Appendix A

Supplemental Water Information

City of Loveland
Estimated Monthly/Annual Usage for Test Year by Customer Class Per Tap Size / Units for Multi-Family
Water Fund

Class and Meter Size	Est. 2008 Counts/Units	Estimated Usage by Month by Tap Size or Number of Units for Multi-Family - Using Average Usage for FY's 2000 - 2006													Estimated Annual Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.	
Residential (Inside City)	Y.E. Counts														
3/4"	20,220	96,484,662	87,442,033	89,156,016	112,632,039	182,474,387	272,641,949	333,701,260	333,633,021	276,380,957	183,456,900	106,696,786	96,380,669	107,472	2,173,087,677
1"	92	606,090	489,315	483,424	699,200	1,706,305	2,848,286	3,786,382	3,766,058	3,300,690	2,091,523	851,229	541,680	230,317	21,189,181
2"	6	385,200	414,000	475,200	698,760	1,069,200	1,512,000	1,928,400	1,618,800	1,580,400	1,186,800	864,000	686,400	2,069,860	12,419,160
Residential (Outside City)															
3/4"	880	5,017,009	4,506,823	4,664,865	5,459,653	7,937,658	11,222,894	13,952,283	13,852,485	10,978,156	8,076,889	5,117,231	4,807,138	107,397	96,583,035
1"	3	24,571	19,857	25,000	37,571	44,714	68,000	85,714	63,857	56,143	27,000	21,429	21,476	164,778	494,333
1 1/2"	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2"	2	204,857	183,857	202,714	173,143	191,286	210,143	220,571	189,571	203,429	191,000	156,143	186,286	1,156,000	2,312,000
3"	3	387,500	357,000	369,000	369,450	448,200	525,600	474,450	416,850	425,700	393,750	388,800	442,050	1,669,450	5,008,350
4"	1	821,429	718,571	772,143	775,000	907,857	1,290,571	1,752,857	1,610,286	1,482,000	1,056,000	744,286	851,429	12,784,429	12,784,429
6"	1	2,130,633	1,659,244	1,832,093	1,835,679	1,904,974	2,298,967	2,907,006	2,577,560	2,386,399	1,833,601	1,417,883	1,873,300	24,646,649	24,646,649
Total Residential	21,218	108,071,251	95,800,702	97,980,456	122,680,495	196,684,581	292,621,411	358,808,953	357,728,478	296,791,873	198,301,473	116,265,785	105,789,418	42,936,351	2,347,524,874
Multi-Family 2-8 Units	Y.E. Units														
3/4"	1,688	7,170,112	6,436,606	6,581,774	7,122,969	9,128,850	12,660,207	15,332,016	15,507,037	13,244,083	9,538,097	6,824,172	6,876,918	72,866	116,421,733
1"	1,078	4,601,011	4,146,439	4,219,482	4,308,014	5,286,701	7,096,914	8,068,721	8,449,408	7,937,250	6,367,084	4,652,815	4,541,274	64,649	69,691,114
1 1/2"	831	2,386,035	2,086,119	2,186,484	2,242,809	3,301,155	4,499,975	4,651,814	5,863,108	5,419,849	4,076,694	2,562,901	2,519,865	50,561	42,015,809
2"	129	328,513	311,841	310,201	326,063	277,405	517,367	301,456	603,731	450,963	460,519	406,961	380,987	36,248	4,675,977
Multi-Family 9+ Units															
3/4"	85	317,830	306,029	290,429	281,389	297,719	348,310	373,242	443,079	388,842	371,201	296,844	230,537	47,123	4,005,460
1"	311	972,184	899,334	876,890	890,966	1,031,308	1,222,360	1,292,381	1,410,011	1,360,024	1,182,326	960,329	946,349	41,973	13,053,452
1 1/4"	20	68,000	60,286	60,571	63,286	61,714	70,143	63,571	67,286	66,429	66,986	58,729	65,714	38,636	772,714
1 1/2"	730	2,243,867	2,121,500	2,170,002	2,232,337	2,715,521	4,183,790	5,125,864	5,492,637	5,280,610	4,113,186	2,660,533	2,500,517	55,947	40,841,155
2"	798	2,297,073	2,124,682	2,209,976	2,279,177	3,189,389	3,825,177	4,452,978	4,417,956	4,147,910	3,133,475	2,332,864	2,368,576	46,089	36,779,244
3"	548	1,966,571	1,754,857	1,767,571	1,923,143	2,421,329	3,239,243	3,896,429	3,977,714	3,820,029	2,909,400	2,032,429	1,994,857	57,833	31,692,571
4"	396	1,516,571	1,464,000	1,472,143	1,532,857	1,977,857	2,968,571	3,615,000	3,924,000	3,742,000	2,576,067	1,600,814	1,682,414	71,044	28,062,286
Total Multi-Family	6,523	23,866,777	21,711,006	22,145,524	23,202,981	29,688,948	40,622,058	47,394,462	50,156,966	46,872,979	34,796,024	24,399,781	24,167,010	582,966	388,011,515
Irrigation Accounts - Inside	Y.E. Counts														
3/4"	102	18,337	11,297	29,745	477,308	2,454,926	4,527,785	5,382,587	5,766,848	5,020,103	3,222,915	599,884	67,618	270,386	27,579,352
1"	96	9,587	11,400	15,400	1,019,755	6,946,626	12,317,460	16,138,000	17,748,606	14,913,900	10,159,920	1,496,152	23,200	841,666	80,799,006
1 1/2"	58	33,833	102,772	64,868	2,541,316	11,823,351	22,046,868	25,822,974	28,425,509	25,647,447	14,387,053	2,661,574	136,860	2,304,912	133,684,912
2"	42	8,818	23,436	106,276	2,665,482	9,498,381	16,963,475	21,413,967	23,259,646	19,042,522	10,982,165	1,866,190	274,508	2,526,045	106,093,880
3"	8	7,724	30,345	3,862	478,897	4,445,103	9,349,241	10,643,586	13,809,931	11,426,759	12,119,310	2,564,138	294,897	8,146,724	65,173,793
4"	2	-	-	3,000	17,380	873,080	2,636,500	3,514,200	5,337,200	4,007,106	3,176,030	941,484	106,000	10,305,991	20,611,982
Wholesale City - Irrigation															
3/4"	3	-	-	-	2,063	11,625	33,563	32,813	36,750	37,125	20,625	750	-	58,438	175,313
1"	8	-	-	640	2,976	144,960	491,520	682,560	791,200	726,720	296,160	17,760	-	394,312	3,154,496
1 1/2"	1	-	-	-	-	5,000	16,000	16,000	14,000	9,000	8,000	2,000	-	70,000	70,000
2"	11	-	-	10,228	5,982	680,302	2,301,509	3,253,877	3,676,509	3,207,368	1,463,772	64,396	-	1,333,086	14,663,946
3"	2	-	-	-	208,925	861,750	1,780,000	2,857,500	3,763,000	2,149,500	583,250	-	-	6,111,963	12,223,925
4"	1	-	-	-	-	219,500	725,000	1,137,500	1,493,750	1,091,250	463,500	125,000	-	5,255,500	5,255,500
Irrigation Accounts - Outside															
3/4"	3	1,167	667	833	34,667	111,500	275,000	309,667	318,833	228,667	73,167	12,333	500	455,667	1,367,000
1 1/2"	1	-	-	-	1,143	134,000	384,714	584,571	619,429	667,429	433,429	22,000	-	2,846,714	2,846,714
Total Irrigation	338	79,466	179,917	234,853	7,495,903	38,210,104	73,848,636	91,789,802	105,081,298	88,174,897	57,389,294	10,352,067	903,582	40,921,393	473,699,819
Commercial - Inside no WQC															
3/4"	536	4,815,000	4,474,316	4,653,390	4,703,835	6,108,387	8,443,920	9,064,621	10,794,532	10,178,493	8,438,503	5,616,586	4,970,017	153,760	82,261,600
1"	162	5,585,792	5,251,790	5,702,833	6,477,127	7,082,542	9,143,344	10,215,864	10,360,681	9,798,817	8,008,252	5,748,710	5,656,956	543,412	88,032,718
1 1/2"	77	4,970,729	4,552,444	4,926,308	5,026,320	6,285,279	7,773,124	8,513,874	9,281,742	8,787,814	7,492,940	5,277,584	4,858,105	1,009,690	77,746,165
2"	72	4,917,916	4,638,879	5,185,956	4,770,791	6,944,440	12,010,945	14,237,881	14,518,088	13,742,846	9,822,046	6,022,048	5,281,680	1,417,966	102,093,526
3"	9	1,812,009	1,790,569	1,867,500	1,889,990	2,582,694	3,638,944	4,007,571	4,911,562	4,869,576	3,961,800	2,516,169	2,019,148	3,987,296	35,886,562
4"	5	517,436	585,128	631,410	536,536	691,809	640,242	667,308	710,897	1,028,846	922,306	786,538	666,769	1,674,846	8,374,231
6"	3	919,871	1,017,459	1,027,429	1,066,641	1,198,859	1,434,986	1,530,882	1,552,941	1,351,765	1,149,529	960,254	951,353	4,717,671	14,153,012
Commercial - Inside with WQC															
3/4"	88	503,917	501,191	520,427	632,964	1,578,108	2,696,538	2,910,531	3,432,303	3,189,262	2,446,146	1,081,370	652,817	228,916	20,144,575
1"	31	470,912	437,036	460,299	483,536	1,168,531	2,229,124	2,597,448	2,634,201	2,541,521	2,053,361	790,340	479,026	526,978	16,336,325
1 1/2"	22	366,270	362,127	394,079	523,810	1,362,952	2,226,540	2,945,887	3,182,317	2,912,730	2,012,476	831,268	411,366	796,856	17,530,822
2"	22	1,629,537	1,341,077	1,482,308	1,520,462	3,188,923	5,423,691	6,820,000	7,733,323	7,060,677	5,282,154	2,578,615	1,520,298	2,069,594	45,531,064
3"	10	391,256	897,641	464,231	521,654	1,417,038	2,319,526	3,230,718	3,942,103	3,204,256	2,068,782	698,672	478,141	1,962,422	19,624,218
4"	3	152,000	192,000	194,000	209,000	1,461,200	2,628,000	4,244,160	4,886,620	3,374,800	2,182,200	328,600	206,000	6,720,193	20,160,580
Commercial - Outside (No Sewer)															
3/4"	74	738,917	664,574	705,028	749,107	1,074,398	1,466,697	1,429,689	1,692,975	1,377,260	1,139,567	812,870	721,434	169,765	12,562,615
1"	11	283,260	251,360	270,710	238,700	233,706	293,634	300,190	324,940	298,870	256,640	213,510	246,043	291,868	3,210,543
1 1/2"	2	528,286	437,143	543,429	412,857	339,714	376,571	417,714	340,857	347,429	277,714	293,429	433,714	2,374,429	4,748,857
2"	2	51,176	61,294	67,647	95,765	164,941	216,824	238,765	246,588	230,941	118,635	76,353	56,166	812,548	1,625,095
4"	1	22,500	23,750	22,500	18,125	20,625	17,500	22,500	20,626	21,875	16,250	14,375	10,625	231,250	231,250
Total Commercial	1,129	28,675,774	27,478,797	29,099,484	28,887,222	42,916,148	62,979,152	73,396,615	80,670,297	74,307,876	57,646,183	34,587,531	29,606,668	29,686,556	570,253,747
Industrial - Industrial Rate															
1 1/2"	1	15,333	18,333	20,000	20,000	21,667	16,667	15,333	18,333	15,667	21,667	17,667	18,667	217,333	217,333
2"	2	52,400	50,800	50,200	46,800	50,800	56,400	59,600	62,600	70,600	73,200	41,800	44,600	329,900	659,800
3"	2	3,919,800	3,574,800	4,248,600	3,824,000	4,796,600	5,237,000	6,066,800	6,518,200	6,026,800	5,839,200	4,396,000	4,506,200	29,477,000	58,954,000
Industrial - Wholesale Rate															
3"	1	100,667	176,667	186,333	116,000	159,000	562,000	535,167	896,667	462,167	242,633	167,667	75,000	3,680,167	3,680,167
4" - Outside	1	460,650	462,100	737,517	418,833	1,006,317	2,324,833	2,217,000	4,794,550	3,466,285	2,198,833	869,833	633,200	19,568,950	19,568,950
Total Industrial	7	4,538,850	4,282,700	5,242,650	4,425,633	6,034,383	8,196,900	8,893,900	12,288,350	10,040,517	8,375,733	5,492,967	5,277,667	53,273,350	83,080,250
Wholesale City - Inside															
3/4"	5	5,441	5,735	5,294	8,368	14,265	22,794	23,676	32,353	24,412	18,088	9,674	7,206	35,441	177,206
1"	11	57,411	29,534	35,110	54,382	121,603	229,796	320,868	321,411	256,726	133,668	59,656	45,944	151,645	1,668,097
1 1/2"	5	34,143	55,000	248,429	256,457	266,143	149,143	120,429	143,286	158,000	278,571	166,114	37,857	382,514	1,912,571
2"	14	674,000	666,019	689,170	719,943	1,181,442	2,208,302	2,479,321	2,809,219	2,496,962	1,487,725	704,781	563,306	1,183,513	16,569,189
4" - Irrigation & Pool	2	-	-	-	30,667	424,773	1,066,000	1,568,000	1,860,667	1,473,333	834,667	228,133	2,667	3,739,453	7,478,907
Wholesale City - Outside															
3/4"	1	1,375	1,000	250	250	125	375	7,125	6,750	5,500	3,125	875	3,500	30,250	30,250
1 1/2"	1	18,500	25,500	31,000	38,000	30,500	36,000	56,000	28,500	16,000	21,500	6,500	8,500	315,500	315,500
Total Wholesale City	39	690,870	772,788	1,009,252	1,108,067	2,038,850	3,711,408	4,575,419	5,192,186	4,431,933	2,777,333	1,174,633	668,979	5,838,317	28,151,720
Total All Classes	29,254	165,911,968	150,225,909	155,712,218	187,760,301	315,673,014	481,979,564	584,858,151	611,116,575	519,620,075	359,287,041	192,252,764	166,423,324	173,241,924	3,890,721,925

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - Average Usage - Fiscal Years 2000 Through 2006

	Avg. YE	Average Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family												
Class and Meter Size	Counts/Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Residential (Inside City)	Y.E. Counts													
3/4"	17,655	85,990,734	76,348,991	77,845,535	98,343,351	159,325,382	238,054,138	291,367,370	291,307,761	241,318,809	160,182,379	93,160,181	84,161,506	1,897,406,157
1"	78	512,071	422,557	417,571	591,714	1,444,000	2,410,429	3,204,314	3,187,114	2,793,286	1,770,000	720,371	458,410	17,931,838
2"	3	160,500	172,500	198,000	291,150	443,500	630,000	803,500	674,500	658,500	494,500	360,000	286,000	5,174,650
Residential (Outside City)														
3/4"	917	5,167,600	4,642,100	4,794,586	5,623,530	8,175,916	11,558,761	14,371,076	14,268,281	11,307,677	8,319,335	5,270,830	4,951,430	98,452,122
1"	3	24,571	19,857	25,000	37,571	44,714	68,000	85,714	63,857	56,143	27,000	21,429	21,476	494,333
1 1/2"	1	72,833	55,000	53,333	50,333	52,833	58,000	59,167	87,667	85,500	75,333	53,833	55,167	759,000
2"	2	204,857	183,857	202,714	173,143	191,286	210,143	220,571	189,571	203,429	191,000	155,143	186,286	2,312,000
3"	3	378,571	340,000	351,429	351,857	426,857	500,571	451,857	397,000	405,429	375,000	370,286	421,000	4,769,857
4"	1	821,429	718,571	772,143	775,000	907,857	1,293,571	1,752,857	1,610,286	1,482,000	1,066,000	744,286	851,429	12,784,429
6"	1	2,130,933	1,659,244	1,832,093	1,835,679	1,904,974	2,298,967	2,907,026	2,577,560	2,385,399	1,823,601	1,417,883	1,873,300	24,646,649
Total Residential	18,663	95,464,100	84,562,679	86,492,404	108,073,329	172,919,320	267,083,580	315,223,453	314,353,608	260,895,170	174,313,149	102,274,241	93,266,003	2,064,731,035
Multi-Family 2-8 Units	Y.E. Units													
3/4"	1,585	7,111,782	6,383,154	6,628,230	7,065,013	9,064,586	12,557,214	15,207,287	15,380,884	13,136,340	9,460,503	6,768,656	6,820,573	115,474,623
1"	1,047	4,468,700	4,027,200	4,088,143	4,184,129	5,134,671	6,882,829	7,857,086	8,206,429	7,704,143	6,183,966	4,519,014	4,410,681	67,667,009
1 1/2"	453	1,300,556	1,137,567	1,192,286	1,223,000	1,800,114	2,453,829	2,845,686	3,197,143	2,955,434	2,223,014	1,408,451	1,374,078	22,911,148
2"	67	171,714	163,000	162,143	170,429	146,000	270,429	157,571	315,571	235,714	240,714	212,714	199,143	2,444,143
Multi-Family 9+ Units														
3/4"	83	311,429	299,857	284,571	275,714	291,714	341,286	365,714	434,143	381,000	363,714	290,857	284,577	3,924,677
1"	287	898,500	831,171	810,429	823,429	963,143	1,129,714	1,194,429	1,303,143	1,275,429	1,092,714	878,302	873,698	12,064,100
1 1/4"	20	68,000	60,286	60,571	63,286	61,714	70,143	63,571	67,286	66,429	56,986	58,729	65,714	772,714
1 1/2"	579	1,779,286	1,682,571	1,720,714	1,770,143	2,153,286	3,317,557	4,064,571	4,355,414	4,187,286	3,261,571	2,110,000	1,982,798	32,385,196
2"	742	2,136,286	1,975,971	2,066,286	2,119,643	2,966,143	3,567,429	4,141,286	4,108,714	3,857,571	2,514,143	2,169,571	2,202,786	34,204,829
3"	548	1,955,571	1,754,857	1,767,571	1,923,143	2,421,329	3,239,243	3,886,429	3,977,714	3,820,029	2,909,400	2,032,429	1,994,857	31,682,571
4"	385	1,516,571	1,464,000	1,472,143	1,532,857	1,877,857	2,968,571	3,616,000	3,924,000	3,742,000	2,576,057	1,600,814	1,682,414	28,062,286
Total Multi-Family	5,807	21,718,396	19,779,625	20,152,087	21,150,784	26,969,557	36,788,243	43,208,630	46,270,441	41,361,375	31,292,803	22,049,538	21,891,819	351,623,298
Irrigation Accounts - Inside	Y.E. Counts													
3/4"	89	16,000	9,857	25,564	416,475	2,142,043	3,950,714	4,696,571	5,031,857	4,380,286	2,812,151	523,429	59,000	24,064,337
1"	60	6,848	8,143	11,000	728,397	4,961,876	8,798,186	11,527,143	12,677,576	10,652,786	7,257,086	1,067,966	16,571	57,713,576
1 1/2"	33	19,000	57,714	36,429	1,427,143	6,639,714	12,381,000	14,501,571	15,963,143	14,403,000	8,079,429	1,489,286	76,857	75,074,286
2"	26	5,429	14,429	66,429	1,641,000	5,847,643	10,443,500	13,183,429	14,319,714	11,723,457	6,761,129	1,142,143	168,000	65,316,300
3"	4	4,000	15,714	2,000	248,000	2,301,929	4,841,571	5,511,857	7,161,571	5,917,429	6,276,071	1,327,857	152,714	33,750,714
4"	1	-	-	2,143	12,414	623,629	1,883,214	2,510,143	3,812,286	2,862,220	2,268,593	672,489	75,714	14,722,844
Wholesale City - Irrigation														
3/4"	2	-	-	-	1,571	8,867	26,571	25,000	28,000	28,286	15,714	571	-	133,571
1"	7	-	-	571	2,657	129,429	438,857	609,429	706,429	648,857	264,429	15,857	-	2,816,514
1 1/2"	1	-	-	-	-	5,000	16,000	16,000	14,000	9,000	8,000	2,000	-	70,000
2"	8	-	-	7,571	4,429	503,600	1,703,714	2,408,714	2,721,571	2,374,286	1,063,571	47,871	-	10,855,129
3"	1	-	-	-	119,386	492,429	1,017,143	1,632,857	2,161,714	1,228,286	333,286	-	-	6,985,100
4"	1	-	-	-	-	219,500	725,000	1,137,500	1,493,750	1,091,250	463,500	125,000	-	5,255,500
Irrigation Accounts - Outside														
3/4"	3	1,000	571	714	29,714	96,571	236,714	266,429	273,286	196,000	62,714	10,571	429	1,171,714
1 1/2"	1	-	-	-	1,143	134,000	384,714	584,571	619,429	667,429	433,429	22,000	-	2,846,714
Total Irrigation	246	52,276	106,429	151,811	4,630,329	24,105,218	46,844,900	68,610,214	66,974,226	56,187,570	36,119,101	6,446,840	550,286	300,776,300
Commercial - Inside no WQC														
3/4"	510	4,591,286	4,266,430	4,437,184	4,485,286	5,824,560	8,061,509	8,643,461	10,292,997	9,705,560	8,046,434	5,366,629	4,739,100	78,439,566
1"	144	4,975,000	4,677,529	5,079,243	4,878,217	6,308,084	8,143,543	9,098,786	9,227,767	8,727,341	7,132,570	5,120,103	5,038,383	78,406,565
1 1/2"	62	4,030,071	3,690,943	3,994,057	4,075,143	5,086,867	6,302,143	6,902,714	7,525,271	7,124,814	6,074,900	4,278,857	3,938,761	63,033,532
2"	52	3,551,829	3,350,302	3,745,413	3,445,571	5,015,429	8,674,571	10,282,914	10,486,286	9,926,380	7,093,700	4,349,257	3,814,553	73,734,213
3"	10	2,013,343	1,999,543	2,075,000	2,111,100	2,880,771	4,043,271	4,462,857	5,467,291	5,399,529	4,402,000	2,796,743	2,243,498	39,873,947
4"	6	576,571	652,000	703,571	597,857	770,873	713,413	743,571	792,143	1,146,429	1,027,714	876,429	730,714	9,331,286
6"	2	744,657	823,657	831,729	863,471	971,314	1,161,657	1,239,286	1,257,143	1,094,286	930,571	760,286	770,143	11,457,200
Commercial - Inside with WQC														
3/4"	83	475,286	472,714	490,857	507,000	1,488,443	2,542,383	2,745,160	3,237,286	3,008,054	2,307,161	1,019,929	615,726	18,909,997
1"	28	421,000	390,714	402,571	432,286	1,045,571	1,992,857	2,322,143	2,356,000	2,272,143	1,835,714	706,571	428,253	14,604,825
1 1/2"	18	298,857	296,286	322,429	428,571	1,115,143	1,821,714	2,410,271	2,603,714	2,383,143	1,646,571	680,129	336,571	14,343,400
2"	20	1,513,141	1,245,286	1,376,429	1,411,857	2,961,143	5,036,284	6,332,857	7,180,943	6,556,343	4,904,857	2,348,000	1,411,706	42,278,845
3"	11	435,971	1,000,229	506,143	581,271	1,578,966	2,564,614	3,599,943	4,392,629	3,570,457	2,306,214	778,743	632,786	21,866,986
4"	2	108,571	137,143	138,571	149,286	1,043,714	1,877,143	3,031,543	3,564,014	2,410,571	1,558,714	234,714	146,429	14,400,414
Commercial - Outside (No Sewer)														
3/4"	68	679,005	601,500	647,864	688,369	987,285	1,347,776	1,313,777	1,555,707	1,266,681	1,047,150	746,961	662,939	11,544,024
1"	14	367,857	326,429	351,571	310,000	303,514	381,343	389,857	422,000	388,143	332,000	277,286	319,537	4,169,537
1 1/2"	1	264,143	218,571	271,714	206,429	169,857	188,286	208,857	170,429	173,714	138,857	146,714	216,857	2,374,429
2"	2	62,143	74,429	82,143	116,286	200,286	263,286	291,143	299,429	280,429	144,067	92,714	66,987	1,973,330
4"	1	25,714	27,143	25,714	20,714	23,571	20,000	26,714	23,571	26,000	18,571	16,429	12,143	264,286
Total Commercial	1,036	25,134,446	24,250,846	25,480,203	25,398,714	37,784,422	55,145,883	64,034,855	70,842,620	65,457,046	50,946,768	30,590,493	26,025,086	501,096,381
Industrial - Industrial Rate														
1 1/2"	1	15,333	18,333	20,000	20,000	21,667	16,667	15,333	16,333	16,667	21,667	17,667	18,667	217,333
2"	1	37,429	36,286	35,857	33,429	36,286	40,286	42,571	44,714	50,429	52,286	29,857	31,857	471,286
3"	1	2,799,857	2,553,429	3,004,714	2,731,429	3,426,143	3,740,714	4,333,429	4,656,857	4,304,857	4,170,857	3,140,000	3,218,714	42,110,000
Industrial - Wholesale Rate														
3"	1	100,667	176,667	186,333	116,000	159,000	562,000	535,167	896,667	462,167	242,833	167,667	75,000	3,680,167
4" - Outside	1	450,650	462,100	737,517	418,833	1,006,317	2,324,833	2,217,000	4,794,550	3,466,283	2,198,833	859,833	633,200	19,568,950
Total Industrial	6	3,403,936	3,246,814	4,014,421	3,319,690	4,649,412	6,684,500	7,143,500	10,408,121	8,298,402	6,686,476	4,215,024	3,977,438	66,047,736
Wholesale City - Inside														
3/4"	5	5,286	5,571	5,143	8,129	13,857	22,143	23,000	31,429	23,714	17,571	9,300	7,000	172,143
1"	10	54,429	28,000	33,286	51,557	115,286	217,857	304,200	304,714	245,286	126,714	56,567	43,557	1,581,443
1 1/2"	5	34,143	55,000	248,429	256,457	266,143	149,143	120,429	143,286	158,000	278,671	165,114	37,857	1,912,571
2"	15	620,857	709,571	745,429	778,714	1,277,886	2,388,571	2,681,714	3,038,543	2,689,714	1,509,171	762,314	609,290	17,521,776
4" - Irrigation & Pool	2	-	-	-	32,857	455,114	1,142,143	1,680,000	1,982,857	1,578,571	894,286	244,429	2,857	8,013,114
Wholesale City - Outside														
3/4"	1	1,833	1,333	333	333	167	500	9,500	9,000	7,333	4,167	1,167	4,667	40,333
1 1/2"	1	18,500	25,500	31,000	38,000	30,500	36,000	56,000	28,500	16,000	21,500	6,500	8,500	315,500
Total Wholesale City	40	735,048	824,976	1,063,619	1,166,048	2,158,952	3,866,267	4,874,843	5,638,329	4,728,619	2,951,961	1,245,381	713,728	29,956,880
Total All Classes	25,798	146,508,201	132,771,369	137,354,546	163,740,894	268,676,881	406,502,463	493,095,496	513,397,445	436,723,181	307,310,278	166,824,518	146,424,359	3,314,231,629

	Average Usage by Month by Tap Size or Per Unit for Multi-Family - FY's 2000 - 2006												
Class and Meter Size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)													
3/4"	4,871	4,325	4,409	5,570	9,024	13,484	16,504	16,500	13,669	9,073	5,277	4,767	107,472
1"	6,577	5,427	5,363	7,600	18,547	30,960	41,156	40,935	35,877	22,734	9,252	5,886	230,317
2"	64,200	69,000	79,200	116,460	178,200	252,000	321,400	269,800	263,400	197,800	144,000	114,400	2,069,860
Residential (Outside City)													
3/4"	5,637	5,064	5,230	6,134	8,919	12,610	15,677	15,565	12,335	9,075	5,750	5,401	107,397
1"	8,190	6,619	8,333	12,524	14,905	22,667	28,571	21,286	18,381	9,000	7,143	7,159	164,778
1 1/2"	72,833	55,000	53,333	50,333	52,833	58,000	59,167	87,667	85,500	75,333	53,833	56,167	759,000
2"	102,429	91,929	101,357	86,571	95,643	105,071	110,286	94,786	101,714	95,500	77,571	93,143	1,156,000
3"	132,500	119,000	123,000	123,150	149,400	175,200	158,150	138,950	141,900	131,250	129,600	147,350	1,669,450
4"	821,429	718,571	772,143	775,000	907,857	1,293,571	1,752,857	1,610,286	1,482,000	1,066,000	744,286	851,429	12,784,429
6"	2,130,933	1,659,244	1,832,093	1,835,679	1,904,974	2,298,967	2,907,026	2,577,560	2,385,399	1,823,601	1,417,883	1,873,300	24,646,649
Total Residential													
Multi-Family 2-8 Units													
3/4"	4,487	4,027	4,119	4,457	5,713	7,923	9,595	9,704	8,288	5,969	4,270	4,303	72,856
1"	4,268	3,846	3,914	3,995	4,904	6,583	7,504	7,838	7,368	5,906	4,316	4,213	64,649
1 1/2"	2,870	2,510	2,631	2,699	3,973	5,415	5,839	7,065	6,522	4,906	3,108	3,032	50,561
2"	2,547	2,417	2,406	2,528	2,150	4,011	2,337	4,680	3,496	3,570	3,155	2,953	36,248
Multi-Family 9+ Units													
3/4"	3,739	3,600	3,417	3,310	3,503	4,098	4,391	5,213	4,575	4,367	3,492	3,418	47,125
1"	3,126	2,892	2,820	2,866	3,316	3,930	4,156	4,534	4,437	3,802	3,056	3,040	41,973
1 1/4"	3,400	3,014	3,029	3,164	3,086	3,507	3,179	3,364	3,321	3,349	2,936	3,286	38,636
1 1/2"	3,074	2,907	2,973	3,068	3,720	5,731	7,022	7,524	7,234	5,635	3,645	3,425	55,947
2"	2,879	2,663	2,769	2,866	3,997	4,793	5,580	5,536	5,198	3,927	2,923	2,968	46,089
3"	3,569	3,202	3,225	3,509	4,418	5,911	7,110	7,260	6,971	5,309	3,709	3,640	57,833
4"	3,939	3,706	3,727	3,981	5,007	7,490	9,152	9,934	9,473	6,522	4,053	4,260	71,044
Total Multi-Family													
Irrigation Accounts - Inside													
3/4"	180	111	292	4,679	24,068	44,390	52,770	56,538	49,217	31,597	5,881	663	270,386
1"	100	119	160	10,622	72,361	128,307	168,104	184,881	155,353	105,833	15,575	242	841,656
1 1/2"	583	1,772	1,118	43,816	203,861	380,118	445,224	490,096	442,197	248,053	45,724	2,360	2,304,912
2"	210	558	2,530	63,464	226,152	403,892	509,866	563,801	453,393	261,480	44,171	6,536	2,526,045
3"	966	3,790	483	59,862	556,636	1,168,666	1,330,448	1,726,241	1,428,346	1,514,914	320,517	36,862	8,146,724
4"	-	-	1,500	8,600	436,540	1,318,250	1,757,100	2,668,800	2,003,554	1,588,015	470,742	53,000	10,306,991
Wholesale City - Irrigation													
3/4"	-	-	-	688	3,875	11,188	10,938	12,250	12,375	6,875	250	-	58,438
1"	-	-	80	372	18,120	61,440	86,320	98,900	90,840	37,020	2,220	-	394,312
1 1/2"	-	-	-	-	5,000	16,000	16,000	14,000	9,000	8,000	2,000	-	70,000
2"	-	-	930	544	61,846	209,228	295,807	334,228	291,579	133,070	5,864	-	1,333,086
3"	-	-	-	104,463	430,875	890,000	1,428,750	1,891,500	1,074,750	291,625	-	-	6,111,963
4"	-	-	-	-	219,500	725,000	1,137,500	1,493,750	1,091,250	463,500	125,000	-	5,255,500
Irrigation Accounts - Outside													
3/4"	389	222	278	11,556	37,167	91,667	103,222	106,278	76,222	24,389	4,111	167	455,667
1 1/2"	-	-	-	1,143	134,000	384,714	584,571	619,429	667,429	433,429	22,000	-	2,846,714
Total Irrigation													
Commercial - Inside no WQC													
3/4"	9,000	8,363	8,696	8,792	11,418	15,793	16,943	20,177	19,025	16,773	10,496	9,290	153,760
1"	34,480	32,419	35,203	33,809	43,719	56,440	63,061	63,955	60,487	49,434	35,486	34,919	543,412
1 1/2"	64,555	59,123	63,976	65,277	81,627	100,950	110,570	120,542	114,127	97,310	68,540	63,092	1,009,690
2"	68,304	64,429	72,027	66,261	96,451	166,819	197,748	201,640	190,873	136,417	83,640	73,357	1,417,966
3"	201,334	199,954	207,500	211,110	288,077	404,327	446,286	545,729	539,953	440,200	279,574	224,350	3,987,335
4"	103,487	117,026	126,282	107,308	138,362	128,046	133,462	142,179	205,769	184,462	157,308	131,154	1,674,846
6"	306,624	339,153	342,476	355,547	399,953	478,329	510,294	517,647	450,588	383,176	316,765	317,118	4,717,671
Commercial - Inside with WQC													
3/4"	5,726	5,695	5,914	7,193	17,933	30,631	33,074	39,003	36,242	27,797	12,288	7,418	228,916
1"	15,191	14,098	14,526	15,598	37,727	71,907	83,789	84,974	81,986	66,237	25,495	15,452	526,978
1 1/2"	16,603	16,460	17,913	23,810	61,952	101,206	133,904	144,651	132,397	91,476	37,785	18,698	796,856
2"	74,070	60,958	67,378	69,112	144,951	246,531	310,000	351,515	320,940	240,096	114,937	69,104	2,069,594
3"	39,126	89,764	45,423	52,165	141,704	231,963	323,072	394,210	320,426	206,878	69,887	47,814	1,962,422
4"	50,667	64,000	64,667	69,667	487,067	876,000	1,414,720	1,663,207	1,124,933	727,400	109,533	68,333	6,720,193
Commercial - Outside (No Sewer)													
3/4"	9,985	8,846	9,527	10,123	14,519	19,820	19,220	22,878	18,613	15,399	10,986	9,749	169,765
1"	25,750	22,850	24,610	21,700	21,246	26,694	27,290	29,540	27,170	23,240	19,410	22,368	291,868
1 1/2"	264,143	218,571	271,714	206,429	169,857	188,286	208,857	170,429	173,714	138,857	146,714	216,857	2,374,429
2"	25,588	30,647	33,824	47,882	82,471	108,412	119,882	123,294	115,471	59,318	38,176	27,580	812,548
4"	22,500	23,750	22,500	18,125	20,625	17,500	22,500	20,625	21,875	16,250	14,375	10,625	231,250
Total Commercial													
Industrial - Industrial Rate													
1 1/2"	15,333	18,333	20,000	20,000	21,667	16,667	15,333	16,333	15,667	21,667	17,667	18,667	217,333
2"	26,200	25,400	25,100	23,400	25,400	28,200	29,800	31,300	35,300	36,600	20,900	22,300	329,900
3"	1,559,900	1,787,400	2,124,300	1,912,000	2,398,300	2,618,500	3,033,400	3,259,100	3,013,400	2,919,600	2,198,000	2,253,100	29,477,000
Industrial - Wholesale Rate													
3"	100,667	176,667	186,333	116,000	159,000	562,000	535,167	896,667	462,167	242,833	167,667	75,000	3,680,167
4" - Outside	450650	462,100	737,517	418,833	1,006,317	2,324,833	2,217,000	4,794,550	3,466,283	2,198,833	859,833	633,200	19,568,950
Total Industrial													
Wholesale City - Inside													
3/4"	1088.23529	1,147	1,059	1,674	2,853	4,559	4,735	6,471	4,882	3,618	1,915	1,441	36,441
1"	5219.17808	2,685	3,192	4,944	11,055	20,890	29,170	29,219	23,521	12,151	5,423	4,177	151,646
1 1/2"	6828.57143	11,000	49,686	51,291	53,229	29,829	24,086	28,657	31,600	55,714	33,023	7,571	382,514
2"	41000	46,858	49,226	51,425	84,369	157,736	177,094	200,668	178,283	106,266	50,342	40,236	1,183,513
4" - Irrigation & Pool	-	-	-	15,333	212,367	533,000	794,000	925,333	736,667	417,333	114,067	1,333	3,739,453
Wholesale City - Outside													
3/4"	1375	1,000	250	250	125	375	7,125	6,750	5,500	3,125	875	3,500	30,250
1 1/2"	18500	25,500	31,000	38,000	30,500	35,000	56,000	28,500	16,000	21,500	6,500	8,500	315,500

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - FY 2006

Class and Meter Size	Year End	Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family													Average Usage by Month by Tap Size or Per Unit for Multi-Family												
	Counts - Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)	Y.E. Counts																										
3/4"	19,307	91,089,547	80,946,553	80,353,411	114,484,659	216,782,922	361,425,234	339,149,734	313,077,175	250,324,500	171,290,611	84,652,000	87,225,121	2,190,801,467	4,718	4,193	4,162	5,930	11,228	18,720	17,566	16,216	12,965	8,872	4,385	4,518	113,472
1"	78	447,000	394,000	354,000	569,000	1,988,000	3,484,000	3,550,000	3,370,000	2,727,000	1,760,000	501,000	425,468	19,569,468	5,731	5,051	4,538	7,295	25,487	44,667	45,513	43,205	34,962	22,564	6,423	5,455	250,891
2"	2	321,000	345,000	396,000	384,000	463,000	1,010,000	986,000	931,000	765,000	569,000	415,000	218,000	6,803,000	160,500	172,500	198,000	192,000	231,500	505,000	493,000	465,500	382,500	284,500	207,500	109,000	3,401,500
Residential (Outside City)																											
3/4"	884	4,909,900	4,099,000	4,144,000	5,915,000	9,448,800	16,065,326	15,706,731	13,334,770	10,919,287	7,842,000	4,701,000	4,418,518	101,504,332	5,554	4,637	4,688	6,691	10,689	18,173	17,768	15,085	12,352	8,871	5,318	4,998	114,824
1"	3	32,000	22,000	60,000	90,000	85,000	182,000	121,000	124,000	62,000	30,000	13,000	13,334	834,334	10,667	7,333	20,000	30,000	28,333	60,667	40,333	41,333	20,667	10,000	4,333	4,445	278,111
1 1/2"	-													-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	2	351,000	320,000	417,000	180,000	216,000	278,000	320,000	202,000	171,000	175,000	154,000	177,000	2,961,000	175,500	160,000	208,500	90,000	108,000	139,000	160,000	101,000	85,500	87,500	77,000	88,500	1,480,500
3"	3	280,000	310,000	303,000	298,000	363,000	468,000	489,000	385,000	350,000	375,000	296,000	339,000	4,256,000	93,333	103,333	101,000	99,333	121,000	156,000	163,000	128,333	116,667	125,000	98,667	113,000	1,418,667
4"	1	770,000	685,000	700,000	690,000	950,000	1,580,000	2,075,000	1,705,000	1,380,000	1,000,000	730,000	865,000	13,130,000	770,000	685,000	700,000	690,000	950,000	1,580,000	2,075,000	1,705,000	1,380,000	1,000,000	730,000	865,000	13,130,000
6"	1	1,500,000	1,280,000	1,260,000	1,180,000	1,540,000	2,150,000	2,610,000	2,070,000	1,710,000	1,330,000	1,010,000	1,180,000	18,820,000	1,500,000	1,280,000	1,260,000	1,180,000	1,540,000	2,150,000	2,610,000	2,070,000	1,710,000	1,330,000	1,010,000	1,180,000	18,820,000
Total Residential	20,281	99,700,447	88,401,553	87,987,411	123,790,659	231,836,722	386,642,560	365,007,465	335,198,945	268,408,787	184,371,611	92,472,000	94,861,441	2,358,879,601													
Multi-Family 2-8 Units	Y.E. Units																										
3/4"	1,597	6,287,000	5,764,500	5,911,500	6,950,000	9,929,000	16,604,000	16,354,000	14,011,000	12,097,100	8,726,000	5,817,000	6,428,811	114,879,911	3,937	3,610	3,702	4,352	6,217	10,397	10,240	8,773	7,575	5,464	3,642	4,026	71,935
1"	1,068	4,369,000	4,011,000	3,859,000	4,216,000	5,287,000	8,556,000	8,858,000	8,045,000	7,894,000	6,083,900	4,127,100	4,340,764	69,646,764	4,091	3,756	3,613	3,948	4,950	8,011	8,294	7,533	7,391	5,697	3,864	4,064	65,212
1 1/2"	704	2,151,000	1,861,000	1,832,000	2,038,000	3,474,000	3,737,000	4,556,000	4,770,000	4,374,000	3,358,000	2,050,000	2,096,870	36,297,870	3,055	2,643	2,602	2,895	4,935	5,308	6,472	6,776	6,213	4,770	2,912	2,979	51,559
2"	124	440,000	392,000	345,000	399,000	520,000	574,000	507,000	616,000	496,000	432,000	383,000	380,000	5,484,000	3,548	3,161	2,782	3,218	4,194	4,629	4,089	4,968	4,000	3,484	3,089	3,065	44,226
Multi-Family 9+ Units																											
3/4"	85	271,000	237,000	243,000	251,000	335,000	421,000	501,000	486,000	425,000	422,000	277,000	263,742	4,132,742	3,188	2,788	2,859	2,953	3,941	4,953	5,894	5,718	5,000	4,965	3,259	3,103	48,620
1"	285	743,000	680,000	665,000	717,000	915,000	1,086,000	1,067,000	1,063,000	1,064,000	972,000	792,000	816,000	10,580,000	2,607	2,386	2,333	2,516	3,211	3,811	3,744	3,730	3,733	3,411	2,779	2,863	37,123
1 1/4"	20	71,000	65,000	66,000	79,000	71,000	89,000	64,000	55,000	64,000	54,000	55,000	66,000	799,000	3,550	3,250	3,300	3,950	3,550	4,450	3,200	2,750	3,200	2,700	2,750	3,300	39,950
1 1/2"	730	2,423,000	2,229,000	2,302,000	2,434,000	4,234,000	6,067,000	7,103,000	6,663,000	5,276,000	3,699,000	2,284,000	2,391,584	47,105,584	3,319	3,053	3,153	3,334	5,800	8,311	9,730	9,127	7,227	5,067	3,129	3,276	64,528
2"	777	2,211,000	1,923,000	1,895,000	2,316,000	3,169,000	3,969,000	4,240,000	4,024,000	3,551,000	2,901,000	1,971,000	1,944,500	34,114,500	2,846	2,475	2,439	2,981	4,079	5,108	5,457	5,179	4,570	3,734	2,537	2,503	43,905
3"	548	2,009,000	1,859,000	1,793,000	2,058,000	2,858,000	3,954,000	4,658,000	4,412,000	4,100,000	2,607,000	1,929,000	1,968,000	34,205,000	3,666	3,392	3,272	3,755	5,215	7,215	8,500	8,051	7,482	4,757	3,520	3,591	62,418
4"	395	1,471,000	1,413,000	1,445,000	1,737,000	2,998,000	4,555,000	4,460,000	4,248,000	3,019,000	2,148,400	1,485,600	1,640,000	30,620,000	3,724	3,577	3,658	4,397	7,590	11,532	11,291	10,754	7,643	5,439	3,761	4,152	77,519
Total Multi-Family	6,333	22,446,000	20,434,500	20,356,500	23,195,000	33,790,000	49,612,000	52,368,000	48,393,000	42,360,100	31,403,300	21,170,700	22,336,271	387,865,371													
Irrigation Accounts - Inside	Y.E. Counts																										
3/4"	129	30,000	15,000	7,000	1,209,000	5,518,000	10,043,000	9,844,000	9,649,000	8,220,000	4,871,000	467,000	4,000	49,877,000	233	116	54	9,372	42,775	77,853	76,310	74,798	63,721	37,760	3,620	31	386,643
1"	85	-	30,000	5,000	1,508,000	11,155,000	17,363,000	21,938,000	20,615,000	16,064,000	10,064,000	945,000	-	99,687,000	-	353	59	17,741	131,235	204,271	258,094	242,529	188,988	118,400	11,118	-	1,172,788
1 1/2"	54	25,000	390,000	91,000	4,045,000	19,071,000	33,363,000	37,223,000	35,590,000	30,473,000	14,494,000	1,202,000	178,000	176,145,000	463	7,222	1,685	74,907	353,167	617,833	689,315	659,074	564,315	268,407	22,259	3,296	3,261,944
2"	41	5,000	53,000	77,000	3,047,000	11,656,000	22,293,000	24,443,000	22,656,000	18,223,000	12,223,000	2,394,000	910,000	117,980,000	122	1,293	1,878	74,317	284,293	543,732	596,171	552,585	444,463	298,122	58,390	22,195	2,877,561
3"	8	-	110,000	14,000	358,000	6,667,000	11,621,000	14,344,000	11,686,000	11,189,000	9,085,000	1,878,000	1,005,000	67,957,000	-	13,750	1,750	44,750	833,375	1,452,625	1,793,000	1,460,750	1,398,625	1,135,625	234,750	125,625	8,494,625
4"	2	-	-	15,000	-	1,921,000	3,666,000	6,588,000	5,615,000	3,903,000	3,130,000	220,000	5,000	25,063,000	-	-	7,500	-	960,500	1,833,000	3,294,000	2,807,500	1,951,500	1,565,000	110,000	2,500	12,531,500
Wholesale City - Irrigation																											
3/4"	3	-	-	-	9,000	40,000	73,000	60,000	45,000	25,000	1,000	-	-	253,000	-	-	-	3,000	13,333	24,333	20,000	15,000	8,333	333	-	-	84,333
1"	8	-	-	4,000	17,000	245,000	613,000	716,000	718,000	564,000	166,000	-	-	3,043,000	-	-	500	2,125	30,625	76,625	89,500	89,750	70,500	20,750	-	-	380,375
1 1/2"	1	-	-	-	-	5,000	16,000	16,000	14,000	9,000	8,000	2,000	-	70,000	-	-	-	-	5,000	16,000	16,000	14,000	9,000	8,000	2,000	-	70,000
2"	11	-	-	53,000	30,000	1,622,000	3,802,000	5,087,000	4,332,000	3,387,000	1,373,000	82,000	-	19,768,000	-	-	4,818	2,727	147,455	345,636	462,455	393,818	307,909	124,818	7,455	-	1,797,091
3"	2	-	-	-	46,000	887,000	2,701,000	2,922,000	2,662,000	2,036,000	523,000	-	-	11,777,000	-	-	-	23,000	443,500	1,350,500	1,461,000	1,331,000	1,018,000	261,500	-	-	5,888,500
4"	1	-	-	-	-	410,000	1,015,000	1,300,000	1,500,000	1,365,000	59,000	-	-	5,649,000	-	-	-	-	410,000	1,015,000	1,300,000	1,500,000	1,365,000	59,000	-	-	5,649,000
Irrigation Accounts - Outside																											
3/4"	3	2,000	1,000	1,000	17,000	138,000	342,000	223,000	153,000	123,000	80,000	1,000	1,000	1,082,000	667	333	333	5,667	46,000	114,000	74,333	51,000	41,000	26,667	333	333	360,667
1 1/2"	1	-	-	-	-	226,000	660,000	935,000	779,000	896,000	756,000	-	-	4,252,000	-	-	-	-	226,000	660,000	935,000	779,000	896,000	756,000	-	-	4,252,000
Total Irrigation	349	62,000	599,000	267,000	10,286,000	59,561,000	107,571,000	125,639,000	116,014,000	96,477,000	56,833,000	7,191,000	2,103,000	582,603,000													
Commercial - Inside no WQC																											
3/4"	514	4,447,000	3,757,600	3,900,000	4,591,000	6,983,000	9,295,000	10,465,000	10,316,000	9,968,000	8,021,000	4,808,000	4,405,722	80,957,522	8,653	7,311	7,588	8,932	13,586	18,084	20,360	20,070	19,393	15,605	9,354	8,571	157,505
1"	151	5,402,000	4,975,000	5,490,000	6,089,000	7,907,000	10,244,000	11,650,000	10,088,000	9,978,000	7,788,000	5,046,000	5,143,878	89,800,878	35,775	32,947	36,358	40,325	52,364	67,841	77,152	66,808	66,079	51,576	33,417	34,065	594,708
1 1/2"	66	4,223,000	3,480,000	3,530,000	3,886,000	5,691,000	7,165,000	8,234,000	7,502,000	7,311,000	5,848,000	3,973,000	4,285,206	65,128,206	63,985	52,727	53,485	58,879	86,227	108,561	124,758	113,667	110,773	88,606	60,197	64,927	986,791
2"	66	4,995,800	4,255,000	4,297,000	4,822,000	6,474,000	9,253,000	11,854,000	12,044,000	12,220,000	9,751,000	6,234,000	4,956,871	91,156,671	75,694	64,470	65,106	73,061	98,091	140,197	179,606	182,485	185,152	147,742	94,455	75,104	1,381,162
3"	11	1,396,000	1,222,000	1,245,000	1,654,000	2,729,000	4,405,000	5,526,000	5,012,000	4,990,000	3,649,000	1,569,000	1,082,387	34,479,387	126,909	111,091	113,182	150,364	248,091	400,455	502,364	455,636	453,636	331,727	142,636	98,399	3,134,490
4"	5	456,000	509,000	555,000	565,000	761,110	513,890	665,000	550,000	725,000	755,000	675,000	605,000	7,335,000	91,200	101,800	111,000	113,000	152,222	102,778	133,000	110,000	145,000	151,000	135,000	121,000	1,467,000
6"	3	803,000	756,000	861,000	912,000	957,000	1,429,000	1,255,000	1,210,000	1,110,000	1,236,000	1,092,000	1,672,000	13,263,000	267,667	252,000	287,000	304,000	319,000	476,333	418,333	403,333	370,000	412,000	364,000	557,333	4,421,000
Commercial - Inside with WQC																											
3/4"	89	433,000	442,000	413,000	814,000	2,646,000	4,175,000	4,136,000	3,369,000	3,445,000	2,361,500	745,500	487,879	23,467,879	4,865	4,966	4,640	9,146	29,730	46,910	46,472	37,854	38,708	26,534	8,376	5,482	263,684
1"	29	345,000	364,000	369,000	523,000	1,595,000	3,254,000	3,387,000	2,051,000	1,947,000	1,545,000	422,000	362,774	16,164,774	11,897	12,552	12,724	18,034	55,000	112,207	116,793	70,724	67,138	53,276	14,552	12,509	557,406
1 1/2"	20	377,000	310,000	300,000	403,000	1,394,000	2,715,000	3,770,000	3,014,000	2,819,000	2,009,000	581,000	402,000	18,094,000	18,850	15,500	15,000	20,150	69,700	135,750	188,500	150,700	140,950	100,450	29,050	20,100	904,700
2"	22	1,538,000	1,368,000	1,444,000	1,797,000	3,837,000	7,427,000	10,029,000	8,409,000	7,237,000	5,020,000	1,559,000	1,580,935	51,245,935	69,909	62,182	65,636	81,682	174,409	337,591	455,864	382,227	328,955	228,182	70,864	71,861	2,329,361
3"	10	436,000	505,000	507,000	784,000	2,126,000	3,031,000	3,948,000	3,384,000	2,241,000	1,281,000	739,000	500,000	19,482,000	43,600	50,500	50,700	78,400	212,600	303,100	394,800	338,400	224,100	128,100	73,900	50,000	1,948,200
4"	3	100,000	130,000	140,000	265,000	2,011,000	3,455,000	4,600,800	3,963,100	2,449,000	1,816,000	173,000	160,000	19,262,900	33,333	43,333	46,667	88,333	670,333	1,151,667	1,533,600	1,321,033	816,333	605,333	57,667	53,333	6,420,967
Commercial - Outside (No Sewer)																											
3/4"	70	618,470	580,540	576,110	783,290	1,118,360	1,624,630	1,680,270	1,415,700	1,330,510	993,290	772,440	669,296	12,162,906	8,835	8,293	8,230	11,190	15,977	23,209	24,004	20,224	19,007	14,190	11,035	9,561	173,756
1"	12	191,000	185,000	166,000	189,000	223,000	229,000	295,000	288,000	298,000	210,000	138,000	152,756	2,564,756	15,917	15,417	13,833	15,750	18,583	19,083	24,583	24,000	24,833	17,500	11,500	12,730	213,730
1 1/2"	1	233,000	136,000	218,000	170,000	137,000	139,000	171,000	102,000	102,000	91,000	87,000	125,000	1,711,000	233,000	136,000	218,000	170,000	137,000	139,000	171,000	102,000	102,000	91,000	87,000	125,000	1,711,000
2"	3	96,000	122,000	112,000	222,000	328,000	608,000	566,000	660,000	294,000	210,000	152,000	68,900	3,438,900	32,000	40,667	37,333	74,000	109,333	202,667	188,667	220,000	98,000	70,000	50,667	22,967	1,146,300
4"	2	10,000	20,000	50,000	35,000	55,000	30,000	50,000	35,000	55,000	40,000	25,000	15,000	420,000	5,000	10,000	25,000	17,500	27,500	15,000	25,000	17,500	27,500	20,000	12,500	7,500	210,000
Total Commercial	1,077	26,100,870	23,117,140	24,173,110	28,504,290	46,972,470	68,992,520	82,282,070	73,412,800	68,519,510	52,624,790	28,760,940	26,675,615	550,136,125													
Industrial - Industrial Rate																											
1 1/2"	1	14,000	19,000	18,000	18,000	20,000	17,000	14,000	15,000	15,000	17,000	17,000	17,000	201,000	14,000	19,000	18,000	18,000	20,000	17,000	14,000	15,000	15,000	17,000	17,000	17,000	201,000
2"	2	64,000	59,000	53,000	54,000	63,000	58,000	83,000	64,000	69,000	130,000	46,000	46,000	789,000	32,000	29,500	26,500	27,000	31,500	29,000	41,500	32,000	34,500	65,000	23,000	23,000	394,500
3"	2	3,966,000	2,794,000	3,173,000	3,486,000	4,516,000	4,561,000	6,587,000	4,534,000	5,047,000	5,106,000	3,769,000	3,878,000	51,417,000	1,983,000	1,397,000	1,586,500	1,743,000	2,258,000	2,280,500	3,293,500	2,267,000	2,523,500	2,553,000	1,884,500	1,939,000	25,708,500
Industrial - Wholesale Rate																											
3"	1	159,000	207,000	300,000	346,000	315,000	799,000	605,000	423,000	442,000	306,000	116,000	128,000	4,145,000	159,000	207,000	300,000	346,000	315,000	799,000	605,000	423,000	442,000	306,000	116,000	128,000	4,145,000
4" - Outside	1	1,122,400	1,386,600	1,303,000	1,816,000	3,069,000	6,704,000	7,237,000	6,182,000	5,820,000	3,810,000	2,253,000	980,700	41,673,700	1122400	1,386,600	1,303,000	1,816,000	3,069,000	6,704,000	7,237,000	6,182,000	5,820,000	3,810,000	2,253,000	980,700	41,673,700
Total Industrial	7	5,325,400	4,465,600	4,847,000	5,720,000	7,973,000	12,139,000	14,526,000	11,218,000	11,393,000	9,368,000	6,201,000	5,049,700	98,225,700													
Wholesale City - Inside																											
3/4"	5	2,000	4,000	3,000	2,000	9,000	17,000	13,000	14,000	14,000	11,000	5,000	4,000	98,000	400	800	600	400	1,800	3,400	2,600	2,800	2,800	2,200	1,000	800	19,600
1"	11	22,000	67,000	77,000	122,000	218,000	416,000	388,000	486,000	339,000	87,000	25,000	29,000	2,276,000	2000	6,091	7,000	11,091	19,818	37,818	35,273	44,182	30,818	7,909	2,273	2,636	206,909
1 1/2"	5	46,000	48,000	66,000	114,000	110,000	137,000	174,000	115,000	103,000	101,000	71,000	76,000	1,161,000	9200	9,600	13,200	22,800	22,000	27,400	34,800	23,000	20,600	20,200	14,200	15,200	232,200
2"	14	616,000	591,000	659,000	748,000	1,093,000	2,114,000	2,392,000	2,695,000	2,424,000	1,162,000	601,000	555,029	15,650,029	44000	42,214	47,071	53,429	78,071	151,000	170,857	192,500	173,143	83,000	42,929	39,645	1,117,859
4" - Irrigation & Pool	2	-	-	-	170,000	1,240,000	2,140,000	1,790,000	2,185,000	960,000	50,000	-	-	8,535,000	-	-	-	85,000	620,000	1,070,000	895,000	1,092,500	480,000	25,000	-	-	4,267,500
Wholesale City - Outside																											
3/4"	1	-	-	-	1,000	-	-	-	-	-	-	-	-	1,000	0	-	-	1,000	-	-	-	-	-	-	-	-	1,000
1 1/2"	1	37,000	51,000	62,000	72,000	61,000	70,000	93,000	57,000	32,000	40,000	13,000	17,000	605,000	37000	51,000	62,000	72,000	61,000	70,000	93,000	57,000	32,000	40,000	13,000	17,000	605,000
Total Wholesale City	39	723,000	761,000	867,000	1,229,000	2,731,000	4,894,000	4,850,000	5,552,000	3,872,000	1,451,000	715,000	681,029	28,326,029													
Total All Classes	28,086	154,357,717	137,778,793	138,498,021	192,724,949	382,864,192	629,851,080	644,672,535	589,788,745	491,030,397	336,051,701	156,510,640	151,707,056	4,005,835,826													

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - FY 2005

Class and Meter Size	Year End Counts - Units	Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Residential (Inside City)	Y.E. Counts													
3/4"	19,211	88,006,193	70,766,600	79,301,239	91,627,523	122,463,288	213,269,015	310,756,400	309,103,800	266,586,018	163,777,600	83,629,800	85,724,200	1,890,931,676
1"	80	400,000	391,000	364,000	532,000	959,000	1,977,000	3,402,000	3,327,000	3,157,000	2,038,000	530,000	378,000	17,546,000
2"	3	-	-	-	198,300	428,000	250,000	621,000	418,000	552,000	420,000	306,000	354,000	3,546,300
Residential (Outside City)														
3/4"	900	4,816,000	3,733,000	4,961,100	3,916,600	6,192,300	9,324,000	13,130,000	13,532,000	11,641,000	8,198,800	4,332,200	4,546,100	88,323,100
1"	3	15,000	11,000	18,000	40,000	40,000	45,000	123,000	72,000	142,000	40,000	16,000	15,000	577,000
1 1/2"	1	82,000	25,000	22,000	-	24,000	55,000	-	57,000	24,000	21,000	23,000	34,000	367,000
2"	2	188,000	177,000	182,000	202,000	208,000	167,000	191,000	167,000	174,000	168,000	157,000	228,000	2,210,000
3"	3	440,000	284,000	294,000	305,000	342,000	421,000	412,000	396,000	403,000	405,000	461,000	462,000	4,625,000
4"	1	905,000	735,000	785,000	840,000	980,000	1,120,000	1,720,000	1,615,000	1,295,000	890,000	545,000	690,000	12,120,000
6"	1	2,040,000	1,510,000	1,480,000	1,200,000	1,410,000	1,490,000	2,180,000	2,250,000	2,030,000	1,370,000	1,160,000	1,300,000	19,420,000
Total Residential	20,205	96,892,193	77,632,600	87,407,339	98,761,423	133,046,588	226,138,015	332,625,400	330,937,800	286,004,018	183,330,400	91,159,000	93,731,300	2,039,666,076
Multi-Family 2-8 Units	Y.E. Units													
3/4"	1,583	6,768,000	5,127,000	6,020,000	5,883,000	6,777,800	9,787,500	13,641,500	14,276,000	12,275,000	9,148,000	5,900,000	6,153,000	101,757,800
1"	1,074	4,463,000	3,272,000	4,036,000	3,685,000	4,408,000	5,929,000	6,830,000	8,129,000	7,523,000	6,101,000	4,372,000	3,990,000	62,747,000
1 1/2"	691	2,074,890	1,439,000	1,995,000	1,611,200	1,201,600	3,356,800	3,034,800	4,100,000	3,237,000	3,207,000	2,171,000	1,721,000	29,149,290
2"	117	351,000	325,000	392,000	342,000	24,000	810,000	23,000	900,000	405,000	380,000	435,000	368,000	4,755,000
Multi-Family 9+ Units														
3/4"	83	241,000	216,000	257,000	172,000	199,000	438,000	304,000	530,000	308,000	334,000	287,000	195,000	3,481,000
1"	285	802,000	718,000	748,000	740,000	827,000	993,000	1,217,000	1,504,000	1,363,000	1,060,000	873,000	712,000	11,557,000
1 1/4"	20	66,000	69,000	61,000	58,000	64,000	67,000	63,000	67,000	71,000	60,000	65,000	68,000	769,000
1 1/2"	729	2,543,000	1,968,000	2,387,000	2,234,000	2,282,000	4,317,000	5,959,000	6,809,000	5,765,000	3,966,000	2,336,000	2,342,000	42,896,000
2"	798	2,678,000	1,694,000	2,928,000	1,750,000	3,164,000	3,489,000	4,195,000	4,087,000	4,046,000	3,256,000	2,337,000	2,582,000	36,208,000
3"	548	1,889,000	1,585,000	1,646,000	1,876,000	2,287,000	3,110,000	4,221,000	4,421,000	3,999,000	3,137,000	1,750,000	2,060,000	31,981,000
4"	395	1,440,000	1,240,000	1,326,000	1,340,000	2,005,000	2,670,000	4,240,000	4,075,000	3,855,000	1,979,000	720,100	2,401,900	27,291,000
Total Multi-Family	6,323	23,316,890	17,641,000	21,795,000	19,691,200	23,239,400	34,957,300	43,737,300	48,898,000	42,847,000	32,630,000	21,246,100	22,592,900	352,592,090
Irrigation Accounts - Inside	Y.E. Counts													
3/4"	94	23,000	11,000	19,000	103,000	1,363,000	3,717,000	4,864,000	5,550,000	5,238,000	3,281,000	432,000	24,000	24,625,000
1"	82	-	3,000	56,000	508,111	3,328,889	8,765,000	14,380,000	15,503,000	15,432,000	10,454,000	1,152,000	37,000	69,619,000
1 1/2"	46	38,000	3,000	-	1,056,000	4,699,000	18,519,000	21,810,000	25,164,000	21,960,000	13,552,000	970,000	72,000	107,846,000
2"	26	1,000	-	9,000	1,618,000	3,006,000	9,129,000	13,247,000	15,370,000	11,972,000	6,425,000	349,000	1,000	61,127,000
3"	5	-	-	-	29,000	1,138,000	6,748,000	5,008,000	10,171,000	5,497,000	16,225,000	-	-	44,816,000
4"	2	-	-	-	51,900	345,400	1,962,500	2,710,000	7,322,000	5,151,000	4,509,000	705,000	170,000	22,926,800
Wholesale City - Irrigation														
3/4"	3	-	-	-	2,000	17,000	60,000	49,000	63,000	48,000	-	-	-	239,000
1"	7	-	-	-	-	42,000	419,000	629,000	738,000	616,000	245,000	-	-	2,689,000
1 1/2"	-													-
2"	8	-	-	-	-	24,000	1,406,000	2,063,000	3,089,000	2,221,000	1,022,000	-	-	9,824,000
3"	1	-	-	-	-	345,000	963,000	1,765,000	1,590,000	1,313,000	264,000	-	-	6,240,000
4"	1	-	-	-	-	10,000	745,000	1,515,000	1,545,000	695,000	560,000	-	-	5,070,000
Irrigation Accounts - Outside														
3/4"	3	-	1,000	1,000	-	20,000	173,000	258,000	230,000	196,000	48,000	1,000	-	928,000
1 1/2"	1	-	-	-	-	135,000	565,000	645,000	632,000	737,000	539,000	4,000	-	3,257,000
Total Irrigation	279	62,000	18,000	85,000	3,370,011	14,473,289	53,170,500	68,943,000	86,957,000	71,076,000	57,124,000	3,613,000	304,000	359,205,800
Commercial - Inside no WQC														
3/4"	526	4,979,000	4,064,000	5,089,000	3,478,000	4,885,000	9,059,111	7,372,889	11,417,000	9,806,000	8,336,600	4,880,000	4,600,000	77,966,600
1"	151	6,093,000	4,828,000	5,878,000	3,996,400	5,692,000	8,138,000	9,246,000	10,375,000	9,428,000	7,531,000	4,716,000	5,365,000	81,286,400
1 1/2"	66	4,193,000	3,649,000	4,634,000	3,050,000	4,771,000	6,342,000	7,233,000	8,262,900	6,554,000	6,090,000	3,780,000	3,737,000	62,295,900
2"	56	4,022,000	3,295,000	5,101,000	2,071,000	4,961,000	8,646,000	12,092,000	11,975,000	10,032,722	8,563,900	3,714,000	4,997,000	79,470,622
3"	12	1,298,000	1,119,300	1,883,400	494,000	1,883,000	3,318,000	3,327,000	5,736,000	4,193,000	4,225,000	1,882,000	1,441,000	30,799,700
4"	5	390,000	475,000	860,000	230,000	730,000	740,000	500,000	485,000	675,000	815,000	540,000	595,000	7,035,000
6"	3	530,000	540,000	890,000	470,000	780,000	880,000	1,080,000	1,060,000	1,030,000	1,248,000	843,000	729,000	10,080,000
Commercial - Inside with WQC														
3/4"	90	492,000	475,000	616,000	427,000	958,000	2,585,000	2,364,000	4,275,000	3,062,000	2,792,000	824,000	1,113,200	19,983,200
1"	29	450,000	279,000	420,000	279,000	715,000	2,056,000	2,056,000	3,249,000	3,072,000	2,929,000	765,000	331,000	16,601,000
1 1/2"	18	336,000	265,000	367,000	484,000	1,028,000	1,937,000	2,445,000	2,661,000	2,348,000	1,760,000	649,000	356,000	14,656,000
2"	21	1,491,000	1,161,000	1,850,000	762,000	2,139,000	5,225,000	6,044,000	9,046,000	6,167,000	5,189,000	1,589,000	1,316,000	41,979,000
3"	11	477,000	484,000	485,000	492,400	926,000	2,847,000	4,101,200	4,817,700	4,025,000	2,390,000	490,100	476,000	22,015,000
4"	2	100,000	115,000	120,000	115,000	235,000	1,605,000	3,695,000	3,890,000	3,035,000	1,560,000	270,000	125,000	14,865,000
Commercial - Outside (No Sewer)														
3/4"	70	800,240	510,170	731,090	345,950	764,240	1,561,210	891,100	1,909,370	1,140,200	1,092,470	571,250	669,530	10,986,830
1"	13	354,000	208,000	210,000	125,000	234,000	522,000	342,000	589,000	471,000	431,000	209,000	169,000	3,864,000
1 1/2"	1	267,000	205,000	160,000	134,000	137,000	144,000	179,000	148,000	126,000	96,000	80,000	111,000	1,796,000
2"	3	55,000	62,000	104,000	65,000	129,000	247,000	476,000	482,000	720,000	154,399	154,000	82,000	2,730,399
4"	1	80,000	90,000	20,000	-	10,000	10,000	-	10,000	20,000	20,000	10,000	10,000	280,000
Total Commercial	1,078	26,407,240	21,624,470	29,427,490	17,015,750	30,977,840	55,872,321	63,444,189	80,367,970	65,904,922	55,246,369	25,996,360	26,222,730	498,700,651
Industrial - Industrial Rate														
1 1/2"	1	16,000	17,000	20,000	20,000	21,000	16,000	16,000	17,000	15,000	16,000	18,000	18,000	210,000
2"	2	56,000	50,000	65,000	40,000	51,000	64,000	66,000	86,000	89,000	69,000	51,000	53,000	740,000
3"	2	3,849,000	3,442,000	6,215,000	1,420,000	4,577,000	4,687,000	4,901,000	6,680,000	4,935,000	5,373,000	3,807,000	3,906,000	53,792,000
Industrial - Wholesale Rate														
3"	1	335,000	738,000	568,000	-	212,000	365,000	364,000	552,000	217,000	230,000	559,000	53,000	4,193,000
4" - Outside	1	1,049,500	740,000	2,522,100	-	1,531,900	6,822,000	-	12,803,000	5,425,000	2,306,000	-	1,110,000	34,309,500
Total Industrial	7	5,305,500	4,987,000	9,390,100	1,480,000	6,392,900	11,954,000	5,347,000	20,138,000	10,681,000	7,994,000	4,435,000	5,140,000	93,244,500
Wholesale City - Inside														
3/4"	5	4,000	4,000	5,000	4,000	13,000	18,000	19,000	24,000	13,000	13,000	7,000	3,000	127,000
1"	13	255,000	44,000	49,000	39,000	151,000	343,000	442,000	550,000	315,000	120,000	25,000	23,000	2,356,000
1 1/2"	5	41,000	27,000	42,000	36,000	97,000	125,000	72,000	170,000	92,000	75,000	50,000	45,000	872,000
2"	16	718,000	658,000	775,000	743,000	929,000	2,039,000	3,081,000	3,300,800	2,686,000	1,620,200	501,000	582,000	17,722,000
4" - Irrigation & Pool	2	-	-	-	-	226,800	670,000	1,810,000	2,340,000	1,670,000	1,370,000	280,000	-	8,366,800
Wholesale City - Outside														
3/4"	1	-	-	-	-	-	-	1,000	-	-	-	-	-	1,000
1 1/2"	-													-
Total Wholesale City	42	1,018,000	733,000	871,000	822,000	1,416,800	3,195,000	6,425,000	6,384,800	4,775,000	3,198,200	553,000	653,000	29,444,800
Total All Classes	27,934	153,001,823	122,836,070	148,975,929	141,143,384	209,546,817	387,287,136	519,521,889	673,713,570	481,287,940	339,522,969	147,372,460	148,643,930	3,372,853,917

Class and Meter Size	Average Usage by Month by Tap Size or Per Unit for Multi-Family												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)													
3/4"	4,581	3,684	4,128	4,764	6,375	11,102	16,176	16,090	13,877	8,838	4,353	4,462	98,430
1"	5,000	4,888	4,550	6,650	11,988	24,713	43,650	41,588	39,463	25,488	6,625	4,725	219,325
2"	-	-	-	66,100	142,667	83,333	207,000	139,333	184,000	140,000	101,667	118,000	1,182,100
Residential (Outside City)													
3/4"	5,351	4,148	5,512	4,352	6,880	10,360	14,589	15,036	12,934	9,110	4,814	5,051	98,137
1"	5,000	3,667	6,000	13,333	13,333	15,000	41,000	24,000	47,333	13,333	5,333	5,000	192,333
1 1/2"	82,000	25,000	22,000	-	24,000	55,000	-	57,000	24,000	21,000	23,000	34,000	367,000
2"	94,000	88,500	91,000	101,000	104,000	83,500	95,500	83,500	87,000	84,500	78,500	114,000	1,105,000
3"	146,667	94,667	98,000	101,667	114,000	140,333	137,333	132,000	134,333	135,000	153,667	154,000	1,541,667
4"	905,000	735,000	785,000	840,000	980,000	1,120,000	1,720,000	1,615,000	1,295,000	890,000	545,000	690,000	12,120,000
6"	2,040,000	1,510,000	1,480,000	1,200,000	1,410,000	1,490,000	2,180,000	2,250,000	2,030,000	1,370,000	1,160,000	1,300,000	19,420,000
Total Residential													
Multi-Family 2-8 Units													
3/4"	4,276	3,239	3,803	3,716	4,282	6,183	8,617	9,018	7,754	5,779	3,727	3,887	64,282
1"	4,155	3,047	3,758	3,431	4,104	5,520	6,359	7,569	7,005	5,681	4,071	3,715	58,424
1 1/2"	3,003	2,082	2,887	2,332	1,739	4,858	4,392	5,933	4,685	4,641	3,142	2,491	42,184
2"	3,000	2,778	3,350	2,923	205	6,923	197	7,692	3,462	3,248	3,718	3,145	40,641
Multi-Family 9+ Units													
3/4"	2,904	2,602	3,096	2,072	2,398	5,277	3,663	6,386	3,711	4,024	3,458	2,349	41,940
1"	2,814	2,519	2,625	2,596	2,902	3,484	4,270	5,277	4,782	3,719	3,063	2,498	40,551
1 1/4"	3,300	3,450	3,050	2,900	3,200	3,350	3,150	3,350	3,550	3,000	3,250	3,400	38,450
1 1/2"	3,488	2,683	3,274	3,064	3,130	5,922	8,174	9,340	7,908	5,440	3,204	3,213	58,842
2"	3,356	2,123	3,669	2,193	3,965	4,372	5,257	5,122	5,070	4,080	2,929	3,236	45,373
3"	3,447	2,892	3,004	3,423	4,173	5,675	7,703	8,068	7,297	5,724	3,193	3,759	58,359
4"	3,646	3,139	3,354	3,392	5,076	6,759	10,734	10,316	9,759	5,010	1,823	6,081	69,091
Total Multi-Family													
Irrigation Accounts - Inside													
3/4"	245	117	202	1,096	14,500	39,543	51,745	59,043	55,723	34,904	4,596	255	261,968
1"	-	37	683	6,196	40,596	106,890	175,366	189,061	188,195	127,488	14,049	451	849,012
1 1/2"	826	65	-	23,000	102,152	402,587	474,130	547,043	477,391	294,609	21,087	1,565	2,344,457
2"	38	-	346	62,231	115,615	351,115	509,500	591,154	460,462	247,115	13,423	38	2,351,038
3"	-	-	-	5,800	227,600	1,349,600	1,001,600	2,034,200	1,099,400	3,245,000	-	-	8,963,200
4"	-	-	-	25,950	172,700	981,250	1,355,000	3,661,000	2,575,500	2,254,500	352,500	85,000	11,463,400
Wholesale City - Irrigation													
3/4"	-	-	-	667	5,667	20,000	16,333	21,000	16,000	-	-	-	79,667
1"	-	-	-	-	6,000	59,857	89,857	105,429	88,000	35,000	-	-	384,143
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	-	-	-	-	3,000	175,625	257,875	386,125	277,625	127,750	-	-	1,228,000
3"	-	-	-	-	345,000	963,000	1,765,000	1,590,000	1,313,000	264,000	-	-	6,240,000
4"	-	-	-	-	10,000	745,000	1,515,000	1,545,000	695,000	560,000	-	-	5,070,000
Irrigation Accounts - Outside													
3/4"	-	333	333	-	6,667	57,667	86,000	76,667	65,333	16,000	333	-	309,333
1 1/2"	-	-	-	-	135,000	565,000	645,000	632,000	737,000	539,000	4,000	-	3,257,000
Total Irrigation													
Commercial - Inside no WQC													
3/4"	9,466	7,726	9,675	6,612	9,287	17,223	14,017	21,705	18,643	15,849	9,278	8,745	148,225
1"	40,351	31,974	38,927	26,466	37,695	53,894	61,232	68,709	62,437	49,874	31,232	35,530	538,321
1 1/2"	63,530	55,288	70,212	46,212	72,288	96,091	109,591	125,195	99,303	92,273	57,273	56,621	943,877
2"	71,821	58,839	91,089	36,982	88,589	154,393	215,929	213,839	179,156	152,927	66,321	89,232	1,419,118
3"	108,167	93,275	156,950	41,167	156,917	276,500	277,250	478,000	349,417	352,083	156,833	120,083	2,566,642
4"	78,000	95,000	172,000	46,000	146,000	148,000	100,000	97,000	135,000	163,000	108,000	119,000	1,407,000
6"	176,667	180,000	296,667	156,667	260,000	293,333	360,000	353,333	343,333	416,000	281,000	243,000	3,360,000
Commercial - Inside with WQC													
3/4"	5,467	5,278	6,844	4,744	10,644	28,833	26,267	47,500	34,022	31,022	9,156	12,369	222,147
1"	15,517	9,621	14,483	9,621	24,655	70,897	70,897	112,034	105,931	101,000	26,379	11,414	572,448
1 1/2"	18,667	14,722	20,389	26,889	57,111	107,611	135,833	147,833	130,444	98,889	36,056	19,778	814,222
2"	71,000	55,286	88,095	36,286	101,857	248,810	287,810	430,762	293,667	247,095	75,667	62,667	1,999,000
3"	43,364	44,000	44,091	44,764	84,236	258,818	372,836	437,973	365,909	217,545	44,555	43,273	2,001,364
4"	50,000	57,500	60,000	57,500	117,500	802,500	1,847,500	1,945,000	1,517,500	780,000	135,000	62,500	7,432,500
Commercial - Outside (No Sewer)													
3/4"	11,432	7,288	10,444	4,942	10,918	22,303	12,730	27,277	16,289	15,607	8,161	9,565	156,955
1"	27,231	16,000	16,154	9,615	18,000	40,154	26,308	45,308	36,231	33,154	16,077	13,000	297,231
1 1/2"	267,000	205,000	160,000	134,000	137,000	144,000	179,000	148,000	126,000	96,000	80,000	111,000	1,796,000
2"	18,333	20,667	34,667	21,667	43,000	82,333	158,667	160,667	240,000	51,466	51,333	27,333	910,133
4"	80,000	90,000	20,000	-	10,000	10,000	-	10,000	20,000	20,000	10,000	10,000	280,000
Total Commercial													
Industrial - Industrial Rate													
1 1/2"	16,000	17,000	20,000	20,000	21,000	16,000	16,000	17,000	15,000	16,000	18,000	18,000	210,000
2"	28,000	25,000	32,500	20,000	25,500	32,000	33,000	43,000	44,500	34,500	25,500	26,500	370,000
3"	1,924,500	1,721,000	3,107,500	710,000	2,288,500	2,343,500	2,450,500	3,340,000	2,467,500	2,686,500	1,903,500	1,953,000	26,896,000
Industrial - Wholesale Rate													
3"	335,000	738,000	568,000	-	212,000	365,000	364,000	552,000	217,000	230,000	559,000	53,000	4,193,000
4" - Outside	1049500	740,000	2,522,100	-	1,531,900	6,822,000	-	12,803,000	5,425,000	2,306,000	-	1,110,000	34,309,500
Total Industrial													
Wholesale City - Inside													
3/4"	800	800	1,000	800	2,600	3,600	3,800	4,800	2,600	2,600	1,400	600	25,400
1"	19615.3846	3,385	3,769	3,000	11,615	26,385	34,000	42,308	24,231	9,231	1,923	1,769	181,231
1 1/2"	8200	5,400	8,400	7,200	19,400	25,000	14,400	34,000	18,400	15,000	10,000	9,000	174,400
2"	44875	41,125	48,438	46,438	58,063	127,438	192,563	206,300	167,813	101,263	36,938	36,375	1,107,625
4" - Irrigation & Pool	-	-	-	-	113,400	335,000	905,000	1,170,000	835,000	685,000	140,000	-	4,183,400
Wholesale City - Outside													
3/4"	0	-	-	-	-	-	1,000	-	-	-	-	-	1,000
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - FY 2004

Class and Meter Size	Year End Counts - Units	Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Residential (Inside City)	Y.E. Counts													
3/4"	18,510	85,106,532	74,906,897	76,988,529	106,700,970	168,378,290	220,436,811	226,163,311	219,758,800	189,298,518	129,898,312	84,891,389	87,034,511	1,669,562,870
1"	78	547,000	386,000	422,000	618,000	1,510,000	2,301,000	2,138,000	2,237,000	1,888,000	1,144,000	514,000	448,000	14,153,000
2"	-													-
Residential (Outside City)														
3/4"	921	4,764,300	4,614,700	4,758,000	6,170,000	8,117,000	9,754,000	11,339,000	10,595,000	8,560,000	6,431,000	4,457,000	4,829,000	84,389,000
1"	3	31,000	23,000	11,000	22,000	58,000	32,000	66,000	36,000	31,000	27,000	22,000	13,000	372,000
1 1/2"	1	28,000	29,000	39,000	38,000	40,000	34,000	59,000	27,000	33,000	27,000	26,000	46,000	426,000
2"	2	164,000	144,000	156,000	157,000	181,000	157,000	174,000	156,000	162,000	137,000	72,000	164,000	1,824,000
3"	3	362,000	317,000	372,000	360,000	441,000	396,000	393,000	328,000	317,000	305,000	308,000	381,000	4,280,000
4"	1	870,000	780,000	930,000	800,000	970,000	1,110,000	1,285,000	1,250,000	985,000	945,000	705,000	885,000	11,515,000
6"	1	2,168,140	1,181,630	1,900,870	1,820,000	2,010,000	1,910,000	2,330,000	1,960,000	1,820,000	1,620,000	1,510,000	1,990,000	22,220,640
Total Residential	19,520	94,040,972	82,382,227	85,577,399	116,685,970	181,706,290	236,130,811	243,947,311	236,347,800	203,094,518	140,534,312	92,505,389	95,790,511	1,808,742,510
Multi-Family 2-8 Units	Y.E. Units													
3/4"	1,582	6,883,611	6,001,389	6,310,000	7,043,000	8,654,000	10,914,000	11,697,611	11,263,389	9,965,000	7,865,000	5,756,000	6,455,000	98,809,000
1"	1,062	4,360,000	3,932,000	4,096,000	4,261,000	5,182,000	6,334,000	7,033,000	6,883,000	6,430,000	5,519,000	4,026,000	4,257,000	62,313,000
1 1/2"	549	1,585,000	1,480,000	1,431,000	1,597,000	2,171,000	2,696,000	2,620,000	3,014,000	2,749,000	2,146,000	1,458,000	1,883,110	24,830,110
2"	100	247,000	228,000	217,000	243,000	252,000	261,000	312,000	288,000	306,000	279,000	251,000	320,000	3,204,000
Multi-Family 9+ Units														
3/4"	83	337,000	281,000	308,000	333,000	288,000	258,000	382,000	463,000	388,000	360,000	290,000	259,000	3,947,000
1"	285	776,000	722,000	762,000	794,000	925,000	1,002,000	1,098,000	999,000	1,026,000	877,000	754,000	828,000	10,563,000
1 1/4"	20	96,000	80,000	70,000	72,000	69,000	98,000	77,000	66,000	58,000	118,000	46,000	62,000	912,000
1 1/2"	713	2,235,000	2,139,000	2,090,000	2,249,000	2,944,000	3,990,000	5,402,000	5,541,000	4,528,000	3,742,000	2,179,000	2,370,000	39,409,000
2"	798	1,996,000	1,874,000	1,887,000	2,264,000	3,382,000	3,445,000	3,845,000	3,968,000	3,674,000	2,959,000	1,988,000	2,323,000	33,605,000
3"	548	2,125,000	1,918,000	1,982,000	2,299,000	2,708,000	2,948,000	4,063,000	3,477,000	3,492,000	2,622,000	1,847,000	2,163,000	31,644,000
4"	395	1,355,000	1,385,000	1,360,000	1,450,000	1,955,000	2,870,000	3,130,000	3,065,000	2,880,000	2,345,000	1,385,000	1,525,000	24,705,000
Total Multi-Family	6,135	21,995,611	20,040,389	20,513,000	22,605,000	28,530,000	34,816,000	39,659,611	39,028,389	35,496,000	28,832,000	19,980,000	22,445,110	333,941,110
Irrigation Accounts - Inside	Y.E. Counts													
3/4"	89	7,000	4,000	7,000	311,000	1,955,000	3,263,000	3,868,000	3,505,000	3,052,000	1,711,000	310,000	14,000	18,007,000
1"	75	-	-	3,000	871,000	6,481,000	10,288,000	11,282,000	12,400,000	10,411,000	6,404,000	1,014,000	26,000	59,180,000
1 1/2"	44	-	-	23,000	2,936,000	8,942,000	16,115,000	15,804,000	17,945,000	15,946,000	8,936,000	1,880,000	64,000	88,591,000
2"	26	-	1,000	-	1,450,000	7,246,000	9,076,000	9,721,000	10,653,000	9,882,000	4,290,000	579,000	1,000	52,899,000
3"	4	-	-	-	54,000	959,000	4,190,000	4,094,000	5,496,000	4,750,000	3,865,000	1,534,000	64,000	25,006,000
4"	2	-	-	-	35,000	1,239,000	3,879,000	2,888,000	4,679,000	2,554,540	2,181,148	377,422	-	17,833,110
Wholesale City - Irrigation														
3/4"	2	-	-	-	-	-	12,000	16,000	16,000	11,000	13,000	-	-	68,000
1"	7	-	-	-	-	96,000	408,000	485,000	492,000	451,000	139,000	-	-	2,071,000
1 1/2"	-													-
2"	8	-	-	-	-	257,000	1,592,000	1,861,000	1,767,000	1,588,000	695,000	-	-	7,760,000
3"	1	-	-	-	58,000	632,000	954,000	1,294,000	909,000	866,000	90,000	-	-	4,803,000
4"	1	-	-	-	-	-	-	795,000	1,260,000	900,000	420,000	175,000	-	3,550,000
Irrigation Accounts - Outside														
3/4"	3	2,000	-	2,000	31,000	57,000	138,000	109,000	139,000	174,000	42,000	12,000	1,000	707,000
1 1/2"	1	-	-	-	-	155,000	248,000	472,000	581,000	286,000	106,000	-	-	1,848,000
Total Irrigation	263	9,000	5,000	35,000	5,746,000	28,019,000	50,163,000	52,689,000	59,842,000	50,871,540	28,897,148	5,881,422	170,000	282,323,110
Commercial - Inside no WQC														
3/4"	519	4,348,200	4,187,000	4,260,000	4,707,000	6,472,000	7,886,000	8,560,700	9,173,300	8,867,400	7,532,200	4,899,800	4,638,200	75,531,800
1"	147	4,714,000	5,013,000	4,760,000	5,092,000	6,269,000	7,538,000	8,194,000	8,220,400	7,390,000	6,596,479	4,552,521	4,811,000	73,150,400
1 1/2"	63	3,716,000	3,399,000	3,656,000	4,789,000	5,357,000	6,201,000	6,496,000	6,947,000	6,202,000	5,696,000	4,302,000	4,216,000	60,977,000
2"	54	3,306,000	3,259,000	3,405,000	3,689,000	5,578,000	9,157,000	10,354,000	10,813,000	8,641,000	6,647,000	5,048,000	3,768,000	73,665,000
3"	10	1,892,000	1,739,000	1,195,000	1,692,000	1,996,500	3,807,500	3,327,000	4,155,000	3,507,000	3,073,000	2,032,000	1,542,000	29,958,000
4"	5	370,000	450,000	490,000	460,000	600,000	480,000	395,000	485,000	530,000	580,000	480,000	470,000	5,790,000
6"	2	550,000	550,000	580,000	650,000	720,000	820,000	840,000	890,000	780,000	770,000	600,000	580,000	8,330,000
Commercial - Inside with WQC														
3/4"	84	465,000	464,000	489,000	617,000	1,790,000	2,752,000	2,621,000	2,941,000	2,805,000	1,850,000	829,000	533,000	18,156,000
1"	29	387,000	359,000	374,000	426,000	893,000	2,062,000	2,026,000	2,274,000	1,929,000	1,395,000	557,000	365,000	13,047,000
1 1/2"	19	292,000	301,000	322,000	465,000	1,524,000	1,957,000	2,358,900	2,758,000	2,276,000	1,510,000	702,000	442,000	14,907,900
2"	20	1,365,000	1,179,000	1,105,000	1,363,000	3,603,000	4,462,000	5,346,000	6,126,000	5,409,000	3,846,000	2,075,000	1,533,000	37,412,000
3"	11	414,500	541,100	549,500	586,400	1,679,300	2,471,300	2,920,000	2,932,000	2,224,900	1,646,100	617,000	545,300	17,127,400
4"	2	110,000	140,000	155,000	130,000	1,540,000	2,185,000	2,320,000	4,350,000	1,425,000	1,080,000	315,000	145,000	13,895,000
Commercial - Outside (No Sewer)														
3/4"	73	651,160	578,730	661,450	710,300	1,052,180	1,165,420	1,292,520	1,438,900	1,158,430	1,006,600	667,120	576,900	10,959,800
1"	16	370,000	329,000	379,000	346,000	361,000	370,000	373,000	353,000	308,000	282,000	268,000	337,000	4,076,000
1 1/2"	1	231,000	197,000	212,000	133,000	142,000	134,000	123,000	110,000	112,000	87,000	120,000	200,000	1,801,000
2"	3	48,000	66,000	101,000	214,000	281,000	224,000	383,000	283,000	255,000	130,000	120,000	57,000	2,162,000
4"	1	10,000	10,000	10,000	-	10,000	10,000	10,000	-	10,000	10,000	10,000	-	90,000
Total Commercial	1,069	23,239,860	22,761,890	22,703,950	26,069,700	39,867,980	63,680,220	57,940,120	64,249,600	53,829,730	43,737,279	28,194,441	24,759,430	461,036,300
Industrial - Industrial Rate														
1 1/2"	1	16,000	19,000	22,000	22,000	24,000	17,000	16,000	17,000	17,000	32,000	18,000	21,000	241,000
2"	2	47,000	47,000	49,000	44,000	52,000	60,000	54,000	34,000	76,000	54,000	45,000	53,000	615,000
3"	2	3,841,000	3,259,000	3,862,000	4,751,000	4,830,000	5,086,000	4,777,000	5,912,000	5,178,000	4,949,000	4,078,000	4,311,000	54,834,000
Industrial - Wholesale Rate														
3"	1	109,000	94,000	191,000	258,000	205,000	641,000	643,000	1,131,000	873,000	666,000	267,000	215,000	5,293,000
4" - Outside	1	-	-	-	-	-	-	2,106,000	5,130,300	3,699,700	3,475,000	1,657,000	893,500	16,961,500
Total Industrial	7	4,013,000	3,419,000	4,124,000	5,075,000	5,111,000	5,804,000	7,596,000	12,224,300	9,843,700	9,176,000	6,065,000	5,493,500	77,944,500
Wholesale City - Inside														
3/4"	5	6,000	3,000	6,000	8,000	13,000	13,000	14,000	26,000	13,000	13,000	8,000	7,000	130,000
1"	11	21,000	14,000	26,000	45,000	111,000	152,000	587,400	335,000	308,000	189,000	74,000	30,000	1,892,400
1 1/2"	5	30,000	32,000	46,000	63,000	91,000	97,000	120,000	113,000	81,000	87,000	59,000	33,000	852,000
2"	15	632,000	686,000	699,000	923,000	1,395,000	2,502,000	2,597,000	2,553,000	2,291,000	1,643,000	858,000	609,000	17,388,000
4" - Irrigation & Pool	3	-	-	-	5,000	320,000	970,000	1,445,000	1,490,000	1,235,000	750,000	60,000	20,000	6,295,000
Wholesale City - Outside														
3/4"	1	-	-	-	-	-	1,000	-	-	-	-	2,000	18,000	21,000
1 1/2"	1	-	-	-	4,000	-	-	19,000	-	-	3,000	-	-	26,000
Total Wholesale City	41	689,000	735,000	777,000	1,048,000	1,930,000	3,736,000	4,782,400	4,517,000	3,928,000	2,685,000	1,061,000	717,000	26,604,400
Total All Classes	27,025	145,987,443	129,343,506	133,730,349	177,229,670	285,163,270	384,331,031	406,614,442	416,209,089	357,063,488	253,856,839	153,687,252	148,375,551	2,990,591,930

Class and Meter Size	Average Usage by Month by Tap Size or Per Unit for Multi-Family												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)													
3/4"	4,598	4,047	4,159	5,765	9,097	11,909	12,218	11,872	10,227	7,018	4,586	4,702	90,198
1"	7,013	4,949	5,410	7,923	19,359	29,500	27,410	28,679	24,205	14,667	6,590	5,744	181,449
2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Residential (Outside City)													
3/4"	5,173	5,011	5,166	6,699	8,813	10,591	12,312	11,504	9,294	6,983	4,839	5,243	91,628
1"	10,333	7,667	3,667	7,333	19,333	10,667	22,000	12,000	10,333	9,000	7,333	4,333	124,000
1 1/2"	28,000	29,000	39,000	38,000	40,000	34,000	59,000	27,000	33,000	27,000	26,000	46,000	426,000
2"	82,000	72,000	78,000	78,500	90,500	78,500	87,000	78,000	81,000	68,500	36,000	82,000	912,000
3"	120,667	105,667	124,000	120,000	147,000	132,000	131,000	109,333	105,667	101,667	102,667	127,000	1,426,667
4"	870,000	780,000	930,000	800,000	970,000	1,110,000	1,285,000	1,250,000	985,000	945,000	705,000	885,000	11,515,000
6"	2,168,140	1,181,630	1,900,870	1,820,000	2,010,000	1,910,000	2,330,000	1,960,000	1,820,000	1,620,000	1,510,000	1,990,000	22,220,640
Total Residential													
Multi-Family 2-8 Units													
3/4"	4,351	3,794	3,989	4,452	5,470	6,899	7,394	7,120	6,300	4,972	3,638	4,080	62,458
1"	4,105	3,702	3,857	4,012	4,879	5,964	6,622	6,481	6,055	5,197	3,791	4,008	58,675
1 1/2"	2,887	2,696	2,607	2,909	3,954	4,911	4,772	5,490	5,007	3,909	2,656	3,430	45,228
2"	2,470	2,280	2,170	2,430	2,520	2,610	3,120	2,880	3,060	2,790	2,510	3,200	32,040
Multi-Family 9+ Units													
3/4"	4,060	3,386	3,711	4,012	3,470	3,108	4,602	5,578	4,675	4,337	3,494	3,120	47,554
1"	2,723	2,533	2,674	2,786	3,246	3,516	3,853	3,505	3,600	3,077	2,646	2,905	37,063
1 1/4"	4,800	4,000	3,500	3,600	3,450	4,900	3,850	3,300	2,900	5,900	2,300	3,100	45,600
1 1/2"	3,135	3,000	2,931	3,154	4,129	5,596	7,576	7,771	6,351	5,248	3,056	3,324	55,272
2"	2,501	2,348	2,365	2,837	4,238	4,317	4,818	4,972	4,604	3,708	2,491	2,911	42,112
3"	3,878	3,500	3,617	4,195	4,942	5,380	7,414	6,345	6,372	4,785	3,370	3,947	57,745
4"	3,430	3,506	3,443	3,671	4,949	7,266	7,924	7,759	7,291	5,937	3,506	3,861	62,544
Total Multi-Family													
Irrigation Accounts - Inside													
3/4"	79	45	79	3,494	21,966	36,663	43,461	39,382	34,292	19,225	3,483	157	202,326
1"	-	-	40	11,613	86,413	137,173	150,427	165,333	138,813	85,387	13,520	347	789,067
1 1/2"	-	-	523	66,727	203,227	366,250	359,182	407,841	362,409	203,091	42,727	1,455	2,013,432
2"	-	38	-	55,769	278,692	349,077	373,885	409,731	380,077	165,000	22,269	38	2,034,577
3"	-	-	-	13,500	239,750	1,047,500	1,023,500	1,374,000	1,187,500	966,250	383,500	16,000	6,251,500
4"	-	-	-	17,500	619,500	1,939,500	1,444,000	2,339,500	1,277,270	1,090,574	188,711	-	8,916,555
Wholesale City - Irrigation													
3/4"	-	-	-	-	-	6,000	8,000	8,000	5,500	6,500	-	-	34,000
1"	-	-	-	-	13,714	58,286	69,286	70,286	64,429	19,857	-	-	295,857
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	-	-	-	-	32,125	199,000	232,625	220,875	198,500	86,875	-	-	970,000
3"	-	-	-	58,000	632,000	954,000	1,294,000	909,000	866,000	90,000	-	-	4,803,000
4"	-	-	-	-	-	-	795,000	1,260,000	900,000	420,000	175,000	-	3,550,000
Irrigation Accounts - Outside													
3/4"	667	-	667	10,333	19,000	46,000	36,333	46,333	58,000	14,000	4,000	333	235,667
1 1/2"	-	-	-	-	155,000	248,000	472,000	581,000	286,000	106,000	-	-	1,848,000
Total Irrigation													
Commercial - Inside no WQC													
3/4"	8,378	8,067	8,208	9,069	12,470	15,195	16,495	17,675	17,086	14,513	9,441	8,937	145,533
1"	32,068	34,102	32,381	34,639	42,646	51,279	55,741	55,921	50,272	44,874	30,970	32,728	497,622
1 1/2"	58,984	53,952	58,032	76,016	85,032	98,429	103,111	110,270	98,444	90,413	68,286	66,921	967,889
2"	61,222	60,352	63,056	68,315	103,296	169,574	191,741	200,241	160,019	123,093	93,481	69,778	1,364,167
3"	189,200	173,900	119,500	169,200	199,650	380,750	332,700	415,500	350,700	307,300	203,200	154,200	2,995,800
4"	74,000	90,000	98,000	92,000	120,000	96,000	79,000	97,000	106,000	116,000	96,000	94,000	1,158,000
6"	275,000	275,000	290,000	325,000	360,000	410,000	420,000	445,000	390,000	385,000	300,000	290,000	4,165,000
Commercial - Inside with WQC													
3/4"	5,536	5,524	5,821	7,345	21,310	32,762	31,202	35,012	33,393	22,024	9,869	6,345	216,143
1"	13,345	12,379	12,897	14,690	30,793	71,103	69,862	78,414	66,517	48,103	19,207	12,586	449,897
1 1/2"	15,368	15,842	16,947	24,474	80,211	103,000	124,153	145,158	119,789	79,474	36,947	23,263	784,626
2"	68,250	58,950	55,250	68,150	180,150	223,100	267,300	306,300	270,450	192,300	103,750	76,650	1,870,600
3"	37,682	49,191	49,955	53,309	152,664	224,664	265,455	266,545	202,264	149,645	56,091	49,573	1,557,036
4"	55,000	70,000	77,500	65,000	770,000	1,092,500	1,160,000	2,175,000	712,500	540,000	157,500	72,500	6,947,500
Commercial - Outside (No Sewer)													
3/4"	8,920	7,928	9,061	9,730	14,413	15,965	17,706	19,711	15,869	13,789	9,139	7,903	150,134
1"	23,125	20,563	23,688	21,625	22,563	23,125	23,313	22,063	19,250	17,625	16,750	21,063	254,750
1 1/2"	231,000	197,000	212,000	133,000	142,000	134,000	123,000	110,000	112,000	87,000	120,000	200,000	1,801,000
2"	16,000	22,000	33,667	71,333	93,667	74,667	127,667	94,333	85,000	43,333	40,000	19,000	720,667
4"	10,000	10,000	10,000	-	10,000	10,000	10,000	-	10,000	10,000	10,000	-	90,000
Total Commercial													
Industrial - Industrial Rate													
1 1/2"	16,000	19,000	22,000	22,000	24,000	17,000	16,000	17,000	17,000	32,000	18,000	21,000	241,000
2"	23,500	23,500	24,500	22,000	26,000	30,000	27,000	17,000	38,000	27,000	22,500	26,500	307,500
3"	1,920,500	1,629,500	1,931,000	2,375,500	2,415,000	2,543,000	2,388,500	2,956,000	2,589,000	2,474,500	2,039,000	2,155,500	27,417,000
Industrial - Wholesale Rate													
3"	109,000	94,000	191,000	258,000	205,000	641,000	643,000	1,131,000	873,000	666,000	267,000	215,000	5,293,000
4" - Outside	0	-	-	-	-	-	2,106,000	5,130,300	3,699,700	3,475,000	1,657,000	893,500	16,961,500
Total Industrial													
Wholesale City - Inside													
3/4"	1200	600	1,200	1,600	2,600	2,600	2,800	5,200	2,600	2,600	1,600	1,400	26,000
1"	1909.09091	1,273	2,364	4,091	10,091	13,818	53,400	30,455	28,000	17,182	6,727	2,727	172,036
1 1/2"	6000	6,400	9,200	12,600	18,200	19,400	24,000	22,600	16,200	17,400	11,800	6,600	170,400
2"	42133.3333	45,733	46,600	61,533	93,000	166,800	173,133	170,200	152,733	109,533	57,200	40,600	1,159,200
4" - Irrigation & Pool	-	-	-	1,667	106,667	323,333	481,667	496,667	411,667	250,000	20,000	6,667	2,098,333
Wholesale City - Outside													
3/4"	0	-	-	-	-	1,000	-	-	-	-	2,000	18,000	21,000
1 1/2"	0	-	-	4,000	-	-	19,000	-	-	3,000	-	-	26,000
Total Wholesale City													
Total All Classes													

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - FY 2003

Class and Meter Size	Year End Counts - Units	Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Residential (Inside City)	Y.E. Counts													
3/4"	17,822	87,480,256	78,800,485	75,472,251	78,866,419	104,544,699	165,472,882	247,850,408	296,114,775	237,261,648	176,355,071	105,162,315	83,377,186	1,736,730,396
1"	77	469,000	470,000	443,000	471,000	598,000	1,362,000	2,424,200	2,918,800	2,672,000	1,947,000	1,050,000	514,000	15,339,000
2"	-													-
Residential (Outside City)														
3/4"	920	5,448,000	5,066,000	4,544,000	4,843,000	6,061,000	8,160,000	12,407,000	14,407,000	10,950,000	8,341,000	5,806,111	5,073,889	91,116,000
1"	3	22,000	16,000	15,000	19,000	26,000	41,000	87,000	35,000	24,000	23,000	19,000	22,000	349,000
1 1/2"	1	28,000	27,000	29,000	25,000	24,000	30,000	19,000	70,000	43,000	28,000	26,000	47,000	396,000
2"	2	210,000	172,000	176,000	161,000	162,000	227,000	192,000	197,000	283,000	315,000	189,000	174,000	2,458,000
3"	3	387,000	395,000	374,000	326,000	333,000	500,000	373,000	373,000	419,000	381,000	358,000	382,000	4,601,000
4"	1	885,000	800,000	885,000	835,000	905,000	1,305,000	1,400,000	1,855,000	1,890,000	1,180,000	935,000	1,055,000	13,930,000
6"	1	2,514,670	1,868,330	2,068,000	1,790,060	1,861,940	2,214,300	2,312,700	2,647,000	2,528,930	2,372,010	1,010,980	2,501,020	25,690,000
Total Residential	18,830	97,443,926	87,617,815	84,006,251	87,325,479	114,515,639	179,321,182	267,045,308	318,617,575	256,071,638	190,942,081	114,566,406	93,146,095	1,890,609,396
Multi-Family 2-8 Units	Y.E. Units													
3/4"	1,590	7,034,000	6,691,000	6,316,000	6,037,000	6,750,000	8,887,000	11,440,200	15,083,800	13,057,000	9,401,000	6,829,000	6,464,000	103,990,000
1"	1,050	4,279,000	4,074,000	3,956,000	3,753,000	4,213,000	4,944,000	5,870,000	7,733,000	7,513,000	5,789,000	4,263,000	4,215,000	60,602,000
1 1/2"	473	1,254,000	1,267,900	1,227,000	1,209,000	1,378,000	1,621,000	2,207,000	3,483,000	2,867,000	2,061,000	1,454,900	1,456,000	21,484,800
2"	78	140,000	130,000	139,000	156,000	154,000	166,000	175,000	258,000	231,000	306,000	237,000	207,000	2,299,000
Multi-Family 9+ Units														
3/4"	83	355,000	376,000	254,000	219,000	254,000	269,000	249,000	333,000	306,000	325,000	218,000	296,000	3,453,000
1"	308	903,000	816,000	830,000	764,000	818,000	997,000	879,000	1,157,000	1,208,000	1,114,000	811,000	779,000	11,076,000
1 1/4"	20	66,000	52,000	57,000	55,000	59,000	55,000	54,000	71,000	64,000	58,900	63,100	84,000	739,000
1 1/2"	665	2,060,000	2,213,000	2,043,000	1,967,000	2,010,000	2,480,000	3,130,000	3,475,000	4,152,000	3,735,000	2,210,000	2,257,000	31,732,000
2"	726	2,189,000	2,656,000	2,084,000	2,152,000	2,365,000	2,983,000	3,427,000	3,974,000	3,727,000	2,612,000	2,046,000	2,049,000	32,264,000
3"	548	1,872,000	1,692,000	1,754,000	1,541,000	1,800,000	2,674,000	3,232,000	4,281,000	4,544,000	3,736,000	2,250,000	1,961,000	31,337,000
4"	395	1,490,000	1,495,000	1,515,000	1,368,000	1,447,000	2,580,000	2,520,000	4,630,000	4,630,000	3,020,000	1,820,000	1,385,000	27,900,000
Total Multi-Family	5,936	21,642,000	21,462,900	20,175,000	19,221,000	21,248,000	27,656,000	33,183,200	44,478,800	42,299,000	32,157,900	22,202,000	21,151,000	306,876,800
Irrigation Accounts - Inside	Y.E. Counts													
3/4"	81	14,000	10,000	7,000	80,000	479,000	1,618,000	3,019,000	4,622,000	4,027,000	2,742,000	610,000	278,000	17,506,000
1"	68	-	23,000	7,000	389,000	1,768,000	5,364,000	9,014,000	13,168,000	11,187,000	7,541,000	1,816,000	15,000	50,292,000
1 1/2"	34	9,000	6,000	45,000	144,000	1,982,000	5,594,000	10,673,000	14,319,000	14,452,000	9,017,000	3,204,000	182,000	59,627,000
2"	26	-	2,000	-	276,000	1,942,000	6,320,000	11,524,000	15,216,000	12,689,000	8,322,000	2,656,000	110,000	59,057,000
3"	4	-	-	-	-	651,000	1,742,000	3,891,000	6,365,000	7,568,000	6,673,000	2,115,000	-	29,006,000
4"	1	-	-	-	-	10,000	1,660,000	2,065,000	4,690,000	3,020,000	1,785,000	1,695,000	355,000	15,280,000
Wholesale City - Irrigation														
3/4"	2	-	-	-	-	-	1,000	15,000	25,000	19,000	16,000	2,000	-	78,000
1"	7	-	-	-	-	8,000	247,000	409,000	674,000	689,000	257,000	51,000	-	2,336,000
1 1/2"														-
2"	8		-	-	-	145,000	993,000	1,431,000	2,698,000	2,696,000	1,045,000	39,000	-	9,047,000
3"	1	-	-	-	-	139,000	665,000	1,652,000	1,860,000	1,045,000	526,000	-	-	5,887,000
4"	1	-	-	-	-	458,000	1,140,000	940,000	1,670,000	1,405,000	815,000	325,000	-	6,753,000
Irrigation Accounts - Outside														
3/4"	3	3,000	2,000	1,000	3,000	27,000	62,000	187,000	178,000	129,000	50,000	-	1,000	643,000
1 1/2"	1	-	-	-	-	1,000	141,000	365,000	510,000	751,000	309,000	-	-	2,077,000
Total Irrigation	237	26,000	43,000	60,000	892,000	7,610,000	25,547,000	45,185,000	65,995,000	59,678,000	39,098,000	12,513,000	941,000	257,588,000
Commercial - Inside no WQC														
3/4"	520	4,394,000	4,225,000	4,173,000	4,111,000	4,873,800	7,193,111	7,204,089	11,138,000	10,149,000	7,963,000	5,411,800	4,603,200	75,439,000
1"	149	4,316,000	4,480,700	4,917,300	4,090,000	5,230,400	7,163,400	8,050,000	9,501,000	9,027,000	7,160,000	5,229,000	4,945,000	74,109,800
1 1/2"	65	4,050,000	3,785,000	3,760,000	3,614,000	3,964,000	5,086,000	5,559,000	6,927,000	7,027,000	6,152,000	4,178,000	3,622,000	57,724,000
2"	52	3,448,000	3,375,000	3,325,000	3,184,000	3,714,000	8,159,000	8,189,000	11,619,000	10,561,000	7,168,000	4,290,000	3,272,000	70,304,000
3"	10	3,000,700	3,261,400	2,841,400	3,019,500	3,792,400	5,449,600	4,647,100	7,783,900	6,584,000	5,112,500	3,842,500	2,855,000	52,190,000
4"	6	460,000	585,000	575,000	430,000	610,000	695,000	605,000	890,000	1,090,000	795,000	670,000	475,000	7,880,000
6"	2	620,000	910,000	670,000	680,000	780,000	920,000	990,000	1,110,000	960,000	840,000	730,000	560,000	9,770,000
Commercial - Inside with WQC														
3/4"	83	528,000	486,000	475,000	541,000	831,000	1,464,000	1,888,000	2,905,000	2,939,000	2,378,000	1,266,000	477,000	16,178,000
1"	27	589,000	500,000	378,000	347,000	645,000	1,191,000	1,577,000	1,798,000	2,028,000	1,581,000	711,000	402,000	11,747,000
1 1/2"	18	279,000	324,000	278,000	319,000	685,000	1,185,000	1,772,000	3,132,000	2,897,000	2,185,000	625,000	315,000	13,996,000
2"	20	2,134,000	1,327,000	1,309,000	1,102,000	1,567,000	2,907,000	3,559,000	6,439,000	6,921,000	4,704,000	2,701,000	1,422,000	36,092,000
3"	12	548,100	4,018,800	547,000	491,200	637,900	1,278,100	1,847,000	3,364,200	3,448,800	2,406,000	839,000	563,900	19,990,000
4"	2	105,000	120,000	120,000	90,000	170,000	1,065,000	1,405,000	3,220,000	3,550,000	1,935,000	235,000	160,000	12,175,000
Commercial - Outside (No Sewer)														
3/4"	72	739,080	763,820	722,015	818,880	939,125	1,151,030	1,161,770	1,383,500	1,231,580	913,020	689,670	662,830	11,176,300
1"	15	385,000	359,000	422,000	309,000	268,600	317,400	342,000	363,000	354,000	277,000	263,000	361,000	4,021,000
1 1/2"	1	240,000	237,000	378,000	184,000	188,000	246,000	226,000	213,000	210,000	172,000	165,000	284,000	2,752,000
2"	2	51,000	72,000	62,000	65,000	74,000	97,000	101,000	205,000	218,000	175,000	51,000	62,000	1,233,000
4"	1	10,000	10,000	10,000	10,000	10,000	10,000	10,000	20,000	10,000	10,000	10,000	10,000	130,000
Total Commercial	1,057	25,905,860	28,839,720	24,962,715	23,405,580	28,980,225	45,577,641	49,132,969	77,011,800	69,206,380	51,926,520	31,906,970	25,051,930	476,907,100
Industrial - Industrial Rate														
1 1/2"	-													-
2"	1	40,000	35,000	22,000	16,000	16,000	19,000	17,000	32,000	24,000	21,000	19,000	14,000	275,000
3"	1	2,159,000	2,367,000	2,011,000	2,175,000	2,748,000	3,650,000	3,046,000	4,608,000	3,668,000	3,179,000	3,067,000	2,484,000	35,162,000
Industrial - Wholesale Rate														
3"	1	-	-	-	-	-	-	272,000	713,000	257,000	78,000	59,000	51,000	1,430,000
4" - Outside	1	8,000	-	-	-	-	-	-	1,036,000	1,247,000	78,000	5,000	-	2,374,000
Total Industrial	4	2,207,000	2,402,000	2,033,000	2,191,000	2,764,000	3,669,000	3,335,000	6,389,000	5,196,000	3,356,000	3,150,000	2,549,000	39,241,000
Wholesale City - Inside														
3/4"	5	6,000	7,000	5,000	12,000	15,000	15,000	13,000	24,000	38,000	17,000	10,000	5,000	167,000
1"	10	40,000	30,000	32,000	59,000	84,000	137,000	176,000	176,000	171,000	119,000	126,000	66,000	1,216,000
1 1/2"	5	28,000	28,000	36,000	43,000	91,000	116,000	89,000	180,000	99,000	89,000	53,000	28,000	880,000
2"	15	570,000	696,000	732,000	648,000	910,000	1,773,000	2,296,000	3,069,000	2,991,000	1,549,000	913,000	594,000	16,741,000
4" - Irrigation & Pool	2	-	-	-	-	54,000	740,000	1,360,000	1,965,000	1,740,000	940,000	270,000	-	7,069,000
Wholesale City - Outside														
3/4"	2	9,000	7,000	-	-	-	-	2,000	10,000	-	5,000	-	-	33,000
1 1/2"	-													-
Total Wholesale City	39	653,000	768,000	805,000	762,000	1,154,000	2,781,000	3,936,000	5,424,000	5,039,000	2,719,000	1,372,000	693,000	26,106,000
Total All Classes	26,103	147,877,786	141,133,435	132,041,966	133,797,059	176,271,864	284,551,823	401,817,467	612,915,975	437,489,018	320,199,501	185,700,376	143,532,025	3,017,328,295

Class and Meter Size	Average Usage by Month by Tap Size or Per Unit for Multi-Family												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)													
3/4"	4,909	4,422	4,235	4,425	5,866	9,285	13,906	16,615	13,313	9,895	5,901	4,678	97,449
1"	6,091	6,104	5,753	6,117	7,766	17,688	31,483	37,906	34,701	25,286	13,636	6,675	199,208
2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Residential (Outside City)													
3/4"	5,922	5,507	4,939	5,264	6,588	8,870	13,486	15,660	11,902	9,066	6,311	5,515	99,039
1"	7,333	5,333	5,000	6,333	8,667	13,667	29,000	11,667	8,000	7,667	6,333	7,333	116,333
1 1/2"	28,000	27,000	29,000	25,000	24,000	30,000	19,000	70,000	43,000	28,000	26,000	47,000	396,000
2"	105,000	86,000	88,000	80,500	81,000	113,500	96,000	98,500	141,500	157,500	94,500	87,000	1,229,000
3"	129,000	131,667	124,667	108,667	111,000	166,667	124,333	124,333	139,667	127,000	119,333	127,333	1,533,667
4"	885,000	800,000	885,000	835,000	905,000	1,305,000	1,400,000	1,855,000	1,890,000	1,180,000	935,000	1,055,000	13,930,000
6"	2,514,670	1,868,330	2,068,000	1,790,060	1,861,940	2,214,300	2,312,700	2,647,000	2,528,930	2,372,010	1,010,980	2,501,020	25,690,000
Total Residential													
Multi-Family 2-8 Units													
3/4"	4,424	4,208	3,972	3,797	4,245	5,589	7,195	9,487	8,212	5,913	4,295	4,065	65,403
1"	4,075	3,880	3,768	3,574	4,012	4,709	5,590	7,365	7,155	5,513	4,060	4,014	57,716
1 1/2"	2,651	2,681	2,594	2,556	2,913	3,427	4,666	7,364	6,061	4,357	3,076	3,078	45,422
2"	1,795	1,667	1,782	2,000	1,974	2,128	2,244	3,308	2,962	3,923	3,038	2,654	29,474
Multi-Family 9+ Units													
3/4"	4,277	4,530	3,060	2,639	3,060	3,241	3,000	4,012	3,687	3,916	2,627	3,566	41,602
1"	2,932	2,649	2,695	2,481	2,656	3,237	2,854	3,756	3,922	3,617	2,633	2,529	35,961
1 1/4"	3,300	2,600	2,850	2,750	2,950	2,750	2,700	3,550	3,200	2,945	3,155	4,200	36,950
1 1/2"	3,098	3,328	3,072	2,958	3,023	3,729	4,707	5,226	6,244	5,617	3,323	3,394	47,717
2"	3,015	3,658	2,871	2,964	3,258	4,109	4,720	5,474	5,134	3,598	2,818	2,822	44,441
3"	3,416	3,088	3,201	2,812	3,285	4,880	5,898	7,812	8,292	6,818	4,106	3,578	57,184
4"	3,772	3,785	3,835	3,463	3,663	6,532	6,380	11,722	11,722	7,646	4,608	3,506	70,633
Total Multi-Family													
Irrigation Accounts - Inside													
3/4"	173	123	86	988	5,914	19,975	37,272	57,062	49,716	33,852	7,531	3,432	216,123
1"	-	338	103	5,721	26,000	78,882	132,559	193,647	164,515	110,897	26,706	221	739,588
1 1/2"	265	176	1,324	4,235	58,294	164,529	313,912	421,147	425,059	265,206	94,235	5,353	1,753,735
2"	-	77	-	10,615	74,692	243,077	443,231	585,231	488,038	320,077	102,154	4,231	2,271,423
3"	-	-	-	-	162,750	435,500	972,750	1,591,250	1,892,250	1,668,250	528,750	-	7,251,500
4"	-	-	-	-	10,000	1,660,000	2,065,000	4,690,000	3,020,000	1,785,000	1,695,000	355,000	15,280,000
Wholesale City - Irrigation													
3/4"	-	-	-	-	-	500	7,500	12,500	9,500	8,000	1,000	-	39,000
1"	-	-	-	-	1,143	35,286	58,429	96,286	98,429	36,714	7,286	-	333,571
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	-	-	-	-	18,125	124,125	178,875	337,250	337,000	130,625	4,875	-	1,130,875
3"	-	-	-	-	139,000	665,000	1,652,000	1,860,000	1,045,000	526,000	-	-	5,887,000
4"	-	-	-	-	458,000	1,140,000	940,000	1,670,000	1,405,000	815,000	325,000	-	6,753,000
Irrigation Accounts - Outside													
3/4"	1,000	667	333	1,000	9,000	20,667	62,333	59,333	43,000	16,667	-	333	214,333
1 1/2"	-	-	-	-	1,000	141,000	365,000	510,000	751,000	309,000	-	-	2,077,000
Total Irrigation													
Commercial - Inside no WQC													
3/4"	8,450	8,125	8,025	7,906	9,373	13,833	13,854	21,419	19,517	15,313	10,407	8,852	145,075
1"	28,966	30,072	33,002	27,450	35,103	48,077	54,027	63,765	60,584	48,054	35,094	33,188	497,381
1 1/2"	62,308	58,231	57,846	55,600	60,985	78,246	85,523	106,569	108,108	94,646	64,277	55,723	888,062
2"	66,308	64,904	63,942	61,231	71,423	156,904	157,481	223,442	203,096	137,846	82,500	62,923	1,352,000
3"	300,070	326,140	284,140	301,950	379,240	544,960	464,710	778,390	658,400	511,250	384,250	285,500	5,219,000
4"	76,667	97,500	95,833	71,667	101,667	115,833	100,833	148,333	181,667	132,500	111,667	79,167	1,313,333
6"	310,000	455,000	335,000	340,000	390,000	460,000	495,000	555,000	480,000	420,000	365,000	280,000	4,885,000
Commercial - Inside with WQC													
3/4"	6,361	5,855	5,723	6,518	10,012	17,639	22,747	35,000	35,410	28,651	15,253	5,747	194,916
1"	21,815	18,519	14,000	12,852	23,889	44,111	58,407	66,593	75,111	58,556	26,333	14,889	435,074
1 1/2"	15,500	18,000	15,444	17,722	38,056	65,833	98,444	174,000	160,944	121,389	34,722	17,500	777,556
2"	106,700	66,350	65,450	55,100	78,350	145,350	177,950	321,950	346,050	235,200	135,050	71,100	1,804,600
3"	45,675	334,900	45,583	40,933	53,158	106,508	153,917	280,350	287,400	200,500	69,917	46,992	1,665,833
4"	52,500	60,000	60,000	45,000	85,000	532,500	702,500	1,610,000	1,775,000	967,500	117,500	80,000	6,087,500
Commercial - Outside (No Sewer)													
3/4"	10,265	10,609	10,028	11,373	13,043	15,987	16,136	19,216	17,105	12,681	9,579	9,206	155,226
1"	25,667	23,933	28,133	20,600	17,907	21,160	22,800	24,200	23,600	18,467	17,533	24,067	268,067
1 1/2"	240,000	237,000	378,000	184,000	188,000	246,000	226,000	213,000	210,000	172,000	165,000	284,000	2,752,000
2"	25,500	36,000	31,000	32,500	37,000	48,500	50,500	102,500	109,000	87,500	25,500	31,000	616,500
4"	10,000	10,000	10,000	10,000	10,000	10,000	10,000	20,000	10,000	10,000	10,000	10,000	130,000
Total Commercial													
Industrial - Industrial Rate													
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	40,000	35,000	22,000	16,000	16,000	19,000	17,000	32,000	24,000	21,000	19,000	14,000	275,000
3"	2,159,000	2,367,000	2,011,000	2,175,000	2,748,000	3,650,000	3,046,000	4,608,000	3,668,000	3,179,000	3,067,000	2,484,000	35,162,000
Industrial - Wholesale Rate													
3"	-	-	-	-	-	-	272,000	713,000	257,000	78,000	59,000	51,000	1,430,000
4" - Outside	8000	-	-	-	-	-	-	1,036,000	1,247,000	78,000	5,000	-	2,374,000
Total Industrial													
Wholesale City - Inside													
3/4"	1200	1,400	1,000	2,400	3,000	3,000	2,600	4,800	7,600	3,400	2,000	1,000	33,400
1"	4000	3,000	3,200	5,900	8,400	13,700	17,600	17,600	17,100	11,900	12,600	6,600	121,600
1 1/2"	5600	5,600	7,200	8,600	18,200	23,200	17,800	36,000	19,800	17,800	10,600	5,600	176,000
2"	38000	46,400	48,800	43,200	60,667	118,200	153,067	204,600	199,400	103,267	60,867	39,600	1,116,067
4" - Irrigation & Pool	-	-	-	-	27,000	370,000	680,000	982,500	870,000	470,000	135,000	-	3,534,500
Wholesale City - Outside													
3/4"	4500	3,500	-	-	-	-	1,000	5,000	-	2,500	-	-	16,500
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total Wholesale City													
Total All Classes													

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - FY 2002

Class and Meter Size	Year End Counts - Units	Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Residential (Inside City)	Y.E. Counts													
3/4"	16,896	87,522,901	79,238,842	76,268,220	108,548,836	193,757,218	222,004,888	311,264,528	305,643,600	241,407,550	137,665,318	91,706,022	81,534,042	1,936,891,344
1"	79	693,000	425,000	411,000	803,000	2,259,000	2,495,000	3,633,000	3,623,000	2,863,000	1,648,000	682,000	432,000	19,967,000
2"	-													-
Residential (Outside City)														
3/4"	930	5,650,000	5,096,000	4,874,000	6,341,000	10,220,420	11,961,000	15,516,000	16,347,000	12,092,900	7,641,100	4,985,500	5,094,500	105,819,420
1"	3	19,000	16,000	19,000	32,000	42,000	51,000	86,000	70,000	53,000	24,000	26,000	44,000	482,000
1 1/2"	1	41,000	36,000	30,000	44,000	30,000	36,000	47,000	91,000	158,000	141,000	42,000	28,000	723,000
2"	2	179,000	168,000	180,000	176,000	200,000	225,000	217,000	225,000	248,000	187,000	192,000	215,000	2,412,000
3"	3	408,000	416,000	451,000	420,000	534,000	574,000	487,000	433,000	470,000	326,000	352,000	368,000	5,236,000
4"	1	880,000	770,000	825,000	790,000	1,080,000	1,425,000	1,925,000	1,512,000	1,769,000	865,000	845,000	990,000	13,676,000
6"	1	1,990,000	1,849,000	2,119,440	2,192,560	2,217,000	2,718,310	3,126,600	2,942,090	2,913,990	1,827,010	1,349,000	1,996,000	27,241,000
Total Residential	17,916	97,782,901	88,014,842	86,177,660	119,347,396	210,339,638	241,519,158	336,302,128	330,786,690	261,972,830	150,324,428	100,178,522	90,701,542	2,112,447,764
Multi-Family 2-8 Units	Y.E. Units													
3/4"	1,597	7,644,500	7,217,500	6,727,800	7,844,200	11,046,000	13,109,000	16,454,000	17,036,000	14,271,000	8,944,000	7,223,000	7,157,000	124,674,000
1"	1,053	4,742,000	4,575,000	4,275,000	4,356,900	5,861,700	7,366,400	7,594,000	7,814,000	7,391,000	5,476,000	4,694,000	4,507,000	68,652,000
1 1/2"	345	830,000	704,000	713,000	765,000	1,701,000	2,069,000	1,796,000	2,278,000	2,309,000	1,466,000	1,205,000	1,133,100	16,968,100
2"	45	24,000	54,000	36,000	37,000	44,000	58,000	59,000	124,000	181,000	241,000	164,000	100,000	1,122,000
Multi-Family 9+ Units														
3/4"	83	301,000	333,000	319,000	301,000	336,000	340,000	330,000	407,000	411,000	401,000	347,000	345,000	4,171,000
1"	283	1,008,000	957,000	921,000	944,000	1,080,000	1,224,000	1,266,000	1,403,000	1,364,000	1,094,000	921,000	984,000	13,163,000
1 1/4"	20	57,000	61,000	64,000	69,000	55,000	59,000	62,000	78,000	80,000	60,000	65,000	67,000	777,000
1 1/2"	665	1,285,000	1,291,000	1,261,000	1,508,000	1,483,000	3,198,900	2,819,000	3,894,900	5,157,000	3,276,000	2,484,000	2,182,000	29,838,800
2"	726	2,167,000	2,238,800	2,148,000	2,472,000	3,572,000	3,855,000	4,049,000	4,139,000	3,919,000	3,041,000	2,438,000	2,326,000	36,364,800
3"	548	1,810,000	1,852,000	1,785,000	1,905,000	2,860,000	3,457,000	3,478,000	4,010,000	3,738,000	2,442,000	2,004,000	2,007,000	31,348,000
4"	395	1,560,000	1,565,000	1,590,000	1,385,000	1,875,000	3,025,000	3,460,000	3,810,000	4,210,000	2,650,000	1,835,000	1,495,000	28,460,000
Total Multi-Family	5,760	21,425,500	20,848,300	19,839,800	21,587,100	29,913,700	37,760,300	41,367,000	44,993,900	43,031,000	29,091,000	23,380,000	22,300,100	355,540,700
Irrigation Accounts - Inside	Y.E. Counts													
3/4"	83	2,000	1,000	3,675	360,325	2,305,000	2,864,000	3,190,000	3,519,000	3,151,000	2,014,000	403,000	2,000	17,815,000
1"	62	14,935	-	2,000	1,023,065	5,963,000	6,880,000	6,632,000	7,911,530	7,155,000	4,398,000	955,000	-	40,934,530
1 1/2"	25	54,000	1,000	-	1,155,000	6,887,000	6,058,000	6,018,000	9,105,000	7,711,000	5,143,000	1,718,000	22,000	43,872,000
2"	26	31,000	10,000	9,000	3,308,000	7,697,900	8,935,500	11,696,000	10,982,000	10,396,000	6,093,000	910,000	35,000	60,103,400
3"	4	28,000	-	-	563,000	4,558,000	3,615,000	2,964,000	4,143,000	3,684,000	3,253,000	1,218,000	-	24,026,000
4"	2	-	-		-	595,000	1,035,000	-	565,000	2,412,000	1,230,000	915,000	-	6,752,000
Wholesale City - Irrigation														
3/4"	2	-	-		-	2,000	4,000	1,000	17,000	18,000	15,000	-	-	57,000
1"	7	-	-	-	-	112,900	110,000	414,000	601,000	687,000	402,000	15,000	-	2,341,900
1 1/2"	-													-
2"	8	-	-	-	1,000	271,000	375,000	1,064,000	1,294,000	1,603,000	854,000	24,000	-	5,486,000
3"	1	-	-	-	56,000	251,000	535,000	767,000	1,742,000	836,000	408,000	-	-	4,595,000
4"	-													-
Irrigation Accounts - Outside														
3/4"	2	-	-	-	29,000	105,000	199,000	209,000	256,000	136,000	42,000	-	-	976,000
1 1/2"	1	-	-	-	8,000	238,000	560,000	615,000	521,000	734,000	245,000	-	-	2,921,000
Total Irrigation	223	129,935	12,000	14,675	6,503,390	28,985,800	31,170,500	33,570,000	40,656,530	38,523,000	24,097,000	6,158,000	59,000	209,879,830
Commercial - Inside no WQC														
3/4"	507	4,732,000	4,500,000	4,403,000	4,563,000	5,984,000	8,165,000	8,357,850	9,639,000	9,380,600	7,264,000	5,483,000	4,692,000	77,173,050
1"	144	5,297,000	4,813,000	4,973,400	4,850,120	6,478,860	8,192,400	8,999,400	9,242,870	8,244,600	6,261,000	5,010,300	4,695,300	77,058,270
1 1/2"	63	4,438,000	4,141,000	4,344,000	4,276,000	5,740,000	6,295,000	6,199,000	7,069,000	6,768,000	5,447,000	4,488,000	4,334,000	63,539,000
2"	48	3,158,000	3,478,111	3,434,880	3,506,000	5,907,000	9,845,000	9,035,400	9,742,000	10,124,000	5,599,000	3,751,000	3,341,000	70,921,400
3"	10	1,611,000	1,944,100	2,063,600	2,182,000	3,857,700	4,892,700	6,652,100	7,322,500	8,919,800	6,088,800	4,096,100	3,431,300	53,261,700
4"	6	495,000	650,000	680,000	645,000	785,000	695,000	795,000	850,000	1,200,000	840,000	605,000	580,000	8,820,000
6"	2	590,000	650,000	660,000	720,000	800,000	970,000	1,120,000	1,060,000	1,040,000	840,000	760,000	680,000	9,890,000
Commercial - Inside with WQC														
3/4"	77	448,000	503,000	475,000	566,000	1,591,100	2,313,000	2,327,000	2,645,000	2,593,000	1,915,000	988,000	520,000	16,884,100
1"	26	295,000	320,000	360,000	406,000	1,330,000	1,681,000	1,578,000	2,014,000	2,059,000	1,357,000	809,000	576,000	12,785,000
1 1/2"	17	214,000	267,000	296,000	506,000	1,205,000	1,293,000	1,167,000	1,409,000	1,275,000	924,000	1,165,900	313,000	10,034,900
2"	20	1,411,000	1,190,000	1,214,000	1,283,000	3,661,000	5,034,000	4,611,000	4,769,600	5,129,400	3,548,000	2,809,000	1,125,000	35,785,000
3"	12	367,700	448,300	455,900	634,100	1,361,800	1,672,900	1,161,300	1,635,000	1,962,100	1,277,300	887,200	662,300	12,525,900
4"	2	110,000	145,000	140,000	155,000	1,530,000	930,000	1,155,000	1,525,000	1,495,000	1,130,000	160,000	150,000	8,625,000
Commercial - Outside (No Sewer)														
3/4"	64	565,333	545,820	555,180	692,000	1,044,000	1,330,160	1,307,930	1,527,120	1,279,630	1,072,160	754,000	696,000	11,369,333
1"	14	364,000	362,000	380,000	388,000	307,000	348,000	368,000	364,000	367,000	302,000	328,000	396,000	4,275,000
1 1/2"	1	313,000	325,000	344,000	341,000	231,000	258,000	264,000	212,000	237,000	162,000	251,000	303,000	3,241,000
2"	2	57,000	70,000	53,000	47,000	140,000	87,000	100,000	120,000	115,000	62,000	57,000	56,000	964,000
4"	1	10,000	10,000	20,000	20,000	10,000	10,000	20,000	20,000	20,000	10,000	10,000	10,000	170,000
Total Commercial	1,016	24,676,033	24,371,331	24,851,969	25,780,220	41,964,080	54,013,160	55,217,580	61,166,090	62,208,130	44,099,260	32,417,505	26,640,900	477,322,653
Industrial - Industrial Rate														
1 1/2"	-													-
2"	1	16,000	18,000	14,000	22,000	20,000	29,000	21,000	36,000	35,000	27,000	14,000	21,000	273,000
3"	1	1,858,000	1,956,000	1,516,000	2,263,000	2,540,000	2,829,000	3,530,000	3,706,000	4,117,000	3,184,000	2,481,000	2,227,000	32,607,000
Industrial - Wholesale Rate														
3"	1	-	13,000	50,000	92,000	221,000	1,563,000	1,050,000	1,635,000	848,000	132,000	-	-	5,613,000
4" - Outside	1	-	-	-	-	-	-	-	-	-	-	134,000	-	134,000
Total Industrial	4	1,874,000	1,987,000	1,580,000	2,377,000	2,781,000	4,421,000	4,601,000	5,377,000	5,000,000	3,343,000	2,629,000	2,248,000	38,627,000
Wholesale City - Inside														
3/4"	5	5,000	8,000	6,000	8,900	13,000	15,000	21,000	21,000	17,000	10,000	9,000	6,000	139,900
1"	10	18,000	19,000	18,000	38,000	79,000	129,000	149,000	122,000	136,000	195,000	83,000	28,000	1,014,000
1 1/2"	5	41,000	45,000	32,000	552,000	346,000	153,000	114,000	145,000	514,000	761,000	52,000	28,000	2,783,000
2"	15	549,000	730,000	718,000	721,000	1,259,200	1,598,000	1,410,000	2,086,000	2,024,000	1,533,000	631,000	588,000	13,847,200
4" - Irrigation & Pool	2	-	-	-	15,000	185,000	580,000	1,100,000	1,585,000	1,620,000	730,000	371,000	-	6,186,000
Wholesale City - Outside														
3/4"	2	1,000	1,000	2,000	1,000	1,000	-	45,000	43,000	44,000	19,000	4,000	8,000	169,000
1 1/2"	-													-
Total Wholesale City	39	614,000	803,000	776,000	1,335,900	1,883,200	2,475,000	2,839,000	4,002,000	4,355,000	3,248,000	1,150,000	658,000	24,139,100
Total All Classes	24,958	146,502,369	136,036,473	132,649,104	176,931,005	315,867,415	371,368,158	473,897,108	486,987,710	415,090,550	264,202,688	165,908,022	142,530,542	3,217,957,047

Class and Meter Size	Average Usage by Month by Tap Size or Per Unit for Multi-Family												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)													
3/4"	5,204	4,690	4,514	6,425	11,468	13,141	18,422	18,084	14,288	8,148	5,428	4,826	114,636
1"	8,772	5,380	5,203	10,165	28,595	31,582	45,987	45,861	36,241	20,861	8,633	5,468	252,747
2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Residential (Outside City)													
3/4"	6,075	5,480	5,241	6,818	10,990	12,861	16,684	17,577	13,003	8,216	5,361	5,478	113,784
1"	6,333	5,333	6,333	10,667	14,000	17,000	28,667	23,333	17,667	8,000	8,667	14,667	160,667
1 1/2"	41,000	36,000	30,000	44,000	30,000	36,000	47,000	91,000	158,000	141,000	42,000	28,000	723,000
2"	89,500	84,000	90,000	88,000	100,000	112,500	108,500	112,500	124,000	93,500	96,000	107,500	1,206,000
3"	136,000	138,667	150,333	140,000	178,000	191,333	162,333	144,333	156,667	108,667	117,333	122,667	1,745,333
4"	880,000	770,000	825,000	790,000	1,080,000	1,425,000	1,925,000	1,512,000	1,769,000	865,000	845,000	990,000	13,676,000
6"	1,990,000	1,849,000	2,119,440	2,192,560	2,217,000	2,718,310	3,126,600	2,942,090	2,913,990	1,827,010	1,349,000	1,996,000	27,241,000
Total Residential													
Multi-Family 2-8 Units													
3/4"	4,787	4,519	4,213	4,912	6,917	8,209	10,303	10,668	8,936	5,601	4,523	4,482	78,068
1"	4,503	4,345	4,060	4,138	5,567	6,996	7,212	7,421	7,019	5,200	4,458	4,280	65,197
1 1/2"	2,406	2,041	2,067	2,217	4,930	5,997	5,206	6,603	6,693	4,249	3,493	3,284	49,186
2"	533	1,200	800	822	978	1,289	1,311	2,756	4,022	5,356	3,644	2,222	24,933
Multi-Family 9+ Units													
3/4"	3,627	4,012	3,843	3,627	4,048	4,096	3,976	4,904	4,952	4,831	4,181	4,157	50,253
1"	3,561	3,382	3,254	3,336	3,816	4,325	4,473	4,958	4,820	3,866	3,254	3,477	46,512
1 1/4"	2,850	3,050	3,200	3,450	2,750	2,950	3,100	3,900	4,000	3,000	3,250	3,350	38,850
1 1/2"	1,932	1,941	1,896	2,268	2,230	4,810	4,239	5,857	7,755	4,926	3,735	3,281	44,872
2"	2,985	3,084	2,959	3,405	4,920	5,310	5,577	5,701	5,398	4,189	3,358	3,204	50,089
3"	3,303	3,380	3,257	3,476	5,219	6,308	6,347	7,318	6,821	4,456	3,657	3,662	57,204
4"	3,949	3,962	4,025	3,506	4,747	7,658	8,759	9,646	10,658	6,709	4,646	3,785	72,051
Total Multi-Family													
Irrigation Accounts - Inside													
3/4"	24	12	44	4,341	27,771	34,506	38,434	42,398	37,964	24,265	4,855	24	214,639
1"	241	-	32	16,501	96,177	110,968	106,968	127,605	115,403	70,935	15,403	-	660,234
1 1/2"	2,160	40	-	46,200	275,480	242,320	240,720	364,200	308,440	205,720	68,720	880	1,754,880
2"	1,192	385	346	127,231	296,073	343,673	449,846	422,385	399,846	234,346	35,000	1,346	2,311,668
3"	7,000	-	-	140,750	1,139,500	903,750	741,000	1,035,750	921,000	813,250	304,500	-	6,006,500
4"	-	-	-	-	297,500	517,500	-	282,500	1,206,000	615,000	457,500	-	3,376,000
Wholesale City - Irrigation													
3/4"	-	-	-	-	1,000	2,000	500	8,500	9,000	7,500	-	-	28,500
1"	-	-	-	-	16,129	15,714	59,143	85,857	98,143	57,429	2,143	-	334,557
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	-	-	-	125	33,875	46,875	133,000	161,750	200,375	106,750	3,000	-	685,750
3"	-	-	-	56,000	251,000	535,000	767,000	1,742,000	836,000	408,000	-	-	4,595,000
4"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Irrigation Accounts - Outside													
3/4"	-	-	-	14,500	52,500	99,500	104,500	128,000	68,000	21,000	-	-	488,000
1 1/2"	-	-	-	8,000	238,000	560,000	615,000	521,000	734,000	245,000	-	-	2,921,000
Total Irrigation													
Commercial - Inside no WQC													
3/4"	9,333	8,803	8,684	9,000	11,804	16,105	16,485	19,012	18,502	14,327	10,815	9,254	152,215
1"	36,785	33,424	34,538	33,681	44,992	56,892	62,496	64,187	57,254	43,479	34,794	32,606	535,127
1 1/2"	70,444	65,730	68,952	67,873	91,111	99,921	98,397	112,206	107,429	86,460	71,238	68,794	1,008,556
2"	65,792	72,461	71,560	73,042	123,063	205,104	188,238	202,958	210,917	116,646	78,146	69,604	1,477,529
3"	161,100	194,410	206,360	218,200	385,770	489,270	665,210	732,250	891,980	608,880	409,610	343,130	5,326,170
4"	82,500	108,333	113,333	107,500	130,833	115,833	132,500	141,667	200,000	140,000	100,833	96,667	1,470,000
6"	295,000	325,000	330,000	360,000	400,000	485,000	560,000	530,000	520,000	420,000	380,000	340,000	4,945,000
Commercial - Inside with WQC													
3/4"	5,818	6,532	6,169	7,351	20,664	30,039	30,221	34,351	33,675	24,870	12,831	6,753	219,274
1"	11,346	12,308	13,846	15,615	51,154	64,654	60,692	77,462	79,192	52,192	31,115	22,154	491,731
1 1/2"	12,588	15,706	17,412	29,765	70,882	76,059	68,647	82,882	75,000	54,353	68,582	18,412	590,288
2"	70,550	59,500	60,700	64,150	183,050	251,700	230,550	238,480	256,470	177,400	140,450	56,250	1,789,250
3"	30,642	37,358	37,992	52,842	113,483	139,408	96,775	136,250	163,508	106,442	73,933	55,192	1,043,825
4"	55,000	72,500	70,000	77,500	765,000	465,000	577,500	762,500	747,500	565,000	80,000	75,000	4,312,500
Commercial - Outside (No Sewer)													
3/4"	8,833	8,528	8,675	10,813	16,313	20,784	20,436	23,861	19,994	16,753	11,781	10,875	177,646
1"	26,000	25,857	27,143	27,714	21,929	24,857	26,286	26,000	26,214	21,571	23,429	28,286	305,357
1 1/2"	313,000	325,000	344,000	341,000	231,000	258,000	264,000	212,000	237,000	162,000	251,000	303,000	3,241,000
2"	28,500	35,000	26,500	23,500	70,000	43,500	50,000	60,000	57,500	31,000	28,500	28,000	482,000
4"	10,000	10,000	20,000	20,000	10,000	10,000	20,000	20,000	20,000	10,000	10,000	10,000	170,000
Total Commercial													
Industrial - Industrial Rate													
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	16,000	18,000	14,000	22,000	20,000	29,000	21,000	36,000	35,000	27,000	14,000	21,000	273,000
3"	1,858,000	1,956,000	1,516,000	2,263,000	2,540,000	2,829,000	3,530,000	3,706,000	4,117,000	3,184,000	2,481,000	2,227,000	32,607,000
Industrial - Wholesale Rate													
3"	-	13,000	50,000	92,000	221,000	1,563,000	1,050,000	1,635,000	848,000	132,000	-	-	5,613,000
4" - Outside	0	-	-	-	-	-	-	-	-	-	134,000	-	134,000
Total Industrial													
Wholesale City - Inside													
3/4"	1000	1,600	1,200	1,780	2,600	3,000	4,200	4,200	3,400	2,000	1,800	1,200	27,980
1"	1800	1,900	1,800	3,800	7,900	12,900	14,900	12,200	13,600	19,500	8,300	2,800	101,400
1 1/2"	8200	9,000	6,400	110,400	69,200	30,600	22,800	29,000	102,800	152,200	10,400	5,600	556,600
2"	36600	48,667	47,867	48,067	83,947	106,533	94,000	139,067	134,933	102,200	42,067	39,200	923,147
4" - Irrigation & Pool	-	-	-	7,500	92,500	290,000	550,000	792,500	810,000	365,000	185,500	-	3,093,000
Wholesale City - Outside													
3/4"	500	500	1,000	500	500	-	22,500	21,500	22,000	9,500	2,000	4,000	84,500
1 1/2"	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total Wholesale City													
Total All Classes													

City of Loveland
Total Usage by Customer Class Per Tap Size / Units for Multi-Family
Water Fund - FY 2001

Class and Meter Size	Year End Counts - Units	Measured Total Usage by Month by Tap Size or Number of Units for Multi-Family													Average Usage by Month by Tap Size or Per Unit for Multi-Family												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Avg.
Residential (Inside City)	Y.E. Counts																										
3/4"	16,275	80,972,066	73,242,757	75,706,068	84,160,060	124,337,040	216,556,360	321,296,100	289,668,437	257,136,663	193,863,235	110,659,236	86,752,198	1,914,340,267	4,975	4,500	4,651	5,171	7,639	13,306	19,740	17,797	15,799	11,910	6,799	5,330	117,617
1"	76	542,100	411,900	416,000	462,000	1,097,000	2,313,000	3,821,000	3,317,000	3,157,000	2,421,000	1,057,000	533,000	19,548,000	7,133	5,420	5,474	6,079	14,434	30,434	50,276	43,645	41,539	31,855	13,908	7,013	257,211
2"	-													-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Residential (Outside City)																											
3/4"	932	5,130,000	4,798,000	4,943,000	5,639,111	7,122,880	11,748,000	16,958,800	15,319,200	13,325,000	10,524,000	6,734,000	5,493,000	107,736,000	5,504	5,149	5,304	6,051	7,643	12,605	18,196	16,437	14,297	11,292	7,225	5,894	115,597
1"	3	26,000	22,000	26,000	31,000	29,000	50,000	61,000	56,000	33,000	21,000	23,000	16,000	394,000	8,667	7,333	8,667	10,333	9,667	16,667	20,333	18,667	11,000	7,000	7,667	5,333	131,333
1 1/2"	1	129,000	108,000	89,000	87,000	82,000	80,000	78,000	93,000	69,000	38,000	33,000	35,000	921,000	129,000	108,000	89,000	87,000	82,000	80,000	78,000	93,000	69,000	38,000	33,000	35,000	921,000
2"	2	177,000	154,000	158,000	168,000	156,000	171,000	217,000	178,000	203,000	176,000	163,000	185,000	2,106,000	88,500	77,000	79,000	84,000	78,000	85,500	108,500	89,000	101,500	88,000	81,500	92,500	1,053,000
3"	3	471,000	414,000	437,000	485,000	449,000	646,000	622,000	526,000	547,000	484,000	523,000	718,000	6,322,000	157,000	138,000	145,667	161,667	149,667	215,333	207,333	175,333	182,333	161,333	174,333	239,333	2,107,333
4"	1	725,000	605,000	660,000	740,000	735,000	1,060,000	2,085,000	1,720,000	1,675,000	1,310,000	845,000	810,000	12,970,000	725,000	605,000	660,000	740,000	735,000	1,060,000	2,085,000	1,720,000	1,675,000	1,310,000	845,000	810,000	12,970,000
6"	1	2,256,720	1,813,850	1,992,150	2,251,920	1,930,080	2,318,360	3,816,880	2,799,760	2,926,810	1,747,190	1,958,390	2,116,610	27,927,720	2,256,720	1,813,850	1,992,150	2,251,920	1,930,080	2,318,360	3,816,880	2,799,760	2,926,810	1,747,190	1,958,390	2,116,610	27,927,720
Total Residential	17,295	90,427,886	81,570,507	84,427,208	94,024,081	135,938,018	234,942,720	348,965,780	313,677,397	279,072,473	210,574,425	121,995,686	96,058,808	2,092,264,967													
Multi-Family 2-8 Units	Y.E. Units																										
3/4"	1,569	7,353,111	6,800,889	7,011,000	7,363,000	8,365,000	12,500,000	18,940,000	17,666,300	15,330,811	11,771,894	7,914,996	7,661,000	128,737,000	4,686	4,335	4,468	4,693	5,331	7,967	12,071	11,259	9,809	7,503	5,045	4,883	82,050
1"	1,016	4,567,900	4,188,000	4,330,000	4,397,000	4,876,000	6,909,000	9,376,000	8,585,000	8,594,000	7,347,000	5,181,000	4,952,000	73,302,900	4,496	4,122	4,262	4,328	4,799	6,800	9,228	8,450	8,459	7,231	5,099	4,874	72,149
1 1/2"	225	603,000	663,000	633,000	722,800	1,075,200	1,788,000	2,186,000	2,473,000	3,322,040	1,827,100	801,260	762,465	16,856,865	2,680	2,947	2,813	3,212	4,779	7,947	9,716	10,991	14,765	8,120	3,561	3,389	74,919
2"	8	-	12,000	6,000	16,000	21,000	24,000	27,000	22,000	32,000	47,000	19,000	19,000	245,000	-	1,500	750	2,000	2,625	3,000	3,375	2,750	4,000	5,875	2,375	2,375	30,625
Multi-Family 9+ Units																											
3/4"	83	374,000	364,000	292,000	328,000	272,000	256,000	370,000	364,000	363,000	327,000	271,000	302,000	3,883,000	4,506	4,386	3,518	3,952	3,277	3,084	4,458	4,386	4,373	3,940	3,265	3,639	46,783
1"	283	1,043,000	932,000	842,000	845,000	953,000	1,261,000	1,394,000	1,446,000	1,437,000	1,301,000	1,027,000	1,021,000	13,502,000	3,686	3,293	2,975	2,986	3,367	4,456	4,926	5,110	5,078	4,597	3,629	3,608	47,710
1 1/4"	20	51,000	46,000	50,000	49,000	59,000	70,000	67,000	72,000	74,000	61,000	64,000	67,000	730,000	2,550	2,300	2,500	2,450	2,950	3,500	3,350	3,600	3,700	3,050	3,200	3,350	36,500
1 1/2"	311	1,048,000	1,045,000	1,039,000	1,004,000	1,025,000	1,528,000	2,022,000	2,274,000	2,649,000	2,758,000	2,086,000	1,335,000	19,813,000	3,370	3,360	3,341	3,228	3,296	4,913	6,502	7,312	8,518	8,868	6,707	4,293	63,707
2"	714	1,906,000	1,807,000	1,833,000	1,993,500	2,208,000	3,627,000	5,168,000	4,055,000	4,048,000	3,306,000	2,447,000	2,336,000	34,733,500	2,669	2,531	2,567	2,792	3,092	5,080	7,238	5,679	5,669	4,629	3,427	3,272	48,646
3"	548	1,967,000	1,751,000	1,744,000	1,796,000	1,937,000	2,833,000	3,898,000	3,491,000	3,431,200	2,965,800	2,151,000	1,954,000	29,919,000	3,589	3,195	3,182	3,277	3,535	5,170	7,113	6,370	6,261	5,412	3,925	3,566	54,597
4"	395	1,800,000	1,636,000	1,656,000	1,725,000	1,575,000	2,135,000	3,690,000	3,880,000	3,880,000	3,080,000	2,035,000	1,730,000	28,820,000	4,557	4,139	4,190	4,367	3,987	5,405	9,342	9,823	9,823	7,797	5,152	4,380	72,962
Total Multi-Family	5,177	20,713,011	19,243,889	19,436,000	20,238,300	22,366,200	32,931,000	47,138,000	44,327,300	43,221,051	34,790,794	23,987,256	22,139,465	350,542,265													
Irrigation Accounts - Inside	Y.E. Counts																										
3/4"	74	13,000	13,000	47,000	277,000	1,283,900	2,816,000	4,063,000	4,119,000	3,565,000	2,816,000	942,000	68,000	20,022,900	176	176	635	3,743	17,350	38,054	54,905	55,662	48,176	38,064	12,730	919	270,580
1"	52	30,000	-	1,000	384,000	1,416,000	5,354,300	9,108,000	9,476,000	7,658,000	5,738,000	1,075,000	33,000	40,274,300	577	-	19	7,385	27,231	102,967	175,154	182,231	147,269	110,365	20,673	635	774,506
1 1/2"	11	7,000	1,000	2,000	63,000	1,130,000	3,034,000	5,402,000	4,363,000	5,652,000	2,899,000	544,000	-	23,117,000	636	91	182	5,727	102,727	275,818	491,091	396,455	513,818	263,545	49,455	-	2,101,545
2"	19	1,000	35,000	-	510,000	3,456,000	8,234,000	11,039,000	11,262,000	10,228,000	6,487,900	883,000	126,000	62,351,900	53	1,842	-	26,842	181,895	433,368	581,000	587,474	538,316	341,468	46,474	6,632	2,755,363
3"	2	-	-	-	-	614,500	2,460,000	3,611,000	5,905,000	4,298,000	1,803,000	2,549,000	-	21,240,500	-	-	-	-	307,250	1,230,000	1,805,500	2,952,500	2,149,000	901,500	1,274,500	-	10,620,250
4"	1	-	-	-	-	255,000	980,000	3,320,000	3,815,000	2,995,000	3,045,000	795,000	-	15,205,000	-	-	-	-	255,000	980,000	3,320,000	3,815,000	2,995,000	3,045,000	795,000	-	15,205,000
Wholesale City - Irrigation																											
3/4"	2	-	-	-	-	-	11,000	12,000	7,000	55,000	49,000	2,000	-	136,000	-	-	-	-	-	5,500	6,000	3,500	27,500	24,500	1,000	-	68,000
1"	7	-	-	-	1,000	130,100	546,000	813,000	809,000	736,000	378,000	37,100	-	3,449,200	-	-	-	143	18,586	78,000	116,143	115,571	105,000	54,000	5,300	-	492,743
1 1/2"	-													-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	8	-	-	-	-	244,300	1,819,000	3,142,000	3,195,000	2,690,000	1,562,000	125,000	-	12,777,300	-	-	-	-	30,538	227,375	392,750	399,375	336,250	195,250	15,625	-	1,597,163
3"	1	-	-	-	367,000	507,000	1,302,000	63,000	3,929,000	1,273,000	522,000	-	-	7,963,000	-	-	-	367,000	507,000	1,302,000	63,000	3,929,000	1,273,000	522,000	-	-	7,963,000
4"	-													-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Irrigation Accounts - Outside																											
3/4"	2	-	-	-	16,000	65,000	386,000	318,000	283,000	225,000	99,000	34,000	-	1,426,000	-	-	-	8,000	32,500	193,000	159,000	141,500	112,500	49,500	17,000	-	713,000
1 1/2"	1	-	-	-	-	-	88,000	657,000	884,000	817,000	740,000	150,000	-	3,336,000	-	-	-	-	-	88,000	657,000	884,000	817,000	740,000	150,000	-	3,336,000
Total Irrigation	180	51,000	49,000	50,000	1,618,000	9,101,800	27,030,300	41,548,000	48,157,000	40,191,000	26,139,000	7,136,100	227,000	201,299,100													
Commercial - Inside no WQC																											
3/4"	496	4,482,400	4,647,011	4,584,869	4,680,700	4,879,657	6,375,370	8,785,300	9,995,380	9,991,600	8,907,400	6,147,000	5,321,680	78,798,287	9,037	9,369	9,244	9,437	9,838	12,854	17,712	20,152	20,144	17,958	12,393	10,729	158,868
1"	135	4,937,000	4,360,000	4,858,000	4,826,000	5,639,000	7,293,000	8,356,100	7,945,100	7,997,100	7,232,300	5,826,900	5,266,500	74,537,000	36,570	32,296	35,985	35,748	41,770	54,022	61,897	58,853	59,238	53,573	43,162	39,011	552,126
1 1/2"	60	3,749,500	3,472,000	3,887,000	4,224,000	5,048,000	6,467,000	7,461,000	8,025,000	8,019,700	6,506,300	4,481,000	3,859,620	65,260,120	62,492	57,867	64,783	70,400	84,133	107,783	124,350	133,750	133,662	108,438	74,683	64,327	1,087,669
2"	44	3,046,000	2,824,000	3,205,000	3,013,000	3,797,000	7,881,000	11,055,000	9,940,000	8,088,000	6,134,000	3,712,000	3,216,000	65,910,000	69,227	64,182	72,841	68,477	86,295	179,114	251,250	225,909	183,818	139,409	84,364	73,068	1,497,955
3"	9	2,371,500	2,366,900	2,898,000	3,078,900	2,702,800	3,115,700	4,087,900	4,539,640	5,571,700	4,756,900	3,261,300	2,876,800	41,628,040	263,500	262,989	322,000	342,100	300,311	346,189	454,211	504,404	619,078	528,544	362,367	319,644	4,625,338
4"	6	1,075,000	1,065,000	985,000	1,015,000	930,000	890,000	945,000	925,000	1,375,000	945,000	1,130,000	750,000	12,030,000	179,167	177,500	164,167	169,167	155,000	148,333	157,500	154,167	229,167	157,500	188,333	125,000	2,005,000
6"	2	960,000	1,120,000	1,000,000	1,280,000	1,260,000	1,420,000	1,490,000	1,290,000	1,190,000	1,080,000	950,000	890,000	13,930,000	480,000	560,000	500,000	640,000	630,000	710,000	745,000	645,000	595,000	540,000	475,000	445,000	6,965,000
Commercial - Inside with WQC																											
3/4"	77	489,000	483,000	497,000	608,000	914,000	1,715,000	2,882,120	3,276,000	3,145,000	2,453,000	1,336,000	629,000	18,427,120	6,351	6,273	6,455	7,896	11,870	22,273	37,430	42,545	40,844	31,857	17,351	8,169	239,313
1"	27	476,000	482,000	505,000	471,000	700,000	1,630,000	3,434,000	2,736,000	2,374,000	2,039,000	979,000	450,000	16,276,000	17,630	17,852	18,704	17,444	25,926	60,370	127,185	101,333	87,926	75,519	36,259	16,667	602,815
1 1/2"	17	312,000	303,000	360,000	296,000	692,000	1,636,000	2,543,000	2,526,000	2,329,000	1,785,000	532,000	265,000	13,579,000	18,353	17,824	21,176	17,412	40,706	96,235	149,588	148,588	137,000	105,000	31,294	15,588	798,765
2"	20	1,313,000	1,231,000	1,249,000	1,574,000	1,943,000	4,119,000	6,561,000	7,448,000	7,311,000	6,208,000	3,054,000	1,559,000	43,570,000	65,650	61,550	62,450	78,700	97,150	205,950	328,050	372,400	365,550	310,400	152,700	77,950	2,178,500
3"	11	362,000	419,200	460,800	440,200	1,604,900	2,562,000	4,616,000	8,091,600	5,248,400	3,581,100	952,900	535,000	28,874,100	32,909	38,109	41,891	40,018	145,900	232,909	419,636	735,600	477,127	325,555	86,627	48,636	2,624,918
4"	2	135,000	130,000	150,000	130,000	390,000	1,155,000	4,415,000	4,145,000	1,965,000	2,050,000	310,000	150,000	15,125,000	67,500	65,000	75,000	65,000	195,000	577,500	2,207,500	2,072,500	982,500	1,025,000	155,000	75,000	7,562,500
Commercial - Outside (No Sewer)																											
3/4"	62	633,770	598,360	598,640	675,720	850,280	1,352,790	1,379,860	1,610,360	1,342,980	1,100,020	736,760	639,240	11,518,770	10,222	9,651	9,655	10,899	13,714	21,819	22,256	25,974	21,661	17,742	11,883	10,310	185,787
1"	15	490,000	431,000	473,000	373,000	332,000	402,000	492,000	452,000	420,000	391,000	362,000	371,000	4,989,000	32,667	28,733	31,533	24,867	22,133	26,800	32,800	30,133	28,000	26,067	24,133	24,733	332,600
1 1/2"	1	372,000	270,000	374,000	269,000	187,000	205,000	274,000	218,000	265,000	202,000	199,000	227,000	3,062,000	372,000	270,000	374,000	269,000	187,000	205,000	274,000	218,000	265,000	202,000	199,000	227,000	3,062,000
2"	2	62,000	65,000	63,000	58,000	117,000	222,000	221,000	176,000	164,000	173,000	56,000	68,000	1,445,000	31,000	32,500	31,500	29,000	58,500	111,000	110,500	88,000	82,000	86,500	28,000	34,000	722,500
4"	1	30,000	20,000	30,000	40,000	40,000	30,000	50,000	40,000	20,000	10,000	20,000	10,000	340,000	30,000	20,000	30,000	40,000	40,000	30,000	50,000	40,000	20,000	10,000	20,000	10,000	340,000
Total Commercial	987	25,296,170	24,287,471	26,178,329	27,052,520	32,026,637	48,470,860	69,048,270	73,379,080	66,817,480	56,614,020	34,045,860	27,082,840	509,299,537													
Industrial - Industrial Rate																											
1 1/2"	-													-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2"	1	19,000	21,000	21,000	23,000	13,000	23,000	27,000	30,000	32,000	33,000	19,000	19,000	280,000	19,000	21,000	21,000	23,000	13,000	23,000	27,000	30,000	32,000	33,000	19,000	19,000	280,000
3"	1	1,594,000	1,994,000	1,950,000	2,497,000	2,503,000	3,097,000	3,564,000	3,719,000	3,573,000	3,712,000	2,627,000	3,307,000	34,137,000	1,594,000	1,994,000	1,950,000	2,497,000	2,503,000	3,097,000	3,564,000	3,719,000	3,573,000	3,712,000	2,627,000	3,307,000	34,137,000
Industrial - Wholesale Rate																											
3"	1	1,000	8,000	-	-	1,000	4,000	277,000	926,000	136,000	46,000	5,000	3,000	1,407,000	1,000	8,000	-	-	1,000	4,000	277,000	926,000	136,000	46,000	5,000	3,000	1,407,000
4" - Outside	1	524,000	646,000	600,000	697,000	1,447,000	423,000	3,959,000	3,616,000	4,600,000	3,524,000	1,110,000	815,000	21,961,000	524000	646,000	600,000	697,000	1,447,000	423,000	3,959,000	3,616,000	4,600,000	3,524,000	1,110,000	815,000	21,961,000
Total Industrial	4	2,138,000	2,669,000	2,571,000	3,217,000	3,964,000	3,547,000	7,827,000	8,291,000	8,341,000	7,315,000	3,761,000	4,144,000	57,785,000													
Wholesale City - Inside																											
3/4"	5	8,000	8,000	6,000	12,000	15,000	28,000	43,000	43,000	32,000	31,000	18,100	16,000	260,100	1600	1,600	1,200	2,400	3,000	5,600	8,600	8,600	6,400	6,200	3,620	3,200	52,020
1"	10	11,000	11,000	12,000	26,900	59,000	164,000	200,000	226,000	205,000	96,000	30,400	113,900	1,155,200	1100	1,100	1,200	2,690	5,900	16,400	20,000	22,600	20,500	9,600	3,040	11,390	115,520
1 1/2"	5	29,000	32,000	33,000	50,200	342,000	275,000	131,000	126,000	113,000	216,000	272,000	30,000	1,649,200	5800	6,400	6,600	10,040	68,400	55,000	26,200	25,200	22,600	43,200	54,400	6,000	329,840
2"	15	661,000	811,000	802,000	811,000	1,518,000	2,614,000	3,347,000	3,439,000	3,076,000	2,327,000	1,054,000	693,000	21,153,000	44066.6667	54,067	53,467	54,067	101,200	174,267	223,133	229,267	205,067	155,133	70,267	46,200	1,410,200
4" - Irrigation & Pool	2	-	-	-	-	445,000	1,175,000	2,110,000	1,970,000	1,775,000	1,350,000	410,000	-	9,235,000	-	-	-	-	222,500	587,500	1,055,000	985,000	887,500	675,000	205,000	-	4,617,500
Wholesale City - Outside																											
3/4"	1	1,000	-	-	-	-	2,000	9,000	1,000	-	1,000	1,000	2,000	17,000	1000	-	-	-	-	2,000	9,000	1,000	-	1,000	1,000	2,000	17,000
1 1/2"	-													-	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total Wholesale City	38	710,000	862,000	853,000	900,100	2,379,000	4,258,000	5,840,000	5,805,000	5,201,000	4,021,000	1,785,500	854,900	33,469,500													
Total All Classes	23,676	139,336,066	128,681,867	133,514,537	147,051,001	206,775,666	361,179,880	520,357,050	493,636,777	442,844,004	338,455,139	192,721,400	151,107,013	3,244,660,389													

Appendix B

Supplemental Sewer Information

City of Loveland
Billed Sewer Flow Analysis by Customer Class by Year
Fiscal Years 2000 Through 2006

	2006				2005				2004				2003			
Class	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.
Residential	4,423	19,314	85,424,941	1,025,099,289	4,189	19,231	80,560,959	966,731,506	4,331	18,508	80,154,658	961,855,894	4,582	17,818	81,821,685	981,860,224
Multi-Family	3,378	6,313	21,327,800	255,933,600	3,357	6,303	21,161,805	253,941,658	3,473	5,923	20,573,384	246,880,608	3,648	5,758	21,003,624	252,043,490
Commercial	33,736	999	33,702,598	404,431,174	30,731	994	30,547,078	366,564,940	29,066	959	27,874,182	334,490,184	33,844	971	32,862,533	394,350,390
Industrial	404,375	4	1,617,500	19,410,000	395,208	4	1,580,833	18,970,000	438,042	4	1,752,167	21,026,000	22,917	1	22,917	275,000
Government - City	52,063	32	1,666,019	19,992,233	50,598	34	1,720,320	20,643,840	53,587	33	1,768,369	21,220,432	55,954	32	1,790,521	21,486,248
Totals	497,975	26,662	143,738,858	1,724,866,296	484,083	26,566	135,570,995	1,626,851,944	528,499	25,427	132,122,760	1,585,473,118	120,955	24,580	137,501,279	1,650,015,352

	2002				2001				2000			
Class	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.	WQA*	Counts**	Billed Flow/mo.	Billed Flow/yr.
Residential	4,878	16,898	82,433,455	989,201,466	4,778	16,281	77,788,969	933,467,633	5,191	15,601	80,981,045	971,772,538
Multi-Family	3,622	5,752	20,833,171	249,998,050	3,855	5,164	19,909,180	238,910,162	3,932	4,984	19,598,072	235,176,862
Commercial	34,042	945	32,169,361	386,032,326	35,182	913	32,121,032	385,452,389	37,276	917	34,182,324	410,187,883
Industrial	22,750	1	22,750	273,000	23,333	1	23,333	280,000	27,250	1	27,250	327,000
Government - City	53,880	31	1,670,282	20,043,388	66,558	31	2,063,283	24,759,396	81,470	30	2,444,104	29,329,252
Totals	119,172	23,627	137,129,019	1,645,548,230	133,706	22,390	131,905,798	1,582,869,581	155,119	21,533	137,232,795	1,646,793,535

	7-Year Average			
Class	WQA	Counts**	Billed Flow/mo.	Billed Flow/yr.
Residential	4,626	17,664	81,309,387	975,712,650
Multi-Family	3,609	5,742	20,629,577	247,554,919
Commercial	33,411	957	31,922,730	383,072,755
Industrial	190,554	2	720,964	8,651,571
Government - City	59,159	32	1,874,700	22,496,398
Totals	291,358	24,398	136,457,358	1,637,488,294

	COS Test Year 2008			
Class	WQA	Counts**	Billed Flow/mo.	Billed Flow/yr.
Residential	4,626	20,245	93,653,370	1,123,840,440
Multi-Family	3,609	6,503	23,471,185	281,654,220
Commercial	33,411	1,053	35,181,783	422,181,396
Industrial	190,554	4	762,214	9,146,571
Government - City	59,159	32	1,893,074	22,716,891
Totals	291,358	27,837	154,961,627	1,859,539,519

* For classes not billed by winter quarter average, the annual usage for the class was divided by twelve.

** Count for Multi-Family class includes number of units, not number of taps.

City of Loveland
Sewer Consumption Summary
Fiscal Years 2000 - 2006

Class and Meter Size	Year End Tap/Units for Multi-Family Counts by Year							See Headers Below for Details							See Headers Below for Details						
	2000	2001	2002	2003	2004	2005	2006	2000	2001	2002	2003	2004	2005	2006	2000	2001	2002	2003	2004	2005	2006
Residential (Inside City)								Average Gallons per Customer per Class per Month by Year							Winter Quarter Average per Month by Customer Class by Year						
3/4"	15,527	16,208	16,825	17,745	18,435	19,153	19,240	5,184	4,773	4,869	4,585	4,326	4,187	4,420	80,488,106	77,367,145	81,926,455	81,365,047	79,740,946	80,189,835	85,034,889
1"	74	73	73	73	73	75	74	6,661	5,778	6,945	6,255	5,645	4,948	5,271	492,939	421,824	507,000	456,638	413,712	371,124	390,052
1 1/2"	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2"	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Residential	15,601	16,281	16,898	17,818	18,508	19,231	19,314	11,845	10,552	11,815	10,841	9,971	9,135	9,691	80,981,045	77,788,969	82,433,455	81,821,685	80,154,658	80,560,959	85,424,941
Multi-Family 2-6 Units								Winter Quarter Average per Customer per Class per Month by Year							Winter Quarter Average per Month by Customer Class by Year						
3/4"	1,569	1,561	1,589	1,530	1,516	1,571	1,581	4,750	4,477	4,491	4,298	4,128	3,838	3,816	7,452,346	6,988,488	7,136,126	6,575,452	6,258,746	6,029,920	6,032,962
1"	1,006	1,016	1,053	1,022	1,034	1,070	1,064	4,292	4,353	4,363	4,035	3,994	3,710	3,881	4,317,409	4,423,034	4,594,096	4,123,600	4,130,022	3,970,148	4,129,008
1 1/2"	185	225	345	453	523	691	704	3,049	2,853	2,201	2,723	2,782	2,695	2,806	564,122	641,862	759,486	1,233,666	1,455,090	1,862,005	1,975,272
2"	-	8	45	8	8	113	124	-	761	856	2,746	2,070	3,066	3,208	-	6,084	38,532	21,970	16,562	346,450	397,826
Multi-Family 9+ Units																					
3/4"	83	83	83	83	83	83	85	3,714	4,194	3,881	4,011	3,771	2,908	2,986	308,256	348,140	322,114	332,930	312,988	241,332	253,838
1"	283	283	283	308	285	285	285	3,482	3,364	3,443	2,797	2,680	2,690	2,476	985,507	952,146	974,454	861,562	763,880	766,584	705,744
1 1/4"	20	20	20	20	20	20	20	2,941	2,484	3,076	2,958	4,157	3,312	3,414	58,812	49,686	61,516	59,150	83,148	66,248	68,276
1 1/2"	239	311	665	665	713	729	730	3,803	3,404	1,950	3,210	3,064	3,193	3,220	908,882	1,058,616	1,296,906	2,134,808	2,184,832	2,327,468	2,350,452
2"	656	714	726	726	798	798	777	2,606	2,625	3,051	3,226	2,438	3,092	2,623	1,709,604	1,874,548	2,215,184	2,342,002	1,945,866	2,467,400	2,037,802
3"	548	548	548	548	548	548	548	3,277	3,369	3,360	3,280	3,716	3,158	3,492	1,795,794	1,846,156	1,841,086	1,797,484	2,036,450	1,730,560	1,913,418
4"	395	395	395	395	395	395	395	3,791	4,355	4,035	3,851	3,508	3,427	3,704	1,497,340	1,720,420	1,593,670	1,521,000	1,385,800	1,353,690	1,463,202
Total Multi-Family	4,984	5,164	5,752	5,758	5,923	6,303	6,313	35,704	36,240	34,707	37,135	36,311	35,089	35,625	19,598,072	19,909,180	20,833,171	21,003,624	20,573,384	21,161,805	21,327,800
Commercial - Inside no WQC								Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average per Account							Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average for Class						
3/4"	484	483	488	494	494	507	499	14,246	13,212	12,799	11,820	11,792	11,862	12,299	6,895,183	6,381,366	6,374,004	5,839,167	5,825,067	6,014,050	6,137,077
1"	132	134	140	145	140	147	148	49,813	46,174	43,682	38,906	37,028	41,844	45,137	6,575,250	6,187,333	6,115,439	5,641,317	5,183,867	6,151,117	6,680,240
1 1/2"	54	57	63	65	62	65	65	102,331	91,069	84,046	74,006	78,852	76,929	80,416	5,525,875	5,190,927	5,294,917	4,810,333	4,888,833	5,000,408	5,227,017
2"	43	41	43	50	49	51	63	123,507	113,341	107,555	114,260	97,153	114,988	118,285	5,310,817	4,647,000	4,624,867	5,713,000	4,760,500	5,864,385	7,451,973
3"	8	9	10	9	9	11	10	383,342	385,445	443,848	442,583	226,880	198,089	249,237	3,066,733	3,469,003	4,438,475	3,983,250	2,041,917	2,178,975	2,492,366
4"	6	6	6	6	5	5	5	228,181	167,083	122,500	109,444	96,500	117,250	122,250	1,369,083	1,002,500	735,000	656,667	482,500	586,250	611,250
6"	3	2	2	1	2	3	3	414,928	580,417	412,083	534,167	347,083	280,000	368,417	1,244,783	1,160,833	824,167	534,167	694,167	840,000	1,105,250
Commercial - Inside with WQC								Winter Quarter Average per Customer per Class per Month by Year							Winter Quarter Average per Month by Customer Class by Year						
3/4"	81	77	77	83	83	90	89	5,838	6,448	6,260	6,064	6,398	6,349	5,951	472,862	496,522	481,986	503,282	531,030	571,427	529,646
1"	27	27	26	26	29	29	29	15,623	18,315	12,675	18,421	12,774	12,104	12,218	421,824	494,494	329,550	478,946	370,440	351,022	354,325
1 1/2"	17	17	17	18	19	18	20	18,292	19,385	15,449	18,543	21,410	20,335	20,559	310,960	329,550	262,626	297,778	406,798	366,023	411,185
2"	20	20	20	20	20	21	22	68,698	64,102	64,474	80,613	61,421	62,454	64,904	1,373,967	1,282,034	1,288,470	1,612,280	1,228,411	1,311,540	1,427,891
3"	11	11	12	12	11	11	10	48,226	38,163	35,825	144,042	45,325	43,955	48,814	530,491	419,796	429,902	1,728,498	498,576	483,510	488,137
4"	2	2	2	2	2	2	3	71,825	70,135	66,755	58,305	67,693	57,344	42,532	143,650	140,270	133,510	116,610	135,386	114,687	127,596
Commercial - Outside no WQC								Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average per Account							Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average for Class						
3/4"	16	15	16	25	21	22	21	24,126	24,360	19,474	15,024	17,630	17,204	17,930	386,019	365,398	311,583	375,608	370,233	378,486	376,523
1"	10	9	10	12	10	9	8	30,258	27,574	21,167	24,535	26,442	16,083	10,240	293,833	248,167	211,667	294,417	266,167	144,750	81,917
1 1/2"	1	1	1	1	1	1	1	188,167	255,167	270,083	229,333	150,083	149,667	142,583	188,167	255,167	270,083	229,333	150,083	149,667	142,583
2"	1	1	1	1	1	1	1	55,917	32,083	27,917	31,000	24,667	22,667	22,750	55,917	32,083	27,917	31,000	24,667	22,667	22,750
4"	-	-	-	-	-	-	1	-	-	-	-	-	-	20,833	-	-	-	-	-	-	20,833
Commercial - Outside with WQC								Winter Quarter Average per Customer per Class per Month by Year							Winter Quarter Average per Month by Customer Class by Year						
1"	1	1	1	1	1	1	1	16,900	18,590	14,196	16,900	15,541	18,115	14,040	16,900	18,590	14,196	16,900	15,541	18,115	14,040
Total Commercial	917	913	945	971	959	994	999	1,860,217	1,971,063	1,780,787	1,965,965	1,344,671	1,267,239	1,419,394	34,182,324	32,121,032	32,169,361	32,862,533	27,874,182	30,547,078	33,702,598
Industrial - Industrial Rate								Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average per Account							Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average for Class						
1 1/2"	-	-	-	-	1	1	1	-	-	-	-	20,083	17,500	16,750	-	-	-	-	20,083	17,500	16,750
2"	1	1	1	1	2	2	2	27,250	23,333	22,750	22,917	25,625	30,833	32,875	27,250	23,333	22,750	22,917	51,250	61,667	65,750
3"	-	-	-	-	1	1	1	-	-	-	-	1,680,833	1,501,667	1,535,000	-	-	-	-	1,680,833	1,501,667	1,535,000
Total Industrial	1	1	1	1	4	4	4	27,250	23,333	22,750	22,917	1,726,542	1,550,000	1,584,625	27,250	23,333	22,750	22,917	1,752,167	1,580,833	1,617,500
Wholesale City - Inside no WQC								Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average per Account							Submitted in Annual Gallons - Divided by 12 to Determine Monthly Average for Class						
3/4"	3	3	3	3	3	3	3	2,639	3,725	2,303	2,778	2,250	2,333	1,528	7,917	11,175	6,908	8,333	6,750	7,000	4,583
1"	8	10	10	10	11	13	11	12,089	9,627	8,450	10,133	14,336	15,103	17,242	96,708	96,267	84,500	101,333	157,700	196,333	189,667
1 1/2"	4	4	4	4	4	4	4	105,454	30,963	54,417	15,625	15,000	16,333	22,125	421,817	123,850	217,667	62,500	60,000	65,333	88,500
2"	11	10	10	10	10	10	9	113,032	120,968	90,892	100,967	111,825	89,417	89,260	1,243,350	1,209,683	908,917	1,009,667	1,118,250	894,167	803,336
4"	-	-	-	1	1	-	-	-	-	-	131,583	10,000	-	-	-	-	-	131,583	10,000	-	-
4" - Pool Flat Rate	1	1	1	1	1	1	1	651,667	600,000	419,167	457,500	390,833	543,067	524,167	651,667	600,000	419,167	457,500	390,833	543,067	524,167
Wholesale City - Inside with WQC								Winter Quarter Average per Customer per Class per Month by Year							Winter Quarter Average per Month by Customer Class by Year						
3/4"	1	1	1	1	1	1	1	4,056	3,380	3,380	3,380	2,944	2,448	2,674	4,056	3,380	3,380	3,380	2,944	2,448	2,674
1 1/2"	1	1	1	1	1	1	1	10,478	11,492	21,970	10,478	16,714	7,020	7,020	10,478	11,492	21,970	10,478	16,714	7,020	7,020
2"	1	1	1	1	1	1	1	8,112	7,436	7,774	5,746	5,178	4,952	5,290	8,112	7,436	7,774	5,746	5,178	4,952	5,290
Wholesale City - Outside with WQC								Winter Quarter Average per Customer per Class per Month by Year							Winter Quarter Average per Month by Customer Class by Year						
1 1/2"	-	-	-	-	-	-	1	-	-	-	-	-	-	40,783	-	-	-	-	-	-	40,783
Total Wholesale City	30	31	31	32	33	34	32	907,526	787,591	608,352	738,190	569,081	680,673	710,088	2,444,104	2,083,283	1,670,282	1,790,521	1,768,369	1,720,320	1,666,019
Total All Classes	21,533	22,390	23,627	24,580	25,427	26,566	26,662	2,842,542	2,828,779	2,458,410	2,775,047	3,686,575	3,542,136	3,759,423	137,232,795	131,905,798	137,129,019	137,501,279	132,122,760	135,570,995	143,738,858

Section 8 – Technical Support Appendices

Appendix 8.K **Air Quality Permit**

The City has applied for construction permits for the WWTP as discussed in Section 4.6, but has not received any permits to date. The most recent correspondence regarding air permitting is enclosed.

CITY OF LOVELAND
DEPARTMENT OF WATER & POWER
SERVICE CENTER
200 North Wilson, Bldg. #1 • Loveland, Colorado 80537
(970) 962-3000 • (970) 962-3400 FAX • (970) 962-2620 TDD

11/13/2009

Mr. Michael J. Harris, P.E.
Stationary Sources Program
Air Pollution Control Division
Colorado Department of Public Health and Environment
APCD-SS-B1
4300 Cherry Creek Drive South
Denver, CO 80246-1530

RE: Facility Wide Permit Application #09LR0212
City of Loveland Wastewater Treatment Facility

Dear Mr. Harris:

As you may remember, we have recently completed a construction project at our Wastewater Treatment Plant which included the installation of a 1,482 hp Cummins generator for emergency backup power and for use in peak shaving. This project started in early November of 2007. At that time it was anticipated that a separate APEN for this generator was all that was required to operate this generator as facility wide emissions based on APEN reportable sources were below permitting levels and therefore didn't require a permit. However, that same month the Denver ozone non-attainment zone was redefined and the area surrounding our plant was included in the new non-attainment zone. With the lowered permitting levels associated with inclusion in the non-attainment zone, facility emission totals were then above permitting levels for VOCs. This required us to submit a facility wide air permit application. Along with the new 1,000 KW Cummins generator, this permit application included reclassifying the use of our existing 600 KW Cummins generator to include peak shaving along with emergency backup power and the inclusion of our plant in the non-attainment area required us to submit a facility wide air permit application. You kindly advised us that we could qualify as a synthetic minor contributor by agreeing on limitations on the total hours of use for these two generators. You also requested updated APEN's for the waste gas flare (02LR0076) and the Wastewater Treatment facility (96LR431).

I updated all APENS's for all sources at our facility. Where appropriate, they are based on actual 2008 data. Additionally, to satisfy the energy demand management goals of our Power Division, this updated application requests operating hours of 800 hours/year for the both generators.

Our consulting engineers, CH2M Hill, reviewed this application and noted a discrepancy in the AIR ID numbers for the Digester Flare source, 02LR0076, and the Wastewater Treatment source, 96LR431. Both APEN's had AIR ID number 089/0076/001. Additionally, the old generator, ENG01 - #04LR0076, has the AIR ID 069/0308/003. My research indicates that this air ID was assigned to the Wastewater Treatment source, 96LR431, in the 1992 APEN submittals from our facility. We are thus requesting that your department review AIR ID numbers in this submittal and correct or reissue AIR ID numbers as you deem necessary.

I also wanted to reassure you that we are not using the new 1,000 KW generator for peak shaving or emergency backup yet. We are still installing the programming for the peak shaving mode and working on operating procedures. During generator testing while installation was taking place, several problems with equipment restarting was observed. We have reprogrammed much of this sequence and are awaiting approval from the Air Pollution Control Division to proceed further.

Should you have any questions regarding the application, please contact me at (970) 962-2572.

Sincerely,

Michael McCrary
Wastewater Treatment Plant Manager

Enclosure

CC: Steve Adams, Water Utilities Manager
Bob Miller, Power Operations Manager

Section 8 – Technical Support Appendices

Appendix 8.L **Odor Control Studies**

The most recent odor management study for the WWTP from 2005 is enclosed.

City of Loveland colorado

Department of Water & Power

Wastewater Treatment Plant Odor Management Phase 2

Project W428HG

Final Report

Prepared by

CH2MHILL

May 2005

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Executive Summary

This Odor Management Plan presents the results of the odor impact assessment conducted by CH2M HILL for the City of Loveland's Wastewater Treatment Plant (WWTP). The objectives of this odor assessment were to determine the treatment plant's baseline odor impacts to the surrounding community and evaluate potential odor control improvements.

An assessment of the WWTP's odor impacts on the surrounding area was conducted with extensive sampling and odor dispersion modeling. The results of the modeling were used to quantify the WWTP's odor impact, to prioritize the potential odor sources, and to develop a phased list of capital improvements that the City will implement as-needed to reduce the offsite impacts and comply with State of Colorado regulations.

Setting Odor Prevention and Control Criteria

A key objective to a successful odor assessment and control program is to determine what level of odor will cause an odor nuisance response by the public, and then control odors to levels lower than these thresholds. It is not reasonable to expect that a treatment plant will never have odors. Neighbors of treatment plants will typically tolerate odors for small portions of time. Treatment plants located in residential communities typically have odor goals of ranging from 4 to 20 dilutions-to-threshold (D/T), with an allowance of 100 hours per year to exceed the threshold. The allowance is to provide a margin of error. Under normal operating conditions the plant is expected to meet its odor threshold. However, plant upsets and equipment failures can and do occur. These abnormal operations would be acceptable within the time period allotted for the allowable hours above the threshold. Commercial/industrial communities typically have odor goals of 20 D/T or higher, with a similar allowance of 100 hours a year to exceed the threshold.

The State of Colorado (State) regulates odors under Regulation 2, Part A – General Provisions. The regulation states that there should be no detectable odors at the site of odor impact after the odorous air is diluted by 7 volumes of odor-free air or more where the land use is either predominantly commercial or residential. For all other land uses the dilution is 15 odor-free air volumes or more. Since the City's WWTP is adjacent to many residential areas, 7 dilutions to threshold (D/T) is the appropriate criterion for the WWTP. To determine compliance with this regulation, the State does not perform any routine sampling of odors. Any testing done by the State would likely be done as the result of a complaint. When the State does come out to sample, they would determine compliance if two samples exceed the standard within a one-hour period.

As part of this Odor Management Project, CH2M HILL has developed an odor control capital improvement program that should allow the City to comply with the State Standard. Due to the conservative nature of the analysis conducted, CH2M HILL recommends that the improvements recommended meet a model-predicted odor control goal that the odor emissions will be less than 7 dilutions-to-threshold (D/T) 99 percent of the time.

Baseline Modeling

The baseline or current odor modeling assessment used emission rates obtained from the two odor sampling events conducted at the Loveland WWTP during 2003 and 2004. The purpose of the two sampling events was to capture the main odor generation periods when the City tends to see the most odor complaints, summer and fall. The first sampling was conducted with the Jerome 631-X hydrogen sulfide (H_2S) analyzer. This sampling event collected H_2S concentration data during 30 sampling rounds from October 2 to October 23, 2003. The second sampling event was conducted using an Environmental Protection Agency (EPA)-approved flux chamber to capture the odor emissions from the plant processes. This was a one-day sampling event conducted on June 2, 2004. Laboratory measurements of ammonia, reduced sulfur compounds, and odor (analysis by an odor panel) were obtained. The sampling results indicate that the odor from the Loveland WWTP is caused by more than just H_2S. To account for the combined effect of all odorous compounds, odor was modeled instead of just H_2S.

CH2M HILL entered odor emission rates from the source sampling and source parameters into an odor dispersion model, Industrial Source Complex – Short Term Version 3 (ISCST3). This model predicted off-site odor impacts at numerous receptor locations surrounding the Loveland WWTP site. Five years of meteorological data from Fort Collins-Loveland Airport were initially evaluated (1999 – 2003); 2003 was the year that resulted in the highest off-site impacts. Therefore, only 2003 meteorological conditions were modeled in subsequent model runs. It is standard practice to use meteorological data from the nearest airport when the local site does not have an on-site meteorological station; however, there may be some slight differences in wind speed and direction due to local topography at the Loveland WWTP.

The baseline odor assessment included all of the treatment processes that are typically on-line in the summer. Two scenarios were modeled based on the two sampling events, capturing the seasonal periods when odor complaints are received: "worst-case" and "one-day". Both baseline model results were compared to the odor threshold of 7 dilutions-to-threshold (D/T), which is consistent with the State of Colorado standard.

Worst-Case Baseline: Jerome meter sampling data as the model input. Jerome meter sampling was conducted over a three-week period. The highest concentrations for each source were selected to represent the worst-case scenario.

One-Day Baseline: Based on flux chamber sampling data as the model input. The flux chamber sampling was conducted on a single day.

The worst-case baseline is considered a worst-case because the sampling event took place in the fall, when odor complaints tend to be highest, and the highest emissions sampled over a period of three weeks were selected. In addition, the worst-case baseline uses H_2S emissions converted into total odor (D/T) while the one-day baseline uses D/T sampled from the main odor sources. The method of conversion (explained in more detail in the main report) adds some additional conservatism to the worst-case baseline. The one-day baseline may be closer to an overall average, or more "typical" day. The sampling was conducted on a single-day, with some of the sources sampled in the early morning. There may also be some differences in results due to type of measurement tool used, time of sampling event, and plant loading/operating conditions, but using the worst-case baseline to prioritize the odor sources will provide the highest odor emissions potential. Under normal or average conditions, the plant's odors will be much lower, and even lower with controls. This conservative approach helps to ensure that the recommendations made will reduce the off-site impacts significantly.

Baseline Results

The worst-case baseline (based on the Jerome meter sampling) which includes the odor impact from all the existing sources at the Loveland WWTP and is based on a 5-minute averaging period, shows the isopleths, or contours, with the hours of yearly exceedance of an odor standard of 7 D/T. This baseline is illustrated in Figure 1. There is a significant off-site area that can perceive the 7 D/T or higher odor levels greater than 100 hours per year. A similar isopleth was created for the one-day baseline (flux chamber sampling) modeling results, shown in Figure 2. The one-day baseline represents a typical day without much noticeable odors in the community surrounding the Loveland WWTP. It shows much smaller impact area focused on the north end of the plant. As described above, the worst-case baseline is intended to capture the worst possible odor impact and is a more conservative approach, which explains the much larger odor impact.

The highest off-site odor impacts from both baseline models were tabulated by odor source to assess their contribution to off-site impacts. This information also allows control efficiency requirements for each odor source to be determined for the plant to meet the odor standard. Table ES-1 presents the maximum 5-minute odor impacts and maximum annual average odor impacts expressed as D/T for each major odor source. The maximum 5-minute odor impacts is the highest D/T predicted at an off-site receptor (location surrounding the plant site) and the annual average D/T is average D/T predicted at an off-site receptor. Figure 3 shows the receptors where the highest maximum 5-minute D/T occurred for all sources combined (Receptor A) and where the highest annual average exceedence occurred for all sources combined (Receptor B). The ratio of the maximum annual odor to the maximum 5-minute odor, peak-to-mean ratio, is a parameter indicating the frequency of the maximum odor occurrence, and is also shown in the table. Note that the maximum odor source impacts are not cumulative because they occur at different times and locations.

TABLE ES-1
Maximum 5-Minute and Annual Average Odor Impacts from Existing Sources at Fenceline Receptors

	Worst-Case Baseline (Jerome Meter Data)			One-Day Baseline (Flux Chamber Data)		
Source Group	**Max 5-min D/T**	**Avg Annual D/T**	**Peak-to-Mean (5-min D/T)/ (Annual D/T)**	**Max 5-min D/T**	**Avg Annual D/T**	**Peak-to-Mean (5-min D/T)/ (Annual D/T)**
All Source	1,128	20.3	55	136	2.2	61
Digester Boiler Room Vent	1,000	18.0	56	67	1.2	56
Aerated Grit Basin	857	3.5	242	71	0.3	238
DAFT	233	0.8	293	50	0.2	293
Trickling Filter	174	1.3	132	70	0.5	133
Screw Pumps	163	1.5	107	18	0.2	107
Primary Clarifier	146	0.7	197	49	0.3	159
Flare	79	0.6	134	3	0.0	135
Headworks Door	30	0.5	63	3	0.0	63
Aeration Basins	28	0.4	69	81	1.0	81
Headworks Building Exhaust	5	0.1	70	1	0.0	69
Digesters	1	0.0	98			
Biosolids Loading	0	0.0				

Predictions based on 2003 surface meteorological data from Fort Collins-Loveland Airport.

Model output was converted to 5-minute average concentrations using a factor of 1.64.

For the worst-case baseline, the maximum combined 5-minute odor impact from all the sources was 1,128 D/T, which is significantly higher than the odor threshold of 7 D/T. The maximum combined 5-minute odor impact from the digester boiler room vent was 1,000 D/T at the fenceline. The digester boiler room vent is the most significant contributor to the off-site odor impact in terms of strongest odors. The next source having the highest maximum 5-minute odor impact is the aerated grit chamber, which generated 857 D/T of maximum 5-minute odor impact at the fenceline. The ratio of maximum 5-minute odor to the maximum annual odor at the digester boiler room vent was only 56, suggesting the mean impact from this source is almost as significant as the peak impact. In contrast, the peak-to-mean ratio for the aerated grit basin was 242, suggesting that this odor source is less chronic and more acute in nature.

The baseline results from both scenarios are much higher than the state standard of 7 D/T, which is an extremely stringent odor threshold to attain and maintain over an entire year. In the worst-case baseline, the worst-case odor emission rates were used and applied over the entire year, regardless of seasonal conditions. This approach ensures that the highest potential odor release scenarios are covered and that the plant will normally have odor emissions that are well below these conservative estimates, with the odor controls recommended.

The ranking of the odor sources was based on the maximum 5-minute odor strength (D/T) and the peak-to-mean ratio analysis from the Worst-Case baseline model. Figure 4 summarizes the ranking of the major odor sources at the plant. The remainder of the analyses conducted were focused on the Worst-Case baseline since those odor impacts are more consistent with the odor complaints from the surrounding community.

Modeling of Odor Control Alternatives

With the major odor sources identified using the baseline modeling, odor control alternatives were considered to reduce the odor emissions from the major sources. The baseline model was then revised to represent the off-site odor impact changes due to an odor control improvement. Seven odor control scenarios were modeled in this analysis to investigate the effect of positively controlling the odor sources. The odor control improvements either eliminate the identified big odor sources completely, such as the trickling filters, or convert the major odor sources into the odor control scrubbers that emit significantly less odor, such as the chemical scrubber treating the Headworks and grit chambers at Stage 4. The major sources controlled were selected based on the prioritization in baseline modeling. The conditions represented in these seven odor control scenarios are shown below in Table ES-2. The check marks indicate which proposed odor control improvements (shown in rows) were modeled in each control scenario (shown in columns).

As shown later in the report (Figures 16-22), the control modeling results show that odor control approaches represented in Stages 1 through 7 can drastically reduce the off-site impacts to levels of insignificance outside the plant fenceline. The modeling results predict that the Loveland WWTP would meet their desired odor control goal of less than 7 D/T 99 percent of the time at Stage 7. However, due to the conservative nature of the modeling analysis, CH2M HILL recommends that the City implement Stages 1 through 5 to meet the State Standard. At that point, the City should continue to monitor their progress to see if additional odor control is required.

TABLE ES-2
Conditions Represented in the Odor Control Modeling

Odor Control Project	Description	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Trickling Filters	Discontinue the use of trickling filters.	✓	✓	✓	✓	✓	✓	✓
Digester Boiler Room Vent	Eliminate the fugitive odors being collected in the HVAC exhaust		✓	✓	✓	✓	✓	✓
Aerated Grit Chamber	Cover aerated grit chamber and install a new carbon unit to treat the air from grit chamber (95% odor removal)			✓	✓	✓	✓	✓
Headworks Building	Ventilate new or modified Headworks building at 12 ACH. Provide a new chemical scrubber to treat the air from both the aerated grit chamber and the Headworks building (99% odor removal). Replace screw pumps or cover and ventilate to the odor control scrubber.				✓	✓	✓	✓
DAFT	Maintain negative pressure inside DAFT by providing 12 ACH ventilation. Add a new carbon unit to treat the air from DAFT (95% odor removal)					✓	✓	✓
Primary Clarifiers	Cover and vent primary clarifiers to odor control scrubber (95% removal efficiency)						✓	✓
Aeration Basins and Digesters	Cover and vent aeration basins to odor control scrubber (95% removal efficiency). Provide odor control for digesters with fixed roof tanks.							✓

Liquid Phase Treatment

Literature and CH2M HILL's experience indicates that liquid phase treatment of odor generating compounds in the collection system forms a cost effective component of multi-phased odor management plans for wastewater treatment facilities when the influent dissolved sulfide concentrations exceed 1.0 milligrams per liter (mg/L). For the City's collection system, the modeling and sampling conducted indicate that the City has influent wastewater dissolved sulfide concentrations greater than 5 mg/L.

The analysis conducted indicates that the Boyd Interceptor and Boyd Relief Interceptor contribute most to the sulfides at the plant. The Southside Interceptor contributes a small portion of the overall sulfide loading to the plant, but the sampling program showed that the forcemain discharge generates high peak hydrogen sulfide concentrations within the Headworks area. These peaks likely generate short-term odor releases that could lead to odor complaints. CH2M HILL recommends an odor management strategy that addresses both of these contributors.

CH2M HILL has considered several sulfide control options. Ferric Chloride addition has the second highest life-cycle costs and ranks third in the non-economic evaluation. Ferric chloride requires special handling procedures and is a corrosive product. Bioxide™ provides the lowest life-cycle cost, but may require more stations than ferric chloride. However, the product is relatively harmless and does not have the same handling and storage requirements. The Town of Castle Rock, Colorado has used Bioxide™ to control odors in their interceptors. There are also numerous Bioxide-equivalent products that can be used.

CH2M HILL recommends that the City begin with Bioxide™ (or equivalent) on the basis that it is the most cost effective and will be added at the lift stations, which will provide an additional benefit of corrosion control in the collection system. The City should consider contacting Castle Rock, Colorado staff regarding their Bioxide™ program and its success. The following approach is suggested for proceeding with the liquid phase, sulfide control program:

1. Conduct a pilot test with Bioxide™ (or equivalent) being added at the Eastside lift station. During the pilot test, conduct sampling of both the dissolved sulfide levels of the influent and the H_2S concentrations at the odors sources.
2. If the pilot test is effective, implement permanent Bioxide™ (or equivalent) dosing stations for Boyd systems first (Eastside and Boyd Lake lift stations), then addresses the smaller contributors should further odor reductions be needed.
3. If the Bioxide™ is not effective, conduct a pilot test with another liquid phase treatment chemical, such as ferric chloride.
4. Commit to a data collection program that will allow stakeholders to evaluate the impact of the proposed mitigation measures. The data collection program would involve monthly sampling of the dissolved sulfide levels at the influent, as well as sampling the odor sources for H_2S using a Jerome meter.

Recommendations

A summary of the recommended long-term improvements, with cost estimates, are included in Table ES-3. CH2M HILL recommends that the City plan to incorporate Stages 1 through 5 in their current CIP, at a capital cost of $1.3 million. It is anticipated that this level of odor control will meet the State Standard, given the conservative nature of the analysis. For the City to have a zero odor emissions plant, Stage 6 and 7 would be necessary, and the additional the cost would be approximately $5 million Therefore, to meet the State Standard, the cost would be $1.3 million and the cost to meet a zero odor emissions goal would be $6.3 million total.

The average annual costs are also estimated in Table ES-3. For future operations at the Loveland WWTP with full scale odor control, the annual operating costs for odor control could be as high as 5 to 15 percent of the annual operating budget. This is what a typical WWTP spends on odor control.

The cumulative odor reduction to be expected from each odor control stage, including liquid phase treatment, is shown in Figure 5. It is assumed that liquid phase treatment is implemented after the trickling filter is taken off-line (Stage 1) and the digester boiler room HVAC intake vent is relocated (Stage 2). For Stages 3 through 7, the predicted odor reduction is shown for each stage with and without the cumulative impact of liquid phase treatment. As additional odor control improvements are implemented, the additional odor reduction impact of liquid phase treatment becomes insignificant. However, liquid phase treatment continues to have benefit by reducing the chemical requirements for the odor control scrubbers.

Plant emissions are variable and so are removal efficiencies of odor control systems. After each phase of capital improvements, the sources should be re-sampled and the odor dispersion model re-run to predict the current plant conditions. This will enable the City to assess the effectiveness of the phased recommendations and confirm if all the capital improvements below are required, or if there are other new odor sources that require control. The cost of a Jerome meter is included in Odor Control Stage 3 so the City can conduct the confirmation sampling. The effort to re-run the dispersion model is included in Stage 4 to confirm the odor control benefits of the stages up through Stage 4. The long-term recommendations provided in Table ES-3 may or may not be necessary in the future, and careful evaluation should be performed before implementation.

Prior to this study, the City was already planning to implement odor control improvements to help reduce the off-site odor impacts. Table ES-4 presents a comparison of the odor control improvements to the City's current five year capital improvement projects (CIP) intended for odor control. It is recommended that the City update their CIP to be consistent with the recommendations presented in Table ES-3 when they conduct the annual review of the CIP.

The City currently has a total of approximately $850,000 set aside for odor control improvements during 2005 through 2006. To implement Stages 1, 2, and 3 along with liquid phase treatment will only cost the City approximately $300,000. Stage 4 is the next odor control improvement recommended that will have a significant impact on the off-site odor reductions. If the City can increase the budget for the odor control improvement projects in 2005 and 2006, it is recommended that the odor control scrubbers recommended in Stage 4 be installed to provide odor control for the current Headworks facility. These scrubbers can be reused for the new Headworks facility, especially if the City is going to maintain the current Headworks building. Also, the City should consider implementing the new Headworks facility earlier than currently planned.

TABLE ES-3
Cost Summary for Long-Term Recommendations

Odor Control Stage	Long Term Recommendations	Air Flow Rate (cfm)	Capital Cost*	Annual Cost	Timing
1	Discontinue use of trickling filters	NA	$10,000	$0	2004
2	Rearrange digester boiler vent HVAC system	NA	$200,000	$0	2005
LPT	Conduct a pilot test of Bioxide™ or equivalent chemical	NA	$37,000	NA	2005
	Implement a liquid phase treatment program	NA	$35,000	$68,000	2005
3	Cover aerated grit chamber and vent to a carbon scrubber	250	$68,000	$6,000	2005
4	Provide odor control for modified Headworks processes, including screw pumps and influent collection well, within existing Headworks building. Vent air from Headworks building through a new chemical scrubber polished with bioscrubber or carbon to achieve 99% removal efficiency.	13,000	$892,000	$87,000	2006 / 2009
5	Vent air from DAFT in a new carbon scrubber.	800	$84,000	$18,000	2008
6	Cover primary clarifiers and vent to new chemical scrubbers	3,800	$1,614,000	TBD	TBD
7	Cover aeration basins and vent to new chemical scrubbers. Replace digester covers with fixed roof covers	8,600	$3,353,000	TBD	TBD

*Total capital costs include construction and engineering costs. Construction costs include 30% contingency; engineering costs are estimated at 25% of construction cost

cfm = cubic feet per minute

TABLE ES-4
Odor Control Recommendations Compared to Current CIP[a]

Odor Control Project	2005	2006	2007	2008	2009	Project Recommendations (Odor Control Stage)
Design & SDC odor control	$70,000	$72,100				Discontinue use of trickling filters, relocate digester room HVAC intake vent, liquid phase treatment, and install new odor control scrubber for aerated grit chamber (Stages 1-3)
Construction odor control	$350,000	$360,500				
Replace existing screw pumps[b]	$30,000	$339,900				
Design and SDC WAS Thickening[b]		$372,345	$191,759	$197,511		Provide odor control as part of WAS thickening improvements (Stage 5)
Construction WAS Thickening[b]			$1,538,305	$1,584,455		
Design and SDC Influent Pumping and Headworks Facility[b]					$514,921	Provide odor control as part of Influent Pumping and Headworks Facility Improvements – project extends beyond 2009 (Stage 4)
Construction Influent Pumping and Headworks Facility[b]					$1,716,400	

[a] Costs include an annual inflation factor

[b] Cost included for these projects is for the entire project, which includes design and construction of new process facilities, where odor control is portion of that project

Introduction

Wastewater treatment plants have inherent odors based on the nature of biological processes. Currently, a majority of odor complaints related to the Loveland WWTP occur in the late fall and winter, as the temperature changes from warmer to colder. Odor complaints have also been received on summer evenings and weekends when more people are at home and outside near the WWTP, making it easier to notice odors. Odor complaints may be increasing because development is moving closer to the WWTP, as reflected in new construction within 400 feet to the north of the plant. An aerial photograph of the Loveland WWTP and surrounding area is included on Figure 6.

The prevailing wind direction is blowing from the southwest, as indicated by the windroses included in Appendix A. The prevailing winds are blowing directly towards the new residential developments and what is currently undeveloped land. This undeveloped land is slated for future development, which will increase the likelihood of odor complaints if conditions remain the same at the WWTP.

The Loveland WWTP is currently undergoing expansion to meet new and more stringent wastewater treatment regulations. The current construction project started in June 2003 and will be completed by November 2004. The process changes that will be conducted as part of the construction project are to change the existing activated sludge process to a step-feed, increase aeration basin volume, install an ultraviolet disinfection system, abandon the existing chlorine contact basin, and provide significant improvements to the electrical system. The changes to the aeration basins will allow elimination of the trickling filter process, which will reduce the odor emissions at the plant.

The State regulates odors under Regulation 2, Part A – General Provisions, which is provided in Appendix B to this TM. The regulation states that there should be no detectable odors at the site of odor impact after the odorous air is diluted by 7 volumes of odor-free air ore more where the land use is either predominantly commercial or residential. For all other land uses the dilution is 15 odor-free air volumes or more. Since the City's WWTP is adjacent to many residential areas, 7 dilutions to threshold (D/T) is the appropriate criterion for the WWTP. Odor emissions are generally measured and regulated in terms of odor strength or D/T, which quantifies the degree of odor perception of a whole air sample. D/T is defined as the point where the odor is barely perceptible to the sampler. The number of dilutions of pure air required to barely perceive the odor then indicates the strength of the sample. Relatively speaking, the higher D/T number, the stronger the odor.

In 2003, CH2M HILL conducted a baseline odor sampling event for the City of Loveland using H_2S as a representative for total odor. The purpose of the sampling work was to assist the City to act quickly to understand and continue to mitigate potential offsite odors. The sampling results from this baseline odor sampling are documented in the *City of Loveland Wastewater Treatment Plant Odor Sampling Technical Memorandum* (CH2M HILL, 2004). The results were used to initially rank odor sources and prioritize recommended improvements. The odor sources found to be significant in the baseline sampling were targeted during the comprehensive odor study as part of the odor management study conducted in 2004, documented in this Odor Management report. This report uses information developed in 2003 and provides updated recommendations for the City to reduce the odor impacts to the surrounding community.

CH2M HILL developed this odor management plan for the Loveland WWTP on behalf of the City. The goals and objectives of the odor management project were to understand existing odor sources, determine the off-site odor impacts, rank the odor sources, and propose an odor control improvements program that will be integrated into the City's capital improvement program (CIP). To understand existing odor sources, field investigations were performed to locate existing odor sources and sample each source's H_2S level. Hydrogen sulfide was used as a surrogate for odor in the initial testing and targeted sources were later sampled for odor as well as H_2S and ammonia. The sampling data was used to develop an odor impact model of the existing treatment plant. After the odor sources were identified, odor control measures were modeled to show the potential reduction in off-site odor impacts.

Current Odor Control at Loveland WWTP

Prior to 1986, the City has relied primarily on operational practices to reduce off-site odor impacts and there was no odor control equipment at the WWTP to reduce the off-site odor impacts. In 1986, due to increasing odor awareness, the City installed the carbon scrubber in the Headworks building to reduce the off-site odor impacts from the grit removal and screenings processes. It was acknowledged during the initial baseline study that the carbon scrubber was not providing effective odor control since the carbon in the scrubber was plugged and not removing odors from the Headworks Building. The City replaced the carbon in March 2004, which has significantly reduced the odors being released from the Headworks Building. Figure 7 shows the offsite odor impact for the Loveland WWTP prior to the carbon changeout. However, odor awareness continues to increase among the neighbors of the WWTP. In response to this increased odor awareness, the City has begun to plan for and implement odor control for the significant odor sources as part of this study.

Setting Odor Prevention and Control Criteria

Odors are highly subjective in nature and each person can have a unique response or reaction to odors at various concentration levels. A key objective to a successful odor assessment and control program is to determine what level of odor, as sensations (subjective phenomena) versus odorant emissions (objective phenomena), will cause an odor nuisance response by the public, and then control odors to levels lower than these thresholds. Successful WWTPs have tended to set their standards together with the surrounding community through a process of trial and error.

It is not reasonable to expect that a treatment plant will never have odors. Neighbors of treatment plants will typically tolerate odors for small portions of time. Treatment plants located in residential communities typically have odor goals of ranging from 4 to 20 dilutions-to-threshold (D/T), with an allowance of 100 hours per year to exceed the threshold. The allowance is to provide a margin of error. Under normal operating conditions the plant is expected to meet its odor threshold. However, plant upsets and equipment failures may occur. These abnormal operations would be acceptable within the time period allotted for the allowable hours above the threshold. Commercial/industrial communities typically have odor goals of 20 D/T or higher, with a similar allowance of 100 hours a year to exceed the threshold.

A relationship between D/T and acceptable hours per year that the threshold D/T could be exceeded without becoming a nuisance odor was developed based on experience at other WWTPs. This relationship is described in **Table 1**. These standards were typically developed with the input of the surrounding community. The neighbors were included in decision-making sessions that determined how often the neighbors would tolerate odors above the threshold without complaining. These standards, when met, allow the community to gain trust in their neighboring WWTP. However, public response is highly subjective. A highly energized and sensitive community may have lower acceptable hours per year exceedence thresholds.

TABLE 1
Acceptable[1] Hours per Year of Odor Exceedance at Various D/T Ratios

Hours of Exceedence per Year	D/T Ratio				
	4	7	20	50	100
0-10	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
10-50	Acceptable	Acceptable	Acceptable	Acceptable	Not Acceptable
50-100	Acceptable	Acceptable	Acceptable	Not Acceptable	Not Acceptable
100+	Acceptable	Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable

1. These acceptable hours are based on CH2M HILL's previous experience at several U.S. and global wastewater treatment and sludge lagoon facilities. However, public response is highly subjective and the above scenarios are intended as a planning guide only. A highly energized and sensitive community may have lower acceptable hours per year exceedence thresholds.

The State odor standard of 7 D/T or more is applicable at all times; it is not possible to obtain a waiver for certain times of the year or for a number of hours. However, to determine compliance with the regulation, the State does not perform any routine sampling of odors. Any testing done by the State would likely be done as the result of a complaint. When the State does come out to sample, they would determine compliance if two samples exceed the standard within a one-hour period. The State does take into account plant upsets and equipment problems that may cause the odors to exceed the limit. Other municipalities within Colorado have been successful by conducting public outreach to educate the surrounding community to call the WWTP with odor complaints rather than the State or county. As part of this Odor Management Project, CH2M HILL recommends has developed an odor control capital improvement program that will allow the City to comply with the State Standard. Due to the conservative nature of the analysis conducted, CH2M HILL recommends that the improvements recommended meet a model-predicted odor control goal that the odor emissions will be less than 7 dilutions-to-threshold (D/T) 99 percent of the time. This will allow the City to respect the boundaries between the community's odor objective and to be consistent with the State Standard.

Odor Complaint History

The City has a procedure in place for responding to odor complaints, which has assisted in expediting the process and response to odors. Odor complaints are received by the plant operator, who logs the complaint and attempts to identify the source of the odor. When possible, action is taken to minimize the release of odors. Follow-up with the residents is conducted if necessary. In March 2004, the City began to monitor the odor complaints received by maintaining detailed logs of each complaint. The area of the most documented odor complaints is highlighted in Figure 8. This figure was used to validate the modeling results to the actual odor impacts indicated by the odor complaints. This provides support for the modeling results and aids in meeting the project objectives. The odor complaints agree with the selected odor control threshold criteria, at less than 7 D/T 99 percent of the time.

Odor Sampling

Two odor sampling events were performed at the Loveland WWTP as part of this odor management study. The purpose of the two sampling events was to capture the main odor generation periods when the City tends to see the most odor complaints, summer and fall. The first sampling was conducted by CH2M HILL and Stewart Environmental, consisting of 30 sampling rounds from October 2 to October 23, 2003. The Jerome meter sampling covered a wide range of the potential odor sources and identified the sources to be sampled as part of the following flux chamber sampling. The second sampling event was conducted by Environmental Management Consulting, using an Environmental Protection Agency (EPA)-approved flux chamber to capture the odor emissions from the plant processes. This was a one-day sampling event conducted on June 2, 2004.

Jerome Meter Sampling

The Jerome H_2S analyzer, shown in Figure 9, measures instantaneous (less than 30-second sampling time) H_2S concentrations. The H_2S concentration data is converted to mass emission rates using assumed air velocities, but their reliability is usually limited by the difficulty of determining the airflow rates and the fact that only a single odor compound concentration is available.

The potential odor sources sampled were identified during a plant walk-through on October 1, 2003, based on the consultant's experience and group members' observation and experience. The plant sample locations are identified on Figure 10. Photographs of each of the sources are included in Appendix C. The Jerome meter sampling results are summarized in Table 2 and in Appendix D, which includes charts that show H_2S concentration over time for each odor source sampled.

Flux Chamber Sampling

With a flux chamber, samples are taken directly from the liquid surface through a closed vessel (innertube with a sampling port on top). The air flow off the liquid surface is measured as well as the mass or quantity of odorous compounds emitted. Together, these two measurements are the flux (or mass emission) of the compounds off the surface. This sampling method is illustrated in Figure 11. The air samples are analyzed in a laboratory for specific compounds and by an odor panel to determine odor intensity. Flux chambers provide the most accurate emission measurements from the surface areas.

During the flux chamber sampling event, stack testing and hand-held instruments such as the Jerome H_2S analyzer and gas detector tubes were also utilized to obtain the data on field H_2S, field ammonia, lab H_2S, lab reduced sulfur compounds, and odor panel responses (results expressed in D/T). Flux chamber sampling results are summarized in Table 3 and included in the Appendix E. The sampling results indicate that the odor from the Loveland

WWTP is caused by more than just H_2S. To account for the combined effect of all odorous compounds, odor was modeled instead of just H_2S.

TABLE 2
Summary of Loveland WWTP Jerome Meter Sampling Results

Location Number	Location Description	Total Number of Samples Taken	H_2S Concentration (ppm)		
			Average	Maximum	Minimum
1	Influent collection well	30	1.10	6.1	0.01
2	Grit hopper	30	2.33	4.7	0.61
3	Headworks odor control exhaust*	30	1.98	4.5	0.50
4	Headworks vent to 1st floor	30	2.84	7.1	0.57
5	Grit truck loading		Not sampled		
6	Headworks effluent channel	29	6.82	18	0.65
7	Aerated grit chamber	30	4.63	21	0.02
8	Aerated grit effluent channel	30	1.17	9.6	0.00
9	Screw pumps (bottom)	30	1.42	8.1	0.14
10	Screw pumps (top)	30	2.88	9.3	0.12
11	Primary splitter box	30	2.67	14.9	0.25
12	Primary clarifier W (center)	30	0.14	0.60	0.01
13	Primary clarifier W (effluent weir)	30	0.54	2.2	0.02
14	Primary clarifier E (center)	29	0.12	0.65	0.01
15	Primary clarifier E (effluent weir)	29	0.37	1.33	0.02
16	Primary effluent wetwell	30	3.45	31	0.14
17	Trickling filter E	30	0.80	3.0	0.03
18	Trickling filter W	30	0.91	2.5	0.02
19	Trickling filter effluent channel E	30	2.77	28	0.04
20	Aeration basin N	30	0.07	0.58	0.01
21	Aeration basin effluent channel	30	0.10	0.45	0.00
22	Final clarifier	30	0.02	0.25	0.00
23	DAF thickener	30	3.00	19	0.61
24	Anaerobic digester (cover)	30	4.54	22	0.04
25	Anaerobic digester (PRV)	28	1.23	31	0.00
26	Digester boiler room vent	30	1.31	17	0.01
27	E digester junction box	30	1.40	31	0.01
28	W digester junction box	30	9.53	31	0.01
29	Biosolids truck loading - at hatch	8	23.0	> 50	23
30	Ambient air 10' from truck loading	7	2.31	18	0.00
31	RAS well	28	0.05	0.33	0.00

*Prior to carbon replacement - after carbon replacement = 0.13 ppm H_2S
Date sampled: October 7-23, 2003 and June 2, 2004

ppm = parts per million

TABLE 3
Summary of Loveland WWTP Flux Chamber Sampling Results Based on Laboratory Analysis

Location Number	Location Description	Odor (D/T)	H_2S (ppmv)	Carbonyl Sulfide (ppmv)	Methyl Mercaptan (ppmv)	Dimethyl Sulfide (ppmv)	CDS (ppmv)	Dimethyl Disulfide (ppmv)
3	Headworks odor control exhaust	90	ND	0.017	ND	ND	0.0018	ND
7	Aerated grit chamber	4,000	26.1	ND	0.339	ND	ND	ND
12	Primary clarifier W (center)	2,400	0.75	ND	0.011	ND	ND	ND
13	Primary clarifier W (effluent weir)	4,400	9.61	ND	0.153	ND	ND	ND
18	Trickling filter W	2,700	7.07	ND	0.579	ND	ND	ND
20	Aeration basin N (Old)	370	0.001	ND	ND	0.0015	0.001	0.006
23	DAF thickener	4,400	9.65	ND	0.415	ND	ND	ND
28	W digester junction box	2,900	3.09	ND	ND	ND	ND	ND
29	Biosolids truck loading - at hatch	3,100	0.002	ND	ND	ND	ND	ND
32	Aeration basin (New)	1,500	ND	ND	ND	0.003	ND	0.027

ND = non detect
ppmv = parts per million by volume
Date sampled: June 2, 2004

In the flux chamber sampling, the new aeration basins had much higher odor levels (1,500 D/T) than expected based on the H_2S concentrations detected. There were significant levels of non-H_2S odorous compounds detected in those samples (dimethyl disulfide [DMDS] and dimethyl sulfide [DMS]) potentially contributing to the elevated odor concentration. Since the new aeration basins had only recently been started when the sampling was conducted, CH2M HILL believes that they are not a significant source of off-site odor impacts. To confirm this, it is recommended that the City resample the aeration basins when all the new basins are optimized.

Nasal Ranger Sampling

As part of both the Jerome Meter and Flux Chamber sampling events, additional sampling was conducted at the WWTP fenceline to determine H_2S and odor concentrations at the property line. A new product by St. Croix Sensory, Inc., called a Nasal Ranger Field Olfactometer, and shown on Figure 12, was used to determine the ambient odor dilution-to-threshold (D/T) values at the fenceline. This nasal organoleptic instrument directly measures and quantifies odor strength in the ambient air using the principle of mixing odorous ambient air with odor-free filtered air in discrete volume ratios. The user's nose is placed firmly inside the nasal mask against the replaceable "comfort seal". The user inhales through the nasal mask at a comfortable breathing rate. The ambient air can pass through an activated carbon filter to remove the odor and then mixed with the odorous ambient air in a discrete volume ratio. The mixed air will pass to the nose. The user chooses dilution factor by adjusting the rotational position of the Nasal Ranger D/T Dial to determine the orifice size and, therefore, the volume of odorous air that enters through the selected orifice.

The fenceline sample locations are identified on Figure 13. A summary of the fenceline sampling results is provided in Table 4, with the detailed results included in Appendix F. When measuring odor strength, the higher D/T number, the stronger the odor. The area to the west of the treatment plant near the Headworks Building had the most significant odors at the fenceline. On a few occasions the odors were found to be at or above 7 D/T, which is in exceedence of the state standard for residential areas. The highest odors detected along the fenceline were detected directly north of the digesters.

TABLE 4
Summary of Loveland WWTP Fenceline Sampling Results

Number	Location Description	H_2S (ppm)		Odor (D/T)	
		Average	Max	Average	Max
1	Fenceline at South Entrance to Headworks	0.123	0.620	4.1	15.0
2	Fenceline at manhole in driveway	0.263	1.500	4.2	30.0
3	Fenceline at rock in driveway	0.077	0.390	1.8	7.0
4	Fenceline at road sign	0.084	0.280	2.7	7.0
5	Main gate	0.039	0.280	3.3	30.0
6	1/2 way up hill from gate	0.039	0.300	1.3	4.0
7	NW corner of fenceline	0.034	0.160	1.9	7.0
8	Fenceline behind power pole	0.030	0.110	1.1	2.0
9	Fenceline past last tree (from W)	0.036	0/450	2.2	15.0
10	Fenceline 1/2 way b/w tree and sludge tanks	0.019	0.140	3.5	30.0
11	Fenceline behind sludge tanks	0.012	0.063	1.3	2.0
12	Fenceline b/w sludge tanks and digesters	0.014	0.130	1.9	15.0
13	Fenceline due East of digester (north of flare)	0.005	0.079	1.0	1.0
14	Canal at road	0.024	0.140	1.3	2.0
15	Canal at 1st break in trees	0.016	0.180	1.5	7.0
16	Canal just past trees	0.020	0.119	3.2	30.0
17	Canal due N of light at sludge tanks	0.016	0.120	1.1	2.0
18	Canal b/w sludge tanks & digesters	0.007	0.066	1.7	7.0
19	Canal at NE corner of plant	0.005	0.021	1.3	2.0
20	Fenceline behind digesters	0.016	0.150	4.7	30.0

Date sampled: October 7-23, 2003 and June 2, 2004

Baseline Model

The baseline odor modeling assessment used emission rates obtained from sampling performed during 2003 and 2004. Several sampling methods were used to obtain reliable and comprehensive odor data, including the EPA's flux chamber for area sources. The sample analyses included measurements of field H_2S, field ammonia, lab reduced sulfur compounds, and odor panel data. The sampling results indicate that the odor from the Loveland WWTP is caused by more than just H_2S. To account for the combined effect of all odorous compounds, odor was modeled instead of just H_2S, ammonia, or reduced sulfur compounds.

Technical Approach

The odor modeling approach is described in the following section, which provides detailed information about the procedures used in the odor modeling analysis.

Odor

Odor is measured in four different ways:

- **Intensity** (strength)
  - Measures odor intensity as a volumetric dilution ratio - final diluted volume at the odor threshold (Vf) to the initial sample volume (Vs) or D/T
- **Butanol Equivalence** (Intensity)
  - Measures odor intensity as an equivalent concentration of n-Butanol, volumetric parts per billion (ppbv)
- **Character** ("what does it smell like?")
- **Hedonic Tone** (degree of unpleasantness)

Odor strength quantifies the degree of odor perception of a whole air sample. Threshold is defined as the point where the odor is barely perceptible to the sampler. The number of dilutions of pure air required to barely perceive the odor then indicates the strength of the sample. The threshold is thus termed dilutions-to-threshold (D/T). Relatively speaking, the higher D/T number indicates the stronger the odor.

To measure odor, air samples are typically collected using a portable air pump and stored in inert sample bags. The sample bags are taken offsite and analyzed by odor specialists using an odor panel comprised of various people that smell the sample. When half the panel does not detect the odor, that is the D/T level reported. **Table 5** describes various D/T levels and human reactions.

TABLE 5
D/T Ratio and Typical Human Reactions

D/T Ratio	Description	Reaction
0 Human Threshold[1]	The lowest concentration at which the average noses can detect the odor.	Human nose can sense the odor and determine a difference from normal background odors. The odor is not alarming at this level, just barely noticeable.
4	The odor is very slightly noticeable above background odors.	Human nose can sense the odor and determine a difference from normal background odors. The odor may cause slight discomfort to some humans, but typically it's not alarming or at nuisance levels.
7	The odor is very slightly noticeable above background odors.	Human nose may determine the source if the nose has previously experienced higher strengths of the particular odor compound. The odor may cause slight discomfort to some humans, but typically it's not alarming or at nuisance levels.
20	The odor is slightly noticeable above background levels.	The human nose may determine the source, regardless if it has been previously detected or not (may cause a slight nuisance odor reaction[2] with some individuals). Typically odors lower than this ratio do not cause odor complaints.
50	The odor is noticeable above background levels.	The human nose can determine the source and may result in a nuisance odor reaction with some individuals.
100 (plus)	The odor is extremely noticeable above background levels.	The human nose can detect the source, and typically results in a nuisance odor reaction.

Notes:
1. Odor threshold concentrations for typical odor causing compounds are ("ppmv" = parts per million measured volumetrically):
H_2S = 0.0008 ppmv
Sulfur/mercaptan compounds = 0.001 ppmv
Ammonia = 2.4 ppmv
2. A nuisance odor reaction typically causes one or several of the following reactions: public complaint, extreme discomfort, sleeplessness, agitation, and/or a strong motivation to stop the odor impact.

As with most wastewater treatment plants, the Loveland WWTP modeling assessment used the odor intensity in the unit of D/T to measure the odor because it is a comprehensive parameter to quantify the odor impact resulting from all kinds of compounds. The odor thresholds used in this model analysis was 7 D/T, required by the State of Colorado regulation for predominantly commercial or residential land, as described earlier in this report.

Emission Sources

Odor emission sources must be defined in terms of their odor emission rates and physical characteristics to be modeled. Sources can be characterized as point, area, or volume sources. Point sources include exhaust air through a duct or vent at a known rate. The height of the release, outlet diameter, exit velocity, and exit gas temperature can be readily defined. Area sources are open tanks or basins. Emissions are released from the liquid surface. Area sources are defined by their release height, width and length of surface area, and angle of rotation. Volume sources are releases that are not easily defined as point or area sources. The physical parameters, actual sampling data, and calculated emission rates for each plant odor source are summarized in Appendix G. The sources modeled are shown in **Table 6.**

TABLE 6
Summary of Loveland WWTP Odor Sources Included in the Modeling Effort

Area Sources	Point Sources	Volume Sources
Rectangular Area Sources: • Aerated Grit Chamber • Old Aeration Basin • New Aeration Basin • East Digester Junction Box • West Digester Junction Box • Screw Pump • Primary Effluent Wetwell • Trickling Filter Effluent Channel • Primary Splitter Box • Aerated Grit Effluent Channel • Influent Collection Well Circular Area Sources: • East Trickling Filter • West Trickling Filter • East Primary Clarifier • West Primary Clarifier • Biosolids Truck Loading Hatch 1 • Biosolids Truck Loading Hatch 2 • Biosolids Truck Loading Hatch 3 • Anaerobic Digester Cover Ring • Final Clarifier 1 • Final Clarifier 2	• Headworks Odor Control Exhaust • Flare	• Grit/Screening Trucks Loading • Digester Boiler Room Vent* • DAFT Door • DAFT Window

* Digester boiler room vent does not have sufficient vertical momentum to be considered a point source. It tends to create mixing and turbulence around boiler box. Therefore, it is considered a volume source.

The site plan drawings (LL05c01.dlv and LL05c02.dlv) were used as the base map to locate the individual sources when setting up the modeling input files. These site plan reference drawings were developed in 2003 from the recent Step Feed, Ultraviolet (UV) Disinfection, and Secondary Electrical Improvements project. The Universal Transverse Mercator (UTM) coordinate system was used to orient each source.

Emission Calculations

For sources near the entrance to the plant (grit handling and primary clarifiers), H_2S measurements are strongly correlated to odor threshold levels. Odors from aeration basins and solids handling areas are more complex and are not accurately characterized by H_2S alone. Odorous compounds from these process areas include amines, reduced sulfur compounds, mercaptans, and fatty acids. These compounds have high odor intensities even without H_2S present. Therefore, the modeling was run based on the odor intensities (D/T) emission, expressed as odor units per second (OU/s), which is the equivalent of D/T x m^3/s. From the perspective of dispersion model, the odor unit is equivalent to the mass of any odor compound, like H_2S, in the unit of gram.

To obtain the appropriate odor emission data for the model input, the following steps were conducted:

1. Convert H_2S data obtained from sampling to odor threshold data (D/T) using H_2S -to-odor unit correlation developed as part of the Orange County Sewer District (OCSD) Odor Control Master Plan:

   1 ppbv H_2S = 2.3355 Odor units (D/T)

2. For stack samples, the odor emission rate is determined by stack flow rate:

   OU/s = (D/T) x (exhaust flow rate, ft^3/min) x ($m^3/35.34\ ft^3$) x (min/60s)

3. For non-aerated area sources, the sweep air flux through the flux chamber is 5 L/min. The surface area of the flux chamber is 0.13 m^2, Therefore, the odor flux is

   Odor flux (OU/min/m^2) = (D/T) x (5 Lpm/1000) /(0.13 m2)

   And the odor emission is:

   Odor Emission (OU/s) = (Odor Flux, OU/min/m^2) x (surface area, ft^2)/ (10.76 ft^2/m^2) /(60 s/min)

4. For the aerated area sources, the odor emissions from these processes is:

   OU/s = (D/T) x (aeration air, ft^3/min) /(35.34 ft^3/m^3) /(60s/min)

The emissions calculated from sampling results are presented in Appendix G.

Model Selection

Dispersion modeling is a mathematical method that relates emissions from a source to ambient air concentrations located downwind. The dispersion model selected for this analysis was the Industrial Source Complex – Short Term Version 3 (ISCST3). The model is recommended by EPA for use in demonstrating compliance with ambient air quality standards. It is designed to assess the combined impacts from multiple sources and source types in simple and intermediate terrain.

Two other models can be used for odor dispersion modeling, AERMOD and CALPUFF. AERMOD is also a Gaussian plume model. The dispersion coefficients are based on boundary layer theory rather than empirically derived from sampling data. AERMOD uses a continuous turbulence spectrum whereas ISCST3 uses discrete stability categories. Validation of the model has been done with data sets with sampling data averaged over a one-hour time period. Although proposed by EPA as a replacement for ISCST3, it has not been used for odor impact assessments.

The CALPUFF model is a Lagrangian puff model. It is approved by EPA for use in long-range transport studies. The model can be used for short transport times. The meteorological data needed to run the model can be a single meteorological station (as would be the case for ISCST3) or developed from several stations (as would be required for long range transport studies). Use of the CALPUFF model for odor studies has been limited due to the large amount of input data required and the little, if any, benefit over ISCST3. For the Loveland WWTP, the ISCST3 output was adjusted using the power law to represent puff conditions, which is the same method by which CALPUFF simulates puff conditions.

A comparison of the ISCST3, AERMOD and CALPUFF models was conducted by Diosey[1]. This comparison showed that maximum predicted impact from a typical wastewater treatment plant was similar for ISCST3 and CALPUFF run in the refined mode. Predicted impacts for AERMOD were a factor of 24 lower than ISCST3 and a factor of two lower for CALPUFF run in the screening model. Therefore, ISCST3 results are the most conservative of the odor dispersion models used in the air quality industry. The other two models were not used for the Loveland WWTP because CALPUFF is very complicated with much longer run times resulting in little benefit and AERMOD is not as conservative as ISCST3.

Model Inputs

The ISCST3 model has several required inputs. The control options (CO) define how the model is to be executed. Many of these control options are default values or options EPA requires for regulatory compliance. The source options (SO) define the physical source parameters and emission rates. As discussed above, different types of sources (point, area and volume) have different physical characteristics. Large buildings close to the stacks or other point sources can radically influence the dispersion pattern, which is known as building downwash. There is an algorithm developed in ISCST3 to estimate the impact of the building on the dispersion of the plume, which is included in this section. The receptor grid (RE) array needs to be defined or the receptor coordinates can be input to define the discrete receptors of interest. Receptors are the off-site locations downwind where ambient concentrations are predicted. The meteorological (ME) data and terrain data to be used in the modeling analysis are defined next. The output (OU) options define how the resulting concentrations are to be summarized and presented in the output file.

The shortest averaging period that can be selected to present the modeling results is one hour because the meteorological data contains only one value for each hourly period. One-hour averaging tends to reduce peak values. Impacts over the 1-hour period tend to round out any puff conditions. From experience, puffs of odor in as little as 3-minute durations can cause odor complaints. Therefore, a power law correction is used to allow an assessment of puff conditions that may occur. The irregular isopleths are due to the variable nature of the wind direction, wind speed, and stability categories. The power law affects only the magnitude of the predicted impact.

As a conservative assumption, the model output is interpreted as a 1-hour average concentration. To make comparisons to odor thresholds with shorter averaging periods (such as five minutes), the following relationship is used:

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[1] Diosey, Phyllis G., Maureen E. Hess, and Larraine Farrell, *Evaluation of Alternative Dispersion Models for Use in Odor Management*, WEFTEC 2002 75th Annual Technical Exhibition and Conference, Conference Proceedings, WEF, Alexandria, VA

$C_1 = C_0 * (t_0 / t_1)^p$

Where:

C_0 = initial (1-hour) concentration with an averaging time, t_0 (60 minutes)

C_1 = desired concentration with an averaging time, t_1 (5 minutes)

p = power law factor of 1/5

The 1/5 power law factor has been demonstrated as the peak-to-mean scaling factor during field and wind tunnel studies performed at wastewater treatment plants and low level releases (Porter et al., 1994). Applying a peak-to-mean scaling factor provides a conservative estimate of short-term puff impacts when demonstrating compliance with ambient odor thresholds. For this odor study, the model runs completed for each of the five years (1999 to 2003) produce the 1-hour maximum concentration based on a 1-hour (or 60-minute) average. To obtain the 5-minute average concentration, the 60-minute concentration is multiplied by 1.64 ($(t_0/t_1)^p = (60/5)^{1/5} = 1.64$). The probability of odor complaints depends on odor intensity and number of hours that the odors exceed the determined acceptable threshold. By measuring surface and upper air in short averaging periods, the magnitude and duration of peak intensities is better quantified.

Meteorological Data

Two types of meteorological data are used to characterize the dispersion environment – surface meteorological data and mixing height data. The surface meteorological data used in this modeling assessment were measured from the Fort Collins-Loveland Airport, which is the closest airport to the Loveland WWTP. The surface data defines the wind speed, wind direction, temperature, and cloud cover used in this analysis. The mixing height data had to be derived from upper air measurements collected at the Stapleton International Airport site, which was the closest location that had all the necessary mixing height data. Mixing height data defines the depth of the surface layer that a plume will disperse. Both surface and upper air data for the 5-year period from year 1999 to year 2003 were used in the screening level model analysis. Then, the year that resulted in the highest off-site impacts (2003) was used in all the modeling described below. The data was purchased through the National Climatic Data Center in Asheville, North Carolina. The ISC-ready meteorological data files were prepared using the PCRAMMET preprocessor program in accordance with EPA procedures.

Terrain Data

Typically, the terrain files used in the dispersion modeling analysis are obtained from the U.S. Geological Survey (USGS) 7.5-minute Digital Elevation Model (DEM) data sets. These terrain files normally contain 30-meter intervals. Based on the terrain data, the dispersion modeling program can calculate the elevations at receptors and odor sources. In this modeling analysis, plant-specific terrain information was used because it has the smaller intervals (10 meters) and is more accurate and up-to-date for the plant location. The terrain elevations were obtained from the topographical information provided by the City using the GIS program for all the defined receptors and odor sources, which were then input back to the dispersion model.

Model Runs

The baseline odor condition at the Loveland WWTP included all the treatment processes units typically on-line in the summer. ISCST3 predicts 1-hour average pollutant concentrations. However, odor nuisances are most often associated with puff conditions, or exposure times on the order of seconds or minutes rather than hours. Averaging over an hour has the effect of smoothing out the concentration peaks. Therefore, the 1-hour concentrations predicted by ISCST3 were converted to peak 5-minute concentrations (using the power law). This reduces the number of data points analyzed by the model from one a minute to one every five minutes. Typically, the shorter the averaging period means the more conservative the values because fewer data points are averaged. The peak 5-minute concentrations are greater than the 1-hour average concentration and better represent puff conditions. The peak 5-minute concentrations of all the model runs were compared to a fenceline threshold of 7 D/T.

A baseline model was created from both sampling events. A review of the emissions in Appendix G shows that the odor emissions obtained from the H_2S data from the Jerome meter sampling are generally higher than those obtained from the flux chamber sampling. The difference may be caused by the following reasons:

- Seasonal differences between the sampling events. The Loveland WWTP typically experiences more odor complaints in the late fall.
- The Jerome sampling results used in the emission calculations were the highest odor that occurred at each process during all 30 sampling times, over a period of 21 days. In reality, not all the highest odor events at each process will occur at the same time. Therefore, this is considered a worst-case condition. The flux chamber sampling was performed on a single day, which may not have captured the worst odor event during the summer. Therefore, it is considered as an average or one-day condition.
- The conversion relationship between odor (D/T) and H_2S used is specific to the Orange County Sanitation District (OCSD) wastewater treatment plant and may overestimate the odor concentrations at other plants. OCSD completed an extremely thorough odor control study in 2001. The data generated provided a good correlation for converting H_2S emissions to D/T that is widely used. A similar correlation factor could not be estimated for Loveland WWTP because the odor concentrations were insensitive to H_2S concentrations reported during the flux chamber sampling. The odor concentrations were not correlated to H_2S concentration.

Two baseline models were performed and compared.

- **Worst Case Baseline:** Model input based on Jerome meter sampling data
- **One-Day Baseline:** Model input based on flux chamber sampling data

Results of Baseline Odor Modeling

Odor impacts can lead to complaints when the off-site concentrations are significantly above the odor threshold or occur at or near odor threshold levels with regular frequency. Odor modeling data were analyzed from five aspects:

- Duration of odor above the threshold at off-site receptors
- Maximum source contribution to off-site impacts and extent of the impacts
- Off-site D/T distribution at certain receptors
- Off-site impact distribution by time of day at certain receptors
- Meteorological conditions when the maximum impact occurred at certain receptors

Duration of Odor Above Threshold

Figures 1 and 2 show the number of hours when odor levels are above the odor threshold at each receptor for the Worst-Case and One-Day sampling, respectively. The area inside the circle, or isopleth, is the area impacted at the number of hours shown.

Worst-Case Baseline (Jerome Meter Sampling)

In the worst-case baseline (based on the Jerome meter sampling), the odor impact from all the existing sources at Loveland WWTP based on a 5-minute averaging period with an odor standard of 7 D/T is shown in Figure 1. There is a significant off-site area that can perceive the 7 D/T or higher odor levels greater than one percent of the time. The residential area northwest of the plant could potentially perceive the odor that is higher than 7 D/T up to 500 hours a year. The residential area further north of the plant could be impacted up to 50 or 100 hours per year. The isopleths are centered at the north end of the plant, which means the highest odor impact occurs at that area. This could be explained by the observed prevalent wind direction that will bring the odor from those big odor sources, such as the headworks, aerated grit chamber, and other sources, to north and northeast areas.

Figure 3 shows the receptors where the highest maximum 5-minute D/T occurred at the plant (Receptor A) and where the highest exceedence occurred at the plant (Receptor B).

One-Day Baseline (Flux Chamber Sampling)

A similar isopleth was created for the one-day baseline (flux chamber sampling) modeling results, shown in Figure 2. This Baseline represents a typical day without much noticeable odors in the community surrounding the Loveland WWTP. It shows a much smaller impact area focused on the north end of the plant. The highest odor impacts are more likely due to two areas - aeration basins/grit chamber area and digester/boiler room area.

Maximum Source Contribution to Off-Site Impacts and Extent of the Impacts

The highest off-site odor impacts from both baseline models were tabulated by source groups to assess their contribution to off-site impacts. Table 7 presents the maximum 5-minute odor impacts and maximum annual average odor impacts expressed as D/T for each major process area (source group). The ratio of the maximum annual odor to the maximum 5-minute odor, peak-to-mean ratio, is a parameter indicating the frequency of the maximum odor occurrence, and is also shown in the table. Note that the maximum source group impacts are not additive because they occur at different times and locations.

For the worst-case baseline, the maximum combined 5-minute odor impact from all the sources was 1,128 D/T, which is significantly higher than the odor threshold of 7 D/T. The maximum combined 5-minute odor impact from the digester boiler room vent was 1,000 D/T. The digester boiler room vent is the most significant contributor to the off-site odor impact in terms of strongest odors. The next source having the highest maximum 5-minute odor impact is the aerated grit chamber. It generated 857 D/T of maximum 5-minute odor impact. The DAFT is the next source having the maximum odor impact of 233 D/T, followed by the trickling filters. The remainder of the sources that had maximum 5-minute odor impact higher than 7 D/T include screw pumps, primary clarifiers, flare, headworks building door, and aeration basins. The ratio of maximum 5-minute odor to the maximum annual odor at the digester boiler room vent was only 56, suggesting the mean impact from this source is almost as significant as the peak impact. While the peak-to-mean ratio for the aerated grit basin was 242, suggesting that that odor source is less chronic and more acute in nature.

For the One-Day baseline modeling, the maximum combined 5-minute odor impact from all sources was 136 D/T, about one eighth of the impact of the Worst-Case baseline. The aeration basins are shown as the biggest contributor to the off-site odor impact for the maximum 5-minute odor, while the digester boiler room vent is still the biggest contributor on an average annual basis.

The prioritization of the odor sources was based on the maximum 5-minute odor strength (D/T) and the peak-to-mean ratio analysis from the Worst-Case baseline model. Figure 4 summarizes the ranking of the major odor sources at the plant. The remainder of the analyses conducted are focused on the Worst-Case baseline since those odor impacts are more consistent with the odor complaints from the surrounding community.

Off-Site D/T Distribution at Certain Receptors

A more detailed analysis of odor impacts was performed at Receptors A and B (see Figure 3) for the worst case baseline. Receptor A is the location where the highest maximum 5-minute D/T occurred based on the 2003 modeling. Receptor B is the location where the maximum exceedence occurred based on the 2003 modeling.

Figure 14 shows that 26 percent of the time (2,278 hours) the odor impact from all the sources at Receptor A was above 7 D/T. Within this time, 11 percent of the time the odor impact was above 100 D/T (964 hours) and 11 percent (964 hours) when the odor was between 20 D/T and 100 D/T. During the remainder of the time (4 percent, 350 hours), the odor was between 7 D/T and 20 D/T. Approximately 74 percent of the time during a year, Receptor A received an odor impact less than 7 D/T.

The odor exceeded 7 D/T for about 2,366 hours per year (27 percent of the time) at Receptor B. Among this time, only one percent of the time the odor impact was above 100 D/T (88 hours), and eight percent (701 hours) when the odor was between 20 D/T and 100 D/T. During the remainder of the time (18 percent, 1,577 hours), the odor impact was between 7 D/T and 20 D/T.

TABLE 7
Maximum 5-Minute and Annual Average Odor Impacts from Existing Sources at Fenceline Receptors

	Worst-Case Baseline (Jerome Meter Data)			One-Day Baseline (Flux Chamber Data)		
Source Group	**Max 5-min D/T**	**Avg Annual D/T**	**Peak-to-Mean (5-min D/T)/ (Annual D/T)**	**Max 5 min D/T**	**Avg Annual D/T**	**Peak-to-Mean (5-min D/T)/ (Annual D/T)**
All Source	1128	20.3	55	136	2.2	61
Digester boiler room vent	1000	18.0	56	67	1.2	56
Aerated Grit Basin	857	3.5	242	71	0.3	238
DAFT	233	0.8	293	50	0.2	293
Trickling Filter	174	1.3	132	70	0.5	133
Screw Pumps	163	1.5	107	18	0.2	107
Primary Clarifier	146	0.7	197	49	0.3	159
Flare	79	0.6	134	3	0.0	135
Headworks Door	30	0.5	63	3	0.0	63
Aeration Basins	28	0.4	69	81	1.0	81
Headworks Building Exhaust	5	0.07	70	1	0.0	69
Digesters	1	0.0	98			
Biosolids Loading	0	0.0				

Notes:

Predictions based on 2003 surface meteorological data from Fort Collins-Loveland Airport.

Model output was converted to 5-minute average concentrations using a factor of 1.64.

Off-Site Impact Distribution by Time of Day at Certain Receptors

The distribution of off-site impacts by time of day over a year at Receptors A and B are shown in Figure 15. Each slice of the pie chart represents the percentage of the exceedences over 7 D/T that occurred during a 4-hour interval of a day in 2003. At Receptor A, approximately 75 percent of the exceedences over 7 D/T occurred between 9 PM and 8 AM, during which time most people are in the hours sleeping. Among these nighttime exceedences, , 21 percent occurred during 9 PM to 12 AM; 26 percent occurred during 1 AM to 4 AM; and 28 percent during 5 PM to 8 PM, respectively. At Receptor B, approximately 67 percent of the exceedences over 7 D/T occurred between 9 PM and 8 AM. In summary, more odor intensities above 7 D/T occurred in the evening and night between 9 PM and 8 AM at Receptor A, and more noticeable odor events occurred between 9 AM to 8 PM at Receptor B.

Meteorological Conditions when the Maximum Impact Occurred at Certain Receptors

Odor impacts, to a large extent, depend on meteorological conditions such as wind direction and wind speed. The meteorological conditions at the specific times in 2003 when the maximum impacts were predicted to occur at Receptors A and B are identified in Table 8. There are a lot of similarities between the meteorological conditions at these two receptors when the maximum impact (maximum D/T) occurred. The maximum impacts at these two receptors both occurred in winter late night, when the temperature was very low. The wind speeds were both 1.03 meters per second. In addition, both occurrences occurred during stability class F, which is the most stable and tends to have the least turbulence and mixing causing the odors to be higher closer to the fenceline. At receptor A, the wind blew from the southwest to northeast when the maximum impacts occurred. At receptor B, the wind blew from the southeast to the northwest when the maximum impacts occurred. This is consistent with the relative location of the receptors and the plant processes since the wind carried the odor emitted from the majority of wastewater treatment processes to the receptors.

TABLE 8
Meteorological Conditions When The Maximum Impact Occurred

Receptor	Date	Hour	Temperature (°F)	Wind Speed (m/s)	Wind Direction	Stability Class
A	01/16/2003	2 AM	18	1.03	From southwest	F
B	11/13/2003	10 PM	34	1.03	From southeast	F

Odor Control Modeling

Technical Approach

Four odor control scenarios were modeled in this analysis to investigate the effect of positively controlling the odor sources. The odor control improvements either eliminate the identified big odor sources completely, such as the trickling filters, or convert the major odor sources into the odor control scrubbers that emit significantly less odor, such as the chemical scrubber treating the headworks and grit chambers at Stage 3. The major sources controlled were selected based on the prioritization in baseline modeling. The four odor control scenarios modeled are:

Stage 1 – Discontinue the operation of the trickling filter as a result of the aeration basin improvement project.

The construction project that is currently being done at the plant includes converting the existing aeration basin to a step-feed process, and adding more aeration basin volume. After these process changes have been completed, the secondary treatment capacity will be sufficient to treat the plant flow without the use of the trickling filter. Since the trickling filters are the fourth biggest odor source based on the baseline modeling results, elimination of trickling filters will reduce the off-site odor impact from the plant.

Stage 2 – In addition to Stage 1, relocate the digester boiler room HVAC intake vent to reduce the odor emission from the digester boiler room vent.

The current sampling results show the maximum H_2S concentration measured at the digester boiler room vent is 17 parts per million (ppm), which is comparable to the H_2S concentration in the digester gas. The normal H_2S concentration from the similar building (such as solids building) HVAC vent is between 0.003 ppm and 0.08 ppm. The high H_2S concentration from Loveland WWTP boiler room is due to the HVAC intake location directly between the digester overflow weirs. The HVAC system is pulling in fugitive odor emissions from the digesters and overflow weirs, circulating through the HVAC system, and blowing the odors directly towards the residential areas with a flowrate of 2,700 cubic feet per minute (cfm). Relocating the HVAC intake vents could bring the H_2S level down to the typical HVAC vent H_2S level. Therefore, in this modeling analysis, it is assumed that the digester boiler room vent emits 0.05 ppm of H_2S after the HVAC intake is relocated. The ventilation air flow in this room is 2,700 cfm. Therefore the odor emission from the vent is reduced to 150 OU/s.

Stage 3 – In addition to Stage 2, the aeration grit chamber would be covered with a new carbon odor control unit installed to treat the air from grit chamber.

The major assumptions made in Stage 3 modeling include:

1. The ventilation airflow from the aerated grit chamber is selected based on 6 air change per hour (ACH) in the air space of the grit chamber. This would required an

airflow of approximately 250 cfm, which is an increase from the current aeration air of 100 cfm.

2. The new carbon unit has 95 percent odor removal efficiency.
3. The carbon unit discharge stack diameter is about 4 inches to allow an appropriate exit velocity (approximately 3,000 fpm).

Stage 4 – In addition to Stage 3, provide odor control for the entire headworks building as part of the new or modified headworks facility currently listed in the City's CIP for the Loveland WWTP. Headworks replacement would include replacing the screw pumps, aerated grit basins, and screening processes with new processes, all contained within a building. In addition, the influent collection well would also be contained for odor control purposes. The air from this facility would be treated in a new chemical scrubber followed by a bioscrubber or carbon scrubber at the same location as the carbon unit modeled in Stage 2, to the east of the existing headworks building. Stage 4 would provide odor control for a new headworks building or a modification of the existing headworks building.

The major assumptions made in Stage 4 modeling include:

1. Ventilate the entire headworks building at 12 ACH, so the air flow is approximately 13,000 cfm.
2. The new chemical scrubber followed by a bioscrubber or carbon scrubber has 99 percent odor removal efficiency.
3. The chemical scrubber discharge stack diameter is about 2.5 feet to allow an appropriate exit velocity (approximately 3,000 fpm).

Stage 5 – In addition to Stage 4, provide odor control for the DAFT by installing a new carbon unit nearby.

1. The ventilation airflow from the DAFT is based on 12 ACH in the DAFT dome. This would required an airflow of approximately 800 cfm, which is higher than the current ventilation airflow of 700 cfm.
2. The new carbon unit has 95 percent odor removal efficiency.
3. The carbon unit discharge stack diameter is about 8 inches to allow an appropriate exit velocity (approximately 3,000 fpm).

Stage 6 - In addition to Stage 5, cover the primary clarifiers and provide the odor control by installing an dedicated odor control chemical scrubber.

1. Ventilate the headspace of the two primary clarifiers and the effluent well at 6 ACH. Assuming 4 feet of free board, the ventilation air would be approximately 3,800 cfm for two 78-foot diameter primary clarifiers and 200 cfm for the effluent wet well.
2. The new chemical scrubber would have 95 percent odor removal efficiency.
3. The chemical scrubber discharge stack diameter is about 16 inches to allow an appropriate exit velocity (approximately 3,000 fpm).

Stage 7 – In addition to Stage 6, cover the aeration basins and provide the odor control by installing an dedicated odor control chemical scrubber for the aeration basins. In addition, install fixed covers for each digester with a gas collection system so that there are no odor emissions from the digester cover perimeters.

1. Ventilate the headspace of the two aeration basins at 6 ACH. Assuming 4 feet of free board, the ventilation air is about 8,600 cfm, which is slightly higher than the aeration air. The odor control chemical scrubber is sized based on 8,600 cfm.
2. The new chemical scrubber has 95 percent odor removal efficiency.
3. The carbon unit discharge stack diameter is about 22 inches to allow an appropriate exit velocity (approximately 3,000 fpm).

The conditions represented in these seven odor control scenarios are shown in Table 9. The check marks indicate which proposed odor control improvements (shown in rows) were modeled in each control scenario (shown in columns). The odor control modeling was performed using the same protocols as Baseline modeling, such as the emission sources, the emission rates, the model selection, and the meteorological data. The odor threshold of 7 D/T was modeled. Equipment cut sheets for each recommended type of odor control are included in Appendix H.

TABLE 9
Conditions Represented in the Odor Control Modeling

Odor Control Project	Description	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Trickling Filters	Discontinue the use of trickling filters.	✓	✓	✓	✓	✓	✓	✓
Digester Boiler Room Vent	Eliminate the fugitive odors being collected in the HVAC exhaust		✓	✓	✓	✓	✓	✓
Aerated Grit Chamber	Cover aerated grit chamber and install a new carbon unit to treat the air from grit chamber (95% odor removal)			✓	✓	✓	✓	✓
Headworks Building	Ventilate new or modified Headworks building at 12 ACH. Provide a new chemical scrubber to treat the air from both the aerated grit chamber and the headworks building (99% odor removal). Replace screw pumps or cover and ventilate to the odor control scrubber.				✓	✓	✓	✓
DAFT	Maintain negative pressure inside DAFT by providing 12 ACH ventilation. Add a new carbon unit to treat the air from DAFT (95% odor removal)					✓	✓	✓
Primary Clarifiers	Cover and vent primary clarifiers to odor control scrubber (95% removal efficiency)						✓	✓
Aeration Basins and Digesters	Cover and vent aeration basins to odor control scrubber (95% removal efficiency). Provide odor control for digesters with fixed roof tanks.							✓

Results of Odor Modeling with Control Scenarios

Duration of Odor Above Threshold

The results of the odor control modeling are shown in Figures 16 through 22, as described below, by showing the number of hours when odor levels are above the odor threshold for each control scenario. These exceedences are not actual exceedences, but worst-case predictions based on the modeling analysis conducted.

The odor exceedences above 7 D/T from all the plant processes under Stage 1 is shown in Figure 16. Compared with the current condition (Baseline, Figure 1), the isopleths under Stage 1 showed the similar shape, but slightly reduced exceedences.

Under odor control stage 2 (Figure 17), the odor impact was reduced significantly compared with the baseline. The exceedence above 7 D/T at the WWTP's north end was reduced from approximately 1,500 hours per year at Baseline to approximately 1,000 hours per year with Stage 2. The location where the highest exceedence occurred within the plant moved from the east boundary of the plant to the west boundary of the plant, and the highest exceedence was reduced from approximately 2,428 hours per year at Baseline to approximately 1,700 hours per year for Stage 2.

The odor impact of the plant processes with the odor threshold of 7 D/T during Stage 3 and Stage 4 are shown in Figure 18 and Figure 19. By controlling the odor emission from the aerated grit chamber and the Headworks, the odor impact was reduced further. The location where the highest exceedence occurred within the plant was on the west plant boundary. It was reduced to 1,400 hours per year under Stage 3 and 970 hours per year under Stage 4. Figures 20 and 21 show the overall impact of the plant during Stage 5 and Stage 6, respectively. Odor control the DAFT under Stage 5 had the significant improvement on the off-site odor impact. The 50-hour –per year isopleth was reduced to a fairly small area around the northern end of the plant. The highest exceedence on the plant boundary was about 700 hours per year. Covering and odor controlling the primary clarifiers under Stage 6 further reduced the off-site odor impact. Only at a limited area at the northwestern corner of the plant can people perceive the odor stronger than 7 D/T (less than 50 hours per year).

Controlling the odor emissions from the aeration basin and digesters under Stage 7 (Figure 22) reduced the off-site odor to an almost non-detectable level at most of the areas. The rare odor impact that is above 7 D/T only occurred at the northwestern corner of the plant.

Although, these seven odor control stages will meet the odor control goal of odors less than 7 D/T 99 percent of the year, it is not required to implement all seven stages to meet the plant's odor control goals. CH2M HILL recommends that the City plan to incorporate Stages 1 through 5 in their current CIP. It is anticipated that this level of odor control will meet the proposed odor control standard, given the conservative nature of the analysis. At each stage, the City should conduct additional sampling and monitoring to see if more improvements are required.

Maximum Source Contribution

The maximum off-site odor impacts are summarized by process unit from the results of odor control modeling as well as the baseline modeling. Table 10 lists the maximum 5-minute odor impacts and annual average odor impacts, expressed as D/T, for the major odor sources controlled and the new odor sources –chemical scrubbers and carbon units.

TABLE 10
Maximum 5-Minute and Annual Average Odor Impact (D/T) from the Entire Plant for Odor Control Scenarios

	All		Digester Boiler Room Vent		Grit Chamber Odor Control		Headworks Odor Control		DAFT Odor Control		Primary Clarifiers Odor Control		Aeration Basins Odor Control	
Model	Max. 5-min D/T	Max. Ann. Ave. D/T	Max. 5-min D/T	Max. Ann. Ave. D/T	Max. 5-min D/T	Max. Ann. Ave. D/T	Max. 5-min D/T	Max. Ann. Ave. D/T	Max. 5-min D/T	Max. Ann. Ave. D/T	Max. 5-min D/T	Max. Ann. Ave. D/T	Max. 5-min D/T	Max. Ann. Ave. D/T
Baseline	1,128	20.6	1,000	18.0										
Stage 1	1,110	19.5	1,000	18.0										
Stage 2	873	6.7	2.9	0.1	2	0.03								
Stage 3	347	3.2	2.9	0.1										
Stage 4	298	1.7	2.9	0.1			3.6	0.02						
Stage 5	154	1.06	2.9	0.1			3.6	0.02	2.5	0.023				
Stage 6	80	0.86	2.9	0.1			3.6	0.02	2.5	0.023	0.5	0.0088		
Stage 7	80	0.65	2.9	0.1			3.6	0.02	2.5	0.023	0.5	0.0088	0.1	0.0014

Liquid Phase Treatment

Although domestic wastewater odors are caused by a variety of organic and inorganic compounds, H_2S is normally the predominant odor-causing compound found in collection systems and at the front end of WWTPs. Liquid phase odor control strategies reduce odors by reducing the hydrogen sulfide concentration in the liquid waste stream to reduce the amount of H_2S released to the atmosphere. There are several liquid phase strategies and chemicals that are used to counter hydrogen sulfide odors. CH2M HILL completed an analysis of collection system, liquid phase treatment alternatives as part of this Odor Management Plan.

The City's wastewater collection system consists of a network of large interceptor sewers (gravity), as well as several lift stations and corresponding forcemains. The location of the major lift stations and interceptors is shown in Figure 23. Wastewater enters the treatment facility primarily by gravity, with one forcemain coming from the Southside lift station directly to the influent collection well. The four main gravity interceptors all have lift stations further upstream that are contributing to elevated sulfide levels in the wastewater. The significant lift stations are South Horseshoe, East Side (or Jellystone), South Side, and Boyd Lake. Hydrogen sulfide concentrations detected in the headworks area of the Loveland WWTP are generally higher than typically found in similar WWTP and have led to odor complaints within both the collection area and the treatment plant vicinity.

Technical Approach

To help determine the cause of the elevated H_2S levels, samples of the influent wastewater were collected in conjunction with the odor sampling effort. In addition, some limited modeling of sulfide production and atmospheric H_2S levels in the conveyance system was performed. This modeling provided rough estimates of the anticipated, worst-case dissolved sulfide and H_2S emissions from each interceptor flowing into the WWTP. The model also predicted the wastewater detention times in each interceptor. The estimated concentrations from the modeling formed the basis of the comparison of liquid phase odor control alternatives.

Sampling

In conjunction with the odor sampling, the City measured the dissolved sulfide levels of the influent wastewater and interceptors to identify potential correlation between influent wastewater concentration and odor emissions. The results of the dissolved sulfide sampling that occurred are shown in Table 11. The locations of the sampling, along with the laboratory analyses are included as Appendix I. These results represent a snapshot of conditions during the sampling period and do not necessarily show the worst-case condition. Rather, the data proves the presence of significant levels of sulfide in the collection system wastewater and points to one potential cause of odors at the plant.

TABLE 11
Summary of Dissolved Sulfide Sampling (Grab Samples)

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	Average
WWTP – Boyd	3.8	2.2	2.4	1.5	1.9	0.7	2.0	1.8	2.0
WWTP – SS	3.8	3.2	3.1	-	10.1	26	14	-	10.0
WWTP – SE 8th	2.0	4.6	3.3	1.3	1.3	0.9	11.0	0.9	3.2
WWTP – NAM	4.2	2.6	3.5	1.1	1.1	0.9	0.2	0.6	1.8
WWTP – Inf	1.8	5.8	2.7	1.1	0.7	0.7	0.3	1.0	1.8
Jellystone – Out	-	3.8	2.7	-	-	-	-	1.4	2.6
Jellystone – In/E	-	-	-	-	-	-	-	2.7	2.7
Jellystone – In/W	-	-	-	-	-	-	-	1.7	1.7
Jellystone – In/S	-	-	-	-	-	-	-	1.7	1.7
M Cove – In	3.5	3.8	-	1.7	-	-	-	-	3.0
M Cove – Out	-	2.6	-	2.3	-	-	-	-	2.5
Denver & 34	2.8	-	-	-	-	-	-	-	2.8

The sampling results indicate that sulfide generation within the collection system contributes significantly to the elevated H_2S levels at the WWTP. As part of this investigation, additional H_2S sampling was conducted with an OdaLog, an H_2S sampling device that continuously monitors H_2S concentrations. The OdaLog was installed downstream of the Auger monster, halfway down the channel sidewall in the Headworks Building. The results are shown on Figure 24. During the week of installation, the average H_2S concentration in the Headworks building was 22 ppm, with peaks greater than 100 ppm.

The wastewater interceptor sampling results indicate that the highest levels of dissolved sulfide comes from the Southside Interceptor. In addition, the frequency of the high peaks shown in the Odalog results correlates to the frequency of the Southside Lift Station cycles. However, the Southside Lift Station interceptor only represents two percent of the overall flow. The peaks are contributing to spikes seen at the WWTP, but the overall mass loading of sulfide is generated by other interceptors.

Modeling

CH2MHILL has developed a spreadsheet model (FMSULFIDE) to estimate sulfide concentration in force mains. It is based on an algorithm published by Boon[2], but incorporates in-house, proprietary algorithms that allow for situations where dissolved

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[2] Boon, Arthur, "Septicity in Sewers: Causes, Consequences and Containment", Water Science and Technology, Vol. 31, No. 7, pp 237-253, 1995

oxygen (DO) is not initially equal to zero. Under this type of situation, the time required to deplete DO is calculated and subtracted from the total residence time providing the actual reaction time available for sulfide production.

The FMSULFIDE model has been developed to facilitate sensitivity analyses through varying flow, biochemical oxygen demand (BOD_5) or temperature data. This allows quick determinations to be made regarding sensitivity of the results to the selected input parameter values, and also helps identify any required data acquisition (e.g., field sampling). In addition, the model calculates the sulfide mass produced on a daily basis (pounds per day [lbs/day]).

A different algorithm was used to follow the fate of the sulfide in gravity sewers. This algorithm was developed by Pomeroy and Parkhurst[3]. The algorithm applies only to pipes flowing less than full and in which little or no DO exists. The equation accounts for sulfide generation by the slime layer, losses of sulfide due to oxidation in the stream, and sulfide emissions to the sewer atmosphere.

Both the force main and gravity sewer algorithms are combined in a model developed by CH2M HILL called the Interceptor Model. The Interceptor Model was used to estimate wastewater liquid-phase sulfide and vapor-phase hydrogen sulfide loading under various conditions and to analyze potential odor control strategies. The Interceptor Model is a predictive, not absolute, tool to determine sulfide loading in the collection system. The model predicts hydrogen sulfide dynamics in wastewater gravity and force main collection and transmission systems. The model accounts for sulfide generation, oxidation, mass transfer across the air/water interface, and liquid-phase bulk transport. Given the flow and wastewater characteristics at the upstream end of the interceptor and each collector or lateral intersection, the Interceptor Model calculates liquid and vapor-phase sulfide concentrations and vapor flow rate due to the liquid drag at downstream locations.

To develop a basis for the comparison of chemical alternatives to treat the wastewater coming to the Loveland WWTP, the main interceptors coming into the WWTP were modeled using the Interceptor Model to determine potential for H_2S generation for each interceptor. The interceptors were then prioritized as potential candidates for liquid phase treatment. The system modeled included approximately 41,400 feet of varying diameter pipe that typically handles a peak flow of 10.6 million gallons per day (mgd): 39,400 ft of gravity sewer ranges from 24-inches to 33-inches and 2,000 feet of forcemain (20-inches).

In addition to the sampling data, average annual data for the influent to the WWTP were collected and used in this analysis. A summary of the actual data used in the Interceptor Model is included in Appendix J. The following assumptions were used in the analysis:

- Chemical addition would occur only in the dry season of June through October.
- Wastewater temperature = 20.3 ° C
- $BOD_5 = 275$ mg/L
- Target dissolved sulfide concentration = 0.5 mg/L

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[3] : Design Manual "Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants EPA/625/1-85/018, pp 20-24, October 1985

Table 12 contains a summary of uncontrolled peak sulfide concentrations predicted by the model for each interceptor. The Boyd Interceptor and Boyd Relief Interceptor have the highest potential for H_2S generation, due to the high concentrations of dissolved sulfide and the significant amount of flow (40 percent of total influent) from these interceptors. While the Southside Lift Station had the highest dissolved sulfide concentration in the sampling, its contribution to the total flow is relatively insignificant. Liquid phase treatment would not be as effective at that lift station for reducing overall sulfide, but could help reduce some of the spikes observed.

TABLE 12
Summary of Interceptor Model Results

Interceptor (listed in order of priority)	Dissolved Sulfide in (mg/L)	Dissolved Sulfide out (mg/L)	H_2S out (g/m^3)	H_2S out (ppmV)	Type
Boyd Interceptor	7.1	7.5	0.79	561	Gravity
Boyd Relief Interceptor	3.1	4.7	0.471	333	Gravity
Southeast 8th Interceptor	4.1	4.5	0.46	322	Gravity
Namaqua Interceptor	4	4.2	0.408	288	Gravity
Southside Liftstation Interceptor	4.2	5.1	0	0	Forcemain

This dissolved sulfide data taken from the City's collection system demonstrates that the City's system has levels significantly above what is found in a typical wastewater collection system. Liquid phase treatment is generally considered if the dissolved sulfide concentrations exceed 1.0 mg/L.

Description of Alternatives

Liquid-phase odor-control strategies reduce odors by reducing the unionized or total sulfide concentration of the liquid waste stream. Although domestic wastewater odors are caused by a variety of organic and inorganic compounds, H_2S is typically the predominant odor-causing compound. A summary of these alternatives is presented in Table 13.

Oxygenation and Aeration

Oxygen inhibits the growth of sulfate-reducing bacteria, chemically oxidized sulfide, and promotes aerobic growth that biologically oxidizes sulfide. At dissolved oxygen levels over 0.5 mg/L, liquid sulfide levels will typically be below 0.1 mg/L. Oxygen reacts with H_2S in accordance with the following reaction:

$$\mathrm{H_2S} + 2\mathrm{O_2} \rightarrow S + \mathrm{H_2SO_4}$$

The reaction with oxygen is very slow (half-life of about 30 minutes).

Wastewater oxygenation can be accomplished by using low-pressure compressors or blowers to inject air into open channels or basins, Venturi aspirators in combination with pumping, or pure oxygen injection into force mains. The effectiveness of air injection in controlling odors is affected by the detention time. If the system detention time is greater than 4 hours, the positive effects of oxygenation are overcome by the oxygen uptake rate of the wastewater and additional injection points will be required. Typical uptake rates for domestic sewage range from 2-26 mg/L per hour. Higher temperatures, higher soluble BOD, and longer detention times will result in higher uptake rates.

Chemical Oxidants

Liquid oxidants may be injected into the wastewater to remove sulfides. Since they are not target-specific, some of the injected oxidant will oxidize other materials within the waste-stream. Thus, more oxidant must be injected than would be required to stoichiometrically react with the sulfide. Chemical oxidants used to remove sulfides from wastewater include the following:

- Hydrogen peroxide
- Chlorine
- Sodium hypochlorite
- Potassium permanganate

Hydrogen Peroxide

Hydrogen peroxide (H_2O_2 or peroxide) provides a source of dissolved oxygen, which reacts with sulfides at a stoichiometric rate of 1 part H_2O_2 to 1 part H_2S in the following reaction:

$$\mathrm{H_2O_2} + \mathrm{H_2}S \rightarrow S + 2H_2O$$

However, literature sources indicate that higher dosage rates are required due to interference with other constituents within the wastewater. In previous studies, a San Francisco Bay Area POTW found required H_2O_2 dosages ranging from 5.5-8.3 parts H_2O_2 per one part H_2S.

At high concentrations (50 percent or greater), H_2O_2 is hazardous to handle. However, H_2O_2 is an economically viable alternative only at these higher concentrations. H_2O_2 also requires adequate mixing to achieve complete reaction and has a relatively long reaction time (approximately 30 minutes) compared to other oxidants. Very often, H_2O_2 is injected too far upstream of the control point to allow for this relatively long reaction time.

Sodium Hypochlorite

An alternative to gaseous chlorine is sodium hypochlorite (NaOCL), also known as bleach. Household bleach, such as Chlorox brand, is approximately 5-percent sodium hypochlorite. Sodium hypochlorite used for odor control is typically delivered in concentrations between 10 and 15 percent. Hypochlorite is a strong oxidizing agent and reacts with H_2S in wastewater. It reacts stoichiometrically at a rate of 8.8 parts hypochlorite per 1 part H_2S in the following reaction:

$$4NaOCl + \mathrm{H_2S} \rightarrow \mathrm{4NaCl} + \mathrm{H_2SO_4}$$

As in the case of gaseous chlorine, hypochlorite acts as an indiscriminate oxidant. As a result, the dosage range is between 10 to 15 parts sodium hypochlorite per 1 part H_2S. One disadvantage of sodium hypochorite is that if anaerobic conditions are encountered, hydrogen sulfide will be present again. Therefore, oxidants need to be injected closer to the treatment plant.

Nitrate Addition

Nitrates do not react with the H_2S; rather, they prevent its formation. Normally, in the absence of free oxygen, sulfate-reducing bacteria will preferentially use nitrate as the terminal electron acceptor, thereby preventing the formation of H_2S. Any H_2S that has already formed is not affected because nitrates act only with the bacteria.

Nitrate is available in both liquid and dry forms from a number of sources. The various types of nitrate are sodium nitrate, ferric nitrate, and calcium nitrate. Calcium nitrate is commonly used in wastewater odor control and corrosion control applications and is available under the trade name of BIOXIDE™. This proprietary calcium nitrate solution has been tested in the City of Los Angeles's sanitary system, the Clark County Sanitation District's collection system, and the New Haven, Connecticut, interceptor systems with success. Sodium nitrate is also available under the trade name of NITRAZYME™.

Iron Salts

Iron salts can be added to the waste stream to form a metal sulfide precipitate. This reaction binds the H_2S in solid precipitants so it cannot escape into the air. Ferric chloride salts ($FeCl_3$) react stoichiometrically with H_2S in wastewater at a rate of 2 parts ferric chloride per 3 parts H_2S in the following reaction:

$$2FeCl_3 + 3H_2S \rightarrow Fe_2S_3 + 6HCl$$

Iron salts, however, also act indiscriminately with other materials. As a result, the dosage ratio ranges from 7 to 20 parts ferric chloride per 1 part H_2S.

Collateral benefits of using iron salts include increased BOD and total suspended solids removal at primary sedimentation tanks, lowered wastewater phosphorus, improved solids settling in secondary clarifiers and digesters, and reductions in the amount of polymer needed for solids conditioning at dewatering. Disadvantages include the need for special handling, including eye and skin protection requirements. In addition, iron salts may have very low pH (0.5-2.5) and can corrode stainless steel, brass and aluminum pumps. Other concerns include the availability of a reliable source of chemicals.

pH Stabilization

There are two methods of reducing H_2S-related odors using pH adjustment. One method shifts the wastewater pH so that chemical equilibrium favors non-odorous sulfide species. The other method uses a temporary, but drastic, pH shift to kill the sulfur-reducing bacteria that produce H_2S. Both methods typically rely on sodium hydroxide as their chemical agent. Only caustic shock dosing is discussed here.

Caustic Shock Dosing

Shock dosing the bacteria living in the interceptor slime layer can also be used to control odor. At very high pH's, sulfate reducing bacteria activity stops. Caustic shock dosing, achieved by adding enough caustic to raise the pH of the wastewater to 13.0 or higher for 20 to 30 minutes, has been demonstrated to inactivate the sulfate-reducing bacteria for periods of 3 to 14 days. Caustic shock loading, practiced by the County Sanitation Districts of Los Angeles, found that a dose of approximately 3,125 pounds of 50-percent caustic solution per million gallons of wastewater was required for 30 minutes to obtain odor control from shock loading.

TABLE 13
Chemical Control of H_2S and Corrosion in Sewers

Approach	Method	Objective	Advantages	Disadvantages	Typical Dosage[a]	Capital Cost[b]	Operating Costs[c]
Improve oxygen balance in wastewater	Good operation and maintenance	Maintain good flow velocity, minimize solids deposition	No additional chemical costs	Effectiveness limited by sewer design and operating conditions	NA	NA	Included in system O&M cost
	Air injection	Increase oxygen in wastewater using compressed air, venturi aspirators, or U-tubes	No chemical costs for air	Low efficiency Control limited Possible off-gassing of odors	10 mg air /mg sulfide	$4.5/ m^3·d	Power, compressor facility life cycle
	Oxygen injection	Increase oxygen in wastewater using liquid oxygen or on-site generation	High efficiency vs. air Low chemical hazard	Must be introduced in pressurized pipe (force main, sidestream or U-tube)	2 mg O_2 /mg sulfide	$4.5/ m^3·d	$0.75/kg O_2 + facility life cycle
Chemical oxidation in wastewater	Sodium hypochlorite solution injection	Oxidize dissolved sulfides to sulfate	Safe vs. chlorine gas	Unstable in storage More cumbersome and costly in bulk quantity	6 mg Cl/mg sulfide	$3/$m^3$.d	$1.30/kg Cl_2 + facility life cycle
	Hydrogen peroxide solution injection	Oxidize dissolved sulfides to sulfate	Rapid reaction rate Simple equipment	High chemical cost Unstable in storage	1 mg H_2O_2 /mg sulfide	$3/$m^3$.d	$4.5/kg H_2O_2 + facility life cycle
	Nitrate addition (BIOXIDE™)	Provide chemical source of oxygen preferred over sulfate by bacteria	Slow-reacting; long lasting Low chemical hazard Simple equipment	High chemical cost Adds nitrogen	10 mg NO_3 /mg sulfide	<$1.5/$m^3$·d	$2.00/kg $NaNO_3$ + facility life cycle
Precipitation of sulfides from wastewater	Iron salts such as ferrous sulfate or ferric chloride	Formation of solid particles of insoluble metallic sulfide	Simple equipment Usually available	Increases metal loading downstream	2 mg Fe/mg sulfide	<$1.5/$m^3$·d	$11/kg Fe + facility life cycle
Alkaline pH shock of wastewater	Caustic Shocking: Periodic (weekly) dosing with sodium hydroxide solution	Upset slime layer and temporarily reduce sulfide generation	Minimal capital investment Moderate chemical cost	Hazardous chemical handling Unpredictable effectiveness	As required to produce target pH	<<$1.5/$m^3$·d	varies

---

[a] One typical dosage shown; actual dosages vary widely, and pilot testing is recommended to confirm actual required dosage

[b] Approximate capital cost in $ shown for installation of treatment at one site for 40,000 m^3/day wastewater flow

[c] Approximate chemical cost shown in $ on m^3/day unit basis (shown as m^3·d) on dry weight basis and in required form (e.g., solution)

Sources: USEPA, 1985; Sulfide in Wastewater Collection and Treatment Systems, presented to ASCE, 1989; and CH2M HILL

Comparison of Alternatives

Both the sampling results and modeling exercise indicate the production of sulfides in the collection system at levels that make liquid phase sulfide control a cost-effective part of an integrated odor management strategy. As part of an initial screening of options, CH2M HILL identified several liquid phase treatment alternatives that the City could initiate within the collection system. A short list of options that would most likely provide an acceptable level of sulfide control was developed that includes:

- Ferric Chloride (iron salts) addition – the iron reacts with sulfide molecules to form a non-dissolvable product that is removed in the clarifiers of the treatment facility. If available, ferrous chloride can also be used. Ferrous chloride is produced by metal products producers during the "pickling" process of raw steel.
- Bioxide™ addition – this proprietary product adds nitrates to the wastewater, thereby preventing the production of sulfide compounds.
-
- Shock dosing using 25% Sodium Hydroxide solution – this process raises the pH in the wastewater to more than 12 for a contact period of 20 minutes and is performed approximately every 10 to 14 days. The high pH condition kills the sulfide-generating bacteria. However, immediately following treatment, sulfide-generating bacteria repopulate the sewer and sulfide production begins to increase.

Table 14 provides information on differences in chemical demand and usage for the anticipated liquid phase treatment assumed to be used for five months during the dry season only (June-October), based on an annual average flow of 5.7 mgd. A summary of the cost evaluation results for all odor control alternatives is presented in Table 15. Material Safety Data Sheets (MSDS) for each chemical considered are included in Appendix K.

TABLE 14
Dosages and Annual Costs for Chemicals Evaluated

Item	**Ferric Chloride ($FeCl_3$)**	**Calcium Nitrate ($Ca(NO_3)_2$)** (Bioxide™)	**Sodium Hydroxide (NaOH)**[1]
Interceptor to be Dosed	Boyd	Boyd	Southside
Dosing Location	Boyd Lake PS	Boyd Lake PS	Southside PS
Assumed Chemical dosage	20 lb $FeCl_2$/lb sulfide removed	1.3 lb $Ca(NO_3)_2$/lb sulfide removed	3,125 lb/MGD wastewater
Chemical unit cost	$0.15 lb active chemical (37% solution)	$1.95/gallon	$1.0/lb active chemical (50% solution)
Chemical Required (lbs/day)	2,552	189	17,902/dose
(gallon/day)			
Chemical Costs ($/day)	$378	$367	$17,902/dose
Chemical Costs ($/season)	**$68,085**	**$66,683**	**$268,567**

[1] Shock dosing once every 10 days.

TABLE 15
Cost Evaluation of Liquid-Phase Odor Control Alternatives

Cost Type	Odor Control Alternatives $FeCl_2$	Bioxide™	NaOH
Capital cost[1]	$35,000	$20,000	$0
Pump replacement cost[2]	$7,000	$7,000	$0
Annual Chemical Cost	$68,085	$66,383	$268,567
Total 20-Year Life Cycle Cost[3]	**$1,004,472**	**$965,281**	**$3,816,411**

[1] Capital costs include pumps, tanks, and containment and do not include additional building and SCADA costs
[2] Assume metering pumps replaced once every 10 years.
[3] Life cycle costs include capital costs plus present worth of annual costs using an interest rate of 3.5% for 20 years.

CH2M HILL considered both economic (capital, operating and maintenance costs) and qualitative (non-monetary) criteria when evaluating the four alternatives. Table 16 contains a summary of our assessment of the qualitative criteria. A rating value developed by City staff allowed CH2M HILL to rank the three technologies. A weighting level of 3 is considered the most favorable and a rating value of 1 is least favorable. The technology with the highest total is considered the most favorable from a non-economic perspective. Some evaluation criteria were more heavily weighted to reflect their higher importance. A weight of 1 is least important and a 3 most important. The alternatives are then ranked, with the highest weighted score ranked the highest.

TABLE 16
Qualitative Evaluation of Liquid-Phase Odor Control Alternatives

Evaluation Criteria	Criterion Weight	Chemical Alternatives Ferric Chloride ($FeCl_3$)	Bioxide™ ($Ca(NO_3)_2$)	Sodium Hydroxide (NaOH)
Proven technology/reliability	3	3	3	2
Odor removal efficiency	3	3	2	2
Space requirements	2	2	1	3
Maintenance requirements	1	1	2	3
Operational Ease	2	2	3	2
Hazardous nature of materials	3	1	3	1
Total Weighted Score		**30**	**34**	**28**
Ranking		**2**	**1**	**3**

Liquid Phase Treatment Conclusions

Sampling results, combined with a modeling exercise using in-house models indicates that factors within the wastewater collection system contribute significantly to odor emissions at the treatment plant. These factors include long detention times and numerous forcemains that lead to the production of H_2S and other reduced sulfur compounds.

The modeling exercise indicates that the Boyd Interceptor and Boyd Relief Interceptor contribute most to the sulfides at the plant. The Southside Interceptor contributes a small portion of the overall sulfide loading to the plant, but the sampling program showed that the forcemain discharge generates high peak hydrogen sulfide concentrations within the headworks area. These peaks likely generate short-term odor releases that could lead to odor complaints. CH2M HILL recommends an odor management strategy that addresses both of these contributors.

Literature and CH2M HILL's experience indicates that liquid phase treatment of odor generating compounds in the collection system forms a cost effective component of multi-phased odor management plans for wastewater treatment facilities when the influent dissolved sulfide concentrations exceed 1.0 mg/L. The modeling exercise predicts a worst-case influent wastewater dissolved sulfide concentration of more than 5 mg/L. Accordingly, the City should consider incorporating a liquid phase program as part of the overall control strategy.

CH2M HILL has considered several sulfide control options. Ferric Chloride addition has the second highest life-cycle costs and ranks third in the non-economic evaluation. Ferric chloride requires special handling procedures and is a corrosive product. Bioxide™ has the lowest life-cycle cost, but may require more stations than ferric chloride. However, the product is relatively harmless and does not have the same handling and storage requirements. Based on the dosage rates and approximate chemical costs used in the analysis, sodium hydroxide (NaOH) appears to be cost prohibitive. The NaOH alternative cost is calculated on shock dosing every 10 days, and actual shock dosing requirements could vary. However, even with major adjustments in unit chemical costs and dosage requirements, the costs would not be competitive with the other chemicals.

CH2M HILL recommends that the City begin with Bioxide™ (or equivalent) on the basis that it is the most cost effective and will be added at the lift stations, which will provide an additional benefit of corrosion control in the collection system. The City should consider contacting Castle Rock, Colorado staff regarding their Bioxide™ program and its success. The following approach is suggested for proceeding with the liquid phase, sulfide control program:

1. Conduct a pilot test with Bioxide™ (or equivalent) being added at the Eastside lift station. During the pilot test, conduct sampling of both the dissolved sulfide levels of the influent and the H_2S concentrations at the odors sources.

2. If the pilot test is effective, implement permanent Bioxide™ (or equivalent) dosing stations for Boyd systems first (Eastside and Boyd Lake lift stations), then addresses the smaller contributors should further odor reductions be needed.

3. If the Bioxide™ is not effective, conduct a pilot test with another liquid phase treatment chemical, such as ferric chloride.

4. Commit to a data collection program that will allow stakeholders to evaluate the impact of the proposed mitigation measures. The data collection program would involve monthly sampling of the dissolved sulfide levels at the influent, as well as sampling the odor sources for H_2S using a Jerome meter.

Conclusions

The baseline odor assessment provides useful information that will enable the development of effective odor control improvements. The assessment establishes:

1. Extent of off-site impacts from the existing treatment plant.
2. Process units that are potential contributors to off-site odor impacts.
3. Effectiveness of various odor control scenarios.

The Loveland WWTP currently has several significant sources that contribute to off-site odor impacts, including the digester boiler room vent, aerated grit chamber, DAFT, and trickling filters.

The worst-case baseline modeling, based on the maximum H_2S concentrations obtained from Jerome meter sampling events in October 2003, shows that the current odor impacts above the 7 D/T odor threshold extend off-site mainly in northeast and southwest directions. The number of hours above 7 D/T is greatest along the northern side of the plant boundary (over 1,500 hours per year). The average condition baseline modeling, based on the flux chamber sampling results, shows the much smaller impact than the worst-case baseline modeling, although the shape of the isopleths is similar. The isopleths also tend to extend mainly in northeast and southwest directions. The highest exceedences (about 1,000 hours per year) also occurred at the north end of the plant.

The control modeling results show that odor control approaches represented at Stage 1 to Stage 4 can efficiently reduce the off-site impact. The maximum 5-minute off-site odor impact is reduced from about 1,130 D/T at Baseline to about 150 D/T at Stage 4. The highest exceedence is reduced from about 2,700 hours per year in the Baseline modeling to approximately 840 hours per year at Stage 4. They either eliminate the identified big odor sources completely, such as the trickling filter, or convert the major odor sources into the odor control scrubbers that emit significantly less odor, such as the chemical scrubber treating the headworks and grit chambers at Stage 3. In order to bring the Loveland WWTP within their desired odor control goal of less than 7 D/T 99percent of the time, the City may be required to conduct additional odor control. The primary clarifiers would be the next significant source of odor control.

Recommendations

In general, Loveland WWTP should continue its ongoing policy of implementing source control and general odor prevention O&M policies, procedures, and approaches to ensure that:

- The headworks scrubber is fully functional and effective
- Short-term fugitive sources are handled
- Process equipment going out of service or drained is controlled

The results of the modeling conducted as part of this Odor Management Plan indicate that the currently planned odor control projects will move the Loveland WWTP toward its odor reduction goal of no odors less than 7 D/T 99 percent of the time, set as part of this project. In addition, some immediate suggestions are provided to help reduce the off-site odor impact quicker.

Immediate Recommendations

Several other best management practices (BMPs) and operation and maintenance (O & M) enhancements could improve the odor prevention program at the Loveland WWTP. The BMPs and O & M enhancements can be implemented immediately and can help reduce the risk of off-site odor impacts. These BMPs and O & M enhancements include:

- **Investigate the boiler room for potential leaks** to the HVAC system. As recommended in Stage 1, this is a significant odor source should be reduced through fairly minor investigation and repair.
- **General housekeeping to reduce fugitive emissions.** Several housekeeping measures are already in place such as:
  - Primary clarifiers are cleaned regularly.
  - Digester gas is combusted.
  - Vessels are cleaned immediately after they are removed from service and drained.

Additional housekeeping measures to consider include washing down process tanks during draining to reduce odor generation and adding hypochlorite tablets to the tanks that are already drained and have small amounts of liquid collected on the bottom.

- **Monitor the sludge blanket in the primary clarifiers** to keep it at a minimum and, if possible, reduce the amount of vertical drop in the effluent weirs. The drop at the effluent weirs promotes stripping of odorous compounds.

As the community surrounding the Loveland WWTP becomes more odor sensitized it will be increasingly more important for the Loveland WWTP to be perceived as a good neighbor. Several recommendations are provided to improve the Odor Response Program, be pro-active in the neighborhood, and respond to off-site odor complaints. Loveland WWTP should consider increasing public outreach efforts and informing key community members of plant upset conditions, for example, and steps being taken to address odor events. One way to increase community involvement is to invite members of the community on-site before and after anticipated events that would cause an increase in odors.

Additional Odor Response actions to consider include:

- **Odor Monitoring.** Odor monitoring programs are helpful to understand the plant's odor sources and the conditions that contribute to significant odor problems off-site. Loveland WWTP should develop on- and off-site odor monitoring using operators or selected staff to routinely check for odors and their off-site impacts at selected odor monitoring stations. This team should visit odor monitoring stations once a day, as well as monitor collection system locations to ensure that the collection system is not adding to the odor problem. The Jerome meter should be used, as well as the nose, to estimate odor and H_2S levels. The Jerome meter sampling performed as part of the Odor Management Plan can be considered the first round of odor monitoring.
- **Consider installing a meteorological station** at the Loveland WWTP to provide better data for future odor modeling.
- **Develop response protocols for high odor events.** Loveland WWTP should develop response protocols for high odor events that consist of a list of immediate odor control strategies available to prevent or reduce the odor from traveling off-site or adversely impacting the community.
- **Have on hand portable odor control units** that can be used for equipment take downs, digester cleanings, and short-term odor vents that need controls.

Short-Term and Long-Term Recommendations

Based on the results of the modeling analysis, short- and long-term odor control improvements are also recommended, as shown in Table 17. These recommendations are based on the City's goal of reducing off-site odor impacts of less than 7 D/T 99 percent of the time.

Plant emissions are variable and so are removal efficiencies of odor control systems. After each phase of capital improvements, the sources should be resampled and the odor dispersion model rerun to predict the current plant conditions. This will enable the City to assess the effectiveness of the phased recommendations and confirm if all the capital improvements below are required, or if there are other new odor sources that require control. The cost of a Jerome meter is included in Odor Control Stage 3 so the City can conduct the confirmation sampling. The effort to re-run the dispersion model is included in Stage 4 to confirm the odor control benefits of the stages up through Stage 4. The long-term recommendations provided in Table 17 may or may not be necessary in the future, and careful evaluation should be performed before implementation.

The long-term recommendations describe in general what type of odor control can be provided for each source. Odor control consists of capturing the air with covers and/or equipment enclosures and treating the air with odor control equipment. Many odor control technologies are available to meet the newer, more stringent odor prevention and control criteria. The technologies that are considered for the City are liquid-phase treatment, single-stage packed tower scrubbers, carbon adsorption, and biofiltration. For the purposes of budgetary planning, a reasonable control technology has been assumed. As the City progresses with each project, a detailed technology selection should be conducted.

A summary of the recommended long-term improvements, with cost estimates, are included in Table 18. The detailed cost estimates are included in Appendix L. CH2M HILL recommends that the City plan to incorporate Stages 1 through 5 in their current CIP. It is anticipated that this level of odor control will meet the proposed odor control standard, given the conservative nature of the analysis. For the City to have a zero odor emissions plant, the cost would include all stages and would be approximately $5 million.

The cumulative odor reductions to be expected from each odor control stage, including liquid phase treatment, are shown in Figure 5. It is assumed that liquid phase treatment is implemented after the trickling filter is taken off-line (Stage 1) and the digester boiler room HVAC intake vent is relocated (Stage 2). For Stages 3 through 7, the predicted odor reduction is shown for each stage with and without the cumulative impact of liquid phase treatment. As additional odor control improvements are implemented, the additional odor reduction impact of liquid phase treatment becomes insignificant. However, liquid phase treatment continues to have benefit by reducing the chemical requirements for the odor control scrubbers.

TABLE 17
Summary of Recommendations for Loveland WWTP Odor Sources

Odor Source	Immediate Recommendations	Short-Term Recommendations	Long-Term Recommendations
WWTP Site	- Select a liquid phase chemical treatment process. - Consider a short-term, shock dosing program (sodium hydroxide) on the Southside forcemain to reduce odor peaks at the treatment plant.	- Develop a phased implementation program that addresses the Boyd systems first, then addresses the smaller contributors should further odor reductions be needed ($35,000 + up to $68,000 annual cost for seasonal use)	- Address future odor impacts from new sources under CIP program. - Update Odor Management Plan after each phase of the odor control program to verify results and if additional improvements are still needed. - Consider odor control for primary clarifiers if still getting small odors that add up from fugitive emissions occurring from all sources.
Digester Boiler Room Vent	- Investigate boiler room, boilers, and digester system for potential fugitive leaks into the boiler room HVAC. Repair any leaks found.	- Relocate HVAC intake vent away from the digesters and digester overflow weirs (Stage 2)	- If relocating HVAC vent does not reduce odors, may be required to install odor control for boiler room HVAC.
Aerated Grit Chamber	None recommended	- Cover aerated grit basin with aluminum covers and vent foul air to new, temporary carbon odor control unit (water regenerable carbon) (Stage 3)	- Will be replaced as part of new or modified Headworks Building
DAF Thickener	- Routine cleaning - Keep the doors closed and provide better ventilation or replace fan	None recommended	- Confirm offsite impacts from DAF thickener - If necessary, maintain negative pressure inside DAF, and ventilate foul air to new odor control equipment
Trickling Filters	- Remove trickling filters from service in December 2004 (Stage 1)	- None recommended	None recommended

TABLE 17
Summary of Recommendations for Loveland WWTP Odor Sources

Odor Source	Immediate Recommendations	Short-Term Recommendations	Long-Term Recommendations
Headworks Building	- Carefully consider wind direction and strength when open garage and removing grit bins - Direct as much building air as possible into the carbon scrubber, seal off rooms and bins to better focus odor removal and supply air. - Minimize entry into the building.	- Install liquid-phase treatment that will reduce the hydrogen sulfide loads for the odor control and provide better odor and corrosion control in the collection system.	- Accelerate the schedule for the Headworks Building and associated odor control prior to the WAS thickening project. Start design in 2005. Screw pumps and aerated grit chamber odor sources will be replaced as part of the new or modified Headworks building. - Ventilate new Headworks facility to minimum of 12 to 20 air changes per hour (ACH), and treat with new single-stage chemical scrubber that is polished by the carbon scrubber or biofilter (Stage 4).
Screw Pumps	None recommended	- Install liquid-phase treatment that will reduce the hydrogen sulfide loads for the odor control and provide better odor and corrosion control in the collection system.	- Will be replaced as part of the new or modified Headworks Building
Primary Clarifiers	- Consider flooding launders and removing sludge blankets quickly.	- If odor complaints persist, consider odor neutralizer for primary clarifiers on days when strong odor/H_2S is observed ($10,000 + up to $8,000 annual chemical costs)	- After completion of improvements listed above and if odor complaints persist, cover primary clarifiers, splitter box, influent junction boxes, and effluent junction box and ventilate to new odor control equipment (Stage 6).
Flare	- Maintain burner ignition system - Increase preventative maintenance programs and focus during odor compliant season	None recommended	- After completion of improvements listed above and odor complaints persist Install enclosed flare system
Aeration Basins	None recommended	- Resample aeration basins to ensure they are not a significant source of remaining off-site odor impacts	- After completion of improvements listed above and if odor complaints persist, odor control would be to cover and treat similar to primary clarifiers (Stage 7).

TABLE 17
Summary of Recommendations for Loveland WWTP Odor Sources

Odor Source	Immediate Recommendations	Short-Term Recommendations	Long-Term Recommendations
Digesters	- Routine maintenance and cleaning - Removal of all foam from the cover immediately - Conduct routine maintenance to prevent foaming and upset conditions	None recommended	None currently recommended. If odor complaints persist after the above recommendations are implemented, consider retrofitting digesters to have fixed roofs. Fixed roof digesters would eliminate fugitive leaks from the circumference of the digester (Stage 7)
Biosolids Truck Loading	None recommended	None recommended	None recommended. Odor control would be an enclosed truck loading area with odor control provided.

TABLE 18
Cost Summary for Long-Term Recommendations

Odor Control Stage	Long Term Recommendations	Air Flow Rate (cfm)	Capital Cost*	Annual Cost	Timing
1	Discontinue use of trickling filters	NA	$10,000	$0	2004
2	Rearrange digester boiler vent HVAC system	NA	$200,000	$0	2005
LPT	Conduct a pilot test of Bioxide™ or equivalent chemical	NA	$37,000	NA	2005
	Implement a liquid phase treatment program	NA	$35,000	$68,000	2005
3	Cover aerated grit chamber and vent to a carbon scrubber	250	$68,000	$6,000	2005
4	Provide odor control for modified Headworks processes, including screw pumps and influent collection well, within existing Headworks building. Vent air from Headworks building a new chemical scrubber polished with bioscrubber or carbon to achieve 99% removal efficiency.	13,000	$892,000	$87,000	2006 / 2009
5	Vent air from DAFT in a new carbon scrubber.	800	$84,000	$18,000	2008
6	Cover primary clarifiers and vent to new chemical scrubbers	3,800	$1,614,000	TBD	TBD
7	Cover aeration basins and vent to new chemical scrubbers. Replace digester covers with fixed roof covers	8,600	$3,353,000	TBD	TBD

*Total capital costs include construction and engineering costs. Construction costs include 30% contingency; engineering costs are estimated at 25% of construction cost

cfm = cubic feet per minute

The average annual costs are also estimated in Table 18. For future operations at the Loveland WWTP with full scale odor control, the annual operating costs for odor control could be as high as 5 to 15 percent of the annual operating budget. This is what a typical WWTP spends on odor control.

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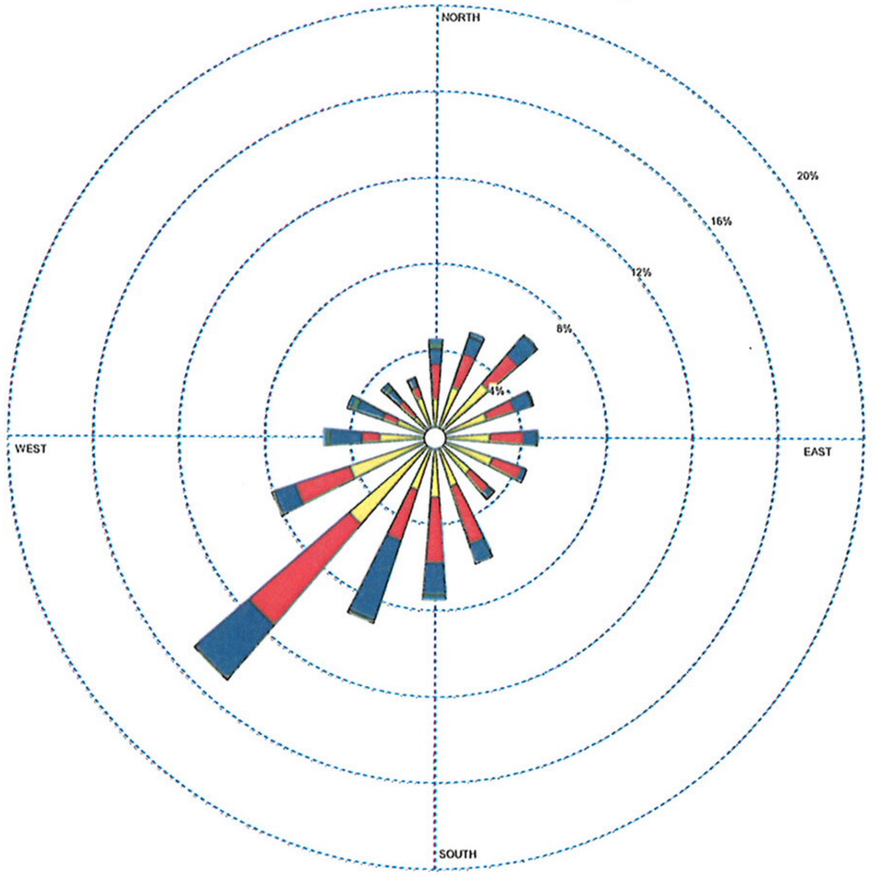
Appendix A – Windroses for 2003 by Season

WIND ROSE PLOT

Station #25650 - ,



Wind Speed (m/s)

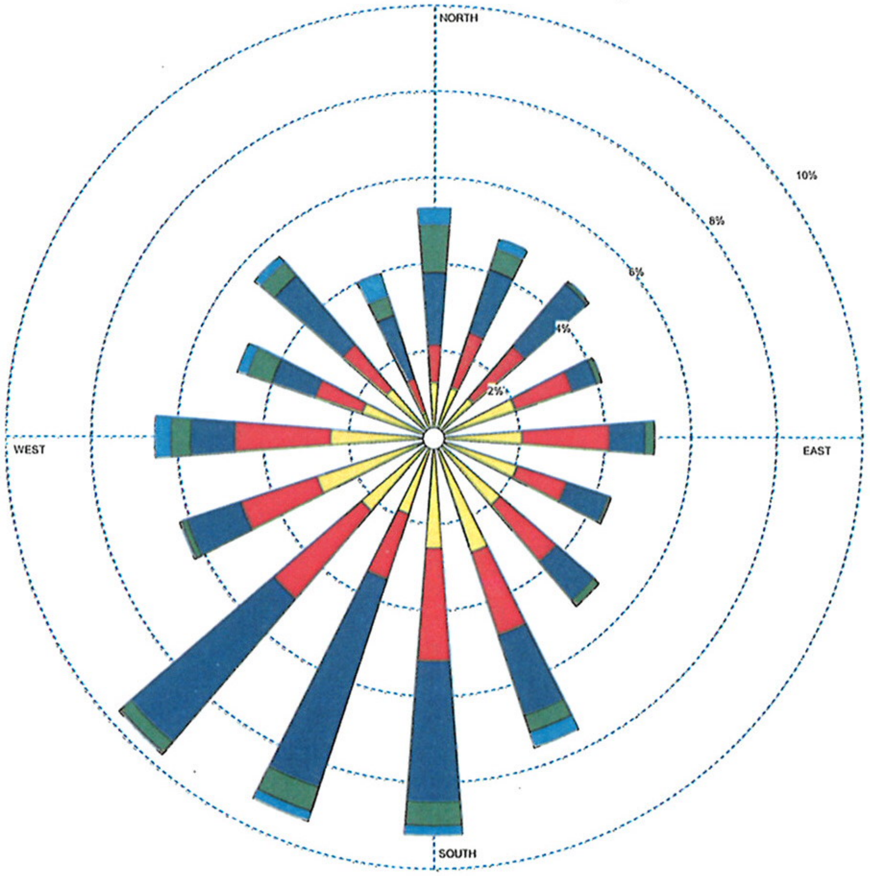
- 🟦 > 11.06
- 🟩 8.49 - 11.06
- 🟦 5.40 - 8.49
- 🟥 3.34 - 5.40
- 🟨 1.80 - 3.34
- ⬛ 0.51 - 1.80

MODELER	DATE **12/1/2004**	COMPANY NAME
DISPLAY **Wind Speed**	UNIT **m/s**	COMMENTS
AVG. WIND SPEED **4.11 m/s**	CALM WINDS **4.85%**	
ORIENTATION **Direction** **(blowing from)**	PLOT YEAR-DATE-TIME **2003** **Sep 1 - Nov 30** **Midnight - 11 PM**	PROJECT/PLOT NO.

WRPLOT View 3.5 by Lakes Environmental Software - www.lakes-environmental.com

WIND ROSE PLOT

Station #25650 - ,

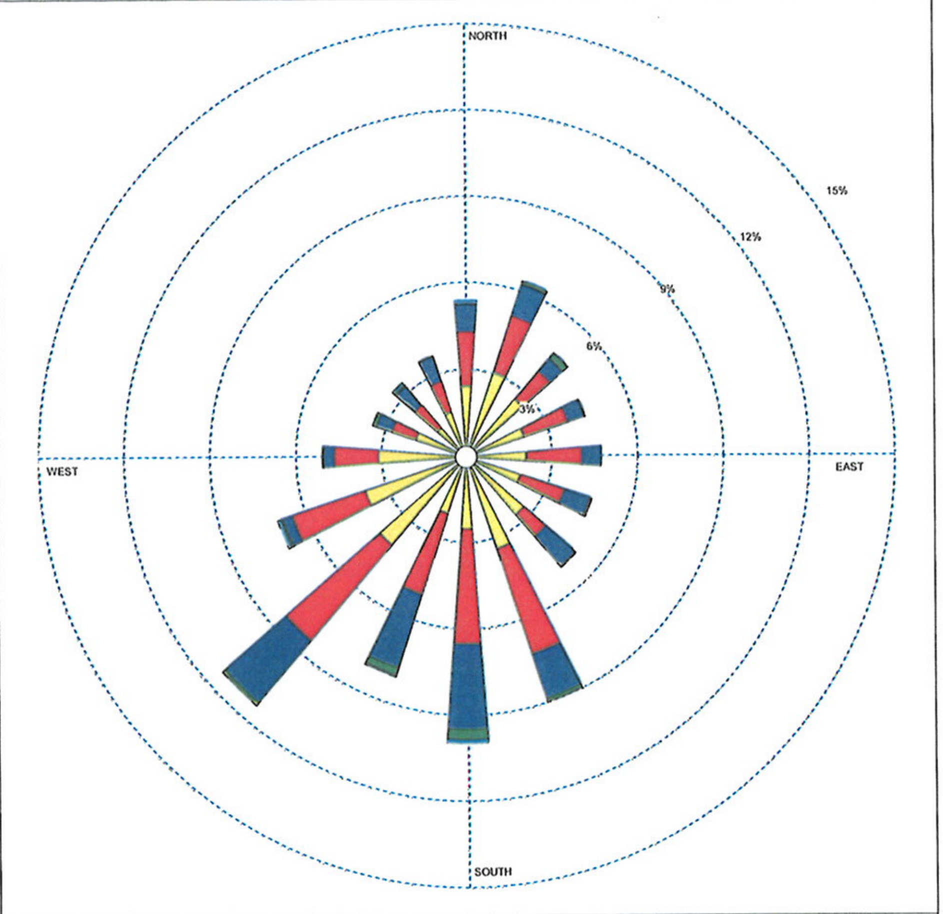


Wind Speed (m/s) 🟦 > 11.06 🟩 8.49 - 11.06 🟦 5.40 - 8.49 🟥 3.34 - 5.40 🟨 1.80 - 3.34 ⬛ 0.51 - 1.80	MODELER	DATE **12/1/2004**	COMPANY NAME
	DISPLAY **Wind Speed**	UNIT **m/s**	COMMENTS
	AVG. WIND SPEED **5.04 m/s**	CALM WINDS **3.40%**	
	ORIENTATION **Direction** **(blowing from)**	PLOT YEAR-DATE-TIME **2003** **Mar 1 - May 31** **Midnight - 11 PM**	PROJECT/PLOT NO.

WRPLOT View 3.5 by Lakes Environmental Software - www.lakes-environmental.com

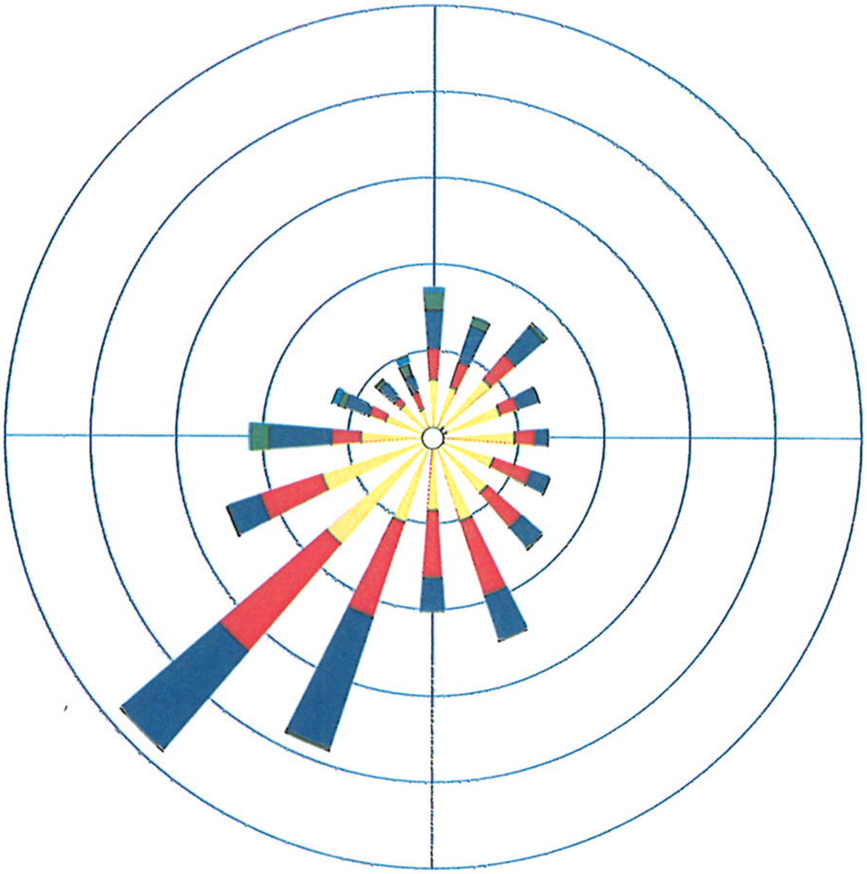
WIND ROSE PLOT

Station #25650 - ,



Wind Speed (m/s)	MODELER	DATE **12/1/2004**	COMPANY NAME
🟦 > 11.06 🟩 8.49 - 11.06 🟦 5.40 - 8.49 🟥 3.34 - 5.40 🟨 1.80 - 3.34 ⬛ 0.51 - 1.80	DISPLAY **Wind Speed**	UNIT **m/s**	COMMENTS
	AVG. WIND SPEED **4.10 m/s**	CALM WINDS **3.61%**	
	ORIENTATION **Direction (blowing from)**	PLOT YEAR-DATE-TIME **2003** **Jun 1 - Aug 31** **Midnight - 11 PM**	PROJECT/PLOT NO.

WRPLOT View 3.5 by Lakes Environmental Software - www.lakes-environmental.com



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MODELER

DATE
12/1/2004

COMPANY NAME

DISPLAY
Wind Speed

UNIT
m/s

COMMENTS

AVG. WIND SPEED
4.29 m/s

CALM WINDS
4.80%

ORIENTATION
Direction
(blowing from)

PLOT YEAR-DATE-TIME
2003
Dec 1 – Feb 28
Midnight - 11 PM

PROJECT/PLOT NO.

WRPLOT View 3.5 by Lakes Environmental Software - www.lakes-environmental.com

Appendix B – State of Colorado Regulation 2, Part A – General Provisions

REGULATION NO. 2

Odor Emission Regulations

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PART A GENERAL PROVISIONS

Pursuant to Section 25-7-109(2)(d), C.R.S., the following Emission Regulations are issued:

I. No person, wherever located, shall cause or allow the emission of odorous air contaminants from any single source such as to result in detectable odors which are measured in excess of the following limits:

I.A. For areas used predominantly for residential or commercial purposes it is a violation if odors are detected after the odorous air has been diluted with seven (7) or more volumes of odor free air.

I.B. In all other land use areas, it is a violation if odors are detected after the odorous air has been diluted with fifteen (15) or more volumes of odor free air.

I.C.

I.C.1. When the source is a manufacturing process or agricultural operation, no violation of Sections I.A. and I.B., Part A, of this Regulation No. 2 shall be cited by the Division, provided that the best practical treatment, maintenance, and control currently available shall be utilized in order to maintain the lowest possible emission of odorous gases and, where applicable, provided there is compliance with Item 4r of the Colorado Department of Health Pasteurized Fluid Milk and Milk Products Regulation adopted April 18, 1967. In determining the best practical control methods, the Division shall not require any method which would result in an arbitrary and unreasonable taking of property or in the practical closing of any lawful business or activity, if such would be without corresponding public benefit.

I.C.2. For all areas it is a violation when odors are detected after the odorous air has been diluted with one hundred twenty seven (127) or more volumes of odor free air in which case provisions of Section I.C.1., Part A, of this Regulation No. 2 shall not be applicable.

II. For the purposes of this Part A of Regulation No. 2, two odor measurements shall be made within a period of one hour, these measurements being separated by at least fifteen (15) minutes. These measurements shall be made outside the property line of the property from which the emission originates.

III. For the purposes of this Part A of Regulation No. 2, personnel for evaluating odors shall be selected using an "intensity rating test" as outline in "Selection and Training of Judges for Sensory Evaluation of the Intensity and Character of Diesel Exhaust Odors." USPHS Pub. #999-AP-32.

IV. The Barnebey-Chaney Scentometer, suitable calibrated, or any other instrument, device, or technique designated by the Colorado Air Pollution Control Division, may be used in the determination of the intensity of an odor and may be used as a guide in the enforcement of this Part A of Regulation No. 2.

V. The provisions of this Part A of Regulation No. 2 shall apply throughout the State of Colorado. Except that this Part A of Regulation No. 2 shall not apply to housed commercial swine feeding operations.