND	ND	ND	ND	1.0	30.0	ND	ND

Summary of Loveland WWTF Fenceline Sampling Results

Sampling Location	Location Description	10/13/2003 4 to 5 pm Odor (D/T)	10/15/2003 9 to 10 am Odor (D/T)	10/15/2003 3 to 4 pm Odor (D/T)	10/15/2003 4 to 5 pm Odor (D/T)	10/17/2003 10 to 11 am Odor (D/T)	10/17/2003 12 to 1 pm Odor (D/T)	10/17/2003 4 to 5 pm Odor (D/T)	10/20/2003 10 to 11 am Odor (D/T)	10/20/2003 2 to 3 pm Odor (D/T)	10/20/2003 7 to 8 pm Odor (D/T)	10/22/2003 7 to 8 am Odor (D/T)
1	Fenceline at South Entrance to Headworks	ND	ND	1.0	2.0	7.0	7.0	ND	ND	ND	ND	1.0
2	Fenceline at manhole in driveway	ND	1.0	1.0	4.0	4.0	2.0	1.0	1.0	7.0	ND	1.0
3	Fenceline at rock in driveway	ND	ND	1.0	2.0	1.0	1.0	1.0	1.0	2.0	ND	1.0
4	Fenceline at roadsign	ND	ND	1.0	ND	2.0	1.0	1.0	1.0	ND	ND	ND
5	Main gate	ND	ND	1.0	1.0	ND	ND	1.0	1.0	ND	ND	1.0
6	1/2 way up hill from gate	ND	1.0	ND	1.0	1.0	1.0	1.0	1.0	ND	ND	ND
7	NW corner of fenceline	ND	1.0	ND	ND	ND	ND	ND	1.0	ND	ND	ND
8	Fenceline behind power pole	ND	1.0	ND	ND	ND	ND	1.0	ND	ND	ND	ND
9	Fenceline past last tree (from W)	ND	1.0	ND	ND	ND	ND	1.0	1.0	1.0	ND	ND
10	Fenceline 1/2 way b/w tree and sludge tanks	ND	ND	ND	ND	1.0	ND	1.0	1.0	2.0	ND	ND
11	Fenceline behind sludge tanks	ND	1.0	ND	2.0	ND	ND	1.0	2.0	1.0	ND	ND
12	Fenceline b/w sludge tanks and digesters	ND	ND	ND	1.0	1.0	ND	1.0	1.0	1.0	ND	1.0
13	Fenceline due East of digester (north of flare)	ND	1.0	ND	ND	ND	ND	ND	1.0	ND	1.0	1.0
14	Canal at road	ND	ND	ND	ND	ND	ND	ND	1.0	1.0	1.0	ND
15	Canal at 1st break in trees	ND	1.0	ND	ND	ND	ND	1.0	1.0	1.0	ND	ND
16	Canal just past trees	ND	1.0	ND	ND	ND	ND	1.0	1.0	2.0	1.0	ND
17	Canal due N of light at sludge tanks	ND	1.0	ND	ND	ND	ND	1.0	1.0	1.0	1.0	ND
18	Canal b/w sludge tanks & digesters	ND	1.0	ND	ND	ND	ND	ND	1.0	1.0	1.0	ND
19	Canal at NE corner of plant	ND	1.0	ND	ND	ND	ND	1.0	2.0	ND	ND	ND
20	Fenceline behind digesters	ND	1.0	ND	ND	ND	ND	15.0	1.0	1.0	ND	1.0

Appendix F
Summary of Loveland WWTP Fenceline Sampling Results

		10/22/2003	10/22/2003	10/23/2003	10/23/2003	10/23/2003	06/02/2004		
		3 to 4 pm	*4 to 5 pm*	*9 to 10 am*	*1 to 2 pm*	*3 to 4 pm*	*1 to 2 pm*		
Sampling Location	Location Description	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Odor (D/T)	Average	Max
1	Fenceline at South Entrance to Headworks	1.0	1.0	ND	ND	1.0	15.0	4.1	15.0
2	Fenceline at manhole in driveway	2.0	1.0	1.0	1.0	7.0	30.0	4.2	30.0
3	Fenceline at rock in driveway	1.0	1.0	1.0	1.0	1.0	7.0	1.8	7.0
4	Fenceline at roadsign	1.0	1.0	ND	2.0	7.0	7.0	2.7	7.0
5	Main gate	ND	1.0	1.0	1.0	2.0	30.0	3.3	30.0
6	1/2 way up hill from gate	1.0	1.0	ND	1.0	1.0	2.0	1.3	4.0
7	NW corner of fenceline	1.0	ND	ND	2.0	2.0	7.0	1.9	7.0
8	Fenceline behind power pole	1.0	1.0	ND	1.0	1.0	2.0	1.1	2.0
9	Fenceline past last tree (from W)	2.0	1.0	1.0	1.0	1.0	15.0	2.2	15.0
10	Fenceline 1/2 way b/w tree and sludge tanks	1.0	1.0	ND	1.0	1.0	30.0	3.5	30.0
11	Fenceline behind sludge tanks	2.0	ND	1.0	ND	1.0	ND	1.3	2.0
12	Fenceline b/w sludge tanks and digesters	1.0	1.0	1.0	1.0	1.0	15.0	1.9	15.0
13	Fenceline due East of digester (north of flare)	ND	ND	ND	1.0	ND	ND	1.0	1.0
14	Canal at road	1.0	ND	ND	ND	2.0	ND	1.3	2.0
15	Canal at 1st break in trees	1.0	ND	ND	1.0	1.0	7.0	1.5	7.0
16	Canal just past trees	2.0	1.0	ND	1.0	1.0	30.0	3.2	30.0
17	Canal due N of light at sludge tanks	1.0	ND	ND	1.0	1.0	ND	1.1	2.0
18	Canal b/w sludge tanks & digesters	2.0	ND	1.0	1.0	ND	7.0	1.7	7.0
19	Canal at NE corner of plant	ND	ND	ND	ND	ND	ND	1.3	2.0
20	Fenceline behind digesters	ND	1.0	1.0	1.0	1.0	ND	4.7	30.0

Appendix G – Baseline Dispersion Modeling Input

Appendix G1 - Worst Case Condition Baseline Modeling Input

Odor Source	Type of Source	Dimension (Dia. or LxW) (ft)	Aera (ft2)	Max H2S (ppm)	Aeration Air or Ventilation Air (cfm)	Air flow from flux chamber (lpm)	Odor Calculated (D/T)	Odor flux (OU/min/m2)	Odor Emission (OU/s)	Note
Trickling filter E	Area	98	7539	3.0		5	7,065	272	3,174	
Trickling filter W	Area	98	7539	2.5		5	5,888	226	2,645	
Primary clarifier weir W	Area	78	955	2.2		5	5,181	199	295	West PC emission = 1474 (weir + surface)
Primary clarifier weir E	Area	78	955	1.2		5	2,850	110	162	East PC emission = 811 (weir + surface)
Primary clarifier surface W	Area	78	3821	2.2		5	5,181	199	1,179	
Primary clarifier surface E	Area	78	3821	1.2		5	2,850	110	649	
Aerated grit chamber	Area	20 x 25	500	21.0	100	13	49,455	4,916	3,808	
Aeration basin (old)	Area	60 x 60 x 4	14400	0.1	5,467	20	236	36	810	
Aeration basin (new)	Area	60 x 60 x 2	7200	0.1	2,733	20	236	36	405	
E digester junction box	Area	4 x 2.5	10	31.0		5	73,005	2,808	43	
W digester junction box	Area	5.5 x 2.5	13.8	31.0		5	73,005	2,808	60	
Biosolids truck loading - at hatch 1	Area	1' dia.	0.8	50.0	17		117,750	15,137	929	Estimated airflow from the hatches based on displacement by the biosolids. Tanker volume is 7500 gallon, and biosolids loading time is 20 min.
Biosolids truck loading - at hatch 2	Area	1' dia.	0.8	50.0	17		117,750	15,137	929	
Biosolids truck loading - at hatch 3	Area	1' dia.	0.8	50.0	17		117,750	15,137	929	
DAF thickener door	Vol.	6 x 3	24	8.8	525		20,724		5,135	Total air from DAFT is 700 cfm
DAF thickener opening	Vol.	2 x 3	6	8.80	175		20,724		1,712	
Headworks odor control exhaust	Point	1.5 x 2.5	3.75	4.50	6,000		10,598		30,008	
Primary effluent wetwell	Area	20 x 24	480	31.0		5	73,005	2,808	2,088	
Trickling filter effluent channel E	Area	2 x 6	12	28.0		5	65,940	2,536	47	
Trickling filter effluent channel W	Area	2 x 6	12	28.0		5	65,940	2,536	47	
Anaerobic Digester (cover)	Area	30	24	22.0		5	51,810	1,993	73	Assume 0.5' wide opening around the digester cover
Influent collection well	Area	5 x 10	50	6.1		5	14,366	553	43	
Final clarifier 1	Area	96	7235	0.02		5	47	2	20	
Final clarifier 2	Area	96	7235	0.02		5	47	2	20	
Primary splitter box	Area	3 x 6	18	14.9		5	35,090	1,350	38	
Screw pumps (top)	Area	half of 45 x 20	450	9.3		5	21,902	842	587	
Screw pumps (bottom)	Area	half of 45 x 20	450	8.1		5	19,076	734	511	
Aerated grit effluent channel	Area	4x14 + 2x15 + 3x4 + (3~8)x4.3	120	6.5		5	15,308	589	109	
Vent from boiler box	Vol.	2 x 2	4	17.0	2,700		40,035		51,014	
Anaerobic Digester (PRV)	Point			2.2			5,181			
flare	Point			4000	64		188,400		5,705	98% removal due to combustion
Grit Truck Loading	Vol.	14' x 12' H door	168	10			23,550		1,867	

Loveland WWTP Odor Dispersion Modeling Input Data

Appendix G2 - Average Condition Baseline Modeling Input

Odor Source	Type of Source	Dimension (Dia. or LxW) (ft)	Aera (ft2)	H2S from Flux Chamber Sampling (ppm)	Odor from Flux Chamber Sampling (D/T)	Aeration Air or Ventilation Air (cfm)	Air flow from flux chamber (lpm)	Odor flux (OU/min/m2)	Odor Emission (OU/s)	Note
Trickling filter E	Area	98	7539	18	2,700		5	104	1,213	
Trickling filter W	Area	98	7539	18	2,700		5	104	1,213	
Primary clarifier weir W	Area	78	955	28	4,400		5	169	250	West PC emission = 797 (weir + surface)
Primary clarifier weir E	Area	78	955	28	4,400		5	169	250	East PC emission = 797 (weir + surface)
Primary clarifier surface W	Area	78	3821	4.1	2,400		5	92	546	
Primary clarifier surface E	Area	78	3821	4.1	2,400		5	92	546	
Aerated grit chamber	Area	20 x 25	500	60	4,000	100	13	398	308	
Aeration basin (old)	Area	60 x 60 x 4	14400	0.014	370	5,467	20	57	1,272	
Aeration basin (new)	Area	60 x 60 x 2	7200	0.019	1,500	2,733	20	231	2,579	
E digester junction box	Area	4 x 2.5	10	12	2,900		5	112	2	
W digester junction box	Area	5.5 x 2.5	13.8	12	2,900		5	112	2	
Biosolids truck loading - at hatch 1	Area	1' dia.	0.8	2	3,100	17		398	24.4	hatches based on displacement by the biosolids. Tanker volume is 7500 gallon.
Biosolids truck loading - at hatch 2	Area	1' dia.	0.8	2	3,100	17		398	24.4	
Biosolids truck loading - at hatch 3	Area	1' dia.	0.8	2	3,100	17		398	24.4	
DAF thickener door	Vol.	6 x 3	24	26	4,400	525			1,090	Total air from DAFT is 700 cfm
DAF thickener opening	Vol.	2 x 3	6	26	4,400	175			363	
Headworks odor control exhaust	Point	1.5 x 2.5	3.75	0.003	90	6,000			255	
Primary effluent wetwell	Area	20 x 24	480				5	135	100	
Trickling filter effluent channel E	Area	2 x 6	12				5	128	2	
Trickling filter effluent channel W	Area	2 x 6	12				5	128	2	
Anaerobic Digester (cover)	Area	30	24				5	115	4	Assume 0.5' wide opening around the digester cover
Influent collection well	Area	5 x 10	50				5	80	6	
Final clarifier 1	Area	96	7235				5	66	744	
Final clarifier 2	Area	96	7235				5	66	744	
Primary splitter box	Area	3 x 6	18				5	99	3	
Screw pumps (top)	Area	half of 45 x 20	450				5	87	61	
Screw pumps (bottom)	Area	half of 45 x 20	450				5	84	59	
Aerated grit effluent channel	Area	4x14 + 2x15 + 3x4 + (3~8)x4.3	120				5	81	15	
Vent from boiler box	Vol.	2 x 2	4			2,700			3,440	
Anaerobic Digester (PRV)	Point									
flare	Point				4000	64			191	98% removal due to combustion
Grit Truck Loading	Vol.	14' x 12' H door	168						182	

Appendix H – Proposed Odor Control Equipment Cut Sheets

Portable Carbon Units for Maintenance

USFilter

US Filter Westates Product Bulletin

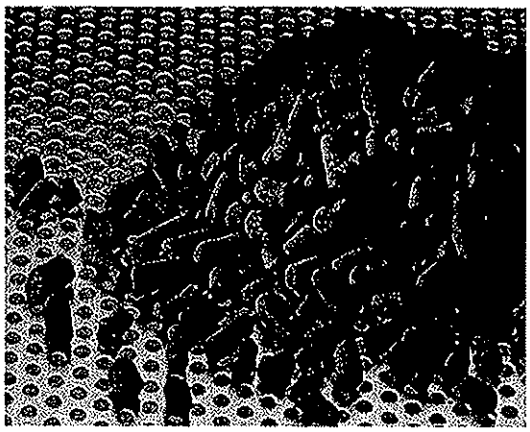
Midas OCM™

(Patent Applied For)

Like Dionysus in the Greek Legend, Midas OCM™ Can Grant You the Power to Turn Your H_2S Odor Problems into Golden Sulfur

DESCRIPTION

Midas OCM™ is unlike any other odor control media that is available in the market place today. A special manufacturing process combining selected active ingredients and premium quality bituminous coal gives ***Midas OCM™*** an extraordinarily high H_2S breakthrough capacity. **This odor control media is not impregnated** and therefore does not suffer the serious drawbacks associated with alkali-impregnated carbons. ***Midas OCM™*** has an ignition temperature that is similar to virgin coal based carbons (>450 °C) and by not being impregnated with a strong alkali, is much safer to load, start-up and remove from an adsorber system.



Midas OCM™ is a high surface area macroporous media with a large pore volume. The lack of an impregnant means all of ***Midas OCM™'s*** pore volume and surface area are available for storing the sulfur produced during the catalytic oxidation of H_2S and for the adsorption of any VOCs that may be present in the gas stream.

Midas OCM™, being a wide-spectrum odor and corrosive gas control media, can be successfully used in any application where impregnated carbons are currently used. The high H_2S and acidic gas loading capacity of ***Midas OCM™*** is not affected by the presence of high CO_2 levels. Its ~4 mm pellet diameter offers a low pressure drop to gas flows and its superior hardness offers excellent resistance to dust and fines formation.

APPLICATIONS

Odorous compounds typical of chemical processes found in sewage treatment plants, refineries and pulp and paper mills are detectable at very low concentrations. ***Midas OCM™*** effectively reduces H_2S concentrations to below odor threshold levels by catalytically oxidizing the H_2S to elemental sulfur. Mercaptans are efficiently oxidized to their respective disulfides, making them more adsorbable by activated carbon. Acidic gases such as HCl and SO_2 are captured and retained by ***Midas OCM™***. The high surface area of ***Midas OCM™*** greatly enhances its ability to remove volatile organic compounds from the gas stream being treated.

Features and Benefits

- Exceptionally high H_2S loading capacity
- Longer bed life means fewer service interruptions, lower O&M costs
- High ignition temperature
- Not impregnated, safe to handle
- No dangerous pH problem when spent
- Low pressure drop
- Backed by technical support and strong QA/QC program

US Filter Westates Offices

Baytown, TX	Los Angeles, CA	Red Bluff, CA	Oakland, CA	Warren, NJ
800-659-1723	800-659-1771	530-527-2664	800-659-1718	800-659-1717

SPECIFICATIONS

Iodine Number, mgI_2/g	1050 min
MPD, mm	3.9 – 4.1
Apparent Density, g/cc	0.46 – 0.52
Hardness No.	95 min
Butane Activity	26 min
H_2S Capacity, gH_2S/cc**	0.30 min

** The H_2S breakthrough capacity is determined using ASTM standard method D6646-01. Prior to testing, the test sample should be completely humidified by exposing the sample to a flow of humid air (>85% RH) for at least 4 hours. Testing is accomplished by passing a moist (85% RH) stream of air containing 1 vol. % H_2S and the selected concentration of CO_2 through a 1 inch inner diameter tube with a nine-inch deep bed of closely packed carbon at a rate of 1,450 cc/min and monitoring to a 50 ppmv H_2S breakthrough. The results are reported as grams of H_2S adsorbed per cc of carbon.

Quality Control

All ***Midas OCM***™ odor control media is extensively quality checked at our State of California certified environmental and carbon testing laboratory located in Los Angeles, CA. The US Filter Westates laboratory is fully equipped to provide complete quality control analyses using ASTM standard test methods in order to assure the consistent quality of all ***Midas OCM***™ carbons.

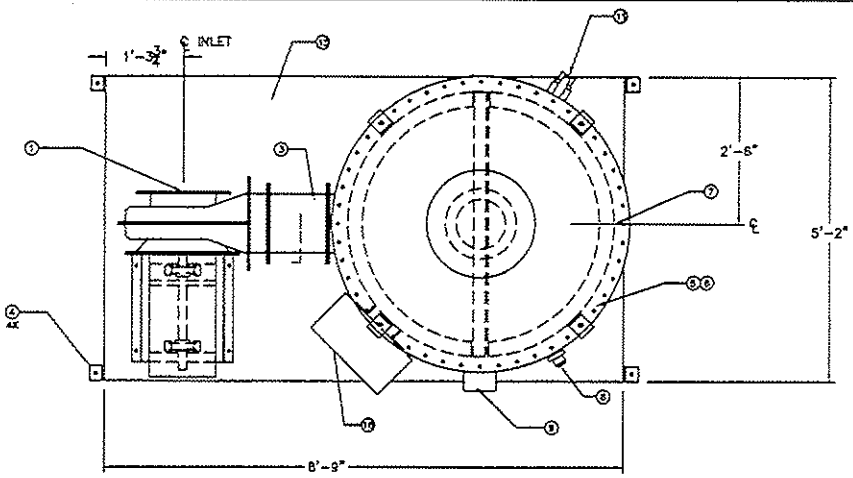
Our technical staff offers hands-on guidance in selecting the most appropriate system, operating conditions and carbon to meet your needs. For more information, contact your nearest US Filter Westates representative.

Safety Note: Unlike impregnated carbons used in odor control applications, ***Midas OCM***™ does not need to undergo long term conditioning prior being put into service. The adsorption of VOCs and the conversion of H_2S to elemental sulfur will lead to the generation of heat within a media bed. Like any carbon bed, this heat of reaction and adsorption needs to be dissipated in order to fully assure the safe operation of the bed.

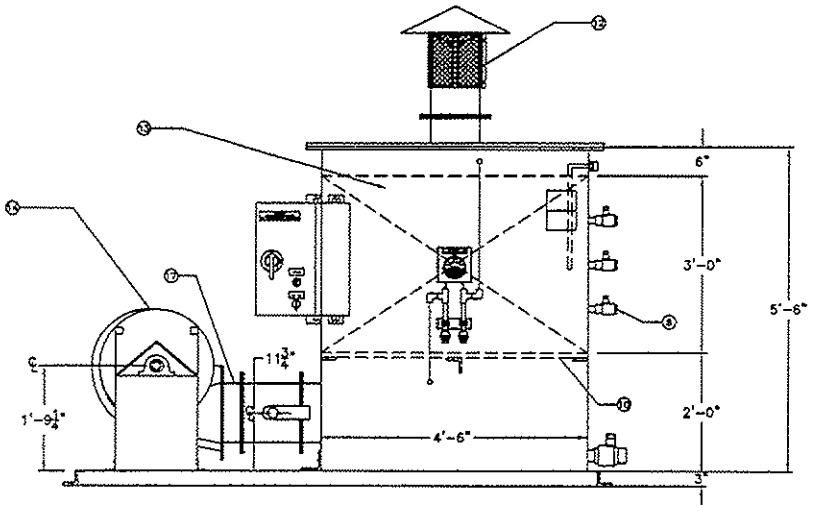
Wet ***Midas OCM***™ readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

ODOR CONTROL COMPARISON CHART

OC PRODUCTS	Density, g/cc	Weight, lbs/ft^3	H_2S Removed, g/cc	H_2S Removed, % of Wt.
Coconut Shell Carbon	0.50	31	0.05	10.0%
Chemically Treated Carbon	0.55	34	0.14	25.4%
Water Wash Carbon	0.56	35	0.09	16.1%
MIDAS OCM	0.48	30	0.30	62.5%



PLAN



ELEVATION

SYSTEM #	1
MODEL NO.	RJC-1000
AIR FLOW RATE, cfm	1000
OPERATING WEIGHT, lbs	2,500

LEGENDS

1 FAN INLET FLANGE (DETAIL IN FAN SECTION)
2 --
3 12" I.D FRP DAMPER
4 SKID ANCHOR LUG, 4X
5 CAUTION TAG
6 ID TAG
7 GROUNDING ROD
8 CARBON SAMPLE VALVE (TYP.)
9 DIFFERENTIAL PRESSURE GAUGE
10 CARBON SUPPORT GRATING AND SCREEN
11 2" DRAIN VALVE
12 10" I.D SCRUBBER OUTLET STACK W/ RAIN CAP
13 ACTIVATED CARBON
14 FAN
15 SKID
16 ELECTRICAL CONTROL PANEL
17 FRP FAN OUTLET TRANSITION PIECE

NOTES:

1. SCRUBBER SYSTEM IS SIZED FOR A PRESSURE DROP OF 6.5" W.C. ACROSS THE SCRUBBER SYSTEM, INLET DUCTWORK AND EXHAUST STACK.
2. INLET DUCTING BY OTHERS. INSTALLATION AND AIRFLOW BALANCING BY OTHERS.
3. CARBON LOADING BY OTHERS.
4. SKID FRAME AS SHOWN SHALL BE FABRICATED FROM CARBON STEEL ANGLE.
5. TOP OF FRAME SHALL BE COVERED WITH 10 GAUGE SHEET. TACK IN PLACE FULL BEAD AROUND TOP EXTERIOR PERIMETER.
6. ENTIRE SKID SANDBLASTED AND COATED WITH TNEMEC 69 EPOXY ENAMEL; COLOR TO BE U.S. FILTER STANDARD BLUE.
7. 3/60/460 CONTROL POWER TO CONTROL PANEL BY OTHERS.
8. GROUND WIRE TO GROUNDING ROD BY OTHERS.
9. SCRUBBER UNIT TO BE FRP (HETRON 922 RESIN); COLOR TO BE WHITE.
10. TRUE ORIENTATION IN PLAN VIEW ONLY.

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN

DESIGNER	KR	DATE 10/12/00
CHECKER		DATE
ENGINEER		DATE --
MANAGER	--	DATE --
FILE	--	
SCALE	NTS	

TITLE: RJC-1000 CARBON ADSORBER
FRP VESSEL W/ RFE-315 FAN
GENERAL ARRANGEMENT DRAWING

CLIENT: --
--

USFilter
RJ ENVIRONMENTAL PRODUCTS
POWAY, CA 92064
(858) 486-8500

PROJECT	CODE	DRAWING	SHEET	REV
--		--	-- OF --	--

SECTION 2: CARBON ADSORBER ODOR CONTROL SYSTEM EQUIPMENT SPECIFICATIONS

PART 1 - GENERAL

1.1 SCOPE

A. Furnish all labor, materials, equipment and incidentals required to install odor control system for the control of atmospheric H_2S and other noxious odors as shown on drawings and specified herein. The odor control system shall be an activated carbon adsorber system consisting of an adsorber vessel, centrifugal fan, activated carbon, interconnecting ductwork and other appurtenances for a complete operating system.

B. The entire system shall be a skid mounted, packaged system consisting of the following major components:
- Equipment Skid
- Air Exhaust Fan
- Adsorber Vessel Inlet Volume Control Damper
- Interconnecting Ductwork as required
- Carbon Adsorber Vessel
- Activated Carbon Media
- Control Panel

1.2 SYSTEM DESCRIPTION

The malodorous air shall enter the carbon adsorber and shall flow through a densely packed bed of activated carbon. The activated carbon shall remove hydrogen sulfide and other odor causing constituents. The air shall continue through the vessel and be exhausted through the outlet.

1.3 QUALITY ASSURANCE

A. All systems shall be supplied by a single manufacturer fully experienced, reputable and qualified in the manufacture of the equipment to be furnished.

B. In order to ensure unity of responsibility, skid, fan, damper, ducting, vessel, control panel, carbon and other miscellaneous system appurtenances shall be furnished by a single manufacturer.

C. Each system shall be a modular carbon adsorption system manufactured by US Filter, RJ Environmental Products, San Diego, California, Model No. RJC-1000 or approved equal.

D. In order to be considered equal, the manufacturer shall submit complete submittal information in accordance with section 1.4 at least ten days prior to opening of bid. No supplier shall be accepted unless it is pre-approved prior to the bid. The supplier shall also provide a list of ten installations where such identical equipment is in service, with names and contact phone numbers.

1.4 SUBMITTALS

A. The Contractor shall submit shop drawings to the Engineer, with as a minimum, the following items:
   1. Certified shop and erection drawings showing details of construction, dimensions, and anchor bolt locations.
   2. Descriptive literature, bulletins and catalogs of the equipment.
   3. The total weight of the packaged equipment as well as the weight of the single largest items.
   4. A complete bill of materials.
   5. Calculations showing theoretical anticipated life of carbon media, based on anticipated average hydrogen sulfide concentrations.
   6. Carbon media MSDS and specification sheet.

1.5 OPERATING INSTRUCTIONS

The Contractor shall provide 5 copies of operation and maintenance manuals for all equipment furnished.

PART 2- PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

The odor control system shall be designed for the following operating conditions and shall meet the following performance criteria when put in service with fresh carbon media:

Air Flow Rate, cfm	1000
Average Inlet H_2S Concentration, ppm	5
Peak Inlet H_2S Concentration, ppm	10
Maximum Outlet H_2S Concentration, ppm	0.1
Minimum Removal Efficiency, %	99.0

2.2 CARBON ADSORBER VESSEL

A. DESIGN CRITERIA: The carbon adsorber vessel should be designed for the following design criteria:

Vessel Diameter, ft	4.5
Vessel Straight Side Height, ft	5.5
Wall Thickness, in	0.25
Wind load, mph	
Seismic Zone	
Internal Positive Pressure, in. WC	+10
Maximum Operating Temperature, °F	150
Carbon Bed Depth, ft.	3.0

B. MATERIAL OF CONSTRUCTION:
   1. The vessel shall be fabricated from premium grade vinyl ester resin FRP construction.
   2. Resin used in fabrication shall be a premium vinyl ester resin such as Hetron 922 by Ashland Chemical, Derakane 411 by Dow Chemical, or approved equal. The resin shall be reinforced with an inner veil of a suitable synthetic organic fiber such as Nexus 111-00010.
   3. Reinforcement: Glass fiber reinforcement used shall be commercial grade corrosion resistant borosilicate glass.

4. Fabrication:
   a. General: Fabrication shall be in accordance with NBS PS 15-69, ASTM D 3299 and ASTM D-4097. All non-molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed with a resin coat prior to the final paraffinated resin coat.
   b. Corrosion Liner: The inner surface of all laminates shall be resin rich and reinforced with one NEXUS 111-00010 with a minimum thickness of 10 mils. The interior corrosion layer shall consist of two layers of 1 1/2 oz. per sq. ft. chopped strand mat. The total corrosion liner thickness shall be a minimum of 100 mils.
   c. Structural Laminate: Structural laminates shall consist of alternating layers of 1-1/2 oz per sq. ft mat or chopped glass and 24 oz per sq. yard woven roving applied to reach a designed thickness. The exterior shall be surface coated with white gel coat containing ultra violet light inhibitors.
5. Fittings: The vessel shall be fitted with the following fittings:

Description	Size (in.)	Type	Qty.
Gas Inlet	12"	Flanged	1
Gas Outlet	10"	Flanged	1
Drain	1	NPT	1
Pressure Tap	1	NPT	2
Carbon Sample	1	NPT	3

2.3 CARBON ADSORBER VESSEL ACCESSORIES

A. **Differential Pressure Gauge** - A Series 2000 differential pressure gauge as manufactured by Dwyer Instruments shall be provided to continuously monitor the pressure drop across the carbon bed. The differential pressure gauge shall be isolated with isolation valves and shall be mounted on the vessel.

B. **Carbon Sample Probes** - Each vessel shall have three (3) 1" diameter sample probes per bed which shall extend into the bed a minimum of twelve inches. The sample probes shall be blocked off with a ball valve constructed of PVC.

C. **Grounding Rod** - A stainless steel rod shall be provided to adequately ground each carbon bed. Rods shall be grounded via a 10-gauge wire.

D. **Carbon Support Grating and Screen** - Each adsorber vessel shall be furnished to accommodate a single bed of activated carbon having an average depth of three feet. The carbon bed shall be supported on a polypropylene screen through an FRP support grating system. The screen and the support system shall be removable through the top cover. The support system shall consist of removable grating. Pall rings or other dumped packing media as a means of carbon support will not be acceptable. The support system shall be designed to withstand a load of at least 150 lbs/ft^2 with a minimum deflection of 1/4" under all conditions.

E. **Access Manways or Removable Top** - The vessel shall have a completely removable top or a 24" diameter access manway.

F. **Exhaust Stack** - The adsorber shall be provided with a straight outlet with rain cap, to prevent rain water from entering into the system.

G. **Anchor Bolts** – The Carbon Adsorber shall be provided with properly sized epoxy HILTI anchor system.

H. **Equipment Tags** - The vessel shall be provided with an I.D. Tag with the following minimum information: Carbon Type, Vessel Dimensions, Date of Manufacture, and Design Conditions.

2.4 ACTIVATED CARBON MEDIA (for Sewage Odors)

A. TYPE: The activated carbon shall be virgin, pelletized, derived from high grade bituminous coal, vapor phase type, suitable for the control of sewage odors. The carbon shall have the following specifications:

B. SPECIFICATIONS:

Iodine Number, mgI_2/g	1050 min
MPD,mm	3.9-4.1
Apparent Density,g/cc	0.46-0.52
Hardness No.	95 min
Butane Activity	26 min
H_2S Capacity, gH_2S/cc**	0.30 min

** The H_2S breakthrough capacity is determined using ASTM standard method D6646-01. Prior to testing, the test sample should be completely humidified by exposing the sample to a flow of humid air (>85% RH) for at least 4 hours. Testing is accomplished by passing a moist (85% RH) stream of air containing 1 vol. % H_2S and the selected concentration of CO_2 through a 1 inch diameter tube with a nine-inch deep bed of closely packed carbon at a rate of 1,450 cc/min and monitoring to a 50 ppmv H_2S breakthrough. The results are reported as grams of H_2S adsorbed per cc of carbon.

2.5 FAN

A. Each unit shall be furnished with a centrifugal, industrial fiberglass reinforced plastic fan that is AMCA certified and licensed to bear an AMCA seal. Each fan shall be V-belt driven, Arrangement No. 10, equipped with undrilled inlet flange, outlet flange, Viton shaft seal, fan guard, and motor enclosure. Each fan and drive motor shall be mounted on a common base assembly designed for mounting on a concrete pad. Fan motor shall be high efficiency, TEFC, 480V, 3 phase, 60 Hz with a 1.15 service factor. Accommodation to accept a hand-held tachometer shall be available for each fan. Each fan shall have a drain with plug.

B. Fan shall include graphite impregnation for grounding.

C. The fan shall be manufactured by NY Blower, Hartzell, or equal.

D. The fan shall be designed for the following operating conditions:

Elevation over Mean Sea Level	
Air Flow Rate, cfm	1,000
S.P. up to Fan Inlet, in. WC	1.5
Adsorber Pressure Drop, in. WC	5.0
Total S.P., in. WC	6.5
Minimum Motor HP	3.0

2.6 EQUIPMENT SKID

The entire system shall be factory assembled on a carbon steel equipment skid to minimize field installation requirements. The skid shall be sand blasted and coated with a two-part epoxy enamel, with a compatible primer coat.

2.7 CONTROL PANEL

The system fan shall be factory wired to a FRP control panel of Nema 4X construction. The control panel shall have a fan control switch with a pilot lamp to indicate the fan running status. The power supplied to the panel shall be 480V, 3 phase, 60 Hz. The panel shall be provided with a power disconnect switch, motor starter and control transformer.

2.8 INTERCONNECTING DUCTWORK AND DAMPER

The odor control system manufacturer shall provide the necessary ductwork between the fan and the adsorber vessel. The ductwork shall include a volume control damper with lockable louver for flow adjustment. Material of construction shall be same as that of adsorber vessel.

2.9 HARDWARE AND GASKETS

All hardware shall be 316 stainless steel. Gaskets shall be a minimum of 1/8" thick, full face, EPDM or neoprene suitable for the intended service.

2.10 FLEXIBLE CONNECTORS

A fan inlet flexible connector shall be included in the ductwork to dampen axial, lateral, and vibration duct movement. A flexible connector shall be installed at the fan outlet only if necessary and recommended by equipment supplier.

PART 3 - EXECUTION

3.1 INSTALLATION

Odor control system shall be furnished and installed in accordance with manufacturer's recommendations. The Contractor shall provide all utility connections, fan inlet ductwork, concrete pads, fencing and other items shown on the drawings not specified in this section. The Contractor shall be responsible for providing a complete and operable system.

3.2 EQUIPMENT WARRANTY

The manufacturer shall warrant that the equipment sold shall be free from defects in material and workmanship for a period of 1 year from the date of system acceptance or 18 months from the date of shipment, whichever occurs first. The warranty does not apply to the carbon media itself.

Regenerable Carbon Scrubber for Aerated Grit Basin (Stage 3) and DAFT (Stage 5)

RAVEN REGENERABLE ODOR CONTROL SYSTEM™

REGENERABLE RADIAL ODOR CONTROL SYSTEMS

The RAVEN line of regenerable radial odor control systems are designed to be a low cost, highly effective system for removing H_2S from municipal wastewater applications. The systems are based on established carbon theories of adsorption followed by water regeneration. The RAVEN system provides the following benefits:

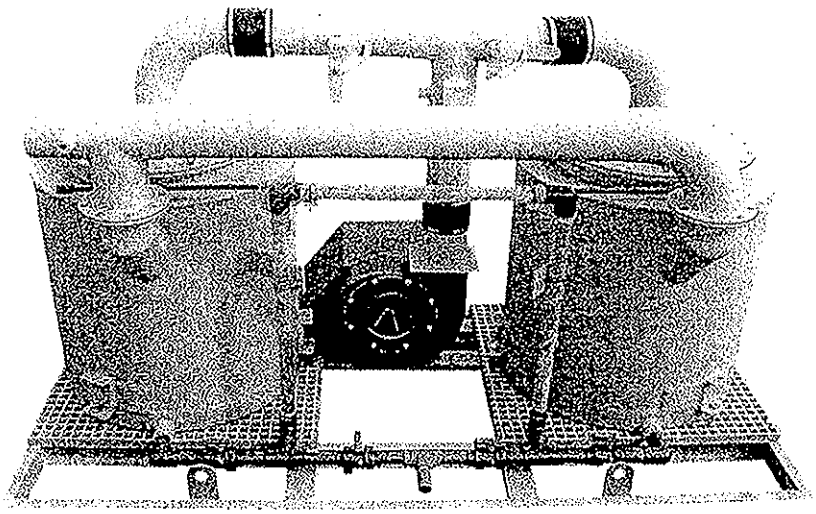
- *Low Capital Cost*
- *Lowest Operating costs for applications up to 50 ppm H_2S*
- *Highly Efficiencies of H_2S removal*
- *Small Footprint*
- *Simple, uncomplicated design (standard off the shelf components)*
- *Highly Reliable with continuous operation*
- *Low maintenance or operator intervention required*
- *Higher media to flow ratio*
- *Low Pressure Drop*

The RAVEN system also comes with several standard add-on options for:

- Automatic Regeneration Package
- Organic Odor Control
- Neutralization of acidic regeneration stream
- Ammonia Treatment

PROCESS DESCRIPTION

The RAVEN utilizes radial flow operation with the foul air entering from the center and is then diffused through the carbon bed. The H_2S is then removed and the clean air is collected in the outer portion of the vessel and exits the exhaust ducting.



P.O. Box 4859
Stateline, NV 89449-4859
phone: 800-429-0150
fax: 775-586-8501
Web Site: www.bayprod.com

"Manufacturers of a COMPLETE line of odor control systems"

BAY PRODUCTS INC.

The complete system is comprised of two vessels with one being on-line while the second being regenerated. This ensure continuous, uninterrupted treatment at all times.

Once the system is saturated with H_2S (this can be done on a time basis or by monitoring equipment), the system will switch (manually or automatically) to the clean vessel and begin the water regeneration of the saturated vessel.

The water regeneration is comprised of water connections on the vessel bottom and outlet duct. The water is run and is discharged until vessel is cleaned (an optional neutralization system can be added to treat the rinse water). Then a bottom drain valve is open to drain the remaining water from the system. Once drained, a small amount of airflow is introduced to dry the vessel. It then remains in standby mode until the on-line bed is saturated. This process continues until the vessel media activity is greatly reduced (usually three to four years).

STANDARD FEATURES & OPTIONS

All **RAVEN** systems come with simple standard components that are readily available for ease of operation and maintenance:

Standard Features:

- FRP (HDPE optional) vessel
- Differential pressure gage
- Fan, FRP, with 3ph/230-460v/60Hz TEFC motor. Graphite impregnated
- Two dampers
- FRP ducting with flexible silicone connectors
- Carbon steel epoxy coated skid
- Duct inlet and outlet
- PVC piping (clear on vertical sections)
- Six water valves (automatic optional)

Available Options:

- ANSI 150 or PS 15-69 flanged inlet or outlet
- **FALCON** Grease/Mist Eliminator™
- Sound Enclosure
- H_2S Bed Monitor
- Various fan options: TEXP, epoxy-coated metal fan or others upon request
- Extra Vessel for organic odor or ammonia control

STANDARD SIZES

The RAVEN system is built around standard sizes and components to minimize manufacturing and replacement costs. The standard RAVEN sizes are:

- 500 cfm
- 2,000 cfm
- 4,000 cfm
- 7,500 cfm
- 10,000 cfm
- 15,000 cfm
- 20,000 cfm

RAVEN REGENERABLE ODOR CONTROL SYSTEM

REGENERABLE RADIAL ODOR CONTROL SYSTEMS

SIZING DATA

RAVEN 500

FLOW	100	200	300	400	500	600
Contact Time (CT) seconds	12.4	6.2	4.1	3.1	2.5	2.1
Face Velocity (FV) ft/min	12.4	24.8	37.2	49.5	61.9	74.3
Differential Pressure (ΔP) in. wc	0.7	1.4	2.1	2.8	3.4	4.1

RAVEN 2000

FLOW	500	750	1000	1250	1500	1750	2000
Contact Time (CT) seconds	9.2	6.2	4.6	3.7	3.1	2.6	2.3
Face Velocity (FV) ft/min	16.4	24.7	32.9	41.1	49.4	57.6	65.8
Differential Pressure (ΔP) in. wc	1.2	1.7	2.3	2.9	3.5	4.1	4.6

RAVEN 5000

FLOW	1000	2000	3000	4000	5000	6000
Contact Time (CT) seconds	11.1	5.5	3.7	2.8	2.2	1.8
Face Velocity (FV) ft/min	13.7	27.4	41.0	54.7	68.4	82.1
Differential Pressure (ΔP) in. wc	1.1	2.2	3.3	4.5	5.6	6.7

RAVEN 7500

FLOW	5000	5500	6000	6500	7000	7500	8000
Contact Time (CT) seconds	3.5	3.2	2.9	2.7	2.5	2.3	2.2
Face Velocity (FV) ft/min	46.4	51.0	55.6	60.3	64.9	69.5	74.2
Differential Pressure (ΔP) in. wc	4.3	4.7	5.2	5.6	6.0	6.4	6.9

RAVEN 10000

FLOW	8000	8500	9000	9500	10000	10500	11000
Contact Time (CT) seconds	2.9	2.7	2.5	2.4	2.3	2.2	2.1
Face Velocity (FV) ft/min	55.2	58.7	62.1	65.6	69.0	72.5	75.9
Differential Pressure (ΔP) in. wc	5.3	5.7	6.0	6.3	6.6	7.0	7.3

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"Manufacturers of a COMPLETE line of odor control systems"

BAY PRODUCTS INC.

RAVEN REGENERABLE ODOR CONTROL SYSTEM

REGENERABLE RADIAL ODOR CONTROL SYSTEMS

RAVEN 15000

FLOW	11000	12000	13000	14000	15000	16000
Contact Time (CT) seconds	3.0	2.7	2.5	2.4	2.2	2.1
Face Velocity (FV) ft/min	55.0	60.0	65.0	70.0	75.0	80.0
Differential Pressure (ΔP) in. wc	5.7	6.2	6.7	7.3	7.8	8.3

RAVEN 20000

FLOW	16000	17000	18000	19000	20000	21000
Contact Time (CT) seconds	2.7	2.5	2.4	2.2	2.1	2.0
Face Velocity (FV) ft/min	53.7	57.0	60.4	63.7	67.1	70.4
Differential Pressure (ΔP) in. wc	5.2	5.5	5.8	6.1	6.5	6.8

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SYSTEM PARAMETERS

Model	Max. Air Flow (cfm)	Total Media Capacity (ft^3)[1]	Total Media Capacity (lbs @ 35lbs/ft3)[1]	Fill Line Size (inches)	Drain/ Overflow Line Size (inches)	Manways (inches)	Standard Interconnecting Duct Size	Skid Size Length x Width (in.)
RAVEN 500	500	41.2	1440	1"	2"	NA	6"	136" x 65"
RAVEN 2000	2000	154.2	5,400	1"	2"	NA	12"	187" x 84"
RAVEN 5000	5000	369.4	13,000	1"	2"	NA	20"	244" x 108"
RAVEN 7500	7500	571.4	20,000	2"	3"	NA	24"	285" x 128"
RAVEN 10000	10000	757.2	26,500	2"	3"	NA	30"	No Skid
RAVEN 15000	15000	1100	38,500	2"	3"	NA	36"	No Skid
RAVEN 20000	20000	1422	50,000	3"	4"	NA	42"	No Skid

NA – Not Applicable for this model
[1] Total of two vessels

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RAVEN REGENERABLE O_OR CONTROL SYSTEM™

REGENERABLE RADIAL ODOR CONTROL SYSTEMS

SYSTEM PARAMETERS

Model	Fan Horsepower	Damper Size (inches)	Footprint	Water used for each Regeneration
RAVEN 500	1.0	6"	136" x 65"	1160
RAVEN 2000	5	12"	187" x 84"	1850
RAVEN 5000	15	20"	244" x 108"	3800
RAVEN 7500	20	24"	285" x 128"	6400
RAVEN 10000	25	30"	332" x 140"	7800
RAVEN 15000	40	36"	385" x 168"	11600
RAVEN 20000	50	42"	443" x 191"	15600

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"Manufacturers of a COMPLETE line of odor control systems"

BAY PRODUCTS INC.

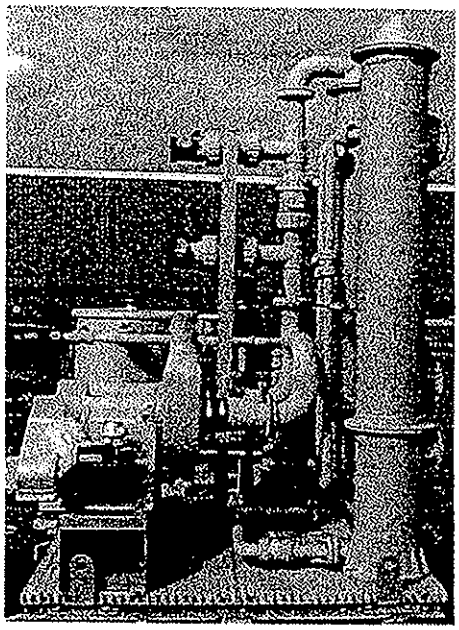
Chemical Scrubber for Headworks Building (Stage 4)

ODORSCRUB™ PACKED TOWER SCRUBBER

HIGH EFFICENCY NEUTRALIZATION ODOR CONTROL SYSTEM

The ODORSCRUB PTS line of packed tower scrubbers is designed to be a low cost, highly effective system for removing H_2S from municipal wastewater applications. The systems are based on neutralization of the H_2S into a caustic solution. Recirculation will increase the concentration of the gas in solution and decrease the quantity of scrubbing solution required. The ODORSCRUB PTS system provides the following benefits:

EFFICIENT – Efficiencies of 99% and better can be achieved in many situations with standard models. For more difficult conditions, the height of the packing bed can be increases to achieve the desired results.



LOW STATIC PRESSURE DROP – Well-designed airflow distribution, packing and scrubber solution hydraulics reduces the resistance to air flow. This results in a pressure drop of approximately 3" w.c. range. Which in turn allows for the use of a low horsepower fan. This will save on electrical and operational costs.

LOW WATER CONSUMPTION – When recirculation is used, make-up rates are designed for a maximum of 1 gpm per 1000 cfm. In many cases the site gas concentrations do not require this amount and thus rates of 0.5 gpm per 1000 cfm are common. Please contact Bay Products for your specific application requirements.

MAINTENANCE FREE – CORROSION RESISTANT – All interior components are fiberglass reinforced plastic. The gas and wash solution see no metal.

RUGGED CONSTRUCTION – Similar to Bay Products' FRP Absorption systems, ODORSCRUB PTS scrubbers have extra thick continuous corners and seamless corners and walls. Packing support systems are well designed for long-term reliability with low operator intervention.

LOW COST – With 14 standard sizes for volumes up to 65,000 cfm, there is a standard pre-engineered size to efficiently match all volumes. New drawings and tooling are not required thus lower capital costs verses other technologies are likely.

PROVEN PROFORMANCE – These have been produced and have long-term proven performance since the 1960's. Bay Products is proud of its commitment to quality and performance.

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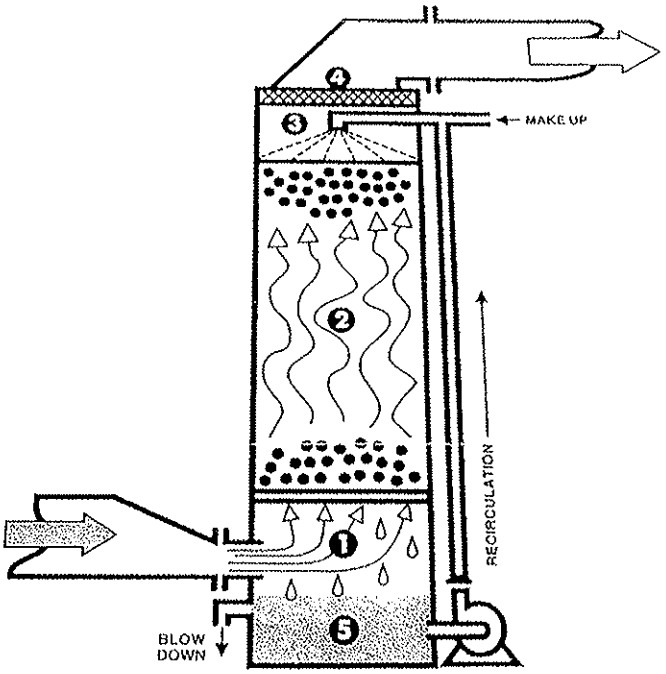
"Manufacturers of a COMPLETE line of odor control systems"

BAY PRODUCTS INC.

CUSTOM TOWERS – If these standard systems do not fit your needs, with our experience and knowledge we are happy to help you with your specific treatment requirements in designing a custom system.

MULTIPLE TECHNOLGY INTEGRATION – In many cases not one technology will result in the best performance and costs. Bay Products designs and manufactures a full line of different treatment technologies. For example in cases where there is a very high level of H2S, it may be more cost effective to utilize an ODORSCRUB PTS followed by a HAWK odor control absorption system.



PROCESS DESCRIPTION

1. High velocity contaminated odorous gas enters the large plenum chamber wherein the velocity is reduced to provide even gas distribution across the bottom of the packing section.
2. The gas flows slowly through a bed of specifically selected packing, which creates a tortuous labyrinth that causes the gas to be completely mixed and reacted with the caustic solution. The counter current flow of gas and solution maintains an absorption driving force throughout the entire depth of the packing bed.
3. Fresh make-up solution is added to the solution being recirculated to compensate for evaporation and to keep the absorbed contaminant concentration in an effective absorption range. In the spray chamber the caustic solution is evenly distributed over the top of the packing bed by a single non-clogging spray nozzle.
4. Clean gas flows through a high efficiency mesh pad, which prevents mist carryover.
5. The caustic solution is collected in the recirculation sump, which has been sized large enough to provide a constant positive head for a recirculation pump.

BAY PRODUCTS, INC.

CHEMICAL WET SCRUBBERS

DESIGN BASICS – SINGLE STAGE – NaOH/NaClO

Tower Diameter

Diameter (D) = 2 x SQRT(CFM/(π x GV)) round to the nearest foot

were:
Diameter in feet
Gas Velocity (GV) is less than 500 ft/min
CFM = Air flow (ft^3/min)

Recirculation Rate

Recirculation Rate (RR) = Loading Rate x π x $(D/2)^2$

were:
Recirculation Rate in gallons/minute
Loading Rate = 10 gpm/ft^2 or greater

Recirculation Rate Pressure

Recirculation Rate Pressure = 2 x (Tower Height) + (Pressure from spray nozzle selection sheet)

Liquid Loading

Liquid Loading (L) = (RR x 8.34 x 60)/(π x $(D/2)^2$) in lb/hr-ft2

Gas Loading

Gas Loading (G) = GV x Air Density x 60 min/h

were:
Gas Loading in lb/hr-ft2
Air Density = 0.075 lb/ft^3 @ 70F & 1 atm

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Height of Transfer Unit

Height of Transfer Unit (HTU) = $3.58 \times L^{A} \times G^{B}$

were:	LANPAC	Q-PAC
A	-0.58	-0.38
B	0.46	0.35

Height of Transfer Unit in feet
L = Liquid Loading

Number of Transfer Units

Number of Transfer Units (NTU) = $\ln(y_1/y_2)$

were:
y_1 = Inlet Concentration
y_2 = Effluent Concentration

Packing Height

Packing Height (z) = HTU x NTU x SF

were:
Packing Height in feet
SF = Safety Factor usually 10% i.e. 1.1

Packing Volume

Packing Volume = $3.14 \times (D/2)^2 \times z$

Sump Volume

Sump Volume (gallons) = RR x RT

were:
RT = Residence Time – recommended 2 to 3 minutes

Sump Height

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Sump Height (ft) = Sump Volume/(23.49 x $(D/2)^2$)

Tower Height

Tower Height = Sump Height + (6 x SQRT(CFM/(π x AV)) + z

were:
AV = 2000
CFM = Air Flow
z = Packing Height

Removal Efficiency

Removal Efficiency (RE) = $((y_1-y_2)/y_1)$x 100

Expected Effluent Concentration

Expected Effluent Concentration $y_2 = y_1 - ((RE \times y_1)/100$

Make up Water Rate

Make up Water (MW) = $y_1/10$

or

Make up Water (MW) = RR x (2% to 5%)

were:
Make up Water in gallons/minute
y_1 = Inlet Concentration (ppm)

Pressure Drop across Packing

ΔP = Air Density x $(GV/60)^{0.65}(10^{C_1+C_2L+C_3L^2})$

were:
Air Density = 0.075 @ 70F & 1 atm
C_1 = -0.4715 + ((G - (12000 x Air Density))/(24000 x Air Density)) x 0.6696
C_2 = (3.03 + ((G – (12000 x Air Density))/(24000 x Air Density))) x 5.06 x 10^{-5}

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$C_3 = (-4.57 + ((G - (12000 \times \text{Air Density}))/(24000 \times \text{Air Denstiy}))) \times (-10.33) \times 10^{-10}$
L = Liquid Loading
G = Gas Loading

Total Pressure Drop

Total Pressure Drop = (Pressure Drop across Packing + (add all other duct and system pressure drops)) x 1.25

Chemical Usage Rates

Sodium Hydroxide - NaOH 50% (gallons/hour) = Air Flow (cfm) x Hydrogen Sulfide Concentration (ppm) x .0024 x .000811 x SF
Sodium Hypochlorite – NaClO 15% (gallons/hour) = Air Flow (cfm) x Hydrogen Sulfide Concentration (ppm) x .0024 x .01231 x SF

were:
SF = added Safety Factor usually 50% i.e. 1.50

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ODORSCRUB™ SINGLE STAGE PACKED TOWER SCRUBBER
HIGH EFFICIENCY NEUTRALIZATION ODOR CONTROL SYSTEM

DESIGN DATA

Chemical Metering Pump Size

Sodium Hydroxide Pump – Max. Pump Size Capacity for 50% Solution

Max. NaOH Feed Rate (gph) = Air Flow (CFM) x H_2S Concentration (ppm) x 0.0574 x 0.000811 x 0.344

Round to the nearest gallon/hour (gph) number and record on Selection Parameter Summary Sheet

Sodium Hypochlorite Pump – Max. Pump Size Capacity for 15% Solution

Max. NaOCl Feed Rate (gph) = Air Flow (CFM) x H_2S Concentration (ppm) x 0.0574 x 0.01231 x 0.0417

Round to the nearest gallon/hour (gph) number and record on Selection Parameter Summary Sheet

ODORSCRUB™ SINGLE STAGE PACKED TOWER SCRUBBER

HIGH EFFICIENCY NEUTRALIZATION ODOR CONTROL SYSTEM

DESIGN DATA

Expected Fan Horsepower Requirements

Air Flow (CFM)	Fan Motor Horsepower*
1000	2
2000	5
3000	7.5
4000	10
5000	10
6000	10
7000	15
8000	15
9000	15
10000	20
11000	20
12000	25
13000	25
14000	25
15000	25
16000	30
17000	30
18000	30
19000	30
20000	35
21000	35
22000	40
23000	40
24000	40
25000	40
26000	45
27000	45
28000	50
29000	50
30000	50

*** Based on 6"w.c. total pressure requirements**

Appendix I – Dissolved Sulfide Sampling Locations and Laboratory Analyses

City of Loveland WWTP Odor Study

Ammonia as N, mg/L

Sample Description	Sample Date 10/7/03
WWTP - Boyd	37
WWTP - NAM	39
WWTP - SE 8th	38
WWTP - SS	23
WWTP - INF	38

City of Loveland WWTP Odor Study

TKN as N, mg/L

Sample Description	Sample Date 10/7/03
WWTP - Boyd	60
WWTP - NAM	58
WWTP - SE 8th	54
WWTP - SS	30
WWTP - INF	60

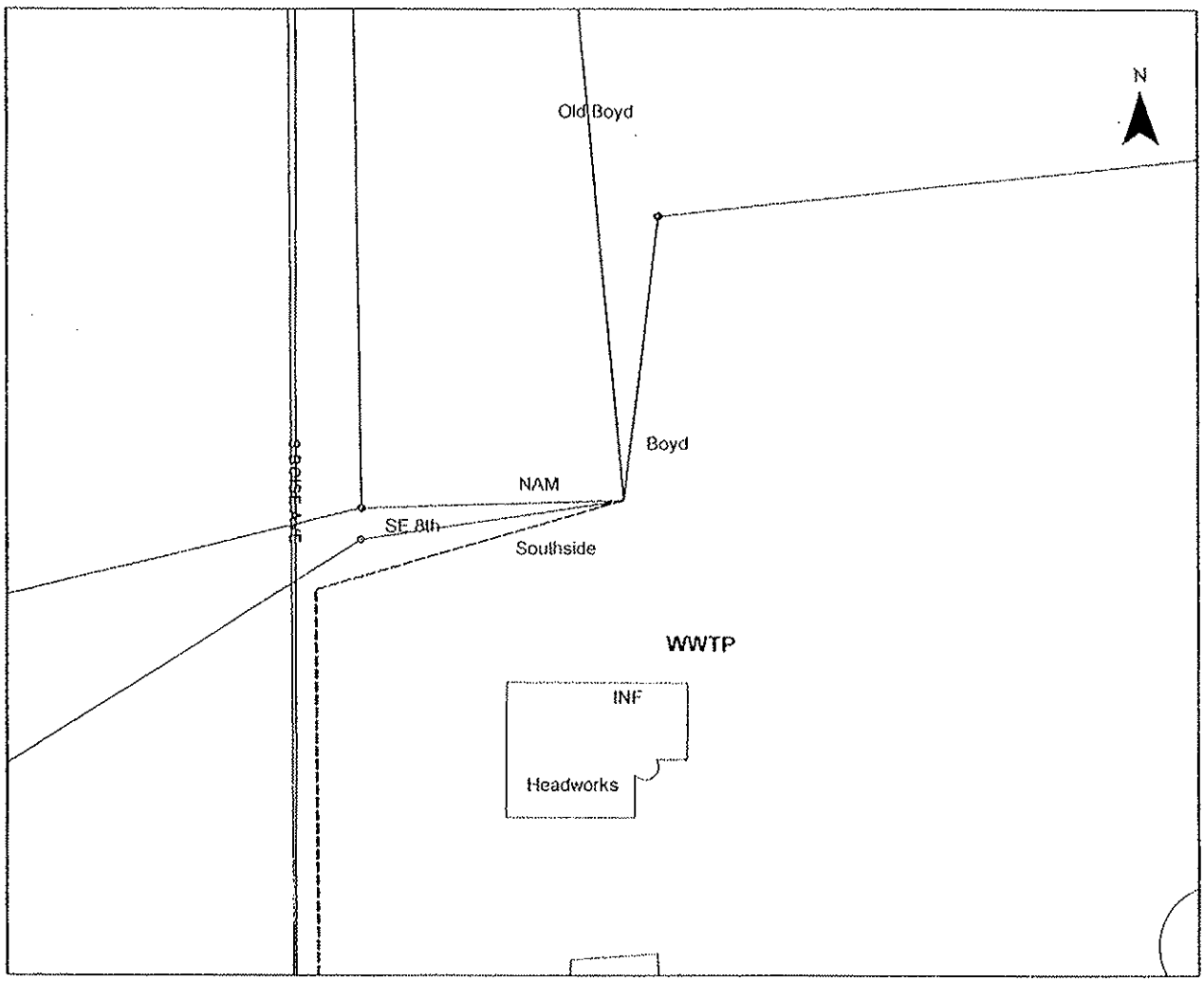
City of Loveland WWTP Odor Study

Dissolved Sulfide, mg/L

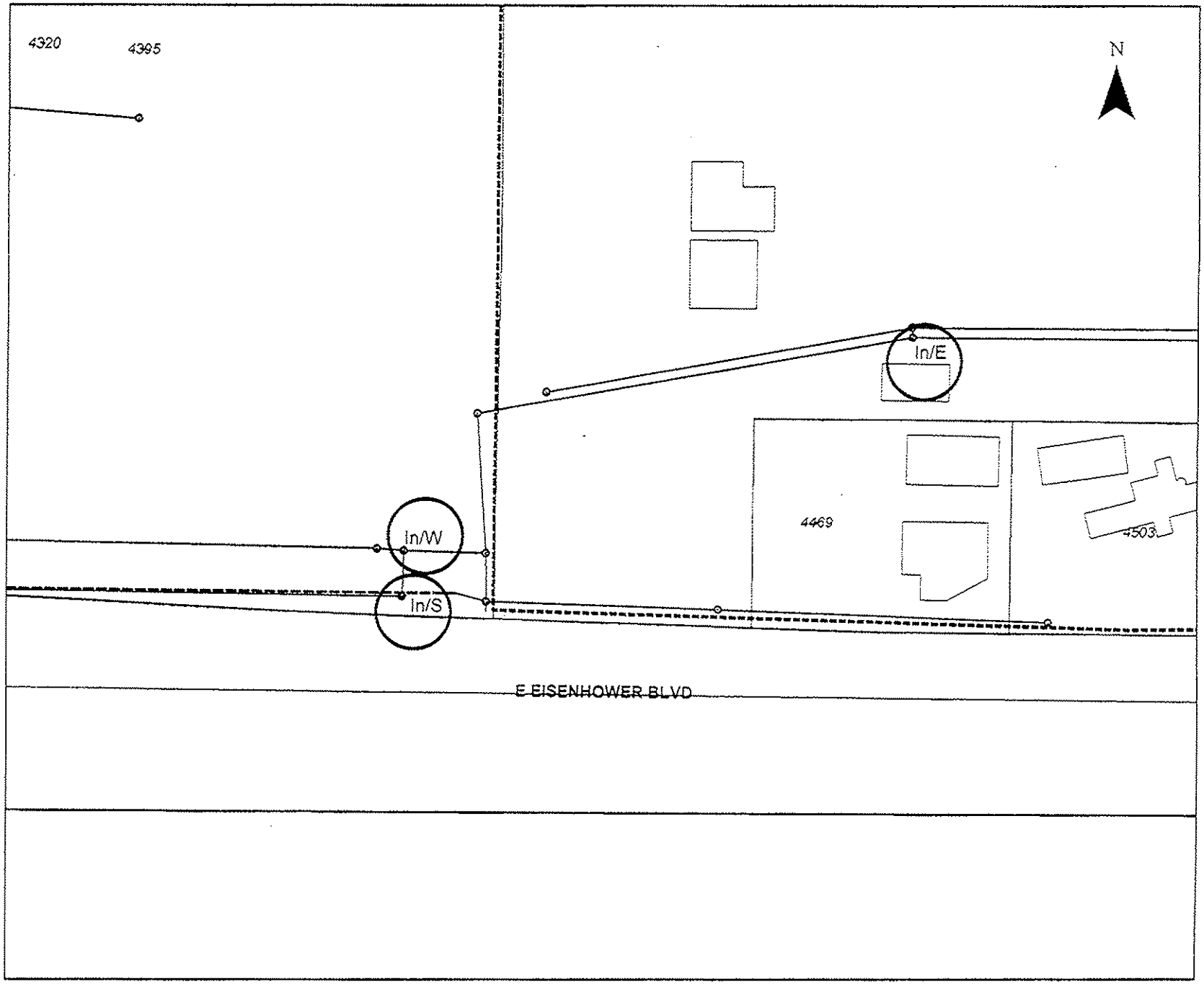
Sample Description	Sample Date							
	10/7/03	10/8/03	10/11/03	10/13/03	10/15/03	10/17/03	10/20/03	10/22/03
WWTP - Boyd	3.8	2.2	2.4	1.5	1.9	0.7	2.0	1.8
WWTP - SS	3.8[1]	3.2[1]	3.1[2]	-	10.1[3]	26[1]	14[1]	-
WWTP - SE 8th	2.0	4.6	3.3	1.3	1.3	0.9	11.0	0.9
WWTP - NAM	4.2	2.6	3.5	1.1	1.1	0.9	0.2	0.6
WWTP - Inf	1.8	5.8	2.7	1.1	0.7	0.7	0.3	1.0
Jellystone - Out	-	3.8	2.7	-	-	-	-	1.4
Jellystone - In/E[a]	-	-	-	-	-	-	-	2.7
Jellystone - In/W[b]	-	-	-	-	-	-	-	1.7
Jellystone - In/S[c]	-	-	-	-	-	-	-	1.7
M Cove - In	3.5	3.8	-	1.7	-	-	-	-
M Cove - Out	-	2.6	-	2.3	-	-	-	-
Denver & 34[4]	2.8	-	-	-	-	-	-	-

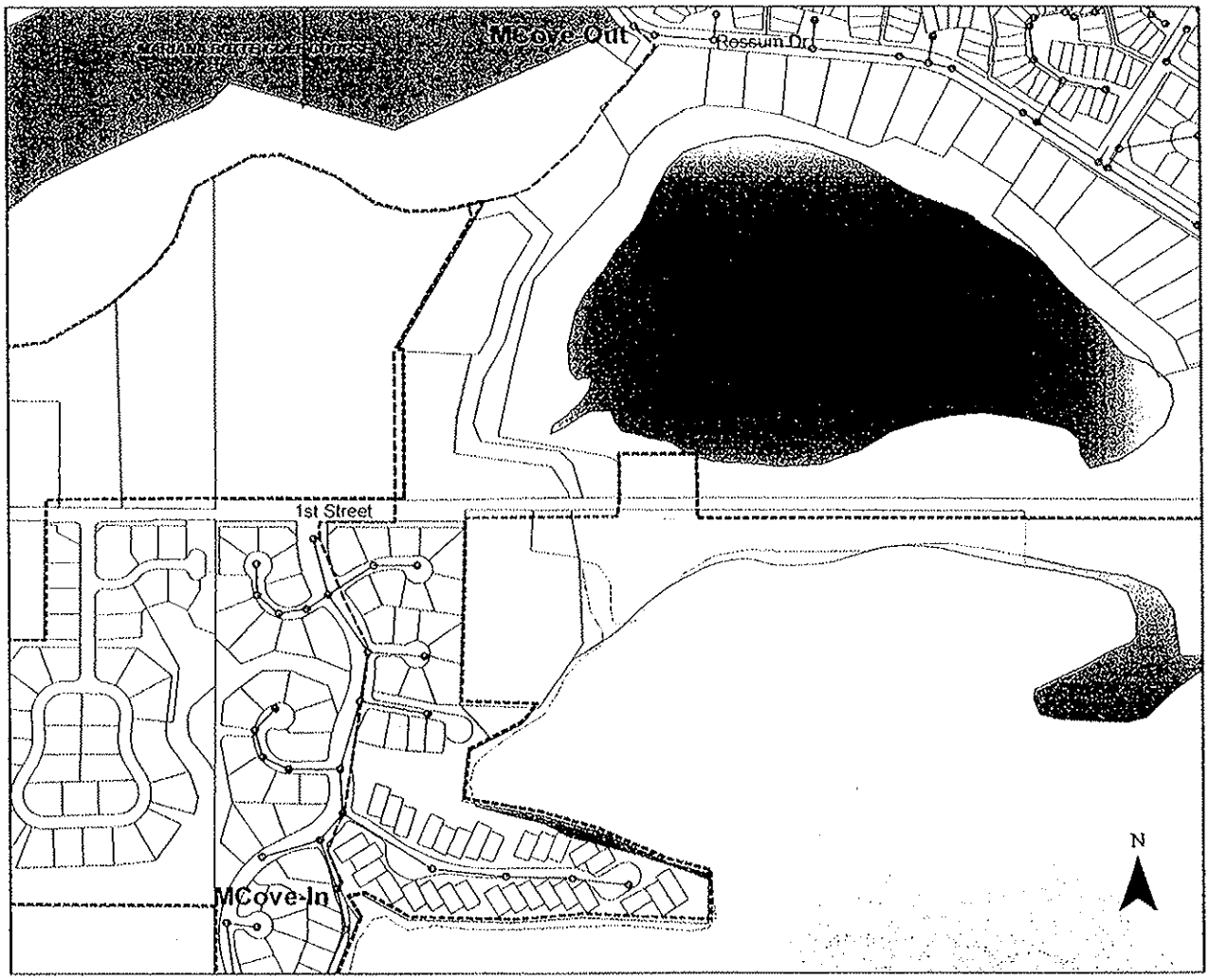
(1) - South Side lift station sample collected within 5 minutes of Influent sample collection.
(2) - South Side lift station sample collected within 15 minutes of Influent sample.
(3) - South Side lift station sample collected 25 minutes after Influent sample was collected.
(4) - Taken at 1st manhole downstream of Jellystone - Out

(a) - 15" sewer line from Outlet Mall - Manhole in RV Park
(b) - Manhole outside lift station from 36" sewer line from west
(c) - Manhole outside lift station from 10" sewer line from west

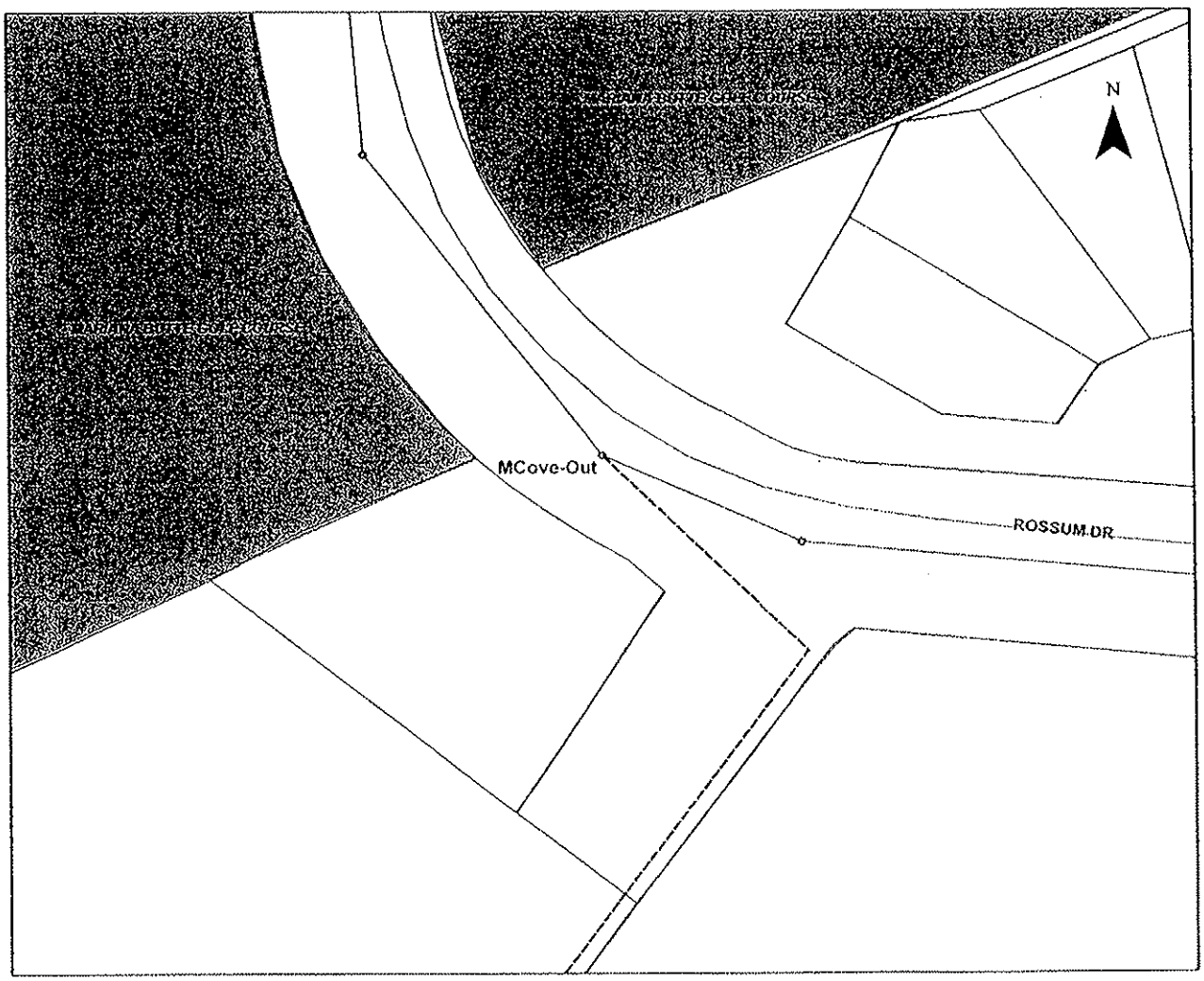

N
Old Boyd
Boyd
NAM
SE 8th
Southside
WWTP
INF
Headworks


N
Jellystone-Out
E EISENHOWER BLVD
N DENVER AVE
Denver & 34


4320
4395
N
In/E
4469
4503
In/W
In/S
E EISENHOWER BLVD


MCove-Out
Possum Dr
1st Street
MCove-In
N


COVE DR
N
LIGHTHOUSE POINT CT
CAPE DORY DR
MCove-In


N
MCove-Out
ROSSUM DR

Stewart Environmental Consultants, Inc.
consulting engineers and scientists

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fax: (970) 226-4946
www.stewartenv.com

Branch Office:
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Colorado Springs, Colorado 80903
ph: (719) 634-3793
fax: (719) 442-6596

October 22, 2003

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-100.2

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the samples received at our laboratory on October 7, 2003.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

CHAIN-OF-CUSTODY RECORD

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland

SAMPLER
Name: Bill Thomas
Signature: Bill Thomas

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. of Cont.	ANALYSIS REQUESTED
	10/1/03	9AM	G	WWTP - Boyd		2	TKN and Ammonia and Dissolved Sulfides
	↑	9AM	G	WWTP - NAM		2	↓
		9AM	G	WWTP - SE8		2	↓
		9AM	G	WWTP - SS		2	↓
		910A	G	WWTP - INF		2	↓
	↓	930A	G	Denver + 34		1	Dissolved Sulfides
	10/1/03	950A	G	MCove - IN		1	Dissolved Sulfides
					10	12	

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thomas	10/1/03 1055	
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
Water
Solid
Liquid
Soil
Sludge

CDH Report Required ____

Sample Kit Sent ____

Report to: Phone: Fax:
Client:
Address
City/State/Zip
Invoice to:
Address:
City/State/Zip:

RESULTS FOR SULFIDE/DISSOLVED

ient Name: City of Loveland
roject No.: 151-100.2
ate Received: 10/07/03
nalyst: KLW
ethod No.: 4500S B E/2

AMPLE ESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
WTP - Boyd	10/07/03	305700	3.8	0.1	10/09/03
WTP - Nam	10/07/03	305701	4.2	0.1	10/09/03
WTP - SE 8th	10/07/03	305702	2.0	0.1	10/09/03
WTP - SS	10/07/03	305703	3.8	0.1	10/09/03
WTP - Inf	10/07/03	305704	1.8	0.1	10/09/03
enver & 34	10/07/03	305705	2.8	0.1	10/09/03
Cove - In	10/07/03	305706	3.5	0.1	10/09/03

ues are reported in parts per million (ppm) unless otherwise noted.
/ = Not Detected

Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

RESULTS FOR AMMONIA AS N

Client Name: City of Loveland
Project No.: 151-100.2
Date Received: 10/07/03
Analyst: ERL
Method No.: 4500NH3 F/2

SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
WWTP - Boyd	10/07/03	305700	37	0.1	10/22/03
WWTP - Nam	10/07/03	305701	39	0.1	10/22/03
WWTP - SE 8th	10/07/03	305702	38	0.1	10/22/03
WWTP - SS	10/07/03	305703	23	0.1	10/22/03
WWTP - Inf	10/07/03	305704	38	0.1	10/22/03

Values are reported in parts per million (ppm) unless otherwise noted.
ND = Not Detected

/2 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

RESULTS FOR TKN AS N

lient Name: City of Loveland
roject No.: 151-100.2
ate Received: 10/07/03
nalyst: ERL
ethod No.: 4500Norg B/2

AMPLE ESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
WTP - Boyd	10/07/03	305700	60	2.0	10/22/03
WTP - Nam	10/07/03	305701	58	2.0	10/22/03
WTP - SE 8th	10/07/03	305702	54	2.0	10/22/03
WTP - SS	10/07/03	305703	30	2.0	10/22/03
WTP - Inf	10/07/03	305704	60	2.0	10/22/03

alues are reported in parts per million (ppm) unless otherwise noted.
D = Not Detected

Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

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consulting engineers and scientists

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fax: (719) 442-6596

October 15, 2003

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-100.2

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the samples received at our laboratory on October 8, 2003.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

RESULTS FOR SULFIDE/DISSOLVED

.lient Name: City of Loveland
'roject No.: 151-100.2
'ate Received: 10/08/03
.nalyst: KLW
:ethod No.: 4500S B E/2

AMPLE ESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
WTP - Boyd	10/08/03	305776	2.2	0.1	10/09/03
WTP - SS	10/08/03	305777	3.2	0.1	10/09/03
WTP - SE 8th	10/08/03	305778	4.6	0.1	10/09/03
WTP - NAM	10/08/03	305779	2.6	0.1	10/09/03
WTP - Inf	10/08/03	305780	5.8	0.1	10/09/03
ellystone - Out	10/08/03	305781	3.8	0.1	10/09/03
Cove - In	10/08/03	305782	3.8	0.1	10/09/03
Cove - Out	10/08/03	305783	2.6	0.1	10/09/03

alues are reported in parts per million (ppm) unless otherwise noted.
D = Not Detected

Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

CHAIN-OF-CU TODY RECORD

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO:

CLIENT NAME: City of Loveland

SAMPLER
Name: Bill Thomas
Signature: Bill Thomas

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc	Total No of Cont	ANALYSIS REQUESTED
	10/8/03	845 A		WWTP - Boyd		1	Dissolved Sulfides
	↑	845 A		WWTP - SS		1	
		845 A		WWTP - SE 8th		1	
		845 A		WWTP - NAM		1	
		850 A		WWTP - INF		1	
		910 A		Jelly Stone - out		1	
		930 A		N Cove - IN		1	
	↓ 10/8/03	940 A		N Cove - out		1	↓
						8	

RELINQUISHED BY	DATE/TIME	RECEIVED BY
[signature]	10/8/03 10 AM	[signature]
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date:

SAMPLE MATRIX
Groundwater
(Water)
Solid
Liquid
Soil
Sludge

CDH Report Required
Sample Kit Sent

Report to: Bill Thomas — Phone: 962-3719 — Fax: 962-3400
Client: City of Loveland
Address: 200 N Wilson Ave
City/State/Zip: Loveland, CO 80537
Invoice to: Same
Address:
City/State/Zip:

Stewart Environmental Consultants, Inc.
consulting engineers and scientists

Corporate Office & Laboratory:
3801 Automation Way, Suite 200
Fort Collins, Colorado 80525
ph: (970) 226-5500
fax: (970) 226-4946
www.stewartenv.com

Branch Office:
20 Boulder Crescent
Colorado Springs, Colorado 80903
ph: (719) 634-3793
fax: (719) 442-6596

October 23, 2003

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-100.2

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the samples received at our laboratory on October 13, 2003.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

RESULTS FOR SULFIDE/DISSOLVED

Client Name: City of Loveland
Project No.: 151-100.2
Date Received: 10/13/03
Analyst: ERL
Method No.: 4500S B E/2

SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
Jellystone - Out	10/11/03	305866	2.7	0.1	10/13/03
WWTP - SE 8th	10/11/03	305867	3.3	0.1	10/13/03
WWTP - Nam	10/11/03	305868	3.5	0.1	10/13/03
WWTP - Boyd	10/11/03	305869	2.4	0.1	10/13/03
WWTP - Inf	10/11/03	305870	2.7	0.1	10/13/03
WWTP - SS	10/11/03	305871	3.1	0.1	10/13/03
M Cove - Out	10/13/03	305872	2.3	0.1	10/20/03
M Cove - In	10/13/03	305873	1.7	0.1	10/20/03
WWTP - Boyd	10/13/03	305874	1.5	0.1	10/20/03
WWTP - Nam	10/13/03	305875	1.1	0.1	10/20/03
WWTP - SE 8th	10/13/03	305876	1.3	0.1	10/20/03
WWTP - Inf	10/13/03	305877	1.1	0.1	10/20/03

Values are reported in parts per million (ppm) unless otherwise noted.
ND = Not Detected

/2 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland

SAMPLER
Name: Bill Thomas
Signature: Bill Thomas

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. of Cont.	ANALYSIS REQUESTED
	10/11/03	7:55 A	C	Influent - comp		1	~~Dissolved Sulfide~~
	10/11	8 AM	C	Influent - Eff		1	
	10/11	8 AM	G	Influent - Air		1	
	10/11	8 AM	G	Influent - Grit		1	
	10/11/03	8:10 A	G	Influent - Inf		1	
	10/11/03	8:25 A	G	Influent SS		1	
						6	

RELINQUISHED BY: Bill Thomas — DATE/TIME: 10/13/03 0945A — RECEIVED BY: K Walker 10/13

RELINQUISHED BY — DATE/TIME — RECEIVED BY

RELINQUISHED BY — DATE/TIME — RECEIVED BY

RELINQUISHED BY — DATE/TIME — RECEIVED BY

ENTERED BY — DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
Wastewater
Solid
Liquid
Soil
Sludge

CDH Report Required ____

Sample Kit Sent ____

Report to: Bill Thomas — Phone: 962-3719
Fax: 962-3400
Client: City of Loveland
Address: 200 N. Wilson
City/State/Zip: Loveland CO 80537
Invoice to: Same
Address:
City/State/Zip:

CHAIN-OF-CUSTODY RECORD

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland

SAMPLER
Name: Bill Thomas
Signature: Bill Thomas

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. of Cont.	ANALYSIS REQUESTED
	10/13/03	8:20A	G	M Core - Out		1	Dissolved Sulfides
	↑	8:30A	G	M Core - IN		1	
		855	G	WWTF - Boyd		1	
		855	G	WWTF NAm		1	
		855	G	WWTF - SE 8th		1	
	10/13/03	9Am	G	WWTF - Inf		1	
			G			1	
						6	

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thomas	10/13/03 9:45A	K Workman 10/13
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY

Requested Completion Date

SAMPLE MATRIX
Groundwater
Waste Water
Solid
Liquid
Soil
Sludge

CDH Report Required ____

Report to: Bill Thomas
Phone: 962-3719
Fax: 962-3400
Client: City of Loveland
Address: 200 N Wilson
City/State/Zip: Loveland 80537
Invoice to: Same
Address:
City/State/Zip:

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www.stewartenv.com

Branch Office:
20 Boulder Crescent
Colorado Springs, Colorado 80903
ph: (719) 634-3793
fax: (719) 442-6596

October 23, 2003

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-100.2

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the samples received at our laboratory on October 15, 2003.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

RESULTS FOR SULFIDE/DISSOLVED

Client Name: City of Loveland
Project No.: 151-100.2
Date Received: 10/15/03
Analyst: ERL
Method No.: 4500S B E/2

SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
WWTP - Boyd	10/15/03	305903	1.9	0.1	10/20/03
WWTP - Nam	10/15/03	305904	1.1	0.1	10/20/03
WWTP - SE 8th	10/15/03	305905	1.3	0.1	10/20/03
WWTP - Inf	10/15/03	305906	0.7	0.1	10/20/03
WWTP - SS	10/15/03	305907	10.1	0.1	10/20/03

Values are reported in parts per million (ppm) unless otherwise noted.
ND = Not Detected

/2 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland

SAMPLER
Name: Bill Thomas
Signature: Bill Thom

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. of Cont.	ANALYSIS REQUESTED
	10/15/03	835 A	G	WWTP - Boyd		1	~~Dissolved~~ Sulfides
	↓	835 A	G	WWTP - NAM		1	↓
		835 A	G	WWTP - SE8		1	
	↓	840 A	G	WWTP - INF		1	
	10/15/03	905 A	G	WWTP - SS		1	↓ ↓
						5	

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thom	10/15/03 910 A	
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
Water
Solid
Liquid
Soil
Sludge

CDH Report Required ____

Sample Kit Sent ____

Report to: Bill Thomas
Phone:
Fax
Client: City of Loveland
Address:
City/State/Zip:
Invoice to: Same
Address:
City/State/Zip:

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Branch Office:
20 Boulder Crescent
Colorado Springs, Colorado 80903
ph: 719 634-3793
fax: 719 442-6596

October 24, 2003

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-100.2

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the samples received at our laboratory on October 17, 2003.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

RESULTS FOR SULFIDE/DISSOLVED

ient Name: City of Loveland
roject No.: 151-100.2
ate Received: 10/17/03
nalyst: ERL
ethod No.: 4500S B E/2

AMPLE ESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
oyd LS - Out	10/14/03	305992	14	0.1	10/24/03
WTP - Boyd	10/17/03	305993	0.7	0.1	10/24/03
WTP - Nam	10/17/03	305994	0.9	0.1	10/24/03
WTP - SE 8th	10/17/03	305995	0.9	0.1	10/24/03
WTP - SS	10/17/03	305996	26	0.1	10/24/03
WTP - Inf	10/17/03	305997	0.7	0.1	10/24/03

alues are reported in parts per million (ppm) unless otherwise noted.
D = Not Detected

standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

Boyd Lake State Park outfall

CHAIN-OF-CUSTODY RECORD

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland

SAMPLER
Name:
Signature:

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. of Cont.	ANALYSIS REQUESTED
	10/14/03	930A	G	Boyd L.S. out	—	1	Dissolved Sulfide
	10/17/03	8[illegible]A	G	WWTP - Boyd		1	↓
	10/17/3	830 A	G	WWTP - Nam		1	↓
	10/17/3	830 A	G	WWTP - SE8		1	↓
	10/17/3	830 A	G	WWTP - SS		1	↓
	10/17/03	830 A	G	WWTP - INF		1	↓

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thomas	10/17/03 930A	[signature] 10/17/03 9:30a
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
Water
Solid
Liquid
Soil
Sludge

CDH Report Required ____

Report to: Bill Thomas Phone: 962-3719
Fax:
Client: City of Loveland
Address: 200 N. Wilson
City/State/Zip:
Invoice to: Same
Address:
City/State/Zip

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www.stewartenv.com

Branch Office:
20 Boulder Crescent
Colorado Springs, Colorado 80903
ph: 719 634-3793
fax: 719 442-6596

October 28, 2003

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-100.2

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the sample received at our laboratory on October 20 and 22, 2003.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

RESULTS FOR SULFIDE/DISSOLVED

Client Name: City of Loveland
Project No.: 151-100.2
Date Received: 10/20/03
Analyst: ERL
Method No.: 4500S B E/2

SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
WWTP - SS	10/20/03	306029	14	0.1	10/27/03
WWTP - SE 8th	10/20/03	306030	11	0.1	10/27/03
WWTP - Boyd	10/20/03	306031	2.0	0.1	10/27/03
WWTP - Nam	10/20/03	306032	0.2	0.1	10/27/03
WWTP - Inf	10/20/03	306033	0.3	0.1	10/27/03
Jellystone - In/E	10/22/03	306134	2.7	0.1	10/27/03
Jellystone - In/W	10/22/03	306135	1.7	0.1	10/27/03
Jellystone - In/S	10/22/03	306136	1.7	0.1	10/27/03
Jellystone - Out	10/22/03	306137	1.4	0.1	10/27/03
WWTP - Boyd	10/22/03	306138	1.8	0.1	10/27/03
WWTP - Nam	10/22/03	306139	0.6	0.1	10/27/03
WWTP - SE 8th	10/22/03	306140	0.9	0.1	10/27/03
WWTP - Inf	10/22/03	306141	1.0	0.1	10/27/03

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ND = Not Detected

/2 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525

PHONE: (970) 226-5500
FACSIMILE (970) 226-4946

CLIENT NO.

CLIENT NAME

SAMPLER
Name: Bill Thomas
Signature: Bill Thomas

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. of Cont.	ANALYSIS REQUESTED
	10/30/03	9AM	G	WWTP - SS		1	Dissolved Sulfide
	↓	↓	G	WWTP - SE8		1	↓
			G	WWTP - Boyd		1	
			G	WWTP - Nam		1	
	↓	↓	G	WWTP INF		1	↓

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thomas	10/30/03 9:10 AM	
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
Water
Solid
Liquid
Soil
Sludge

CDH Report Required ____

Sample Kit Sent ____

Report to: Bill Thomas
Phone:
Fax:
Client:
Address:
City/State/Zip:
Invoice to:
Address: Same
City/State/Zip:

CHAIN-OF-CUSTODY RECORD

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland

SAMPLER
Name: Bill Thomas
Signature: Bill Thomas

Stewart Sample No.	Date 2003	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. Of Cont.	ANALYSIS REQUESTED
	10/22/03	8:40 A	G	Jellystone - IN/E (1)		1	Dissolved Sulfide
	10/22/3	8:45 A	G	Jellystone - IN/W (2)		1	
	10/22/3	8:45 A	G	Jellystone - IN/S (3)		1	
	10/22/3	8:55 A	G	Jellystone - OUT (4)		1	
	10/22/3	9 AM	G	WWTP - Boyd		1	
	10/22/3	9 AM	G	WWTP - Nam		1	
	10/22/3	9 AM	G	WWTP - SE 8		1	
	10/22/3	9:25 A	G	WWTP - Inf		1	

Notes:
(1) Sewer from Mall Taken on Rt Fork
(2) N Sewer line from West of L.S.
(3) S Sewer line from West of L.S.
(4) 34" Sewer out Fall

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thomas	10/22/03 1355	Cindy Lee 10/22/03 13:55
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
~~Waste~~ Water
Solid
Liquid
Soil
Sludge

CDH Report Required ____
Sample Kit Sent ____

Report to: Bill Thomas Phone:
Fax:
Client: City of Loveland
Address:
City/State/Zip:
Invoice to:
Address: Same
City/State/Zip:

Stewart Environmental Consultants, Inc.
consulting engineers and scientists

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www.stewartenv.com

Branch Office:
20 Boulder Crescent
Colorado Springs, Colorado 80903
ph: 719 634-3793
fax: 719 442-6596

June 11, 2004

Mr. Bill Thomas
City of Loveland
200 North Wilson
Loveland, Colorado 80537

Subject: Laboratory Testing Results
Job No.: 151-104

Dear Mr. Thomas:

Please find enclosed laboratory testing results for the samples received at our laboratory on June 2, 2004.

We appreciate the opportunity to provide these analytical services and look forward to working with you in the future. If you have any questions regarding this report, do not hesitate to contact us.

Sincerely,

STEWART ENVIRONMENTAL CONSULTANTS, INC.

Richard G. Patterson, PE
Operations Manager

Enc.

RESULTS FOR SULFIDE

Client Name: City of Loveland
Project No.: 151-104
Date Received: 06/02/04
Analyst: DJL
Method No.: 4500S E/2

SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
SE 8th	06/02/04	403194	4.5	0.1	06/08/04
Namaqua	06/02/04	403195	14.0	0.1	06/08/04
Boyd (Old)	06/02/04	403196	7.5	0.3	06/08/04
SS-Inf	06/02/04	403197	17.0	0.2	06/08/04
S Side	06/02/04	403198	38.7	0.3	06/08/04
Influent	06/02/04	403199	10.6	0.2	06/08/04
Pri Clar Inf	06/02/04	403200	12.4	0.2	06/08/04
Boyd (New)	06/02/04	403201	4.7	0.3	06/08/04

Values are reported in parts per million (ppm) unless otherwise noted.
ND = Not Detected

/2 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

RESULTS FOR SULFIDE/DISSOLVED

.ient Name: City of Loveland
'roject No.: 151-104
)ate Received: 06/02/04
.nalyst: DJL
Iethod No.: 4500S B E/2

SAMPLE DESCRIPTION	SAMPLE DATE	SAMPLE NUMBER	TESTED VALUE	DETECT LIMIT	DATE OF ANALYSIS
SE 8th	06/02/04	403194	4.5	0.1	06/08/04
Iamaqua	06/02/04	403195	0.8	0.2	06/08/04
Boyd (Old)	06/02/04	403196	7.5	0.3	06/08/04
SS-Inf	06/02/04	403197	4.2	0.2	06/08/04
S Side	06/02/04	403198	5.1	0.3	06/08/04
Influent	06/02/04	403199	5.4	0.2	06/08/04
Pri Clar Inf	06/02/04	403200	9.2	0.2	06/08/04
Boyd (New)	06/02/04	403201	4.7	0.3	06/08/04

Values are reported in parts per million (ppm) unless otherwise noted.
ND = Not Detected

2 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992

CHAIN-OF-CUS)DY RECORD

STEWART ENVIRONMENTAL CONSULTANTS, INC.
3801 Automation Way, Suite 200, Fort Collins, CO 80525
PHONE: (970) 226-5500
FACSIMILE: (970) 226-4946

CLIENT NO.

CLIENT NAME: City of Loveland - WWTP

SAMPLER
Name: Bill Thomas
Signature: Bill Thom

Stewart Sample No.	Date 2004	Time Sample Collected	Sample Matrix Comp/Grab	SAMPLE IDENTIFICATION	Field Info pH HNU, etc.	Total No. Of Cont.	ANALYSIS REQUESTED
	6/2	0800	G	SE 8th	7/2.5	1	Dissolved Sulfide, Total Sulfide
	6/2	0800	G	Namaqua	7/2.5	1	
	6/2	0805	G	Boyd (old)	7/2.5	1	
	6/2	0820	G	SS-Inf	7/2.5	1	
	6/2	0830	G	S Side	7/2.5	1	
	6/2	0832	G	Influent	7/2.5	1	
	6/2	0845	G	Pri Clar Inf	7/2.5	1	
	6/2	0805	G	Boyd (new)	7/2.5	1	

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Bill Thom	6/7/04 1030	6/2
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
RELINQUISHED BY	DATE/TIME	RECEIVED BY
ENTERED BY		DATE/TIME

Requested Completion Date

SAMPLE MATRIX
Groundwater
Water
Solid
(Liquid)
Soil
Sludge

CDPHE Report Required ____

Sample Kit Sent ____

Report to: Bill Thomas
Phone: 962-3719
Fax: 962-3400
Client: City of Loveland
Address: 200 N Wilson Ave.
City/State/Zip: Loveland, CO 80537
Invoice to: Same
Address:
City/State/Zip:

Appendix J – Liquid Phase Treatment Analysis

Liquid Phase Treatment Analysis

Dissoloved Sulfide and Hydrogen Sulfide Generation Estimation
Conditon 1: Based on maximum temperature, average flow, average pH and BOD

	TOT MGD	INF Temp(C)	INF pH	INF BOD5	INF TSS	INF NH3
Average	5.5	15.8	7.5	285	261	25.0
Annual Average	5.7	16.2	7.4	275	267	21.6
Max	8.7	20.3	7.7	516	698	330.0

	Total Sulfide (mg/L)	Dissolved Sulfide (mg/L)
WWTP Influent	10.6	5.8

Interceptor	Diameter (in)	Diameter (m)	Slope	Length (ft)	Length (m)	% of Plant Flow	Flow (mgd)	Flow (m3/s)	Velocity (m/s)	Detention Time (min)
Boyd Interceptor (old)	24	0.610	0.001	13000	3963	30	1.72	0.075	0.64	103
Boyd Relief Interceptor (new)	30	0.762	0.001	13000	3963	10	0.57	0.025	0.46	144
Namaqua Interceptor	33	0.838	0.001	6900	2104	38	2.18	0.095	0.67	52
Southeast 8th Interceptor	24	0.610	0.001	6500	1982	20	1.15	0.050	0.57	58
Southside Liftstation Interceptor	20	0.508	NA	2000	610	2	0.11	0.005	0.02	411
	Based on Loveland data					flow in gpm	472	0.030	0.15	69

Interceptor	Dissolved Slufide in (mg/L)	Dissolved Sulfide out (mg/L)	H2S out (g/m3)	H2S out (ppmV)	Type	Hot spot
Boyd Interceptor (old)	7.1	7.5	0.79	561	gravity	y
Boyd Relief Interceptor (new)	3.1	4.7	0.471	333	gravity	y
Namaqua Interceptor	4	4.2	0.408	288	gravity	y
Southeast 8th Interceptor	4.1	4.5	0.46	322	gravity	y
Southside Liftstation Interceptor	4.2	5.1	0	0	forcemain	y

Appendix J
Summary of Liquid Phase Treatment Alternatives

	Ferric Chloride	Bioxide	Sodium Hydroxide
Capital cost	$35,000	$20,000	$0
Pump replacement costs	$7,000	$7,000	
Chemical Costs ($/season)	$68,085	$66,383	$268,527
Total 20-Year Life Cycle Cost	**$1,004,472**	**$965,281**	**$3,816,411**

Interest rate 3.50%
Life 20 years

Appendix J
Liquid Phase Treatment Analysis

Ferric Chloride	performs best when added to long forcemails with detention times greater than 2 hours	
Treat to	0.5	mg/L dissovled sulfide
Location	Boyd Lake and Eastside Lift Stations	
Flow	2.29	mgd
Dissolved Sulfide at inlet	7.1	mg/L
Sulifde removed	126.1	lbs/day
Assumed Chemical dosage	20	lbs/lbs H2S removed
Chemical unit cost	$0.15	lbs
Chemical Required (lbs/day)		
(gallon/day)	2522	
Chemical Costs ($/day)	$378.25	
Chemical Costs ($/season)	$68,085	
Total	**$68,085**	
Capital Costs	$35,000	

Appendix J
Liquid Phase Treatment Analysis

Bioxide	performs best when added to long forcemails with detention times greater than 2 hours	
Treat to	0.5	mg/L dissovled sulfide

Location	Boyd Lake and Eastside Lift Stations	
Flow	2.29	mgd
Dissolved Sulfide at inlet	7.1	mg/L
Sulifde removed	126.1	lbs/day
Assumed Chemical dosage	1.5	gallons BIOIXDE to I lb sufide
Chemical unit cost	$1.95	gallon
Chemical Required (lbs/day)		
(gallon/day)	189	
Chemical Costs ($/day)	$369	
Chemical Costs ($/season)	**$66,383**	

Capital Costs	$20,000

Appendix J
Liquid Phase Treatment Analysis

Sodium Hydroxide (NaOH)			
Average Flow	5.7	mgd	
Dosing rate	3,125	lb/MGD wastewater	
Chemical unit cost	$1.00	lb	2750 lbs
Chemical Required (lbs/dose)	17,902		
(gallon/day)			
Chemical Costs ($/day)			
Chemical Costs ($/season)	**$268,527**		
Capital cost	0		

Appendix K – Material Safety Data Sheets (MSDS) for Liquid Phase Treatment Chemicals

MSDS Number: F1080 * * * * * *Effective Date: 02/18/03* * * * * *Supercedes: 02/21/00*

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker®

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response In Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Ferric Chloride Solution

1. Product Identification

Synonyms: Iron (III) Chloride Solution
CAS No.: 7705-08-0
Molecular Weight: Not applicable to mixtures.
Chemical Formula: FeCl3 in H2O
Product Codes: 5251

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Ferric Chloride	7705-08-0	35 - 45%	Yes
Water	7732-18-5	55 - 65%	No

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO ANY AREA OF CONTACT. HARMFUL IF SWALLOWED OR INHALED. AFFECTS THE LIVER.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Extremely destructive to tissues of the mucous membranes and upper respiratory tract. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting.
Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach. Can cause sore throat, vomiting, diarrhea. Low systemic toxicity in small quantities but larger doses may cause systemic effects. Pink urine discoloration is a strong indicator of iron poisoning. Liver damage, coma and death may follow, sometimes delayed as long as three days.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur.
Eye Contact:
Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns.
Chronic Exposure:
Repeated ingestion may cause liver damage. Prolonged exposure of the eyes may cause discoloration.
Aggravation of Pre-existing Conditions:
No information found.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Irritating hydrogen chloride fumes may form in fire.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Water, dry chemical, foam or carbon dioxide. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Containers of this material are hazardous when empty since they retain product residues; observe all warnings for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-ACGIH Threshold Limit Value (TLV):
1 mg/m3 (TWA) soluble iron salt as Fe
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (NIOSH type N100 filters) may be worn for up to 50 times the exposure limit

or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids. glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Orange to brown liquid.

Odor:
Acid odor.

Solubility:
Complete (100%)

Specific Gravity:
1.40

pH:
No information found.

% Volatiles by volume @ 21C (70F):
55-65

Boiling Point:
230C (446F)

Melting Point:
No information found.

Vapor Density (Air=1):
No information found.

Vapor Pressure (mm Hg):
No information found.

Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
May produce hydrogen chloride.

Hazardous Polymerization:
This substance does not polymerize.

Incompatibilities:
Metals, allyl chloride, sodium, potassium.

Conditions to Avoid:

Incompatibles.

11. Toxicological Information

Oral rat LD50: 450 mg/kg (anhydrous); investigated as a mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Ferric Chloride (7705-08-0)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Ferric Chloride (7705-08-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Ferric Chloride (7705-08-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Ferric Chloride (7705-08-0)	No	No	No	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Ferric Chloride (7705-08-0)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
DANGER! CORROSIVE. CAUSES BURNS TO ANY AREA OF CONTACT. HARMFUL IF SWALLOWED OR INHALED. AFFECTS THE LIVER.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.
Product Use:

Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8.
Disclaimer:
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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **S4037** * * * * * *Effective Date: **10/28/04*** * * * * * *Supercedes: **07/07/04***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SODIUM HYDROXIDE SOLUTIONS (MORE THAN 10% NaOH)

1. Product Identification

Synonyms: Caustic soda solution; lye solution; sodium hydroxide liquid; sodium hydrate solution,Sodium Hydroxide Concentrate Solution StandARd®, Sodium Hydroxide, DILUT-IT® Analytical Concentrates, sodium hydroxide volumetric solutions
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH in water
Product Codes:
J.T. Baker: 0337, 0338, 0339, 0392, 3719, 3725, 3727, 3729, 4689, 4690, 5000, 5661, 5666, 5668, 5669, 5671, 5672, 5674, 5676
Mallinckrodt: 6290, 7701, 7702, 7703, 7705, 7706, 7775, H369, H382, H385, V038, V679

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	10 - 60%	Yes
Water	7732-18-5	40 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:
Severe irritant. Effects from inhalation of mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.
Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days after exposure.
Skin Contact:
Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.
Eye Contact:
Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water. Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.
Explosion:
May cause fire and explosions when in contact with incompatible materials.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Contain and recover liquid when possible. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRACIT®-2 or BuCAIM® caustic neutralizers are recommended for spills of this product.

---

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Store above 16C (60F) to prevent freezing. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
- ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Physical data is displayed for 10%, 30% and 50% aqueous sodium hydroxide solutions. (Merck Index).

Appearance:
Clear, colorless solution.

Odor:
Odorless.

Solubility:
Completely miscible with water.

Density:
10% solution - 1.11; 30% solution - 1.33; 50% solution - 1.53
pH:
14.0 (10%, 30% and 50% solutions)
% Volatiles by volume @ 21C (70F):
No information found.
Boiling Point:
For 10% solution = 105C (221F); for 30% solution = 115C (239F); for 50% solution = 140C (284F).
Melting Point:
For 10% solution = -10C (14 F); for 30% solution = 1C (34F); for 50% solution = 12C (53.6F).
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
13 @ 60C (140F) (50% solution)
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.
Conditions to Avoid:
Heat, moisture, incompatibles.

---

11. Toxicological Information

Sodium hydroxide: irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe. Investigated as a mutagen.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Sodium Hydroxide (1310-73-2)	No	No	None

Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE SOLUTION
Hazard Class: 8
UN/NA: UN1824
Packing Group: II
Information reported for product/size: 360LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLUTION
Hazard Class: 8
UN/NA: UN1824
Packing Group: II
Information reported for product/size: 360LB

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------

Ingredient	TSCA	EC	Japan	Australia
Sodium Hydroxide (1310-73-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Sodium Hydroxide (1310-73-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Sodium Hydroxide (1310-73-2)	No	No	No	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Sodium Hydroxide (1310-73-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: Yes (Mixture / Liquid)

Australian Hazchem Code: 2R
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

USFilter

Material Safety Data Sheet

SECTION 1 – CHEMICAL PRODUCT AND COMPANY INFORMATION

Product Name: BIOXIDE-AQ™
Part Number: None **Chemical Family:** Inorganic salt solution/Aromatic Ketone

Manufacturer's Name: USFilter Davis Products
Address: 2650 Tallevast Rd, Sarasota, FL 34243
Product/Technical Information Phone Number: 1.941.355.2971
Medical/Handling Emergency Phone Number: CHEMTREC 1.800.424.9300
Transportation Emergency Phone Number: CHEMTREC 1.800.424.9300

Issue Date: March 17, 2000
Revision Date/Revision Number: none

SECTION 2 – COMPOSITION INFORMATION

Chemical Name	Percent by Weight	CAS#
Proprietary Nutrient Solution for removal of reduced sulfur compounds from wastewater	Active: 58 - 60% H_2O: 40 - 42%	

SECTION 3 – HAZARDS IDENTIFICATION

Appearance & Odor: Cloudy light brown solution.
Emergency Overview: Solution contains no hazardous substances as listed in 40CFR302. May cause skin and eye irritation and may irritate the respiratory tract if inhaled.
Fire & Explosion Hazards: Minimal.
Primary Route(s) of Exposure: Skin and eye contact, ingestion and inhalation.
Inhalation – Acute Effects: Inhaling spray or dust may irritate the respiratory tract.
Skin Contact – Acute Effects: This product may irritate the skin.
Eye Contact – Acute Effects: This product may irritate the eyes.
Ingestion – Acute Effects: Ingestion of large amounts may result in violent gastroenteritis.

SECTION 4 – FIRST AID MEASURES

Inhalation First Aid: Remove affected person from area to fresh air and provide oxygen if breathing is difficult. Give artificial respiration ONLY if breathing has stopped. Obtain medical attention if individual shows symptoms of exposure.

SECTION 4 – FIRST AID MEASURES (continued)

Skin Contact First Aid: Immediately remove clothing from affected area and wash skin vigorously with flowing water and soap. Clothing must be washed before reuse. **DO NOT instruct person to neutralize affected skin area.** Obtain medical attention if irritation occurs.

Eye Contact First Aid: Immediately irrigate eyes with flowing water continuously for 15-20 minutes while holding eyes open. Contacts should be removed before or during flushing. **DO NOT instruct person to neutralize. OBTAIN MEDICAL ATTENTION IMMEDIATELY.**

Ingestion First Aid: If victim is alert and not convulsing rinse mouth with water and give water to drink. **Induce vomiting.** When vomiting occurs, have affected person lean forward with head down to avoid breathing in of vomitus. Rinse mouth again and give more water to drink. DO NOT have unqualified personnel induce vomiting. **OBTAIN MEDICAL ATTENTION IMMEDIATELY.**

Medical Conditions Aggravated: None known.

Note to Physician: Treat patient symptomatically.

SECTION 5 – FIRE FIGHTING MEASURES

Flash Point/Method: Not applicable.

Auto Ignition Temperature: Not applicable.

Upper/Lower Explosion Limits: Not applicable.

Extinguishing Media: Not applicable.

Fire Fighting Procedures: Not applicable.

Fire & Explosion Hazards: Minimal.

Hazardous Products of Decomposition and/or Combustion: Decomposition may produce nitrogen oxides, ammonia.

NFPA Ratings:

HEALTH-1 FLAMMABILITY-0 REACTIVITY-1 OTHER-None

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Mop up and containerize, or dilute to acceptable level with water.
Recover for recycling or landfill. Triple rinse containers with water, then recycle or landfill.

DO NOT DUMP ON THE GROUND OR INTO ANY BODY OF WATER. All disposal methods must be in compliance with all Federal, State, Local, and Provincial laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator.

SECTION 7 – HANDLING AND STORAGE

Handling: Wash thoroughly after handling, immediately remove and dispose of any spillage. Immediately rinse contaminated clothing thoroughly with water
Storage: Store in dry place at ambient temperatures apart from combustible and other readily oxidizable materials, food, beverage, and excessive heat.
General Comments: Rinse empty containers with water only.

SECTION 8 –PERSONAL PROTECTION/ EXPOSURE CONTROL

Respiratory Protection: None required under normal use conditions. Use a dust mask if product is dry.
Skin Protection: Rubber protective gloves and other protective clothing as appropriate to prevent skin contact.
Eye Protection: Safety glasses or goggles are recommended
Ventilation Protection: Adequate general or mechanical exhaust ventilation.
Other Protection: Safety showers, with quick opening valves which stay open, and eye wash fountains, or other means of washing the eyes with a gentle flow of cool to tepid tap water should be readily available in all areas where this material is handled or stored. Water should be supplied through insulated and heat-traced lines to prevent freeze-ups in cold weather. Employees should wash their hands and face before eating, drinking, or using tobacco products. Educate and train employees on the safe use and handling of this product.
Exposure Limits:
No occupational exposure limits have been established for this material.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance & Odor: Cloudy light brown solution.

Vapor Pressure: 20	**Vapor Density (Air=1):** 0.03
Boiling Point: of solution 220° F	**Melting Point:** Not applicable
Specific Gravity: at 20° C 1.45	**Solubility in Water:** >99%
Volatile Percentage: (water) 40	**pH:** 5.5-7.5
Flash Point/method: Not applicable	**Auto Ignition Temperature:** Not applicable

Upper/Lower Explosion Limits: Not applicable
Other: Evaporation rate: (water) 0.95

SECTION 10 – STABILITY AND REACTIVITY

Stability: This material is stable under normal use conditions.
Incompatibilities: This product is incompatible with organic materials, reducing agents, chlorine or hypochlorite products, and caustic products.
Polymerization: Hazardous polymerization will not occur.
Decomposition: Decomposition may produce nitrogen oxides and ammonia

SECTION 10 – STABILITY AND REACTIVITY – (continued)

Conditions to Avoid: Avoid drying, do not place solution in contact with organics, chlorine or hypochlorite products, and caustic products.

SECTION 11 – TOXICOLOGICAL INFORMATION

Inhalation – Acute: Inhaling spray or dust may irritate the respiratory tract.
Inhalation – Chronic: No chronic inhalation effects for this product are known.
Skin Contact – Acute: This product may irritate skin.
Skin Contact – Chronic: No chronic dermal effects for this product are known.
Eye Contact – Acute: This product may irritate eyes.
Ingestion – Acute: Ingestion of large amounts may result in violent gastroenteritis. Active ingredient - TXDS orl-hmn LDLo: 500 mg/kg; orl-rat LDLo 200 mg/kg.
Ingestion – Chronic: No chronic ingestion effects for this product are known.
Carcinogenicity/Mutagenicity: No carcinogenic or mutagenic properties of this product are known.
Reproductive Effects: No reproductive effects of this product are known.
Neurotoxicity: No neurotoxic effects of this product are known.
Other Effects: None known.
Target Organs: Target organs include the skin and eyes.

SECTION 12 – ECOLOGICAL INFORMATION

No ecological effects of this product are known.

Safely store product to prevent inadvertent release to the environment and water supplies.

SECTION 13 – DISPOSAL CONSIDERATIONS

Contains no hazardous substances as listed in 40 CFR 302.

Material that cannot be used, or reprocessed for use, and empty containers should be disposed of in accordance with all applicable regulations. Product containers should be thoroughly emptied before disposal. Generators of waste material are required to evaluate all waste for compliance with RCRA and any local disposal procedures and regulations. NOTE: State and local regulations may be more stringent than federal regulations.

SECTION 14 – TRANSPORTATION INFORMATION

DOT Shipping Description: Non-Regulated.

SECTION 15 – REGULATORY INFORMATION

****

Contains no hazardous substances as listed in 40 CFR 302.

SECTION 16 – OTHER INFORMATION

****

Disclaimer: The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the user thereof. It is the buyer's responsibility to ensure that its activities comply with federal, state, provincial, and local laws.

Created by: USFilter Davis Products

Appendix L – Summary of Cost Estimates

Loveland WWTP
Odor Control Scenario Cost Estimates

interest rate 3.5%
inflation rate 2.5%

Control Scenario	Alternative Description	Expected Life (years)	Air Flow Rate (cfm)	Capital	Annual	Total Annual Cost
1	Discontinue use of trickling filters.	-	-	$10,000	-	-
2	Relocated digester boiler room HVAC intake	-	-	$200,000	-	-
3	Cover aerated grit chamber and vent to a carbon scrubber, purchase of Jerome Meter	7	250	$67,430	$6,000	$17,497
4	Replace headworks processes, including crew pumps and influent collection well, within existing headworks building. Vent air from headworks building a new chemical scrubber with 90% removal efficiency. Conduct additional sampling and modeling to confirm odor reduction benefit.	15	13,000	$891,191	$87,000	$181,383
5	Vent air from DAFT in a new carbon scrubber.	10	800	$83,182	$18,000	$30,168
6	Cover primary clarifiers and vent to new chemical scrubber	15	3,800	$1,613,175	TBD	TBD
7	Cover aeration basins and vent to new chemical scrubber	15	8,600	$2,352,975	TBD	TBD
7	Repleace each digester floating cover with a fixed roof	20	-	$1,000,000	TBD	TBD

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Appendix L

Loveland WWTP Odor Control Preliminary Estimate Information
Stage 3 - Temporary Odor Control for Aerated Grit Chamber
Order of Magnitude Cost Opinion

Capital Cost	Quanity	Unit	Cost	Total Cost
Regenerable Carbon Vessel (250 cfm), including carbon, vessel, and fan	1	EA	$8,000	$8,000
Aluminum cover	500	SF	$30	$15,000
Ductwork	50	LF	$72.09	$3,605
Miscellaneous Mechanical and Electrical Installation			10%	$2,660
			Subtotal	$26,605
Field Detail Allowance			5%	$1,330
			Subtotal	$27,935
Contractor's Overhead			10%	$2,793
			Subtotal	$30,728
Contractor's Profit			5%	$1,536
			Subtotal	$32,265
Project Contingency			30%	$9,679
			Subtotal	$41,944
Engineering, Legal, and Administration			25%	$10,486
			Project Total	**$52,430**

Loveland WWTP Odor Control Preliminary Estimate Information
Stage 3 - Temporary Odor Control for Aerated Grit Chamber
Order of Magnitude Cost Opinion

Description	Qty	Unit	Material Unit Cost	Labor Unit Cost	Total Cost
Annual Costs					
Blower, Recirc & Feed Pumps Power Usage	65,323	kW-hr	0.05	0	$3,266
Regenerable Carbon for Odor Control	170	LBS	2.00	0	$339
Maintenance	0.02	FTE	0.00	90,000	$1,800
					$5,405
Contingency	10%				$541
Total Annual Cost (Rounded)					**$6,000**

NOTES
Contingency is for scope changes that are presently unforeseen.

Appendix L

Loveland WWTP Odor Control Preliminary Estimate Information
Stage 4 - Odor Control for New Headworks Building
Order of Magnitude Cost Opinion

Capital Cost	Quanity	Unit	Cost	Total Cost
Single-stage chemical scrubber (13,000 cfm), including tower and internals, fan, recirucating pumps, chemical metering pumps, and controls	1	EA	130,800	$130,800
Carbon polishing scrubber (13,000 cfm), including internals, etc.	13,000	CFM	20	$260,000
Ductwork	500	LF	72	$36,045
Miscellaneous Mechanical and Electrical Installation			10%	$42,685
			Subtotal	$426,845
Field Detail Allowance			5%	$21,342
			Subtotal	$448,187
Contractor's Overhead			10%	$44,819
			Subtotal	$493,006
Contractor's Profit			5%	$24,650
			Subtotal	$517,656
Project Contingency			30%	$155,297
			Subtotal	$672,953
Engineering, Legal, and Administration			25%	$168,238
			Project Total	**$841,191**

Loveland WWTP Odor Control Preliminary Estimate Information
Stage 4 - Odor Control for New Headworks Building
Order of Magnitude Cost Opinion

Description	Qty	Unit	Material Unit Cost	Labor Unit Cost	Total Cost
Annual Costs					
Blower, Recirc & Feed Pumps Power Usage	163,308	kW-hr	0.05	0	$8,165
Sodium Hydroxide	570	GAL	0.64	0	$365
Sodium Hypochlorite	10,430	GAL	0.40	0	$4,172
Water					$3,865
Regenerable Carbon for Odor Control	17,628	LBS	1.50	0	$26,442
Operations	0.2	FTE	0.00	90,000	$18,000
Maintenance	0.2	FTE	0.00	90,000	$18,000
					$79,009
Contingency	10%				$7,901
Total Annual Cost (Rounded)					**$87,000**

NOTES
Contingency is for scope changes that are presently unforeseen.

Appendix L

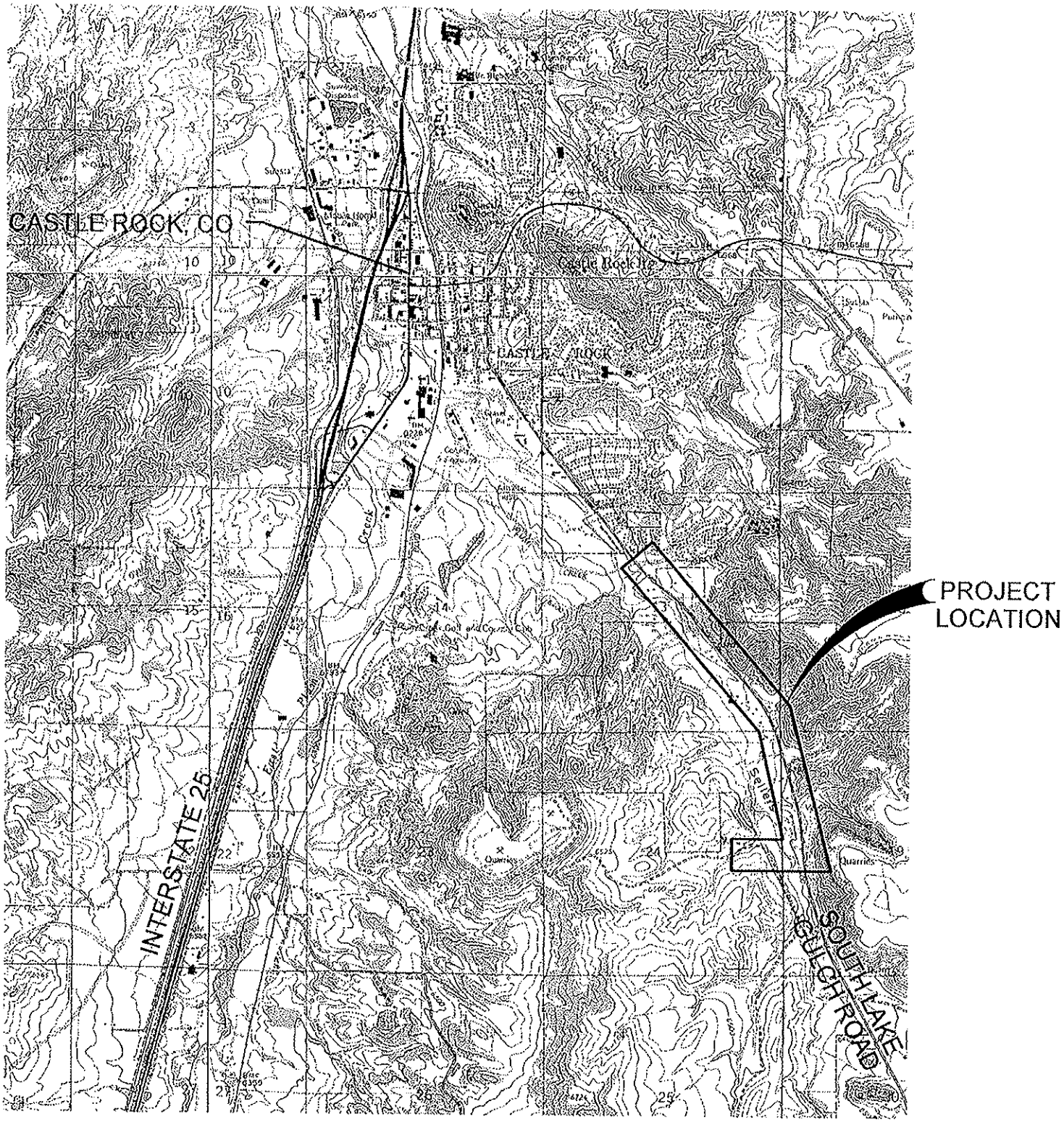
Loveland WWTP Odor Control Preliminary Estimate Information
Stage 5 - Odor Control for DAFT
Order of Magnitude Cost Opinion

Capital Cost	Quanity	Unit	Cost	Total Cost
Regenerable Carbon Vessel (800 cfm), including carbon, vessel, and fan	1	EA	$35,000	$35,000
Ductwork	100	LF	$72.09	$7,209
Miscellaneous Mechanical and Electrical Installation			10%	$4,221
			Subtotal	$42,209
Field Detail Allowance			5%	$2,110
			Subtotal	$44,319
Contractor's Overhead			10%	$4,432
			Subtotal	$48,751
Contractor's Profit			5%	$2,438
			Subtotal	$51,189
Project Contingency			30%	$15,357
			Subtotal	$66,546
Engineering, Legal, and Administration			25%	$16,636
			Project Total	**$83,182**

Loveland WWTP Odor Control Preliminary Estimate Information
Stage 5 - Odor Control for DAFT
Order of Magnitude Cost Opinion

Description	Qty	Unit	Material Unit Cost	Labor Unit Cost	Total Cost
Annual Costs					
Blower, Recirc & Feed Pumps Power Usage	97,985	kW-hr	0.05	0	$4,899
Regenerable Carbon for Odor Control	1,085	LBS	2.00	0	$2,170
Maintenance	0.10	FTE	0.00	90,000	$9,000
					$16,069
Contingency	10%				$1,607
Total Annual Cost (Rounded)					**$18,000**

NOTES
Contingency is for scope changes that are presently unforeseen.



VICINITY MAP

NTS

Appendix M – Figures

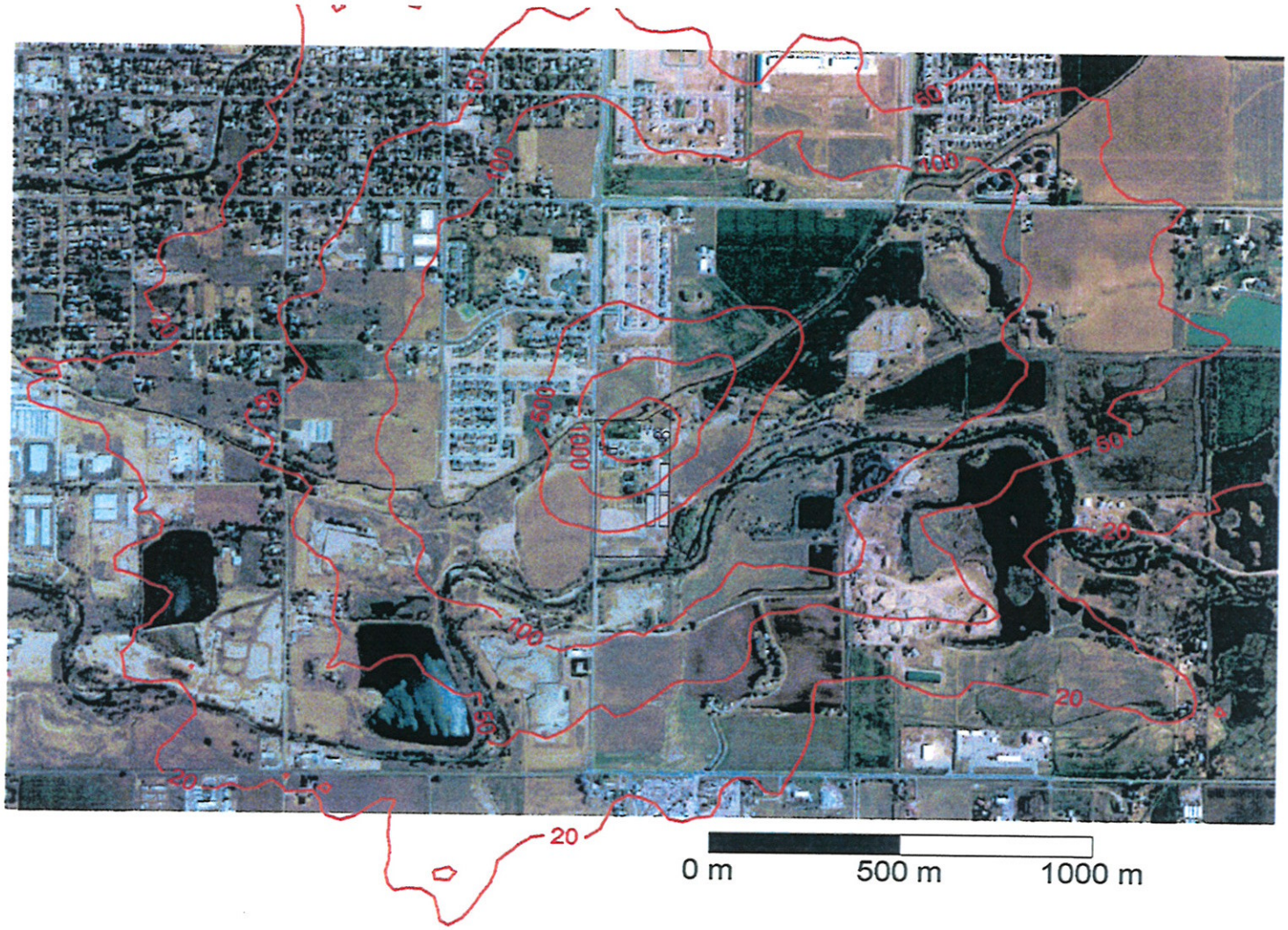


Figure 1 Worst-Case Baseline Modeling Results, Number of Hours per Year above 7 D/T from All Sources

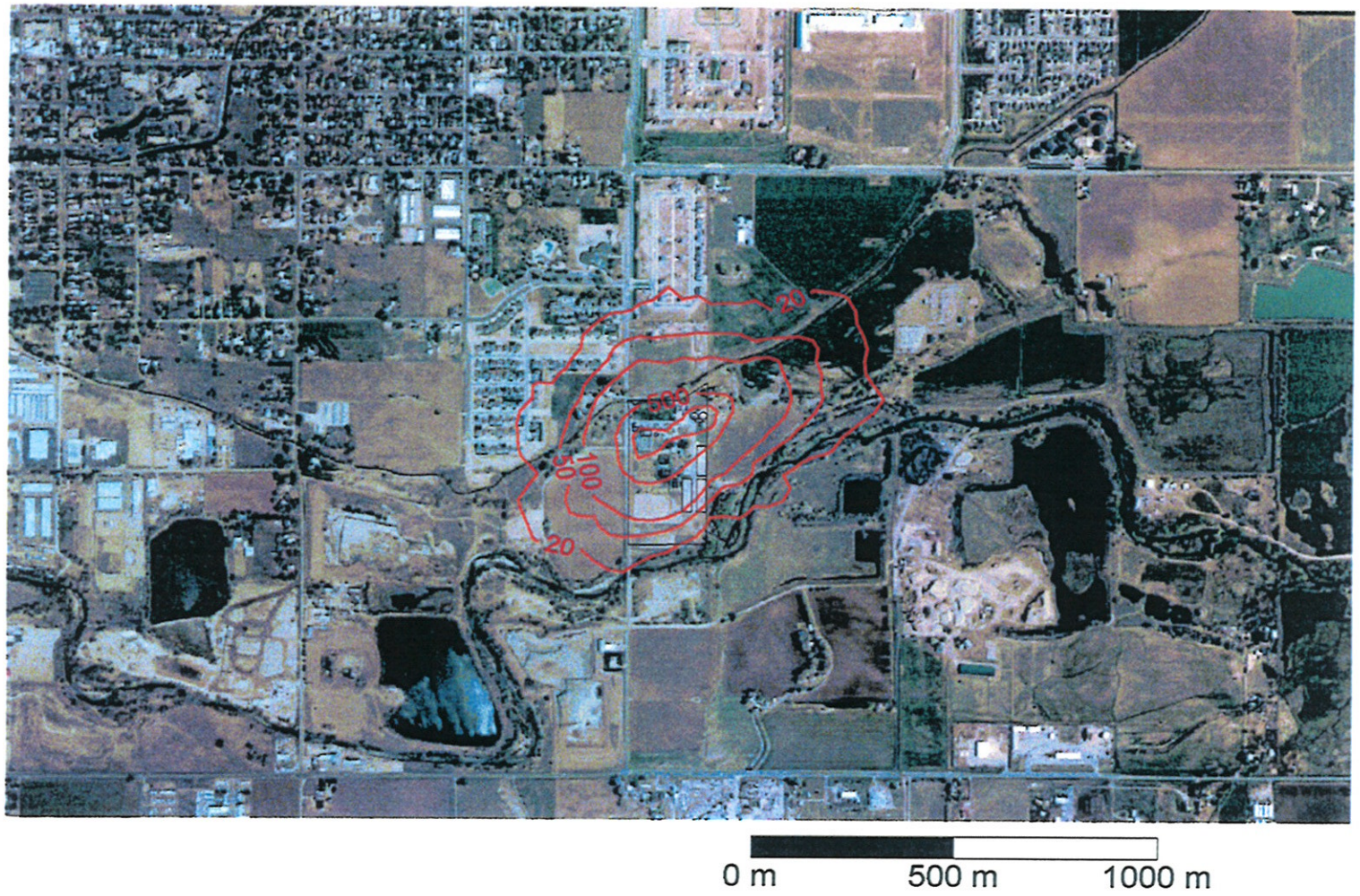


Figure 2 One-Day Baseline Modeling Results, Number of Hours per Year above 7 D/T for All Sources

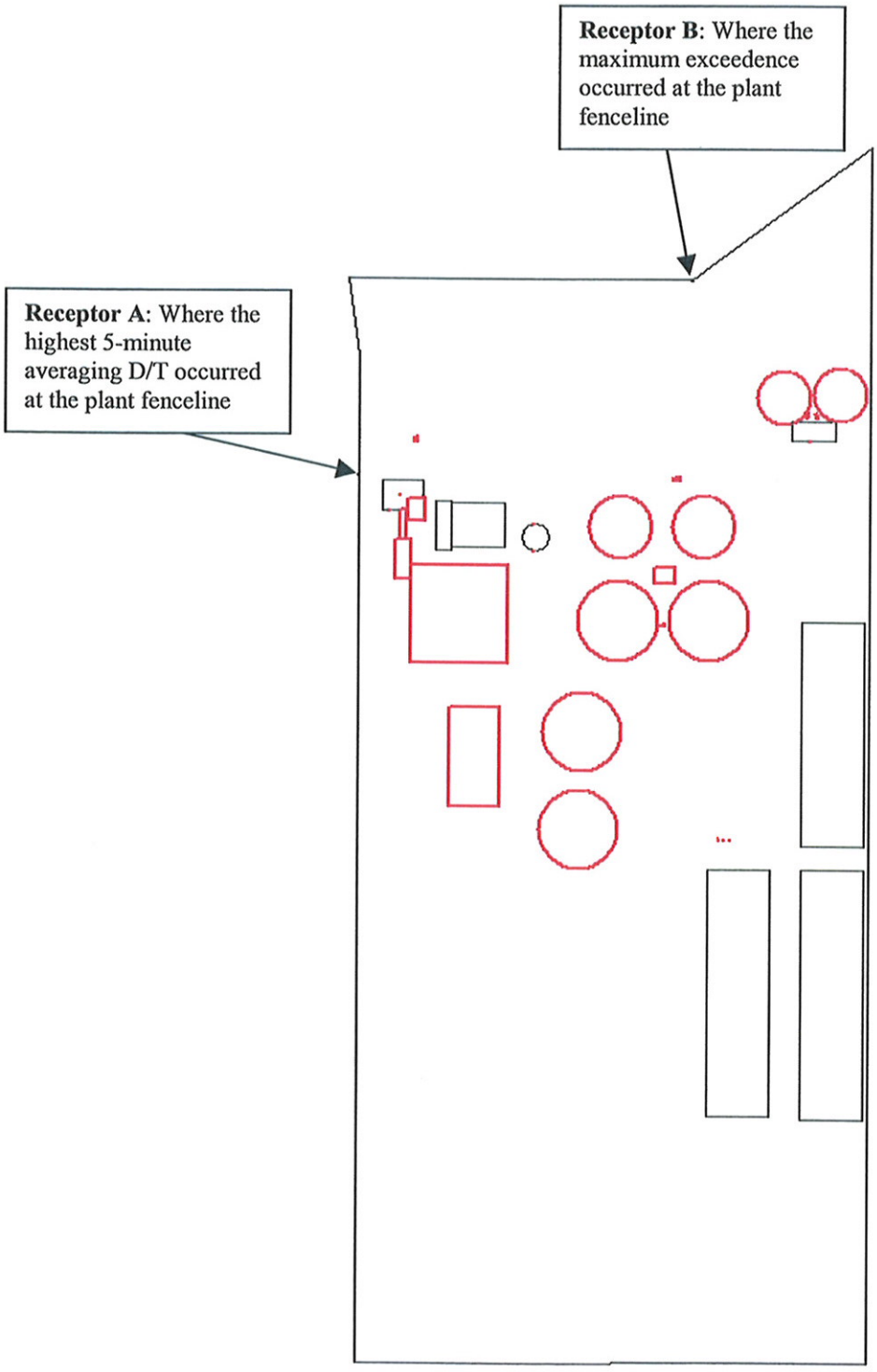


Figure 3 Off-Site Receptors

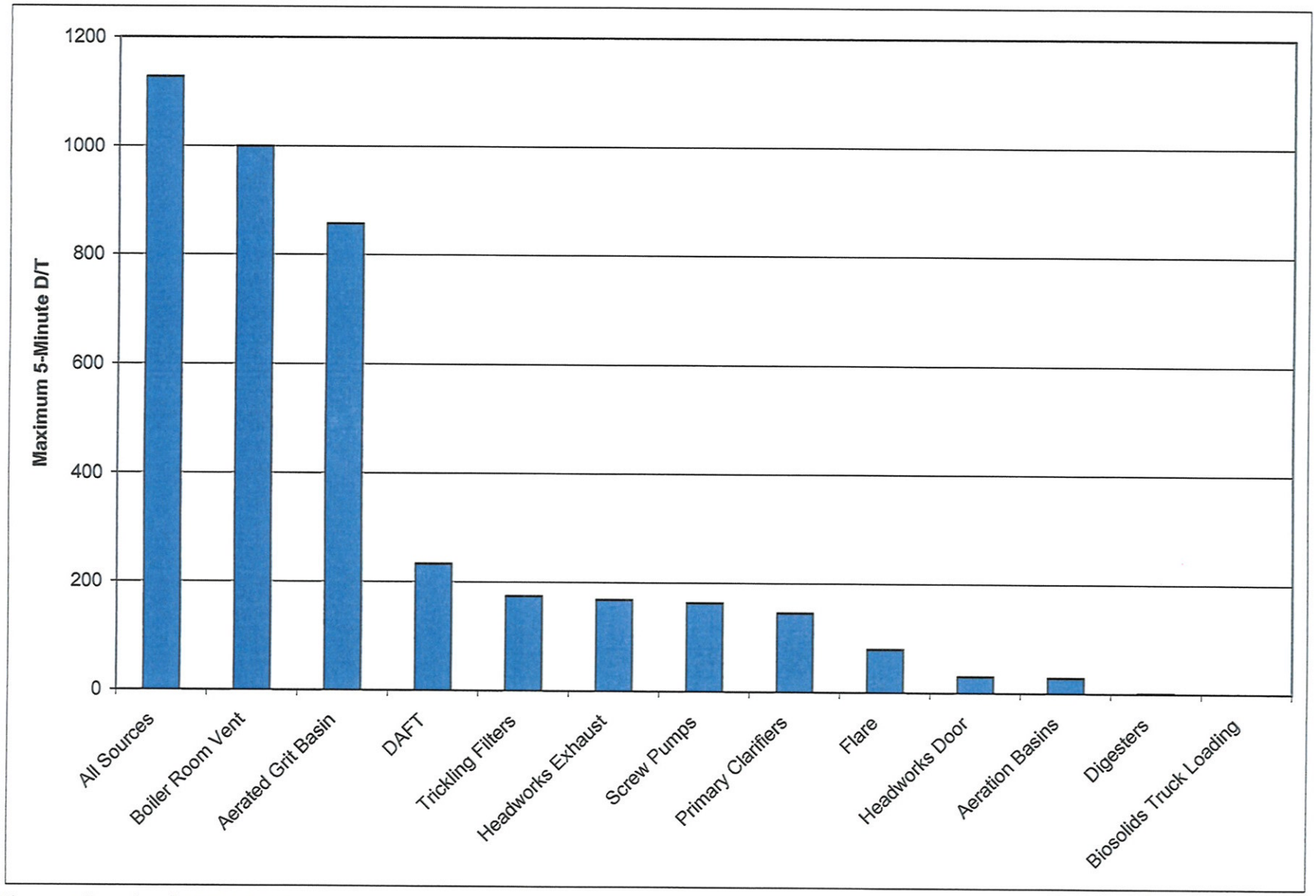


Figure 4 Loveland WWTP Odor Source Prioritization

FIGURE 5
Aerial Photograph of the Loveland WWTP and Surrounding Vicinity

FIGURE 6
Location of Majority of Odor Complaints

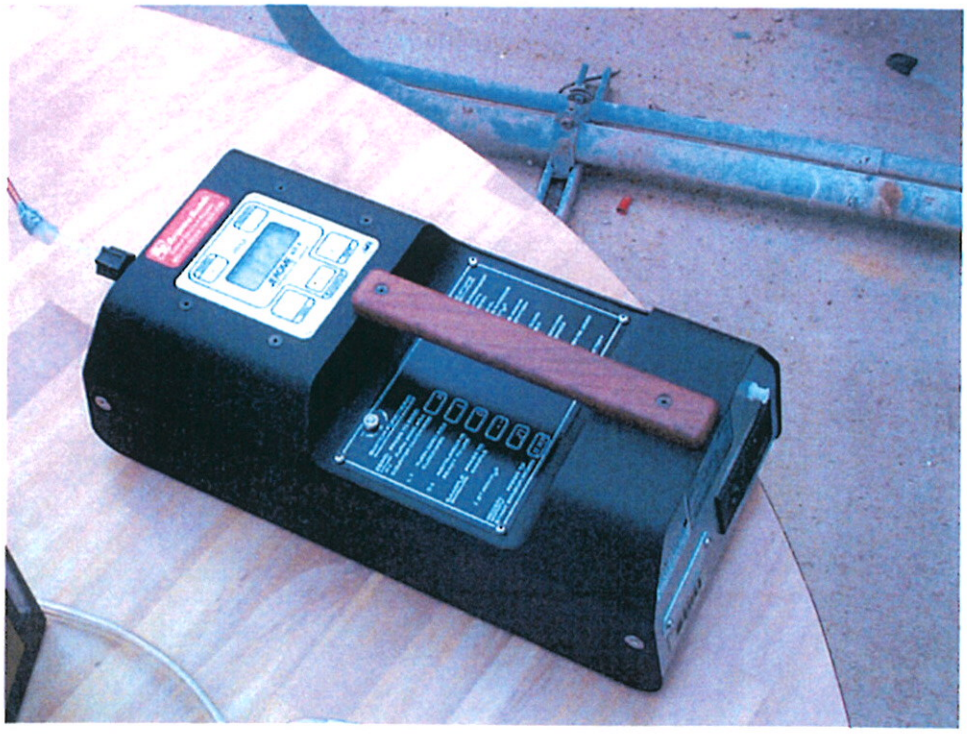


FIGURE 7
Jerome Meter

FIGURE 8
Sampling Locations for the Plant Sampling

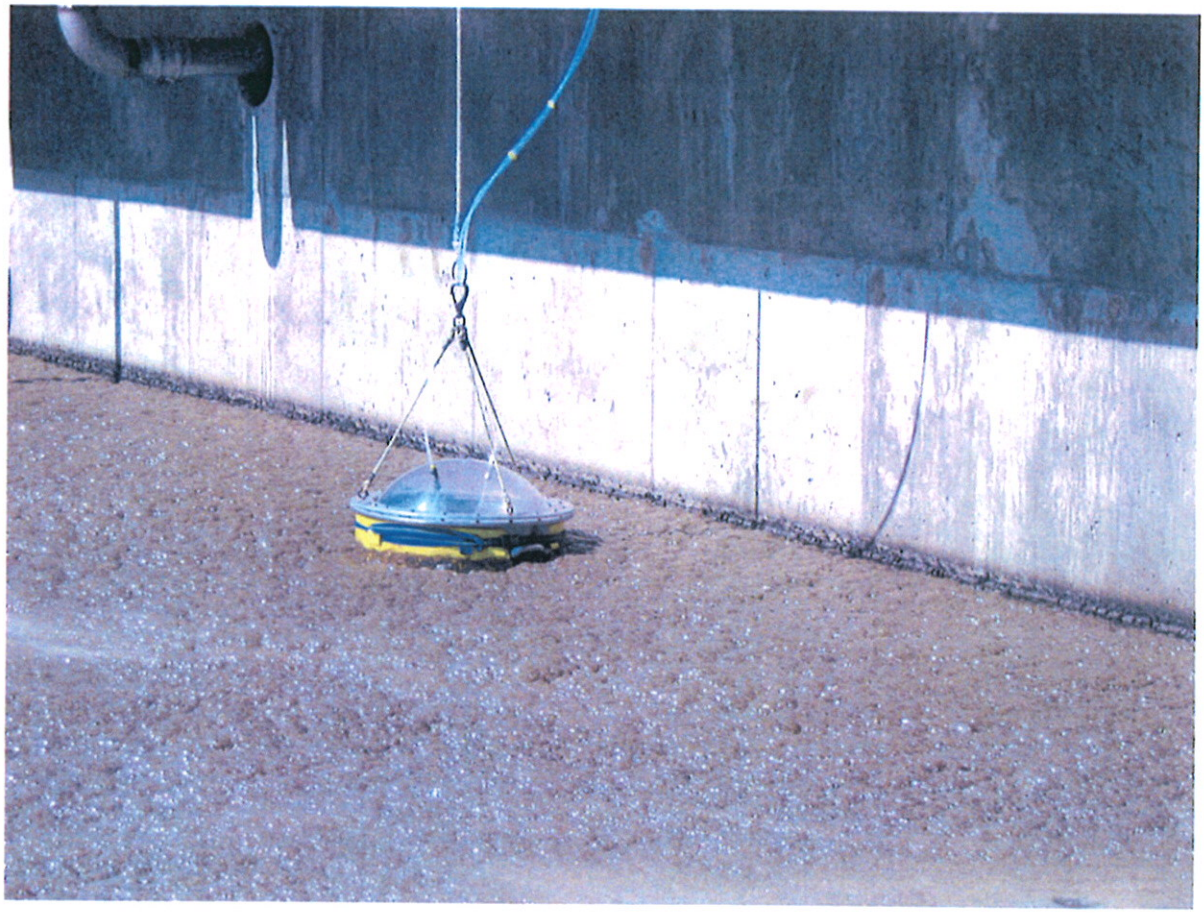


FIGURE 9
Flux Chamber Sampling

FIGURE 10
Nasal Ranger

FIGURE 11
Sampling Locations for the Fenceline Sampling

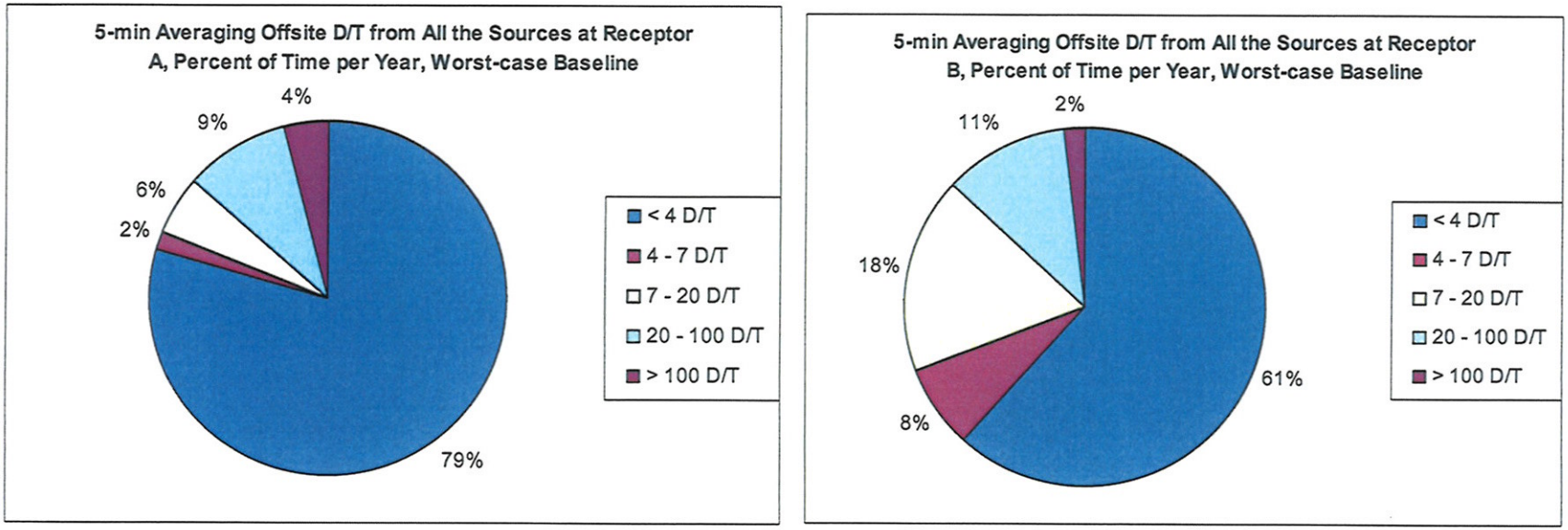


Figure 12 Percent of Time per Year – Offsite Odor Impact in D/T from All Sources, Worst-Case Baseline

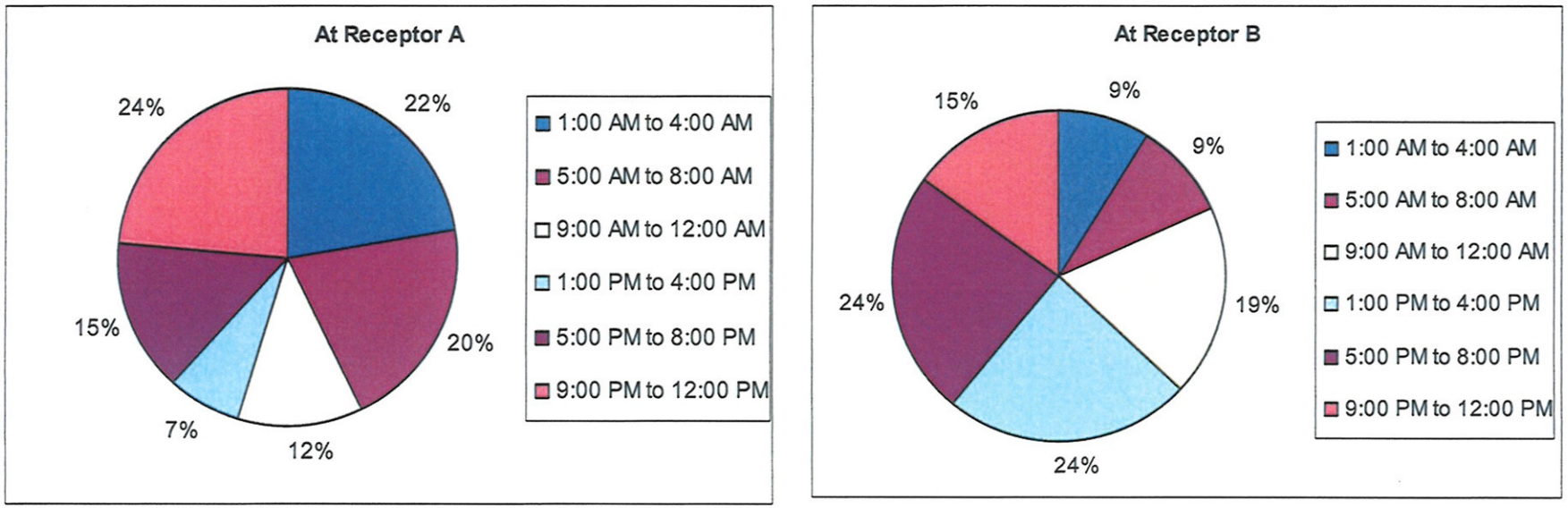


Figure 13 Frequency of Exceedences above 7 D/T by Time of Day over a Year from All Sources, Worst-Case Baseline

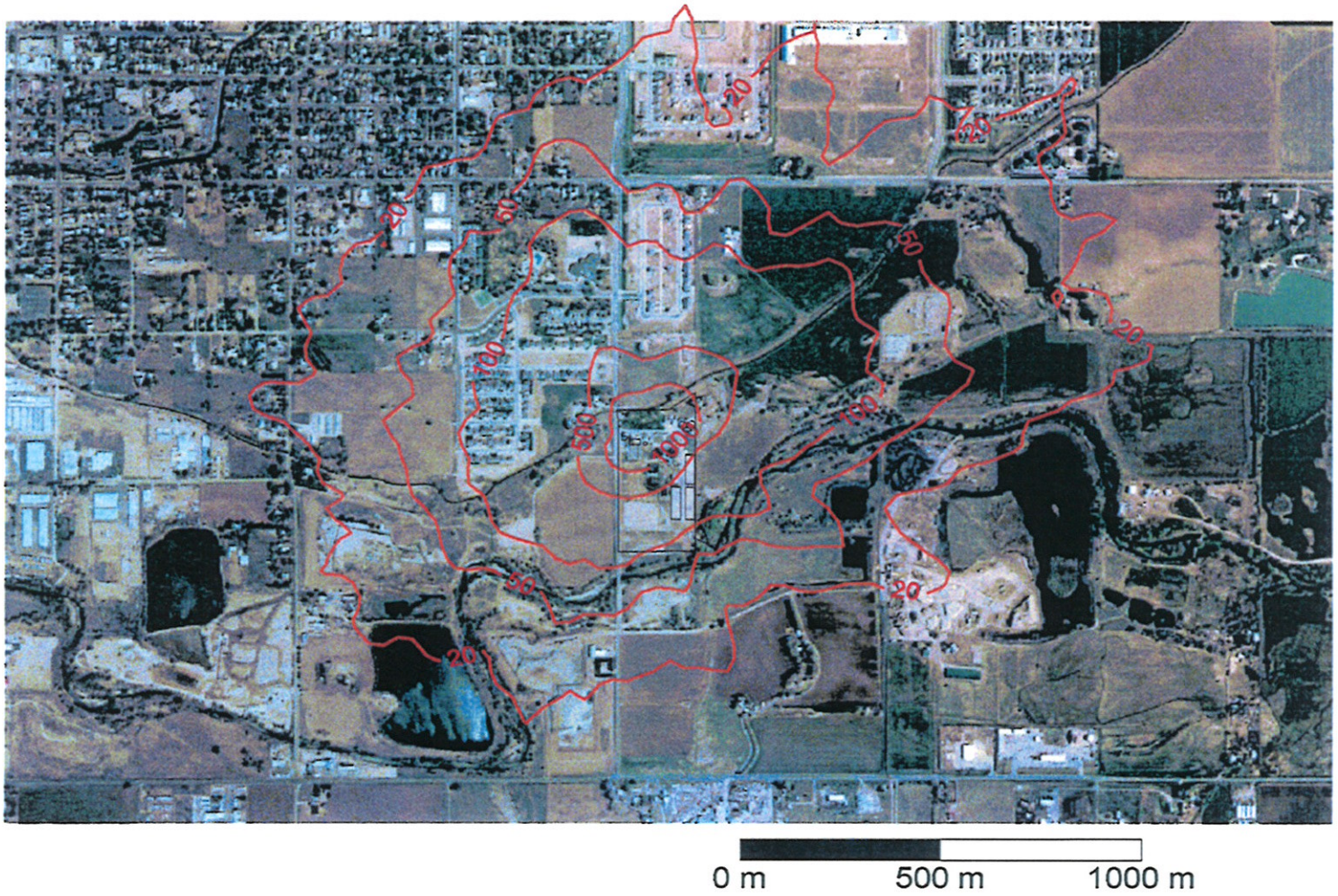


Figure 14 Odor Control Stage 1 – Boiler Room Vent Repair and Discontinue Use of Trickling Filters, Number of Hours per Year above 7 D/T for All Sources

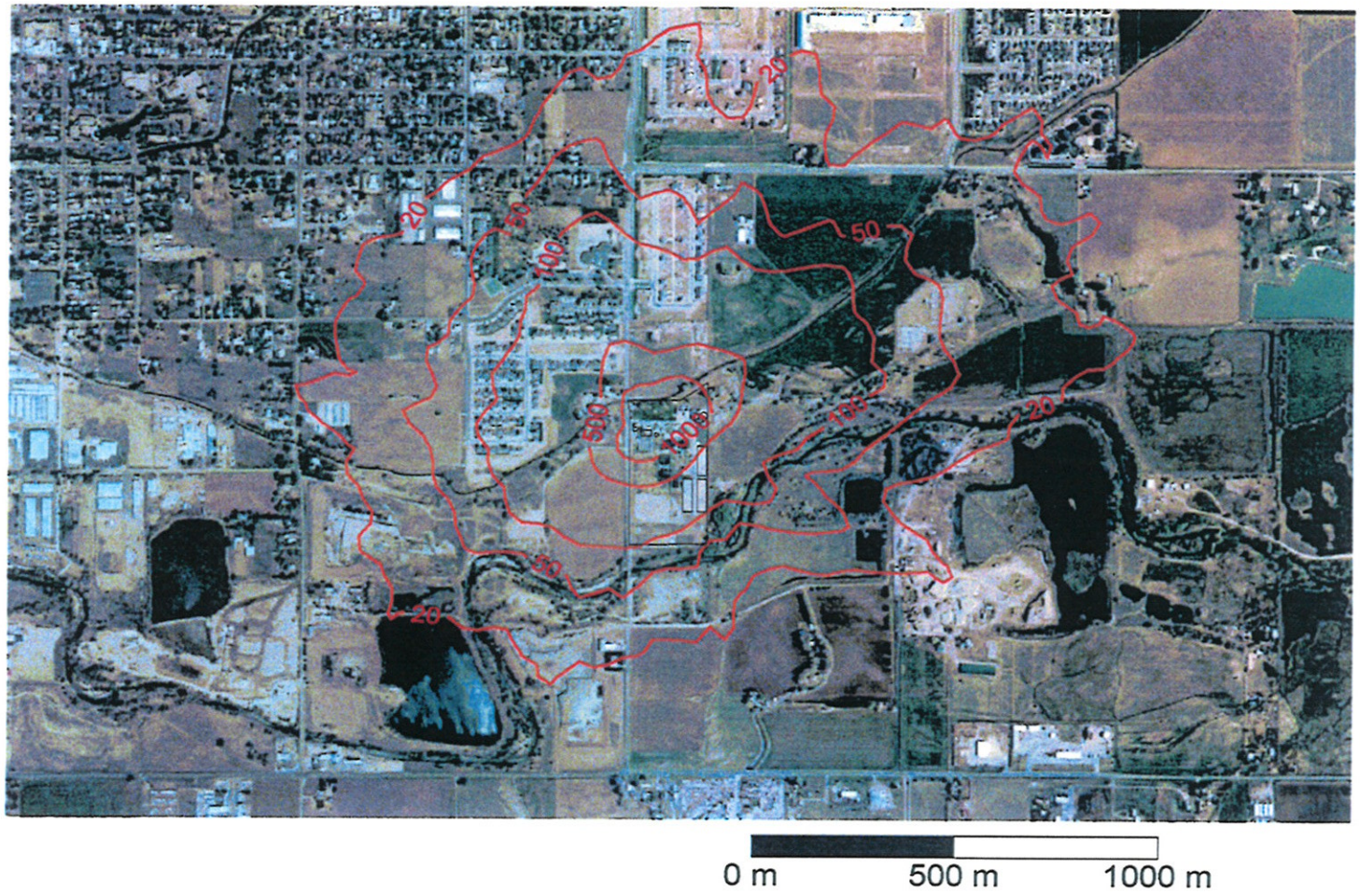


Figure 15 Odor Control Stage 2 – Odor Control for Aerated Grit Basin, Number of Hours per Year above 7 D/T for All Sources

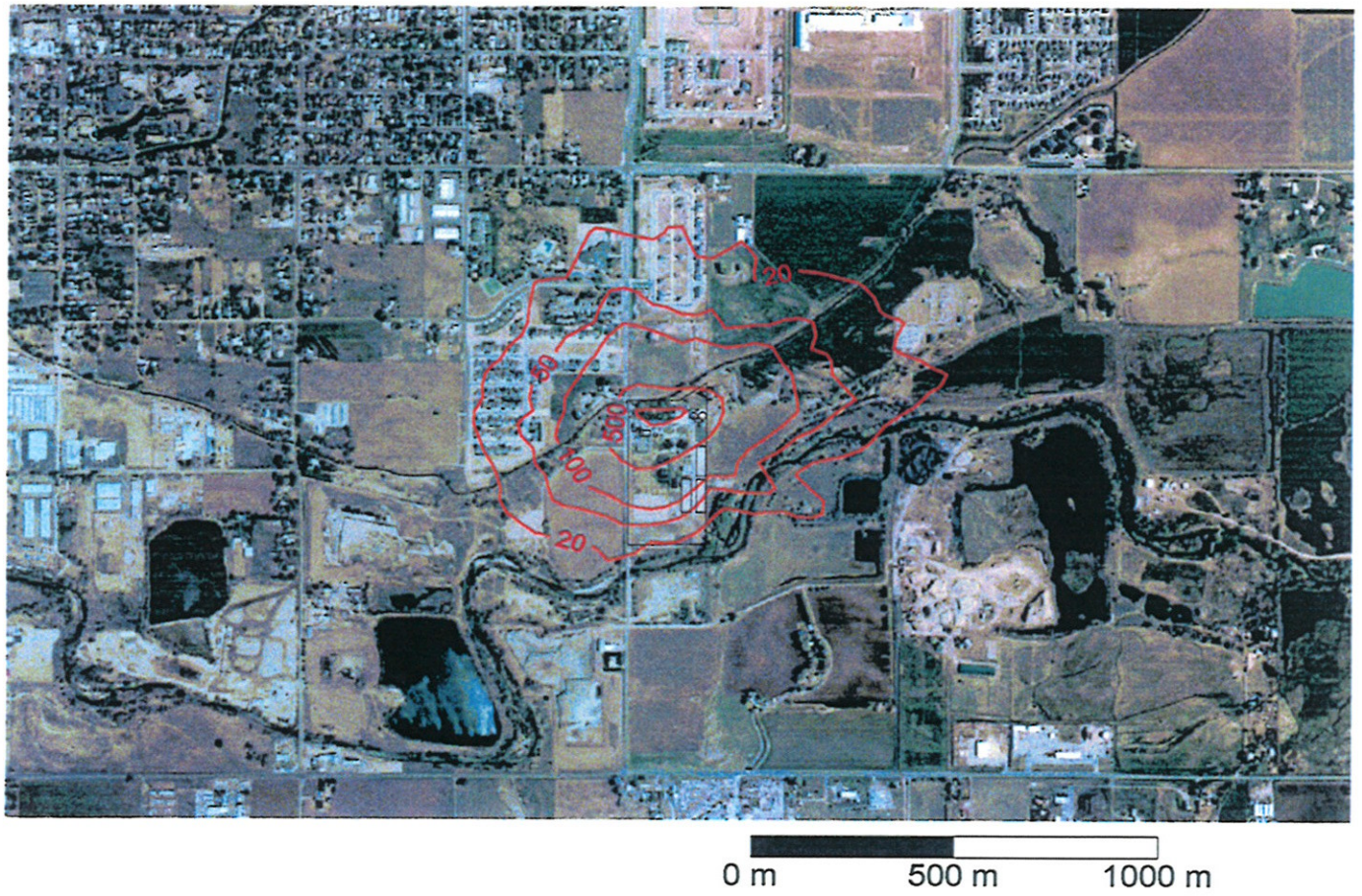


Figure 16 Odor Control Stage 3 – Odor Control for New Headworks Facility, Number of Hours per Year above 7 D/T for All Sources

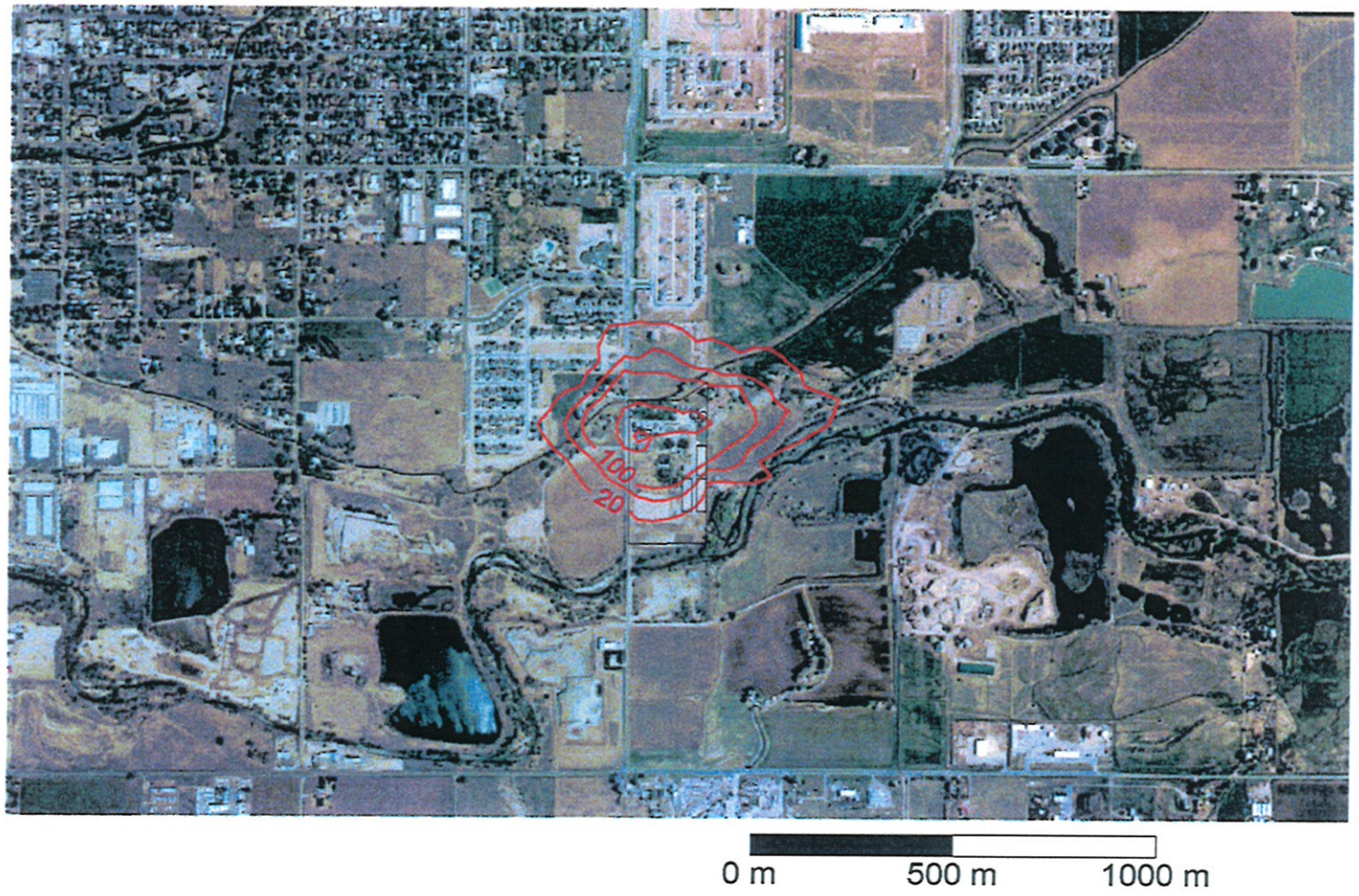


Figure 17 Odor Control Stage 4 – Odor Control for DAFT, Number of Hours per Year above 7 D/T for All Sources

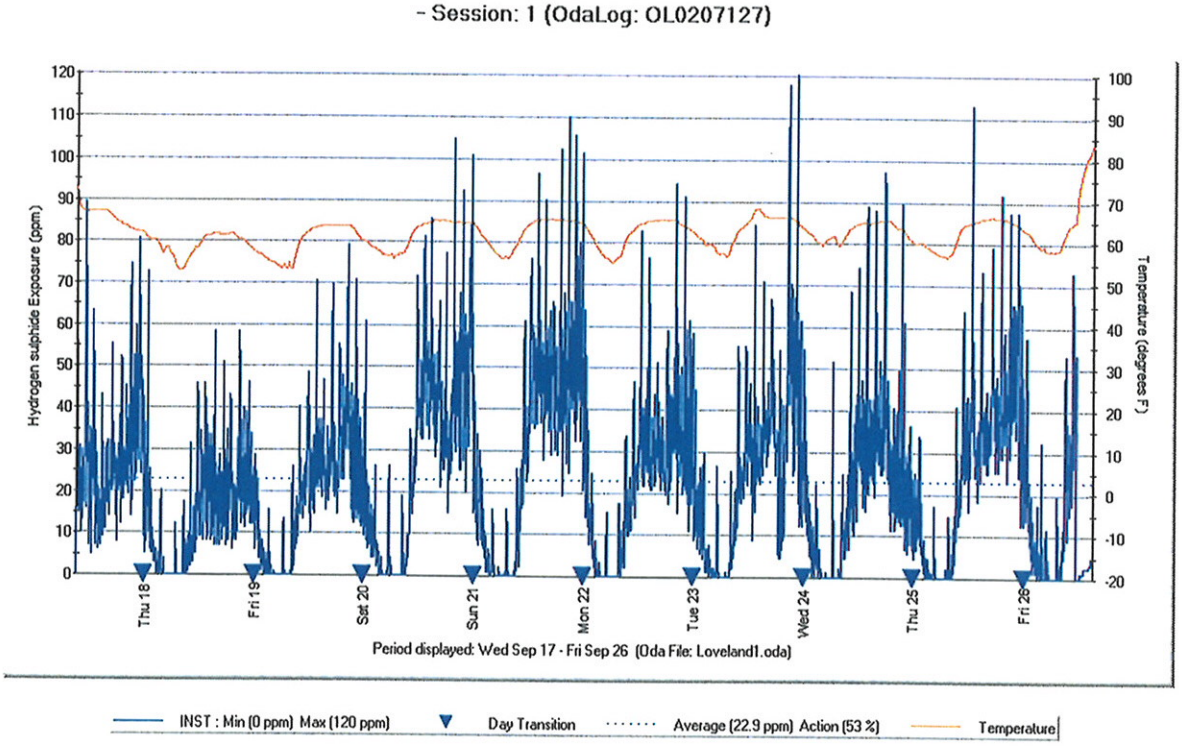


FIGURE 18
Results of OdaLog Sampling in Headworks Channel

Section 8 – Technical Support Appendices

Appendix 8.M **Stormwater Management Plan and Permit**

The current stormwater management plan and permit for the WWTP site is enclosed.

Report

City of Loveland Wastewater Treatment Plant Stormwater Management Plan

Prepared for

City of Loveland
Department of Water and Power
200 North Wilson Avenue
Loveland, Colorado 80537

March 2003

Updated January , 2008

CH2MHILL

9193 South Jamaica Street
Englewood, Colorado 80112

1. Introduction

Under the Colorado Department of Public Health and Environment, Water Quality Control Division (CDPHE-WQCD) Colorado Discharge Permit System (CDPS), domestic wastewater treatment facilities are considered "associated with light industrial activity." Colorado Regulation 61.3(2)(e)(iii)(I) requires permits for stormwater discharges associated with industrial activity as described in the federal regulations. The federal regulations, 40 CFR 122.26, describes an industrial activity in part as:

> "Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage treatment recycling, and reclamation of municipal domestic sludge, including land dedicated to the disposal of sewage sludge that are located within the confines of the facility, with a design flow of 1.0 mgd or more, or required to have an approved pretreatment program under 40 CFR part 403. Not included are farm lands, domestic gardens or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with section 405 of the CWA."

The CDPHE has issued a general permit that covers discharges associated with light industrial activity including domestic wastewater treatment works (Appendix A). This permit requires the development and implementation of a Storm Water Management Plan (SWMP). This plan is meant to comply with this requirement.

1.1 Pollution Prevention Team

Name:	Michael McCrary
Title:	Interim WWTP Manager
Phone:	(970) 962-2572
Responsibilities:	Responsible for storm water pollution prevention activities at the Loveland Wastewater Treatment Plant. These responsibilities include:

(a) Updating the SWMP as required.

(b) Performing semi-annual inspections of the facility.

(c) Ensuring that storm water pollution prevention is included in employee training classes.

(d) Supervising spill and leak cleanup.

(e) Supervising facility and procedural changes identified to minimize pollutant exposure to storm water.

Name:	Stephen Adams
Title:	Water Utility Manager
Phone:	(970) 962-3559
Responsibilities:	Supervises the Treatment Manager in implementing and updating the SWMP. In the event that the Treatment Manager is unavailable, he assumes the responsibilities outlined above.

1.2 Revision History

Initial Date: March 6, 2003	By: CH2M HILL
Revision Date: 12-10-2003	By: Johnny Tuxhorn/Al Paquet
Revision Date: 01-26-2005	By: Al Paquet
Revision Date: 01/09/2008	By: Michael McCrary
Revision Date:	By:
Revision Date:	By:
Revision Date:	By:
Revision Date:	By:
Revision Date:	By:
Revision Date:	By:
Revision Date:	By:
Revision Date:	By:

1.3 Certification of SWMP

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature: _____

Name: Stephen C. Adams

Title: Water Utility Manager

Certification Date: _____

2. Facility Description

The purpose of this section is to describe the wastewater treatment plant facility and the processes that occur at the facility.

2.1 Background

The Loveland Wastewater Treatment Plant (WWTP) was built to protect the waters of the Big Thompson River from raw sewage discharges. The WWTP includes those processes necessary to remove solids, floating material and pollutant loading that would otherwise deplete the natural assimilative capacity of the Big Thompson River. In this manner, the Loveland WWTP also protects the beneficial uses designated by the State of Colorado for the Big Thompson River. Regulation 38 – *Classification and Numeric Standards for South Platte River Basin, Laramie River Basin, Republican River Basin, Smokey Hill River Basin* defines those beneficial uses as Class 1a Recreation (May 1 through October 15), Class 2 Recreation (October 16 through April 30), Warm Water Aquatic Life Class 2, and Agricultural Use.

2.1.1 Location

The WWTP is located in the southern portion of the City at 920 South Boise Avenue, approximately one quarter mile north of County Road 402 on County Road 11E. The plant lies within the Big Thompson River drainage basin. The WWTP primarily treatsdomestic and commercial wastewater and discharges treated effluent to the Big Thompson River.

The WWTP was originally designed and constructed in 1960 as a primary treatment plant. The plant was upgraded to a secondary treatment plant in the early 1970s using a two-stage trickling filter process. Further expansion was completed in 1984 and 1986 to increase treatment capacity to 8.0 mgd. The City completed Wastewater Treatment Plant improvements in 2005 that increased the treatment capacity to 10.0 mgd.

2.1.1 WWTP Processes

The WWTP collects wastewater from the City of Loveland. The plant influent travels through the Headworks Building where a grinder/screen removes larger materials, washes the material, and discharges the screenings to a dumpster bin. The aerated grit chamber allows grit to settle while solids are suspended. Settled grit is discharged to the grit classifier. The classifier washes the grit material and conveys it to a dumpster, located inside the Headworks Building. The waste material in the dumpster is collected on a weekly basis. Influent flows to the aerated grit tanks that remove grit material. The grit is collected in a grit hopper in the Headworks Building. On a weekly basis, the material is hauled offsite.

Screw pumps convey the aerated grit effluent from the grit tanks and to the two primary clarifiers. In the primary clarifiers, some of the more dense materials are removed through settling. The material removed from the wastewater in the primary clarifier is pumped to the Digester Building from the primary sludge pump station. After digestion, the material is conveyed to the sludge loadout area and discharged into a truck. The truck loading

operation is performed outdoors on the south side of the existing Chlorine/Sulfur Dioxide Building. Digested solids are hauled via trucks to an application site located off of the WWTP property. The material is land applied in accordance with the City's Biosolids Disposal Program.

Primary clarifier effluent travels to a splitter box where the flow is split into the two trickling filters. The trickling filters have a bypass to the aeration basins that may be used if flows are high. From the trickling filters, flow is lifted at the aeration lift station and sent to the aeration basins.

The treatment plant has Six aeration basins that operate in parallel trains of three basins in a step feed process. Return activated sludge (RAS) from the secondary clarifiers is returned to the head of the aeration basins.. Flow leaves the aeration basins and travels to a splitter box where the flow is split into the two secondary clarifiers.

Additional solids are settled out in the secondary clarifiers. These solids are collected and conveyed to the dissolved air flotation (DAF) thickener for solids thickening. Supernatant from the DAF thickener are conveyed to the head of the plant. Thickened solids are pumped to the Digester Building. As with the primary clarifier solids, the digested material is conveyed to the sludge loadout area and hauled to an application site located off of the WWTP property.

Downstream of the secondary clarifiers, the flow is combined and flows by gravity to the Ultraviolet Disinfection (UV) Facility. The UV facility has two operating channels each with two banks of lamps. Down stream magnetic flow meters are used to pace the lamp intensity and the number of channels and banks in service. . The disinfected plant effluent is discharged into the plant effluent pipe and subsequently flows into the Big Thompson River.

The WWTP is served by underground electrical service, from two separate sources, and is equipped with a standby engine generator capable of supporting critical loads such as the UV Disinfection Facility. The standby diesel engine generator set was constructed as part of the WWTP improvements project completed in 2005.

No vehicle maintenance occurs on site. Washing of vehicles is performed at the Sludge Holding Tank Building. This area is not covered and waters flow south to the storm drain inlets along the plant roadway.

The digested solids load out area is located outdoors, south of the former Chlorine/Sulfur Dioxide Building now used for Storage. The loading area is washed every day or so by the truck drivers. An inlet is located in this load-out area to ensure that the wash down water is collected. Wash waters are collected in the inlet and routed to the filtrate pump station where the waters are pumped to the head of the wastewater treatment plant.

2.2 Maps

Figure 1 shows a vicinity map for the City's wastewater treatment plant. Figure 2 provides a site plan with the facility structures, outfalls, runoff drainage areas and ground cover characteristics identified.

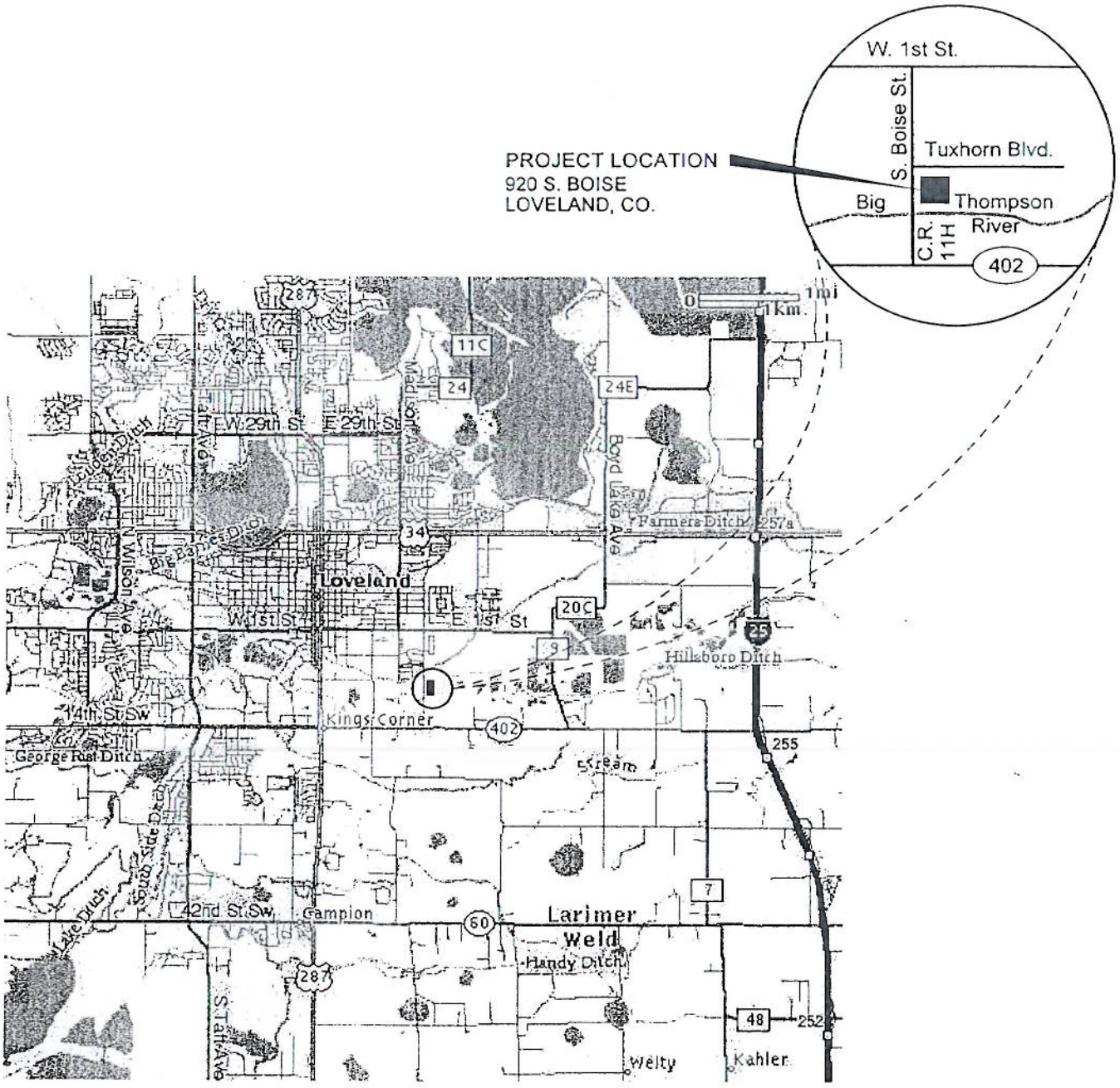
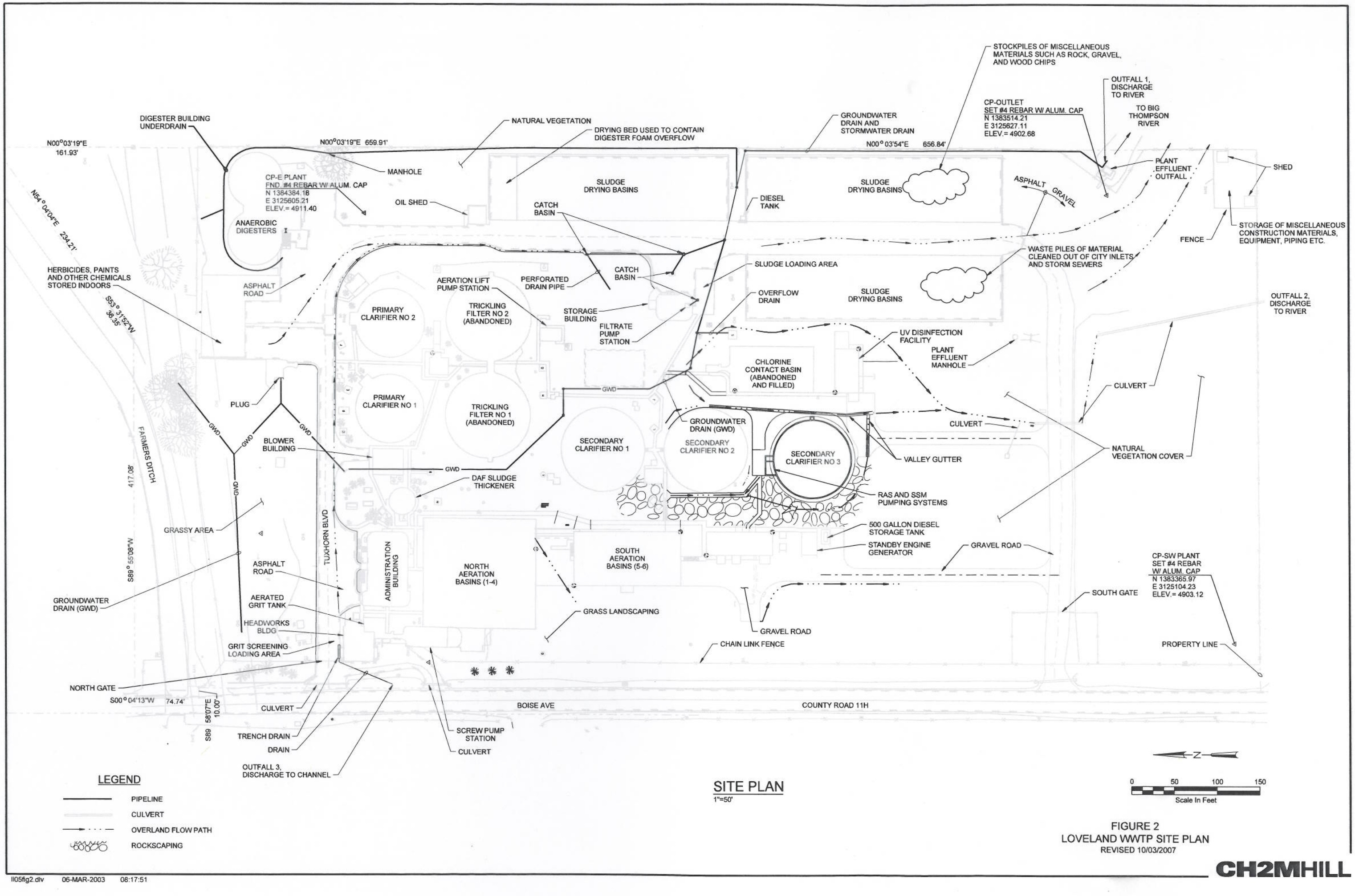


FIGURE 1
VICINITY MAP

CH2MHILL



SITE PLAN
1"=50'

FIGURE 2
LOVELAND WWTP SITE PLAN
REVISED 10/03/2007

3.0 Potential Pollutants, Outfalls, and Monitoring

3.1 Outfalls and Potential Pollutants

3.1.1 Outfalls

There aretwo storm water outfalls from the Loveland WWTP site. They are discussed in Table 3-1. Storm water from outfalls 1 and 2 enters the Big Thompson River.

TABLE 3-1
Storm Water Outfalls at the Loveland WWTP

Outfall	Description	Potential Pollutant Sources	Potential Pollutants
001	Groundwater drain that drains the central area of the plant. This also includes run off from the paved areas around the north side of headworks building, main plant entrance, administration building, solids holding tanks, garage building, digester building, oil shed, and several of the abandoned sludge drying beds.	Any release from loading and unloading activities of wastes from screening, wastes from dumpster, sludge for land application, and lubricating oils. Sludge foam that may over flow the digester treatment units. Wash water from vehicle washing and washing down the maintenance area and sludge loading area.	TSS, CBOD, oil and grease, ammonia, fecal coliform, nitrates, sulfate, organic pollutants, solvents and floatables.
002	Drains mostly grassy areas on the south side of the plant as well as channelized areas. This includes run off from around the aeration basins, trickling filter no. 1, secondary clarifiers, and chlorine contact basin.	Sewage that may be released through a pipe break. Herbicides applied to the grassy areas and sediment from areas not vegetated or paved.	TSS, CBOD, ammonia, fecal coliform, nitrates, chlorine, sulfate, and organic pollutants.

3.1.2 Significant Dust or Particulate Generating Processes

A site evaluation of the facility and operations being performed at the facility confirmed there are not any processes that produce significant dust or particulate pollutants that could be released into the air or contaminate surface water.

3.1.3 Onsite Waste Disposal Practices

Based on a site evaluation of the facility, there are not any waste materials that are disposed of onsite.

3.1.4 Sara Title 313

The Loveland WWTP is subject to Section 313 of the Federal Emergency Planning and Community Right to Know requirements (title III of the Superfund Amendments and Reauthorization Act of 1986). As of November 2004,the WWTP no longer uses chlorine gas onsite, which is considered a hazardous substance and is subject to reportable quantity spill requirements. The UV disinfection Facility replaced the Chlorine Disinfection Facility. All products or materials containing 313 water priority pollutants are stored indoors and are not considered potential pollutant sources. See Appendix B for a list of the substances stored on-site.

3.1.5 Significant Spills or Leaks of Toxic or Hazardous Substances

At the time of SWMP preparation, there have not been any significant spills or leaks of toxic or hazardous substances at the facility within the past three years. The anaerobic digesters have occasionally overflowed the treatment units. These spills have occurred approximately once per year and were contained on the facility. Spill material was disposed of offsite.

3.2 Monitoring

3.2.1 Monitoring Stations

ROUTINE PERIODIC MONITORING OF STORM WATER IS NOT REQUIRED UNLESS REQUESTED BY THE CDPHE.

Sampling of stormwater may be required by the CDPHE-WQCD on a case-by-case basis, such as in the event that there is reason to suspect noncompliance with the Stormwater Management Plan or to measure the effectiveness of the BMPs in removing pollutants in the effluent.

If sampling is required, the permit requires that the results be reported to the CDPHE-WQCD on an annual basis along with the Annual Report, unless otherwise specified by the CDPHE-WQCD. Results shall be reported on CDPHE-approved discharge monitoring report forms.

If requested, stormwater sampling will involve obtaining a grab sample from each outfall and checking the sample for characteristics of color, odors, turbidity, hydrocarbon sheen, and other indications of pollution. If any pollution problems are noted from the sampling results, an investigation and identification of the source and cause of the pollution will be performed and appropriate corrective actions will be taken.

3.2.2 Sampling Protocols

The following sampling procedures will be used should the CDPHE-WQCD request sample collection, unless they request a different procedure. The CDPHE-WQCD will specify the parameters to be monitored.

1. Storm water outfall samples will be collected from discharges resulting from a rainfall event that is greater than 0.1 inch in magnitude and occurs at least 72 hours after any previous storm events that are 0.1 inch or greater. Composite samples will be obtained except as noted in item 2.

2. Grab samples will be used for monitoring for the following parameters:

   - pH
   - Temperature
   - Cyanide
   - Total Phenols
   - Residual Chlorine
   - Oil And Grease
   - Fecal Coliform
   - Fecal Streptococcus

3. Composite samples will be used to monitor for any other parameters. Composite samples will be taken in accordance with Colorado Discharge Permit System Regulations (Regulation No. 61). If discrete composite sampling is done, at least three separate aliquots will be taken in each hour of discharge for the entire discharge or for the first three hours of the discharge, with each aliquot being separated by a minimum period of fifteen minutes.

4. Quantitative data must be reported for the grab sample taken during the first thirty minutes of the discharge for all pollutants specified in Regulation 61.4(3)(b)(i).

5. Sample analysis will conform to the approved methods in 40 CFR Part 136.

6. The following information will be collected for each storm event unless otherwise directed by the CDPHE-WQCD:

   a. Date, duration, start and ending times and magnitude in inches of the storm event sampled.

   b. The total volume of the storm water discharges. This can be calculated by multiplying the magnitude of the storm, times the area drained times the runoff coefficient.

   c. The duration between the storm event samples and the end of the previous measurable (greater than 0.1 inch) rainfall.

7. Each monitoring point will provide a representative sample of the storm water being discharged. Flow will be measured at each stormwater outfall. Rather than sampling all outfalls it is possible to sample a single representative outfall. This determination will be made a the time that sampling is requested.

4.0 Pollutant Control Strategy

4.1 Source Specific Controls

In the previous section, Table 3-1 provided a list of potential pollutants that could be found at the Loveland WWTP. Table 4-1 lists the potential sources of pollutants and the controls or best management practices (BMPs) in place to prevent their entering the storm water.

TABLE 4-1
Sources of Pollutants and BMPs at the Loveland WWTP

Source	Location	Outfall	Pollutant Minimization/ BMPs
Sludge	Anaerobic Digesters	001	The anaerobic digesters have, in the past, overflowed the treatment units due to upsets in the treatment process. When this has occurred, typically foamy materials overflows and runs down the driveway. Plant operators can anticipate when this is going to happen and control the incident by installing an earthen berm to divert the digester flow into the first drying bed where the foamy material is contained. Unless contained, the foamy material could run down the street and enter into a storm sewer inlet, which discharges to the outfall channel and then into the Big Thompson River.
Raw or partially treated wastewater	Throughout plant	001 & 002	Wastewater is conveyed between facilities through underground pipelines that would not result in the contamination of stormwater. The potential sites for discharge would be at above ground connections to treatment units.
Diesel Storage Tank - Standby Electric Generator	South of Blower Building	002	A standby electrical generator and 500 gallon diesel storage tank was installed in 2004.The diesel storage tank is furnished with double wall construction and leak sensors between the inner and out wall Leaks are signaled to the plant SCADA system. Care is used by fueling contractor to avoid spills while transferring diesel fuel.
Temporary Diesel fuel station	Near Chlorine Building	001	Currently, the plant has a 500-gallon diesel fuel tank with secondary containment. This is going to be removed from the plant and fueling activities will be performed offsite at a commercial site.
Vehicle washing	Maintenance Shop	001	Currently, vehicles are washed near the Maintenance Shop, but this practice will no longer be performed outdoors. All washing will be performed either indoors where floor drains are connected to the sanitary sewer or offsite at a commercial site or at the City's Service Center.
Screenings from Headworks	Headworks Building	001 &	The auger screenings from the Headworks are disposed of in dumpsters kept indoors. City's solid waste department picks up the screenings approximately once per week. This is performed inside the Headworks Building. During this loading activity special care will be provided to ensure materials spilled are cleaned up and do not get discharged into the storm drain .

TABLE 4-1
Sources of Pollutants and BMPs at the Loveland WWTP

Source	Location	Outfall	Pollutant Minimization/ BMPs
Grit from Headworks	Headworks Building	001 &	Grit is removed from the Headworks Building approximately once a week. Loading activities are performed indoors where floor drains are connected to the treatment works inlet channel. During this loading activity special care will be provided to ensure materials spilled are cleaned up and do not get discharged into the storm drain.
Lubricating oils	Oil Shed	001	Lubricating oils for maintaining equipment and the treatment facility are stored inside a shed on the east side of the site. This shed is located in the flow path of stormwater when larger storm events occur. A berm has been installed to prevent stormwater from flooding the shed. Any spills inside the shed are cleaned up immediately using absorbent blankets or floor dry (kitty litter). To prevent leaky valves on the drums from causing oil stains on the concrete floor of the shed, spill pallets should be used to store drums of oil used on a regular basis.
Herbicides	Grassy Areas and Maintenance Shop	002	Small quantities of herbicides and insecticides are stored indoors in a locked cabinet. Herbicides stored onsite are applied by a trained applicator and are generally used only for spot weeding. The Parks Department will apply herbicides on the larger grassy areas. Herbicides will not be applied prior to forecasted storm events.
Paints, solvents and other miscellaneous materials	Maintenance Shop	001	Paint, solvents, degreasers, lubricants and miscellaneous cleaners are stored indoors in cabinets. These materials are used for building maintenance activities.
Miscellaneous Storage Area	Southeast corner of property near outfall	Overland Flow	This storage are contains miscellaneous construction materials, used valves, pipes, old equipment, etc. Some of these materials are greasy or have engine parts that may not be drained of all liquids. This storage area will be cleaned out on a regular basis and any materials that may contain liquids will be drained prior to storage.
Stockpiled Materials	Sludge Drying Basins	Overland Flow	Stockpiles of gravel, rock and wood chips are stored in the sludge drying beds, which are no longer being used for sludge treatment. These beds are depressed with a sloping entrance and containment walls on three sides. Materials stored in the drying beds will not contaminate stormwater. During loading and unloading activities care shall be taken to ensure all the material is within the depressed area of the beds and any material spilled is cleaned up afterward.
Waste piles of material cleaned out of City inlets	Sludge Drying Basins	Overland Flow	Piles of waste material cleaned out of City inlets and storm sewers are temporarily stored at the Plant before being taken to landfill. This material is stored inside the drying beds where it will not contaminate stormwater. During loading and unloading activities care shall be taken to ensure all the material is within the depressed area of the beds and any material spilled is cleaned up afterward.

4.2 Facility Wide Control Strategy

The following measures are those that are implemented on the site as a whole.

4.2.1 Good Housekeeping Measures and Controls

Good housekeeping practices help to maintain a clean and orderly work environment. At this facility, the following types of good housekeeping measures help to prevent pollutants from entering storm water discharges.

Operation and Maintenance

- Floors and ground surfaces are kept clean and dry using brooms or shovels.
- Curbs are cleaned out every couple of months.
- Paved areas are swept by the City street sweeper twice per year or on an as needed basis.
- The digested solids loading area is sprayed down every couple of days. Care is taken to ensure water from cleaning this area is directed toward the inlet drain that is connected to the filtrate pump station and not stormwater inlets.
- Garbage and waste materials are regularly picked up and properly disposed of.
- All spillage is promptly removed. Where it is impractical to constantly remove spillage, it is contained in the immediate area.
- Equipment is routinely inspected to make sure it is in working order.
- The importance of spill cleanup procedures is communicated to employees using signs.

Material Storage Practices

- Adequate aisle space is provided to facilitate material transfer and easy access for inspections.
- Containers, drums, and bags of material are stored away from direct traffic routes to prevent accidental spills.
- Where appropriate containers are stored on spill pallets to capture small spills or leaks.
- Containers are stacked according to manufacturers instructions.

Material Inventory Procedures

- Containers are labeled with the name of the material, expiration date, and health hazards.
- Inventory of all materials located at the facility is updated once per year.
- Storage areas with toxic or hazardous materials have been specially designed to contain spills.

4.2.2 Preventive Maintenance and Inspections

The facility's preventive maintenance and inspection program includes:

- Regular inspection and testing of the facility's storm water control systems to uncover conditions that could result in breakdowns or failures that could result in discharges of pollutants to surface waters. The inspections and testing is performed by City staff.
- Roadside ditches outside the facility's entrance are maintained to prevent runoff from flowing onto the facility.
- Proper maintenance of storm water control systems.
- The City performs maintenance of equipment as specified by the equipment manufacturers. The City's service technicians perform routine rounds to check equipment, oil levels and to perform repairs twice a week or on an as needed basis. Tracking of maintenance requirements and completed maintenance activities is achieved through a computer software scheduling program.

4.2.3 Employee Participation

- Information on good housekeeping practices is distributed to employees using signs, bulletin boards, and training or staff meetings when possible.
- Good housekeeping measures are discussed at employee meetings, as appropriate.
- Good housekeeping tips and reminders are posted at employee gathering areas.

4.2.4 Erosion and Sediment Controls

Most of the facility is either paved, landscaped or has natural vegetation. There is one area where natural vegetation has not produced significant ground cover and there is some bare soil. This area has been seeded in the past without success. Runoff from this area enters a culvert and discharges into a vegetated area before entering another culvert and discharging outside the facility property. Sediment from the culverts will be removed on an as needed basis.

4.2.5 Identification of Discharges other than Stormwater

The facility's storm sewer system is interconnected with a groundwater drain system. Therefore, discharges from outfall 001 include both stormwater and groundwater. Groundwater discharges from outfall 001 occur frequently and are not subject to storm or precipitation events. Based on a visual observation of the facility, there not any other non-stormwater discharges.

5.0 Spill Prevention and Response Practices

Loveland WWTP personnel will take appropriate measures to prevent spills and to prevent any spills that might occur from impacting waters of the State. This includes taking preventive measures around inlets in the immediate vicinity of fueling and liquid chemical transfer areas so as to prevent the ready release of spilled fuel or liquid chemicals via storm drains.

5.1 Procedures

IN THE CASE OF AN EMERGENCY TAKE MEASURES TO FIRST PROTECT HUMAN LIFE AND SAFETY. IN THE CASE OF A FIRE CALL 911, MEASURES SHOULD BE TAKEN TO PUT OUT THE FIRE FIST. THE CONTROL OF SPILLS IS SECONDARY.

When a spill is discovered, the employee discovering the spill must immediately stop the source of the spill and commence containment of the spill in as small an area as possible. The employee will immediately report the spill to the WWTP Plant Manager. The Plant Manager will dispatch additional personnel or equipment as required to assist in the containment of the spill. The Plant Manager will provide any required notifications to government agencies and recommend options for cleanup, storage, and disposal of spill residue. The Plant Manager will be responsible for logging the event on the "Spill Report Form." (Appendix C). The following items list the appropriate measures to be taken for each type of spill.

Leaks, Seeps, and Other Non-Flowing Releases of Non-Flammable Products

1. Take actions and/or confirm that containment is provided by checking the position of valves, placement of sandbags, absorbent booms, etc. and other devices that provide containment.
2. Notify the Plant Manager of the spill location and status. Note actions taken under Step 1 above.

Leaks, Seeps, and Other Non-Flowing Releases of Flammable Products

1. Call for assistance from other personnel
2. Terminate possible ignition sources such motors, vehicles, etc.
3. Post qualified personnel at a safe location to warn others and prevent ignition.
4. Take actions and/or confirm that containment is provided by checking the position of valves, placement of sandbags, etc and other devices that provide containment.
5. Notify the Plant Manager of the spill location and status. Note actions taken under Steps 1 through 4 above.

Flowing Releases of Non-Flammable Products

1. Call for assistance from other personnel. Terminate source.
2. Take actions and/or confirm that containment is provided by checking the position of valves, placement of sandbags, etc. and other devices that provide containment.
3. Notify the Plant Manager of the spill location and status. Note actions taken under Steps 1 and 2 above.

Flowing Release of Flammable Products

1. Call for assistance from all personnel in immediate area; warn other personnel, including those off-site, that they may be in immediate danger. Call 911 City of Loveland Fire Department HAZMAT Response.
2. Terminate source and any ignition source such as motors, vehicles, etc.
3. Post qualified personnel at a safe location to warn others and prevent ignition.
4. Notify the Plant Manager of the spill location and status. Note actions taken under Steps 1 through 3 above. If manager is not available, call the Fire Department immediately.
5. Take actions and/or confirm that containment is provided by checking the position of valves, placement of sandbags, etc.

5.2 Notification

Notification to the CDPHE is required if there is any release or suspected release of any substance, including oil or hazardous substances, that spills into or threaten state waters. Unless otherwise noted notifications are to be made by the Plant Manager and only after emergency responses related to the release have been implemented. This will prevent misinformation and assures that notifications are properly conducted.

The notification requirements are as follows:

1. **Spill into/or Threatens State Waters:** Immediate notification is required for releases that occur beneath the surface of the land or impact or threaten waters of the state or threaten the public health and welfare. Notifications that will be made are:
   a. For any substance, regardless of quantity, contact CDPHE at 1-877-518-5608. State as follows:
      (a) Give your name and inform them that you are calling for the City of Loveland, Colorado, WWTP.
      (b) Give location of spill (name of city and state).
      (c) Describe nature of spill, type of product, and estimate size of spill.
      (d) Describe type of action taken thus far, type of assistance or equipment needed.
   b. For any quantity of oil or hazardous substances, call the National Response Center at 1-800-424-8802. State as follows:

(a) Give your name and inform them that you are calling for the City of Loveland, Colorado, WWTP.

(b) Give location of spill (name of city and state).

(c) Describe nature of spill, type of product, and estimate size of spill.

(d) Describe type of action taken thus far, type of assistance or equipment needed.

2. **Reportable Quantity Spill on Land Surface:** Immediate notification is required of a release upon the land surface of an oil in a quantity that exceeds 25 gallons, or of a hazardous substance that equals or exceeds 10 pounds or its reportable quantity under Section 101(14) of the Comprehensive Environmental Response, compensation and Liability Act of 1980 as amended (40 CFR Part 302) and Section 329(3) of the Emergency Planning and Community Right to Know Act of 1986 (40 CFR Part 355) whichever is less. Appendix D lists the substances and their reportable quality. This requirement does apply at a minimum to the substances listed in Table 5-1.

TABLE 5-1
Substances Requiring Notification

Substance	Reportable Quantity
Sodium Hypochlorite (Chlorite)	100 lbs.
Diesel Fuel	25 Gallons

The procedures to be followed are as follows:

a. Call the National Response Center at 1-800-424-8802. State as follows:

(a) Give your name and inform them that you are calling for the City of Loveland, Colorado, WWTP.

(b) Give location of spill (name of city and state).

(c) Describe nature of spill, type of product, and estimate size of spill.

(d) Describe type of action taken thus far, type of assistance or equipment needed.

3. Notification is not required for release of oil upon the land surface of 25 gallons or less that will not constitute a threat to public health and welfare, the environment or a threat of entering the waters of the state.

4. Notification, as required in paragraphs 1 and 2 above, will be made to the CDPHE using the 24 hours a day telephone number to report environmental spills. All information known about the release at the time of discovery is to be included, such as the time of

occurrence, quantity and type of material, location and any corrective or clean up actions presently being taken. Table 5-2 lists these phone numbers.

TABLE 5-2
Emergency Notification Contacts

Name	Position	Number
Mr. Michael McCrary	Lead Operator	(970) 962-2572
Mr. Johnny Tuxhorn	Treatment Manager	(970) 962-2570
Mr. Stephen Adams	Water Utility Manager	(970) 962-3559
Mrs. Tracy Turner-Naranjo	Loveland Risk Management	(970) 962-2323
	Loveland Fire Department	911
	Loveland Police	911
	Ambulance	911
	Hospital	911
	National Response Center	1-800-424-8802
	CDPHE – Report Environmental Spills (24 hrs/day)	1-877-518-5608
	Colorado Emergency Planning Committee	303-273-1622
	State Police	911
Stewart Environmental Mr. Thomas Norman	Vice President	(970) 226-5500
RMCAT	Emergency Response	(800) 930-0011

5.3 Reports

The CDPHE requires written notification of a spill or discharge of oil or other substance that may cause pollution of the waters of the state. A written report must be submitted to the WQCD within five days after becoming aware of the spill or discharge.

The CDPHE requires a written final report within 15 days for all releases of an oil or hazardous substance that require implementation of a contingency plan. The CDPHE may also require additional reports on the status of the clean up until any required remedial action has been complete.

Written notifications or reports must contain at a minimum:

1. Date, time and duration of the release.

2. Location of the release.
3. Person or persons causing and responsible for the release.
4. Type and amount of oil or hazardous substance released.
5. Cause of the release.
6. Environmental damage caused by the release.
7. Actions taken to respond, contain, and clean up the release.
8. Location and method of ultimate disposal of the oil and hazardous substance and other contaminate materials.
9. Actions taken to prevent a reoccurrence of the release.
10. Any known or anticipated acute or chronic health risks associate with the release.
11. When appropriate advice regarding medical attention necessary for exposed individuals.

5.4 Actions to be taken by the WWTP

The following actions will be taken by the WWTP as appropriate for a spill.

1. **Containment:** Wherever an oil or hazardous substance is released, it is the duty of the Plant Manager to take or cause to be taken, within 24 hours, all necessary steps to stop the release and contain all released material. As soon as the release has been stopped and contained the Plant Manager will ensure that action is taken to preclude a continued or future release. Notify the City's Risk Management Department of a spill. The City has a Contract with an Emergency Responsder for Spill Containment and Cleanup. The Loveland Fire Hazmat Team, Risk Management , or Plant Manager may initiate action from Emergency Responder.
2. **Investigation:** When a release occurs, the responsible person shall determine all of the affected environment and provide other pertinent information deemed necessary for the CDPHE to fully assess the impacts of the release including, but not limited to, the names and addresses of adjacent landowners and existing water users. The release investigation will be conducted in a timely and diligent manner and in accordance with a schedule established by CDPHE.
3. **Remedial Action:** The WWTP will develop a written remedial action plan if requested by CDPHE. Once developed, the plan will be sent to CDPHE for its written approval.
4. **Disposal:** Wastes generated from the clean up of an oil or hazardous substance release will be disposed of in accordance with state and federal regulations. Other waste will be disposed of as determined by the CDPHE. Approval of CDPHE will be obtained prior to any disposal action.

6. Employee Training

Employee training is provided to inform employees of the components and goals of the SWMP. New employees receive initial training in storm water pollution prevention and good housekeeping techniques prior to beginning their work assignment. Thereafter, training is provided on the job and during training sessions once a year.

The SWMP training addresses three major areas:

- Spill prevention and response
- Good housekeeping
- Materials management practices

Appendix D includes documentation of training.

7. Facility Inspections

Twice a year, once in the spring and once in the fall, City staff will conduct an inspection to:

- Confirm the accuracy of the description of potential pollutant sources contained in the SWMP.
- Determine the effectiveness of the Plan.
- Assess compliance with the terms and conditions of the storm water permit.

During the evaluation, material handling and storage areas, loading and unloading areas, process areas and other potential sources of pollution will be visually inspected for evidence of actual or potential pollutant discharges to the drainage system. Structural stormwater management measures, sediment and control measures, and other structural pollution prevention measures shall be inspected to ensure they are operating correctly. A review of the SWMP will be performed to determine if any changes to the plan are necessary.

The results of each inspection are recorded on the Semi – Annual Site Inspection Report form. The report describes:

- Who conducted the inspection,
- When the inspection was conducted,
- Scope of the inspection,
- Findings of the inspection,
- Any corrective actions taken, and
- When corrective actions were implemented.

The inspection report(s) are retained at the facility for at least 3 years after the date that the NPDES storm water permit expires. Completed inspection report forms will be provided in Appendix E of the SWMP.

Based on the results of each inspection, the list of potential pollutant sources and the measures and controls described in this Plan are to be revised (if appropriate) within 2 weeks of the inspection. Any changes to the SWMP as a result of the inspection shall be implemented in a timely manner, but in no case more than 90 days after the inspection.

8. SWMP Reviews and Updates

The SWMP will be reviewed annually by City staff to ensure it is effective in minimizing the discharge of pollutants. The SWMP will be updated by City staff, if necessary.

The SWMP will be updated and the necessary changes made and implemented within 90 days, unless the CDPHE provides an extension. This update will occur if:

- Any SWMP review indicates changes are needed.
- The recognition of any deficiencies or needed changes is discovered as a result of a facility inspection.
- Any changes occur at the facility that require the SWMP to be modified.

Records of the following information will be maintained for a period of at least three years relative to SWMP reviews and changes,

- Who conducted the review,
- Findings of the review, and
- Any changes made to the SWMP.

Amendments to the SWMP shall be summarized in the next Annual Report to be submitted to CDPHE-WQCD.

8.1 CDPHE-WQCD Review of SWMP

The WQCD may request, at any time, to review the SWMP and may require modifications to the plan if it does not meet one or more minimum requirements of the CDPS General permit. If notified that the SWMP is inadequate, changes must be made to the plan, implemented at the facility, and the plan resubmitted to the WQCD within 30 days after such notification.

9. Record Keeping and Reporting

9.1 Record Keeping

The CDPS General permit requires documentation of spills, inspections, maintenance, and monitoring (if appropriate) to be maintained onsite with the SWMP for a period of at least three years after the expiration of permit.

9.1.1 Spills

A record-keeping system has been set up at the facility for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. The records contain the following information:

- Date and time of the incident,
- Duration of the spill/leak/discharge,
- Cause of the spill/leak/discharge,
- Response procedures implemented,
- Persons notified, and
- Environmental problems associated with the spill/leak/discharge.

Records of spills and leaks will be attached in Appendix F of the SWMP.

9.1.2 Inspections

A separate record-keeping system has been established to document inspection and maintenance activities. Results of each inspection are recorded on the Semi-Annual Site Inspection Report form and completed forms are attached in Appendix E of the SWMP.

9.1.3 Monitoring

Records of any monitoring required by the CDPHE are retained in the SWMP in Appendix G for at least 3 years after the monitoring date or the expiration of the permit, whichever is longer.

9.2 Reporting

9.2.1 Annual Report

An Annual Report detailing the facility's compliance with the SWMP will be submitted to the WQCD before February 15 of each year. The Annual Report will cover activities occurring between January 1 through December 31, of the previous year, and will contain , at minimum:

1. Name of the facility, address, phone number and permit certification number.
2. A report of the facility's overall compliance with the SWMP.

3. A summary of each comprehensive stormwater facility inspection made, including date, findings, and actions taken.
4. Results and interpretation of any stormwater monitoring performed.
5. The report shall be signed and certified for accuracy by the Water and Power Department's Water Utilities Manager..

The Annual Report will be submitted to the following address:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD-P-B2
4300 Cherry Creek Drive South
Denver, CO 80246-1530

9.2.2 Other Reporting

The WWTP staff must report instances of non-compliance such as:

1. Failure to implement a SWMP compliance schedule requirement.
2. Failure to carryout any requirement of the permit, such as failure to conduct inspections or failure to revise the SWMP as required or failure to certify the SWMP.
3. Stormwater discharges that:
   a. Are not free from toxic substances, alone or in combination with other substances, which create conditions unsuitable for aquatic life, such as a fish kill.
   b. Contain pollutants at concentrations or levels that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.