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**1978
Treatment
Plant Report**

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METROPOLITAN
WASTE
CONTROL
COMMISSION
Twin Cities Area

1978 ANNUAL WASTEWATER
TREATMENT PLANT REPORT

Prepared by the

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ABSTRACT

This is the 1978 Quality Control Report of Wastewater Treatment Plant Data for treatment facilities owned and operated by the Metropolitan Waste Control Commission (MWCC).

During 1978, 91 billion gallons of wastewater were treated at the Commission's 19 treatment plants. This represented an increase of approximately 10 percent in flow volume from the previous year. Overall annual removal efficiencies for biochemical oxygen demand (BOD) and total suspended solids (TSS) were 83 percent and 84 percent respectively. Overall annual effluent concentrations for BOD and TSS were 36 mg/l and 38 mg/l respectively as compared to 1977 effluent concentration of 38 mg/l for BOD and 44 mg/l for TSS.

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I. Introduction

During 1978, the Metropolitan Waste Control Commission operated 19 wastewater treatment plants located within the seven county Twin Cities Metropolitan Area. The purpose of this report is to summarize the efficiencies attained by these treatment plants during 1978, and compare 1978 performances to past performances and performance goals projected for 1978.

The Metropolitan Waste Control Commission was established as the area-wide operational water pollution control agency by the Minnesota Legislature through the Metropolitan Sewer Act in 1969. This Act gave the Commission formal charge to prevent, abate, and control water pollution in lakes, rivers, and streams of the Metropolitan Area. The discharge of these responsibilities required that the Commission acquire, construct, operate, and maintain all interceptors and treatment works necessary for the collection, treatment, and disposal of wastewater in the area.

The first section of this report explains the National Pollutant Discharge Elimination System (NPDES) permitting procedures and existing effluent quality limitations. In addition, an overall summary of treatment efficiencies and effluent qualities obtained by the Commission's treatment facilities is presented.

In the second section of this report each treatment plant is analyzed in detail. For each treatment plant there is a liquid and solids flow diagram, influent and effluent quality tabulations and trending charts, a general discussion of plant history and 1978 operations, and statistical analyses of effluent concentrations. The statistical analyses of effluent

concentrations compare the 1978 effluent characteristics with those of the previous three years, and illustrates the effluent concentrations and the percentage of the time these values occurred. In addition, ash pond discharge data are presented for the Metropolitan Plant, and effluent heavy metals concentrations are shown for the Anoka and Metropolitan Plants.

II. Effluent Standards

In 1972, Public Law 92-500 was enacted by Congress which stated that the minimum goal for publicly owned treatment works was to achieve secondary treatment levels by July 1, 1977. The July 1, 1977 deadline was eased with passage of the 1977 Clean Water Act. The new legislation amended PL 92-500 and under certain conditions, allowed an extension of the requirement for meeting secondary treatment standards to July 1, 1983.

Secondary treatment as defined in the State of Minnesota Water Pollution Control Rules and Regulations, WPC-15, is as shown in Table 1.

TABLE 1
DEFINITION OF SECONDARY TREATMENT EFFLUENT - WPC-15

Constituent	30-Day Mean	7 Consecutive Day Mean
BOD - Biochemical Oxygen Demand, mg/l*	25	45
TSS - Total Suspended Solids, mg/l*	30	45
Fecal Coliform Bacteria, Number/100 ml**	200	400
Phosphorus, mg/l***	1	-
Turbidity*	25	-
pH Range****	6.5 - 8.5	-

* Arithmetic Mean

** Geometric Mean

*** In effect where discharge is directly to lake or reservoir

**** Not subject to averaging

During 1974, the National Pollutant Discharge Elimination System (NPDES) program was established and all the Commission plants were issued discharge permits by the Minnesota Pollution Control Agency (MPCA). The permits stipulated interim effluent quality standards to be achieved for compliance with permit conditions. Effluent quality standards established for each plant were the same as, more stringent than, or less stringent than those

of secondary treatment, depending upon the water quality standards of the receiving waters and the practicability of attaining certain levels of treatment under existing operating conditions.

Permits for five of the Commission's treatment plants were reissued in 1978 and effluent quality standards were revised. The standards now in effect may be revised in the future as receiving water quality standards change and as facilities are constructed capable of achieving higher levels of treatment. The NPDES effluent quality limitations in effect during 1978 are shown in Table 2.

TABLE 2
NPDES INTERIM EFFLUENT LIMITATIONS - 1978*

Treatment Plant (a)	Standards Applicable	5-Day BOD, mg/l		TSS, mg/l		Fecal Coliform MPN/100 ml		Turbidity NTU	Phosphorus P
		7-day avg	30-day avg	7-day avg	30-day avg	Geometric Mean	7-day mean	30-day mean	
Anoka (b)	At All Times	45	25	45	30	400	200	25	-
Apple Valley	Jan 1-Apr 30	-	20	-	10	400	200	25	-
	May 1-Dec 31	-	20	-	15	400	200	25	-
Bayport	At All Times	45	25	45	30	-	200	-	-
Blue Lake	At All Times	45	25	45	30	400	200	25	1.0
Chaska	At All Times	-	50	-	80	-	200	-	-
Cottage Grove	At All Times	-	70	-	40	-	200	-	-
Farmington	At All Times	-	60	-	55	-	200	-	-
Hastings	At All Times	45	25	45	30	400	200	25	-
Lakeville	Nov 1-Apr 30	-	95	-	60	-	200	-	-
	May 1-Oct 31	-	50	-	60	-	200	-	-
Long Lake	Jan 1-Mar 31	-	65	-	45	-	200	-	-
	Apr 1-Dec 31	-	35	-	45	-	200	-	-
Maple Plain	At All Times	-	25	-	30	400	200	-	-
Metropolitan	Jan 1-Apr 30	-	80	-	80	-	200	-	-
	May 1-Oct 31	-	60	-	70	-	200	-	-
	Nov 1-Dec 31	-	40	-	40	-	200	-	-
Orono	At All Times	-	25	-	30	-	200	25	-
Prior Lake	At All Times	-	30	-	35	400	200	-	-
Rosemount	At All Times	45	25	45	30	400	200	25	1.0
Savage	May 1-Oct 31	-	35	-	30	-	200	-	-
	Nov 1-Apr 30	-	45	-	30	-	200	-	-
Seneca	At All Times	45	25	45	30	400	200	25	-
Stillwater	At All Times	45	25	45	30	400	200	-	1.0
Waconia	At All Times	-	35	-	75	-	200	-	-

(a) General Requirements for Essentially All Plants:

- 1) The pH shall not be less than 6.5 nor greater than 8.5. These upper and lower limitations are not subject to averaging and shall be met at all times.
 - 2) There shall be no discharging of floating solids or visible foam in other than trace amounts.
 - 3) The discharge shall not contain oil or other substances in amounts sufficient to create a visible color or film.
- (b) Additional 30-day mean permit standards for Anoka; chromium-0.4 mg/l, copper-0.3 mg/l, lead-0.5 mg/l, zinc-0.5 mg/l, cyanide-0.5 mg/l.
- (c) For the period Jan 1-June 30, six month average for BOD shall not exceed 70 mg/l and six month average for TSS shall not exceed 60 mg/l. For the period July 1-Dec 31, six month average for BOD shall not exceed 45 mg/l and six month average for TSS shall not exceed 55 mg/l.

* This list is not a complete list of effluent limitations, but a compilation of standards useful for control purposes only.

III. Summary of Treatment Plant Efficiencies

Treatment plants operated by the Commission are shown in Table 3 together with annual average flows, and BOD and TSS effluent concentrations and removals. Also included in Table 3 are summary data on the overall operation of existing plants for the period 1971-1978.

Table 4 includes 1978 effluent BOD and TSS data together with nitrogen, phosphorus, turbidity, and fecal coliform bacterial counts for 1978. In addition, Table 4 lists applicable NPDES effluent limitations for the above parameters for each treatment plant operated in 1978.

During 1978, 91 billion gallons of wastewater were treated achieving overall removal efficiencies of 83 percent for BOD and 84 percent for TSS. The total volume of wastewater treated during 1978 increased from that treated in 1977 by 8 billion gallons. The overall BOD removal efficiency decreased from 84 percent in 1977 to 83 percent in 1978 whereas the overall TSS removal efficiency of 84 percent remained unchanged from 1977.

Of the 91 billion gallons of wastewater received during 1978, 84 percent was treated at the Commission's largest facility, the Metropolitan Wastewater Treatment Plant. Approximately 10 percent of the total flow was divided between the next two larger facilities, Blue Lake and Seneca. The remaining 6 percent was treated at 16 smaller plants scattered throughout the seven county area.

Effluent quality during 1978 at the Metropolitan Plant improved over that of 1977. Average effluent BOD and TSS concentration values during 1978 were 39 mg/l and 43 mg/l, as compared to 1977 average effluent BOD and TSS values of 42 mg/l and 49 mg/l. This represents an

TABLE 3
FLOW, EFFLUENT
CONCENTRATIONS, REMOVALS

	FLOW (MGD)										EFFLUENT CONCENTRATIONS, (mg/l)										REMOVAL EFFICIENCY, (%)										Annual Average BOD										Annual Average TSS									
	Annual Average Flow (MGD)										Annual Average BOD										Annual Average TSS										Annual Average BOD										Annual Average TSS									
	1971	1972	1973	1974	1975	1976	1977	1978	1971	1972	1973	1974	1975	1976	1977	1978	1971	1972	1973	1974	1975	1976	1977	1978	1971	1972	1973	1974	1975	1976	1977	1978	1971	1972	1973	1974	1975	1976	1977	1978	1971	1972	1973	1974	1975	1976	1977	1978		
ANOKA	1.76	1.93	1.88	1.78	1.62	1.77	1.92	2.01	20	29	36	21	16	11	9	12	24	36	40	19	13	15	14	16	89	87	85	91	92	94	95	94	90	88	85	94	94	92	92	90										
APPLE VALLEY	0.57	0.71	1.16	1.26	1.48	1.46	1.67	1.94	74	113	22	24	7	7	6	12	93	148	16	14	5	5	3	6	65	52	90	89	97	96	97	94	64	55	95	96	98	98	99	98										
BAYPORT	0.48	0.48	0.42	0.45	0.56	0.50	0.48	0.47	27	40	32	9	15	14	11	8	22	43	28	15	10	8	10	8	88	86	86	97	95	95	95	96	90	84	86	95	97	96	93	94										
BLUE LAKE	-	-	3.94	6.78	9.05	9.03	9.86	12.49	-	-	12	18	15	15	13	13	-	-	22	21	14	19	13	14	-	-	96	94	94	95	95	95	95	-	-	91	94	96	95	96	96									
CHASKA	0.53	0.58	0.74	0.75	0.91	0.81	0.75	0.97	36	49	52	58	43	42	44	78	72	86	79	91	62	55	54	66	79	75	74	69	81	83	78	61	66	54	57	53	73	81	70	63										
COTTAGE GROVE	0.62	0.85	0.92	0.91	0.91	0.91	0.97	1.31	53	52	60	36	25	55	39	34	63	70	93	84	36	25	23	28	81	80	76	85	89	72	81	83	82	78	66	71	85	86	90	86										
FARMINGTON	0.35	0.30	0.40	0.35	0.59	0.37	0.35	0.52	39	52	46	85	64	29	76	31	70	77	54	75	29	23	34	34	86	87	86	91	86	94	83	91	73	74	76	79	88	90	86	82										
HASTINGS	0.91	1.14	1.32	1.29	1.29	1.30	1.40	1.42	12	7	15	34	15	12	16	18	10	10	18	26	20	21	18	20	96	97	92	81	91	94	92	93	97	97	92	87	90	90	90	92										
LAKEVILLE	0.45	0.36	0.33	0.37	0.50	0.38	0.36	0.48	36	33	34	25	28	34	51	67	47	36	36	30	33	39	53	68	75	78	84	94	92	94	88	77	73	83	89	96	97	96	93	82										
LONG LAKE	0.18	0.17	0.15	0.20	0.23	0.19	0.21	0.30	53	24	18	35	40	41	43	42	35	47	23	50	39	48	37	30	75	86	93	86	73	78	79	74	83	84	92	89	79	82	86	85										
MAPLE PLAIN	0.22	0.28	0.22	0.24	0.33	0.22	0.18	0.26	12	11	13	10	9	8	11	11	20	13	13	19	12	16	16	10	90	86	93	95	89	94	93	92	68	79	89	90	86	88	91	96	96									
MEDINA	0.07	0.09	0.07	0.08	0.09	0.07	0.08	0.14	12	9	14	10	13	14	25	22	11	15	16	13	13	15	20	18	92	90	90	92	92	94	86	93	92	88	88	91	91	96	88	96										
METROPOLITAN	213	213	202	196	202	196	194	210	84	72	46	42	41	67	42	39	72	54	37	43	40	60	49	43	66	73	82	84	83	75	83	82	77	83	88	86	87	82	83	81										
ORONO	0.20	0.25	0.27	0.34	0.32	0.31	0.34	0.46	15	10	10	6	6	8	12	24	19	15	10	10	11	17	21	32	88	93	94	96	94	93	91	79	86	91	94	93	88	88	81											
PRIOR LAKE	0.10	0.12	0.13	0.17	0.31	0.44	0.10	0.01	34	26	28	22	24	35	22	24	28	33	27	25	28	17	17	82	78	80	80	77	68	71	78	89	82	86	80	80	80	88												
ROSEMOUNT	-	-	0.20	0.20	0.22	0.24	0.27	0.29	-	-	7	23	16	14	14	13	-	-	2	9	4	3	3	4	-	-	90	91	92	94	93	93	-	-	96	96	98	99	98											
SAVAGE	0.31	0.33	0.29	0.38	0.42	0.38	0.39	0.37	22	26	28	27	21	20	46	27	24	28	14	15	13	10	14	15	84	88	84	85	88	88	84	85	91	96	95	96	94	94												
SENECA	-	7.76	10.12	9.89	10.34	10.81	11.72	12.71	-	29	16	15	11	15	16	21	-	29	17	19	16	15	17	-	88	94	94	95	94	93	92	-	88	93	94	94	93	93	93											
STILLWATER	2.14	1.96	1.88	1.92	2.09	2.10	2.11	2.21	24	17	14	12	11	8	12																																			

TABLE 4
1978 ANNUAL SUMMARY
TREATMENT PLANT EFFLUENT QUALITY DATA

Treatment Plant	Wastewater Design Flow	Flow 1978 Average	1978 Avg. Percent Removal	Effluent Concentrations											
				BOD, mg/l		TSS, mg/l		Fecal Coliform Geometric Mean MPN/100 ml		Nutrients, mg/l		Turbidity NTU			
				NPDES Limit	1978 Avg.	NPDES Limit	1978 Avg.	NPDES Limit	1978 Avg.	Total P	Kj-N	NPDES Limit	1978 Avg.	NPDES Limit	1978 Avg.
	mgd	mgd	BOD TSS												
Anoka	2.46	2.01	94 90	25	12	30	16	200	40	3.0	18.3	25	8		
Apple Valley (1) (a)	1.50	1.94	94 98	20/20	12	10/15	6	200	16	4.4	21.5	25	6		
Bayport	0.65	0.47	96 94	25	8	30	8	200	2	1.0	0.3	5.7	4		
Blue Lake	20.00	12.49	95 96	25	13	30	14	200	9	3.9	16.4	25	11		
Chaska	0.75	0.97	61 63	50	78	80	66	200	20	2.6	14.2	30			
Cottage Grove	0.90	1.31	83 86	70	34	40	28	200	43	5.0	25.6	15			
Farmington	0.59	0.52	91 82	60	31	55	34	200	18	18.3	16.5	19			
Hastings	1.83	1.42	93 92	25	18	30	20	200	26	4.6	27.9	25	12		
Lakeville (2)	0.25	0.48	77 82	95/50	67	60/60	68	200	84	4.8	19.8	74			
Long Lake (3)	0.19	0.30	74 85	65/35	42	45/45	30	200	21	5.0	18.8	21			
Maple Plain	0.20	0.26	92 96	25	11	30	10	200	45	3.7	9.6	6			
Medina	0.10	0.14	93 96	----	22	----	18	----	----	4.5	12.8	9			
Metropolitan (4) (b)	218	210	82 81	80/60/40	39	80/70/40	43	200	198	2.4	13.9	19			
Orono	0.40	0.46	79 81	25	24	30	32	200	27	2.9	12.8	25	12		
Prior Lake	0.24	0.01	78 88	30	24	35	17	200	6	6.4	16.5	14			
Rosemount	0.60	0.29	93 98	25	13	30	4	200	1	1.0	0.4	30.5	25	5	
Savage (5)	0.36	0.37	85 94	35/45	27	30/30	15	200	8	4.5	12.0	13			
Seneca	24.00	12.71	92 93	25	21	30	17	200	12	4.0	24.2	25	10		
Stillwater	3.02	2.21	93 94	25	10	30	10	200	2	1.0	0.4	15.5	7		
Waconia	0.20	0.20	90 89	35	31	75	40	200	0	4.0	19.0	25			

(1) Jan 1-Apr 30/May 1-Dec 31

(a) There are additional NPDES limits for the Anoka Plant. These 30-day limits are:
chromium-0.4 mg/l, copper-0.3 mg/l, lead-0.5 mg/l, zinc-0.5 mg/l, cyanide-0.5 mg/l.

(2) Nov 1-Apr 30/May 1-Oct 31

(3) Jan 1-Mar 31/Apr 1-Dec 31

(4) Jan 1-Apr 30/May 1-Oct 31/Nov 1-Dec 31

(5) May 1-Oct 31/Nov 1-Apr 30

(b) For the period Jan 1-June 30, the six month average for BOD shall not exceed 70 mg/l and the six month average for TSS shall not exceed 60 mg/l. For the period Jul 1-Dec 31, the six month average for BOD shall not exceed 45 mg/l and the six month average for TSS shall not exceed 55 mg/l.

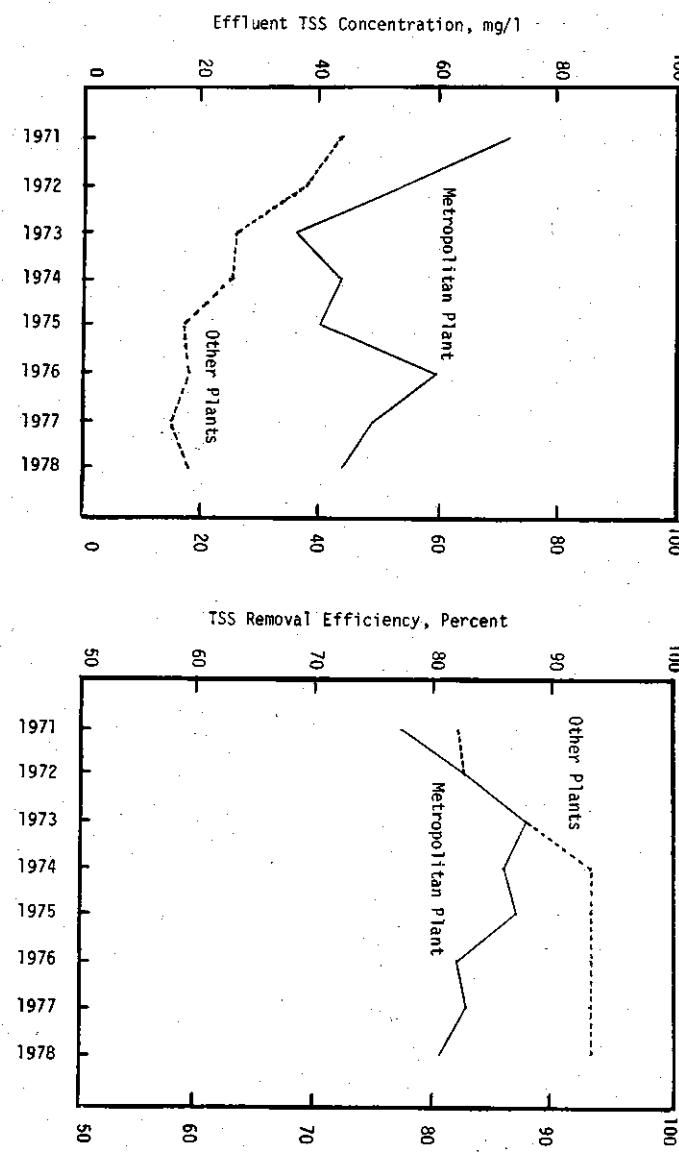
improvement over 1977 BOD and TSS values of 7 percent and 12 percent respectively. Removal efficiencies for BOD and TSS decreased from 83 percent and 83 percent in 1977 to 82 percent and 81 percent in 1978.

Although the average effluent concentration of all plants except Metro was well within standards set for secondary treatment as defined in WPC-15, the average effluent quality for all plants except Metro declined slightly from the previous year. Average effluent BOD and TSS concentration values during 1978 were 19 mg/l and 18 mg/l, respectively, as compared to 1977 average effluent BOD and TSS values of 17 mg/l and 15 mg/l. Annual average effluent values for these smaller plants were lower than applicable standards by 28 percent for BOD and 40 percent for TSS. Removal efficiencies were 92 percent for BOD and 93 percent for TSS.

Figure 1 illustrates the trend in effluent quality data for the largest plant, the Metropolitan Plant, as compared to the overall performance of the other plants for the past eight years.

Statistical analyses of effluent BOD and TSS data are presented in Table 5 and 6, respectively. These tables compare the 50, 75, and 90 percentile BOD and TSS values of 1976 and 1977 with those of 1978 for each of the treatment plant effluents. An explanation of the tables is that for the percent of time shown, the effluent concentration was equal to or less than the tabulated value. For example, in Table 6 the effluent suspended solids value for the Anoka Treatment Plant was equal to or less than 13 mg/l 50 percent of the time, equal to or less than 20 mg/l 75 percent of the time, and equal to or less than 28 mg/l 90 percent of the time during 1978. A statistical analysis such as this can be used to compare treatment efficiencies achieved at each plant

FIGURE 1
BOD Percent Removal and Effluent Concentration Trends



TSS Percent Removal and Effluent Concentration Trends

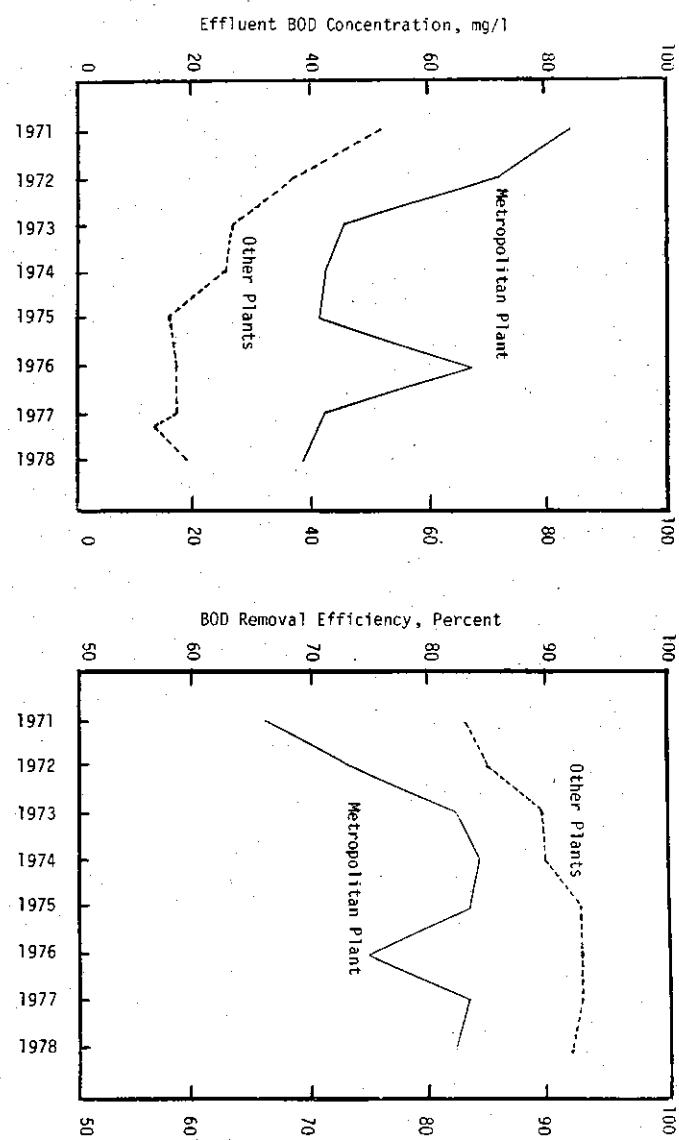


TABLE 5
 STATISTICAL ANALYSES OF BIOCHEMICAL
 OXYGEN DEMAND EFFLUENT DATA FOR
 1976, 1977, AND 1978
 TREATMENT PLANT EFFLUENT STATISTICAL DATA

BIOCHEMICAL OXYGEN DEMAND, mg/l*

TREATMENT PLANT	50% OF TIME			75% OF TIME			90% OF TIME		
	1976	1977	1978	1976	1977	1978	1976	1977	1978
ANOKA	9	7	11	14	10	16	22	13	22
APPLE VALLEY	4	4	10	6	6	16	18	10	24
BAYPORT	10	7	6	20	10	10	26	16	14
BLUE LAKE	16	10	11	20	15	14	24	20	22
CHASKA	25	33	61	49	58	100	114	98	140
COTTAGE GROVE	51	31	28	70	44	38	95	69	52
FARMINGTON	24	25	23	39	111	34	50	175	45
HASTINGS	10	13	16	16	19	22	22	29	28
LAKEVILLE	32	25	59	44	48	85	76	78	120
LONG LAKE	36	31	30	54	61	40	73	89	84
MAPLE PLAIN	5	8	7	8	17	14	21	26	22
MEDINA	--	--	20	--	--	32	--	--	42
METRO	60	40	40	80	51	53	141	62	64
ORONO	7	7	15	10	12	29	16	20	38
PRIOR LAKE	30	18	18	40	28	34	59	53	43
ROSEMOUNT	13	12	11	18	18	15	24	23	22
SAVAGE	18	20	26	24	30	34	37	42	42
SENECA	12	14	18	19	20	25	28	28	39
STILLWATER	8	8	8	11	14	14	14	24	18
WACONIA	36	38	--	89	54	--	137	140	--

* The data shows that for the percent of time shown, the effluent concentration was equal to or less than the tabulated values.

TABLE 6
 STATISTICAL ANALYSES OF TOTAL SUSPENDED
 SOLIDS EFFLUENT DATA FOR
 1976, 1977, AND 1978
 TREATMENT PLANT EFFLUENT STATISTICAL DATA

TREATMENT PLANT	TOTAL SUSPENDED SOLIDS, mg/l*								
	50% OF TIME			75% OF TIME			90% OF TIME		
	1976	1977	1978	1976	1977	1978	1976	1977	1978
ANOKA	13	12	13	19	16	20	28	21	28
APPLE VALLEY	2	2	6	4	4	8	10	6	11
BAYPORT	7	10	8	10	12	10	13	15	12
BLUE LAKE	18	11	13	24	17	18	29	20	22
CHASKA	33	36	58	66	71	88	122	121	120
COTTAGE GROVE	18	12	17	28	22	28	48	44	51
FARMINGTON	21	30	32	30	39	42	38	58	55
HASTINGS	17	16	18	24	24	25	34	29	33
LAKEVILLE	36	49	60	48	64	80	65	87	114
LONG LAKE	37	34	27	65	44	39	95	58	52
MAPLE PLAIN	7	7	6	30	24	12	48	42	40
MEDINA	--	--	16	--	--	22	--	--	34
METRO	48	40	37	77	53	55	104	88	78
ORONO	10	9	20	24	17	36	39	26	98
PRIOR LAKE	27	12	13	32	24	28	40	36	33
ROSEMOUNT	3	2	3	4	3	5	6	5	7
SAVAGE	9	10	14	11	16	20	14	29	25
SENECA	11	14	14	18	18	19	27	22	27
STILLWATER	9	7	10	12	10	14	16	13	18
WACONIA	52	38	--	66	48	--	86	70	--

* The data shows that for the percent of time shown, the effluent concentration was equal to or less than the tabulated values.

during 1976 and 1977 with those achieved during 1978.

Statistical analyses presented in Table 5 illustrate that the 90 percentile values for effluent BOD concentrations in 1978 decreased from those of 1977 at nine plants, increased from those of 1977 at eight plants and remained the same at one plant. Table 6 illustrates that the 90 percentile values for effluent TSS concentrations in 1978 decreased from those of 1977 at eight plants, and increased from those of 1977 at ten plants.

Of the plants that experienced effluent quality deterioration during 1978, five plants treated wastewater volumes in excess of their design capacities. In addition, increases in flow of up to 49 percent from the previous year were observed at eleven additional plants.

Corrective measures are planned at many of the plants where effluent quality deteriorated in 1978. Chaska, Cottage Grove, and Savage have plant improvements in progress with completion set for mid-1979. The Farmington and Lakeville Plants will be phased-out in mid-1979 and their flows diverted to the Empire Plant for treatment. Orono and Long Lake will also be phased-out and their flows diverted to Blue Lake upon completion of the Orono-Long Lake Interceptor.

During 1978, the Commission continued to utilize a recently implemented criteria by which to rapidly assess plant performance. The assessment is made in terms of three parameters: Frequency (F), Severity (S), and Noncompliance Index (NCI).

Frequency (F) is the frequency of compliance with NPDES standards. It is calculated by dividing the total number of BOD and TSS analyses complying with standards by the total number of BOD and TSS analyses performed and expressing the result as a percentage.

Severity (S) is the deviation from the standard for those BOD and TSS analyses which exceed NPDES standards. It is determined by locating the median value of those values exceeding standards and expressing the deviation as a percent of standard.

In judging the performance of plants, both the frequency and severity must be considered; therefore, noncompliance index was developed to allow a rapid, single-number, assessment of performance. The noncompliance index (NCI) is determined by multiplying the percent severity by the non-compliance (100 - frequency) and dividing by 100.

During 1978, frequency and severity goals were included as program objectives for all treatment plants operated by the Commission. These goals were arrived at after reviewing past performance and NPDES permit limitations for each of the plants.

Table 7 compares frequency goals with actual 1978 values. The nearer the frequency number is to 100 percent, the better the plant performance as related to effluent quality standards.

Table 8 compares severity goals with actual severity values from 1978. The larger the severity number, the greater the magnitude of violations of effluent standards.

Table 9 compares noncompliance index goals (calculated using frequency and severity goals) with actual 1978 values. A low noncompliance index indicates better overall compliance with effluent quality standards.

Table 10 summarizes data from Table 7, 8, and 9 and compares it with previous year performance.

TABLE 7
FREQUENCY - 1978
COMPARISON OF ACTUAL WITH GOALS

<u>Treatment Plant</u>	<u>Frequency Goal, %</u>	<u>Actual Frequency, %</u>
Anoka	93	93
Apple Valley	90	86
Bayport	92	99
Blue Lake	93	97
Chaska	84	56
Cottage Grove	92	91
Farmington	85	91
Hastings	90	86
Lakeville	85	60
Long Lake	75	75
Maple Plain	88	94
Metropolitan	75	85
Orono	92	65
Rosemount	93	97
Savage	75	93
Seneca	93	86
Stillwater	95	99

TABLE 8
SEVERITY - 1978
COMPARISON OF ACTUAL WITH GOALS

<u>Treatment Plant</u>	<u>Severity Goal, %</u>	<u>Actual Severity, %</u>
Anoka	33	27
Apple Valley	66	20
Bayport	33	12
Blue Lake	25	44
Chaska	50	66
Cottage Grove	33	65
Farmington	60	19
Hastings	33	20
Lakeville	33	33
Long Lake	33	22
Maple Plain	40	35
Metropolitan	40	20
Orono	45	52
Rosemount	20	20
Savage	33	14
Seneca	33	43
Stillwater	33	48

TABLE 9
NON COMPLIANCE INDEX - 1978
COMPARISON OF ACTUAL WITH PROPOSED

<u>Treatment Plant</u>	<u>Noncompliance Index Goal</u>	<u>Actual Noncompliance Index</u>
Anoka	2.3	1.9
Apple Valley	6.6	2.8
Bayport	2.6	0.1
Blue Lake	1.8	1.3
Chaska	8.0	29.0
Cottage Grove	2.6	5.8
Farmington	9.0	1.7
Hastings	3.3	3.0
Lakeville	5.0	13.2
Long Lake	8.2	5.5
Maple Plain	4.8	2.1
Metropolitan	10.0	3.0
Orono	3.6	18.2
Rosemount	1.4	0.6
Savage	8.2	1.0
Seneca	2.3	6.0
Stillwater	1.6	0.5

TABLE 10

ACTUAL FREQUENCY, SEVERITY, AND NONCOMPLIANCE INDEX VALUES
FOR 1978 COMPARED TO ACTUAL 1977 VALUES AND 1978 GOALS

Treatment Plant	Frequency			Severity			Noncompliance Index		
	Actual 1977	Actual 1978	Goal 1978	Actual 1977	Actual 1978	Goal 1978	Actual 1977	Actual 1978	Goal 1978
Anoka	97	93	93	33	27	33	1.0	1.9	2.3
Apple Valley	99	86	90	65	20	66	0.6	2.8	6.6
Bayport	98	99	92	20	12	33	0.4	0.1	2.6
Blue Lake	98	97	93	20	44	25	0.4	1.3	1.8
Chaska	75	56	84	51	66	50	12.8	29.0	8.0
Cottage Grove	90	91	92	60	65	33	6.0	5.8	2.6
Farmington	79	91	85	113	19	60	23.7	1.7	9.0
Hastings	89	86	90	20	20	33	2.2	3.0	3.3
Lakeville	78	60	85	36	33	33	7.9	13.2	5.0
Long Lake	71	75	75	29	22	33	8.4	5.5	8.2
Maple Plain	87	94	88	40	35	40	5.2	2.1	4.8
Medina	76	78	85	40	44	33	9.6	9.7	5.0
Metropolitan	74	85	75	24	20	40	6.2	3.0	10.0
Orono	95	65	92	36	52	45	1.8	18.2	3.6
Rosemount	97	97	93	16	20	20	0.5	0.6	1.4
Savage	88	93	75	21	14	33	2.5	1.0	8.2
Seneca	93	86	93	20	43	33	1.4	6.0	2.3
Stillwater	96	99	95	68	48	33	2.7	0.5	1.6

The performance of treatment plants in 1978 towards meeting frequency and severity objectives is summarized in Table 11.

TABLE 11
SUMMARY OF TREATMENT PLANTS MEETING FREQUENCY AND SEVERITY GOALS DURING 1978

<u>Plants Meeting Both Indices</u>	<u>Plants Meeting One Index</u>	<u>Plants Meeting Neither Index</u>
Anoka	Apple Valley	Chaska
Bayport	Blue Lake	Cottage Grove
Farmington	Hastings	Medina
Long Lake	Lakeville	Orono
Maple Plain	Stillwater	Seneca
Metropolitan		
Rosemount		
Savage		

A comparison of 1978 frequency and severity data with 1977 data shows that goal attainment in 1978 was less successful than in the previous year. The majority of plants met at least one of the projected goals for 1978. Factors influencing goal attainment included industrial waste problems, hydraulic or organic overloading, plant equipment malfunctions, algal growth in effluent ponds, and effluent chlorination interferences. It is anticipated that with completion of several plant improvement projects in 1979, and the phaseout of several plants in 1979, that goal attainment will be more easily achieved.

During 1978, the Metropolitan Treatment Plant expansion program continued. Work is continuing on new secondary and final process units and on four sludge processing projects. Start-up of the new pretreatment and primary systems was initiated in March, 1978. Construction was completed on the Prior Lake Lift Station in May, 1978, and operation of the Prior Lake Treatment Plant was terminated. Final work was completed on the Waconia Interceptor and operation of the Waconia Treatment Plant was terminated in January, 1978.

Improvements to upgrade effluent quality were underway at the Chaska, Cottage Grove, and Savage Plants. These improvements include the construction of additional process units to treat increasing wastewater strength and flow.

Construction is continuing on the 6 mgd Empire Treatment Plant. A seven-mile interceptor sewer to serve the facility is also under construction. By mid-1979, the plant and interceptor will be completed allowing for the existing Apple Valley, Farmington, and Lakeville Treatment Plants to be closed.

IV. Individual Treatment Plant Reports

This section contains the individual treatment plant reports for 1978. A summary listing of each treatment plant and corresponding treatment process, design flow, and receiving water is shown in Table 11. Figure 2 shows the locations of each treatment plant. For each plant report there is an introduction briefly describing the history of the plant, its design basis, 1978 plant operations, and a statement regarding the future of the plant. The introduction is followed by a liquid and solids flow diagram of the treatment process together with a graphical presentation of flows for individual months of 1978 and annual averages for 1971-1978. Monthly flow data are shown as a vertical bar corresponding to the range of flow for that month with the top cross bar representing the maximum flow and the bottom cross bar the minimum flow. A solid line connects the vertical bars and is drawn to the average wastewater flow for that month. On the wastewater flow graphs the horizontal dashed line represents the design flow for that plant. Flow data are followed by 1978 Monthly Influent and Effluent Quality Summaries. These tables contain monthly and annual average data on virtually all of the parameters for which the influent and effluent of that plant are analyzed.

Graphs of BOD and TSS for 1978 show a vertical bar which encompasses the maximum and minimum parameter range for that month. The solid line connects the monthly averages, and the horizontal dashed line on the effluent portion of the graph is the NPDES standard (30 day mean) for that plant. Fecal coliform data are also presented graphically with the 1971-1978 annual averages (arithmetic average of monthly geometric means)

shown on one graph and the 1978 monthly geometric means shown on another graph. A dashed line is drawn at a fecal coliform concentration of 200 MPN/100 ml which is the NPDES standard (30 day geometric mean) for all treatment plants. Finally, plots of effluent BOD and TSS are shown illustrating the percent of the time the effluent concentrations were less than or equal to a given value. On these graphs, data from 1974-1977 are compared to data obtained during 1978. Additional tables for effluent heavy metals are presented for the Anoka and Metropolitan Plant as well as ash pond effluent data for the Metropolitan Plant.

TABLE 11
1978 WASTEWATER TREATMENT PLANTS

<u>Treatment Plant</u>	<u>Treatment Process</u>	<u>Design Capacity, mg/d</u>	<u>Effluent Receiving Water</u>
Anoka	Activated Sludge	2.46	Mississippi River
Apple Valley	Activated Sludge (Complete Mix)	1.50	Ditch to Vermillion River
Bayport	Activated Sludge (Contact Stabilization)	0.65	St. Croix River
Blue Lake	Activated Sludge (Complete Mix)	20.00	Minnesota River
Chaska	Activated Sludge (Contact Stabilization)	0.75	Minnesota River
Cottage Grove	Activated Sludge (Contact Stabilization)	0.90	Mississippi River
Farmington	High-Rate Trickling Filter	0.59	Vermillion River
Hastings	Activated Sludge	1.83	Mississippi River
Lakeville	High-Rate Trickling Filter	0.25	Vermillion River
Long Lake	High-Rate Trickling Filter	0.19	Long Lake Creek to Lake Minnetonka
Maple Plain	High-Rate Trickling Filter Activated Sludge	0.20	Painter Creek to Lake Minnetonka
Medina	Aerated Pond	0.10	Seepage Pond (No surface discharge)
Metropolitan	Activated Sludge	218	Mississippi River
Orono	Activated Sludge	0.40	French Lake to Lake Minnetonka
Prior Lake	High-Rate Trickling Filter	0.24	Credit River
Rosemount	Physical-Chemical	0.60	Mississippi River
Savage	High-Rate Trickling Filter	0.36	Creek to Minnesota River
Seneca	Activated Sludge	24.00	Minnesota River
So. St. Paul (1)	High-Rate Trickling Filter	10.00	Mississippi River
Stillwater	Activated Sludge	3.02	St. Croix River
Waconia	High-Rate Trickling Filter	0.20	Burandt Lake

(1) Maintained as a pre-treatment facility, but may discharge in an emergency situation.
Effluent is normally pumped to the Metropolitan Plant.



**METROPOLITAN
WASTE
CONTROL
COMMISSION**
Twin Cities Area

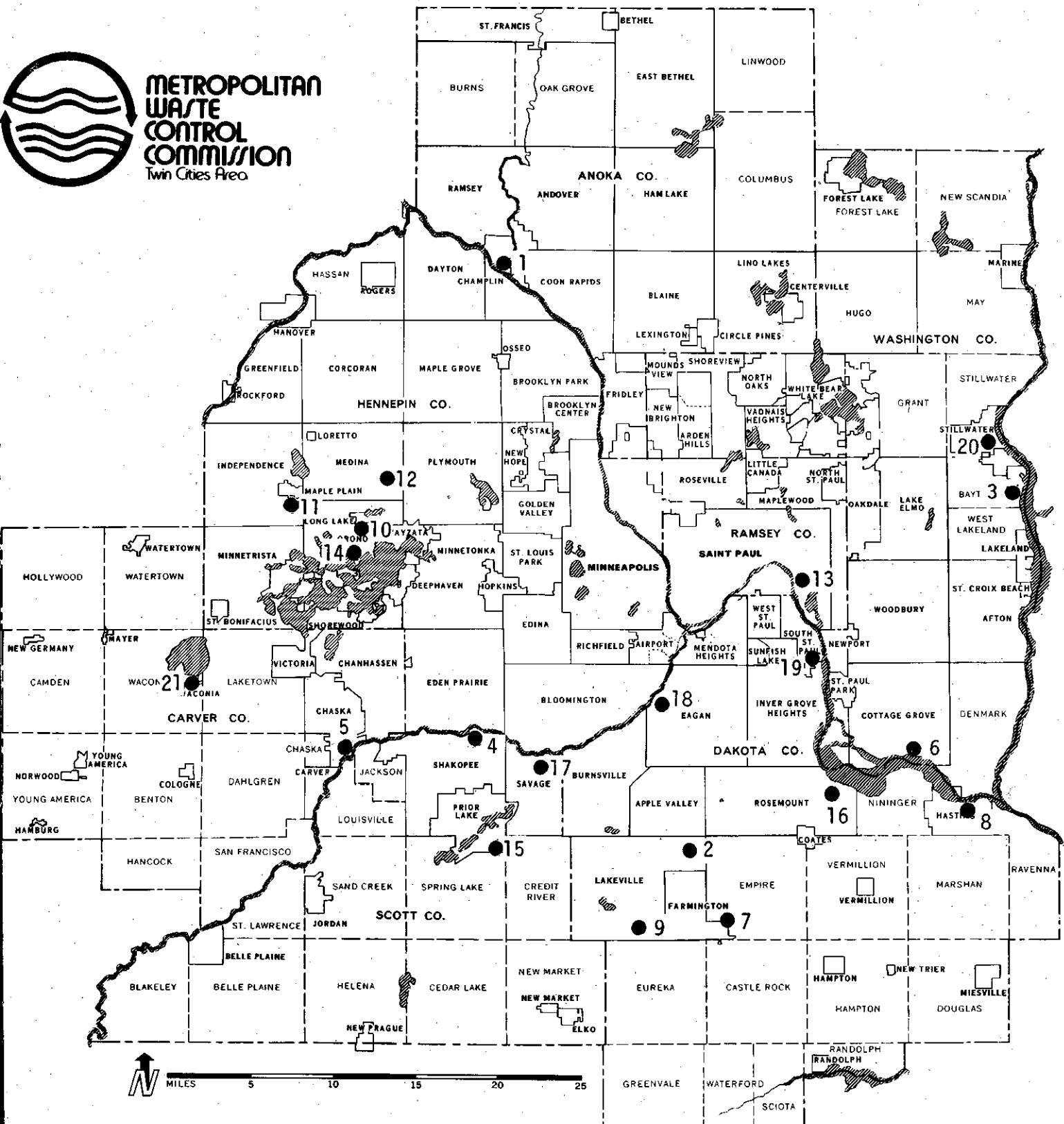


FIGURE 2 - LOCATIONS OF WASTEWATER TREATMENT PLANTS

● Treatment Plants in Operation During 1978

1	Anoka	8	Hastings	15	Prior Lake
2	Apple Valley	9	Lakeville	16	Rosemount
3	Bayport	10	Long Lake	17	Savage
4	Blue Lake	11	Maple Plain	18	Seneca
5	Chaska	12	Medina	19	South St. Paul
6	Cottage Grove	13	Metropolitan	20	Stillwater
7	Farmington	14	Orono	21	Waconia

ANOKA WASTEWATER TREATMENT PLANT

Description:

The Anoka Wastewater Treatment Plant was built in two stages. The original plant, constructed in 1954-1955, had a capacity of 1.4 mgd. Expansions completed in 1969 increased the plant to its present capacity of 2.45 mgd. Biological treatment of wastewater is accomplished by the conventional activated sludge process.

Plant Operations:

The daily average wastewater flow to the Anoka Plant increased from 1.92 mgd in 1977 to 2.02 mgd in 1978. At no time during 1978 did the monthly average flow exceed the design capacity of the plant. NPDES permit limitations were violated during eight months of the year. With the exception of suspended solids and fecal coliform noncompliances in May, all permit violations pertained to heavy metals, particularly copper and cyanide. These violations were the result of unacceptably high industrial waste discharges of copper and cyanide into the plant. The suspended solids and fecal coliform violations in May were the direct result of the toxic effect of the heavy metals. Overall effluent quality in 1978 declined slightly from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978.

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	9	7	11	14	10	16	22	13	22
TSS	13	12	13	19	16	20	28	21	28

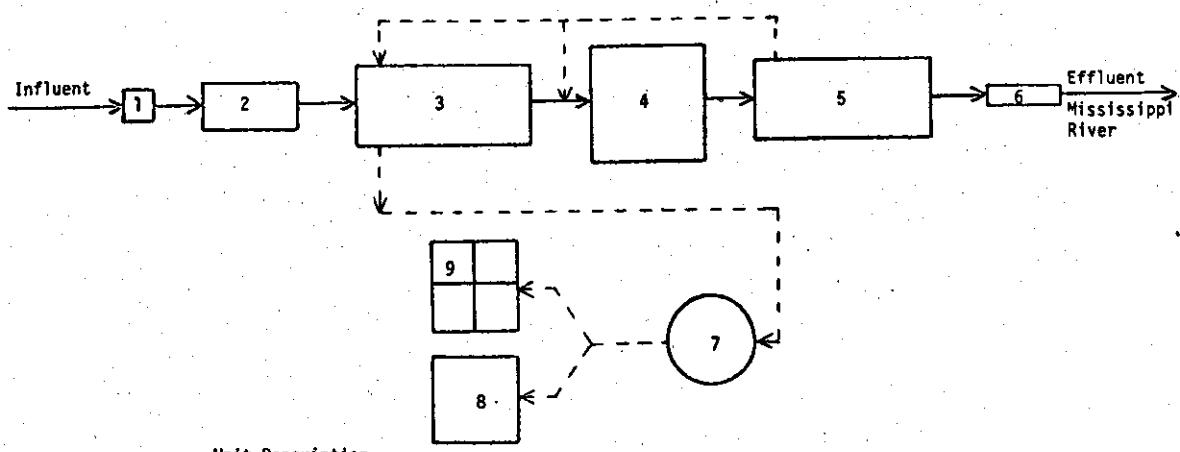
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

This plant is considered one of the Commissions permanent treatment facilities and is expected to operate for some time in the future.

ANOKA WASTEWATER TREATMENT PLANT

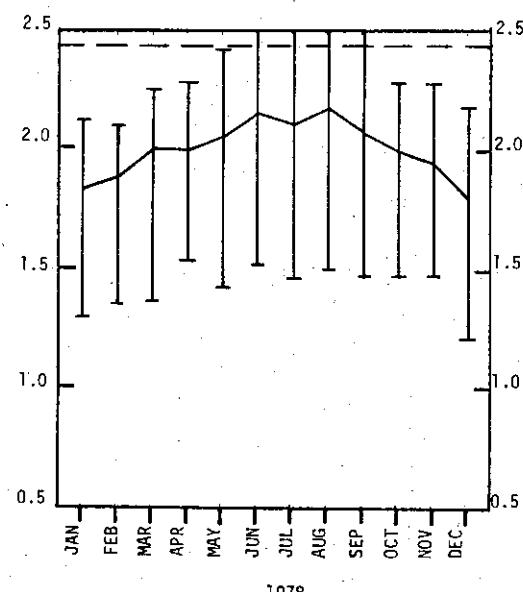
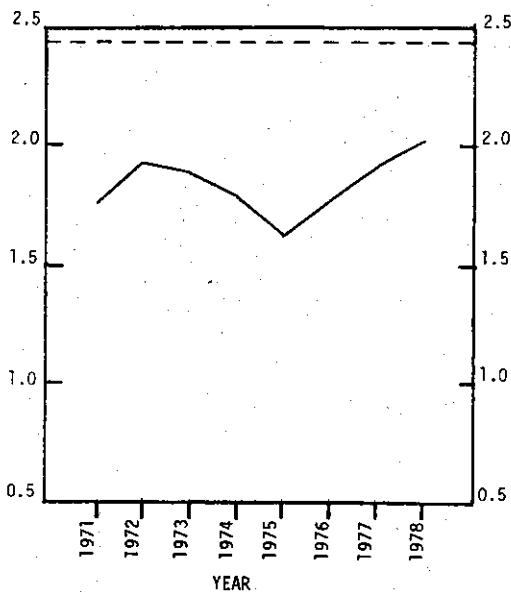
FLOW DIAGRAM



Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



**MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: ANOKA**

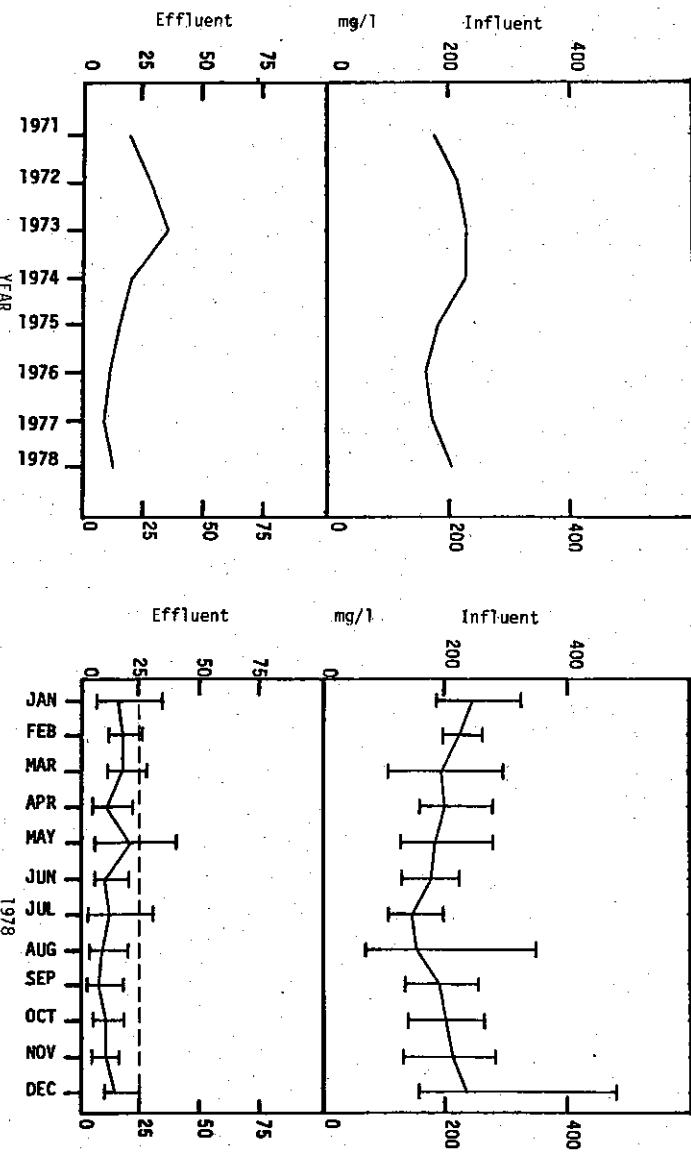
MONTH	WASTEWATER FLOW MGD.	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	1.84	59	244	442	187	28.9	18.7	5.9	7.9-8.7
FEBRUARY	1.89	59	225	496	150	27.8	16.8	6.2	7.8-8.6
MARCH	2.00	59	195	344	140	22.8	17.6	4.9	8.0-8.4
APRIL	2.00	59	203	406	159	24.4	20.6	5.1	7.8-8.4
MAY	2.06	62	188	355	163	23.7	17.4	5.1	7.1-8.6
JUNE	2.16	69	180	339	175	21.4	16.8	4.7	7.5-8.3
JULY	2.12	70	145	328	182	24.6	18.6	5.4	7.5-8.1
AUGUST	2.19	71	157	201	157	17.3	14.2	3.7	7.3-8.2
SEPTEMBER	2.08	70	193	411	197	23.5	20.0	5.2	7.7-8.1
OCTOBER	2.00	68	204	302	147	22.4	19.8	4.4	7.7-8.1
NOVEMBER	1.95	67	217	370	142	25.0	21.0	4.8	7.6-8.1
DECEMBER	1.81	60	241	390	165	28.9	23.5	5.3	7.7-8.1
1978 AVERAGE	2.01	64	199	365	164	24.2	18.8	5.1	7.1-8.7
1977 AVERAGE	1.92	64	175	363	176	25.7	18.4	6.1	7.1-9.5

**MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: ANOKA**

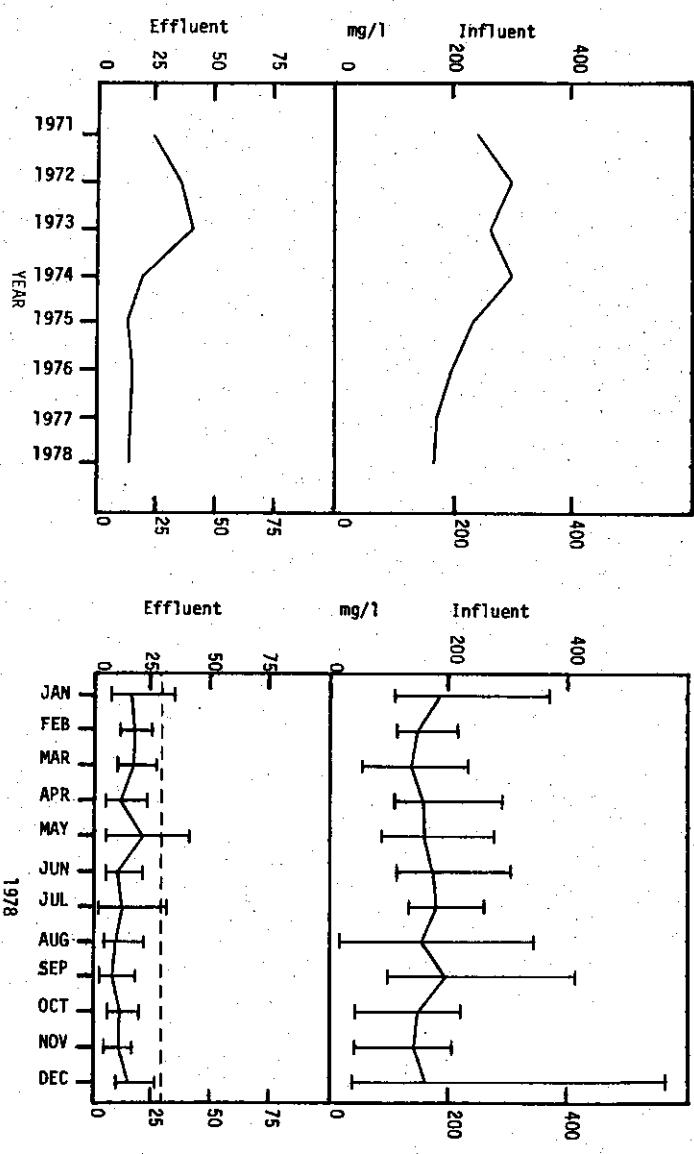
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL	BOD	TSS
* NPDES Limitation															
JANUARY	15	106	17	62	11	23.5	18.7	0.06	0.15	3.8	2.6	7.3-7.7	94	91	
FEBRUARY	17	98	20	1	11	20.9	16.8	0.06	0.16	3.9	2.8	7.4-7.6	92	87	
MARCH	17	78	23	3	11	18.1	15.2	0.11	0.25	3.5	2.8	7.1-7.7	91	84	
APRIL	10	72	13	2	7	18.7	17.2	0.06	0.37	2.7	3.1	7.5-7.7	95	92	
MAY	20	100	31	142	18	20.7	16.7	0.57	0.39	3.3	3.0	7.5-7.7	89	81	
JUNE	8	61	10	38	5	16.7	14.6	0.06	0.33	2.5	3.0	7.4-7.7	96	94	
JULY	11	38	12	75	5	12.0	10.7	2.42	0.97	2.6	2.8	7.3-7.9	92	93	
AUGUST	8	63	10	11	6	15.1	13.6	0.17	0.21	2.4	2.8	7.4-7.6	95	94	
SEPTEMBER	7	55	11	36	6	17.5	20.0	0.10	0.40	2.7	2.9	7.4-7.7	96	95	
OCTOBER	10	65	16	47	8	17.7	19.8	0.25	0.40	2.7	3.0	7.1-7.6	95	89	
NOVEMBER	10	57	14	26	7	18.0	16.3	1.48	1.93	2.6	3.0	7.1-8.2	95	90	
DECEMBER	14	76	17	32	7	21.2	17.4	0.45	0.90	3.6	3.7	7.2-7.6	93	90	
1978 AVERAGE	12	72	16	40	8	18.3	16.4	0.48	0.54	3.0	2.9	7.1-8.2	94	90	
1977 AVERAGE	9	63	14	21	8	18.8	15.9	1.38	0.93	3.8	1.6	7.1-8.0	95	92	

BIOCHEMICAL OXYGEN DEMAND



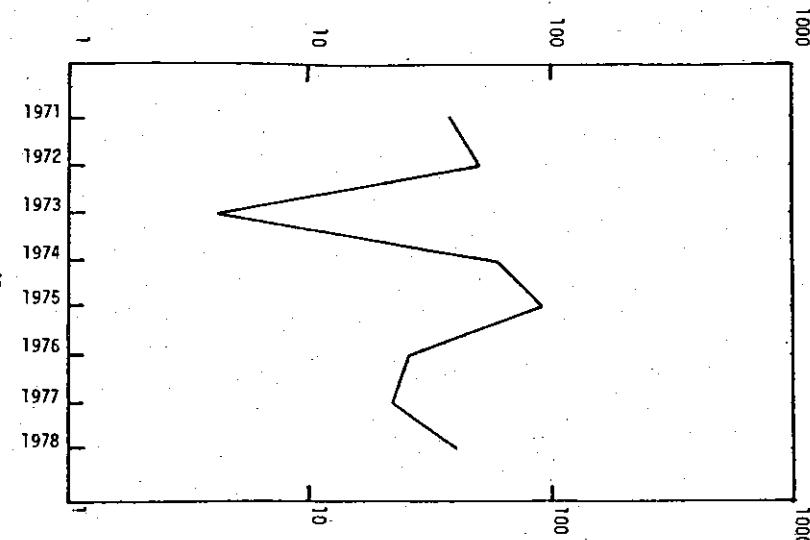
TOTAL SUSPENDED SOLIDS



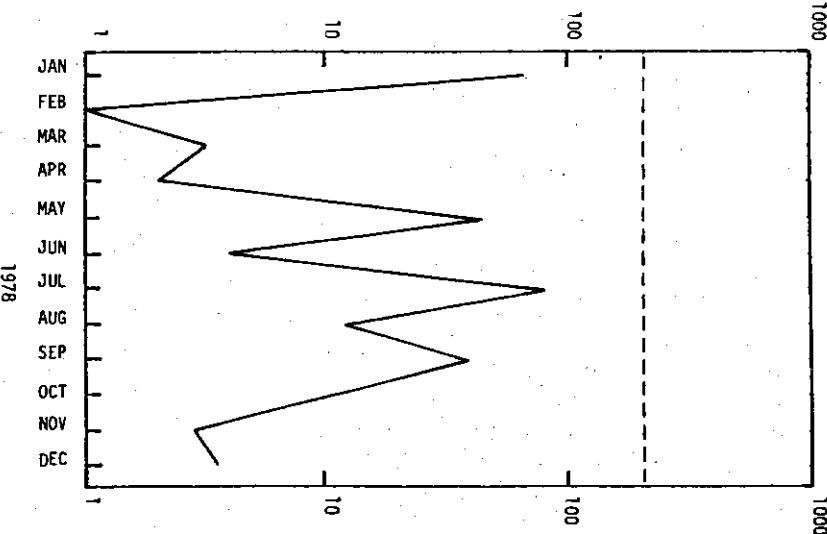
EFFLUENT FECAL COLIFORMS

ANOKA

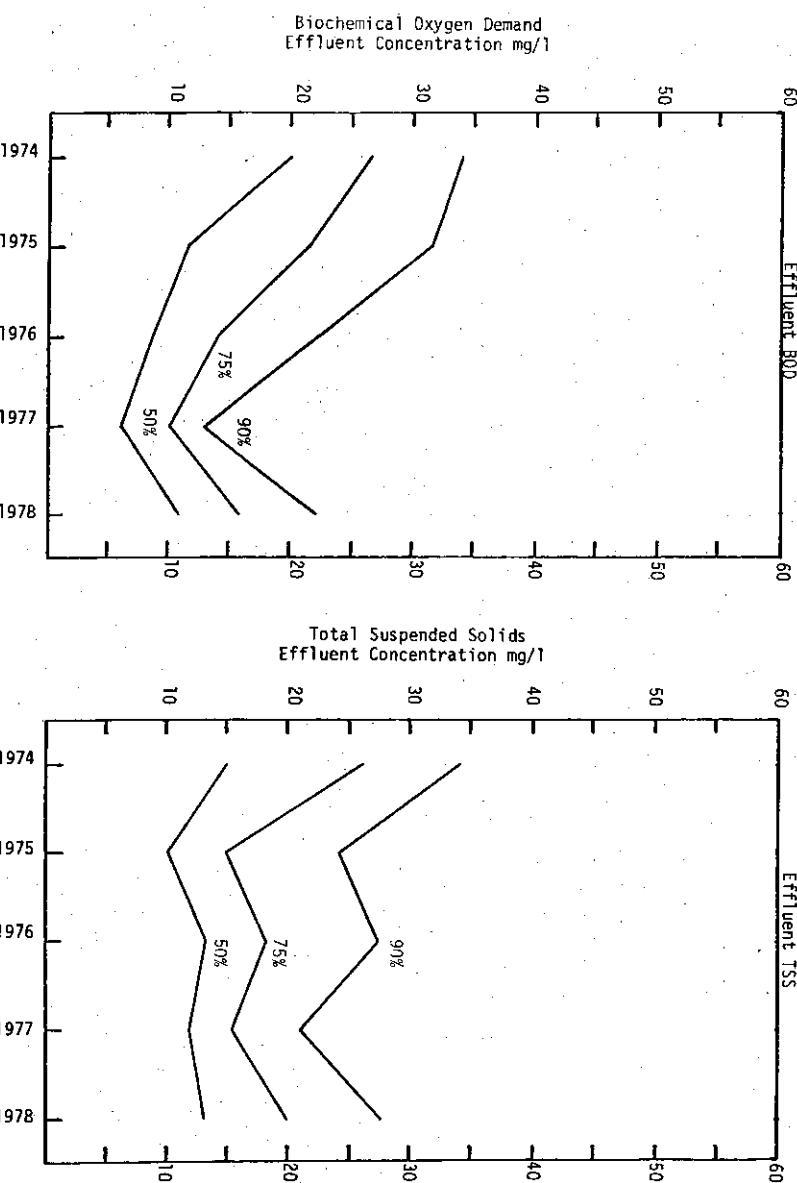
Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means



Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means



STATISTICAL ANALYSIS*



* Percent of Time Effluent Concentrations are Equal to or Less than Plotted Values

ANOKA

1978 EFFLUENT HEAVY METALS

34

MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	CN mg/l
January	0.98	0.17	0.10	<0.10	1.597
February	0.48	0.23	0.09	<0.10	1.033
March	0.56	0.40	0.09	<0.10	0.370
April	0.33	0.28	0.05	<0.10	0.186
May	0.70	0.66	0.08	<0.11	0.377
June	0.08	0.09	0.05	<0.10	0.042
July	0.08	0.09	0.05	<0.10	0.051
August	0.08	0.12	0.05	<0.11	0.048
September	0.06	0.09	0.08	<0.10	0.071
October	0.12	0.23	0.09	<0.20	0.127
November	0.18	0.22	0.05	<0.10	0.164
December	0.23	0.14	0.07	<0.10	0.185
1978 Average	0.32	0.23	0.07	<0.11	0.354

APPLE VALLEY WASTEWATER TREATMENT PLANT

Description:

The original Apple Valley Wastewater Treatment Plant was built in 1965 as a contact stabilization unit with a design flow of 0.5 mgd. Expansion of the plant to its present capacity of 1.5 mgd was accomplished by addition of a 1.0 mgd complete mix activated sludge unit in 1972.

Plant Operation:

The daily average wastewater flow to the Apple Valley Treatment Plant increased from 1.67 mgd in 1977 to 1.95 mgd in 1978. Monthly average flow to the plant exceeded the design capacity during all 12 months of 1978. Excepting for a BOD violation in February, all NPDES monthly permit limitations were met throughout the year. This violation was caused by excessive chlorination of return sludge for bulking control, thus reducing biological activity. Overall effluent quality in 1978 declined from that in the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	4	4	10	6	6	16	18	10	24
TSS	2	2	6	4	4	8	10	6	11

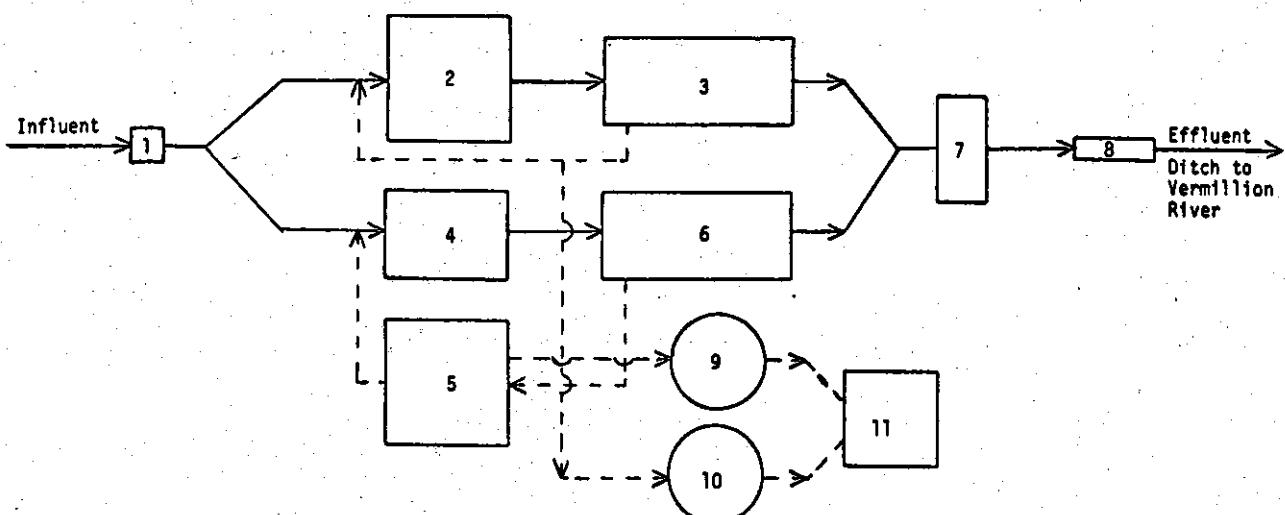
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

With the completion of the new Empire Plant the Apple Valley Plant will be phased-out and its flow diverted to the new plant. This changeover is scheduled to occur in May of 1979.

APPLE VALLEY WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Activated Sludge
3. Final Sedimentation
4. Activated Sludge
5. Sludge Reaeration
6. Final Sedimentation
7. Effluent Filters
8. Chlorination

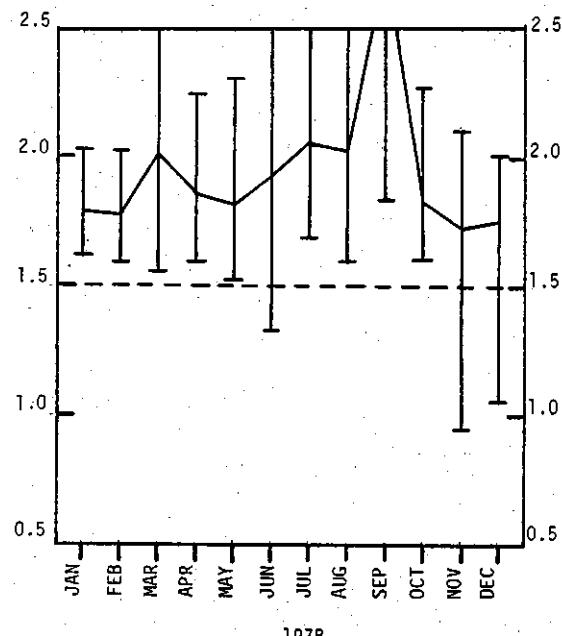
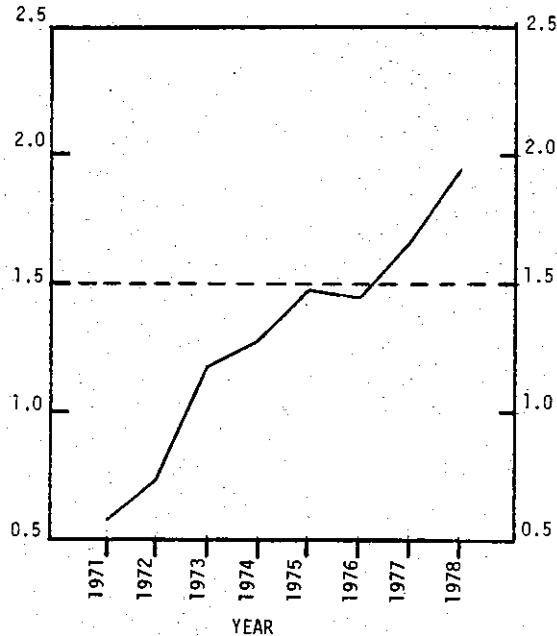
Solid Phase

9. Aerobic Digestion
10. Aerobic Digestion
11. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



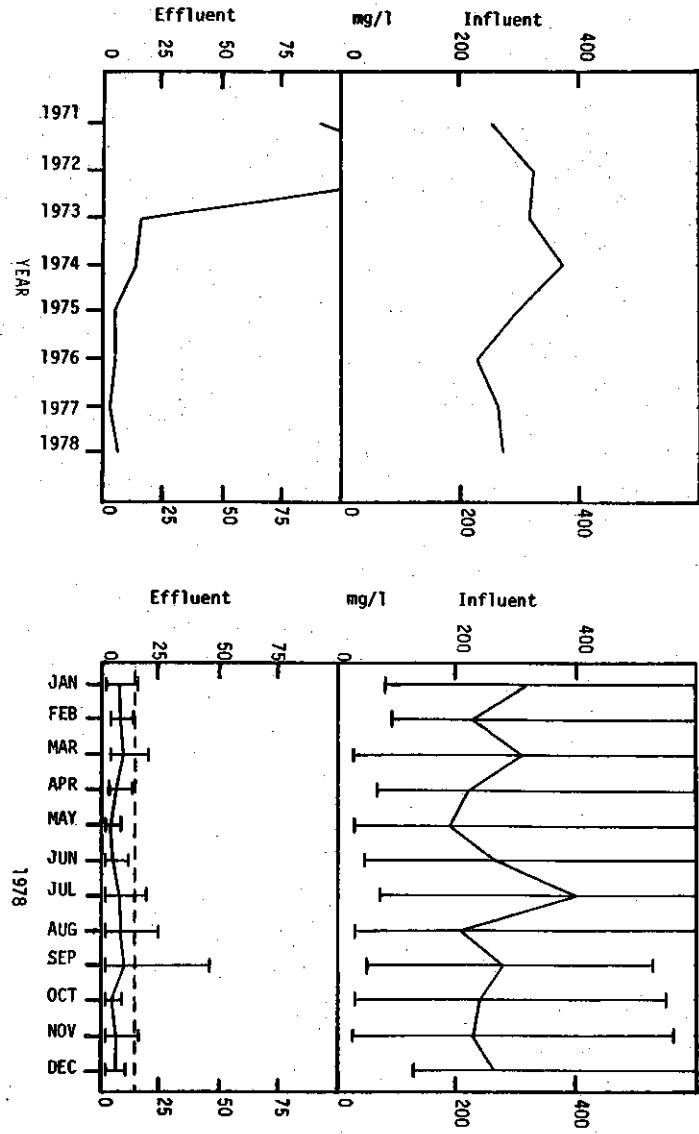
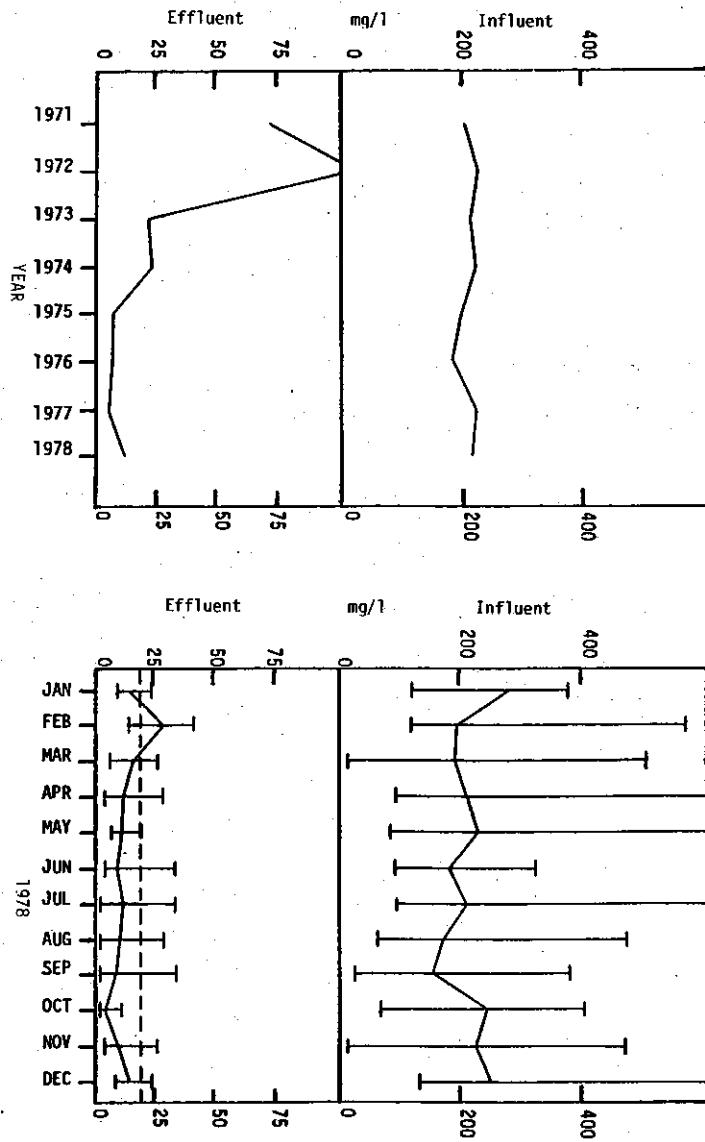
**MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: APPLE VALLEY**

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	1.78	58	284	611	321	41.5	30.0	10.2	7.7-8.1
FEBRUARY	1.77	55	198	336	224	31.9	24.2	7.6	7.7-8.1
MARCH	2.02	50	197	833	314	37.0	24.9	10.1	7.7-8.3
APRIL	1.86	50	214	324	225	29.8	25.2	6.5	7.5-8.2
MAY	1.82	54	234	304	291	34.4	26.4	7.0	7.7-8.1
JUNE	1.93	59	183	320	272	30.3	24.6	6.6	7.4-8.0
JULY	2.06	63	275	559	403	32.5	21.8	9.2	7.5-7.9
AUGUST	2.03	64	172	187	208	25.6	21.1	5.8	7.4-7.9
SEPTEMBER	2.76	68	159	318	284	17.8	16.3	3.7	7.5-8.2
OCTOBER	1.82	64	247	180	242	21.8	20.1	5.9	7.7-8.1
NOVEMBER	1.72	62	232	286	233	28.4	24.8	6.6	7.6-8.1
DECEMBER	1.75	58	257	367	266	44.8	35.6	7.8	7.7-8.2
1978 AVERAGE	1.94	59	216	385	274	31.3	24.6	7.2	7.4-8.3
1977 AVERAGE	1.67	59	228	471	271	36.1	28.6	8.5	7.0-8.5

**MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: APPLE VALLEY**

* See Table 2

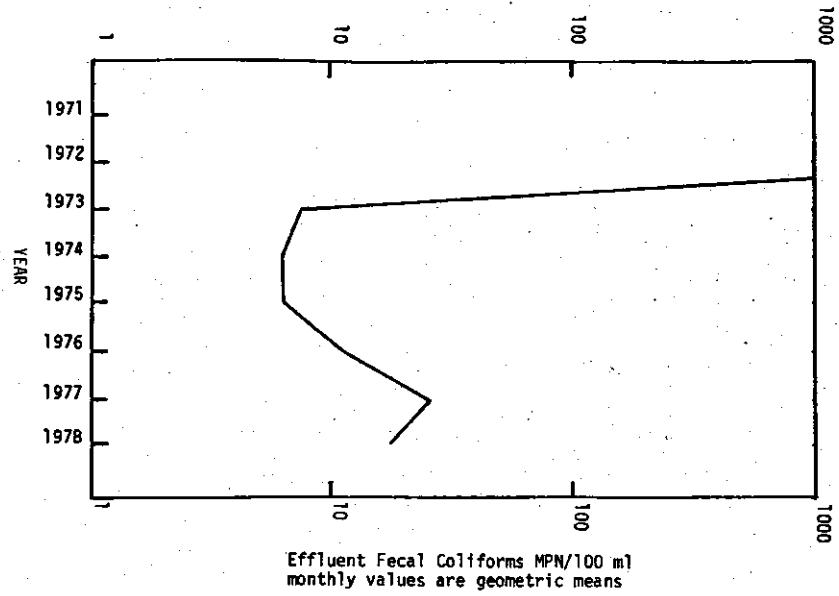
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
* NPDES Limitation														
JANUARY	14	75	6	3	6	26.1	22.0	0.41	2.56	5.4	7.3	7.3-7.7	95	98
FEBRUARY	28	91	6	9	8	28.8	19.6	0.17	1.36	5.8	7.8	7.2-7.7	96	97
MARCH	16	72	9	2	7	23.8	21.2	0.20	0.20	5.0	8.7	7.4-7.7	92	97
APRIL	12	74	7	5	6	26.1	24.4	0.17	0.16	5.3	8.6	7.3-7.9	94	97
MAY	11	73	4	10	4	28.5	22.9	0.79	0.15	5.5	7.7	7.3-7.9	95	99
JUNE	8	62	5	14	4	20.5	17.9	0.31	2.16	4.5	7.6	7.3-7.7	96	98
JULY	11	48	7	23	6	16.1	13.9	1.20	1.88	3.0	6.9	7.3-7.8	95	98
AUGUST	10	33	8	26	6	15.0	13.2	1.03	1.59	4.1	6.8	7.2-7.7	94	96
SEPTEMBER	8	30	10	69	7	12.6	12.4	0.43	0.72	2.7	6.8	7.2-7.8	95	96
OCTOBER	4	29	3	6	2	17.6	16.9	0.80	1.35	4.0	6.5	7.3-7.6	98	99
NOVEMBER	10	42	6	19	4	19.1	17.3	0.61	1.98	3.7	6.6	7.2-7.6	96	97
DECEMBER	15	56	7	11	6	23.4	21.3	0.59	1.61	3.9	7.0	7.4-7.7	94	97
1978 AVERAGE	12	57	6	16	6	21.5	18.6	0.56	1.31	4.4	7.4	7.2-7.9	94	98
1977 AVERAGE	6	52	3	24	3	22.5	20.2	0.38	1.21	4.9	7.2	7.0-8.0	97	99



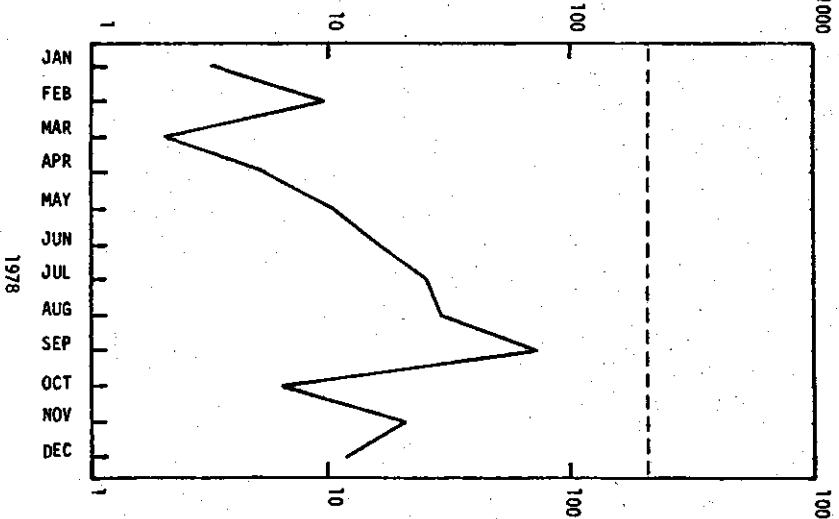
EFFLUENT FECAL COLIFORMS

APPLE VALLEY

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

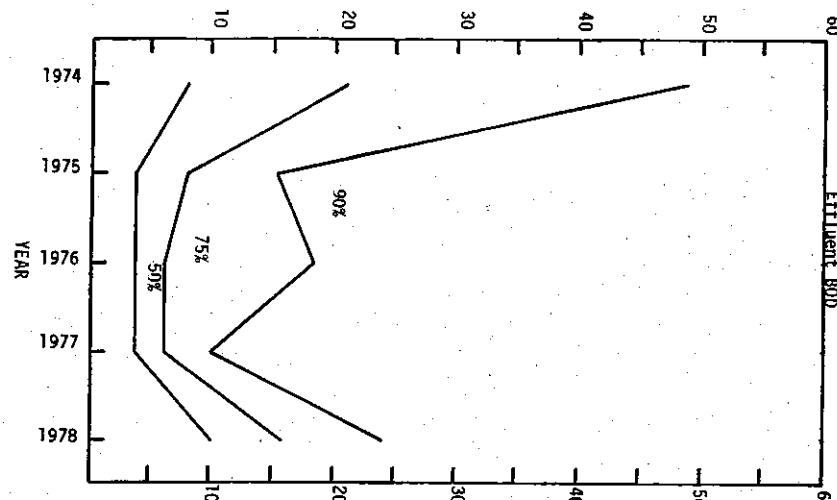


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means

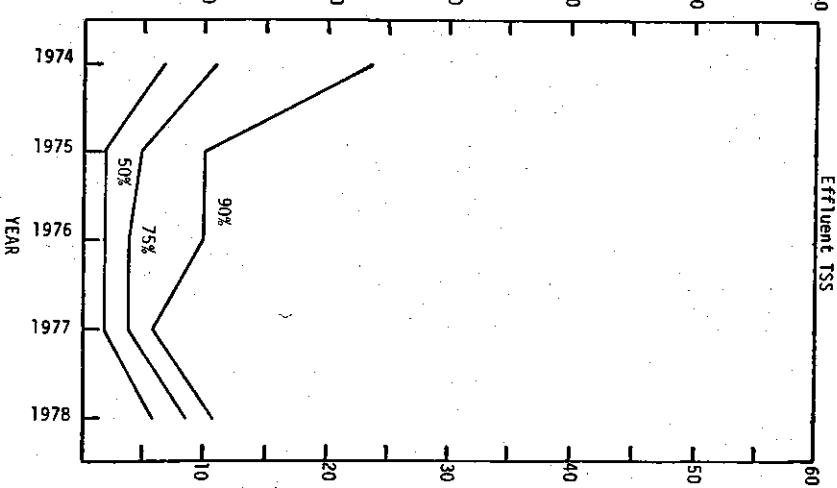


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values

40

BAYPORT WASTEWATER TREATMENT PLANT

Description:

The original Bayport Wastewater Treatment Plant was built in 1929. After modifications to the original plant in 1956 and 1958, and extensive remodeling and additions in 1964, the plant was essentially the same as it exists today. Phosphorus removal facilities were added to the plant in 1973. The plant is designed to treat an average daily flow of 0.65 mgd with preliminary treatment, a contact stabilization process, and chemical precipitation for phosphorus removal.

Plant Operation:

The daily average wastewater flow to the Bayport Plant decreased slightly from 0.48 mgd in 1977 to 0.47 mgd in 1978. At no time during 1978 did the monthly average flow exceed the design capacity of the plant. There were no violations of NPDES monthly effluent limitations during the year. Overall effluent quality in 1978 showed improvement from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	10	7	6	20	10	10	26	16	14
TSS	7	10	8	10	12	10	13	15	12

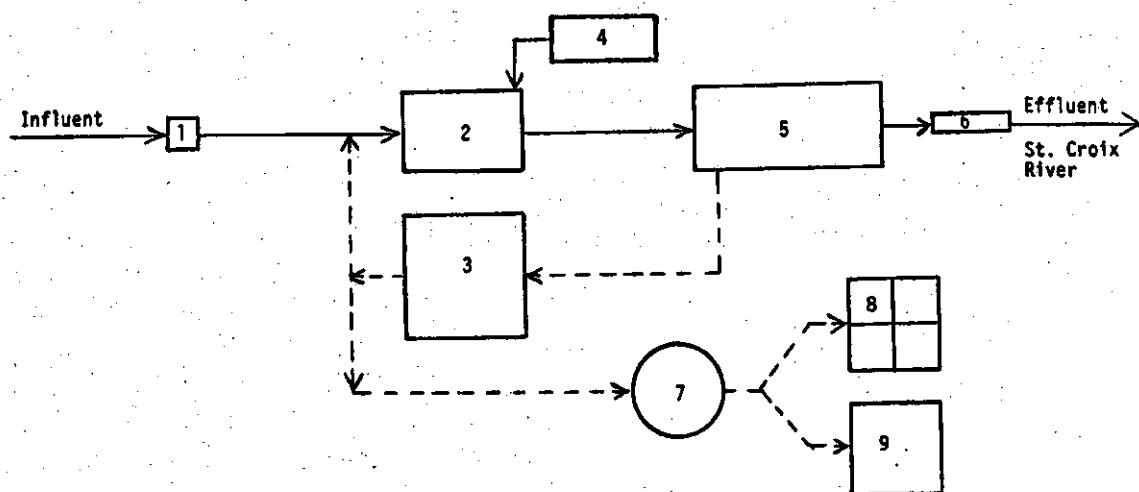
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Bayport Wastewater Treatment Plant is considered a permanent facility.

BAYPORT WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Activated Sludge
3. Sludge Reaeration
4. Chemical Addition
5. Final Sedimentation
6. Chlorination

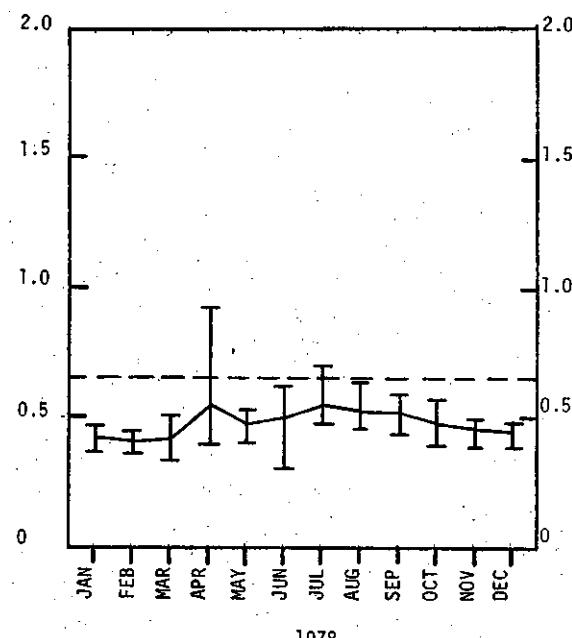
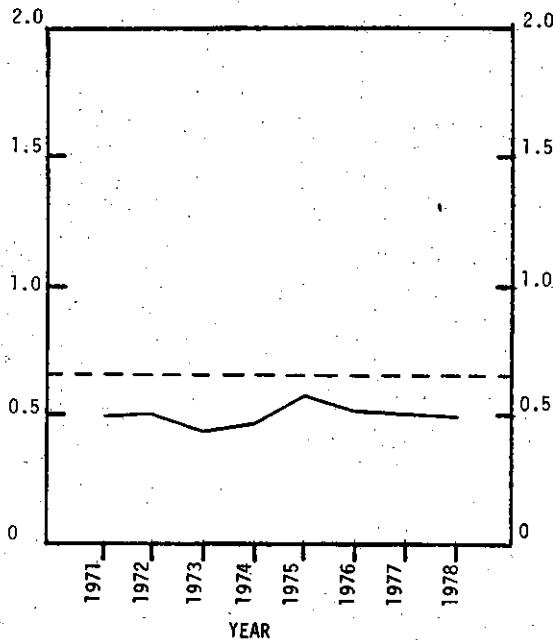
Solids Phase

7. Aerobic Digestion
8. Sand Drying Beds
9. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: BAYPORT

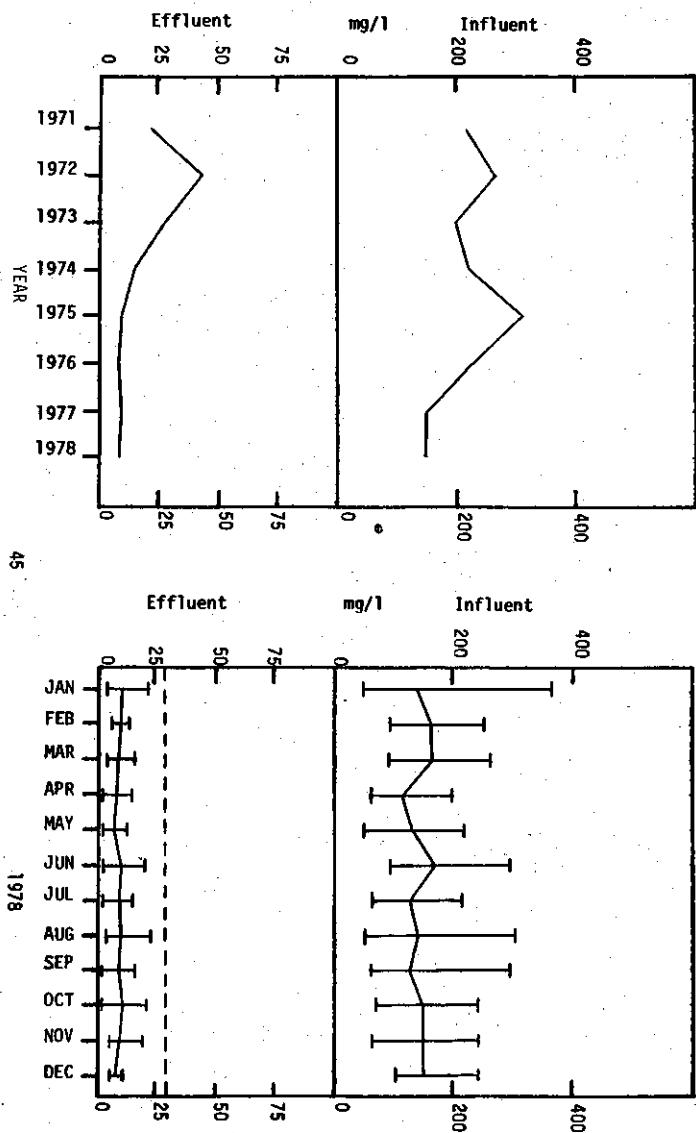
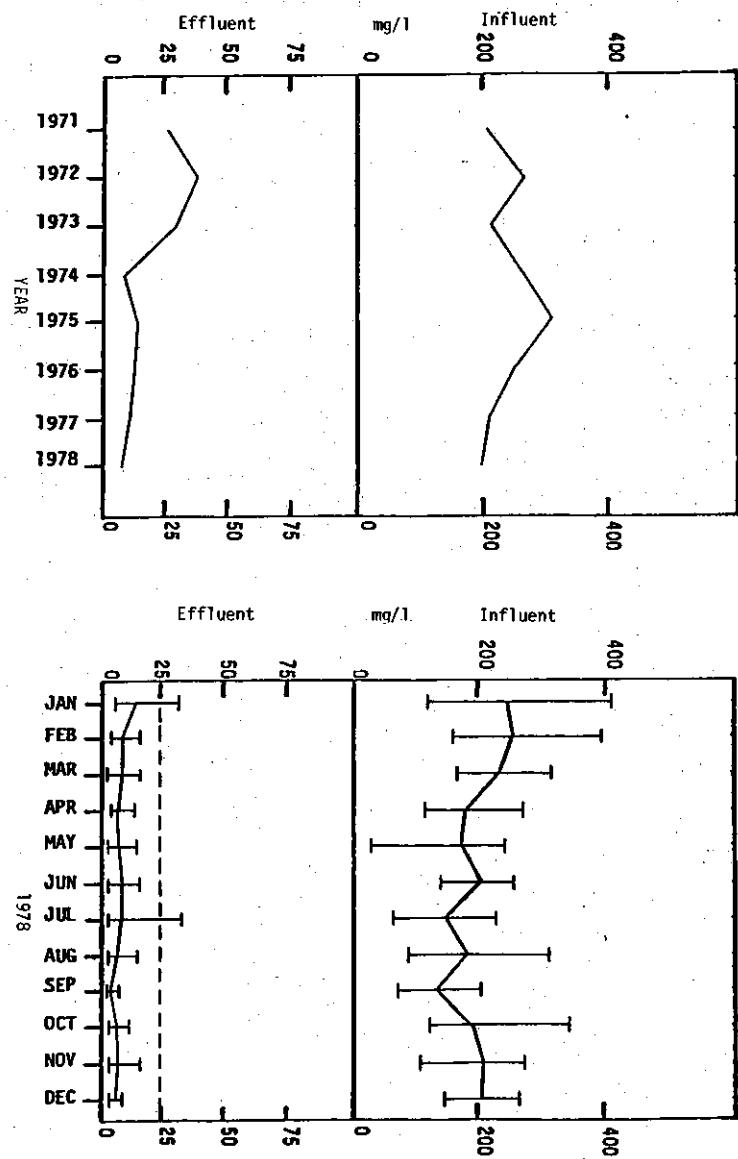
MONTH	WASTEWATER FLOW MGQ	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.43	62	247	429	140	25.0	20.4	5.5	7.8-9.1
FEBRUARY	0.40	61	259	476	163	26.0	21.6	6.6	7.8-9.3
MARCH	0.41	63	233	468	164	25.3	27.9	5.9	7.6-8.8
APRIL	0.53	62	181	334	115	18.6	16.5	5.4	7.5-9.1
MAY	0.46	67	187	321	131	21.6	17.8	4.9	7.5-8.4
JUNE	0.48	67	209	407	169	20.5	17.4	5.2	7.6-8.7
JULY	0.54	71	147	307	130	15.8	12.4	3.8	7.0-8.5
AUGUST	0.52	72	183	223	142	17.3	14.7	4.5	7.0-8.4
SEPTEMBER	0.51	72	138	282	128	20.0	16.8	4.3	7.3-8.0
OCTOBER	0.47	69	196	279	147	24.9	22.4	4.3	7.4-8.4
NOVEMBER	0.45	67	210	287	150	21.1	18.4	4.2	7.5-8.4
DECEMBER	0.43	64	208	341	154	23.8	19.3	4.6	7.6-8.5
1978 AVERAGE	0.47	66	200	346	144	21.7	18.3	4.9	7.0-9.3
1977 AVERAGE	0.48	65	228	387	147	22.0	17.3	5.3	6-9-9.0

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: BAYPORT

* See Table 2

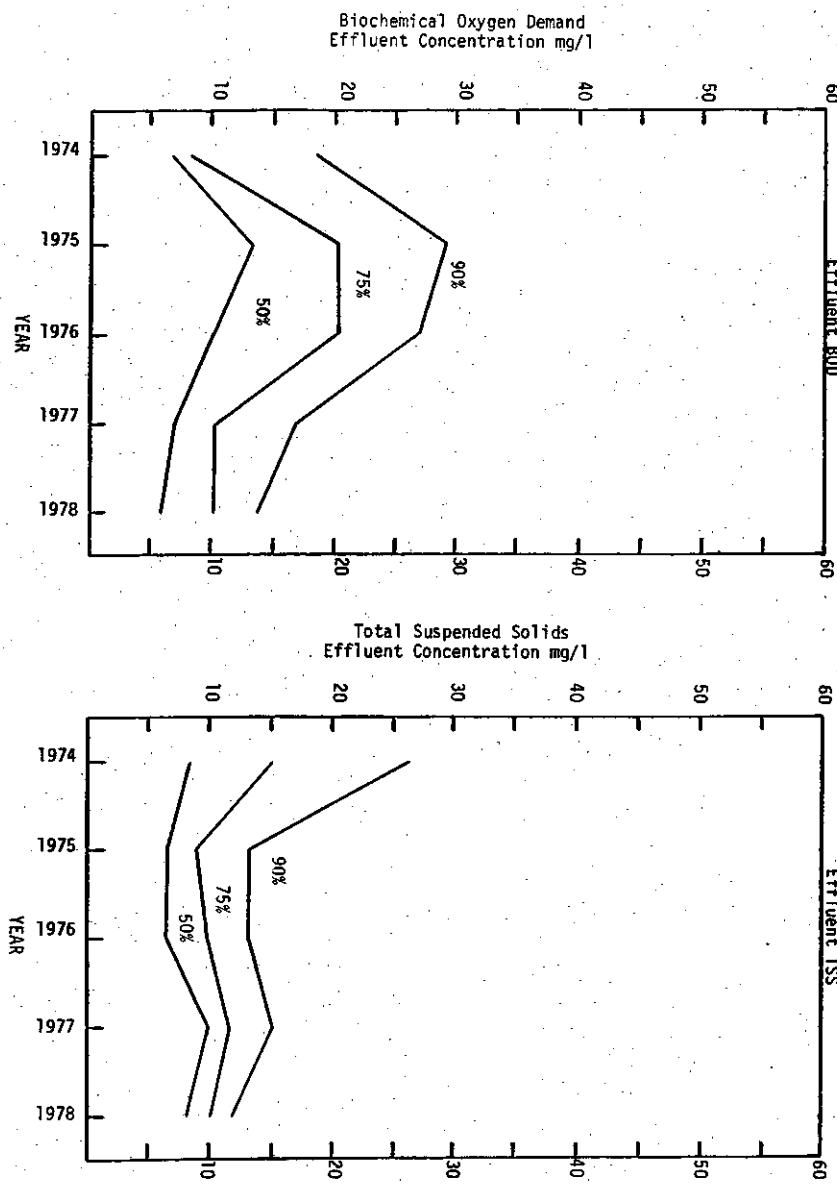
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
*NPDES Limitation														
JANUARY	14	42	10	1	6	7.6	5.6	0.04	1.89	0.6	4.0	6.9-7.6	94	93
FEBRUARY	8	23	8	1	4	7.4	6.2	0.05	0.34	0.5	3.9	7.0-7.3	97	95
MARCH	8	35	8	1	4	6.9	4.8	0.10	2.12	0.4	3.8	6.8-7.3	97	95
APRIL	7	29	7	1	4	6.0	4.5	0.14	1.88	0.3	3.5	6.9-7.3	96	94
MAY	7	27	5	2	4	5.4	4.3	0.12	3.03	0.3	3.0	7.0-7.2	96	96
JUNE	9	35	9	3	5	5.1	3.8	0.15	4.89	0.3	3.1	6.8-7.2	96	95
JULY	9	23	8	2	3	4.2	3.2	0.16	4.06	0.2	3.1	6.8-7.2	94	94
AUGUST	6	28	9	2	5	4.2	3.5	0.19	2.85	0.4	2.9	6.8-7.4	96	93
SEPTEMBER	3	26	8	2	5	4.8	4.6	1.03	5.34	0.2	3.3	7.0-7.6	97	94
OCTOBER	6	30	9	2	5	6.1	5.3	0.32	9.25	0.3	3.5	7.0-7.5	97	94
NOVEMBER	7	21	8	2	4	5.3	4.5	0.67	7.51	0.2	4.1	6.9-7.1	97	95
DECEMBER	6	23	7	2	4	5.9	5.0	0.07	5.26	0.3	4.2	7.0-7.1	97	95
1978 AVERAGE	8	28	8	2	4	5.7	4.6	0.25	4.04	0.3	3.5	6.8-7.6	96	94
1977 AVERAGE	11	37	10	16	6	6.0	4.5	0.10	2.55	0.5	3.5	6.4-7.7	95	93

BIOCHEMICAL OXYGEN DEMAND

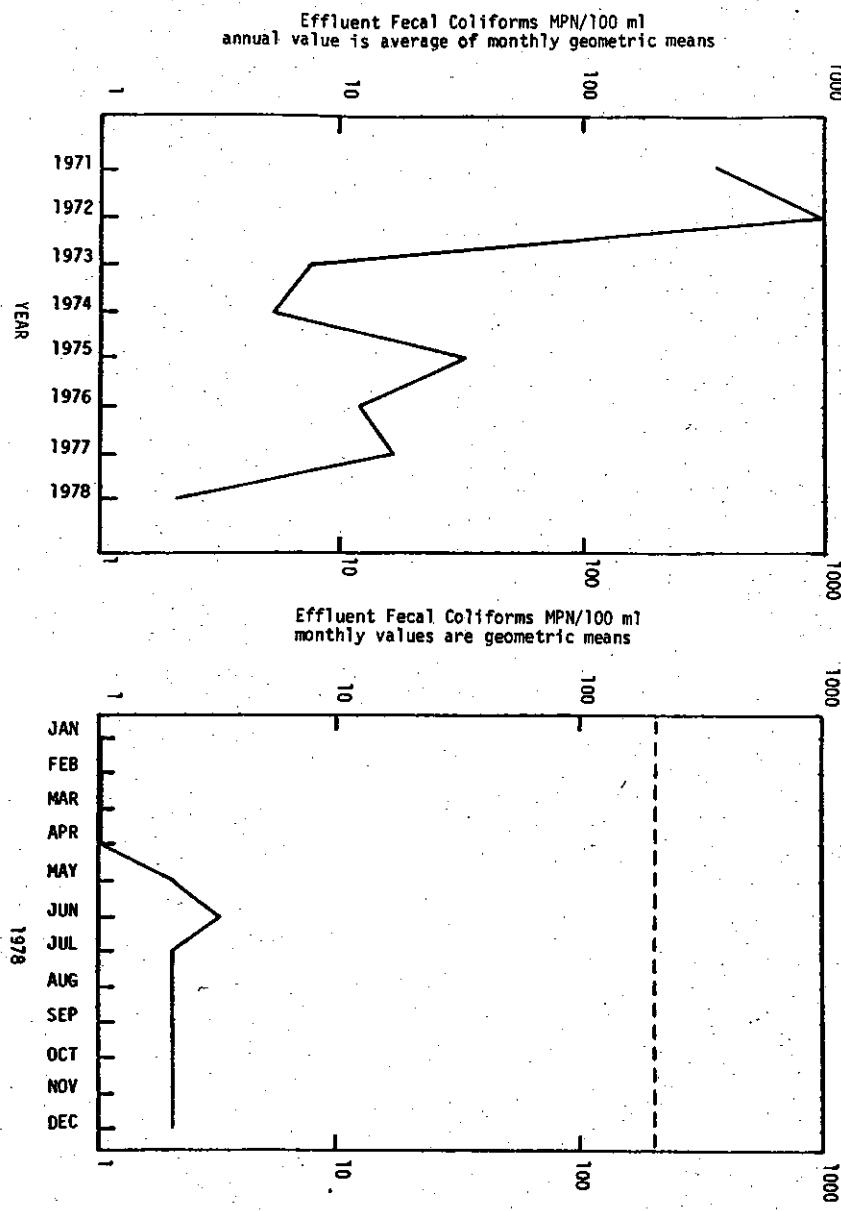


EFFLUENT FECAL COLIFORMS

BAYPORT



STATISTICAL ANALYSIS*



BLUE LAKE WASTEWATER TREATMENT PLANT

Description:

The Blue Lake Treatment Plant is being constructed in stages. Stage 1, placed into operation in July, 1971, consisted of an aerated pond. Stage 2, placed into operation in October 1973, consists of preliminary treatment, complete mix activated sludge process, and effluent polishing in the old aeration pond. Sludge disposal facilities will be provided on site in the future. The plant is designed to treat an average daily flow of 20 mgd.

Plant Operation:

The daily average wastewater flow to the Blue Lake Plant increased from 9.86 mgd in 1977 to 12.49 mgd in 1978. At no time during 1978 did the monthly average flow exceed the design capacity of the plant. NPDES monthly effluent limitations were met during the entire year. Overall effluent quality in 1978 showed no significant change from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*									
50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	16	10	11	20	15	14	24	20	22
TSS	18	11	13	24	17	18	29	20	22

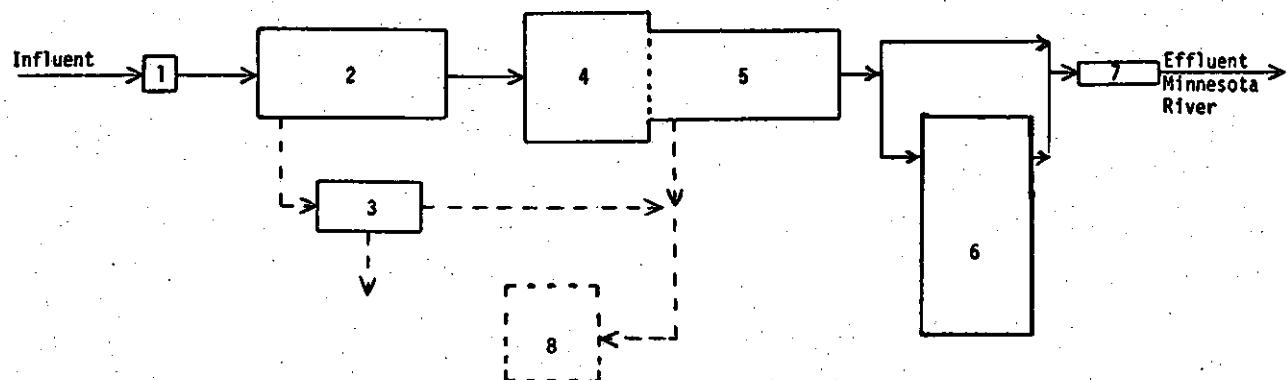
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

This plant is considered one of the Commission's permanent plants and its capacity is adequate to meet 1985 conditions. Space has been set aside for future expansion. Engineering studies concerning sludge disposal at this plant are being conducted.

BLUE LAKE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Primary Sedimentation
3. Grit Removal
4. Activated Sludge
5. Final Sedimentation
6. Aerated Effluent Pond
7. Chlorination

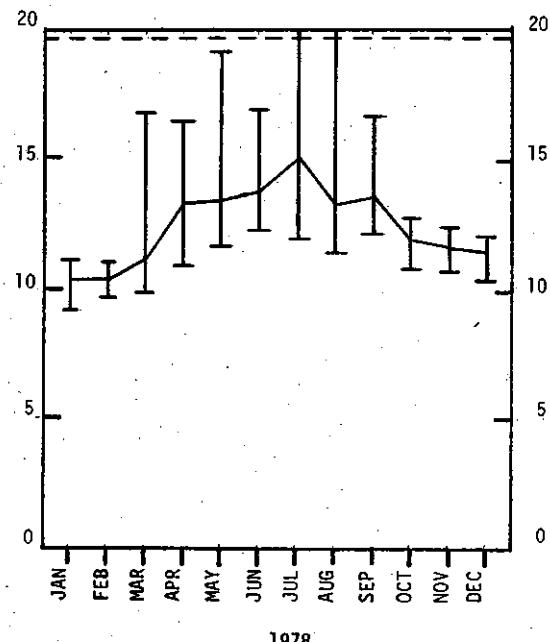
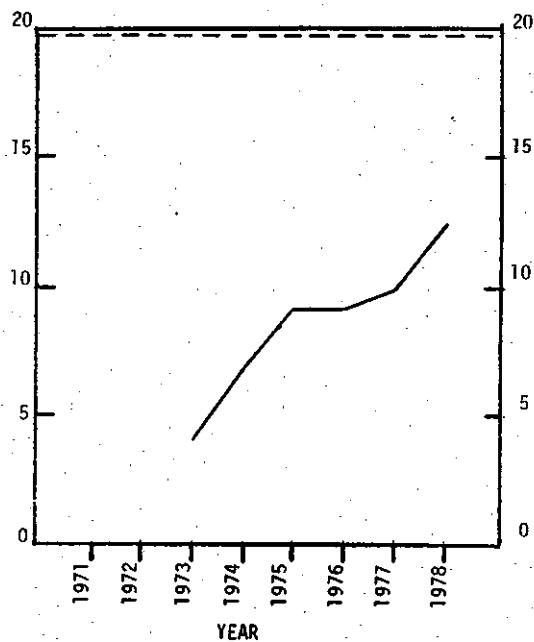
Solids Phase

8. Stage III (Future)

Legend

- Liquid Flow
- - - Solids Transfer
- █ Existing Process Units
- Future Process Units

**WASTEWATER FLOW
(mgd)**



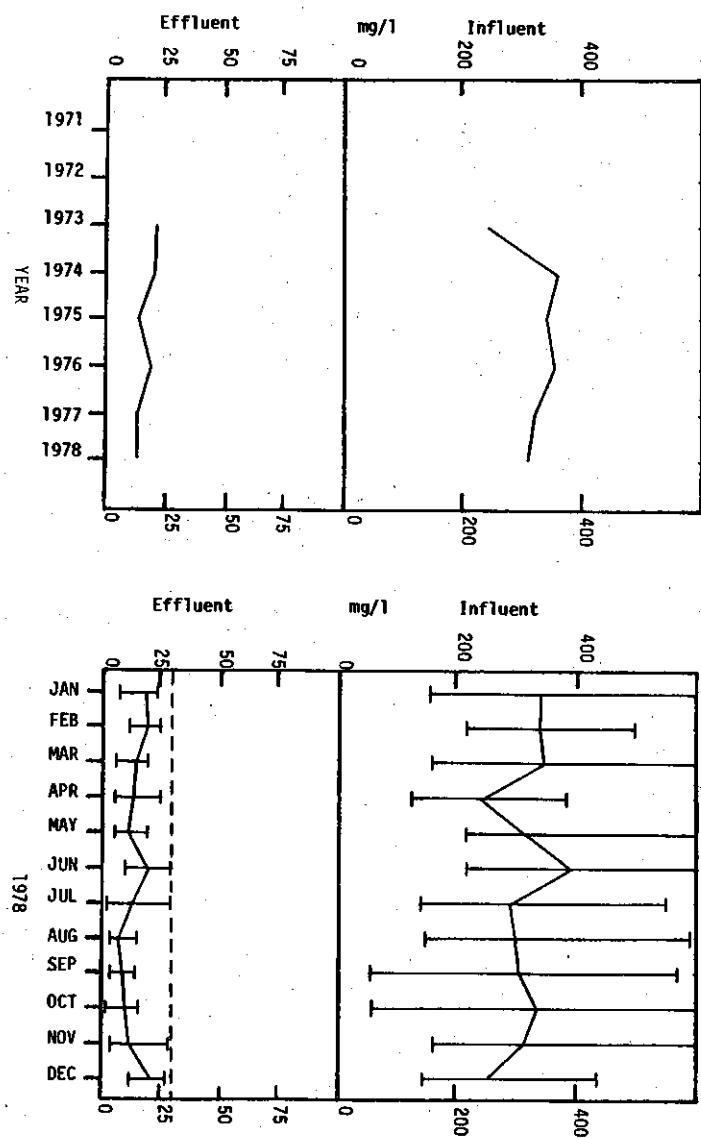
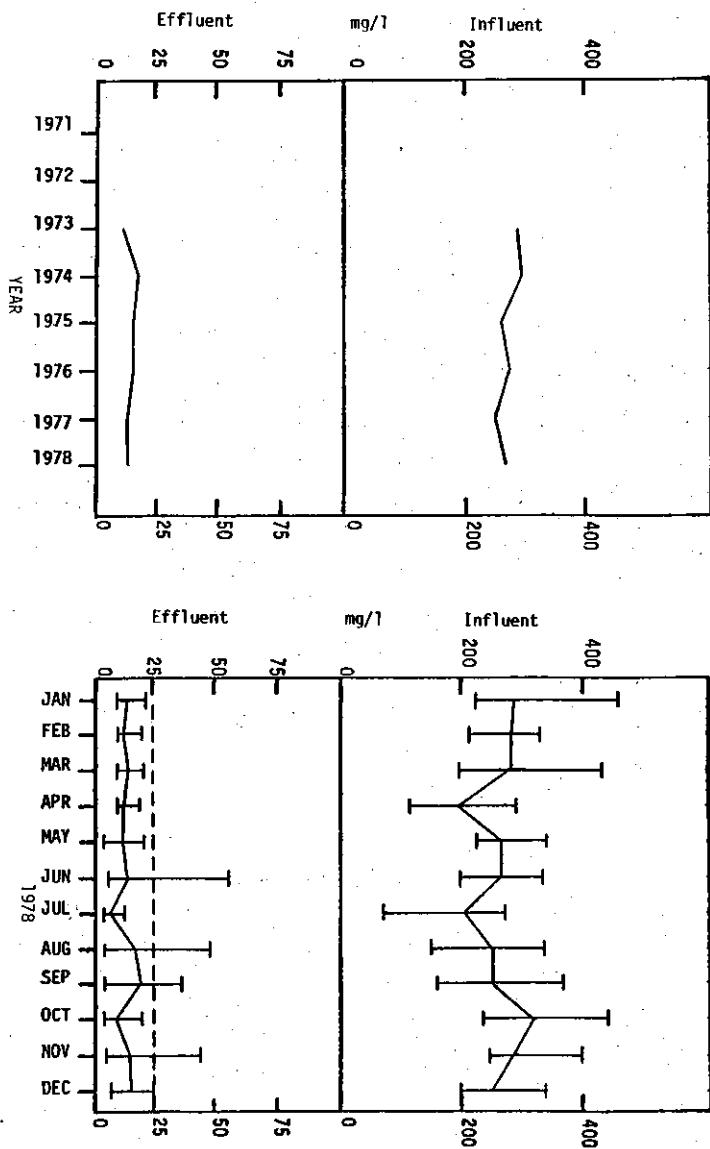
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: BLUE LAKE

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	10.43	53	294	745	345	27.0	17.6	6.9	7.3-7.9
FEBRUARY*	10.40	51	288	769	341	22.8	17.1	6.7	7.3-7.7
MARCH	11.23	52	285	751	350	22.5	17.6	6.2	7.3-7.8
APRIL	13.42	51	195	523	243	19.9	16.1	5.4	7.3-7.7
MAY	13.4	55	268	635	319	21.4	15.0	6.6	6.8-7.6
JUNE	13.8	58	269	678	395	18.8	14.1	6.7	7.0-7.9
JULY	15.1	60	204	529	293	17.8	12.9	5.4	6.6-7.5
AUGUST	13.4	62	255	579	301	18.4	13.9	5.6	7.0-7.8
SEPTEMBER	13.6	63	257	628	311	19.4	13.8	5.8	7.0-7.9
OCTOBER	12.0	61	326	715	338	23.1	17.9	7.0	6.9-7.8
NOVEMBER	11.6	58	292	665	317	23.8	18.3	6.2	6.9-7.6
DECEMBER	11.5	55	258	565	256	28.4	20.3	7.6	7.2-7.8
1978 AVERAGE	12.49	57	266	648	317	21.9	16.2	6.3	6.6-7.9
1977 AVERAGE	9.86	58	258	636	324	25.2	17.1	7.2	6.4-8.2

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: BLUE LAKE

* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
*NPDES Limitation														
JANUARY	13	108	18	4	12	17.2	12.5	0.19	0.16	3.9	12.8	7.5-7.9	96	95
FEBRUARY	12	128	18	2	13	17.9	15.4	0.04	0.07	4.2	13.6	7.5-8.0	96	95
MARCH	14	135	14	1	11	17.6	15.4	0.02	0.73	4.4	13.4	7.5-7.9	95	96
APRIL	12	103	13	4	10	16.8	15.6	0.11	0.10	3.8	13.2	7.5-7.7	94	95
MAY	11	100	11	6	10	15.5	12.5	0.02	0.08	3.5	12.0	7.5-7.9	96	96
JUNE	14	88	19	9	13	17.0	15.6	0.36	0.04	3.7	9.9	7.5-7.6	95	95
JULY	6	80	13	5	11	15.3	13.7	0.05	0.15	3.0	10.0	7.3-7.7	97	96
AUGUST	16	77	7	13	8	14.9	13.6	0.76	0.48	3.3	10.1	7.5-7.8	94	98
SEPTEMBER	18	75	8	4	8	12.4	11.4	1.44	1.99	3.7	9.5	7.4-7.8	93	97
OCTOBER	8	83	10	28	8	13.5	12.9	0.31	0.05	3.7	10.1	7.2-7.8	97	97
NOVEMBER	14	85	12	26	9	16.8	15.9	0.27	0.09	4.3	10.1	7.5-7.8	95	96
DECEMBER	15	85	21	71	15	22.5	17.3	0.27	0.11	5.0	10.8	7.4-7.9	94	92
1978 AVERAGE	13	96	14	9	11	16.4	14.3	0.32	0.34	3.9	11.3	7.2-8.0	95	96
1977 AVERAGE	13	91	13	4	8	18.7	16.6	0.23	0.39	4.7	11.7	7.2-8.4	95	96

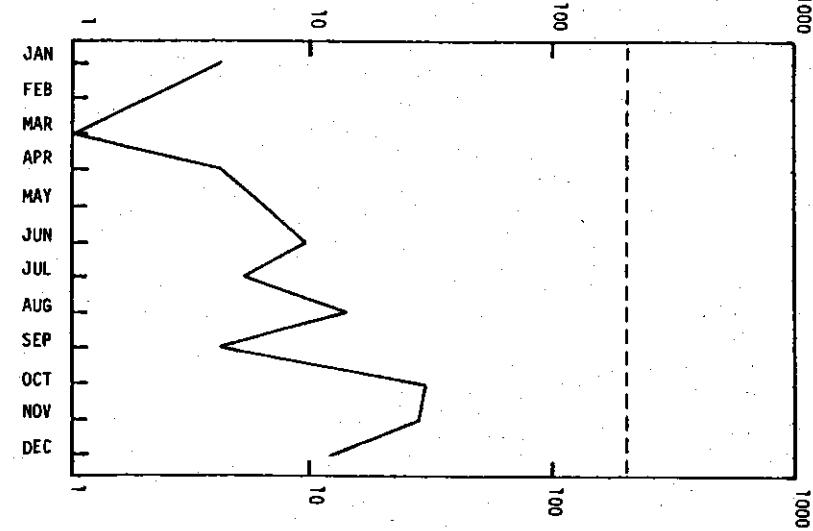
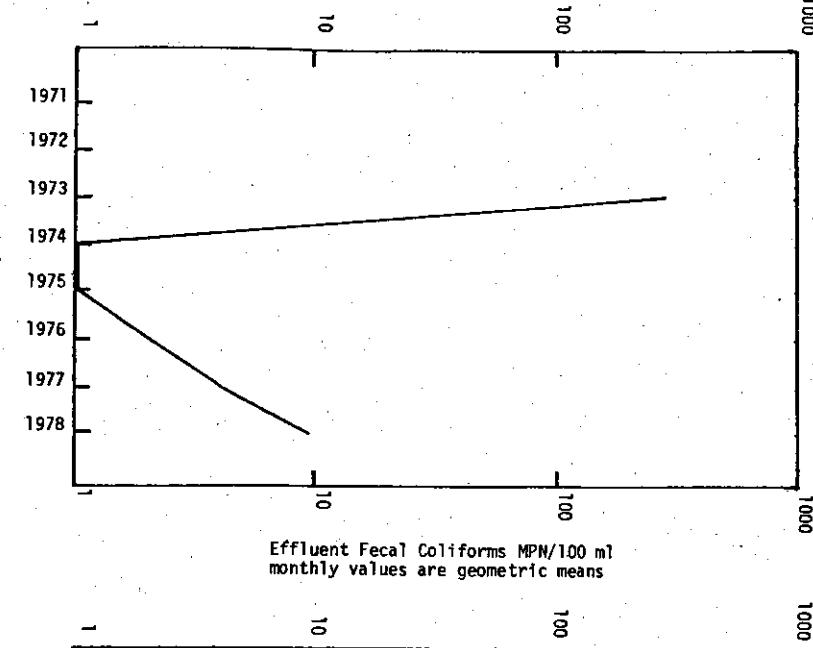


EFFLUENT FECAL COLIFORMS

BLUE LAKE

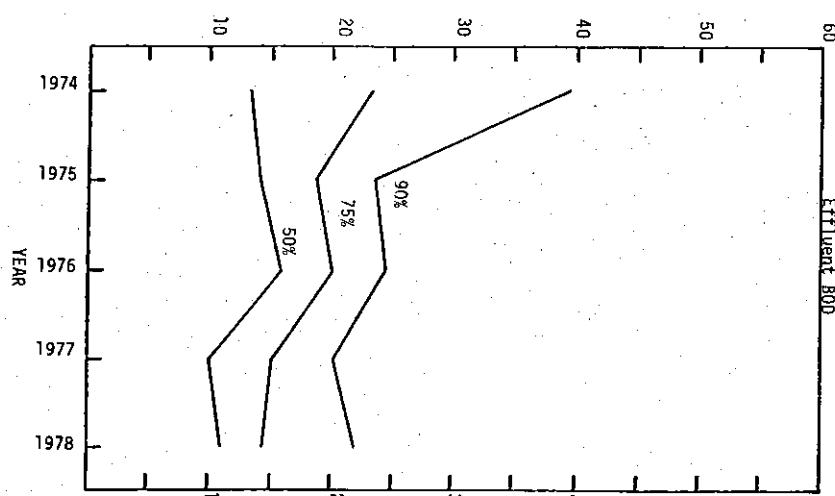
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Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

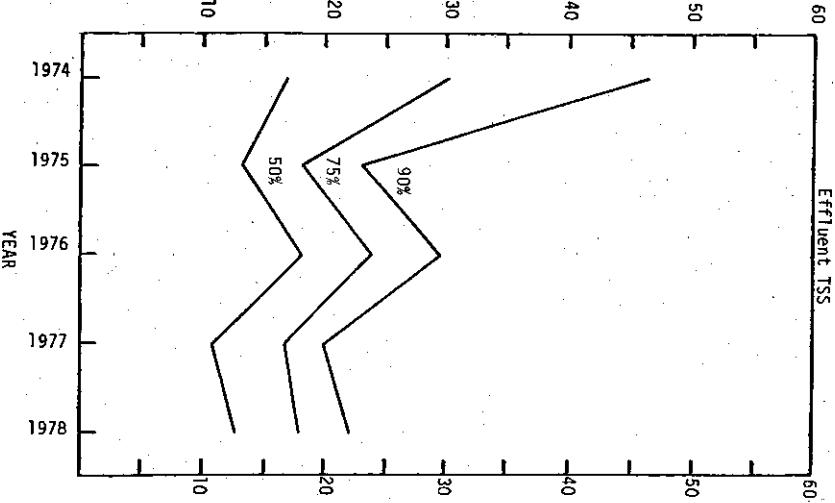


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or Less than Plotted Values

CHASKA WASTEWATER TREATMENT PLANT

Description:

The Chaska Wastewater Treatment Plant was constructed in 1963 with an average daily flow treatment capacity of 0.75 mgd. The treatment process involves primary treatment, a pure oxygen activated sludge process (added in 1973), and final effluent filtration.

Plant Operation:

The daily average wastewater flow to the Chaska Plant increased from 0.75 mgd in 1977 to 0.97 mgd in 1978. The monthly average flow exceeded the design capacity of the plant during all months except January. The Chaska Plant failed to meet NPDES monthly effluent limitations on a number of occasions. BOD violations occurred in all months except September. TSS violations occurred in January, March, April, and June. These violations are mainly the result of two problems; during colder weather it is difficult to maintain adequate process control. Secondly, high flows inhibit the establishment of a stable activated sludge process. Improvements are now under construction which will upgrade the plants' capacity. Overall effluent quality in 1978 showed a significant deterioration from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	25	33	61	49	58	100	114	98	140
TSS	33	36	58	66	71	88	122	121	120

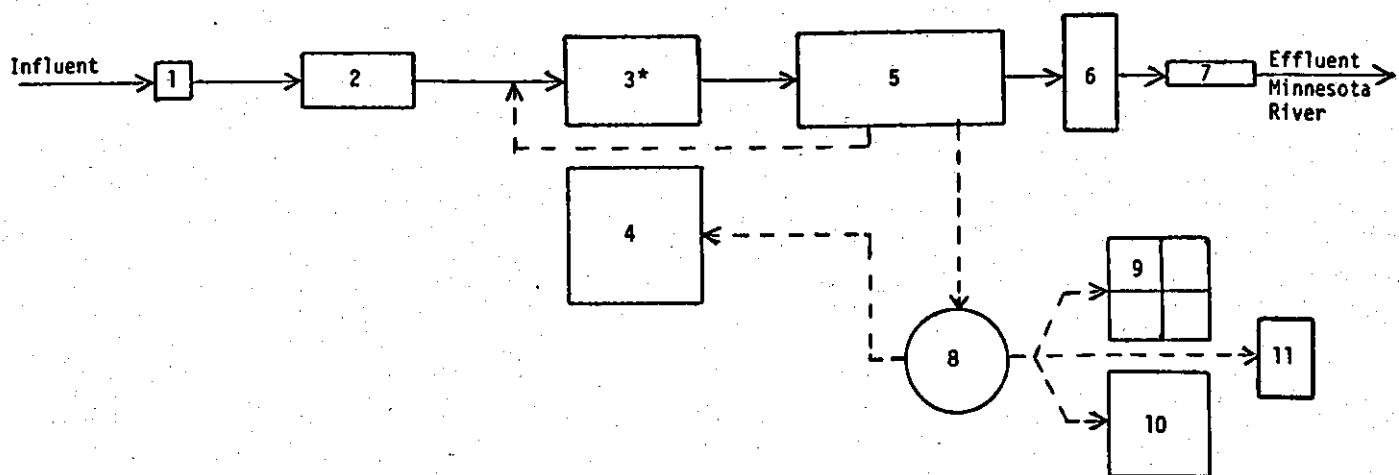
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Chaska Wastewater Treatment Plant is considered a permanent facility.

CHASKA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



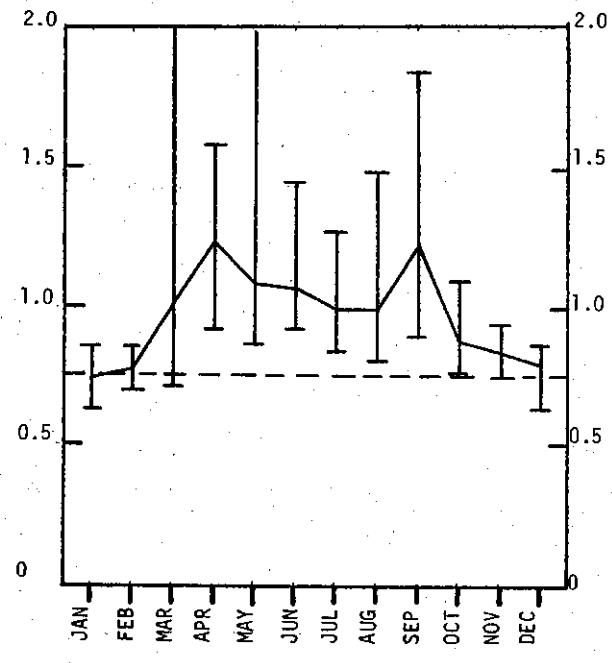
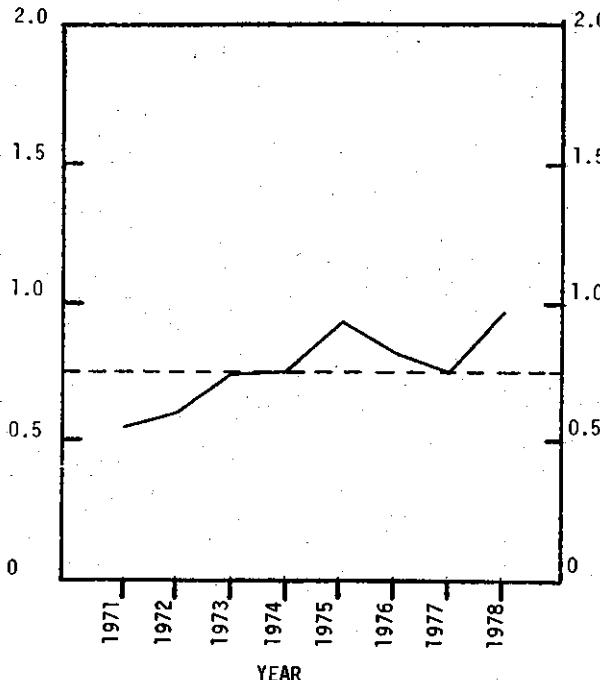
Unit Description

Liquid Phase	Solids Phase
1. Screening	8. Aerobic Digestion
2. Grit Removal	9. Sand Drying Beds
3. Activated Sludge	10. Land Spread
4. Supernatant Storage Tank	11. Haul to Blue Lake System
5. Final Sedimentation	* Pure Oxygen
6. Effluent Filtration	
7. Chlorination	

Legend

- Liquid Flow
- - - Solids Transfer
- Boxed unit = Existing Process Units
- Unboxed unit = Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: CHASKA

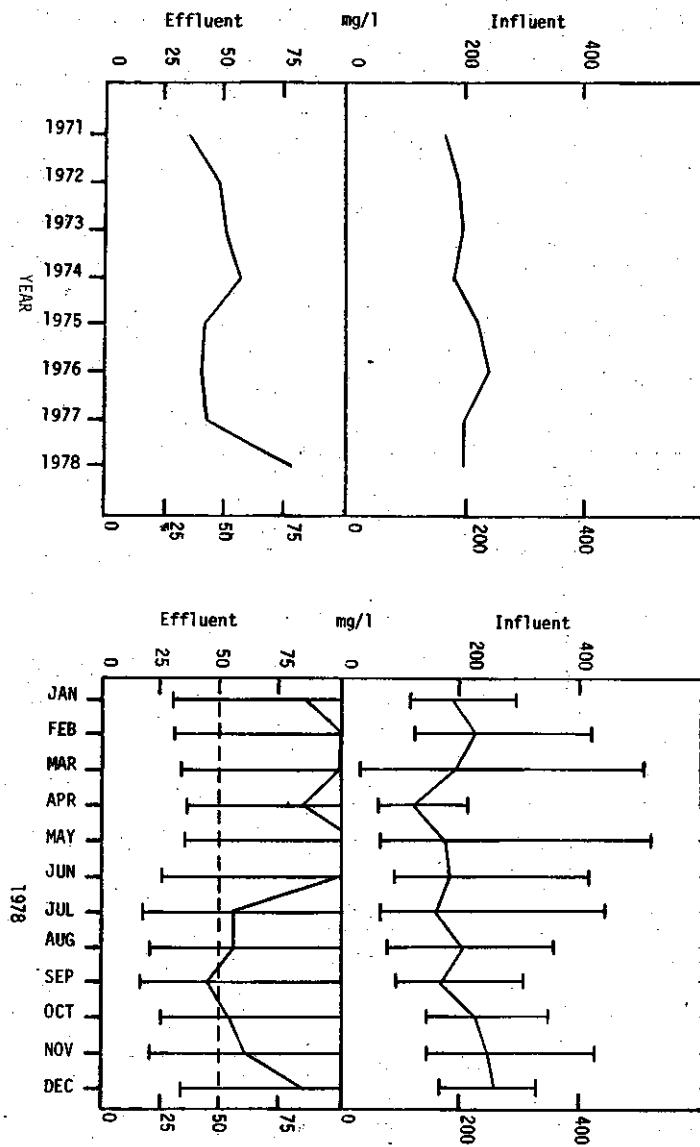
MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.73	N/A	190	312	185	21.6	16.8	4.4	7.4-8.2
FEBRUARY	0.77	N/A	230	402	163	21.6	15.9	4.5	7.0-7.9
MARCH	1.01	N/A	197	451	253	23.0	19.2	4.5	7.3-8.1
APRIL	1.24	N/A	128	282	109	15.5	11.2	2.8	7.3-8.0
MAY	1.08	N/A	179	918	145	15.3	11.4	3.7	7.1-8.2
JUNE	1.06	60	186	326	148	16.1	11.6	3.8	7.0-7.9
JULY	0.98	62	166	364	157	17.1	11.0	4.0	7.4-8.3
AUGUST	0.99	65	207	304	201	16.0	12.2	3.4	7.2-7.9
SEPTEMBER	1.22	65	174	304	180	15.6	12.3	3.6	7.2-8.1
OCTOBER	0.87	63	231	301	200	19.3	16.8	3.8	7.3-8.0
NOVEMBER	0.84	60	248	419	201	20.9	18.3	4.1	7.5-8.1
DECEMBER	0.79	N/A	259	460	215	26.9	19.6	5.8	7.2-8.1
1978 AVERAGE	0.97	62	200	404	180	19.1	14.7	4.0	7.0-8.3
1977 AVERAGE	0.75	58	203	407	180	19.4	12.9	4.4	5.0-10.4

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: CHASKA

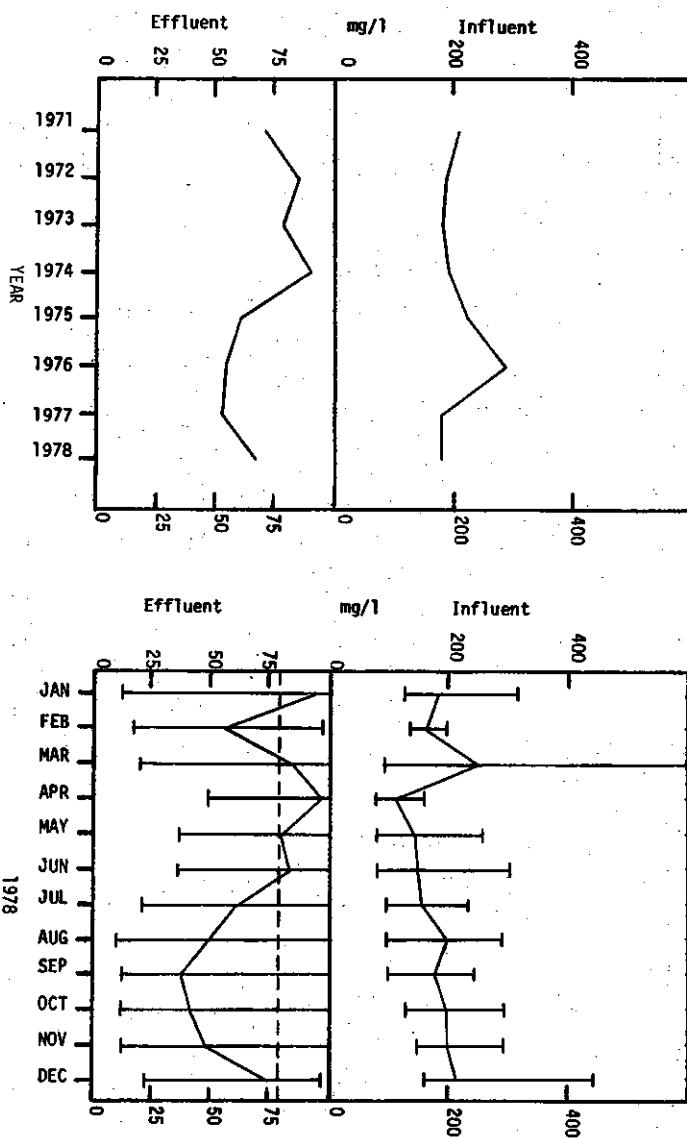
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL
	BOD	TSS											
*NPDES Limitation													
JANUARY	86	130	93	21	42	16.5	12.1	0.12	0.17	3.0	6.7	7.2-8.0	55 50
FEBRUARY	101	233	55	6	33	17.5	11.9	0.11	0.13	3.2	5.6	7.0-7.9	56 66
MARCH	99	277	84	33	44	19.2	13.6	0.14	0.35	3.8	8.2	7.2-7.7	50 67
APRIL	85	228	97	40	44	13.2	10.0	0.12	0.60	2.4	10.2	7.2-7.7	34 11
MAY	108	932	79	8	38	12.7	8.3	0.05	0.18	2.7	9.3	7.1-7.7	40 45
JUNE	101	174	83	42	31	11.6	7.9	0.07	0.06	2.3	8.4	7.0-7.8	46 44
JULY	56	213	60	25	22	13.5	8.1	0.17	0.09	2.7	5.6	6.9-7.8	66 62
AUGUST	56	100	49	14	23	8.4	5.0	0.26	3.51	1.6	4.8	6.7-7.4	73 76
SEPTEMBER	45	79	37	32	18	9.4	7.6	0.80	0.31	1.1	6.1	6.5-7.1	74 80
OCTOBER	54	90	40	9	16	12.0	9.5	1.00	0.63	1.8	5.1	6.7-7.4	76 80
NOVEMBER	61	136	47	3	22	16.2	13.3	1.05	1.01	2.5	5.4	6.7-7.2	75 76
DECEMBER	86	201	73	12	32	20.3	13.3	0.40	0.50	4.1	6.0	6.7-7.3	67 66
1978 AVERAGE	78	233	66	20	30	14.2	10.0	0.36	0.63	2.6	6.8	6.5-8.0	61 63
1977 AVERAGE	44	129	54	11	21	10.9	7.5	0.10	0.20	1.8	8.2	6.5-7.8	78 70

BIOCHEMICAL OXYGEN DEMAND



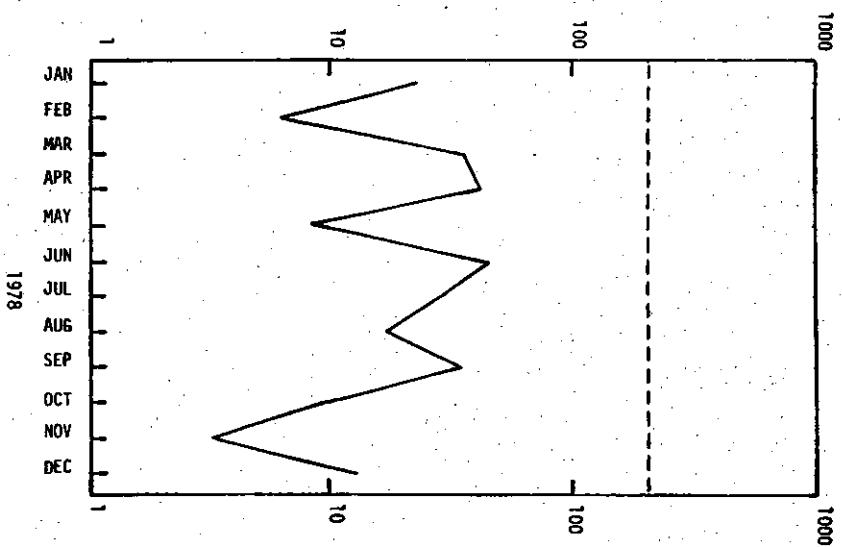
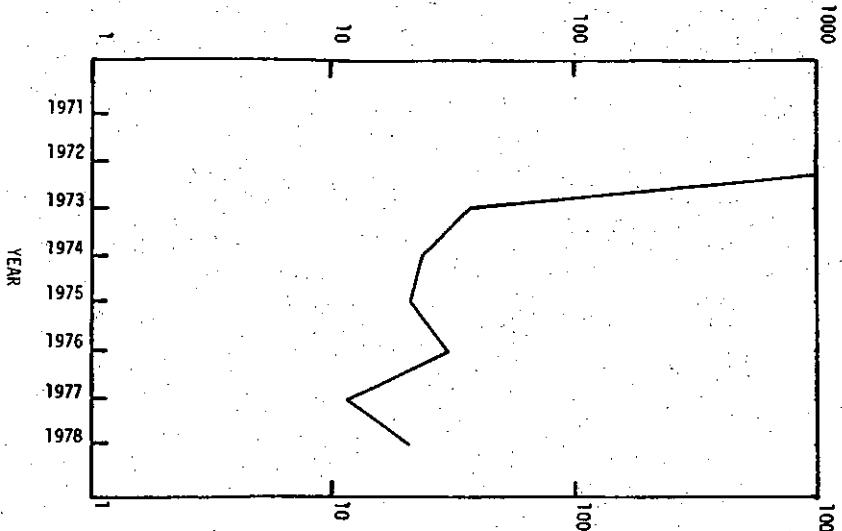
TOTAL SUSPENDED SOLIDS



EFFLUENT FECAL COLIFORMS

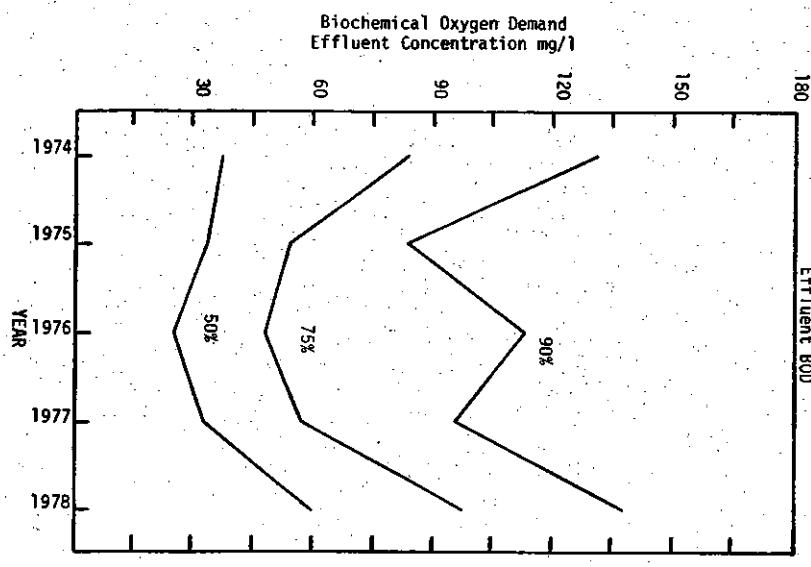
CHASKA

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means.

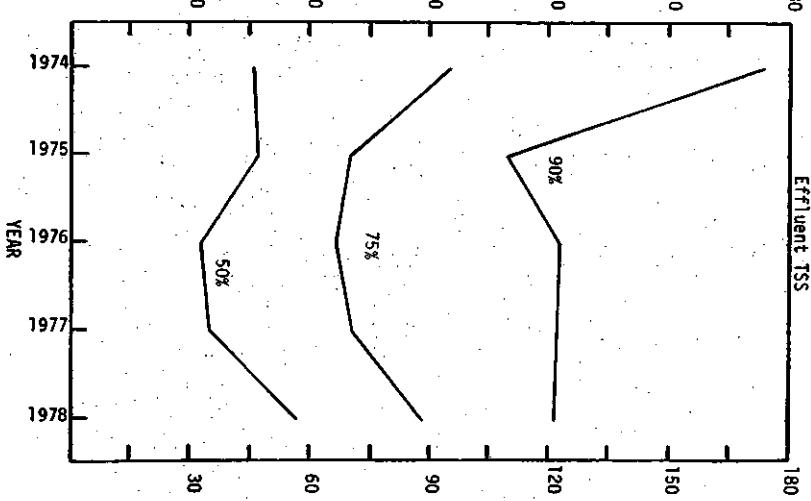


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values.

CHASKA
1978 EFFLUENT HEAVY METALS

MONTH	Cu mg/l	Zn mg/l
January	<0.05	0.05
February	0.04	0.18
March	0.02	0.08
April	<0.04	0.27
May	<0.03	0.10
June	<0.03	0.14
July	<0.02	0.08
August	<0.03	0.09
September	<0.04	0.45
October	<0.04	0.08
November	<0.02	0.05
December	<0.02	0.12
1978 Average	<0.03	0.14

COTTAGE GROVE WASTEWATER TREATMENT PLANT

Description:

The Cottage Grove Wastewater Treatment Plant was constructed in 1962. Expansions and modifications were made in 1963 and 1968, bringing the plant design capacity to 0.9 mgd and allowing the plant to be operated as a complete mix, contact stabilization, or step feed activated sludge process. Final effluent filtration was added in 1974.

Plant Operation:

The daily average wastewater flow to the Cottage Grove Plant increased from 0.97 in 1977 to 1.36 mgd in 1978. The monthly average wastewater flow exceeded the design capacity of the plant during all but one month of the year. There were several violations of NPDES monthly effluent limitations during the year. The TSS limitation was exceeded in September and December. These violations were the result of excessively high inflows and equipment failures. The fecal coliform limitation was exceeded in October. This violation was the result of poor mixing in the chlorine contact zone due to excessively high inflow volumes. Expansion of the Cottage Grove Plant is expected to be completed at the end of February, 1979. This will provide the plant with the means to improve overall treatment efficiency. Overall effluent quality in 1978 showed mixed results, with BOD quality improving over the past year while TSS and fecal coliform quality deteriorated somewhat. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	51	31	28	70	44	38	95	69	52
TSS	18	12	17	28	22	28	48	44	51

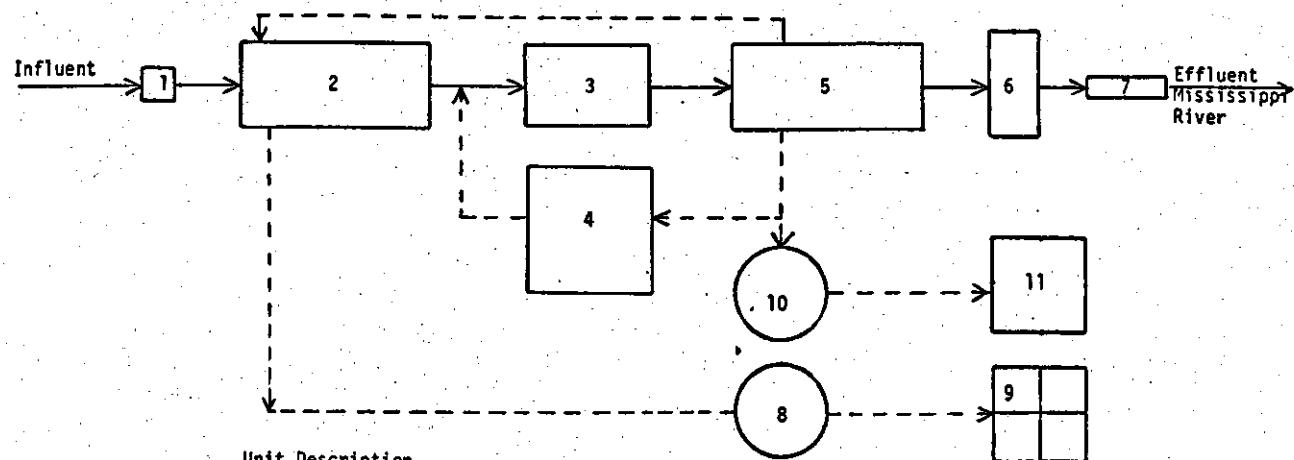
* Percent of time effluent concentrations equal to or less than value shown.

Plant Future:

The Cottage Grove Plant is considered one of the Commission's permanent facilities. Plant expansion is now underway.

COTTAGE GROVE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Primary Sedimentation
3. Activated Sludge
4. Sludge Reaeration
5. Final Sedimentation
6. Effluent Filtration
7. Chlorination

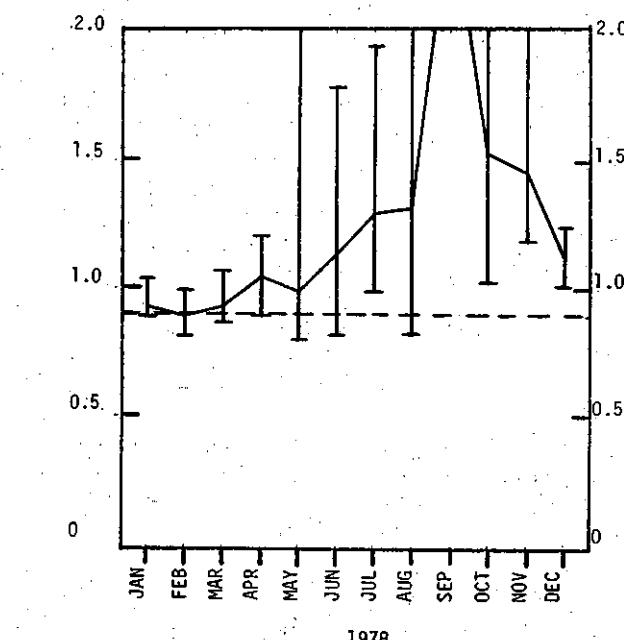
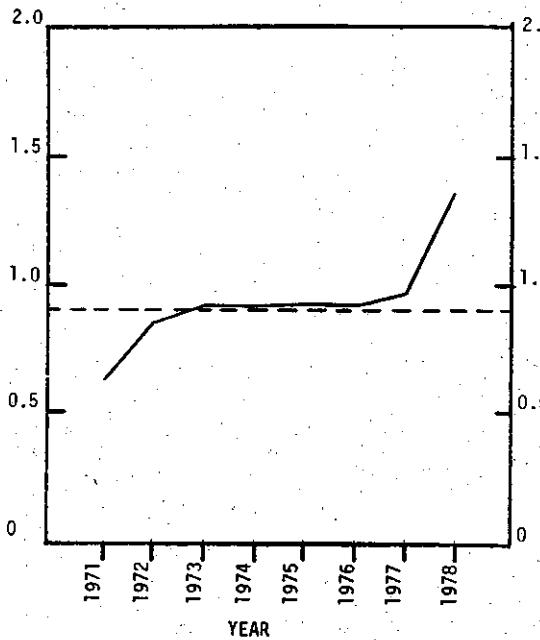
Solid Phase

8. Anaerobic Digestion
9. Sand Drying Beds
10. Aerobic Digestion
11. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- () Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: COTTAGE GROVE

MONTH	WASTEWATER FLOW MGD	TEMP. °F.	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	PH RANGE
JANUARY	0.93	54	244	452	228	40.2	30.6	8.2	7.8-8.7
FEBRUARY	0.90	53	244	541	234	38.9	30.5	8.5	7.8-8.7
MARCH	0.93	53	221	469	222	44.4	35.6	8.2	7.8-8.8
APRIL	1.05	54	240	532	239	37.6	29.9	7.8	8.0-8.8
MAY	0.98	59	225	459	218	35.8	27.0	8.2	7.6-8.7
JUNE	1.14	62	217	404	222	37.3	30.5	7.9	7.6-8.5
JULY	1.30	66	103	188	147	19.1	15.9	3.7	7.5-8.3
AUGUST	1.32	68	154	174	175	22.4	18.3	4.6	7.5-8.2
SEPTEMBER	3.00	67	71	193	118	12.6	10.9	2.8	7.0-8.1
OCTOBER	1.53	66	149	222	135	19.1	16.5	4.1	7.4-8.2
NOVEMBER	1.47	62	247	372	261	30.9	27.3	5.9	7.4-8.4
DECEMBER	1.12	57	261	390	195	40.5	31.4	8.0	7.7-8.7
1978 AVERAGE	1.31	60	198	366	200	31.6	25.4	6.5	7.0-8.8
1977 AVERAGE	0.97	62	209	459	220	38.7	30.7	8.1	6.8-9.1

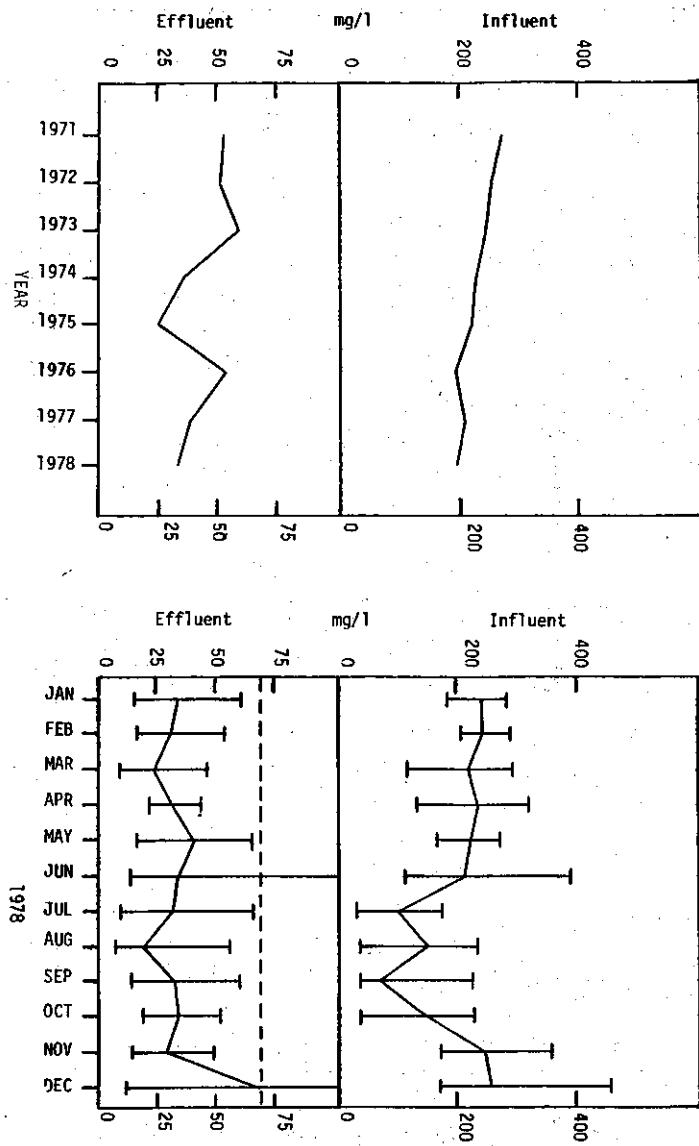
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: COTTAGE GROVE

* See Table 2

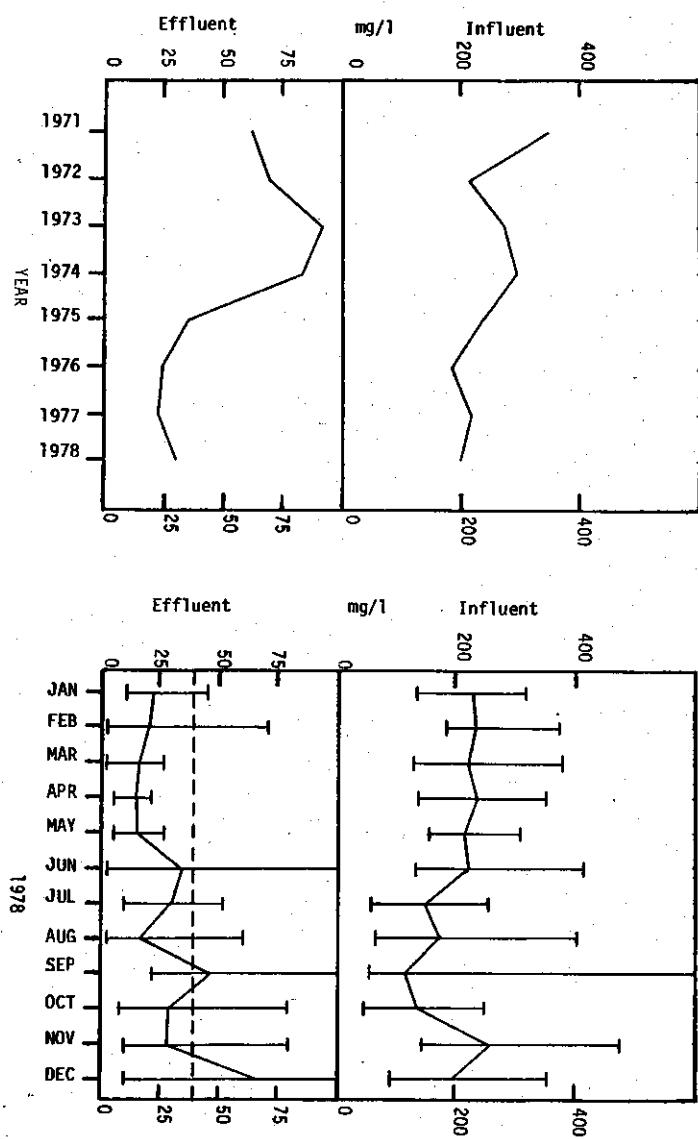
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	PH RANGE	% REMOVAL
	BOD	TSS											
+NPDES Limitation													
JANUARY	34	118	21	59	14	33.0	26.1	0.87	2.45	6.2	6.4	7.3-7.8	86 91
FEBRUARY	30	110	19	6	14	35.6	29.9	1.00	2.20	6.6	7.0	7.5-7.9	88 92
MARCH	23	90	15	6	10	30.3	26.0	0.84	3.36	5.8	7.2	7.3-7.9	90 93
APRIL	31	102	14	6	12	29.6	24.8	0.88	3.09	5.4	6.4	7.3-8.0	87 94
MAY	40	82	15	5	12	29.5	23.8	1.47	2.79	5.6	6.8	7.3-7.9	82 93
JUNE	33	72	34	70	14	25.2	21.8	1.02	1.77	5.0	5.7	7.1-7.8	85 85
JULY	32	89	30	18	17	15.1	12.3	0.87	1.14	2.8	4.2	6.8-7.6	69 80
AUGUST	19	55	17	82	10	18.6	15.4	0.95	1.05	4.2	4.3	7.0-7.6	88 90
SEPTEMBER	32	94	47	28	21	9.7	7.7	0.56	2.29	2.5	4.1	7.1-7.5	56 60
OCTOBER	33	76	28	207	17	18.0	15.9	0.96	2.22	3.9	4.9	7.1-7.5	78 79
NOVEMBER	28	101	29	23	17	27.6	24.6	0.17	0.93	4.8	5.2	7.1-7.8	89 89
DECEMBER	69	157	67	5	26	34.6	28.6	0.12	0.57	6.6	5.5	7.1-7.7	74 66
1978 AVERAGE	34	96	28	43	15	25.6	21.4	0.81	1.99	5.0	5.6	6.8-8.0	83 86
1977 AVERAGE	39	80	23	30	15	23.0	19.7	2.47	5.42	6.1	5.3	6.7-8.1	81 90

COTTAGE GROVE

BIOCHEMICAL OXYGEN DEMAND



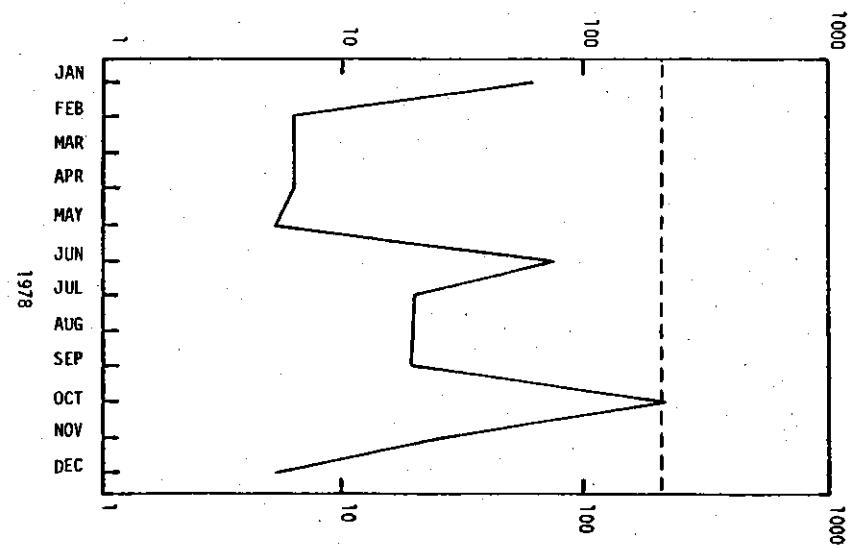
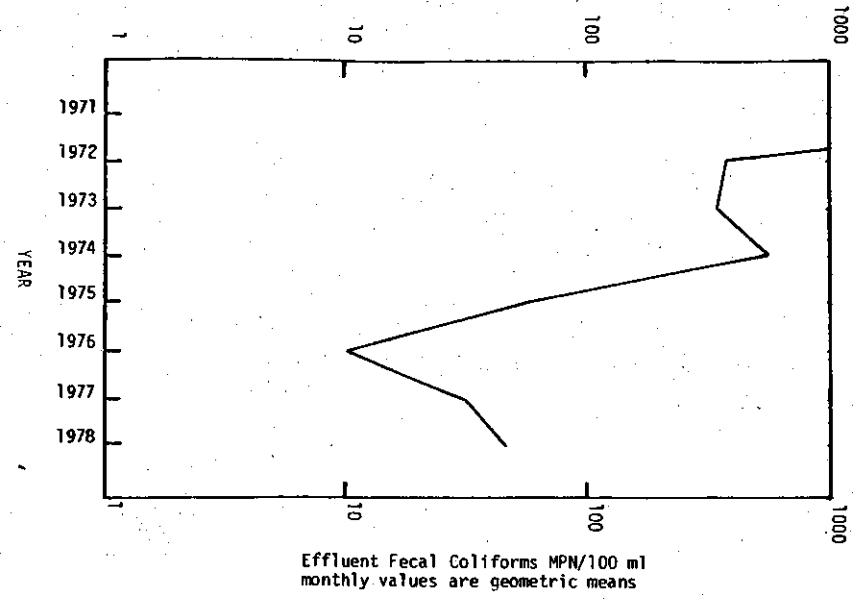
TOTAL SUSPENDED SOLIDS



EFFLUENT FECAL COLIFORMS

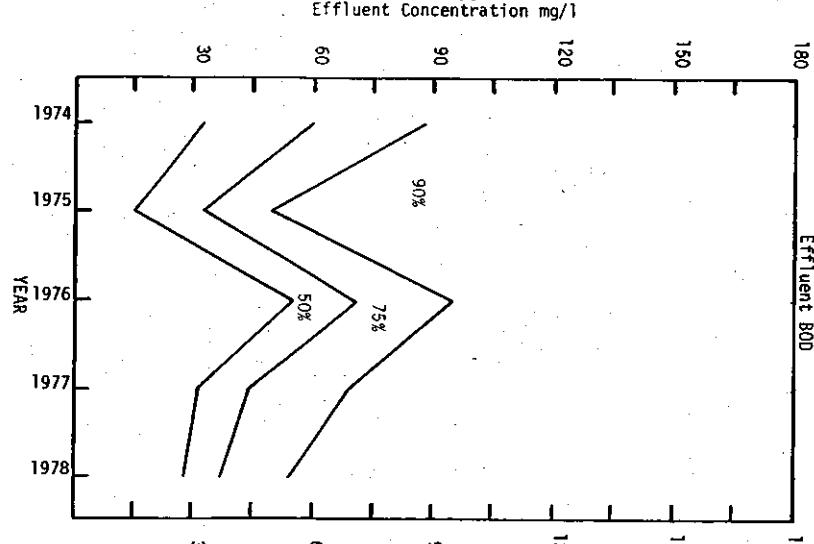
COTTAGE GROVE

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

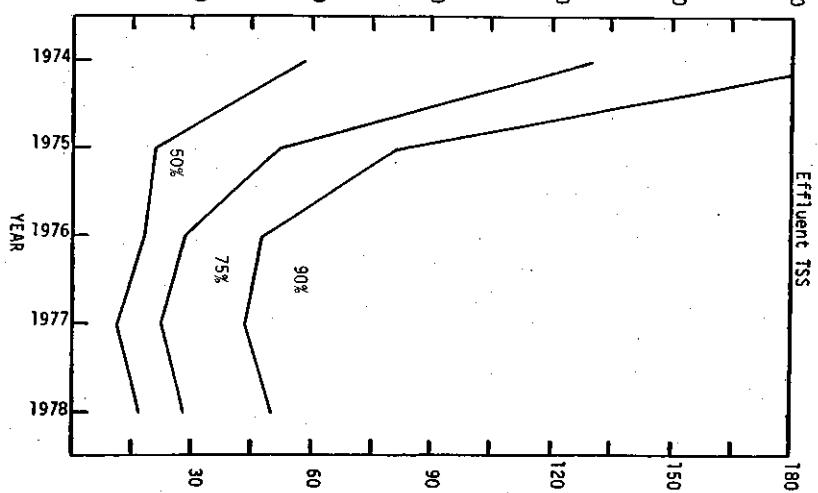


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than plotted values.

FARMINGTON WASTEWATER TREATMENT PLANT

Description:

The Farmington Wastewater Treatment Plant was constructed in 1958 as a two stage high rate trickling filter plant with a design capacity of 0.54 mgd. Final effluent filtration was added in 1975.

Plant Operation:

The daily average wastewater flow to the Farmington Plant increased from 0.35 mgd in 1977 to 0.52 mgd in 1978. The monthly average waste water flow exceeded the design capacity of the plant during 6 months of 1978. The NPDES monthly effluent limitation for BOD was violated in January. This violation was the result of a series of abnormally high strength industrial wastes discharged by a creamery in Farmington. There were no other permit violations during the year. Overall effluent quality in 1978 showed improvement from the previous year with marked improvement in effluent BOD quality. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	24	25	23	39	111	34	50	175	45
TSS	21	30	32	30	39	42	38	58	55

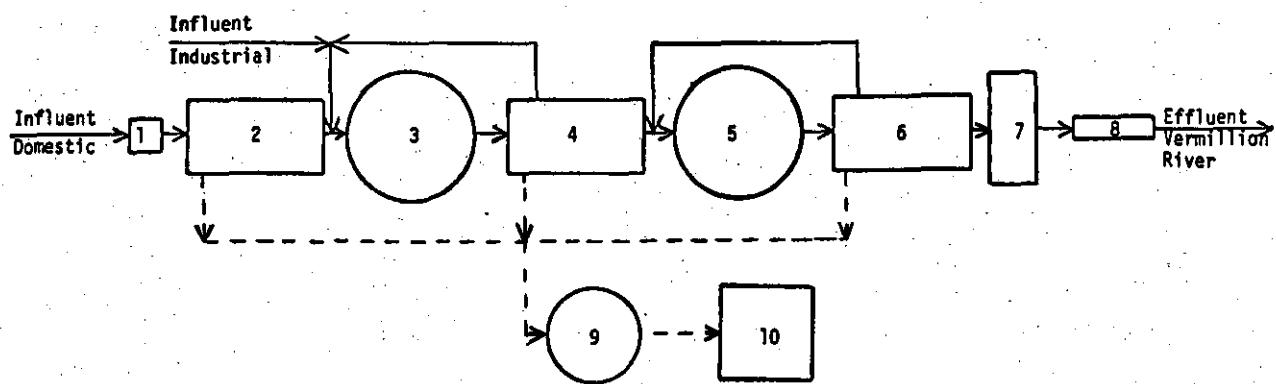
* Percent of time effluent concentrations equal to or less than value shown.

Plant Future:

With the completion of the new Empire Plant the Farmington Plant will be phased-out and its flow diverted to the new plant. This changeover is scheduled to occur in May of 1979.

FARMINGTON WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Primary Sedimentation
3. First Stage Trickling Filter
4. Intermediate Sedimentation
5. Second Stage Trickling Filter
6. Final Sedimentation
7. Effluent Filtration

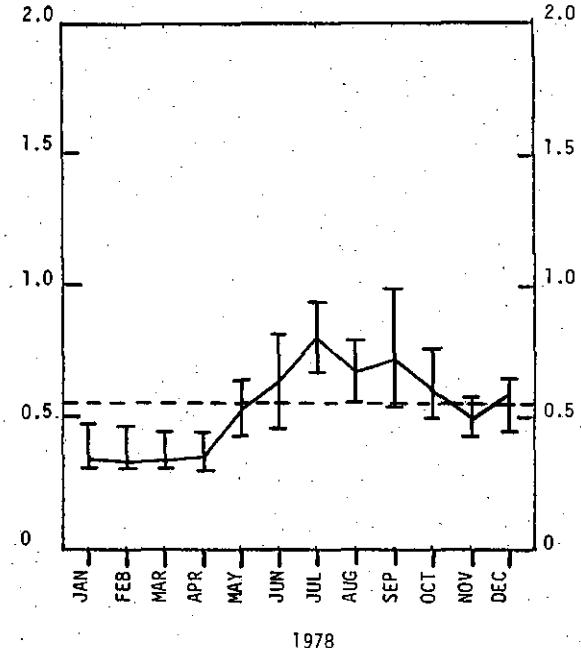
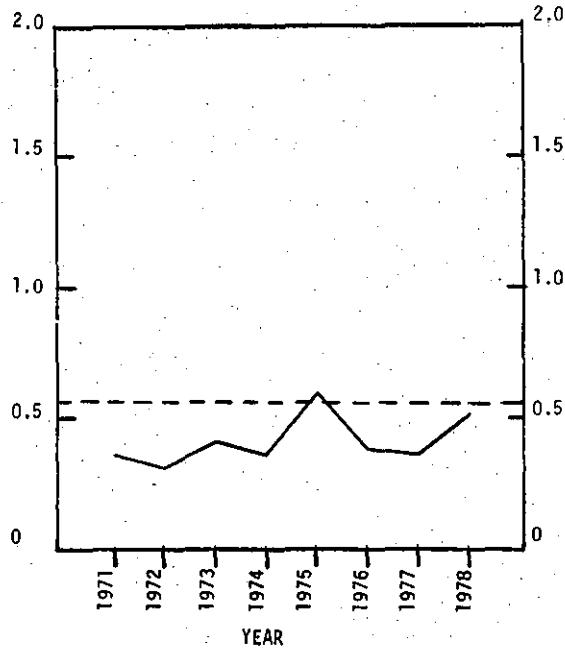
Solid Phase

9. Anaerobic Digestion
10. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: FARMINGTON

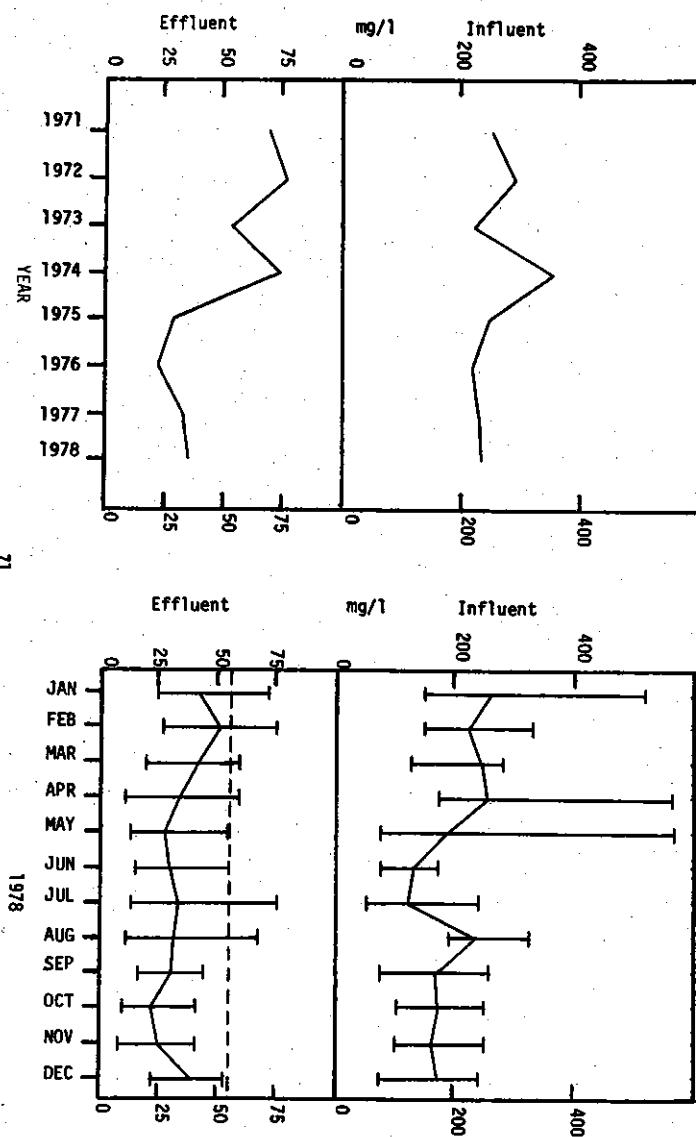
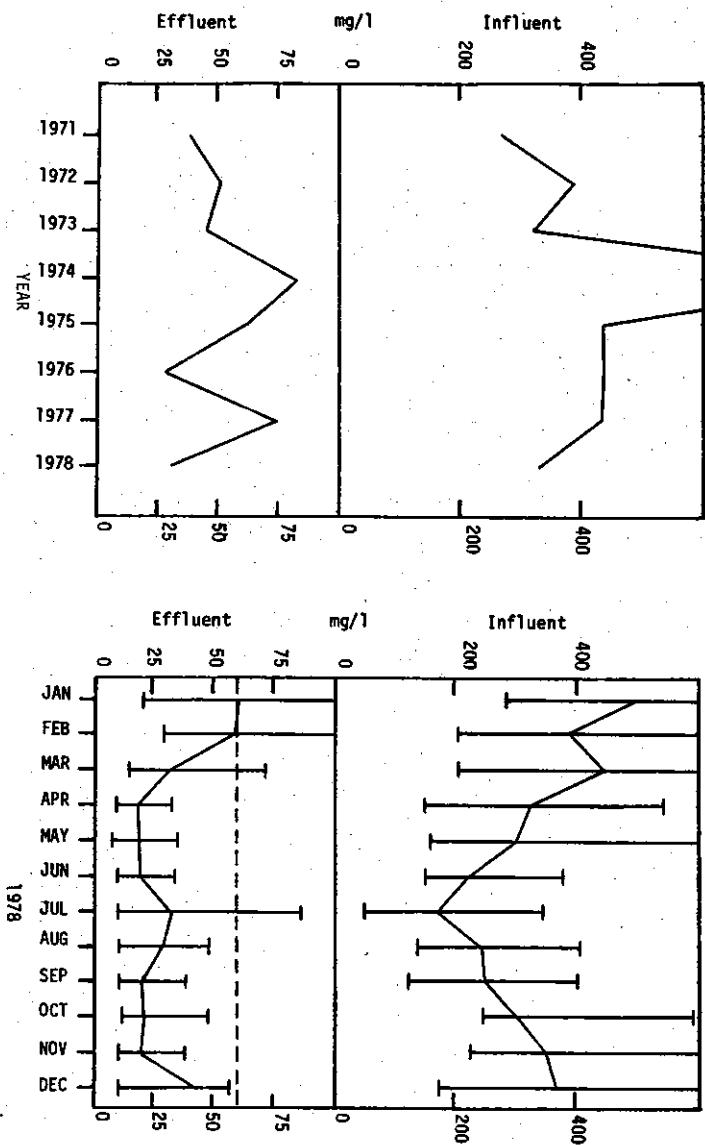
MONTH	MASTEWATER FLOW MGD.	TEMP F DOM IND	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE	
									DOM	IND
JANUARY	0.33	54 74	519	1421	265	39.1	22.4	25.7	7.4-8.4	5.0-8.9
FEBRUARY	0.32	53 74	490	774	227	35.3	23.3	20.9	7.4-8.6	4.9-11.3
MARCH	0.33	52 74	460	1018	248	41.7	21.0	21.6	7.5-8.7	5.0-10.8
APRIL	0.34	54 73	334	604	260	29.2	18.1	21.7	7.4-8.5	5.6-9.8
MAY	0.52	58 75	310	544	192	25.3	14.5	20.3	7.3-8.5	5.1-9.5
JUNE	0.63	62 75	223	377	129	17.7	11.9	19.0	7.4-8.2	5.5-10.5
JULY	0.80	64 76	174	268	125	14.6	8.9	13.2	7.0-8.1	4.9-11.5
AUGUST	0.67	65 77	249	285	142	17.0	11.4	12.7	7.4-7.9	5.2-10.5
SEPTEMBER	0.72	66 77	255	468	172	22.6	13.1	17.9	7.4-7.9	5.5-8.6
OCTOBER	0.60	64 75	311	383	177	22.7	15.4	19.9	7.4-8.1	5.9-7.8
NOVEMBER	0.49	60 73	357	381	163	22.4	16.3	18.3	7.4-8.5	6.1-10.6
DECEMBER	0.53	56 71	377	613	172	30.7	15.4	24.5	7.4-8.4	5.4-11.4
1978 AVERAGE	0.52	59 74	338	595	189	26.5	16.0	19.6	7.0-8.7	4.9-11.5
1977 AVERAGE	0.35	61 75	447	698	235	31.8	18.3	26.2	7.0-8.8	3.7-12.5

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: FARMINGTON

* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJ-N mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL	
													BOD	TSS
*NPDES Limitation														
JANUARY	61	242	43	19	27	19.8	14.0	0.24	0.56	20.2	3.0	6.8-7.9	88	84
FEBRUARY	59	193	53	15	29	24.4	18.2	0.19	0.54	24.2	2.9	7.1-7.8	88	77
MARCH	31	160	43	6	25	24.4	21.1	0.35	1.24	22.8	3.4	7.1-7.8	93	83
APRIL	18	100	35	6	20	18.1	15.4	0.43	2.06	21.0	3.8-	7.1-7.7	95	87
MAY	18	97	28	7	16	16.0	13.2	0.35	1.28	20.9	4.2	7.1-7.6	94	85
JUNE	19	88	29	17	14	13.4	11.0	0.29	1.40	16.7	4.0	7.1-7.6	92	77
JULY	32	102	34	51	17	11.4	8.4	0.17	0.36	14.3	3.6	7.1-7.5	81	73
AUGUST	28	91	31	47	17	15.6	12.3	0.26	0.68	16.5	3.2	7.0-7.6	89	78
SEPTEMBER	20	91	30	9	16	11.9	10.5	0.34	0.93	15.6	3.7	7.1-7.5	92	83
OCTOBER	21	81	21	12	13	10.8	9.3	0.35	1.13	16.3	4.0	7.1-7.8	93	88
NOVEMBER	20	71	24	6	13	13.6	11.9	0.46	1.92	13.6	4.3	7.1-7.9	95	85
DECEMBER	43	131	38	24	18	18.3	14.5	0.27	0.93	17.0	3.8	7.1-7.9	89	78
1978 AVERAGE	31	127	34	18	19	16.5	13.3	0.31	1.09	18.3	3.7	5.8-7.9	91	82
1977 AVERAGE	76	177	34	36	30	21.2	17.0	0.25	0.65	23.4	1.7	6.8-8.0	83	86

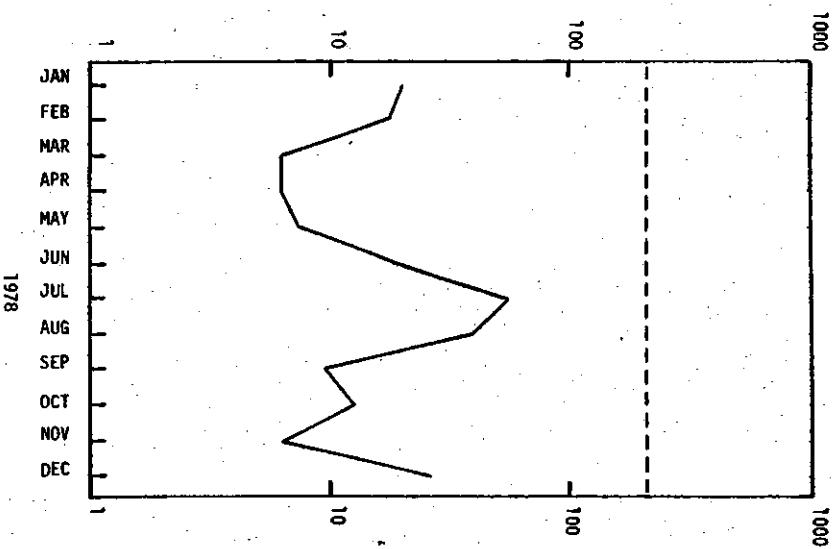
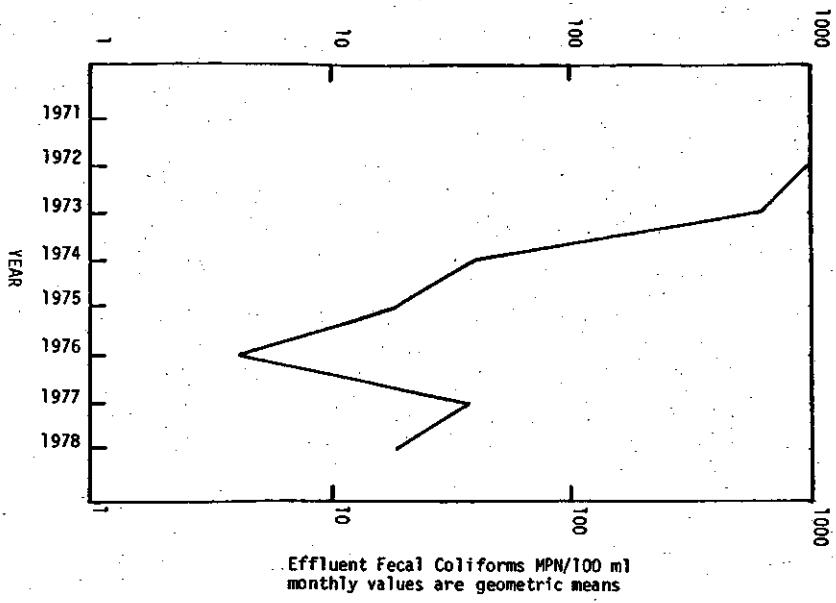
BIOCHEMICAL OXYGEN DEMAND



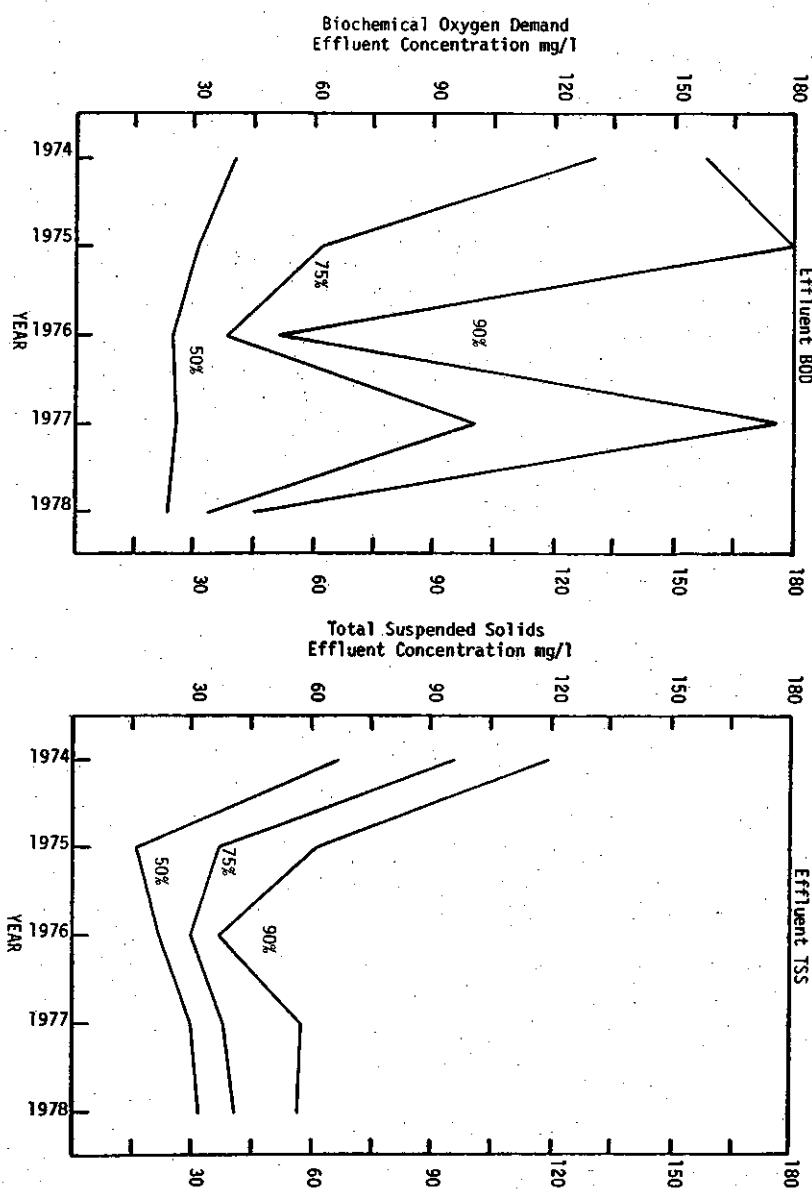
EFFLUENT FECAL COLIFORMS

FARMINGTON

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means



STATISTICAL ANALYSIS*



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values.

HASTINGS WASTEWATER TREATMENT PLANT

Description:

The Hastings Wastewater Treatment Plant was constructed in 1955 as a primary treatment facility. In 1967 the plant was modified to include secondary treatment with a flow capacity of 1.83 mgd. The plant can be operated as either a conventional or step feed activated sludge process.

Plant Operation:

The daily average wastewater flow to the Hastings Plant increased from 1.40 mgd in 1977 to 1.42 mgd in 1978. At no time in 1978 did the monthly average flow exceed the design capacity of the plant. The NPDES monthly effluent limitation for BOD was violated in February. This was the result of an inability to control sludge bulking problems during a portion of the month. All other NPDES monthly limits were met in 1978. Overall effluent quality in 1978 showed little significant change from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	10	13	16	16	19	22	22	29	28
TSS	17	16	18	24	24	25	34	29	33

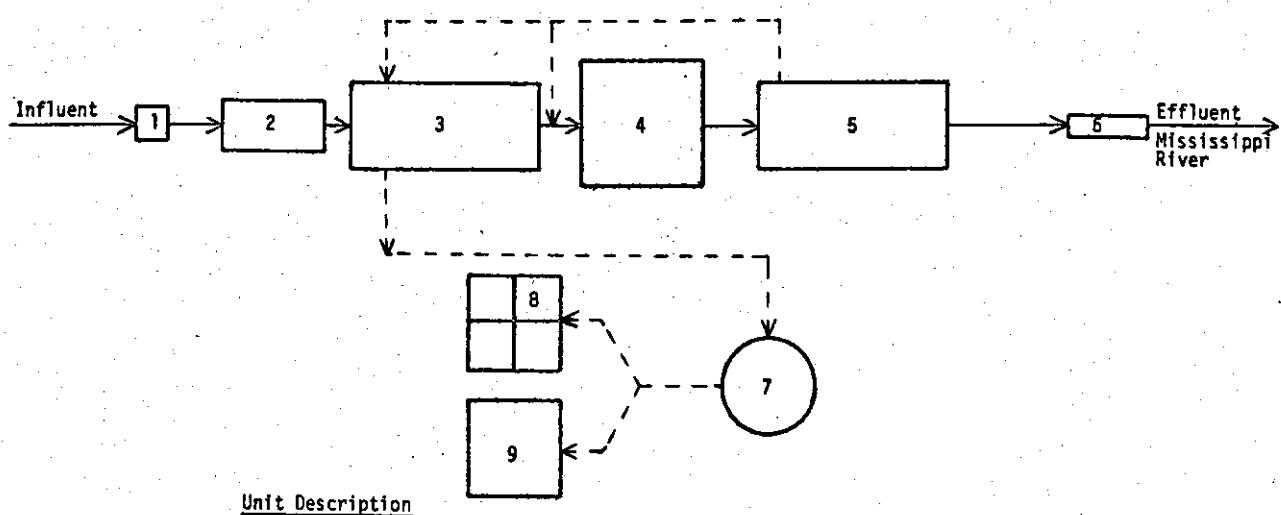
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Hastings Treatment Plant is considered one of the Commission's permanent facilities. It is proposed to expand this plant as necessary to meet future requirements.

HASTINGS WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Grit Removal
3. Primary Sedimentation
4. Activated Sludge
5. Final Sedimentation
6. Chlorination

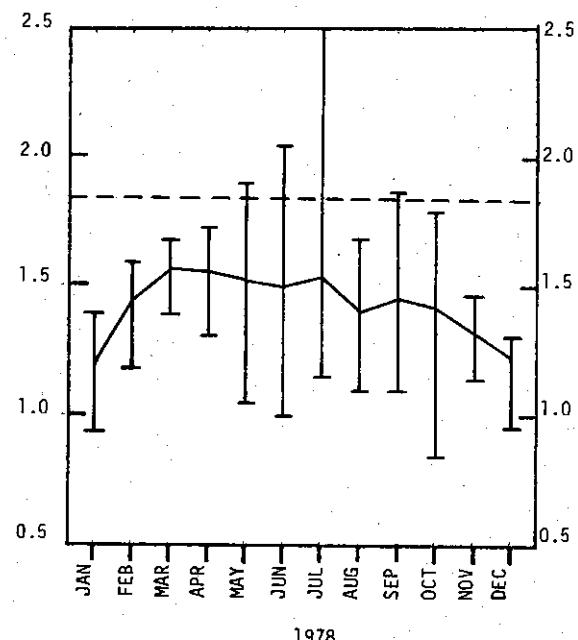
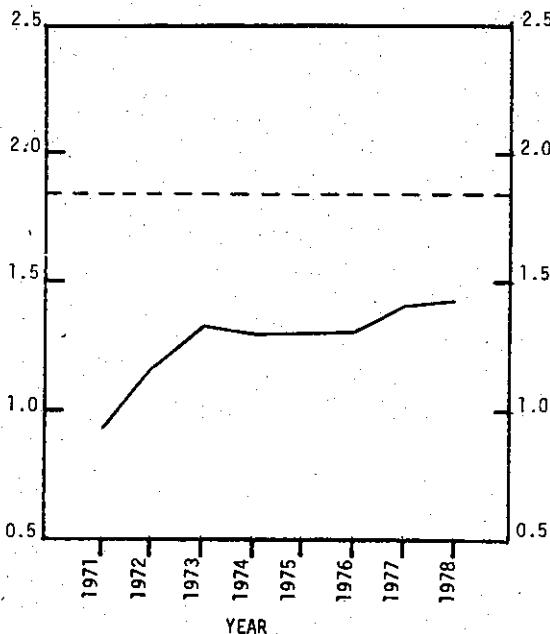
Solid Phase

7. Anaerobic Digestion
8. Sand Drying Beds
9. Land Spreading

Legend

- Liquid Flow
- Solids Transfer
- Existing Process Units
- ▨ Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: HASTINGS

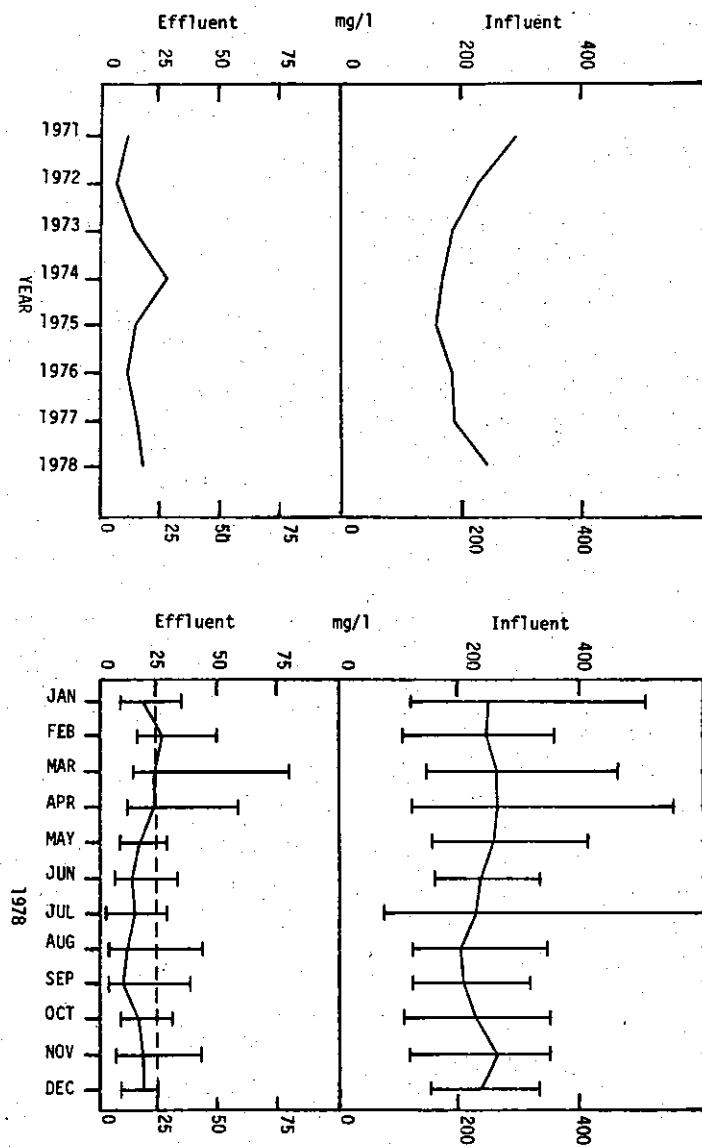
MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	1.19	55	253	516	188	46.5	36.2	7.8	6.8-8.5
FEBRUARY	1.44	54	250	502	239	37.2	27.9	8.3	7.4-9.1
MARCH	1.56	54	267	571	258	35.5	27.7	8.6	7.6-8.8
APRIL	1.55	55	267	480	264	45.6	37.8	8.9	7.4-8.9
MAY	1.52	59	262	605	289	36.8	26.6	10.7	3.0-8.5
JUNE	1.49	64	241	538	265	31.0	23.8	9.0	7.2-9.0
JULY	1.53	65	228	335	266	32.5	25.6	7.6	7.3-8.6
AUGUST	1.40	69	206	310	268	26.3	21.8	6.1	7.4-8.9
SEPTEMBER	1.45	69	211	409	262	30.5	23.0	7.4	7.3-8.7
OCTOBER	1.41	67	231	459	244	36.8	29.0	7.9	7.2-9.2
NOVEMBER	1.31	64	266	534	279	38.5	32.1	9.2	7.6-9.0
DECEMBER	1.21	60	239	484	202	41.9	34.9	8.9	7.2-9.1
1978 AVERAGE	1.42	61	243	479	252	36.6	28.9	8.4	3.0-9.2
1977 AVERAGE	1.40	60	189	412	184	30.2	23.6	6.7	6.4-9.9

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: HASTINGS

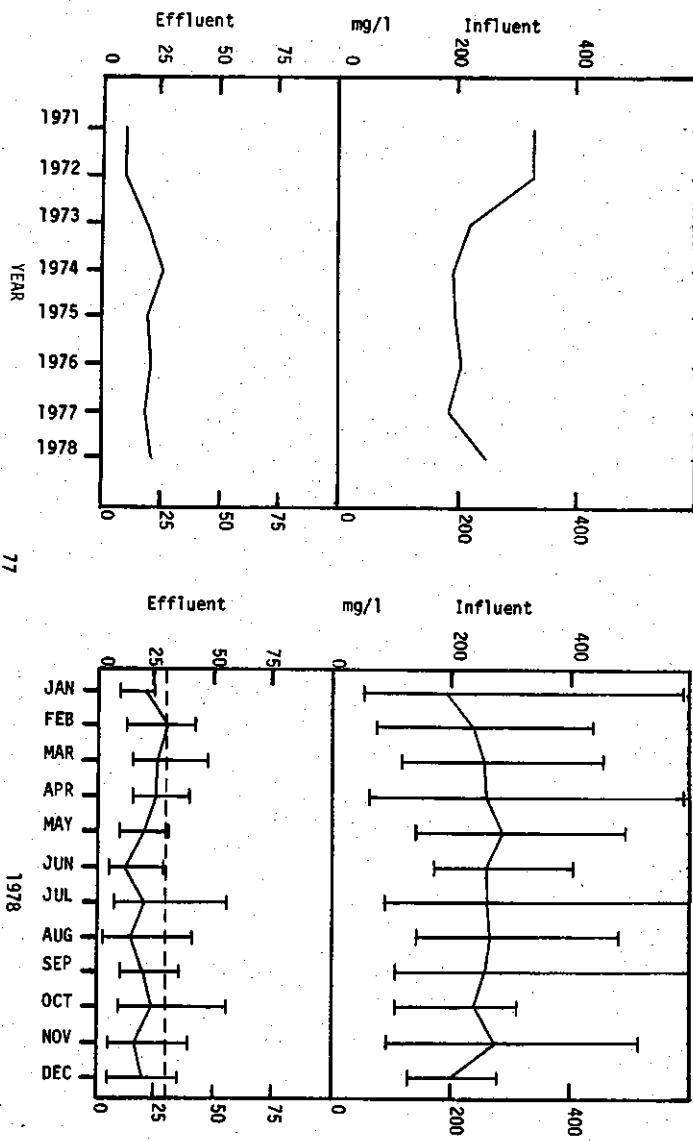
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
*NPDES Limitation														
JANUARY	18	116	20	12	12	41.5	36.5	0.12	0.38	4.8	10.0	7.2-7.7	93	89
FEBRUARY	27	112	29	27	17	31.1	25.5	0.11	0.23	5.0	10.0	7.3-7.9	89	88
MARCH	23	113	25	15	14	29.8	27.2	0.12	0.51	4.4	9.8	7.2-7.8	91	90
APRIL	23	107	25	38	16	34.1	31.8	0.15	0.75	5.0	8.8	7.3-7.8	91	91
MAY	17	87	19	23	11	27.2	23.5	0.42	0.37	5.0	8.1	7.3-7.8	94	94
JUNE	14	83	12	66	7	22.4	20.0	0.12	0.55	3.8	7.3	7.0-7.9	94	95
JULY	15	77	20	74	9	22.6	19.0	2.40	1.33	4.2	6.8	7.0-7.8	93	92
AUGUST	12	64	14	11	9	21.0	18.8	0.25	0.47	4.5	6.8	7.0-8.1	94	95
SEPTEMBER	10	68	19	18	10	19.9	18.0	0.54	0.81	3.3	6.3	7.3-7.7	95	93
OCTOBER	17	97	23	8	13	27.4	24.6	1.08	0.67	4.4	6.1	7.0-8.0	93	91
NOVEMBER	18	68	16	10	9	24.0	21.4	2.76	2.85	4.7	7.3	7.0-7.9	93	94
DECEMBER	19	109	19	16	11	34.1	28.0	1.68	2.30	6.1	8.0	7.1-7.9	92	91
1978 AVERAGE	18	92	20	26	12	27.9	24.5	0.81	0.94	4.6	7.9	7.0-8.1	93	92
1977 AVERAGE	16	79	18	48	14	21.8	19.5	0.70	1.70	3.4	7.9	7.0-8.0	92	90

BIOCHEMICAL OXYGEN DEMAND



TOTAL SUSPENDED SOLIDS

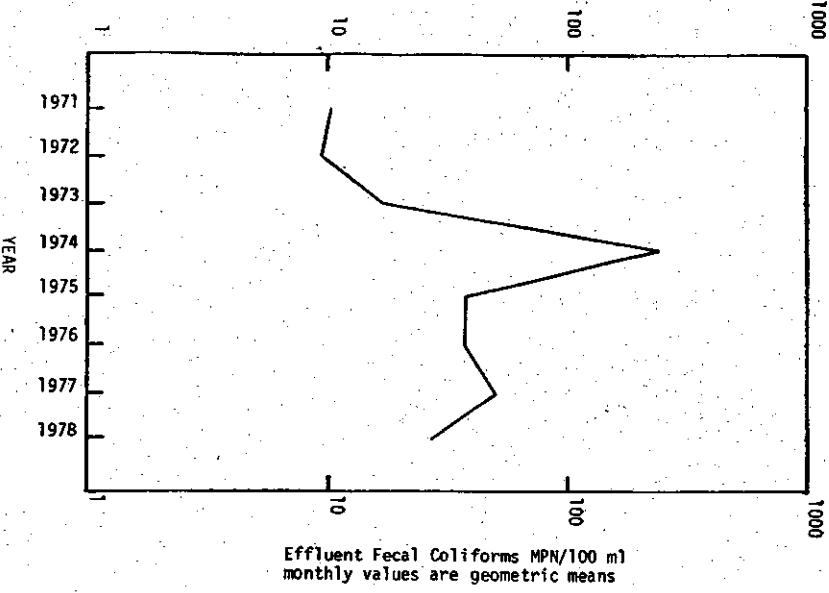


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EFFLUENT Fecal Coliforms

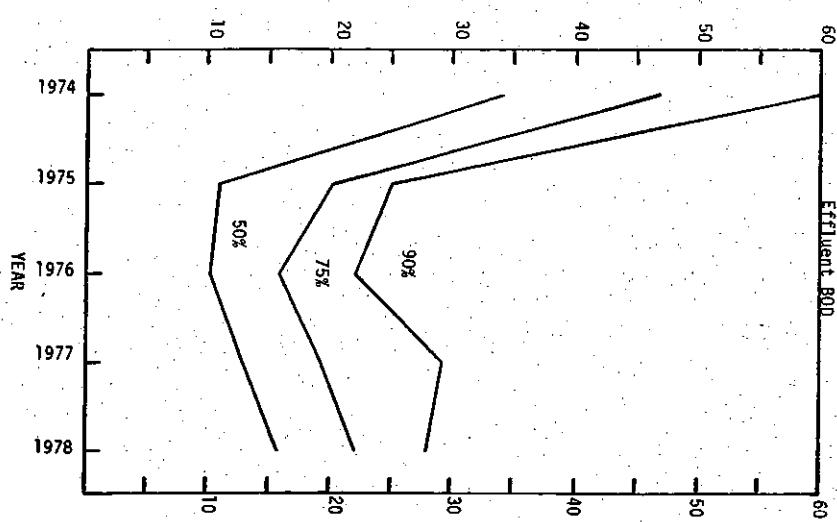
HASTINGS

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

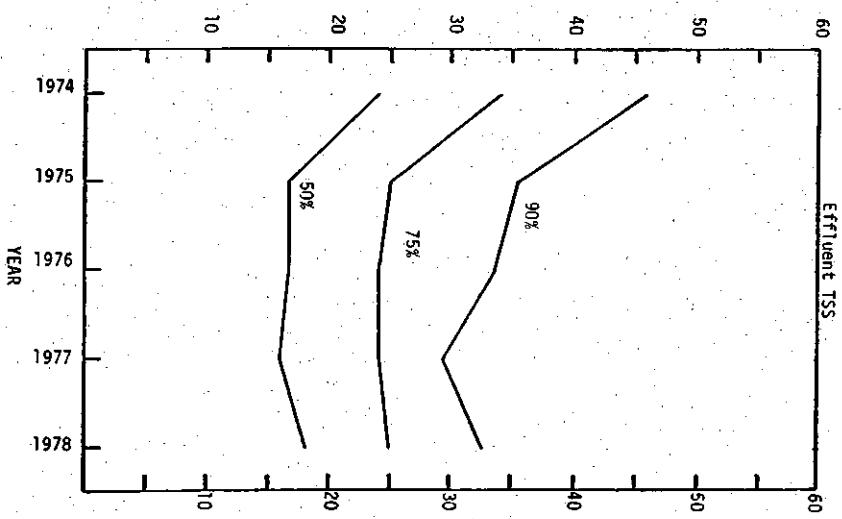


STATISTICAL ANALYSIS*

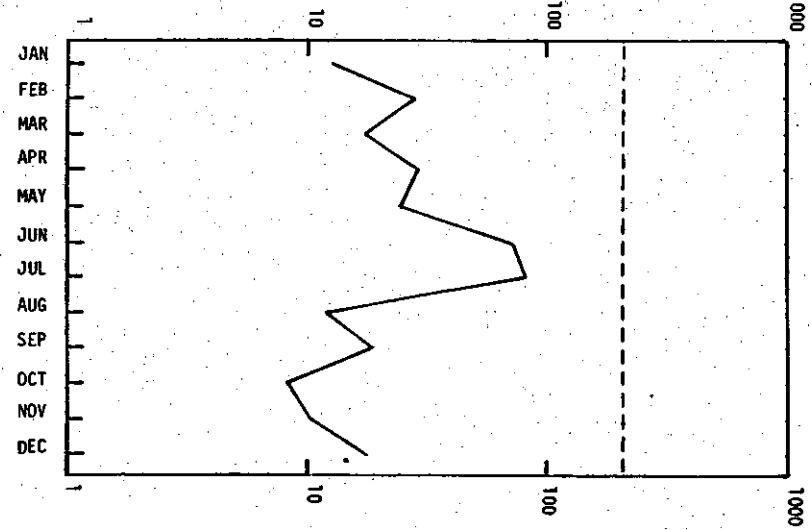
Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values



1978

LAKEVILLE WASTEWATER TREATMENT PLANT

Description:

The original Lakeville Wastewater Treatment Plant was constructed in 1934 and was converted to a two-stage high rate trickling filter plant in 1962. The present plant capacity is 0.25 mgd.

Plant Operation:

The daily average wastewater flow to the Lakeville Plant increased from 0.36 mgd in 1977 to 0.49 mgd in 1978. The monthly average flow to the plant exceeded the design capacity of the plant during all 12 months of 1978. NPDES monthly effluent limitations were exceeded during 8 months for TSS, during 3 months for BOD, and during one month for pH. These violations are the result of several factors. The Lakeville Plant has been operating well beyond its design capacity for a number of years. In addition, the trickling filter facility at the Lakeville Plant is not capable of providing satisfactory biological treatment during the colder months. The Lakeville Plant also experiences periodic slugs of heavy oil and grease from industrial waste sources which hinder removal of sludge from the primary settling tank. Overall effluent quality in 1978 showed significant deterioration from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentration, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	32	25	59	44	48	85	76	78	120
TSS	36	49	60	48	64	80	65	87	114

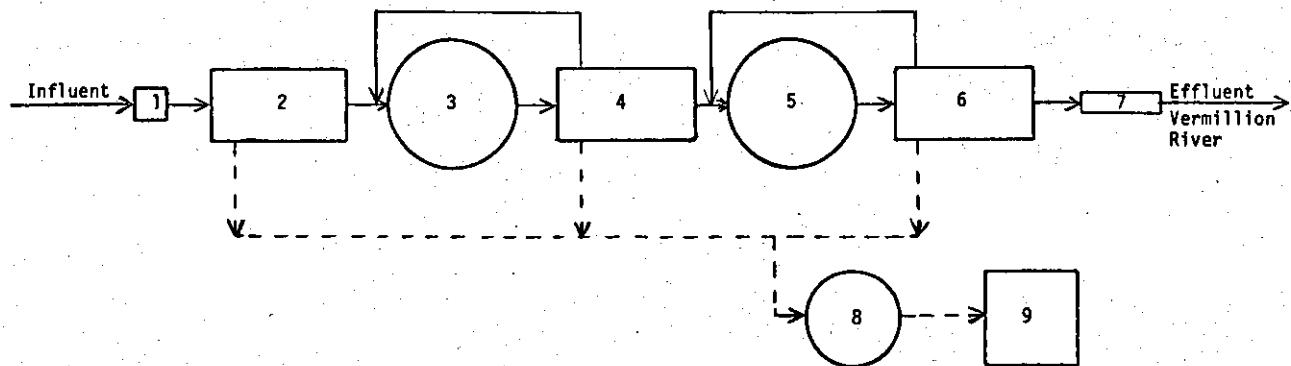
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

With the completion of the new Empire Plant, the Lakeville Plant will be phased-out and its flow diverted to the new plant. This changeover is scheduled to occur in May of 1979.

LAKEVILLE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Primary Sedimentation
3. First Stage Trickling Filter
4. Intermediate Sedimentation
5. Second Stage Trickling Filter
6. Final Sedimentation
7. Chlorination

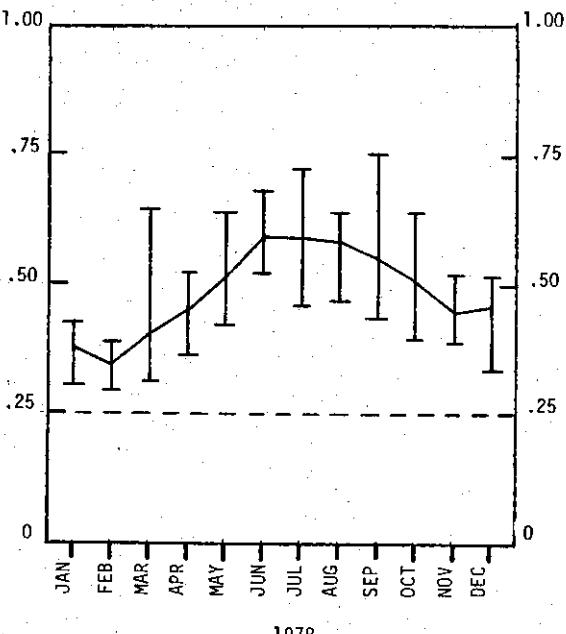
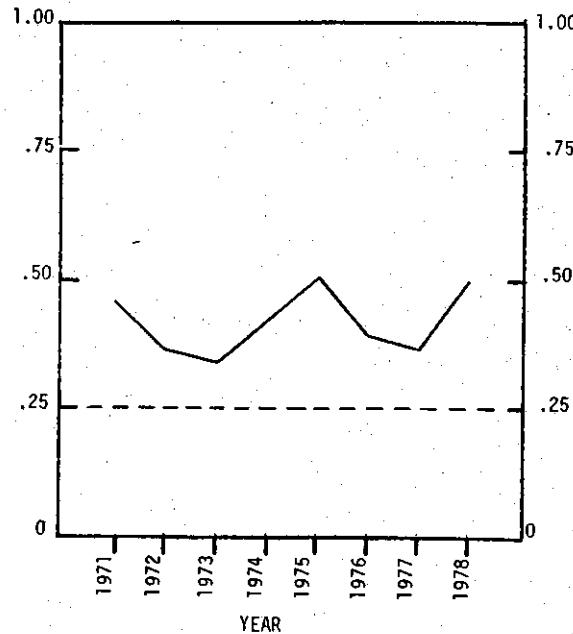
Solid Phase

8. Anaerobic Digestion
9. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



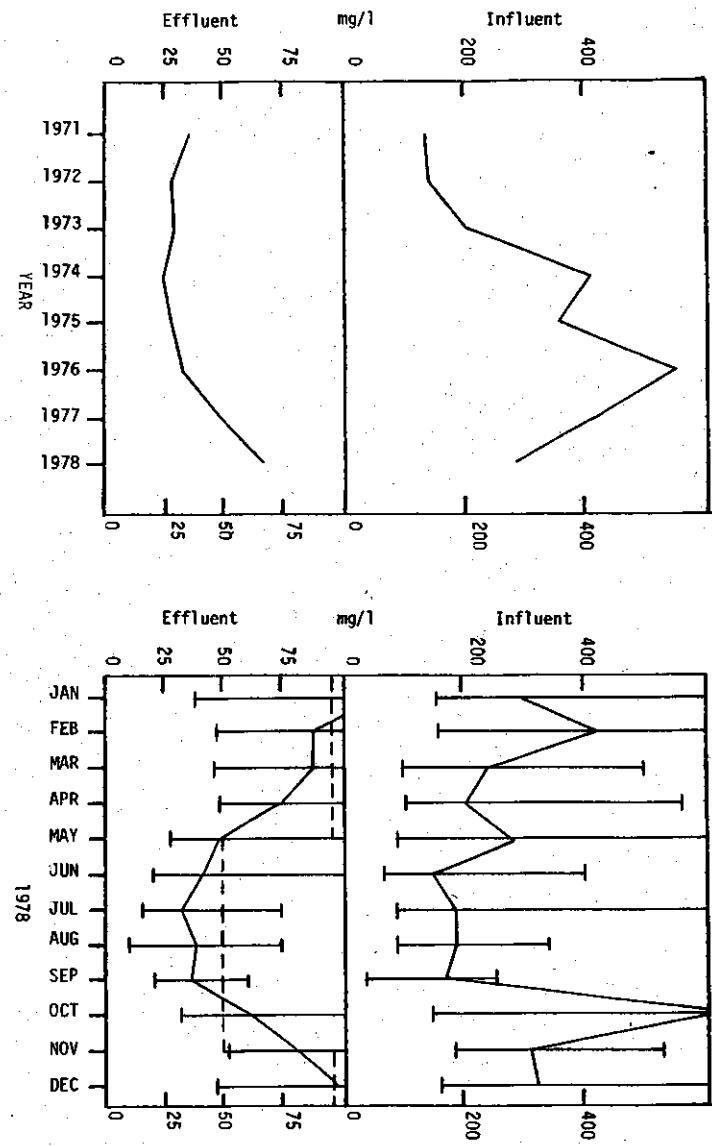
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: LAKEVILLE

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.37	44	303	2469	322	35.5	27.6	6.1	7.4-10.0
FEBRUARY	0.34	46	440	2232	399	43.3	27.3	7.6	6.4-8.2
MARCH	0.40	47	241	4651	476	33.6	26.4	6.5	7.2-8.1
APRIL	0.45	51	203	498	281	30.4	25.4	5.3	7.5-8.2
MAY	0.52	62	285	547	298	27.9	20.8	5.2	7.2-8.2
JUNE	0.59	67	155	361	374	23.1	19.1	4.8	7.2-8.4
JULY	0.59	67	191	504	291	26.1	19.6	5.2	7.0-8.1
AUGUST	0.58	69	191	406	269	27.1	21.8	4.7	7.0-11.6
SEPTEMBER	0.55	68	172	288	260	26.3	20.4	5.0	7.5-8.0
OCTOBER	0.51	65	646	1828	780	40.0	32.6	8.4	7.7-8.6
NOVEMBER	0.44	60	318	672	402	42.0	31.4	10.0	7.6-8.4
DECEMBER	0.46	55	330	541	508	37.2	28.0	7.3	7.8-8.3
1978 AVERAGE	0.48	58	290	1250	388	32.7	25.0	6.3	6.4-11.6
1977 AVERAGE	0.36	56	432	1658	759	34.2	26.6	7.4	7.0-8.0

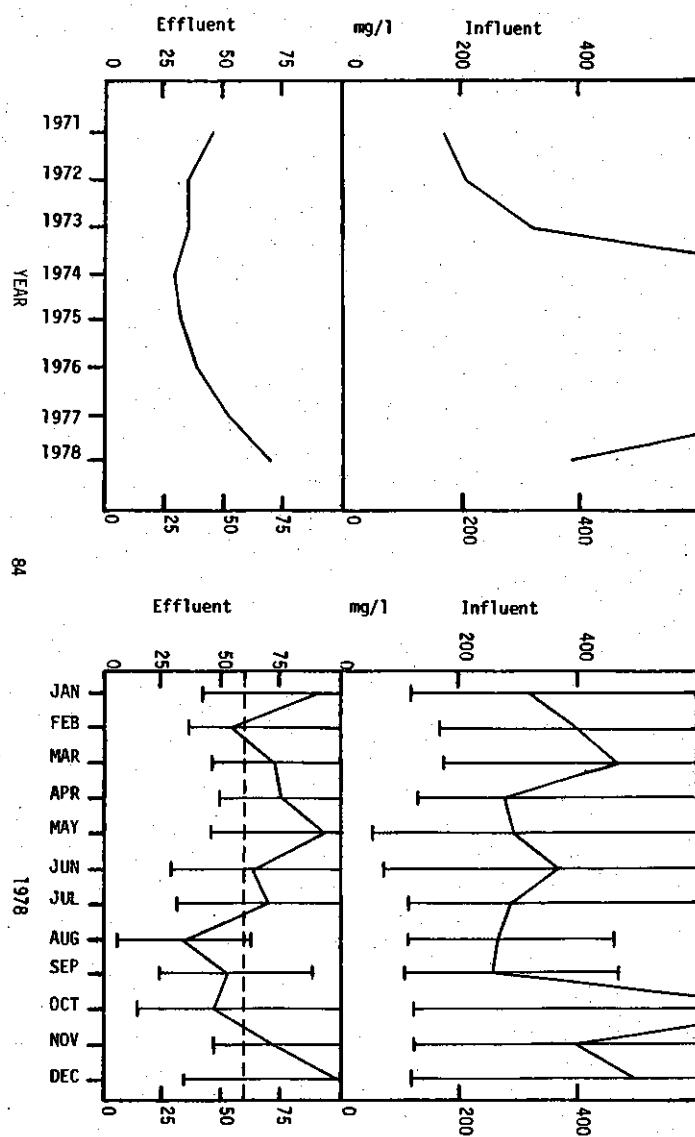
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: LAKEVILLE

* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL	
	BOD	TSS	BOD										BOD	TSS
*NPDES Limitation														
JANUARY	116	362	90	108	86	25.1	19.4	0.21	0.42	5.4	4.6	7.4-8.0	62	72
FEBRUARY	88	275	54	32	85	27.7	21.0	0.13	0.20	6.3	4.4	6.3-8.0	80	87
MARCH	88	443	73	60	88	22.3	19.8	0.16	0.14	5.7	4.4	7.2-7.8	63	85
APRIL	75	260	78	79	104	21.4	17.9	0.16	0.18	4.8	5.0	7.3-7.9	63	72
MAY	48	547	93	83	83	16.1	11.5	0.35	1.05	4.5	4.8	7.2-7.8	83	69
JUNE	41	170	63	102	52	11.1	7.9	0.27	0.97	3.1	4.3	7.3-7.8	74	83
JULY	32	165	69	121	49	12.1	7.9	0.31	1.38	3.4	4.4	7.5-8.1	83	76
AUGUST	38	133	33	39	35	12.6	10.4	0.16	0.70	3.5	4.2	7.2-8.0	80	88
SEPTEMBER	37	230	52	168	65	18.4	13.5	0.15	0.49	5.1	4.1	7.3-7.9	79	80
OCTOBER	63	198	46	100	73	18.8	16.1	0.12	0.50	4.5	3.2	7.3-8.1	90	94
NOVEMBER	82	263	72	19	91	18.7	14.2	0.23	0.92	4.9	3.2	7.1-7.9	96	74
DECEMBER	98	579	99	99	82	33.3	25.7	0.21	1.04	6.9	3.7	7.4-8.0	70	81
1978 AVERAGE	67	302	68	84	74	19.8	15.4	0.21	0.67	4.8	4.2	6.3-8.1	77	82
1977 AVERAGE	51	217	53	12	60	17.7	13.5	0.87	2.08	5.3	5.1	7.1-8.2	88	93



TOTAL SUSPENDED SOLIDS

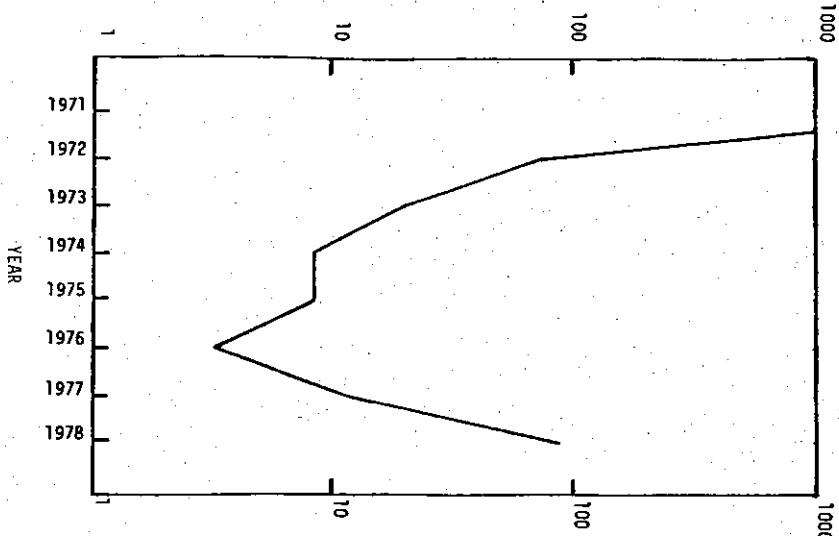


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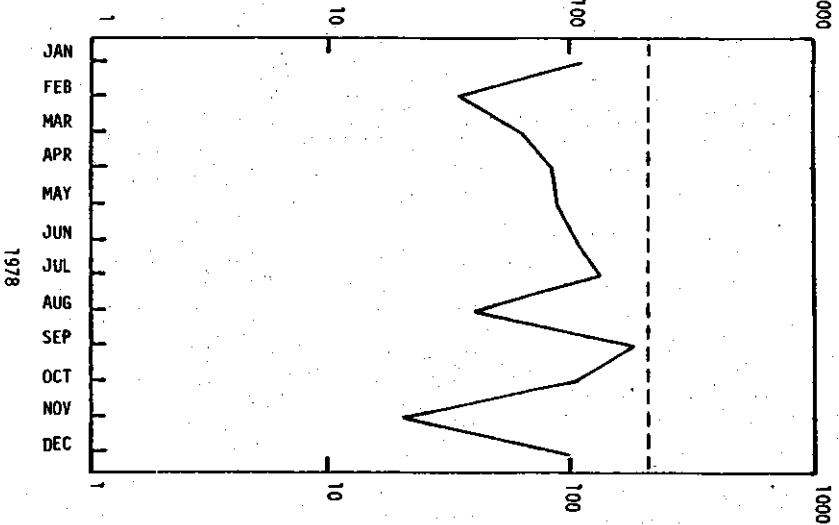
EFFLUENT Fecal Coliforms

LAKEVILLE

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

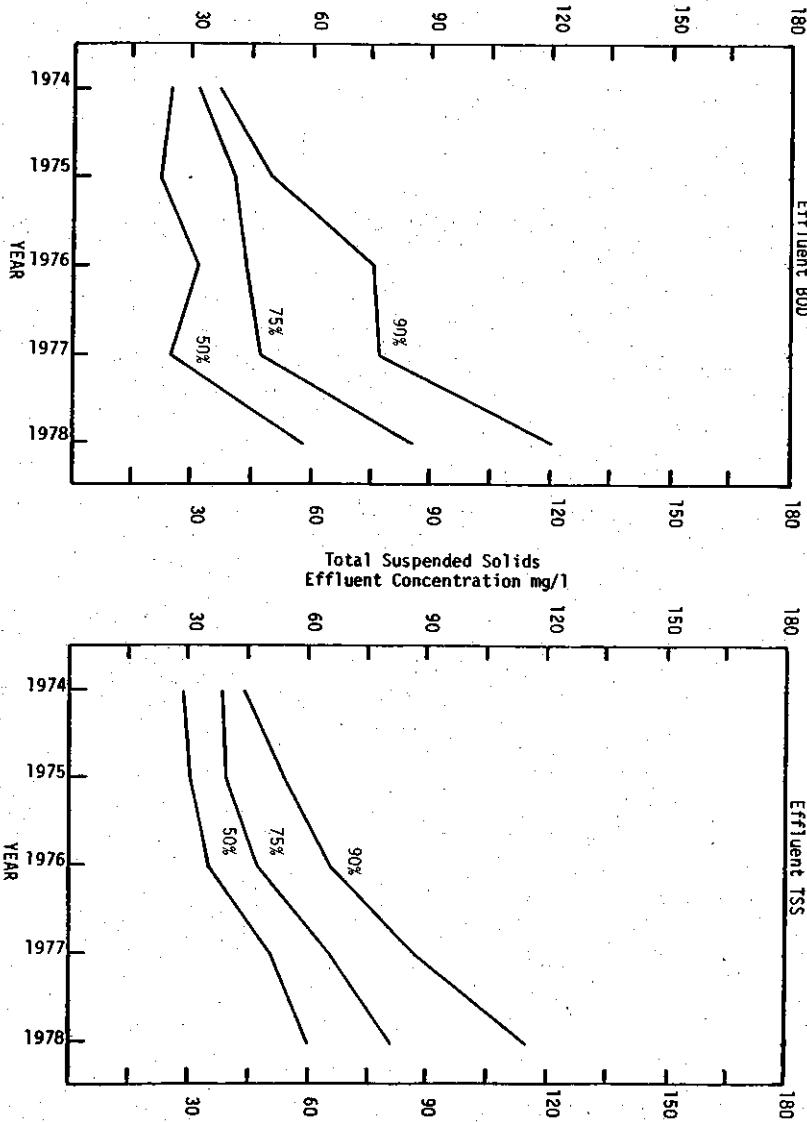


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means

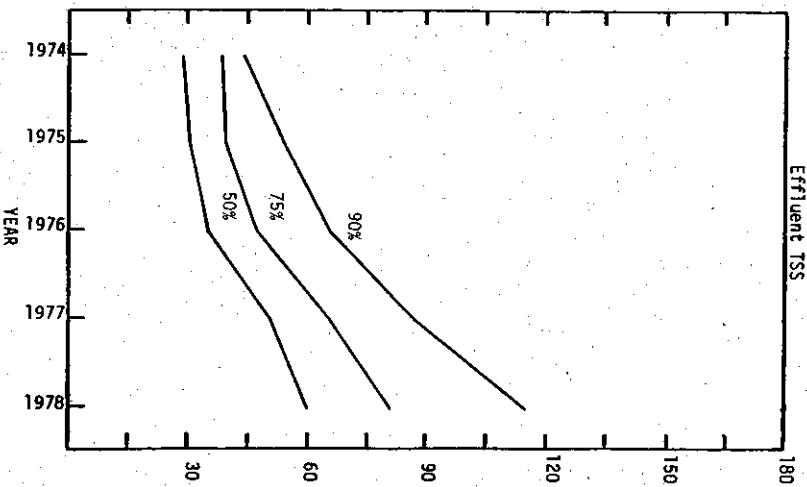


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or Less than Plotted Values.

LONG LAKE WASTEWATER TREATMENT PLANT

Description:

The Long Lake Wastewater Treatment Plant was constructed in 1964 as a high-rate trickling filter process facility with a design capacity of 0.19 mgd. The treatment facility is followed by an effluent polishing pond with a 60 day retention period.

Plant Operation:

The daily average wastewater flow to the Long Lake Plant increased from 0.21 mgd in 1977 to 0.31 mgd in 1978. The monthly average flow to the plant exceeded the design capacity during all but one month in 1978. The NPDES monthly effluent limitation for BOD was not met in January, February, and December. These violations were caused by resolubilization of BOD from bottom deposits in the effluent pond. This condition is the result of pond ice cover which causes anaerobic conditions in the pond. The NPDES monthly effluent limitation for TSS was not met in August. This was the result of extensive algal growth in the effluent pond. Overall effluent quality in 1978 showed improvement from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	36	31	30	54	61	40	73	89	84
TSS	37	34	27	65	44	39	95	58	52

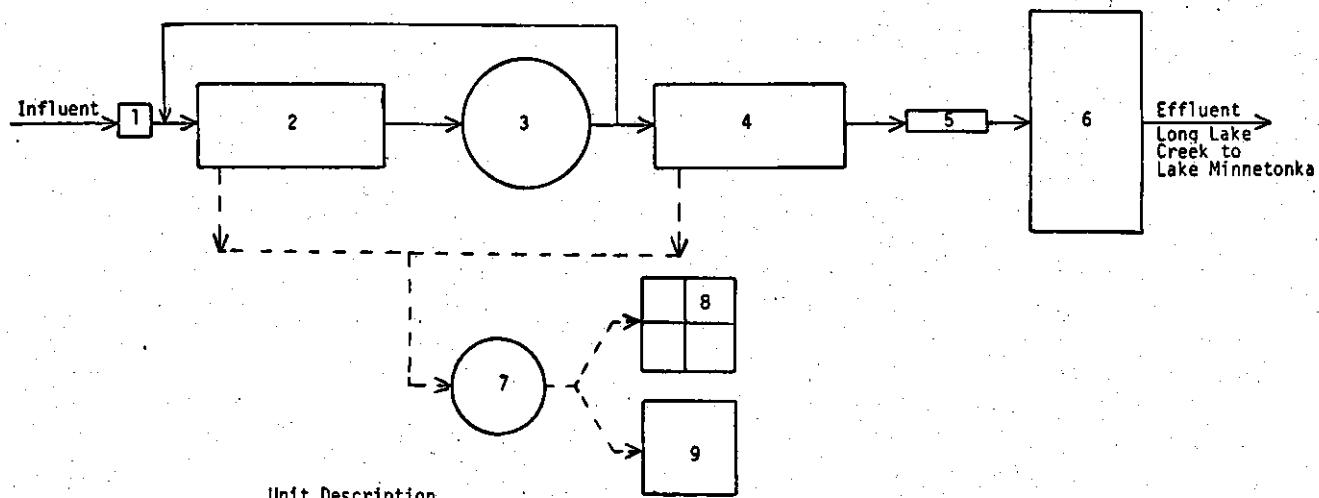
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Long Lake Plant will be phased-out upon completion of the Long Lake-Orono Interceptor, scheduled for December, 1979. The flow will then be treated at the Blue Lake Treatment Plant.

LONG LAKE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Primary Sedimentation
3. Trickling Filter
4. Final Sedimentation
5. Chlorination
6. Effluent Pond

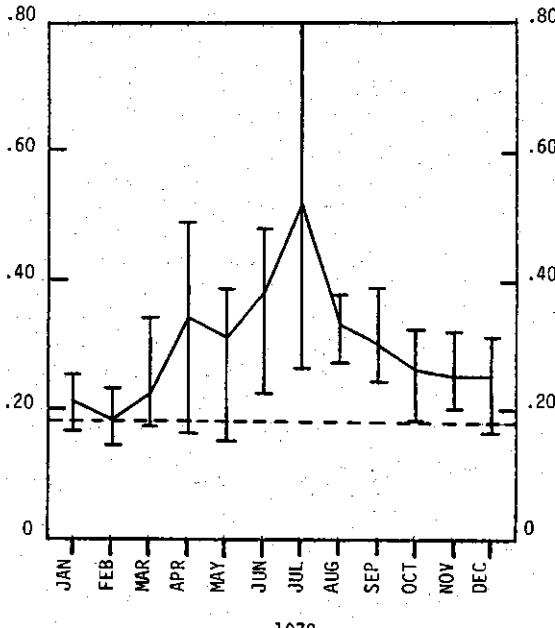
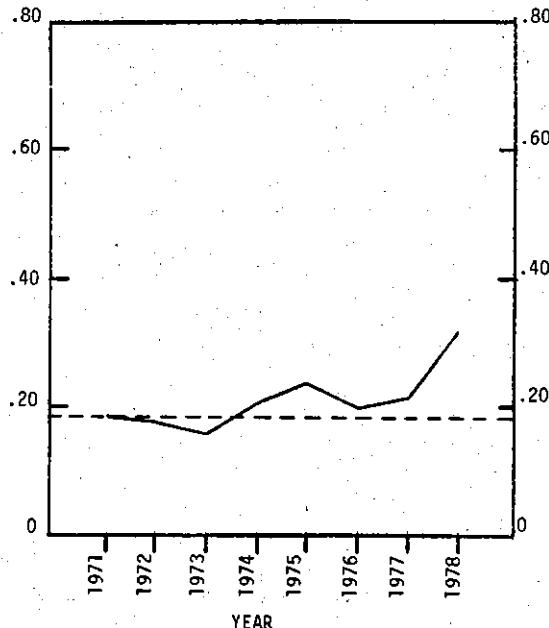
Solid Phase

7. Anaerobic Digestion
8. Sand Drying Beds
9. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: LONG LAKE

MONTH	WASTEWATER FLOW MGD.	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	PH RANGE
JANUARY	0.21	50	175	296	199	43.6	31.1	6.9	8.1-8.5
FEBRUARY	0.18	49	202	392	202	56.2	33.9	7.9	7.9-9.1
MARCH	0.22	47	151	343	231	44.5	34.0	7.1	7.6-8.2
APRIL	0.34	47	85	173	110	23.8	14.1	3.0	7.5-8.0
MAY	0.31	51	103	190	133	28.0	20.1	4.1	7.2-7.7
JUNE	0.38	55	92	164	99	21.5	16.3	3.4	7.0-7.6
JULY	0.52	60	63	125	87	20.5	16.1	3.2	7.5-7.7
AUGUST	0.33	62	261	160	340	28.5	21.5	4.2	7.4-7.9
SEPTEMBER	0.30	62	135	230	181	32.0	24.3	5.4	7.6-7.9
OCTOBER	0.26	61	180	240	228	33.1	26.4	4.9	7.9-8.1
NOVEMBER	0.25	58	233	368	240	42.0	31.7	6.7	7.9-8.2
DECEMBER	0.25	54	275	395	295	48.6	33.8	8.4	7.3-8.1
1978 AVERAGE	0.30	55	163	256	195	35.2	25.3	5.4	7.0-9.1
1977 AVERAGE	0.21	56	201	410	274	44.2	35.3	6.9	7.4-8.7

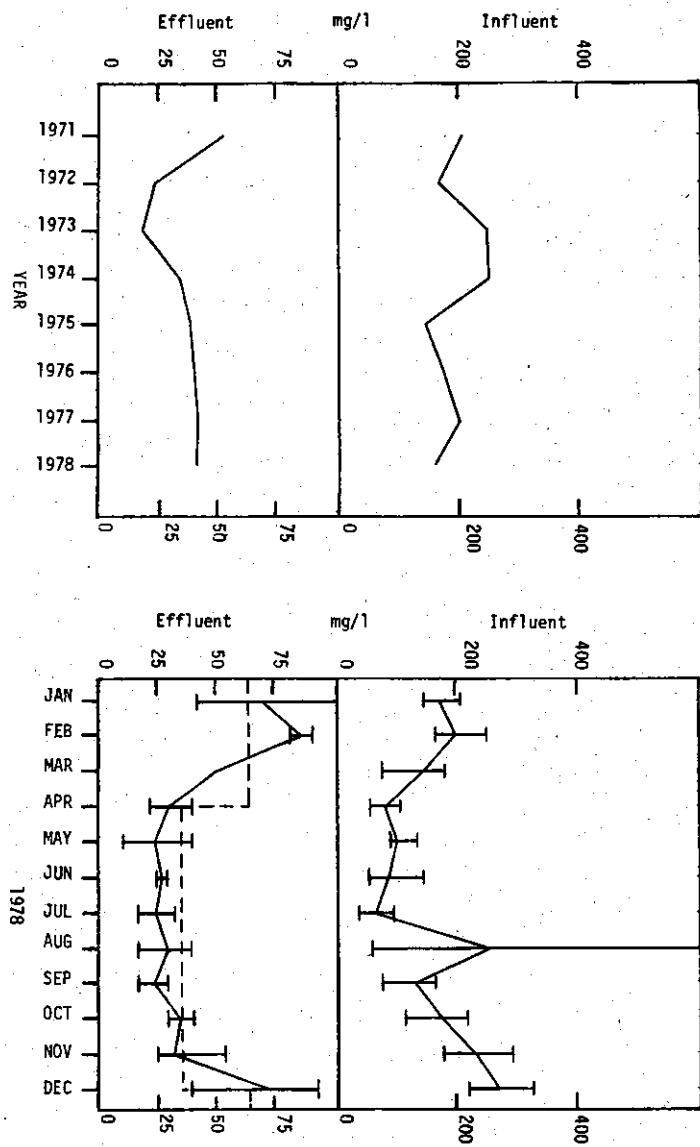
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: LONG LAKE

* See Table 2

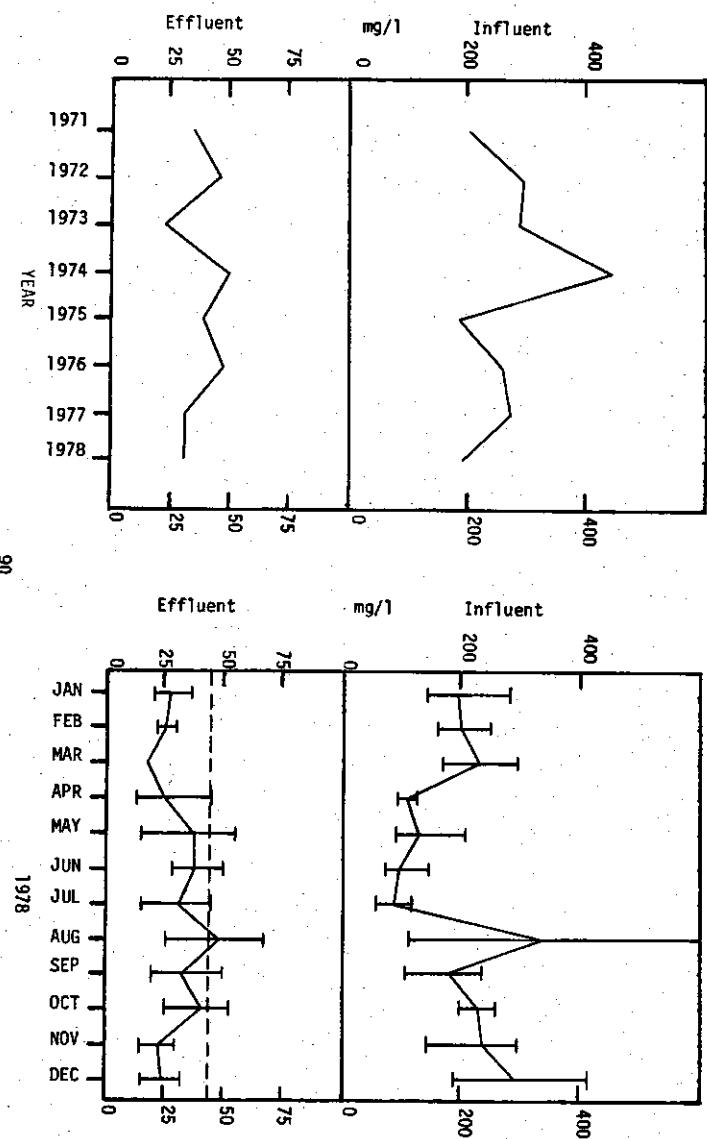
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJ-N mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	PH RANGE	% REMOVAL	
													BOD	TSS
*NPDES Limitation														
JANUARY	70	188	27	0	42	34.0	25.9	0.13	0.25	7.7	4.2	7.5-8.1	60	86
FEBRUARY	87	201	25	7	42	36.1	27.9	0.10	0.15	9.8	5.2	7.2-7.9	57	88
MARCH	50	104	16	0	25	24.0	18.5	0.08	0.05	5.8	2.0	7.4-7.4	67	91
APRIL	30	83	24	62	16	17.4	13.4	0.04	0.29	4.0	1.8	7.4-7.7	65	78
MAY	24	78	37	28	11	13.2	8.7	0.21	0.15	3.7	7.8	7.9-8.5	77	73
JUNE	26	90	36	29	14	7.5	4.0	0.09	0.08	2.3	7.5	7.9-8.7	72	63
JULY	24	87	29	11	11	8.5	4.9	0.04	0.05	2.7	2.8	7.9-8.3	62	67
AUGUST	29	105	47	36	16	7.0	3.7	0.16	0.18	2.5	5.6	8.3-8.7	89	76
SEPTEMBER	23	102	31	39	14	12.4	9.1	0.08	0.21	4.2	2.5	7.7-8.2	83	83
OCTOBER	34	89	40	14	13	14.3	11.3	0.14	0.44	4.4	9.3	8.1-8.5	81	82
NOVEMBER	32	90	21	3	10	19.0	16.0	0.10	0.57	5.5	4.8	7.5-8.0	86	91
DECEMBER	74	212	23	20	43	31.9	27.6	0.08	0.82	7.7	1.5	7.0-7.7	73	92
1978 AVERAGE	42	119	30	21	21	18.8	14.2	0.10	0.27	5.0	4.6	7.0-8.7	74	85
1977 AVERAGE	43	132	37	30	25	24.5	20.5	0.12	0.42	5.9	3.9	7.0-8.9	79	86

LONG LAKE

BIOCHEMICAL OXYGEN DEMAND



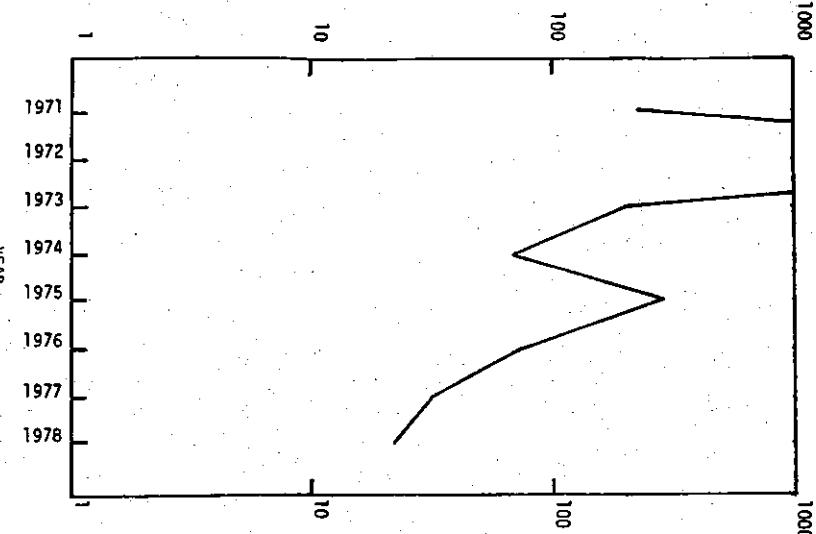
TOTAL SUSPENDED SOLIDS



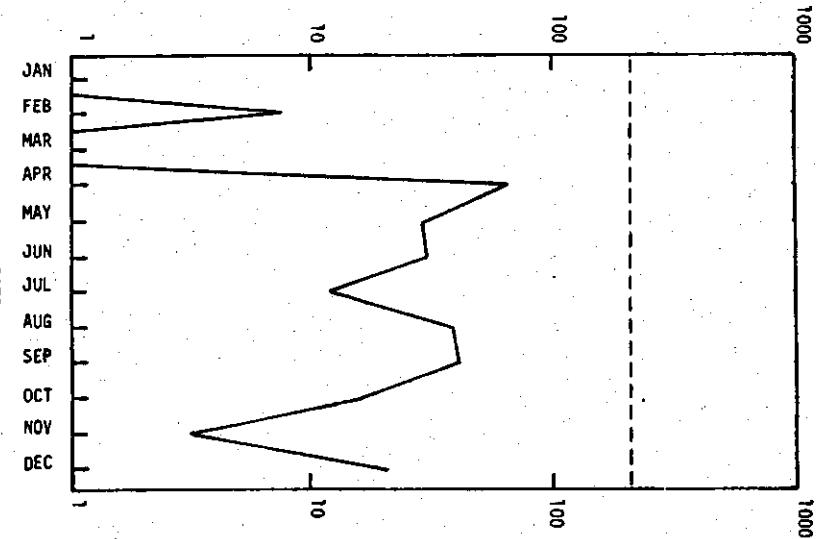
EFFLUENT FECAL COLIFORMS

LONG LAKE

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

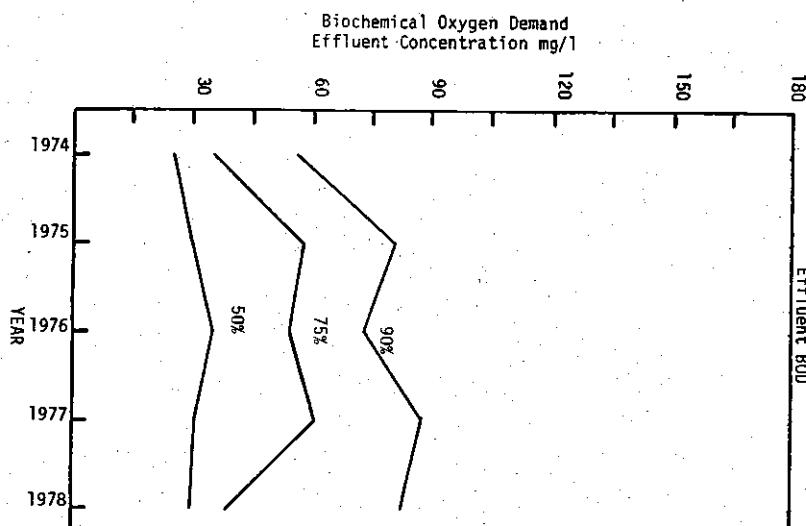


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means



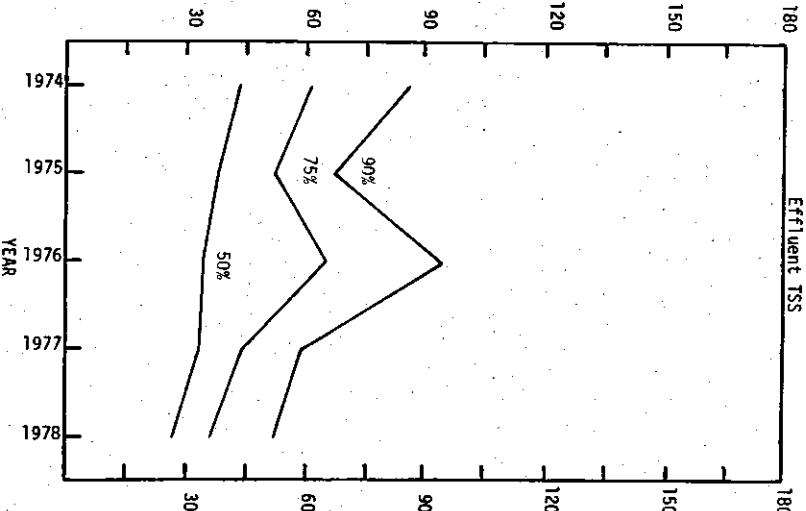
STATISTICAL ANALYSIS*

Effluent BOD



Biochemical Oxygen Demand
Effluent Concentration mg/l

Effluent TSS



Total Suspended Solids
Effluent Concentration mg/l

* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values.

MAPLE PLAIN WASTEWATER TREATMENT PLANT

Description:

The Maple Plain Wastewater Treatment Plant was constructed in 1952 and expanded in 1965 to its present capacity of 0.22 mgd. The plant is operated as a high-rate trickling filter plant followed by an activated sludge process and effluent polishing pond.

Plant Operation:

The daily average wastewater flow to the Maple Plain Plant increased from 0.18 mgd in 1977 to 0.26 mgd in 1978. The monthly average flow exceeded the design capacity of the plant during 6 months of 1978. The NPDES monthly effluent limitation for TSS was violated in June. This violation was the result of high algal growth in the effluent polishing pond. The NPDES monthly effluent limitation for fecal coliform was violated in July. This violation was caused by erratic chlorinator performance during a portion of the month. Overall effluent quality in 1978 showed mixed results, with TSS quality improving, fecal coliform quality declining, and BOD quality remaining the same. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

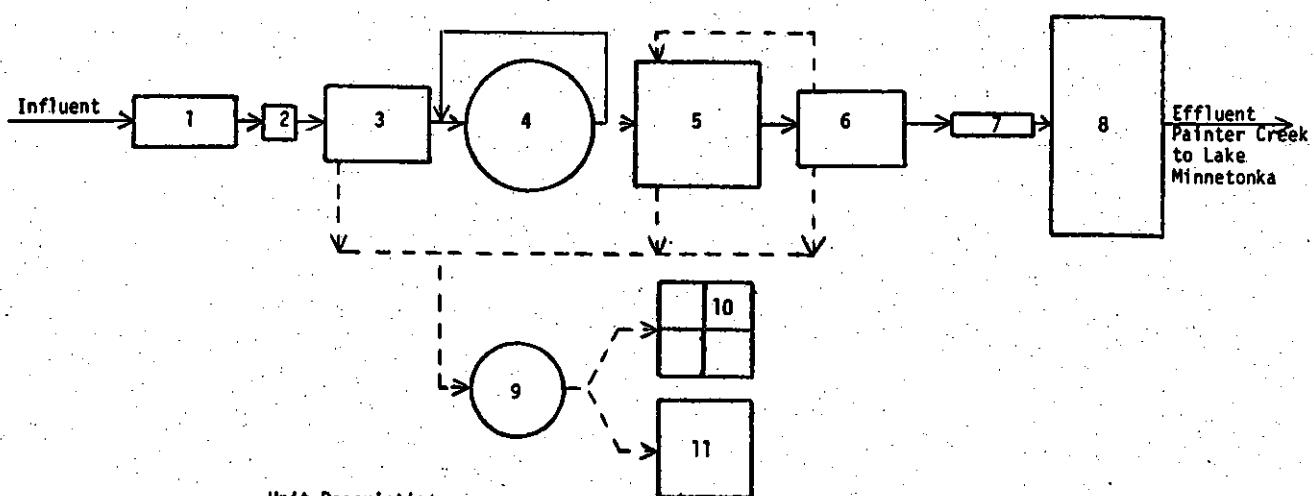
50% of Time			75% of Time			90% of Time				
	1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	5	8	7		8	17	14	21	26	22
TSS	7	7	6		30	24	12	48	42	40

* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Maple Plain Treatment Plant is considered a semipermanent plant. Studies concerning future expansion and possible addition of advanced treatment are presently being conducted.

MAPLE PLAIN WASTEWATER TREATMENT PLANT
FLOW DIAGRAM



Unit Description

Liquid Phase

1. Grit Removal
2. Screening
3. Primary Sedimentation
4. Trickling Filter
5. Activated Sludge
6. Final Sedimentation
7. Chlorination
8. Effluent Pond

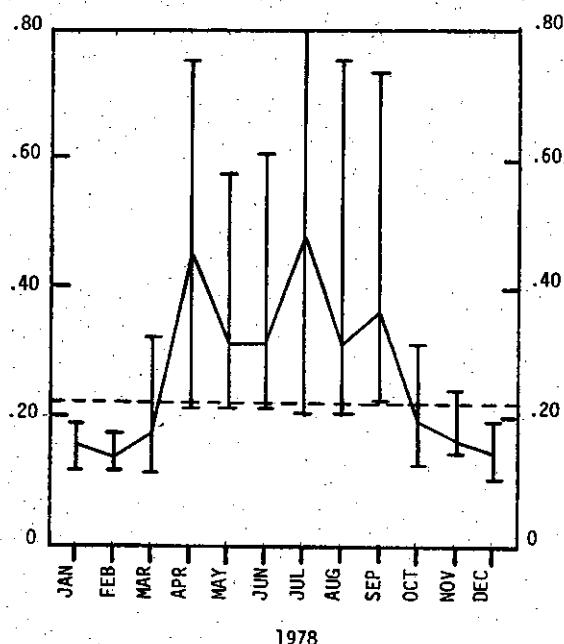
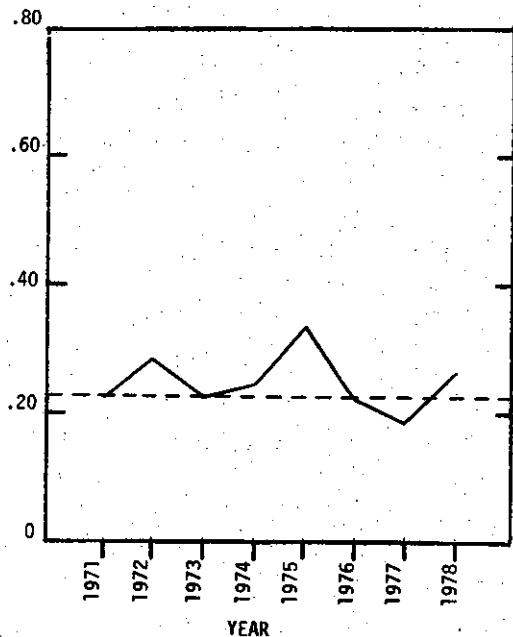
Solid Phase

9. Anaerobic Digestion
10. Sand Drying Beds
11. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- █ Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



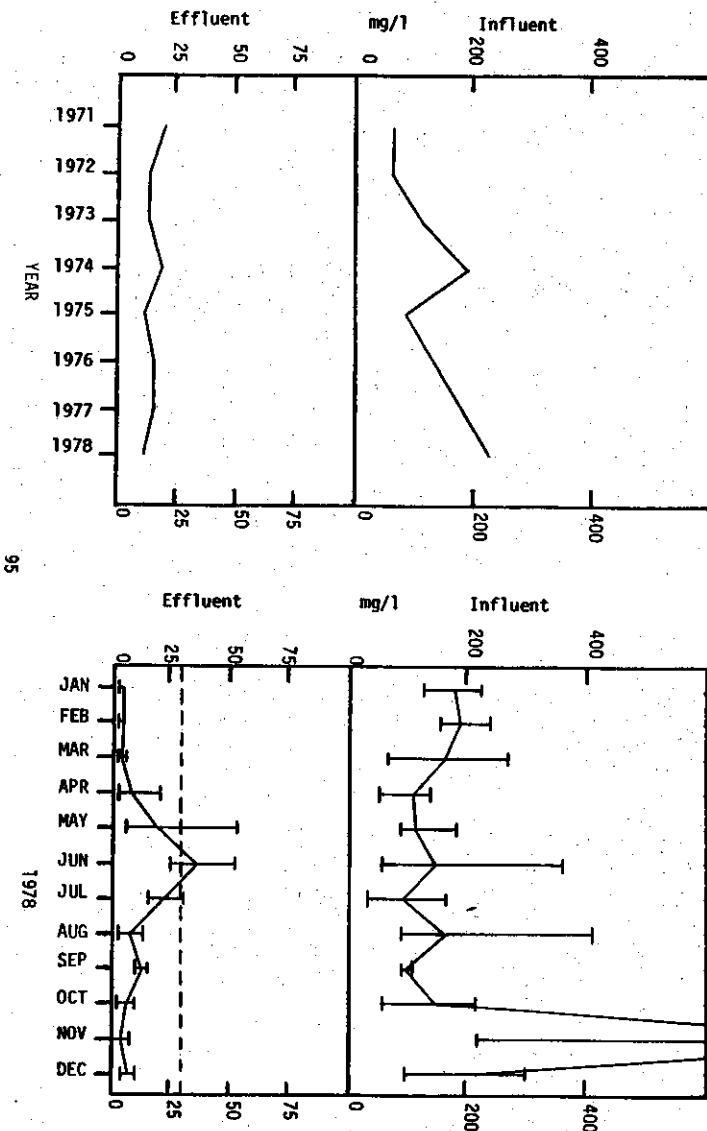
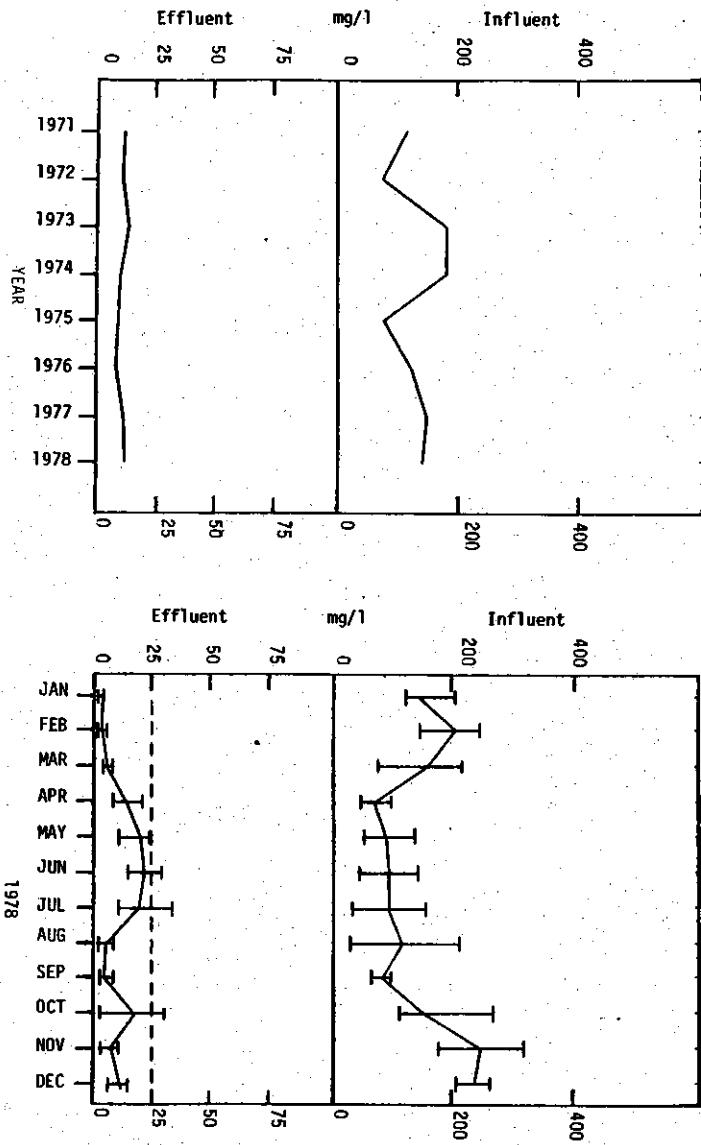
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: MAPLE PLAIN

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.15	48	146	376	179	42.6	31.9	10.4	7.6-7.8
FEBRUARY	0.13	47	210	350	188	44.4	33.6	7.6	7.6-7.8
MARCH	0.17	48	163	348	167	42.7	31.7	6.8	7.5-7.9
APRIL	0.45	47	68	146	109	17.5	8.6	2.0	7.5-7.8
MAY	0.31	49	87	162	115	21.4	13.8	3.3	7.6-7.9
JUNE	0.31	53	94	152	147	16.0	13.5	2.9	7.5-7.8
JULY	0.48	60	94	157	93	16.0	10.5	2.4	7.2-7.9
AUGUST	0.31	63	120	118	263	19.1	12.7	3.3	7.3-7.9
SEPTEMBER	0.36	63	83	131	98	18.0	15.8	3.0	7.8-8.0
OCTOBER	0.19	60	154	220	147	29.8	25.3	4.8	7.6-7.8
NOVEMBER	0.16	56	247	1053	1009	35.3	28.3	6.0	7.5-7.8
DECEMBER	0.14	48	241	365	216	43.3	32.1	6.5	7.5-7.8
1978 AVERAGE	0.26	54	142	298	228	28.8	21.4	4.9	7.2-8.0
1979 AVERAGE	0.18	56	156	352	182	33.8	27.0	6.2	7.0-9.5

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: MAPLE PLAIN

* See Table 2

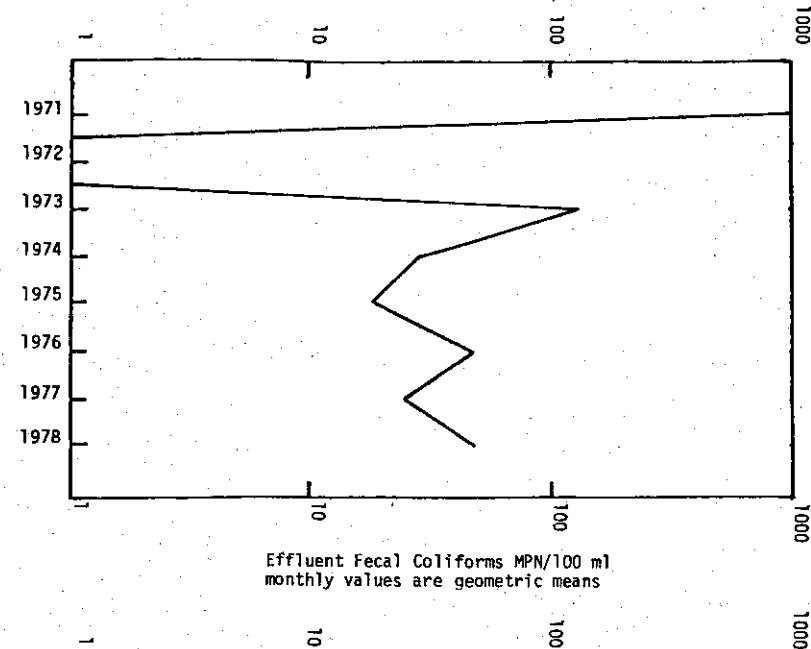
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
*NPDES Limitation														
JANUARY	2	52	2	0	2	6.1	3.2	0.12	9.07	4.7	5.8	6.8-7.0	99	99
FEBRUARY	3	24	1	0	2	7.4	4.9	0.12	9.65	5.3	5.8	6.9-7.1	99	99
MARCH	5	50	2	0	3	13.1	10.8	0.22	4.74	5.1	5.6	6.8-7.3	97	99
APRIL	14	42	8	0	6	7.4	4.4	0.21	3.06	2.2	7.6	7.3-7.7	93	93
MAY	19	64	18	4	10	11.7	8.4	0.47	0.63	3.1	7.8	7.4-8.0	78	84
JUNE	21	79	36	135	11	10.5	7.5	0.16	0.56	3.2	9.9	8.1-8.7	78	75
JULY	19	57	22	247	9	7.5	4.3	0.51	2.32	2.3	11.7	7.7-8.6	79	76
AUGUST	5	27	6	4	6	3.7	2.1	0.19	6.50	3.1	5.4	7.2-7.9	96	96
SEPTEMBER	5	32	10	84	5	4.0	2.6	0.21	4.80	3.0	6.9	7.8-8.0	95	90
OCTOBER	17	48	6	59	9	12.4	11.3	0.04	0.44	3.9	5.4	6.8-7.7	89	96
NOVEMBER	6	28	3	2	5	12.9	10.9	0.11	2.53	4.4	6.7	7.0-7.6	97	99
DECEMBER	11	36	6	1	5	18.9	17.4	0.06	1.26	3.9	7.3	7.0-7.2	95	97
1978 AVERAGE	11	45	10	45	6	9.6	7.3	0.20	3.75	3.7	7.2	5.8-8.7	92	96
1979 AVERAGE	17	55	16	23	7	7.3	4.4	0.52	8.02	4.2	9.1	6.6-8.4	93	91



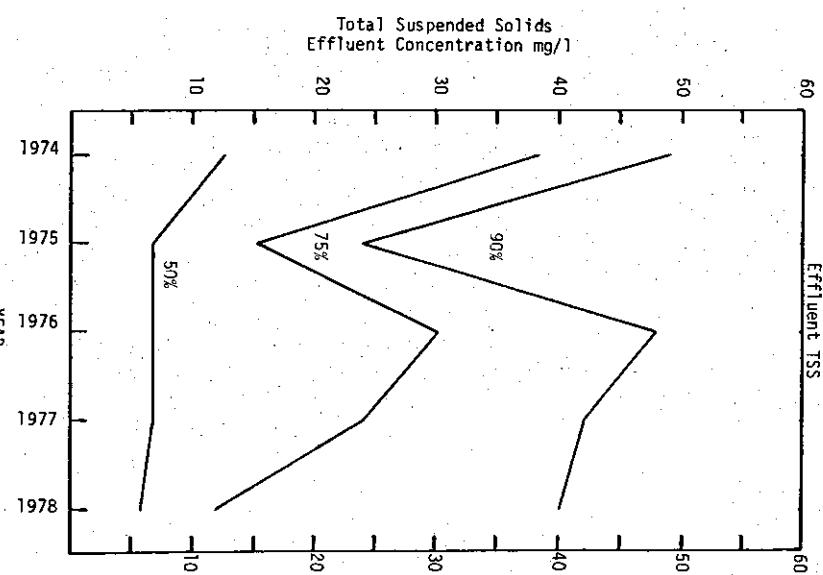
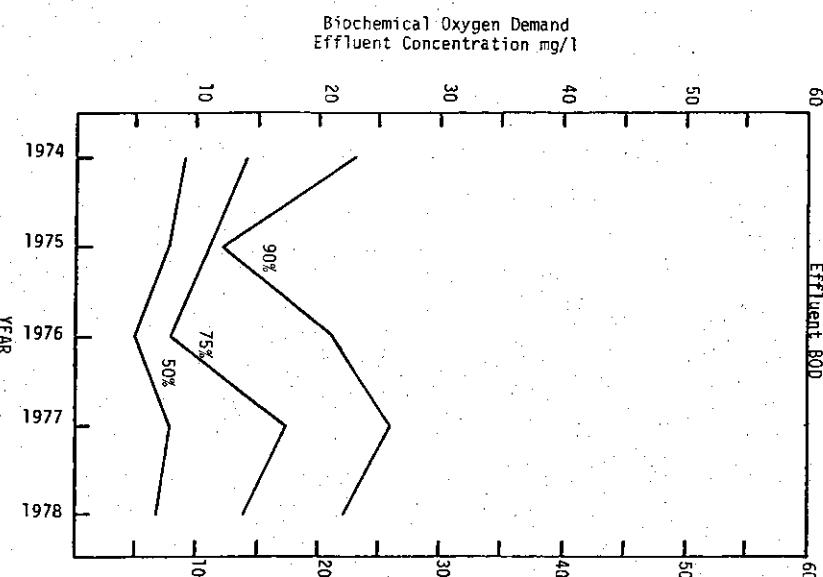
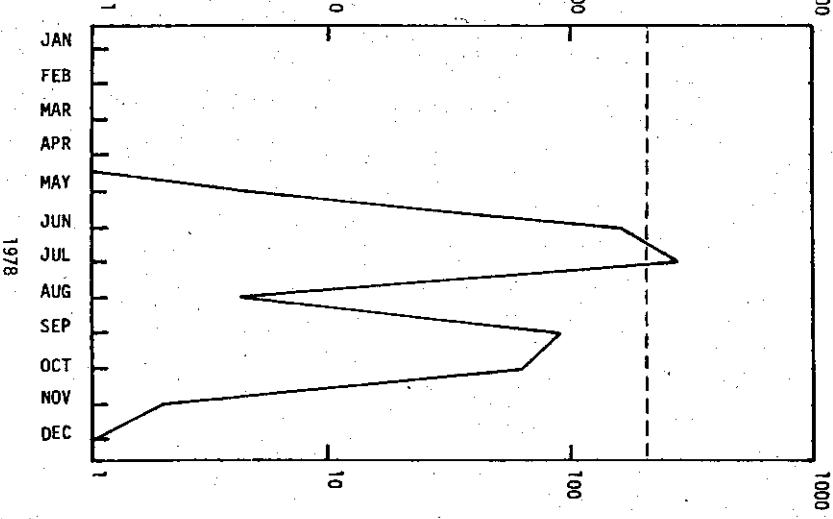
EFFLUENT FECAL COLIFORMS

MAPLE PLAIN

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means



STATISTICAL ANALYSIS*



* Percent of Time Effluent Concentrations are Equal to or Less than Plotted Values

MEDINA WASTEWATER TREATMENT PLANT

Description:

The Medina Wastewater Treatment Plant was constructed in 1969 and has a design capacity of 0.10 mgd. The plant consists of a two-stage aerated lagoon process with the effluent then disposed of by percolation and evaporation. There is no surface discharge from this plant.

Plant Operation:

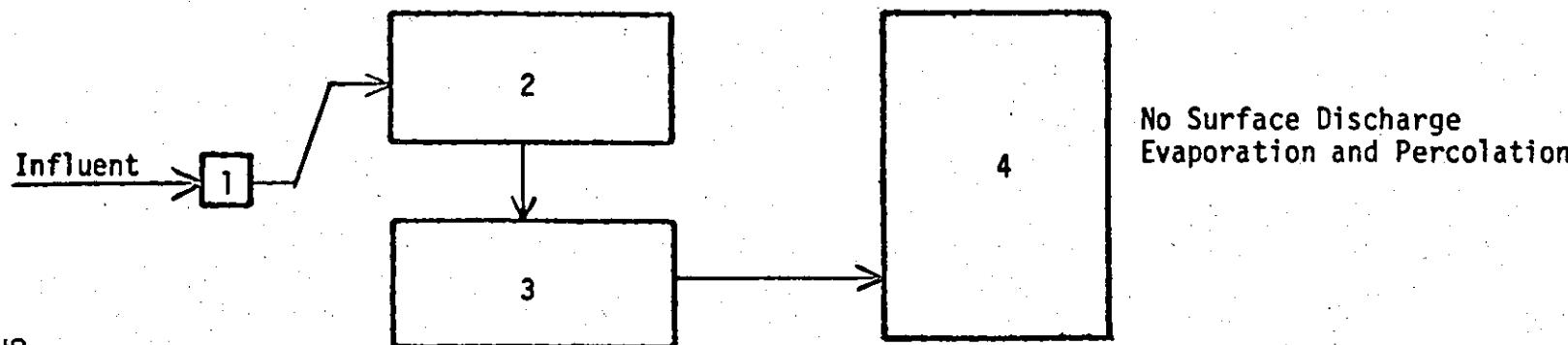
The Medina Plant operated at about 145 percent of its design capacity during 1978. Due to lack of surface discharge there is no NPDES permit for this plant. Effluent samples taken prior to discharge into the seepage pond, indicate removal rates of approximately 93 percent for BOD and 96 percent for TSS.

Plant Future:

The Medina Treatment Plant is considered a semipermanent plant. Studies are presently being conducted to better determine the future of this plant.

MEDINA WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



66

Unit Description

Liquid Phase

1. Screening
2. Primary Aerated Pond
3. Final Aerated Pond
4. Absorption Pond

Legend

- Liquid Flow
- - - Solids Transfer
- [Box] Existing Process Units
- [Dashed Box] Future Process Units

MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: MEDINA

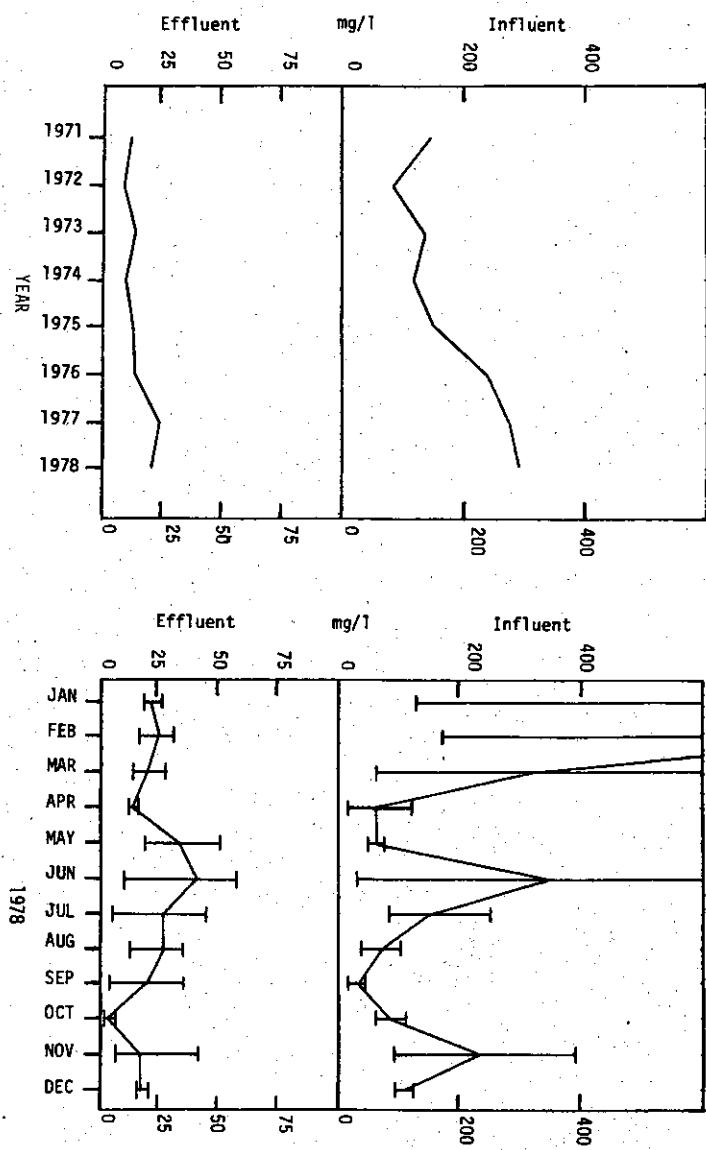
MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.065	-	1118	1940	1630	26.8	15.6	10.5	-
FEBRUARY	0.062	-	950	1020	1704	41.5	25.5	14.0	-
MARCH	0.063	36	334	612	374	21.7	16.3	4.9	7.4-7.5
APRIL	0.157	46	66	140	186	11.2	7.9	2.6	7.0-7.5
MAY	0.143	59	65	158	100	10.5	6.4	3.4	7.1-8.6
JUNE	0.183	69	362	435	517	12.3	5.9	12.1	7.2-7.5
JULY	0.285	73	155	367	431	13.9	6.8	4.9	7.6-7.9
AUGUST	0.143	70	74	145	147	12.3	6.3	2.8	7.5-8.0
SEPTEMBER	0.295	72	34	92	49	16.1	10.3	2.7	7.6-7.8
OCTOBER	0.204	62	87	154	82	22.9	18.3	4.6	7.5-7.6
NOVEMBER	0.082	55	240	300	528	32.3	24.9	7.3	7.5-7.6
DECEMBER	0.060	50	110	175	101	28.5	23.7	4.6	7.6-7.8
1978 AVERAGE	0.145	59	300	462	487	20.8	14.0	6.2	7.0-8.6
1977 AVERAGE	0.082	57	285	550	385	25.2	19.2	7.4	6.9-8.5

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: MEDINA

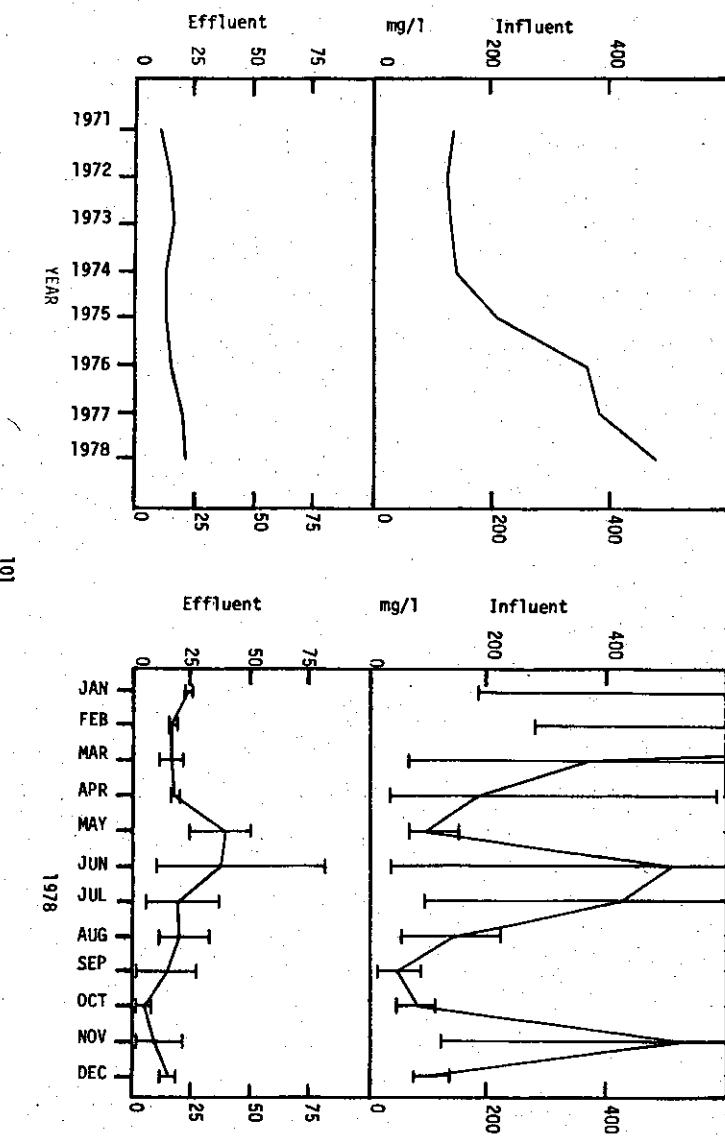
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJ-N mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL	
													BOD	TSS
*NPDES Limitation														
JANUARY	21	76	24		11	20.1	17.4	0.07	0.35	5.6	13.8	7.3-8.2	98	99
FEBRUARY	25	84	15		14	23.1	19.4	0.03	0.19	6.1	12.0	7.7-7.9	97	99
MARCH	20	80	15		13	23.2	20.5	0.03	0.08	5.5	10.6	7.1-8.0	94	96
APRIL	14	52	16		9	15.0	13.2	0.09	0.28	4.2	10.6	7.3-8.0	79	91
MAY	34	74	39		14	8.0	4.1	0.15	0.58	3.4	11.0	7.2-9.1	47	61
JUNE	41	67	36		12	4.6	2.3	0.25	0.82	3.9	5.5	7.4-7.7	89	93
JULY	27	41	18		7	6.8	3.9	0.64	0.15	3.1	4.0	7.5-8.0	82	96
AUGUST	27	53	18		8	4.4	2.4	0.83	0.83	3.6	4.2	7.7-8.2	64	88
SEPTEMBER	20	47	14		7	4.5	2.3	1.09	1.26	4.2	5.0	7.7-7.8	43	72
OCTOBER	4	29	4		4	9.1	7.5	0.23	0.97	4.1	6.2	7.5-7.8	96	96
NOVEMBER	17	46	8		6	14.2	12.2	0.16	1.80	4.6	6.7	7.4-7.6	93	98
DECEMBER	17	62	14		8	20.3	18.5	0.10	1.89	5.6	7.3	7.5-7.7	94	97
1978 AVERAGE	22	59	18		9	12.8	10.3	0.31	0.77	4.5	8.1	7.1-9.1	93	96
1977 AVERAGE	25	77	20		9	16.7	14.4	0.25	0.72	5.4	7.3	7.3-8.9	86	88

BIOCHEMICAL OXYGEN DEMAND



TOTAL SUSPENDED SOLIDS



METROPOLITAN WASTEWATER TREATMENT PLANT

Description:

The Metropolitan Wastewater Treatment Plant has been constructed in several stages. The original plant was constructed in 1938 and provided primary treatment only. In 1966, the secondary portion of the treatment works was placed into operation providing a high-rate activated sludge process with a design capacity of approximately 218 mgd. In 1972, four more aeration tanks and air compressors were placed into operation, allowing enough capacity to operate a step aeration activated sludge process. In March of 1978, new pretreatment and primary facilities were placed into operation.

Plant Operation:

The daily average wastewater flow to the Metropolitan Treatment Plant increased from 194 mgd in 1977 to 210 mgd in 1978. The monthly average flow exceeded the design capacity of the plant during six months of 1978. There were several violations of NPDES monthly effluent limitations. NPDES monthly fecal coliform limitations for the plant effluent were exceeded in October and November. These violations were the result of inadequate mixing in the east effluent chlorination channel. This problem has since been remedied. The monthly TSS limitation for the plant effluent was exceeded in December. This failure was due to construction work which temporarily put some treatment facilities out of service. There were also failures to meet NPDES monthly limitations on the ash pond discharge. The ash pond discharge did not meet monthly limitations for fecal coliform in February, March, April, and June.

These failures occurred because of the use of unchlorinated effluent to convey the ash to the ash settling basin. Discharge from the ash settling basin was terminated in mid-July with the ash being recycled into the plant aeration system. Overall plant effluent quality in 1978 showed improvement from the previous year in BOD and TSS quality, and a decline in the fecal coliform quality. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	60	40	40	80	51	53	141	62	64
TSS	48	40	37	77	53	55	104	88	78

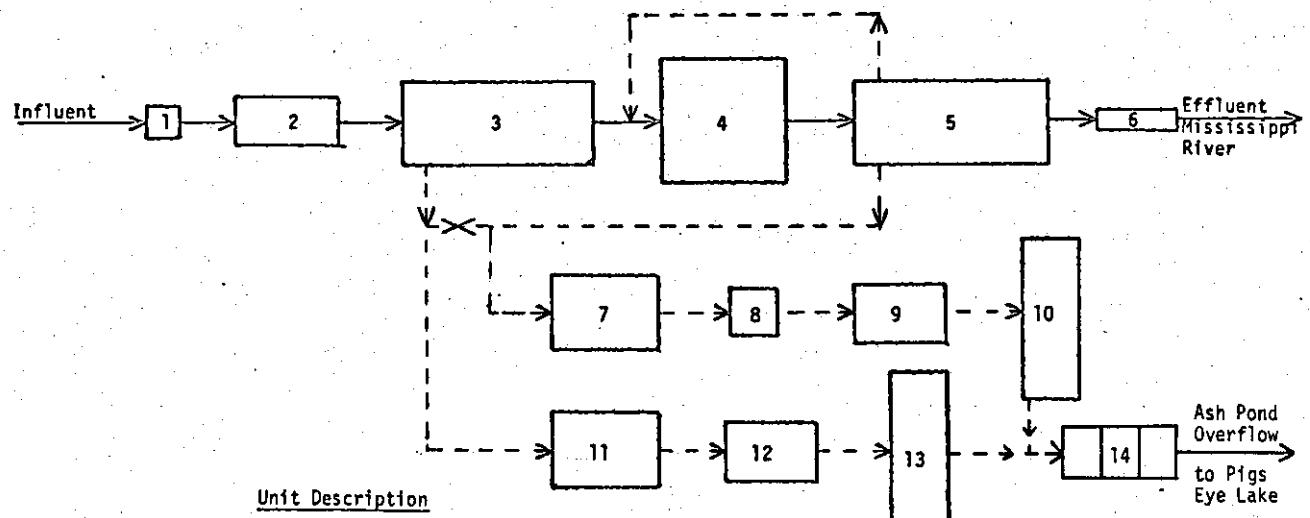
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Metropolitan Plant is the largest treatment facility in the MWCC system and is considered a permanent installation. At present, construction is underway to expand plant process units which will result in more effective treatment and better effluent quality.

METROPOLITAN WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening

2. Grit Removal

3. Primary Sedimentation

4. Activated Sludge

5. Final Sedimentation

6. Chlorination

Solid Phase

7. Gravity Thickening

8. Holding Tank

9. Vacuum Filtration

10. Incineration

11. Concentration

12. Vacuum Filtration

13. Incineration

14. Ash Pond

Legend

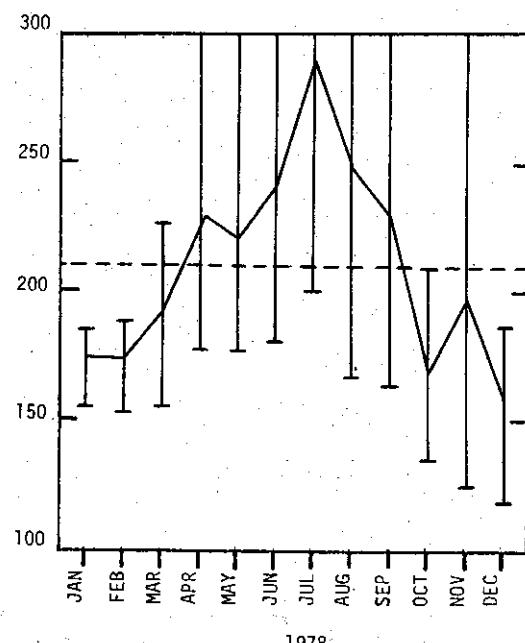
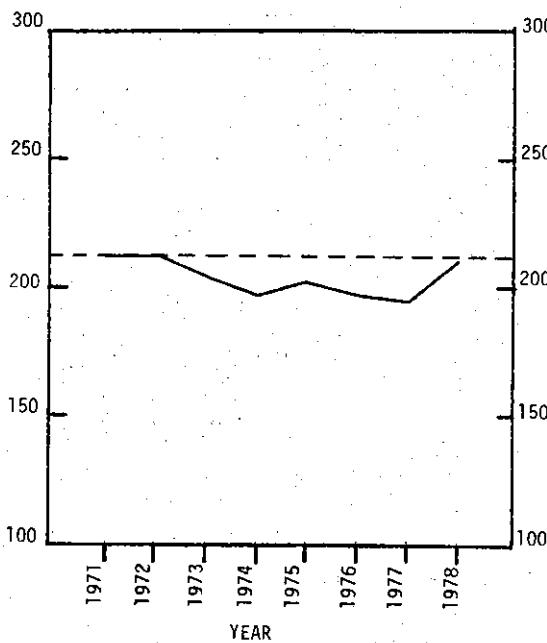
— Liquid Flow

- - - Solids Transfer

□ Existing Process Units

() Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: METROPOLITAN

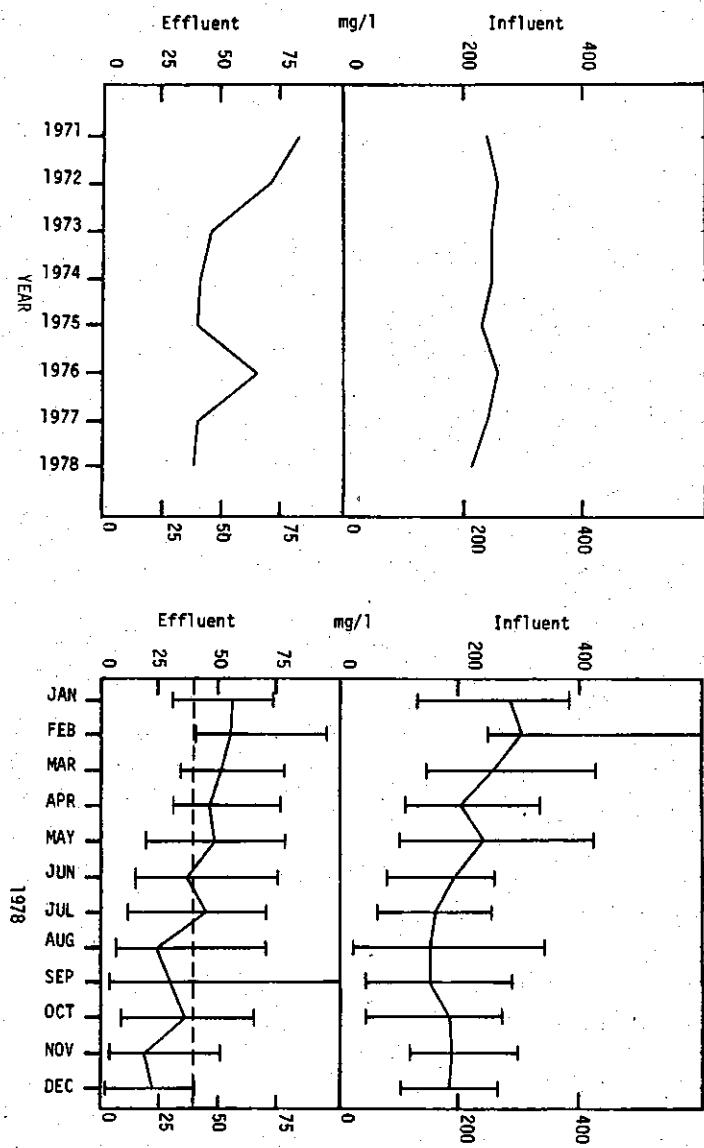
MONTH	WASTEWATER FLOW MGD.	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	174	56	289	723	325	27.5	21.5	6.4	6.8-7.6
FEBRUARY	173	56	311	781	325	26.6	19.8	6.7	6.0-7.5
MARCH	191	56	264	706	342	25.6	19.4	6.0	6.6-7.7
APRIL	226	55	207	492	225	19.3	14.4	3.9	7.2-7.6
MAY	220	63	244	530	225	22.3	13.0	5.6	5.4-7.8
JUNE	242	66	201	513	228	16.0	12.3	3.8	5.2-7.8
JULY	292	-	167	411	205	16.6	11.4	3.9	6.8-7.5
AUGUST	250	-	160	424	219	16.2	9.9	4.4	6.3-7.8
SEPTEMBER	230	-	158	387	198	15.1	11.4	3.2	4.0-7.6
OCTOBER	169	-	190	438	174	19.1	15.5	4.3	5.8-7.9
NOVEMBER	197	-	197	446	174	21.6	17.0	5.0	6.3-7.7
DECEMBER	157	-	188	402	135	22.5	17.2	5.5	5.8-9.1
1978 AVERAGE	210	59	215	521	231	20.7	15.2	4.9	4.0-9.1
1977 AVERAGE	194	64	246	631	288	24.4	18.5	6.1	6.3-9.0

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: METROPOLITAN

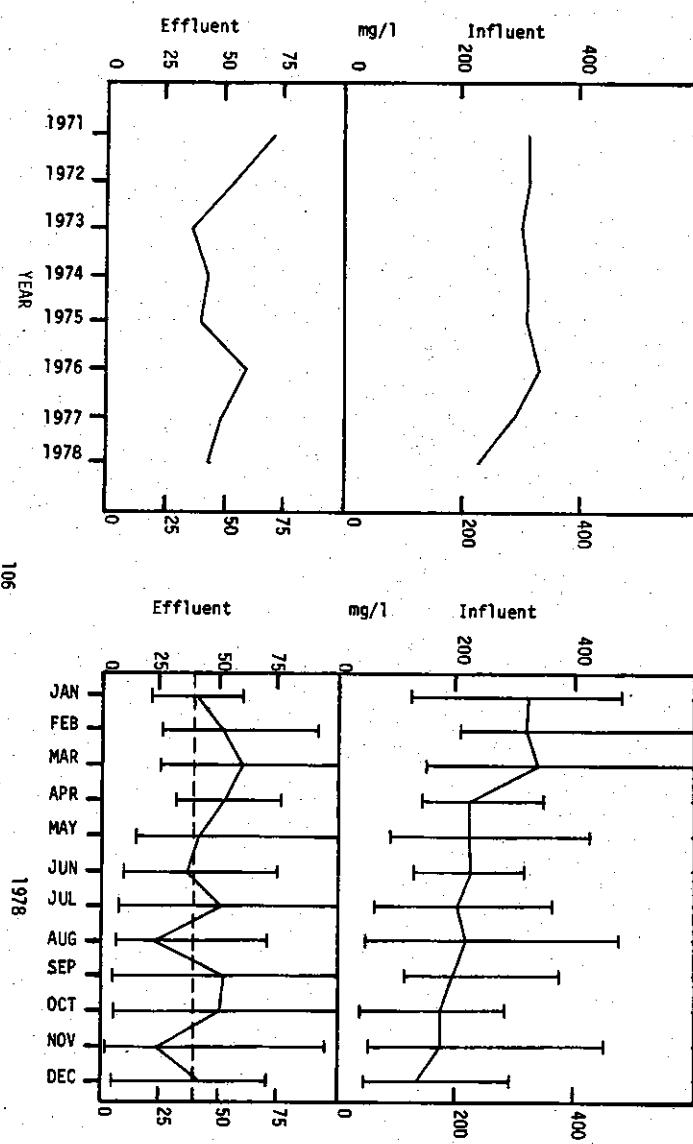
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJ-N mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
*NPDES Limitation														
JANUARY	57	193	39	5	22	20.8	15.6	1.33	0.24	3.4	3.2	7.3-7.8	80	88
FEBRUARY	55	197	51	3	23	19.8	15.1	1.06	0.23	3.5	3.4	7.5-7.8	82	84
MARCH	52	179	59	3	22	17.1	13.2	0.90	0.25	2.9	3.0	7.2-7.7	80	83
APRIL	47	160	51	2	22	15.2	10.8	1.13	0.57	2.5	1.6	6.9-7.6	77	77
MAY	48	167	41	51	16	14.6	10.1	1.31	0.38	2.3	2.3	6.8-7.8	80	82
JUNE	37	133	36	55	17	12.4	9.2	0.78	0.14	2.2	1.9	6.9-7.5	82	84
JULY	45	154	50	194	24	12.5	8.1	1.31	0.16	2.2	2.0	6.9-7.4	73	76
AUGUST	24	94	22	148	9	9.1	5.9	3.74	0.92	1.7	4.2	6.9-7.7	85	90
SEPTEMBER	30	115	51	134	18	6.7	3.2	2.25	3.09	2.0	4.1	6.3-7.6	81	74
OCTOBER	37	147	49	1117	19	10.7	7.6	0.88	1.72	1.8	4.5	6.8-7.7	81	72
NOVEMBER	19	112	23	660	12	10.4	7.2	0.75	3.66	1.7	3.7	5.9-7.8	91	87
DECEMBER	22	145	41	10	20	17.2	12.7	0.10	1.74	3.2	2.8	6.4-7.8	88	70
1978 AVERAGE	39	150	43	198	19	13.9	9.9	1.30	1.09	2.4	3.1	5.9-7.8	82	81
1977 AVERAGE	42	178	49	24	26	22.0	14.6	0.17	0.39	3.4	2.8	5.8-8.0	83	83

BIOCHEMICAL OXYGEN DEMAND



TOTAL SUSPENDED SOLIDS

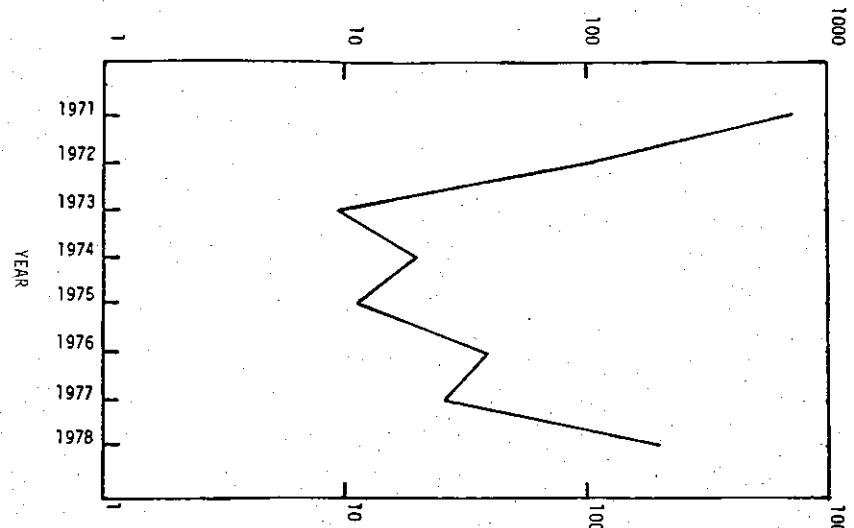


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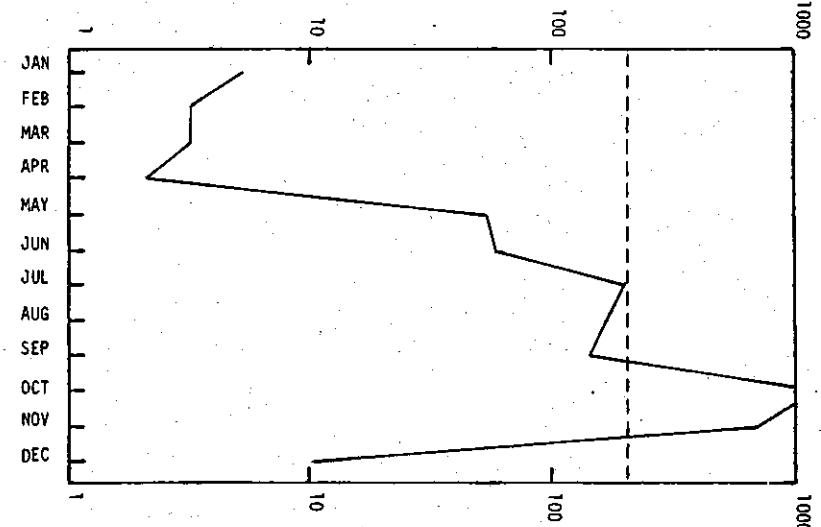
METROPOLITAN

EFFLUENT FECAL COLIFORMS

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

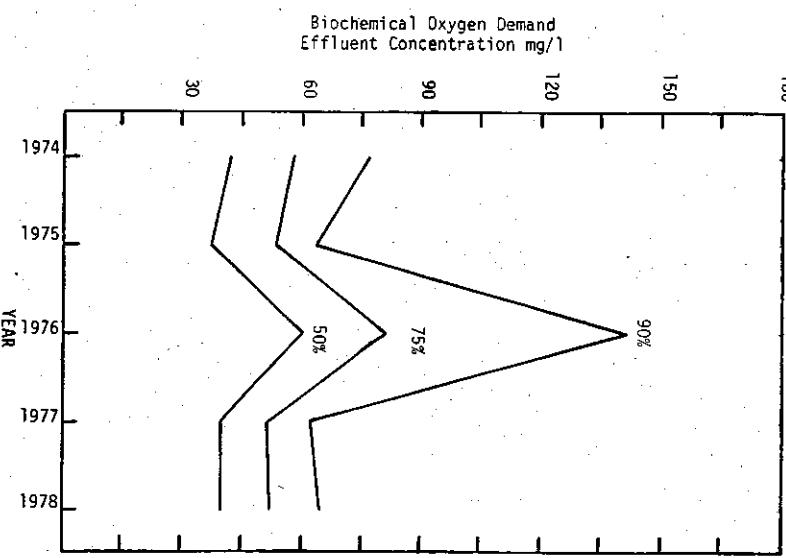
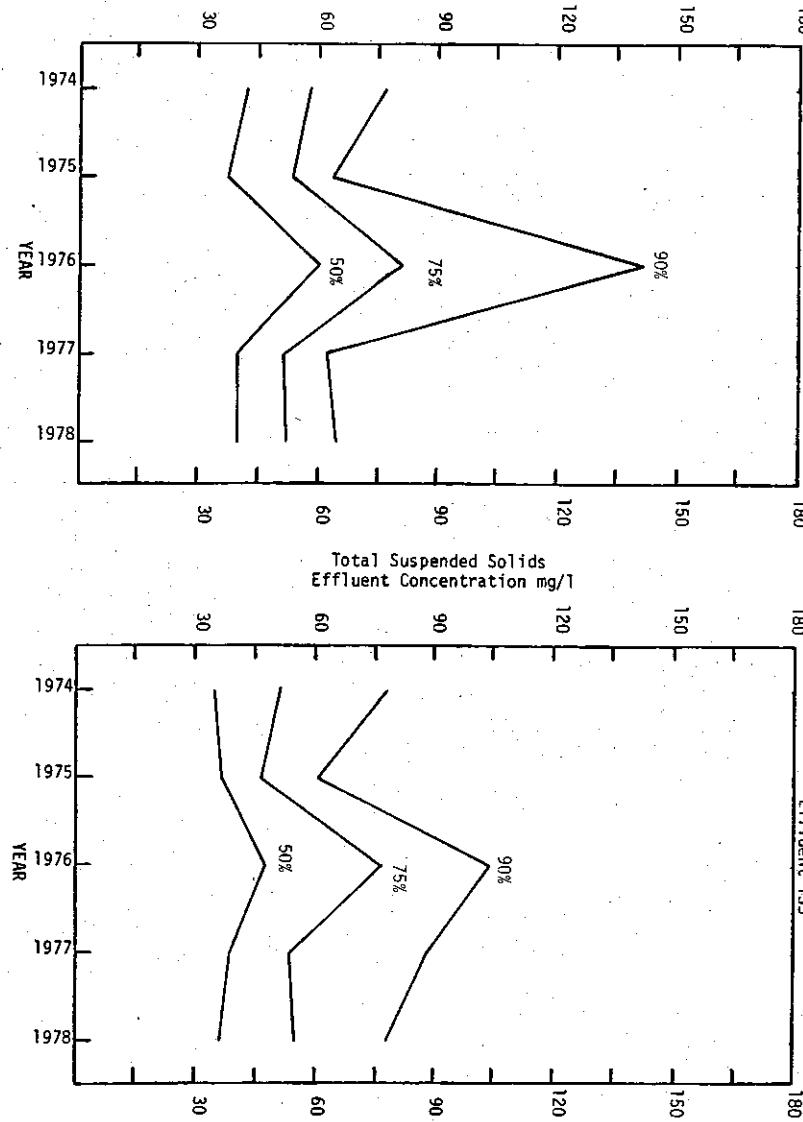


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means



STATISTICAL ANALYSIS*

Effluent BOD

Biochemical Oxygen Demand
Effluent Concentration mg/lTotal Suspended Solids
Effluent Concentration mg/l

* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values.

METROPOLITAN

ASH POND

1978 MONTHLY DATA SUMMARY

MONTH	INFLUENT FLOW mgd	1978 MONTHLY EFFLUENT CONCENTRATIONS										
		BOD mg/l	COD mg/l	TSS mg/l	D.O. mg/l	TURB. JTU	pH RANGE	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	P mg/l	Kj-N mg/l	NH ₃ mg/l	NO ₃ mg/l
NPDES Limitation												
January		40	136	124	5.1	159	8.8-11.2	716	3.0	18.6	16.4	0.12
February		45	-	76	5.6	90	8.2-10.5	1979	2.5	19.0	16.6	0.11
March		24	-	46	4.4	46	8.2-9.5	1026	1.9	21.1	19.0	0.14
April		25	-	35	5.0	39	8.5-9.9	218	1.8	16.7	14.7	0.16
May		31	120	43	4.3	56	9.2-9.8	77	1.6	16.6	13.2	0.08
June		34	109	44	3.7	50	9.1-9.8	328	1.4	16.6	14.0	0.04
July		30	-	45	5.1	39	9.2-10.2	186	-	-	-	-
August												
September												
October												
November												
December												
1978 Average		33	122	59	4.7	68	8.2-11.2	647	2.0	18.1	15.6	0.11

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METROPOLITAN
1978 EFFLUENT HEAVY METALS

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MONTH	Cu mg/l	Cr mg/l	Zn mg/l	Pb mg/l	CN mg/l	Cd mg/l	Hg ug/l	Ni* mg/l	As* ug/l	Sn* ug/l
January	0.10	0.14	0.18	<0.10	0.102	<0.02	<0.8			
February	0.11	0.15	0.22	<0.10	0.103	<0.02	<5.9			
March	0.11	0.14	0.21	<0.10	0.036	<0.02	<1.8			
April	0.09	0.12	0.20	<0.10	0.041	<0.02	<0.8			
May	0.08	0.22	0.14	<0.10	0.063	<0.02	<0.4			
June	0.06	<0.09	0.13	<0.10	0.045	<0.02	<0.8			
July	0.08	<0.14	0.17	<0.10	0.035	<0.02	<0.7			
August	0.05	0.09	0.12	<0.11	0.082	<0.02	<0.8	0.10	1.7	4.0
September	0.09	<0.09	0.18	<0.44	0.028	<0.02	<0.7	<0.07	1.8	<3.5
October	0.11	0.17	0.29	<0.15	0.039	<0.03	0.9	0.12	<1.6	5.6
November	0.09	<0.13	0.15	<0.10	0.040	<0.02	<0.8	<0.10	1.3	<3.4
December	<0.10	<0.11	0.19	<0.11	0.046	<0.02	<1.0	0.10	1.5	<3.0
1978 Average	<0.09	<0.13	0.18	<0.13	0.055	<0.02	<1.3	<0.10	<1.6	<3.9

*NPDES reporting of these parameters began in August, 1978.

ORONO WASTEWATER TREATMENT PLANT

Description:

The Orono Wastewater Treatment Plant was constructed in 1964 and consists of a contact stabilization process and an effluent polishing pond. The plant has a design capacity of 0.4 mgd. The effluent polishing pond has a detention time of 60 days and is normally drawn down in late fall with no further discharge occurring until the following spring.

Plant Operation:

The daily average wastewater flow to the Orono Treatment Plant increased from 0.34 mgd in 1977 to 0.47 mgd in 1978. The monthly average flow exceeded the design capacity of the plant during six months of 1978. The NPDES monthly effluent limitation for BOD was exceeded in January, April, May, and December, and the monthly effluent limitation for TSS was exceeded in March, April, May, and June. These violations were primarily the result of large algal populations which existed in the effluent pond. Mechanical problems were also experienced on several occasions. Overall effluent quality in 1978 showed a significant decline from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	7	7	15	10	12	29	16	20	38
TSS	10	9	20	24	17	36	39	26	98

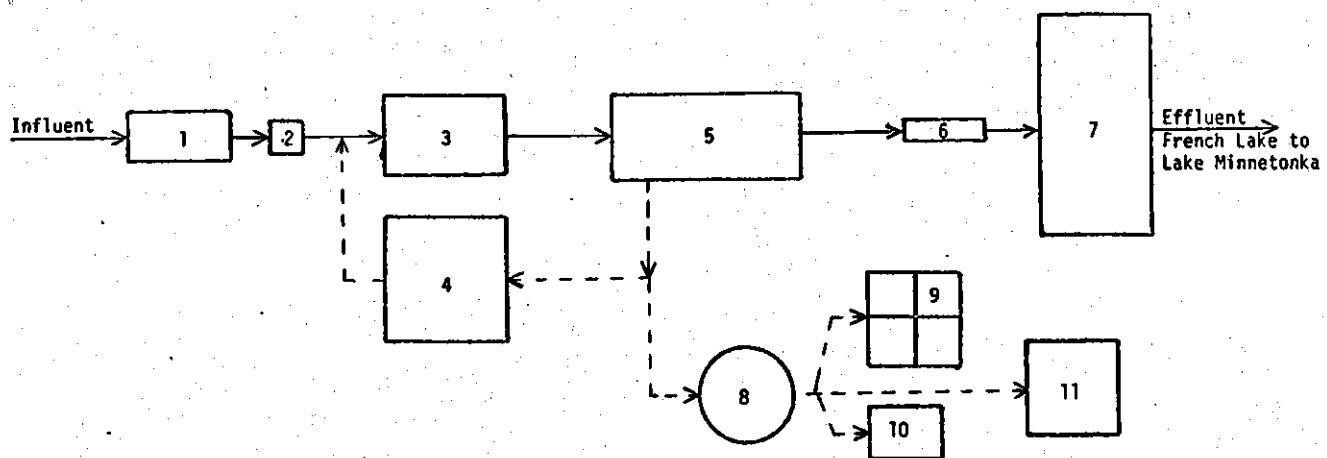
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Orono Treatment Plant will be phased-out upon completion of the Long Lake-Orono Interceptor, scheduled for December of 1979. The flow will then be treated at the Blue Lake Treatment Plant.

ORONO WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Grit Removal
2. Screening
3. Activated Sludge
4. Sludge Reaeration
5. Final Sedimentation
6. Chlorination
7. Effluent Pond

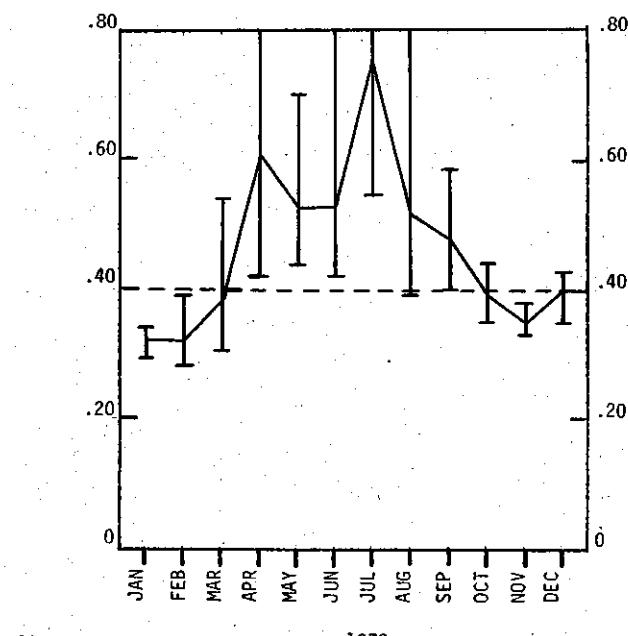
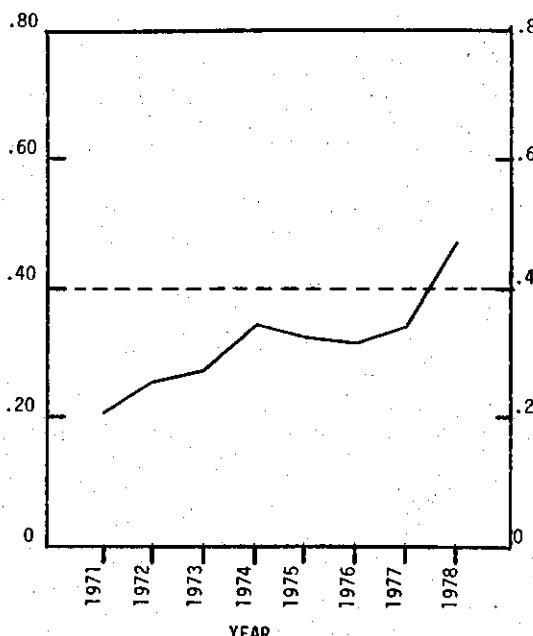
Solid Phase

8. Aerobic Digestion
9. Sand Drying Beds
10. Hauled to Metro System
11. Land Spread

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: ORONO

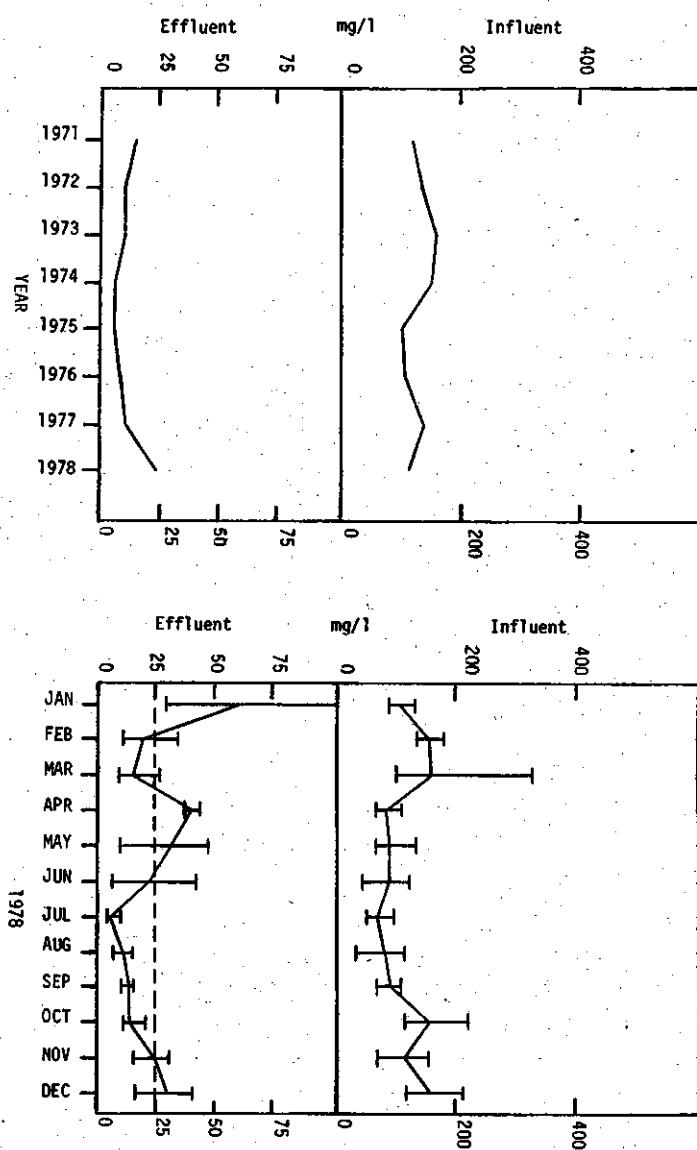
MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.32	48	110	227	139	25.0	21.5	4.0	7.6-7.7
FEBRUARY	0.32	46	160	333	192	35.8	29.6	6.3	7.6-8.0
MARCH	0.38	47	164	380	226	30.0	24.1	5.9	7.6-7.8
APRIL	0.61	45	87	190	139	20.9	18.5	2.9	7.6-7.8
MAY	0.53	49	93	201	143	20.4	14.1	4.0	7.5-7.7
JUNE	0.53	54	91	201	128	22.5	19.9	4.1	7.5-7.8
JULY	0.76	59	71	187	121	19.5	15.5	3.5	7.6-7.8
AUGUST	0.52	62	81	84	178	13.7	11.6	2.8	7.1-7.7
SEPTEMBER	0.48	63	94	159	159	21.6	18.0	3.6	7.3-7.8
OCTOBER	0.39	60	160	172	180	23.8	20.8	4.2	7.5-7.8
NOVEMBER	0.35	57	119	176	210	22.6	19.7	4.2	7.6-7.8
DECEMBER	0.38	51	164	214	191	30.2	26.5	5.3	7.6-7.7
1978 AVERAGE	0.46	53	116	210	167	23.8	20.0	4.2	7.1-8.0
1977 AVERAGE	0.34	54	141	291	176	29.4	25.6	5.7	7.4-7.8

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: ORONO

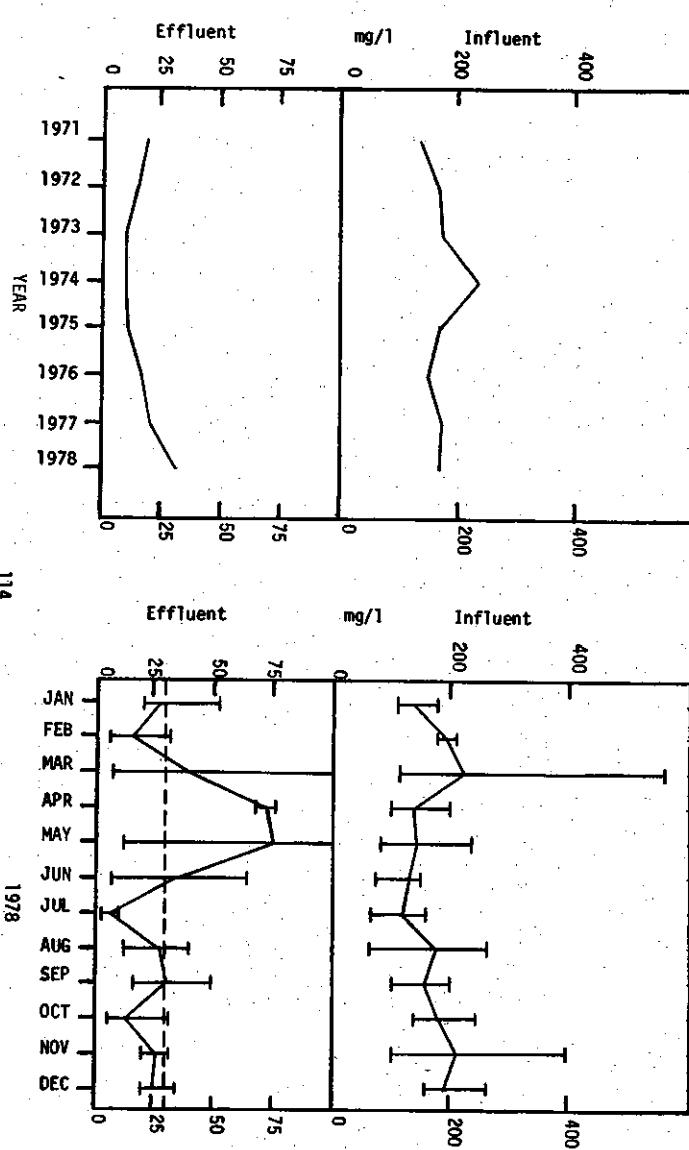
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL	
													BOD	TSS
*NPDES Limitation														
JANUARY	61	180	28	10	22	29.2	25.0	0.04	0.08	6.2	4.4	7.6-8.3	45	80
FEBRUARY	19	79	14	1	11	25.9	22.0	0.04	0.10	3.8	4.8	7.5-8.0	88	93
MARCH	15	92	38	0	.19	23.8	23.0	0.05	0.10	3.0	3.8	7.9-8.3	91	83
APRIL	40	132	71	75	15	9.2	2.8	0.17	0.72	1.5	10.2	8.2-9.0	54	49
MAY	30	114	74	39	18	9.4	4.6	1.47	0.05	2.1	10.1	8.6-10.0	68	48
JUNE	21	91	33	53	9	6.1	3.9	0.10	0.07	1.8	3.9	8.7-9.0	77	74
JULY	5	40	5	7	4	9.4	7.5	0.18	0.11	3.4	1.9	7.8-8.7	93	96
AUGUST	11	54	26	22	7	4.4	1.8	0.32	0.24	2.1	5.2	8.4-8.8	87	84
SEPTEMBER	13	71	30	19	11	4.8	2.1	0.31	0.44	2.6	6.9	8.4-8.7	86	81
OCTOBER	14	53	12	68	6	6.5	4.0	0.15	0.53	2.2	5.5	8.3-8.6	91	93
NOVEMBER	24	75	26	7	8	5.9	2.0	0.19	1.45	2.0	6.8	8.1-8.3	79	87
DECEMBER	29	214	24	19	14	18.5	17.0	0.11	0.52	3.9	3.5	7.9-8.1	82	87
1978 AVERAGE	24	100	32	27	12	12.8	9.6	0.26	0.37	2.9	5.6	7.5-10.0	79	81
1977 AVERAGE	12	52	21	34	7	13.0	10.6	0.21	0.47	3.2	4.9	7.1-9.5	91	88

BIOCHEMICAL OXYGEN DEMAND



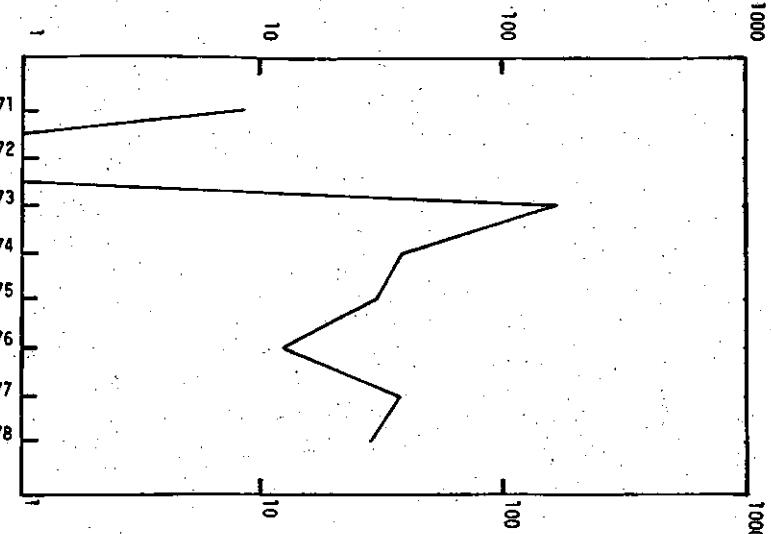
TOTAL SUSPENDED SOLIDS



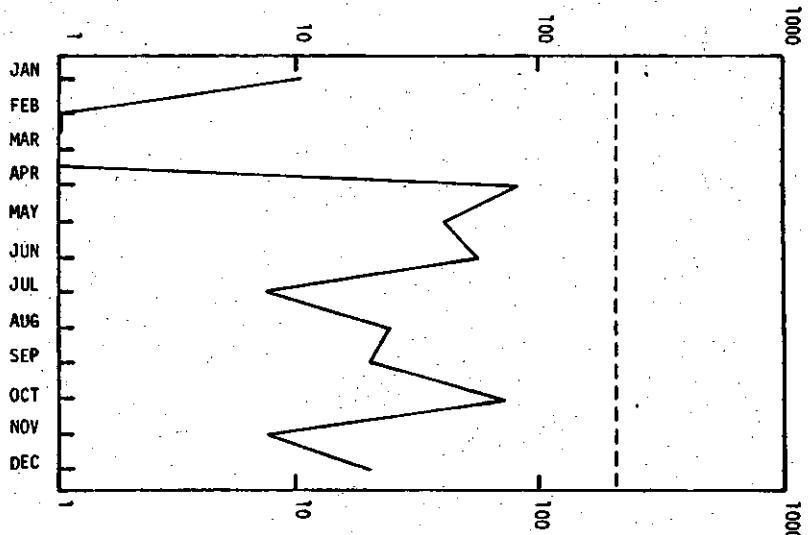
EFFLUENT FECAL COLIFORMS

ORONO

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

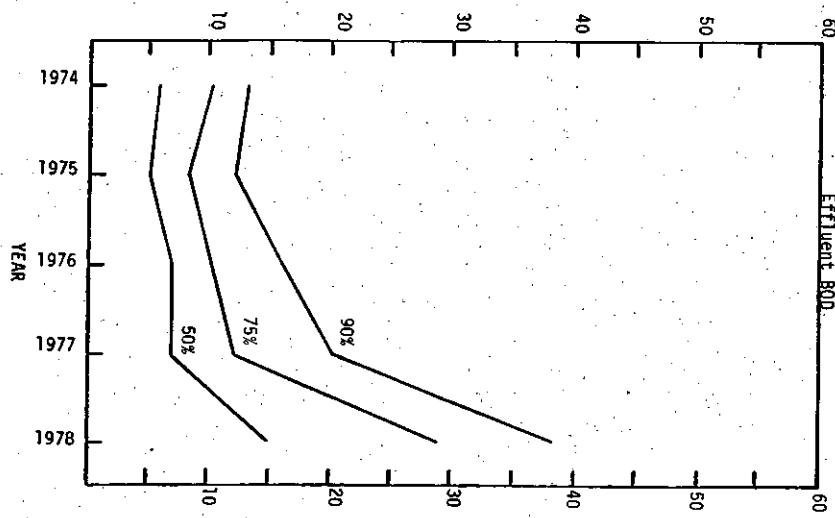


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means



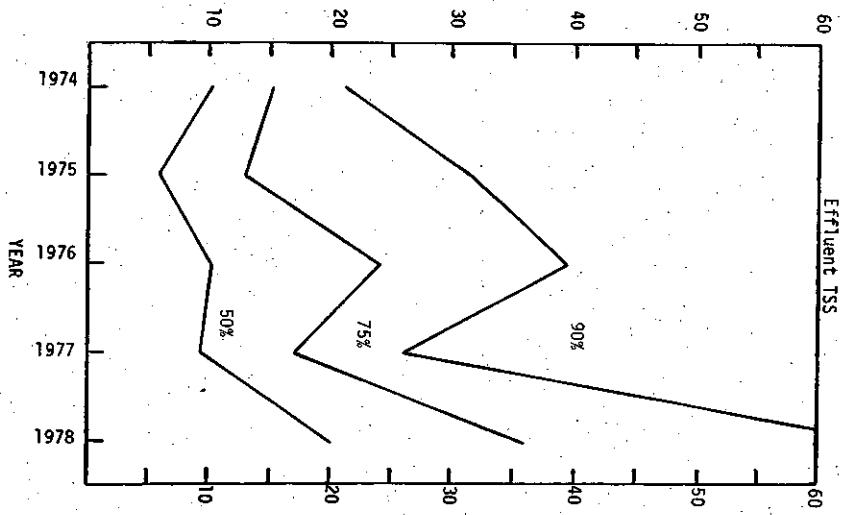
STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Effluent BOD

Total Suspended Solids
Effluent Concentration mg/l



Effluent TSS

* Percent of Time Effluent Concentrations are Equal to or Less than Plotted Values

PRIOR LAKE WASTEWATER TREATMENT PLANT

Description:

The Prior Lake Wastewater Treatment Plant was constructed in 1960 to provide preliminary, primary, and secondary treatment with a design capacity of 0.24 mgd. Secondary treatment is accomplished by use of a trickling filter process.

Plant Operation:

The daily average wastewater flow to the Prior Lake Treatment Plant decreased from 0.10 mgd in 1977 to 0.01 mgd in 1978. On May 23, 1978, discharge from the Prior Lake Treatment Plant was terminated and all subsequent flow diverted to the Blue Lake Treatment Plant. NPDES monthly effluent limitations for BOD were exceeded in January and April. Overall effluent quality in 1978 declined from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

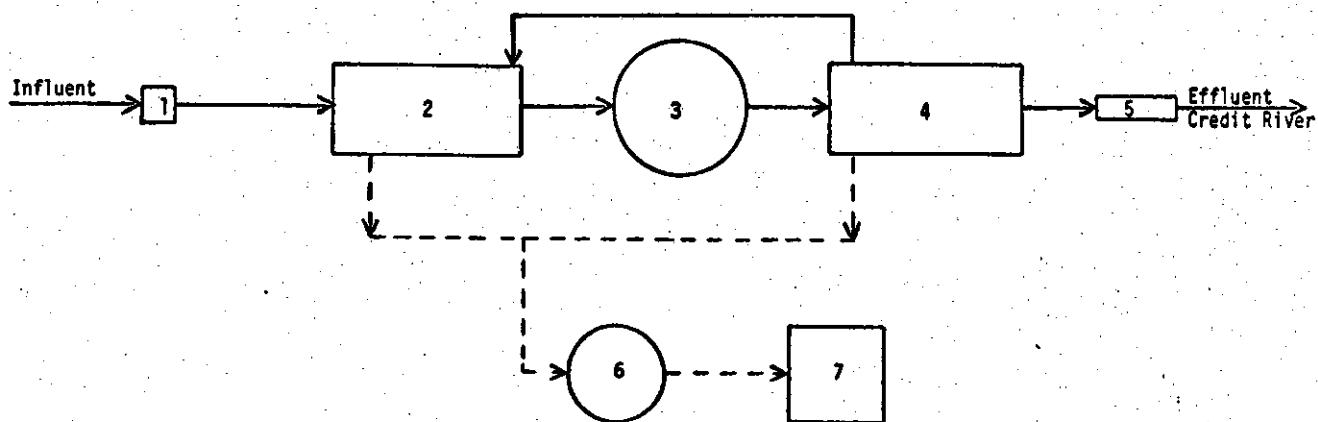
Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	30	18	18	40	28	34	59	53	43
TSS	27	12	13	32	24	28	40	36	33

* Percent of time effluent concentration equal to or less than value shown.

PRIOR LAKE WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening & Grit Removal
2. Primary Sedimentation
3. Trickling Filter
4. Final Sedimentation
5. Chlorination

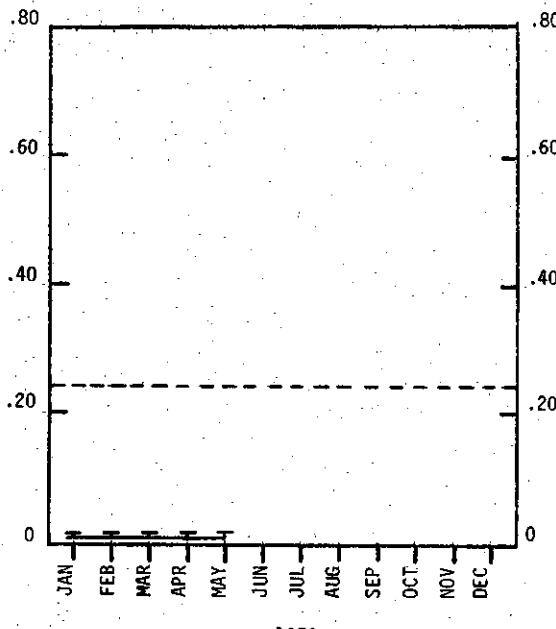
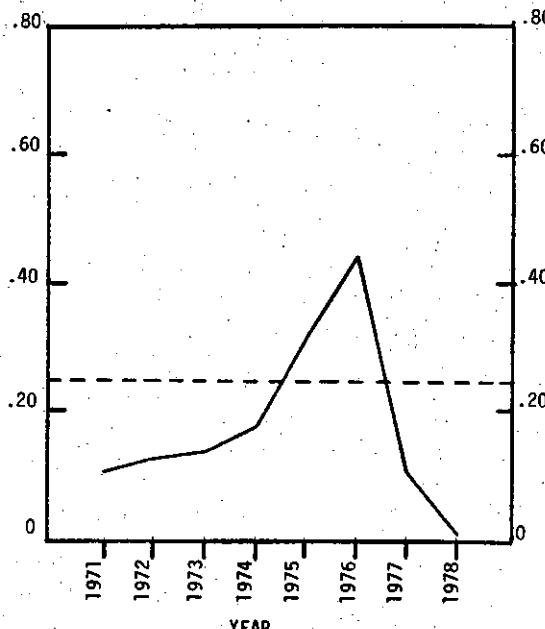
Solid Phase

6. Anaerobic Digestion
7. Sand Drying Beds

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



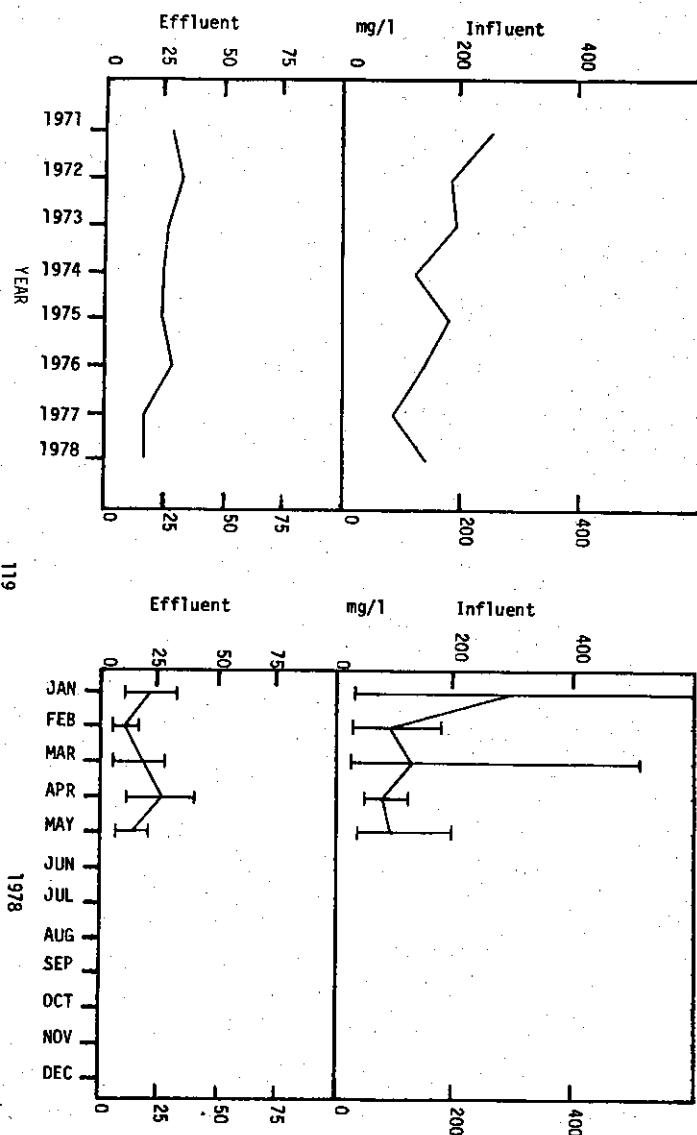
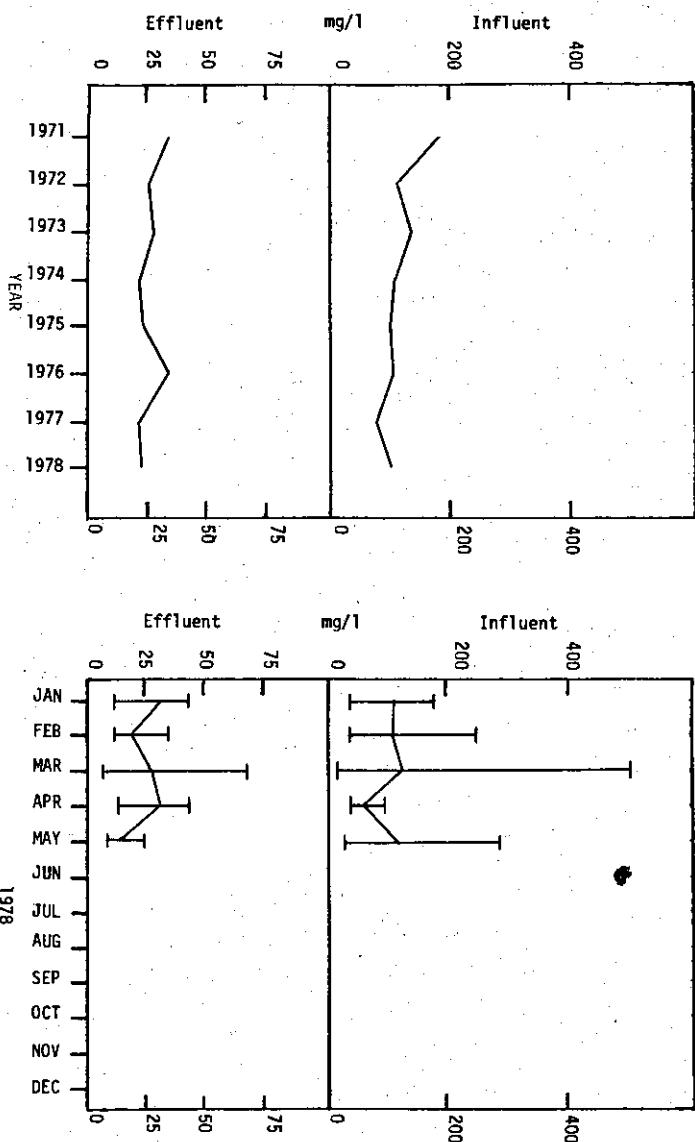
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: PRIOR LAKE

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.01	45	113	381	300	32.0	25.9	8.7	7.2-7.8
FEBRUARY	0.01	45	112	243	90	31.4	23.6	10.5	7.3-7.6
MARCH	0.01	47	128	277	127	24.1	20.3	8.7	7.3-7.6
APRIL	0.01	51	58	127	78	12.7	8.2	7.2	7.4-7.6
MAY	0.01	57	123	227	92	24.3	17.5	9.9	7.4-7.8
JUNE									
JULY									
AUGUST									
SEPTEMBER									
OCTOBER									
NOVEMBER									
DECEMBER									
1978 AVERAGE	0.01	49	107	251	137	24.9	19.1	9.0	7.2-7.8
1977 AVERAGE	0.10	57	76	168	83	28.9	25.3	7.4	7.0-7.8

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: PRIOR LAKE

* See Table 2

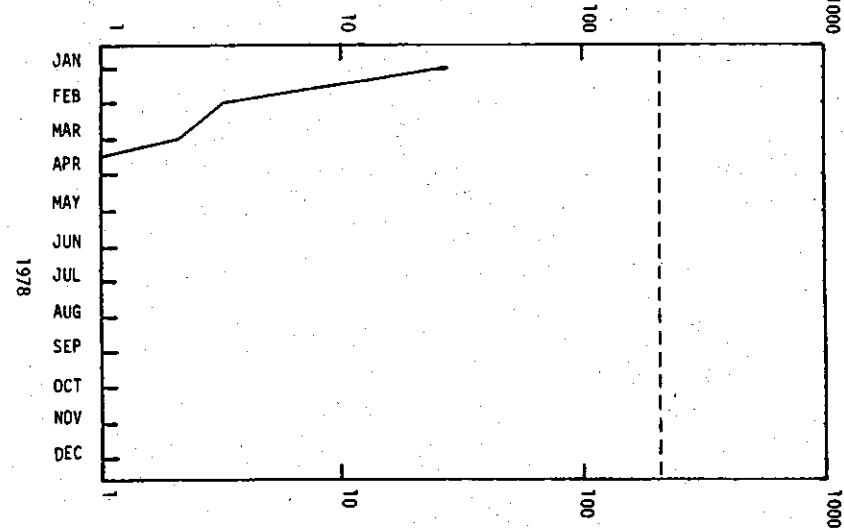
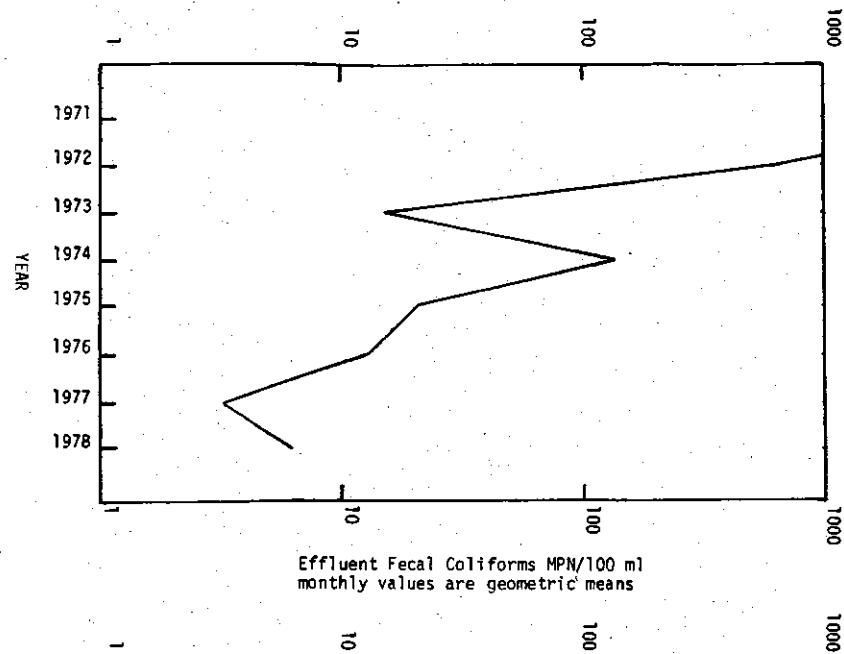
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
*NPDES Limitation														
JANUARY	31	121	27	26	20	22.1	19.2	0.25	2.74	5.8	6.4	7.0-7.6	73	93
FEBRUARY	18	70	10	3	12	19.9	12.6	0.22	5.03	6.5	6.8	7.2-7.5	84	89
MARCH	27	89	18	2	14	17.7	15.4	0.66	4.08	6.5	6.7	7.2-7.5	79	86
APRIL	31	84	28	0	16	15.5	5.7	-	6.85	6.0	6.8	7.2-7.5	47	64
MAY	14	60	10	0	8	7.5	4.2	0.53	11.56	7.4	6.6	7.3-7.6	89	89
JUNE														
JULY														
AUGUST														
SEPTEMBER														
OCTOBER														
NOVEMBER														
DECEMBER														
1978 AVERAGE	24	85	17	6	14	16.5	11.4	0.42	6.05	6.4	6.7	7.0-7.6	78	88
1977 AVERAGE	22	77	17	3	14	15.1	12.4	0.32	5.48	5.5	6.2	6.7-7.7	71	80



EFFLUENT FECAL COLIFORMS

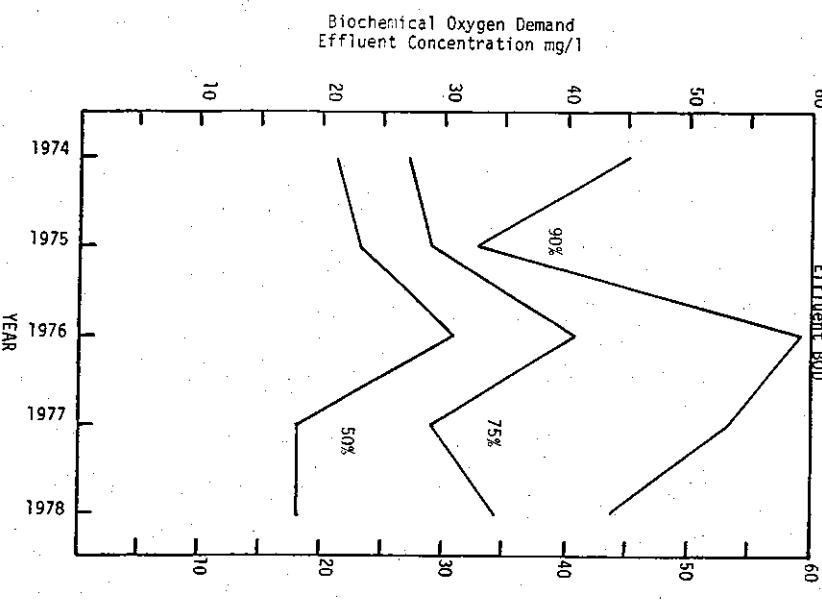
PRIOR LAKE

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

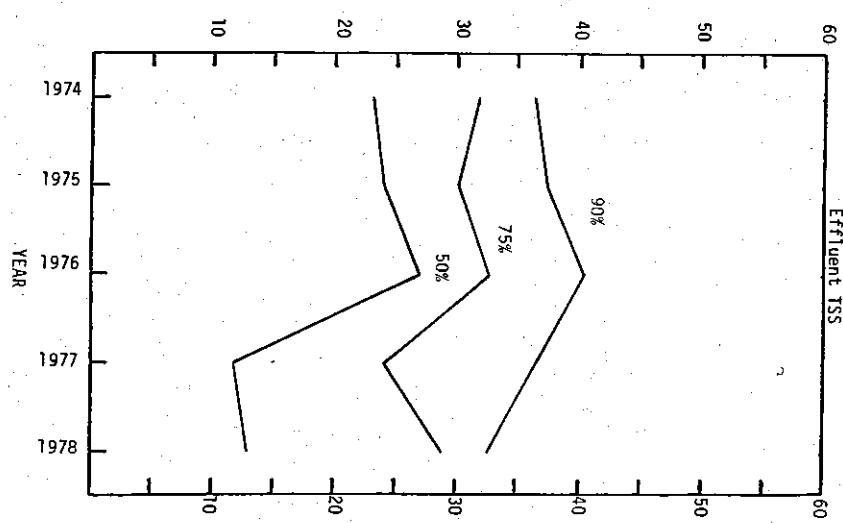


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values

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ROSEMOUNT WASTEWATER TREATMENT PLANT

Description:

The Rosemount Advanced Wastewater Treatment Plant was initially conceived as an expansion of the then existing trickling filter plant. Subsequent evaluations determined that expansion of the trickling filter plant was not feasible and a new plant of the physical-chemical type with a design capacity of 0.60 mgd was constructed in 1973.

Plant Operation:

The daily average wastewater flow to the Rosemount Treatment Plant increased from 0.27 mgd in 1977 to 0.29 mgd in 1978. The monthly average flow did not exceed the design capacity of the plant at any time during the year. The NPDES permit limitation for total phosphorus was violated in January. This was the only violation which occurred during the year. Overall effluent quality in 1978 showed almost no change from the previous year. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	13	12	11	18	18	15	24	23	22
TSS	3	2	3	4	3	5	6	5	7

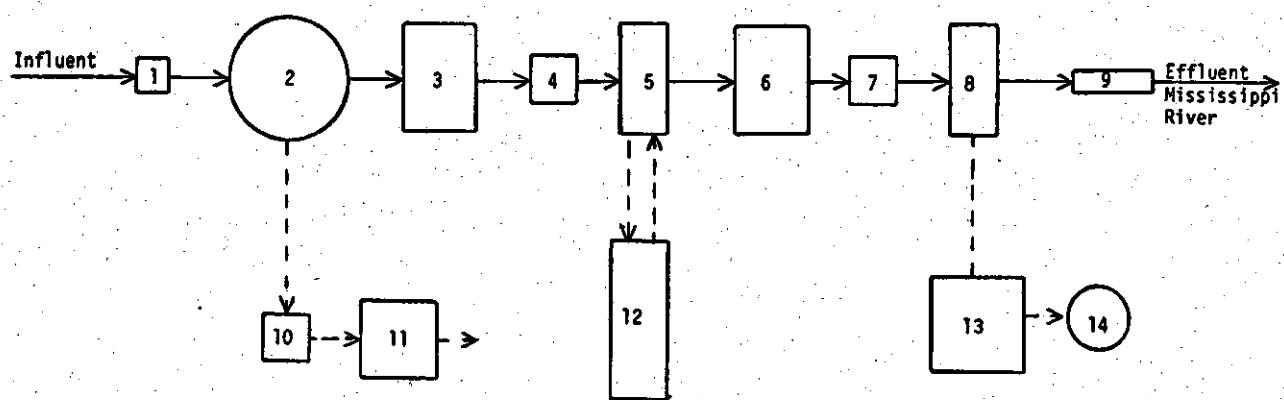
* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

This plant is considered one of the Commission's permanent facilities.

ROSEMOUNT ADVANCED WASTEWATER TREATMENT PLANT

FLOW DIAGRAM



Unit Description

Liquid Phase

1. Screening
2. Solids Contact Clarifier
3. Dual Media Filters
4. Filtered Water Storage
5. Granular Carbon Columns
6. Dual Media Filters
7. Filtered Water Storage
8. Ion Exchange Columns
9. Chlorination

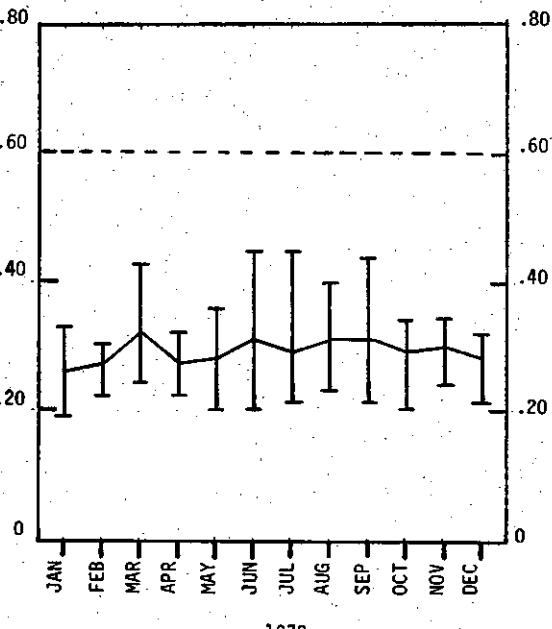
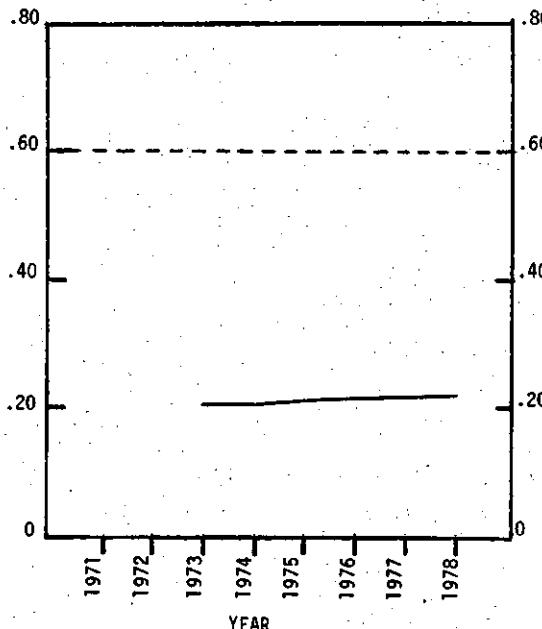
Solid Phase

10. Sludge Holding Tank
11. Sludge Dewatering
12. Carbon Regeneration System
13. Ion Exchange Regeneration System
14. Ammonia Recovery

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- Future Process Units

WASTEWATER FLOW
(mgd)



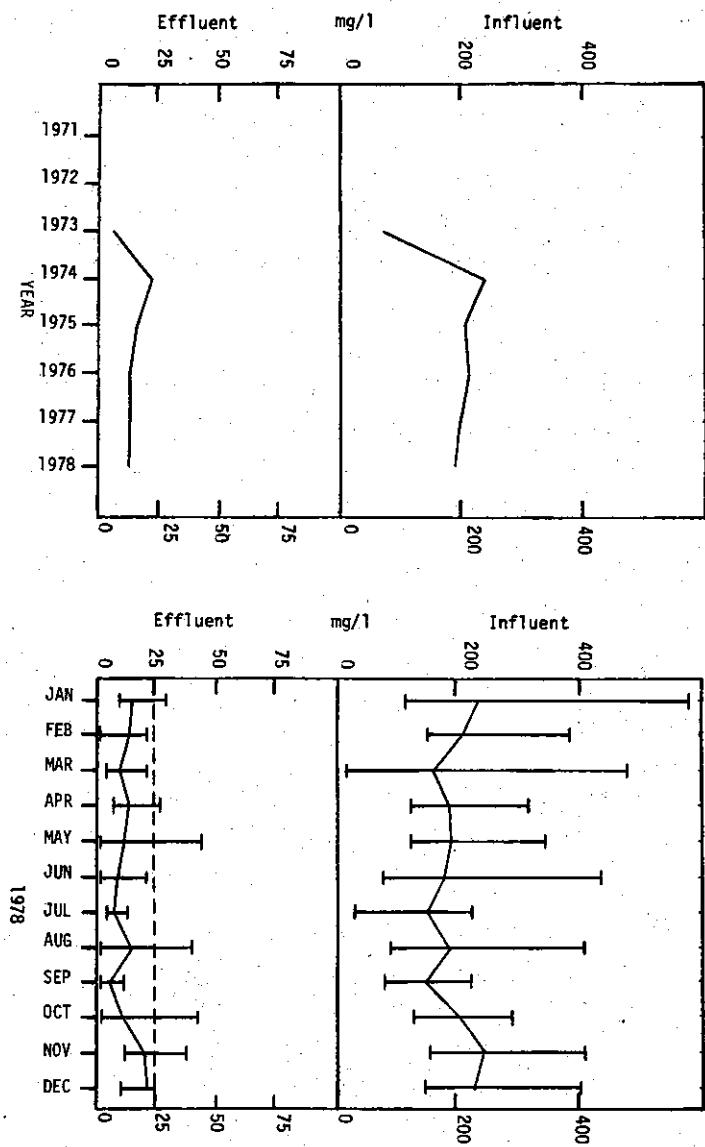
MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: ROSEMOUNT

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	0.26	54	241		267	41.9	32.8	8.4	7.3-8.1
FEBRUARY	0.27	52	214		245	39.5	30.1	8.3	7.3-8.1
MARCH	0.32	49	165		224	30.9	24.4	6.1	7.4-7.9
APRIL	0.27	50	191		201	38.5	28.9	8.1	7.5-8.0
MAY	0.28	51	196		233	40.1	28.8	8.9	7.6-8.0
JUNE	0.31	54	185		234	29.8	24.9	7.4	7.2-7.9
JULY	0.29	59	152		344	27.0	22.1	5.9	7.0-7.8
AUGUST	0.31	62	188		233	28.4	22.6	7.0	7.2-8.5
SEPTEMBER	0.31	64	152		194	30.1	23.4	6.1	7.0-7.9
OCTOBER	0.29	63	208		185	38.4	34.7	7.8	7.3-9.7
NOVEMBER	0.30	61	253		236	40.4	32.8	8.4	7.0-7.9
DECEMBER	0.28	58	237		225	43.1	35.1	7.9	6.8-8.2
1978 AVERAGE	0.29	56	198		235	35.7	28.4	7.5	6.8-9.7
1977 AVERAGE	0.27	56	203	501	226	40.6	30.7	8.1	6.7-8.6

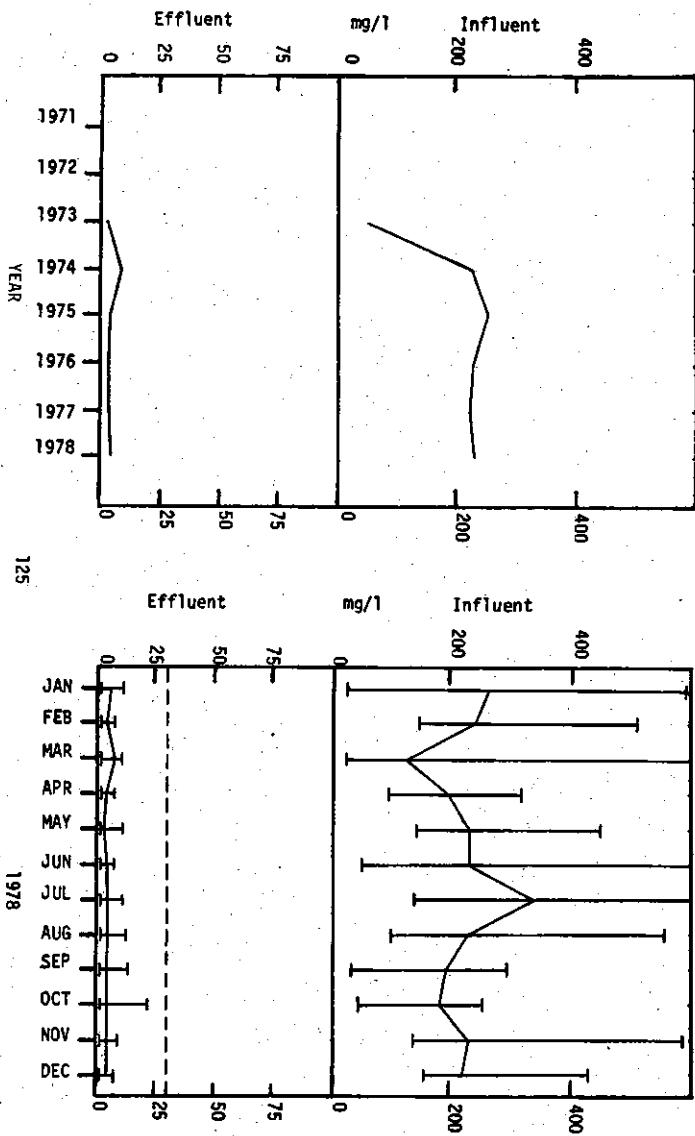
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: ROSEMOUNT

* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJ-N mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	TSS	
*NPDES Limitation															
JANUARY	15		5	1		7	35.5	32.4	0.06	0.10	1.3	6.0	7.0-8.0	94	98
FEBRUARY	14		3	0		5	32.8	30.0	0.30	0.62	0.5	6.8	6.9-7.8	95	99
MARCH	10		7	2		4	27.9	25.1	0.28	1.24	0.2	6.5	7.2-7.9	94	99
APRIL	13		3	0		4	34.0	29.8	0.07	0.92	0.4	5.4	7.3-7.7	93	99
MAY	12		2	1		4	34.7	27.0	0.02	1.09	0.3	6.0	7.0-7.7	94	99
JUNE	8		3	1		4	26.5	25.3	0.12	1.85	0.3	5.6	7.1-7.7	96	99
JULY	7		3	1		3	24.9	24.1	0.02	1.23	0.2	6.4	6.7-7.6	95	99
AUGUST	15		4	1		6	23.8	22.8	0.09	0.18	0.2	5.4	6.5-7.6	92	98
SEPTEMBER	5		4	1		3	28.4	24.2	0.03	0.26	0.2	5.5	6.5-7.8	97	98
OCTOBER	11	33	4	1		1	30.7	31.8	0.05	0.05	0.3	5.8	6.6-7.5	95	98
NOVEMBER	20	35	4	1		9	32.3	31.7	0.11	0.79	0.5	6.7	6.7-8.4	92	98
DECEMBER	21	39	4	1		9	34.9	34.1	0.07	0.04	0.3	6.5	6.5-7.6	91	98
1978 AVERAGE	13	36	4	1		5	30.5	28.2	0.10	0.69	0.4	6.0	6.5-8.4	93	98
1977 AVERAGE	14	37	3	2		6	17.7	15.8	0.15	0.51	0.7	6.2	6.3-8.8	93	99



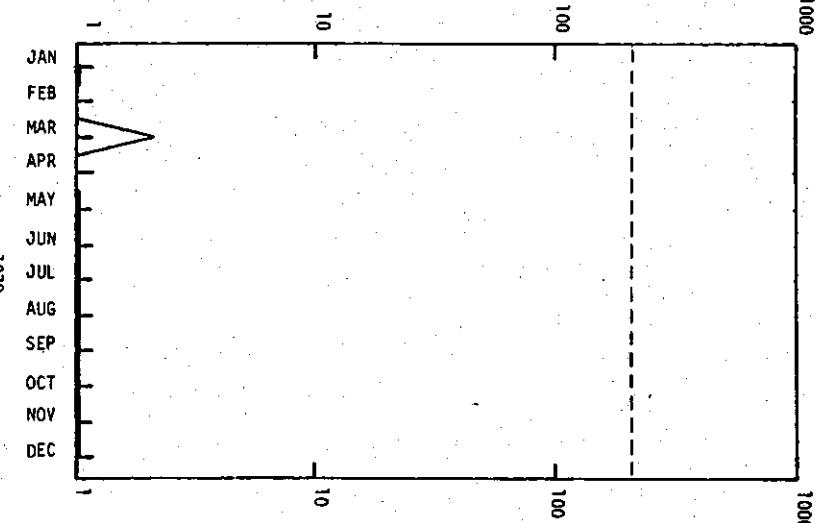
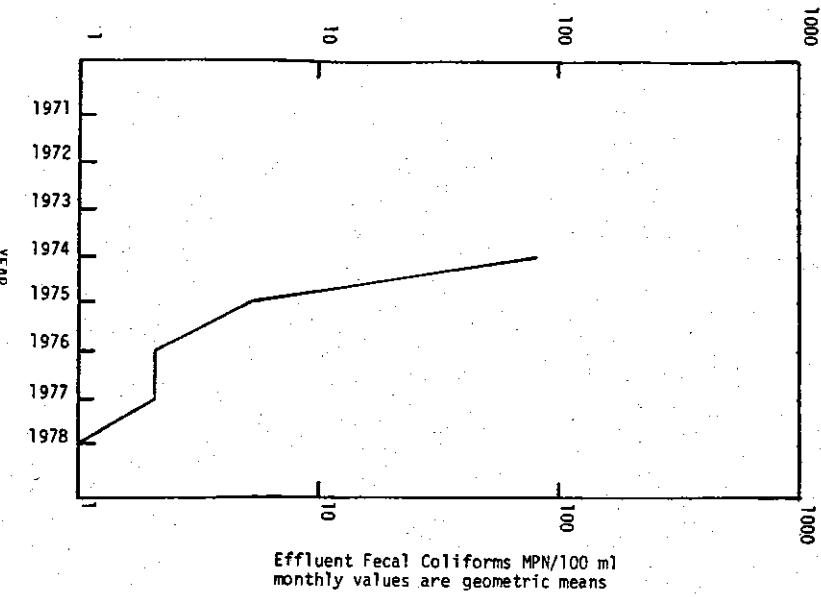
TOTAL SUSPENDED SOLIDS



EFFLUENT FECAL COLIFORMS

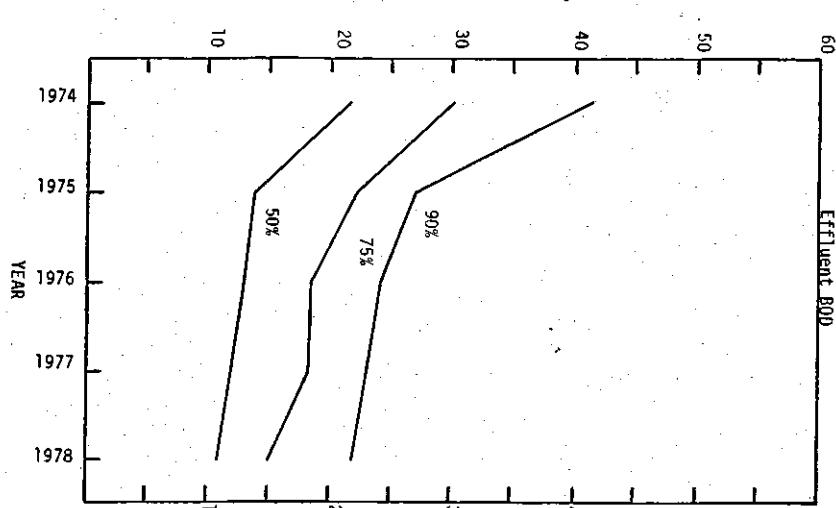
ROSEMOUNT

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

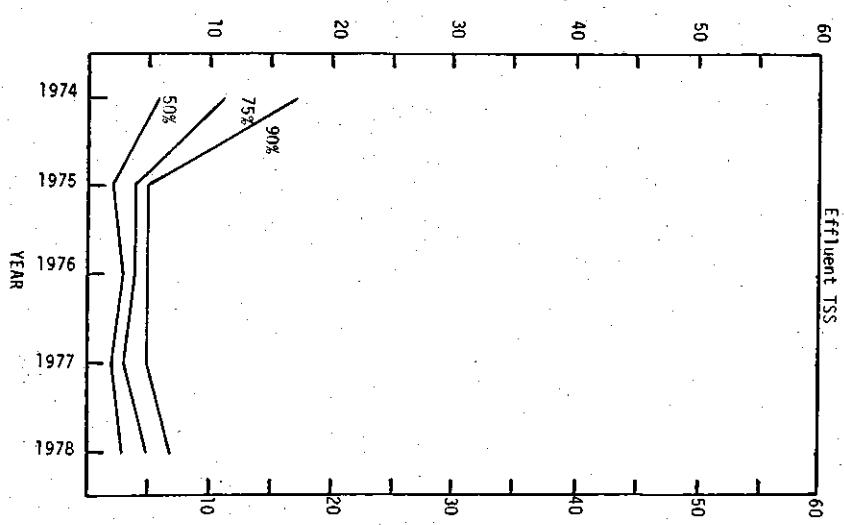


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values

SAVAGE WASTEWATER TREATMENT PLANT

Description:

The Savage Wastewater Treatment Plant was built in 1963 and has a design capacity of 0.36 mgd. The treatment plant provides screening grit removal, primary sedimentation, and biological treatment by means of a high-rate trickling filter process.

Plant Operation:

The daily average wastewater flow to the Savage Plant decreased from 0.39 mgd in 1977 to 0.37 mgd in 1978. Monthly average flows exceeded the design capacity of the plant during five months of the year. The Savage Plant failed to comply with NPDES monthly effluent pH limitations during February and April. These violations were the result of unacceptable industrial discharges to the plant. All other monthly effluent limitations were met during the year. Overall effluent quality in 1978 showed mixed results with BOD and fecal coliform quality improving and TSS quality showing a slight decline. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

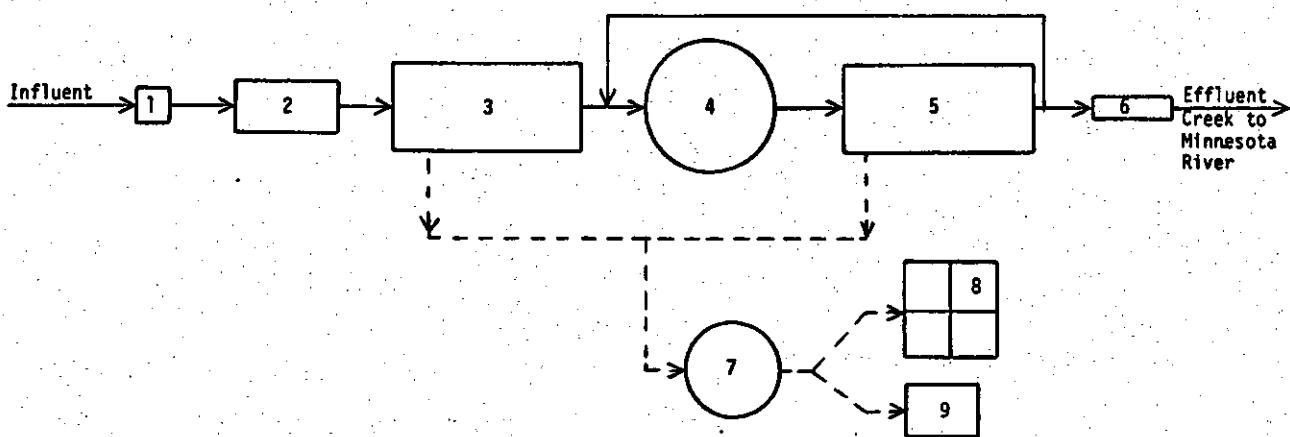
50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	18	20	26	24	30	34	37	42	42
TSS	9	10	14	11	16	20	14	29	25

* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Savage Treatment Plant is considered a semipermanent plant. Additional process units are now being constructed which will improve plant performance.

SAVAGE WASTEWATER TREATMENT PLANT
FLOW DIAGRAM



Unit Description

Liquid Phase

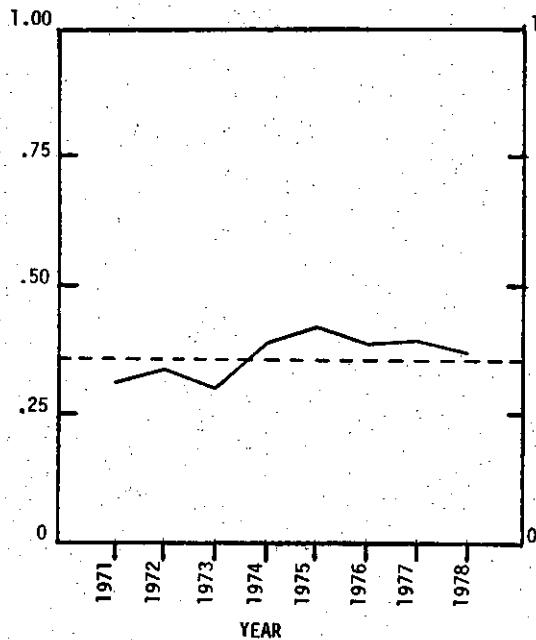
- 1. Screening
- 2. Grit Removal
- 3. Primary Sedimentation
- 4. Trickling Filter
- 5. Final Sedimentation
- 6. Chlorination
- 7. Anaerobic Digestion
- 8. Sand Drying Beds
- 9. Haul to Seneca Plant System

Solid Phase

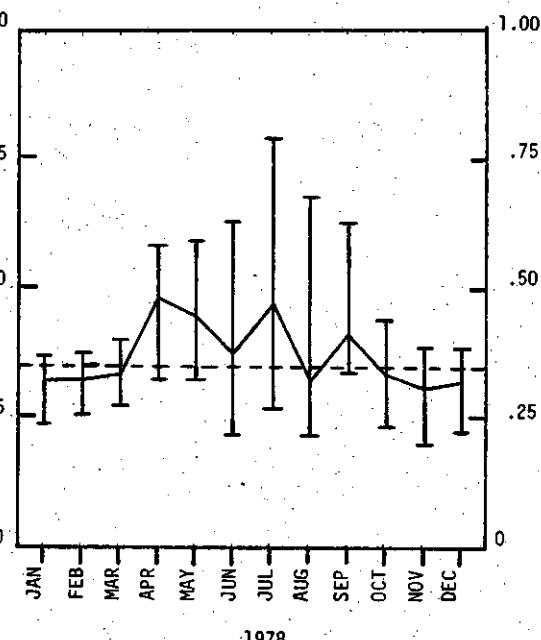
Legend

- Liquid Flow
- - - Solids Transfer
- [] Existing Process Units
- [] Future Process Units

WASTEWATER FLOW
(mgd)



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MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: SAVAGE

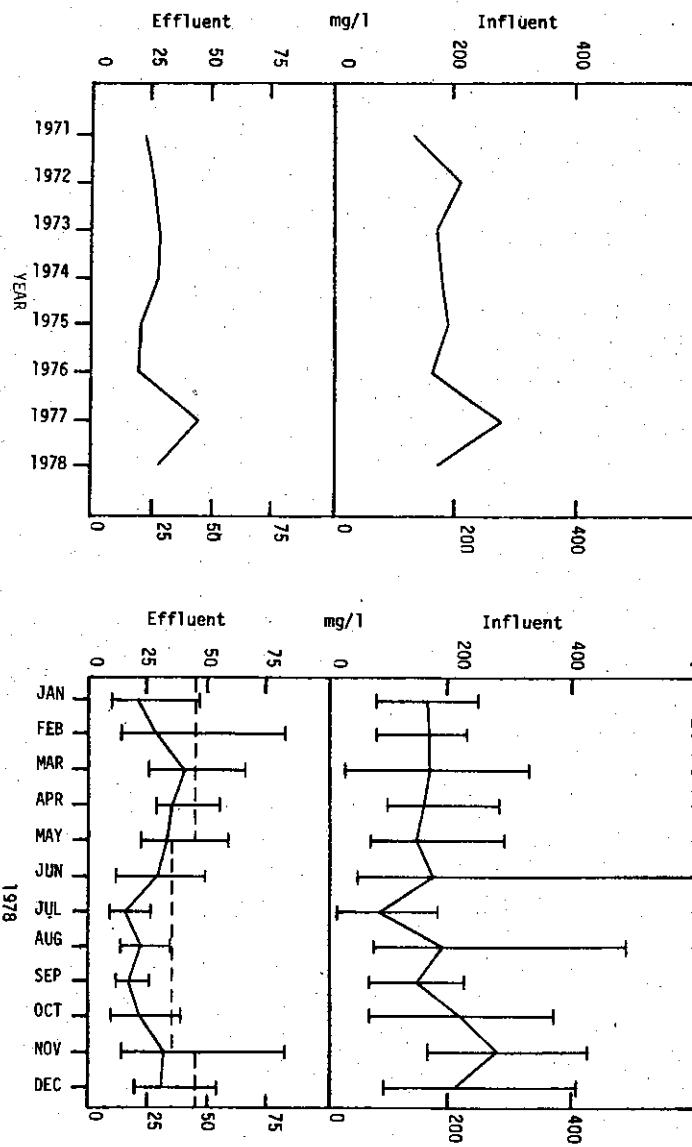
MONTH	WASTEWATER FLOW MGD.	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	PH RANGE
JANUARY	0.32	57	166	309	215	26.2	15.5	5.0	7.4-12.4
FEBRUARY	0.32	56	169	335	208	25.0	18.0	4.7	7.4-12.6
MARCH	0.33	58	169	316	262	20.2	15.2	4.4	7.4-8.0
APRIL	0.48	61	161	450	228	19.8	14.2	3.4	2.1-7.8
MAY	0.44	61	151	399	240	20.7	15.0	28.0	7.4-12.4
JUNE	0.37	62	188	237	343	16.3	13.3	4.3	7.4-7.9
JULY	0.47	63	80	184	148	14.9	9.9	3.5	7.4-7.8
AUGUST	0.32	66	194	219	312	20.3	15.7	3.7	7.4-7.8
SEPTEMBER	0.41	65	146	269	257	17.3	13.5	3.7	7.4-7.8
OCTOBER	0.33	63	225	329	268	22.6	15.4	4.9	7.4-7.8
NOVEMBER	0.30	61	287	453	387	28.2	19.9	29.9	7.4-7.8
DECEMBER	0.32	61	214	265	307	21.4	15.3	4.9	7.4-7.8
1978 AVERAGE	0.37	61	179	314	265	21.1	15.1	8.4	2.1-12.6
1977 AVERAGE	0.39	66	283	392	249	24.0	18.4	13.2	5.4-12.5

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: SAVAGE

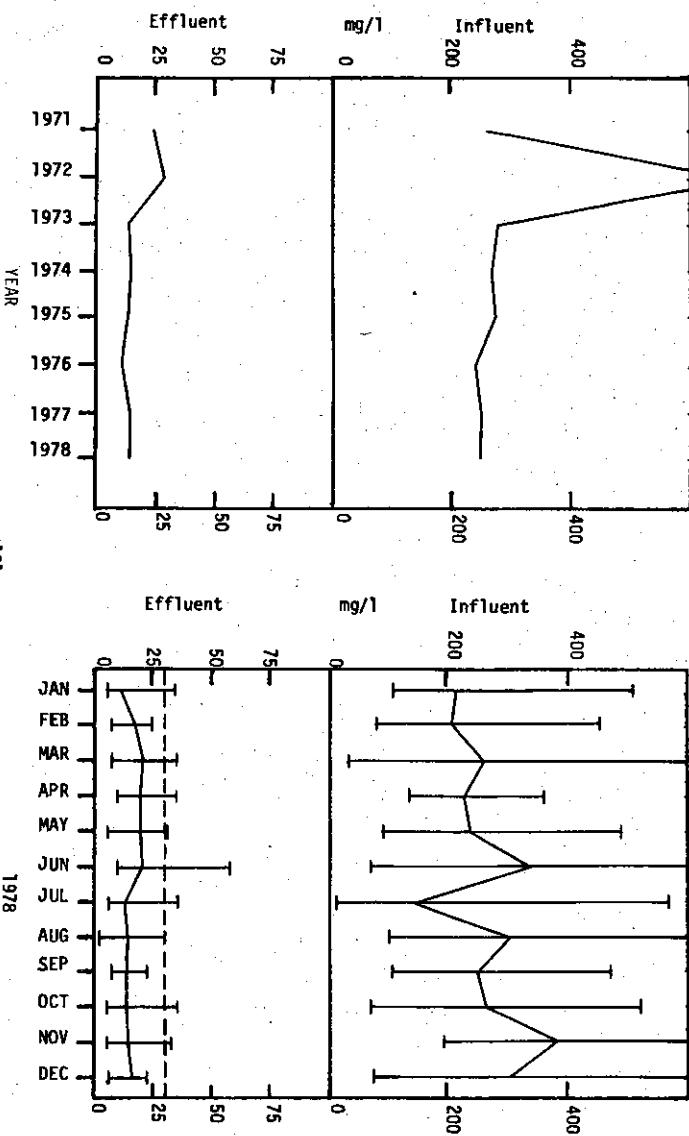
* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	PH RANGE	% REMOVAL BOD	% REMOVAL TSS
NPDES Limitation														
JANUARY	21	100	11	22	10	11.8	9.0	0.50	0.58	4.4	6.5	7.2-7.8	87	95
FEBRUARY	28	120	12	8	14	18.1	11.5	0.31	0.57	5.1	6.6	7.2-9.4	83	94
MARCH	40	82	20	6	19	14.9	13.2	0.09	0.14	6.1	6.5	7.2-7.8	76	92
APRIL	35	103	18	8	19	10.7	7.3	0.12	0.55	3.3	6.4	7.2-9.6	78	92
MAY	33	77	19	6	16	12.2	9.1	0.08	0.18	3.7	6.5	7.2-7.6	78	92
JUNE	28	67	20	16	15	10.6	8.8	0.10	0.19	6.7	6.5	7.2-7.7	85	94
JULY	15	39	13	14	9	9.1	6.1	0.18	0.61	5.8	6.5	7.2-7.7	82	91
AUGUST	22	61	14	3	10	10.1	7.4	0.59	0.64	5.6	6.5	7.2-7.6	89	96
SEPTEMBER	17	45	13	5	8	6.7	4.7	0.38	1.02	2.9	6.5	7.2-7.6	88	95
OCTOBER	21	51	13	6	10	11.6	7.8	0.41	1.56	2.8	6.5	7.2-7.6	91	95
NOVEMBER	37	88	14	3	12	15.4	12.1	0.55	1.62	4.1	6.6	7.2-7.6	87	96
DECEMBER	30	84	16	4	12	12.4	9.6	0.34	1.35	3.0	6.6	7.2-7.6	83	95
1978 AVERAGE	27	76	15	8	13	12.0	8.9	0.30	0.75	4.5	6.5	7.2-9.6	85	94
1977 AVERAGE	46	100	14	16	14	12.6	9.7	0.45	0.77	8.3	6.5	6.5-9.2	84	94

BIOCHEMICAL OXYGEN DEMAND



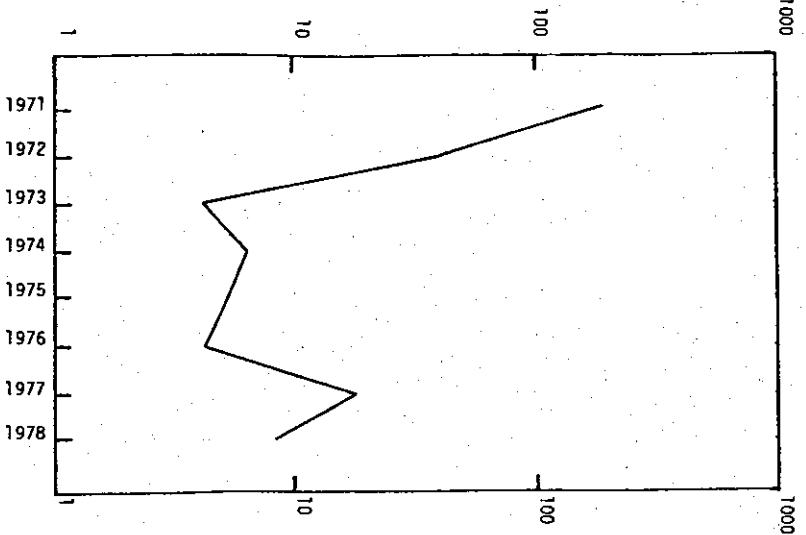
TOTAL SUSPENDED SOLIDS



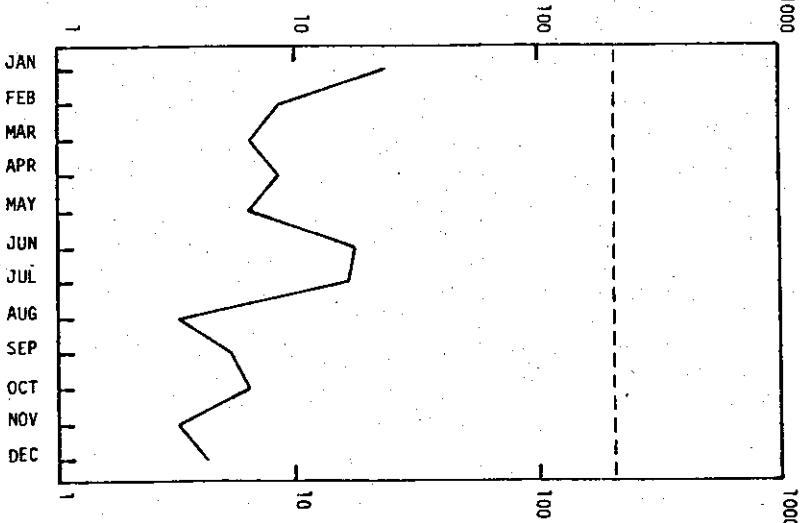
EFFLUENT FECAL COLIFORMS

SAVAGE

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

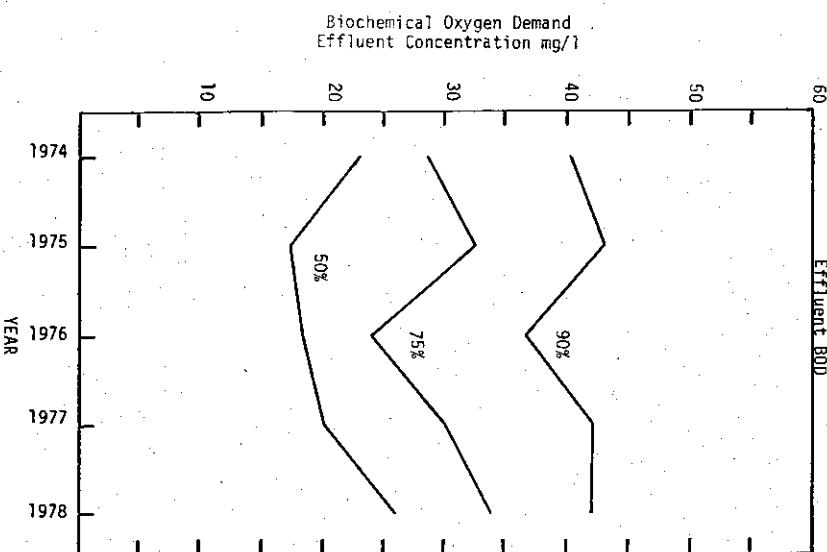


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means

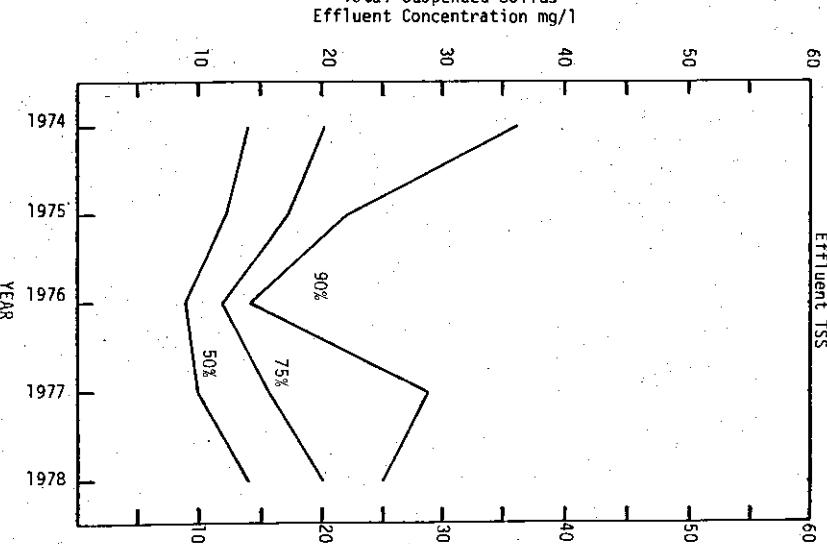


STATISTICAL ANALYSIS*

Effluent BOD



Effluent TSS



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values

SENECA WASTEWATER TREATMENT PLANT

Description:

The Seneca Wastewater Treatment Plant was placed into operation in July, 1972, and has a design capacity of 24 mgd. The treatment plant provides screening, grit removal, primary sedimentation, and a complete mix activated sludge process.

Plant Operation:

The daily average wastewater flow to the Seneca Plant increased from 11.72 mgd in 1977 to 12.7 mgd in 1978. At no time during 1978 did the monthly average flow exceed the design capacity of the plant. The Seneca Plant failed to comply with NPDES monthly effluent BOD limitations in April, May, July, and August. These failures have been attributed to nitrification occurring in the BOD test, thus, the violations are not true indicators of plant performance. All other monthly permit limitations were met during the year. Overall effluent quality in 1978 showed mixed results, with BOD and TSS quality declining and fecal coliform quality improving. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

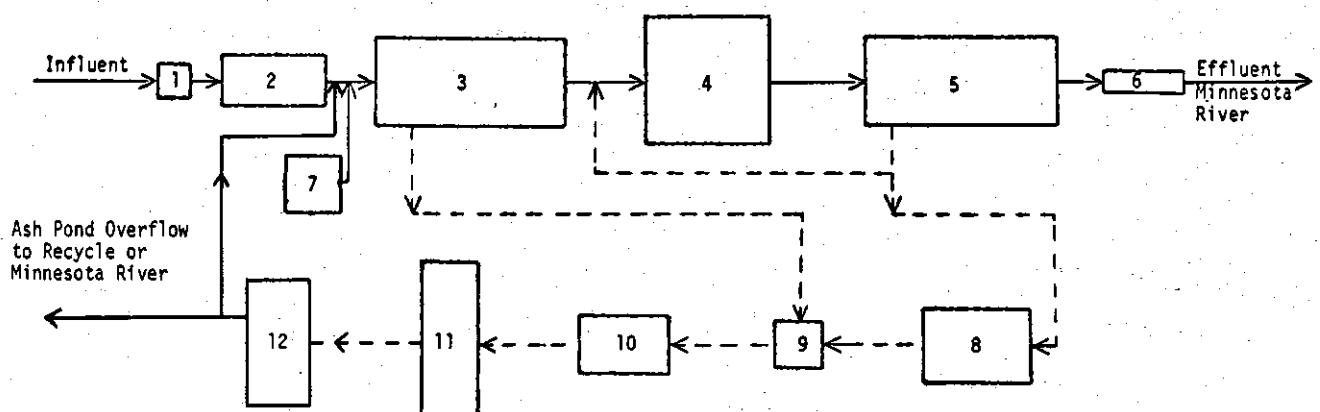
50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	12	14	18	19	20	25	28	28	39
TSS	11	14	14	18	18	19	27	22	27

* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Seneca Treatment Plant is considered a permanent facility. Space has been set aside for future expansion.

SENECA WASTEWATER TREATMENT PLANT
FLOW DIAGRAM



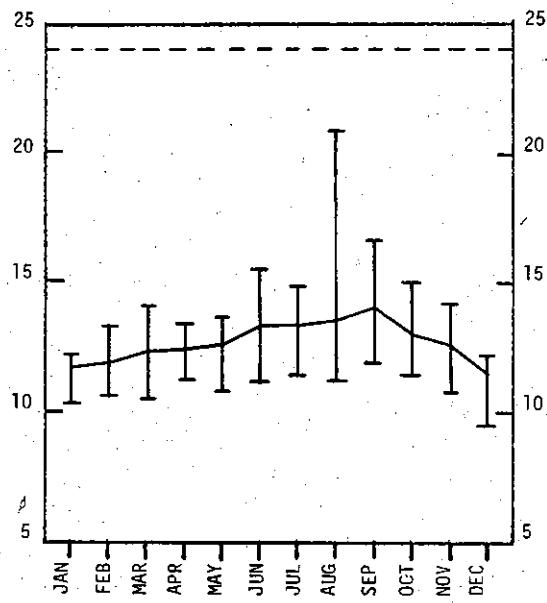
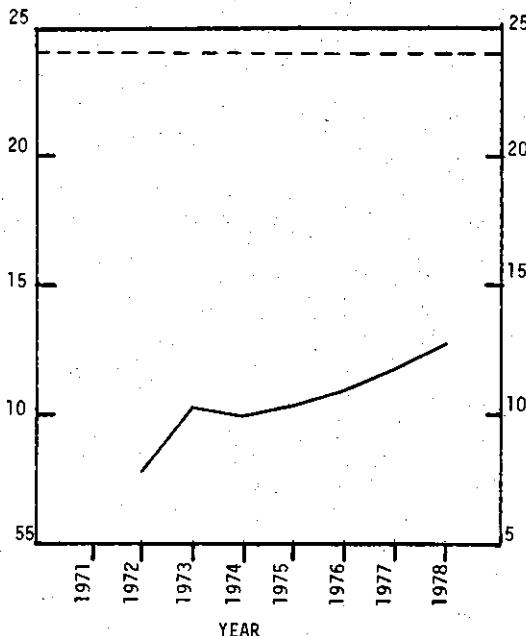
Unit Description

Liquid Phase	Solid Phase
1. Screening	8. Flotation Thickener
2. Grit Removal	9. Holding Tank
3. Primary Sedimentation	10. Vacuum Filtration
4. Activated Sludge	11. Incineration
5. Final Sedimentation	12. Ash Pond
6. Chlorination	
7. Chemical Addition and/or Pre-Chlorination	

Legend

- Liquid Flow
- - - Solids Transfer
- Existing Process Units
- [] Future Process Units

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: SENECA

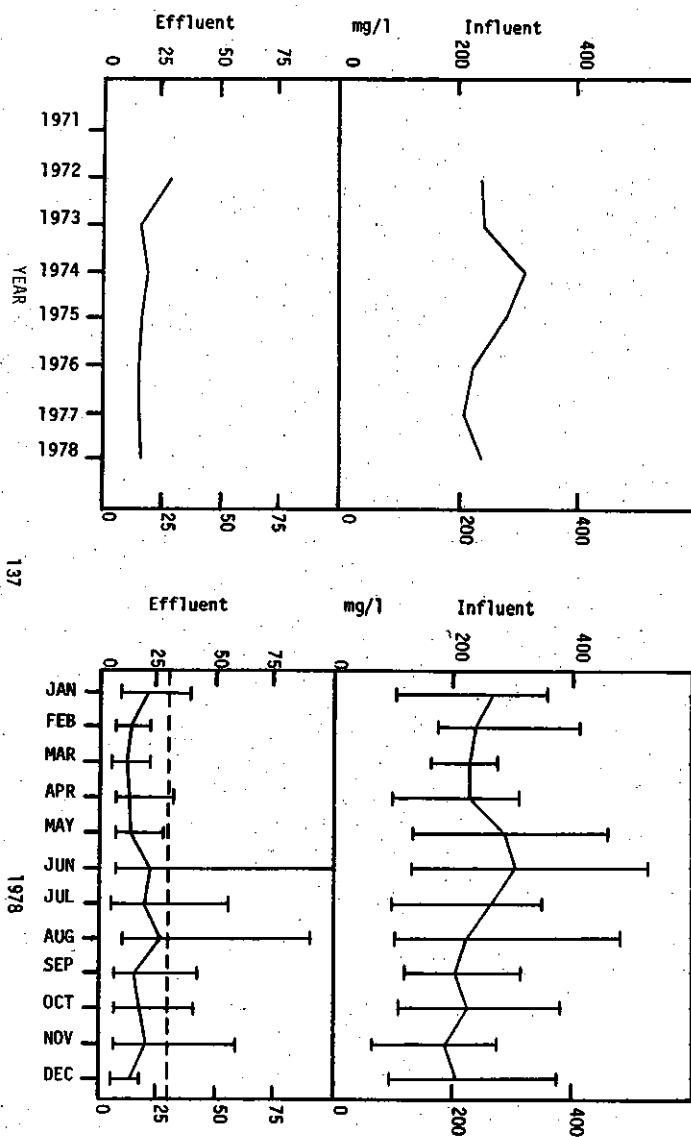
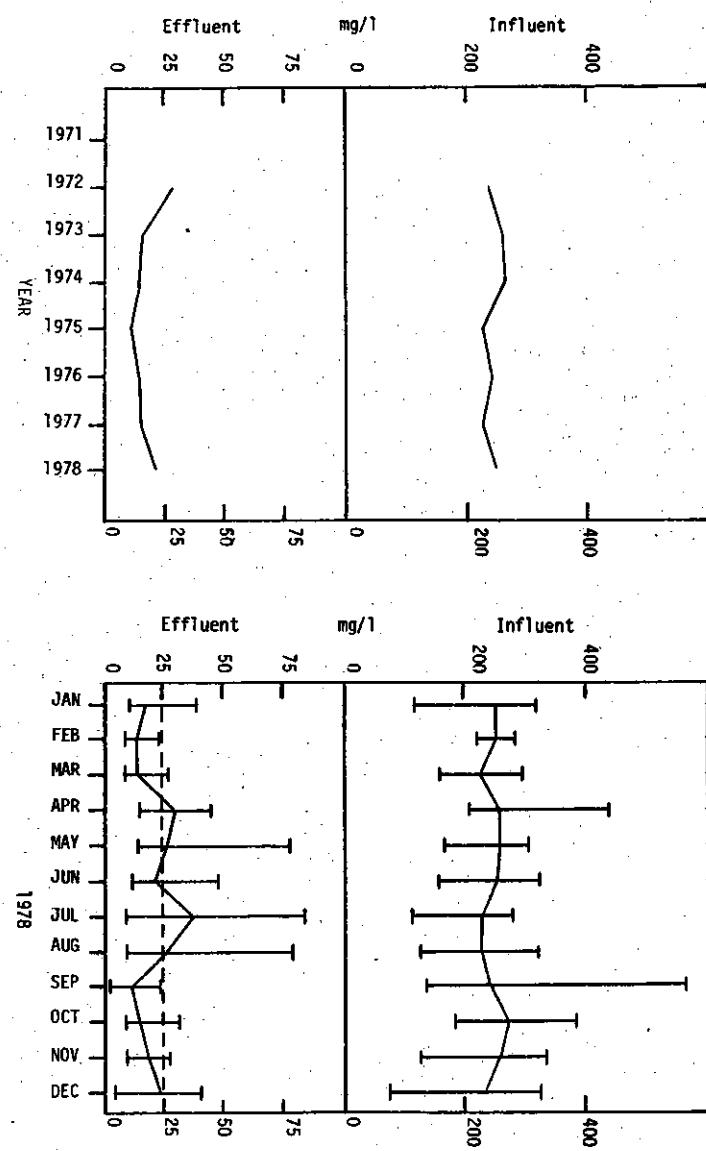
MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	Kj-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	11.62	-	258	576	271	31.5	26.0	7.4	6.3-7.6
FEBRUARY	11.85	-	258	550	204	31.4	23.0	7.9	7.1-7.7
MARCH	12.21	-	231	530	228	31.2	26.8	8.2	7.0-7.5
APRIL	12.31	-	262	534	228	28.5	23.8	7.4	6.9-7.7
MAY	12.5	51	263	559	291	30.3	21.2	9.3	6.7-8.9
JUNE	13.2	66	260	598	309	24.5	19.5	7.5	7.1-8.0
JULY	13.3	70	232	515	266	23.8	19.4	5.5	6.5-8.3
AUGUST	13.5	72	232	469	224	23.8	18.4	6.4	7.0-8.1
SEPTEMBER	14.0	72	246	446	206	25.9	20.1	5.8	6.8-8.1
OCTOBER	13.0	67	280	544	226	36.2	29.5	7.7	6.6-8.2
NOVEMBER	12.5	63	266	462	188	31.0	27.7	5.6	6.5-8.0
DECEMBER	12.5	55	239	491	208	37.3	28.8	7.0	7.0-8.3
1978 AVERAGE	12.7	64	252	523	240	29.6	23.7	7.1	6.3-8.9
1977 AVERAGE	11.72		203	484	209	32.1	26.1	7.6	6.7-9.3

MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: SENECA

* See Table 2

MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KjN mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL BOD	% REMOVAL TSS
NPDES Limitation														
JANUARY	17	90	21	5	11	27.2	23.5	0.28	0.38	4.6	8.9	7.0-7.8	93	92
FEBRUARY	13	89	13	2	8	27.1	21.8	0.23	0.28	4.3	9.0	7.4-7.8	95	95
MARCH	13	78	11	2	7	26.9	21.4	0.13	0.46	4.4	8.8	7.1-7.8	94	95
APRIL	30	83	13	23	8	27.1	24.0	0.55	0.38	3.9	8.8	7.0-7.8	89	94
MAY	27	73	13	4	8	25.1	20.6	0.26	0.39	4.1	8.1	6.6-8.0	90	96
JUNE	22	84	22	36	12	23.5	20.2	0.64	0.25	4.0	8.1	7.1-7.9	92	93
JULY	38	70	18	44	10	23.1	18.6	1.14	0.25	4.7	7.7	7.4-8.1	84	93
AUGUST	26.	83	26	11	14	19.6	15.8	0.59	0.41	3.4	7.6	7.3-7.8	89	88
SEPTEMBER	11	67	14	6	8	16.6	14.5	0.31	0.43	3.2	7.8	7.3-7.7	96	93
OCTOBER	15	73	17	6	10	21.7	18.1	0.26	0.39	4.1	7.9	7.1-7.8	95	92
NOVEMBER	19	91	20	5	11	26.0	20.9	0.42	1.08	4.2	7.8	7.2-7.7	93	89
DECEMBER	24	95	13	4	8	27.0	23.3	0.12	0.72	3.3	8.6	7.1-7.7	90	94
1978 AVERAGE	21	81	17	12	10	24.2	20.2	0.41	0.45	4.0	8.3	6.6-8.1	92	93
1977 AVERAGE	16	76	15	49	8	24.3	21.2	0.57	0.41	3.7	8.1	7.2-8.5	93	93

BIOCHEMICAL OXYGEN DEMAND

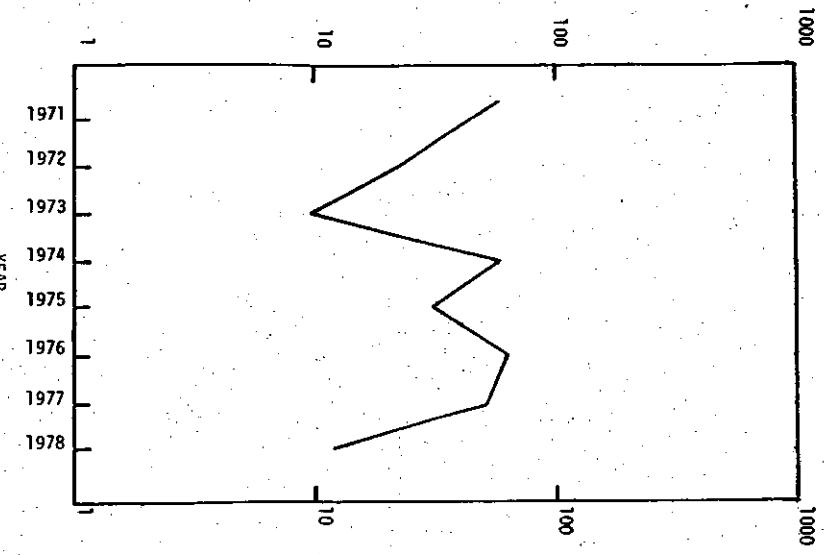


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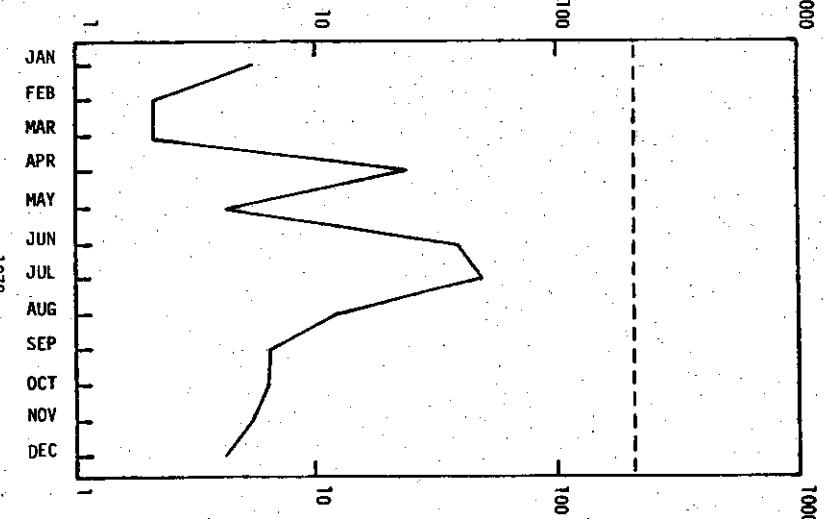
EFFLUENT FECAL COLIFORMS

SENECA

Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means

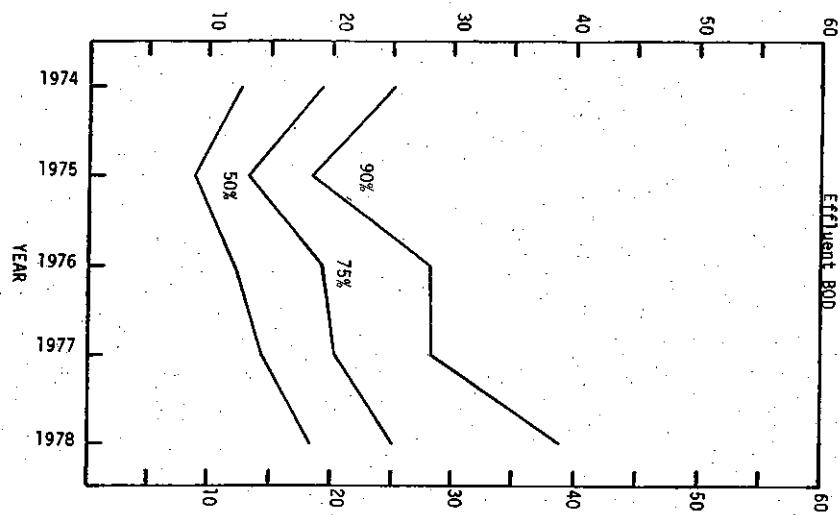


Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means

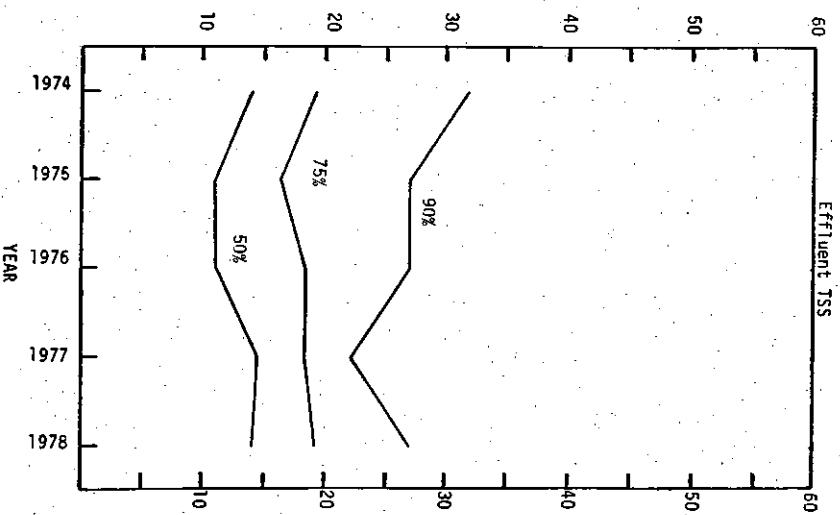


STATISTICAL ANALYSIS*

Biochemical Oxygen Demand
Effluent Concentration mg/l



Total Suspended Solids
Effluent Concentration mg/l



* Percent of Time Effluent Concentrations are Equal to or less than Plotted Values

STILLWATER WASTEWATER TREATMENT PLANT

Description:

The Stillwater Wastewater Treatment Plant was built in two stages. The original plant was constructed in 1959 and provided only primary treatment. Secondary treatment facilities were added in 1977 with the capability to be operated as a conventional, contact stabilization, or step aeration activated sludge process. In 1973, chemical facilities were added to allow for phosphorus removal. The plant has a design capacity of 3.0 mgd.

Plant Operation:

The daily average wastewater flow to the Stillwater Treatment Plant increased from 2.11 mgd in 1977 to 2.21 mgd in 1978. At no time during 1978 did the monthly average flow to the plant exceed the design capacity. There were no violations of NPDES monthly effluent limitations during the year. Overall effluent quality in 1978 showed mixed results, with improvement in BOD and fecal coliform, and a slight decline in TSS quality. Statistical analyses of data show the following trend in effluent BOD and TSS from 1976 to 1978:

Effluent Concentrations, mg/l*

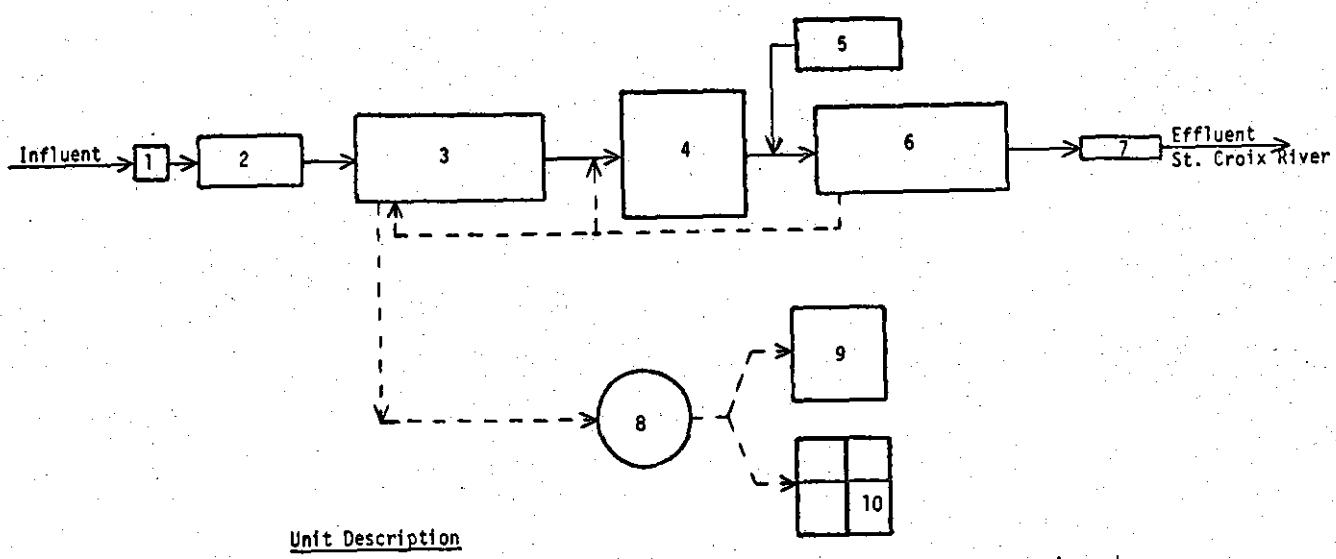
50% of Time			75% of Time			90% of Time			
1976	1977	1978	1976	1977	1978	1976	1977	1978	
BOD	8	8	8	11	14	14	14	24	18
TSS	9	7	10	12	10	14	16	13	18

* Percent of time effluent concentration equal to or less than value shown.

Plant Future:

The Stillwater Treatment Plant is considered to be a permanent facility.

**STILLWATER WASTEWATER TREATMENT PLANT
FLOW DIAGRAM**



Unit Description

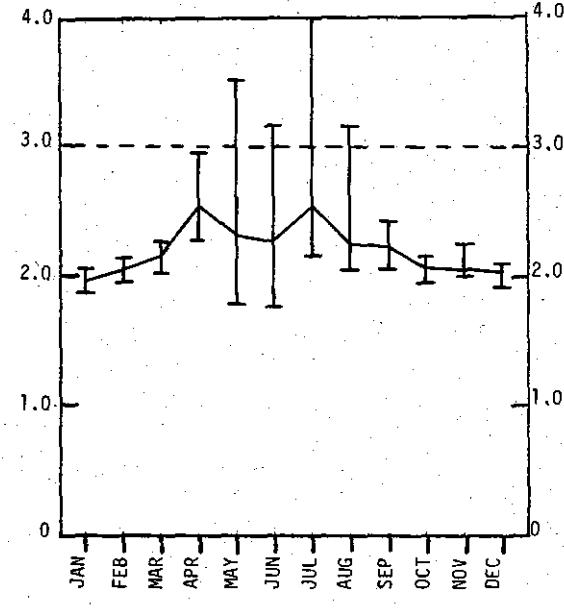
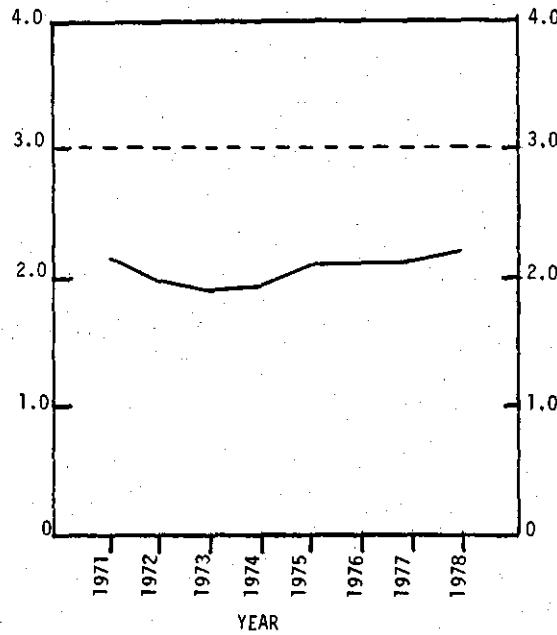
Liquid Phase

- 1. Screening
- 2. Grit Removal
- 3. Primary Sedimentation
- 4. Activated Sludge
- 5. Chemical Precipitation
- 6. Final Sedimentation
- 7. Chlorination
- 8. Anaerobic Digestion
- 9. Land Spread
- 10. Sand Drying Bed

Solid Phase

Legend

WASTEWATER FLOW
(mgd)



MONTHLY SUMMARY OF INFLUENT QUALITY
TREATMENT PLANT: STILLWATER

MONTH	WASTEWATER FLOW MGD	TEMP. °F	BOD mg/l	COD mg/l	TSS mg/l	KJ-N mg/l	NH ₃ mg/l	TOTAL P mg/l	pH RANGE
JANUARY	1.96	51	128	232	124	18.4	16.5	4.3	7.6-7.9
FEBRUARY	2.05	50	112	240	100	18.8	15.6	4.7	7.4-8.0
MARCH	2.16	49	105	252	113	20.5	16.6	4.3	7.5-8.0
APRIL	2.55	49	97	186	103	15.1	13.0	3.3	7.4-8.0
MAY	2.31	54	106	188	108	16.6	12.9	3.9	7.4-7.9
JUNE	2.28	59	107	222	120	15.4	12.9	4.2	7.4-8.6
JULY	2.54	63	91	158	112	17.3	14.3	3.4	7.6-7.9
AUGUST	2.26	63	165	149	188	17.0	12.5	4.2	7.4-8.1
SEPTEMBER	2.24	63	213	279	267	27.0	24.3	5.3	7.4-7.9
OCTOBER	2.07	61	212	235	202	22.8	19.5	4.5	7.4-8.2
NOVEMBER	2.06	57	271	341	339	20.2	18.7	8.6	7.4-8.4
DECEMBER	2.02	54	143	235	116	20.8	17.4	5.0	7.6-7.9
1978 AVERAGE	2.21	56	146	226	158	19.2	16.2	4.6	7.4-8.6
1977 AVERAGE	2.11	57	116	216	118	18.4	14.4	7.9	6.8-8.8

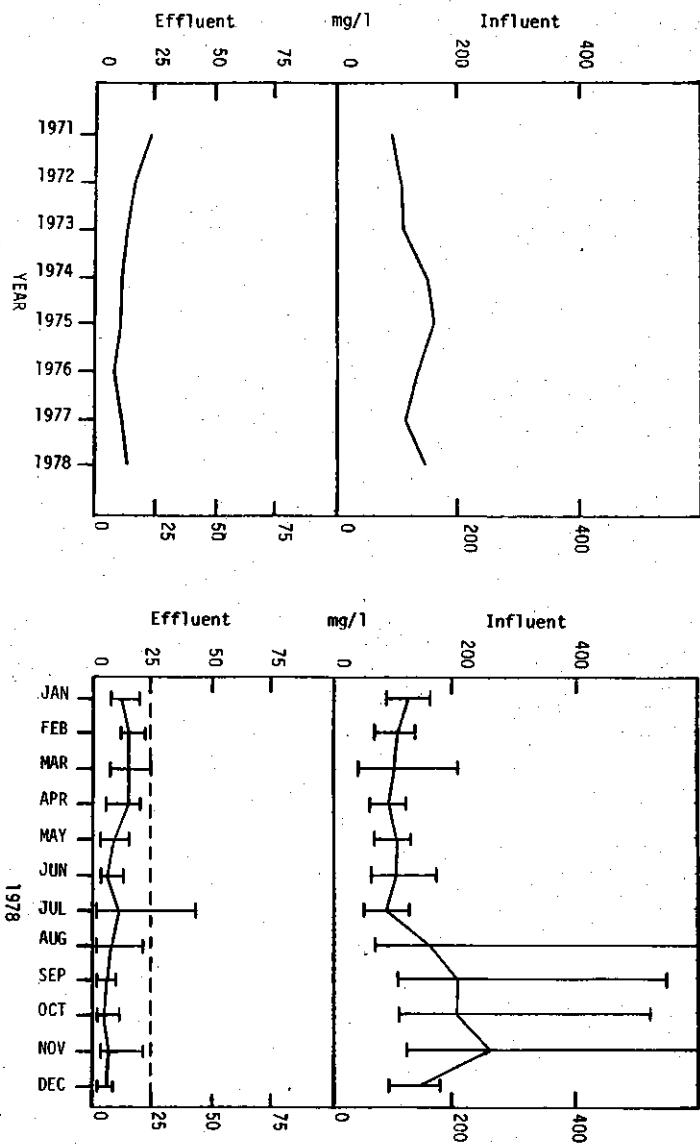
MONTHLY SUMMARY OF EFFLUENT QUALITY
TREATMENT PLANT: STILLWATER

* See Table 2

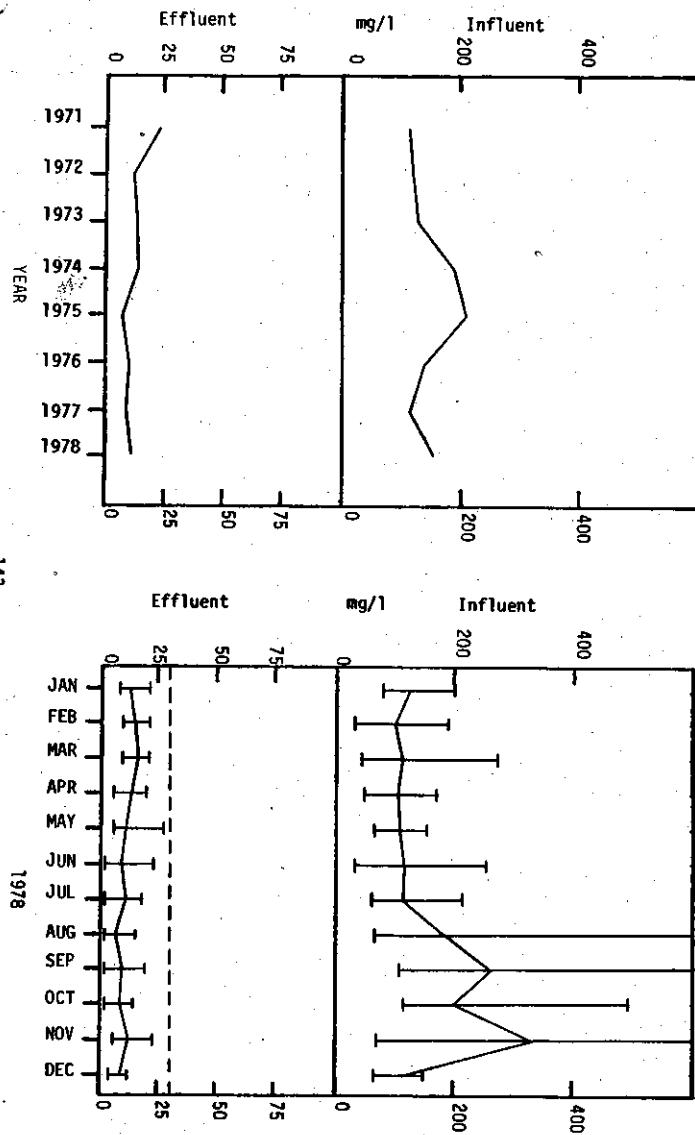
MONTH	BOD mg/l	COD mg/l	TSS mg/l	FECAL COLIFORM GEOMETRIC MEAN MPN/100 ml	TURB. JTU	KJ-N mg/l	NH ₃ mg/l	NO ₂ mg/l	NO ₃ mg/l	TOTAL P mg/l	D.O. mg/l	pH RANGE	% REMOVAL	
													BOD	TSS
*NPDES Limitation														
JANUARY	12	51	11	1	8	17.6	16.7	0.15	0.15	0.4	5.1	7.0-7.2	91	91
FEBRUARY	15	43	14	2	10	17.5	15.7	0.04	0.06	0.4	5.3	7.1-7.2	87	86
MARCH	15	61	15	1	10	17.5	15.7	0.04	0.14	0.5	5.2	7.1-7.8	85	87
APRIL	15	50	13	1	9	13.6	11.6	0.15	0.90	0.4	5.5	7.1-7.5	85	87
MAY	9	38	10	1	7	16.0	14.0	0.12	0.88	0.4	4.5	7.1-7.4	92	91
JUNE	6	33	8	2	5	15.0	14.0	0.12	0.13	0.3	4.0	7.0-7.2	94	93
JULY	12	25	10	2	5	12.9	11.6	0.10	0.05	0.3	3.8	7.0-7.3	87	91
AUGUST	8	22	6	4	4	14.3	12.8	0.48	0.39	0.2	3.6	7.0-7.3	95	97
SEPTEMBER	6	21	9	2	5	13.3	12.2	0.61	0.49	0.2	3.9	7.0-7.2	97	97
OCTOBER	5	24	8	1	5	16.1	15.5	0.20	0.38	0.3	4.3	7.0-7.3	98	96
NOVEMBER	7	27	12	1	7	16.2	15.6	0.04	1.08	0.5	4.3	7.1-7.3	97	96
DECEMBER	6	22	8	2	5	16.4	15.6	0.07	0.70	0.3	4.5	7.1-7.3	96	93
1978 AVERAGE	10	35	10	2	7	15.5	14.2	0.18	0.45	0.4	4.5	7.0-7.8	93	94
1977 AVERAGE	12	36	8	3	6	14.4	13.3	0.53	0.93	0.4	4.8	6.8-7.5	90	93

STILLWATER

BIOCHEMICAL OXYGEN DEMAND



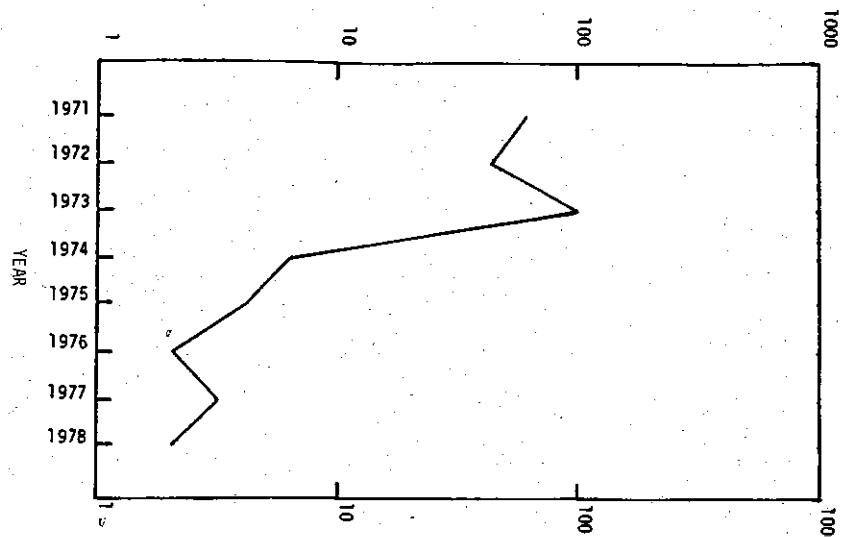
TOTAL SUSPENDED SOLIDS



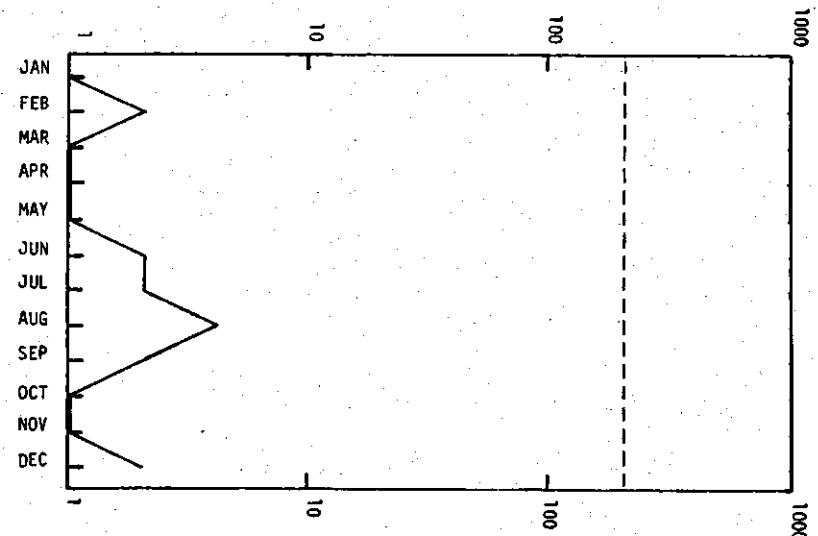
EFFLUENT FECAL COLIFORMS

STILLWATER

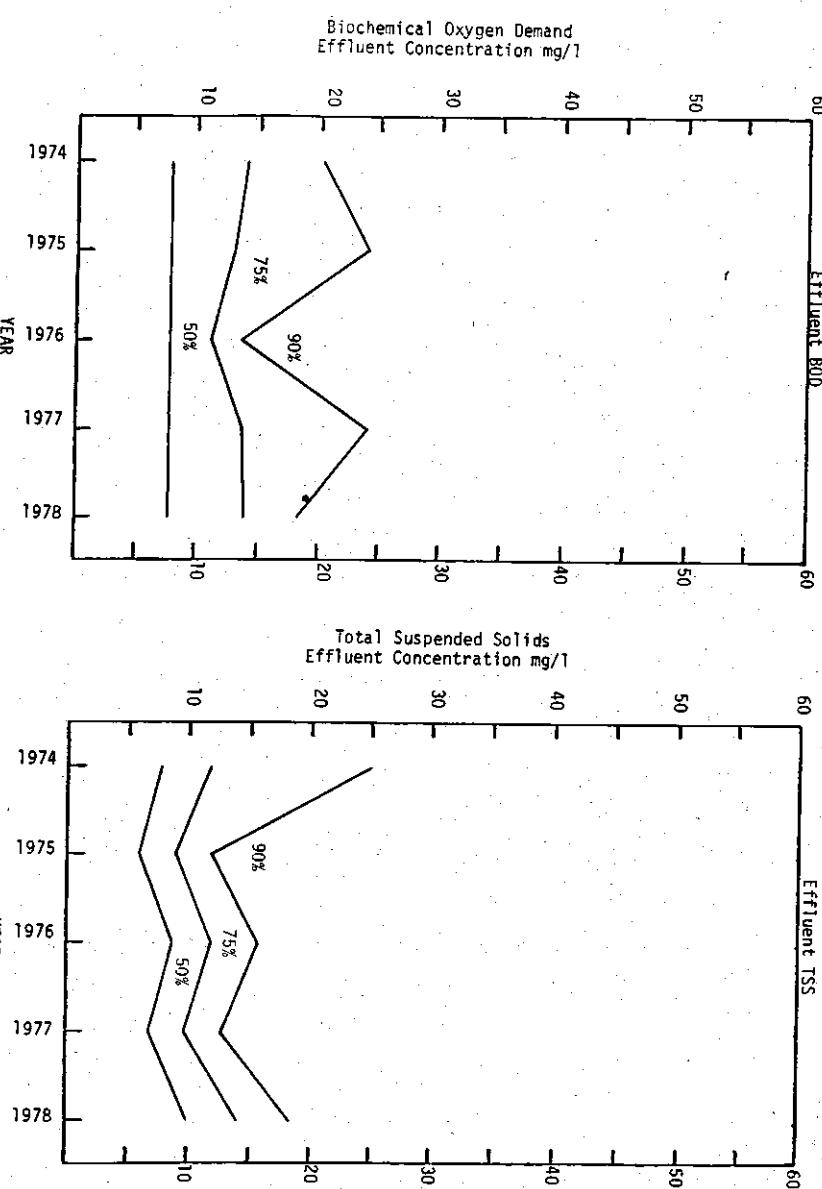
Effluent Fecal Coliforms MPN/100 ml
annual value is average of monthly geometric means



Effluent Fecal Coliforms MPN/100 ml
monthly values are geometric means



STATISTICAL ANALYSIS*



* Percent of Time Effluent Concentrations are Equal to or Less than Plotted Values

APPENDIX

ABBREVIATIONS, STATISTICAL TABLES, AND 1971
THROUGH 1978: TREATMENT PLANT QUALITY DATA

A B B R E V I A T I O N S

MGD or mgd	Million Gallons per Day
mg/l	Milligrams per Liter
ug/l	Micrograms per Liter
MPN/100 ml	Most Probable Number per 100 Milliliters
JTU	Jackson Turbidity Units
°F	Degrees Fahrenheit
BOD	Biochemical Oxygen Demand (generally means BOD ₅ , or Five Day Biochemical Oxygen Demand)
COD	Chemical Oxygen Demand
D.O.	Dissolved Oxygen
Kj-N	Kjeldahl Nitrogen
NH ₃	Ammonia (nitrogen)
NO ₂	Nitrite (nitrogen)
NO ₃	Nitrate (nitrogen)
pH	Indicates Acidity/Alkalinity level
Total P	Total Phosphorus
TSS	Total Suspended Solids
Turb.	Turbidity
>	Greater Than
<	Less Than
INF	Influent
EFF	Effluent
NPDES	National Pollutant Discharge Elimination System
Std.	Standard
Cd	Cadmium

Cr	Chromium
Cu	Copper
Hg	Mercury
Ni	Nickel
Pb	Lead
As	Arsenic
Zn	Zinc
Sn	Tin
Cn	Cyanide

Definition of Parameters

Biochemical Oxygen Demand (BOD) is a measure of the dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in wastewater. A low BOD in the plant discharge is desirable because this would cause the least amount of oxygen depletion in the receiving body of water.

Chemical Oxygen Demand (COD) is a measure of the dissolved oxygen required to chemically oxidize the organic matter present in wastewater. A low COD is desirable in plant effluent discharges.

Total Suspended Solids (TSS) is a measure of the amount of particulate matter found suspended in a given amount of wastewater.

pH is a measure of the hydrogen ion concentration in a given sample of water. It is used as an indication of acidity or alkalinity.

Dissolved Oxygen (DO) is a measure of the concentration of oxygen dissolved in a given sample of water. A sufficient DO level in plant effluent discharges is important because dissolved oxygen is required for the life processes of aquatic organisms.

Fecal Coliform organisms are present in wastewater and are used as indicators of possible pathogenic pollution.

Ammonia (NH_3), Nitrate (NO_3), and Nitrite (NO_2) are nitrogenous compounds found in wastewater. Excessive discharges of these compounds can adversely affect the receiving body of water. They are also used to monitor treatment plant processes.

Phosphorus (P) is monitored because it also can have adverse effects on the receiving body of water if discharged in sufficient quantities.

Heavy Metals covered in this report include the following; copper (Cu), chromium (Cr), zinc (Zn), lead (Pb), cadmium (Cd), mercury (Hg), nickel (Ni), arsenic (As), and tin (Sn). Close monitoring of heavy metals is necessary due to their toxicity in sufficient concentrations.

I N F L U E N T B O D D A T A 1 9 7 1 - 1 9 7 8

TREATMENT PLANT	ANNUAL AVERAGE VALUES, BOD (mg/l)				1971 - 1978			
	1971	1972	1973	1974	1975	1976	1977	1978
ANOKA	182	223	240	237	189	170	175	199
APPLE VALLEY	211	235	220	228	204	189	228	216
BAYPORT	225	286	229	282	330	270	228	200
BLUE LAKE	-	-	300	304	271	282	258	266
CHASKA	171	196	200	185	222	241	203	200
COTTAGE GROVE	279	260	250	234	222	197	209	198
FARMINGTON	279	400	329	957	453	452	447	338
HASTINGS	300	233	183	175	161	187	189	243
LAKEVILLE	144	150	213	426	373	570	432	290
LONG LAKE	212	171	257	258	150	183	201	163
MAPLE PLAIN	120	79	186	186	80	129	156	142
MEDINA	150	90	140	124	156	246	285	300
METROPOLITAN	247	267	256	256	241	266	246	215
ORONO	125	143	167	158	105	110	141	116
PRIOR LAKE	189	118	140	111	104	110	76	103
ROSEMOUNT	-	-	70	246	213	220	203	198
SAVAGE	138	217	175	184	191	163	283	179
SENECA	-	242	267	270	235	247	230	252
STILLWATER	89	106	108	157	161	140	116	146
WACONIA	-	-	-	-	169	676	341	-

INFLUENT TSS DATA 1971-1978

TREATMENT PLANT	ANNUAL AVERAGE VALUES, TSS(mg/l) 1971-1978							
	1971	1972	1973	1974	1975	1976	1977	1978
ANOKA	240	300	267	302	234	195	176	164
APPLE VALLEY	258	329	320	378	300	229	271	274
BAYPORT	220	269	200	326	317	227	147	144
BLUE LAKE	-	-	244	364	347	361	324	317
CHASKA	212	190	184	194	226	292	180	180
COTTAGE GROVE	350	318	274	294	241	185	220	200
FARMINGTON	259	296	225	361	250	223	235	189
HASTINGS	333	333	225	198	199	207	184	252
LAKEVILLE	174	212	327	849	997	876	759	388
LONG LAKE	206	294	288	446	187	261	274	195
MAPLE PLAIN	63	62	118	193	83	134	182	228
MEDINA	138	125	133	141	214	365	385	487
METROPOLITAN	313	318	308	317	316	332	288	231
ORONO	136	167	167	235	168	146	176	167
PRIOR LAKE	255	183	193	123	180	139	83	149
ROSEMOUNT	-	-	50	230	258	230	226	235
SAVAGE	267	700	280	269	278	241	249	265
SENECA	-	242	243	319	282	225	209	240
STILLWATER	115	120	130	193	210	140	118	158
WACONIA	-	-	-	-	187	381	270	-

EFFLUENT COLIFORM DATA 1971 - 1978

TREATMENT PLANT	ANNUAL VALUE IS ARITHMETIC AVG. OF MONTHLY GEOMETRIC MEANS							
	1971	1972	1973	1974	1975	1976	1977	1978
ANOKA	37	49	4	57	85	24	21	40
APPLE VALLEY	402393	11449	7	6	6	11	24	16
BAYPORT	335	988	7	5	31	12	16	2
BLUE LAKE	-	-	275	1	1	2	4	9
CHASKA	320363	2375	35	22	20	29	11	20
COTTAGE GROVE	20615	362	320	537	55	10	30	43
FARMINGTON	5836	914	597	39	17	4	36	18
HASTINGS	10	9	16	228	36	35	48	26
LAKEVILLE	12685	686	19	8	8	3	12	84
LONG LAKE	217	64240	195	65	274	70	30	21
MAPLE PLAIN	983	0	129	27	17	44	23	45
MEDINA	-	-	-	-	--	-	-	-
METROPOLITAN	683	96	9	19	11	38	24	198
ORONO	8	0	146	36	28	12	34	27
PRIOR LAKE	8957	607	14	125	20	12	3	8
ROSEMOUNT	-	-	-	75	5	2	2	1
SAVAGE	180	37	4	6	5	4	16	8
SENECA	-	22	9	56	30	59	49	12
STILLWATER	58	42	94	6	4	2	3	2
WACONIA	-	-	-	-	2054	97	79	-

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