88-e05

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COLLEGE PLACE STP CLASS II INSPECTION

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ABSTRACT

A Class II inspection was conducted at the College Place Sewage Treatment Plant (STP) on June 23-25, 1987. The plant is a trickling filter facility followed by a lagoon system. Overall plant efficiency was acceptable during the inspection, although the mechanical portion of the plant was functioning less efficiently than expected. The cause of the reduced efficiency was not found, but soluble BOD_5 testing is recommended to help discern if treatability or plant operation is the problem source. Partial nitrification at the plant lead to the recommendation that $CBOD_5$ tests be allowed for NPDES permit compliance testing.

INTRODUCTION

A Class II inspection was conducted at the College Place STP on June 23-25, 1987. The inspection was designed to:

1. Measure treatment provided by process units.
2. Estimate loads to parallel streams of the treatment process.
3. Review analytical procedures and split samples to evaluate sampling and analytical accuracy.
4. Compare survey results to NPDES permit limits.

Conducting the inspection were Carl Neuchterlein of the Ecology Eastern Regional Office and Marc Heffner of the Ecology Water Quality Investigations Section. College Place STP staff who assisted were Al Rader, chief operator, and Marty Binghan, laboratory analyst.

The College Place STP is a secondary facility discharging into Garrison Creek as limited by NPDES Permit #WA-002065-6. A schematic of the treatment process is presented in Figure 1. The process starts with a headworks structure that includes a Parshall flume, comminutor, and three hydraseives. After pumping, the flow is split and routed through one of two parallel trains consisting of: primary clarifier (PC), trickling filter (TF), and secondary clarifier (SC) units. The secondary effluent is then sent through a series of three lagoons including a rock filter that is part of the discharge structure of the final lagoon. After chlorination, flow passes through a chlorine contact chamber, over a Cippoletti weir, and is discharged. Summer flow is either discharged to Garrison Creek or spray irrigated on a nearby hay field.

PROCEDURES

Ecology composite samples were collected at eight sites in the plant for two consecutive days. Isco automatic compositors were set to collect 200 mLs of sample every 30 minutes for 24 hours at six sites. Hand composites consisting of four equal volumes were collected at the other sites. Sampling times, sample locations, and

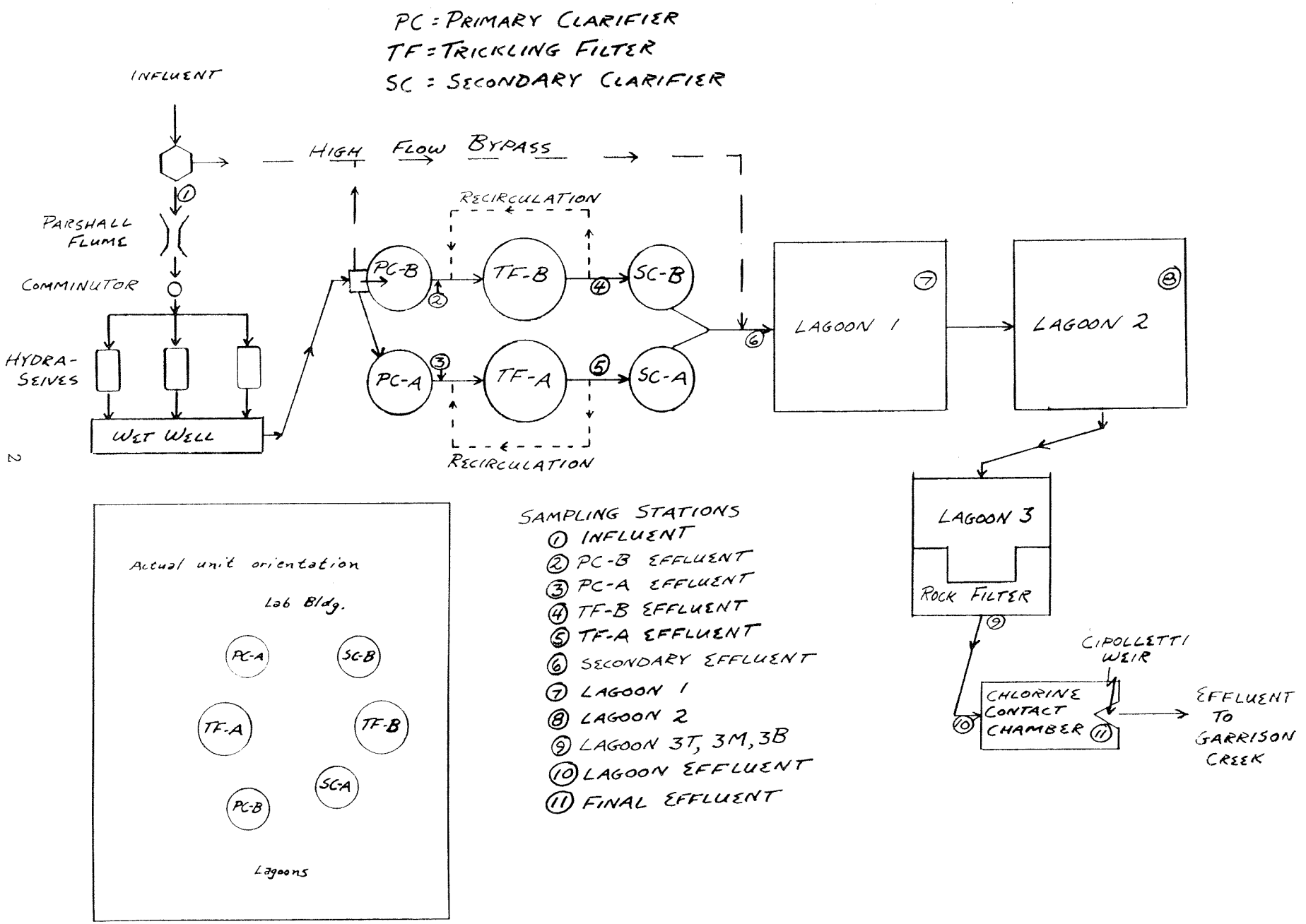

Figure 1. Flow scheme - College Place, 6/87.

parameters analyzed are included in Figure 1 or Table 1. Ecology grab samples were also collected for field and laboratory analysis as described in Table 2.

College Place composite samples were collected at 12 locations. The College Place sampling program calls for collection of approximately half of the sampling stations on each of two consecutive days. Automatic composite samplers collected influent and effluent samples while hand composites consisting of two to four grabs of equal volume were collected at the other sites. The influent composite was flow paced while the effluent sampler collected approximately 150 mLs of sample hourly for 24 hours. All College Place composites were split for analysis by the Ecology and College Place laboratories (Table 1).

Ecology instantaneous flow measurements were made at the influent Parshall flume and the effluent Cippoletti weir. An unsuccessful attempt was made to measure clarifier effluent flow rates using a Marsh-McBernie magnetic flowmeter. Dimensions of the treatment units were measured.

RESULTS AND DISCUSSION

Plant flows are measured at the influent Parshall flume and at a Cippoletti weir at the chlorine contact chamber discharge (Table 3). The influent flow meter had been malfunctioning for some time prior to the inspection and was not functional during the inspection. A replacement unit had been ordered. Ecology flume measurements showed the throat of the flume was bowed; being approximately one-half-inch narrow at its minimum width. The effluent meter was functional but was not accurate. A flow rate of 0.6 MGD was estimated from the Ecology instantaneous measurements for loading calculations in this report. Flow measurement has been a historic problem at the plant that needs to be corrected. The operator reported that new meters have been installed since the inspection (Nuechterlein, 1988).

Sizes of the treatment units are included in Table 4. Physical measurements of the mechanical portion of the plant closely approximate the design data. However, there were some discrepancies in lagoon size. A survey is suggested if knowledge of exact sizes becomes necessary.

Ecology data are summarized on Tables 5 and 6. The data are compared to College Place laboratory results on Table 7. Comparison of split samples suggests that most Ecology and College Place samples were similar. The influent sample was different with the College Place sample having higher BOD_5 and TSS concentrations than the Ecology samples. The College Place influent sample is considered suspect since it was flow proportional and the flow meter was malfunctioning.

Comparison of BOD_5 and TSS analytical results from both labs show Ecology found higher concentrations of both parameters in the split samples. The relationship between COD, BOD_5, and inhibited BOD_5 ($CBOD_5$) results for individual samples do not compare well for either lab in all cases. BOD_5, $CBOD_5$, COD, TSS, and nitrogen

Table 1. Composite sample collection - College Place, 6/87.

Station	Date	Time	Sampler	Laboratory	BOD_5 (mg/L)	Inhib. BOD_5 (mg/L)	COD (mg/L)	Solids (mg/L) TS	TNVS	TSS	TNVSS	Turb. (NTU)	Nutrients++ (mg/L) NH_3-N	NO_2 + NO_3-N	Total -P	Cond. (umhos/cm)	Alkalinity (mg/L as $CaCO_3$)
Influent	6/23-24	1300-1300	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		1200-1200	Col. Pl+	Ecology	X		X			X		X	X	X	X	--	X
				Col. Pl	X	X				X							
	6/24-25	1330-1330	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		Duplicate	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
Primary Effl. A	6/23-24	1300-1300	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		*	Col. Pl	Ecology	X		X			X		X	X	X	X	--	--
				Col. Pl	X					X							
	6/24-25	1330-1330	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
Primary Effl. B	6/23-24	1300-1300	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		*	Col. Pl	Ecology	X		X			X		X	X	X	X	--	--
				Col. Pl	X					X							
	6/24-25	1330-1330	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
Tr. Filt. A	6/24-25	*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X							
Tr. Filt. B	6/24-25	*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X							
Secondary Effluent	6/23-24	1300-1300	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		Duplicate		Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		*	Col. Pl	Ecology	X		X			X		X	X	X	X	--	--
				Col. Pl	X					X							
	6/24-25	1330-1330	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
Lagoon 1	6/23-24	**	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
	6/24-25	**	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X				X	X		
Lagoon 2	6/23-24	**	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
	6/24-25	**	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X				X	X		
Lagoon 3	6/23-24	1300-1300	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
	6/24-25	1330-1330	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
3T		*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X							
3M		*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X							
3B		*	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X					X							
Final Effluent	6/23-24	1300-1300	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X
		1200-1200	Col. Pl	Ecology	X		X			X		X	X	X	X	X	X
				Col. Pl	X	X				X				X	X		
	6/24-25	1330-1330	Ecology	Ecology	X	X	X	X	X	X	X	X	X	X	X	X	X

*hand composite collected by College Place. Two to four equal volumes of sample collected from 1200-1200 hours.
**hand composite collected by Ecology. Equal volumes collected at times noted below:
Lagoon 1 - 6/23-24: 6/23 @ 1350 & 1540; 6/24 @ 0805 & 1140
Lagoon 2 - 6/23-24: 6/23 @ 1400 & 1545; 6/24 @ 0815 & 1145
Lagoon 1 - 6/24-25: 6/24 @ 1350 & 1520; 6/25 @ 0820 & 1035
Lagoon 2 - 6/24-25: 6/24 @ 1345 & 1515; 6/25 @ 0825 & 1040
+flow-paced sample. All other samples time paced.
++College Place reported results for NO_2-N and NO_3-N individually. For phosphorus College Place reported total phosphates, ortho phosphates, and phosphorus.

Table 2. Grab sample collection - College Place, 6/87.

			FIELD ANALYSIS									LABORATORY ANALYSIS				
						Dissolved Oxygen (mg/L)				Chlorine Residual (mg/L)						
Sample*	Date	Time	Temp. (°C)	Cond. (umhos/cm)	pH (S.U.)	In	Out	Top	Middle	Bottom	Free	Total	COD (mg/L)	TSS (mg/L)	Fecal Coliform (#/100 mL)	Total Coliform (#/100 mL)	Metals and Percent Solids
Influent	6/23	1425	X	X	X												
	6/24	0850	X	X	X												
Hydraseive																	
Before	6/23	1450											X	X			
After													X	X			
Before	6/24	0855											X	X			
After													X	X			
Before	6/25	1105											X	X			
After													X	X			
Primary Clarifier-A Eff.	6/23	1435	X	X	X												
Primary Clarifier-B Eff.	6/23	1430	X	X	X												
	6/24	0905	X	X	X												
Secondary Clarifier-A	6/25	1025				X	X										
Secondary Clarifier-B	6/25	1025				X	X										
Secondary Clarifier Effluent	6/23	1415	X	X	X												
	6/24	0900	X	X	X												
Lagoon 1	6/23	1350	X	X	X												
	6/24	0840	X	X	X												
	6/25	1035						X	X	X							
Lagoon 2	6/23	1400	X	X	X												
	6/24	0830	X	X	X												
	6/25	1040						X	X	X							
Rock Filter	6/25	1050						X	X	X							
Final Effluent	6/23	1505	X	X	X						X	X					
	6/24	0820	X	X	X						X	X			MF X	MF X	
	6/24	1340													MF X	MF X	
	6/25	0835													MF X	MF X	
															MPN X	MPN X	
		1045					X								MF X	MF X	
															MPN X	MPN X	
Sludge (Dried)	6/24																X
(Digester)	6/25																X

* = sample collection and analysis by Ecology
MF = membrane filtration technique
MPN = most probable number technique

Table 3. Flow measurements - College Place, 6/87.

Date	Time	Ecology Instantaneous Measurement (MGD)	Plant Meter*
Influent			
6/23	1050	0.73	*Plant meter read 2.6 MGD throughout the inspection.
	1440	0.43	
	1535	0.58	
6/24	0800	0.71	
	1130	0.81	
	1425	0.73	
	1525	0.71	
6/25	0815	0.91	
	1105	1.03	
	1305	0.75	

			Plant Meter Measurements		
Date	Time	Ecology Instantaneous Measurement (MGD)	Instantaneous (MGD)	Totalizer	Flow for Time Increment (MGD)
Effluent					
6/23	1025	0.54	0.39	2150804	
					0.41
	1510	0.58	0.43	2151634	
					0.38
6/24	0820	0.54	0.43	2154347	
					0.42
	1435	0.46	0.39	2155430	
					0.41
6/25	0835	0.54	0.43	2158144	

Table 4. Unit sizes - College Place, 6/87.

Unit	Size		
	Design Data	Operator's Measurement	Ecology's Measurement
Primary clarifiers (A & B)			
diameter (feet)	30		30
depth (feet)	9.5		10.5
Trickling filters (A & B)			
diameter (feet)	42		42
depth (feet)			5
Secondary clarifier A			
diameter (feet)	26		26
depth (feet)	9.5		10
Secondary clarifier B			
diameter (feet)	30		30
depth (feet)	9.5		10
Lagoon #1			
surface (acres)	3.3	2.55	3.2
depth (feet)	5.0	6.0	
volume (MG)	5.3		5.2*
Lagoon #2			
surface (acres)	2.7	2.0	2.3
depth (feet)	7.5	7.0	
volume (MG)	5.5		4.6**
Lagoon #3			
surface (acres)	1.7	1.7	2.0+
depth (feet)	8	7.5	
volume (MG)			
Rock filter			
surface (acres)			0.4

*Calculated using 5.5-foot depth
**Calculated using 7-foot depth
+Does not include rock filter

Table 5. Ecology laboratory analyses of composite samples - College Place, 6/87.

Station	Date	Time	Sampler	BOD_5 (mg/L)	Inhib. BOD_5 (mg/L)	COD (mg/L)	Solids (mg/L) TS	TNVS	TSS	TNVSS	Turb. (NTU)	Nutrients (mg/L) NH_3-N	NO_2-N + NO_3-N	Total -P	Cond. (umhos/cm)	Alkalinity (mg/L as $CaCO_3$)
Influent	6/23-24	1300-1300	Ecology	170	120	350	600	290	150	23	35	20	0.05	8.7	648	229
		1200-1200+	Col. Pl	280		680			250		40	16	0.06	11	--	213
	6/24-25	1330-1330	Ecology	200	160	300	570	250	140	21	35	22	0.49	3.7	615	260
		Duplicate	Ecology	190	170	320	500	250	94	25	30	27	0.49	8.7	616	230
Primary Effluent A	6/23-24	1300-1300	Ecology	160	130	290	500	280	60	11	5	32	0.05	11	677	242
		*	Col. Pl	140		360			65		28	20	0.04	8.8	--	--
	6/24-25	1330-1330	Ecology	170	120	320	530	240	47	12	28	24	0.12	9.2	659	240
Primary Effluent B	6/23-24	1300-1300	Ecology	170	130	310	510	280	55	11	31	38	0.04	8.9	683	248
		*	Col. Pl	150		300			73		31	31	0.04	11	--	--
	6/24-25	1330-1330	Ecology	170	140	280	550	240	71	18	31	25	0.10	9.8	674	250
Trickling Filter A	6/24-25	*	Col. Pl	>150		330			150		34	27	0.23	11	628	230
Trickling Filter B	6/24-25	*	Col. Pl	>150		250			140		30	25	0.28	11	649	230
Secondary Effluent	6/23-24	1300-1300	Ecology	77	54	180	500	280	33	8	17	29	0.05	11	663	239
		Duplicate		79	56	160	530	260	30	5	18	31	0.11	11	663	241
		*	Col. Pl	68		160			39		17	27	0.02	9.6	--	--
	6/24-25	1330-1330	Ecology	93	55	170	450	260	52	13	18	27	0.07	9.7	653	240
Lagoon 1	6/23-24	**	Ecology	110	23	120	480	270	49	9	6	21	0.61	9.1	623	213
	6/24-25	**	Ecology	58	24	120	480	250	49	6	7	15	0.54	9.8	618	210
		*	Col. Pl	65		130			48		8	15	0.56	10	616	210
Lagoon 2	6/23-24	**	Ecology	>150	22	96	440	260	46	6	6	3.9	3.4	9.8	536	163
	6/24-25	**	Ecology	95	27	97	460	240	46	6	7	1.7	4.5	11	526	150
		*	Col. Pl	96		110			41		7	1.1	4.9	11	521	150
Lagoon 3	6/23-24	1300-1300	Ecology	75	12	50	420	240	12	3	5	3.4	0.20	9.6	509	173
	6/24-25	1330-1330	Ecology	60	13	64	380	220	8	3	9	2.1	0.28	9.8	515	180
3T		*	Col. Pl	60		81			27		7	0.43	3.2	9.7	510	150
3M		*	Col. Pl	>150		370			370		80	3.7	1.3	17	517	180
3B		*	Col. Pl	>150		230			1700		115	1.1	3.0	30	515	190
Final Effluent	6/23-24	1300-1300	Ecology	51	11	73	430	250	12	3	5	3.5	0.20	9.0	509	171
		1200-1200	Col. Pl	46		47			11		5	3.5	0.23	9.2	510	172
	6/24-25	1330-1330	Ecology	54	12	60	380	220	11	3	5	2.4	0.23	11	512	170

*hand composite collected by College Place. Two to four equal volumes of sample collected from 1200-1200 hours.
**hand composite collected by Ecology. Equal volumes collected at times noted below:
Lagoon 1 - 6/23-24: 6/23 @ 1350 & 1540; 6/24 @ 0805 & 1140
Lagoon 2 - 6/23-24: 6/23 @ 1400 & 1545; 6/24 @ 0815 & 1145
Lagoon 1 - 6/24-25: 6/24 @ 1350 & 1520; 6/25 @ 0820 & 1035
Lagoon 2 - 6/24-25: 6/24 @ 1345 & 1515; 6/25 @ 0825 & 1040
+Flow-paced sample. All other samples time-paced.

Table 6. Ecology Grab Sample Results - College Place, 6/87.

			Field Analyses									Laboratory Analyses			
						Dissolved Oxygen (mg/L)				Chlorine Residual (mg/L)				Fecal	Total
Sample	Date	Time	Temp. (°C)	Cond. (umhos/cm)	pH (S.U.)	In	Out	Top	Middle	Bottom	Free	Total	COD (mg/L)	TSS (mg/L)	Coliform (#/100 mL)	Coliform (#/100 mL)
Influent	6/23	1425	21.9	550	7.5											
	6/24	0850	21.7	620	8.1											
Hydrasieve																
Before	6/23	1450											710	190		
After													580	200		
Before	6/24	0855											380	200		
After													340	170		
Before	6/25	1105											670	140		
After													370	140		
Primary Clarifier A - Eff.	6/23	1435	21.8	650	7.5											
Primary Clarifier B - Eff.	6/23	1430	21.8	670	7.4											
	6/24	0905	20.9	700	7.5											
Secondary Clarifier A	6/25	1025				5.4	1.8									
Secondary Clarifier B	6/25	1025				5.3	2.5									
Secondary Clarifier Effluent	6/23	1415	21.5	600	7.8											
	6/24	0900	19.9	630	7.7											
Lagoon 1	6/23	1350	21.9	590	8.4											
	6/24	0840	20.5	600	8.3											
	6/25	1035						10.4	9.5	0.3						
Lagoon 2	6/23	1400	21.7	520	8.3											
	6/24	0830	20.8	510	7.6											
	6/25	1040						7.5	5.2	4.0						
Rock Filter	6/25	1050						3.2	0.7	0.8						
Final Effluent	6/23	1505	21.0	475	7.8						<0.1	<0.1			MF 440	MF 3300x
	6/24	0820	21.0	465	7.5						<0.1	<0.1			MF 480	MF 4700x
	6/24	1340													MF 450	MF 2300x
	6/25	0835													MPN 800	MPN 800
		1045					6.5								MF 310	MF 3000x
															MPN 1300	MPN 9000

MF = Membrane filtration test
MPN = Most probable number best
x = Many background organisms

Table 7. Ecology/College Place laboratory/sampling comparison - College Place, 6/87.

Station	Date	Time	Sampler	Laboratory	BOD_5 (mg/L)	Inhib. BOD_5 (mg/L)	COD (mg/L)	TSS (mg/L)	Nutrients (mg/L) NH_3-N	NO_3-N	NO_2N	NO_2 + NO_3-N	Total -P	Phos-phorus	Total Phos-phates	Ortho Phos-phates
Influent	6/23-24	1300-1300	Ecology	Ecology	170	120	350	150				0.05	8.7			
		1200-1200++	Col. Pl	Ecology	280		680	250	16			0.06	11			
				Col. Pl	230	228		234		13.2	0.132	13.3		11	>50	33
Primary Effluent A	6/23-24	1300-1300	Ecology	Ecology	160	130	290	60				0.05	11			
		*	Col. Pl	Ecology	140		360	65	20			0.04	8.8			
				Col. Pl	112			35								
Primary Effluent B	6/23-24	1300-1300	Ecology	Ecology	170	130	310	55				0.04	8.9			
		*	Col. Pl	Ecology	150		300	73	31			0.04	11			
				Col. Pl	110			43								
Trickling Filter A	6/24-25	*	Col. Pl	Ecology	>150		330	150	27			0.23	11			
				Col. Pl	96			131								
Trickling Filter B	6/24-25	*	Col. Pl	Ecology	>150		250	140	25			0.28	11			
				Col. Pl	100			156								
Secondary Effluent	6/23-24	1300-1300	Ecology	Ecology	78	55	170	32				0.08	11			
		*	Col. Pl	Ecology	68		160	39	27			0.02	9.6			
				Col. Pl	58			12								
Lagoon 1	6/24-25	**	Ecology	Ecology	58		120	49				0.54	9.8			
		*	Col. Pl	Ecology	65		130	48	15			0.56	10			
				Col. Pl	24			44		17.6	>1.65	>19.2		>17	43	>50
Lagoon 2	6/24-25	**	Ecology	Ecology	95	27	97	46				4.5	11			
		*	Col. Pl	Ecology	96		110	41	1.1			4.9	11			
				Col. Pl	47			47		52.8	>1.65	>54.4		>17	>50	>50
Lagoon 3	6/24-25	*	Col. Pl													
3T				Ecology	60		81	27	0.43			3.2	9.7			
				Col. Pl	38			28								
3M				Ecology	>150		370	370	3.7			1.3	17			
				Col. Pl	74			231								
3B				Ecology	>150		230	1700	1.1			3.0	30			
				Col. Pl	182			1405								
Final	6/23-24	1300-1300	Ecology	Ecology	51	11	73	12				0.20	9.0			
		1200-1200	Col. Pl	Ecology	46		47	11	3.5			0.23	9.2			
				Col. Pl	23	8		5		8.8	1.023	9.8		16	50	47

*Hand composite collected by College Place. Two to four equal volumes of sample collected from 1200-1200 hours.
**Hand composite collected by Ecology. Equal volumes collected at times noted below:

Lagoon 1 - 6/24-25: 6/24 at 1350 & 1520; 6/25 at 0825 & 1035
Lagoon 2 - 6/24-25: 6/24 at 1345 & 1515; 6/25 at 0825 & 1040

+College Place results reported for NO_2-N and NO_3-N. Results summed and reported as NO_2+NO_3-N for comparison.
++Flow-paced sample. All other samples time-paced.

data were reviewed to determine which data may be most accurate. The "most accurate" results are summarized in Table 8 and are used for further analysis in this report.

The data summary suggests that good treatment was being provided through the plant. Table 9 compares inspection data to NPDES permit limits. All parameters were within limits except for fecal coliforms. The coliform violations were expected because the chlorinators malfunctioned during the inspection and were inoperable. The chlorinators were repaired shortly after the inspection. The low coliform counts suggest that the treatment prior to chlorination reduced coliforms significantly.

Table 10 presents removal efficiencies through the plant. The primary clarifiers and trickling filters were reducing the load to the lagoons, but not as much as was expected. Primary clarifier and trickling filter sizing appeared adequate for the inspection flow (Table 11). The secondary clarifiers appeared to be the capacity limiting part of the mechanical plant. Analysis of the primary effluent and trickling filter effluent samples did not suggest that unequal performance of the parallel trains was a problem. Attempts to measure flows in each of the clarifiers were unsuccessful due to failure of the Ecology Marsh-McBernie flow meter; so the loading balance of the parallel trains could not be evaluated. Plant operation appeared appropriate and was not an apparent source of the lower-than-expected performance in the mechanical portion of the plant.

Treatability of the waste should be considered as a cause. Testing for soluble BOD_5 two times per month along with the routine influent and mechanical plant effluent tests is recommended. Treatability should be suspected if the soluble BOD_5 is routinely greater than 60 percent of the total influent BOD_5.

Treatment in the lagoons included BOD_5 reduction in the first cell and nitrification in cell 2 (Table 8). The apparent increase in BOD_5 in cell 2 is likely the result of this partial nitrification. The $CBOD_5$ was the same in cells 1 and 2. The rock filter effectively removed TSS from the effluent allowing permit compliance. The lack of $CBOD_5$ reduction in the second cell and lack of nitrification in the first cell accompanied by the fact that the cells are of similar size suggests that lagoon BOD_5 loading was approximately one-half of lagoon capacity during the inspection.

$CBOD_5$, rather than BOD_5, monitoring is recommended for College Place. The cell 2 $BOD_5/CBOD_5$ observations and the accompanying decrease in ammonia concentrations indicate that $CBOD_5$ effluent monitoring is appropriate for accurate measure of oxygen reduction due to biological activity on organic material. The BOD_5 measurement can include oxygen reduction in plants due to ammonia where partial nitrification occurs. Thus, treatment beyond what the permit requires is penalized unless $CBOD_5$ is monitored.

Metals data for College Place sludge samples are summarized in Table 12. The College Place sludge metals concentrations fell within the ranges of concentrations found in sludges from trickling filter and RBC plants around the state.

Table 8. Selected plant data* - College Place, 6/87.

	BOD_5 (mg/L)	Inhibited BOD_5 (mg/L)	TSS (mg/L)	NH_3-N (mg/L)	NO_2+NO_3-N (mg/L)	Total-P (mg/L)	Alkalinity (mg/L as $CaCO_3$)
Influent	185	140	145	23	0.27	8.7	245
Primary Effluent A	165	125	55	28	0.09	10	240
Primary Effluent B	170	135	63	31	0.07	9.3	249
Secondary Effluent	60	55	40	29	0.06	10	240
Lagoon 1	24	24	48	18	0.57	9.5	210
Lagoon 2	47	24	44	2.3	4.0	11	155
Final Effluent	23	10	11	3.0	0.21	10	170

*Data selected from Ecology and College Place laboratory results. Selected from available data on the basis of reasonable relationships for parameters presented.

Table 9. NPDES permit comparison - College Place, 6/87.

Parameter	NPDES Permit Limits Monthly Average	NPDES Permit Limits Weekly Average	Inspection Data Composite Data*	Inspection Data Grab Samples
BOD_5				
(mg/L)	30	45	23	
(lbs/D)	220	330	115	
(percent removal)	85		88	
TSS				
(mg/L)	30	45	11	
(lbs/D)	228	342	55	
(percent removal)			92	
Fecal coliform (#/100 mL)	200	400		440; 450; 310
pH (S.U.)	not outside 6.5 - 8.5			7.5; 7.8
Flow (MGD)	0.91		0.6**	

*From Table 8.
**Estimated from Ecology instantaneous influent flows.

Table 10. Treatment efficiency+ - College Place, 6/87.

Treatment	Removal		
	BOD_5	Inhibited BOD_5	TSS
Primary clarifier			
Actual	10%	7%	60%
Expected*	25 - 40%		50 - 65%
Trickling filter/secondary clarifier			
Actual	64%	58%	35%
Expected**	78 - 82%**		
Lagoons	62%	82%	73%
System	88%	93%	92%

+Calculated with data from Table 8
*Metcalf & Eddy, 1972
**WPCF, 1976 - 78% using NRC formula
82% using Galler & Gataas formula

Table 11. Mechanical plant loading - College Place, 6/87.

Unit	Size*	State Criteria (Ecology, 1985)	Capacity at State Criteria	Inspection
Primary Clarifiers (2)	diameter = 30 feet depth ~ 9.55 feet surface area (total) = 1410 ft^2	800 - 1200 gpd/ft^2 depth 8 - 12 ft	1.13 - 1.69 MGD	0.6 MGD
Trickling Filters (2)	diameter = 42 feet depth = 5 feet volume (total) = 13,850 ft^3 area (total) = 0.064 acre	25 - 300 lb BOD_5/1000 ft^3 High rate 10 - 40 MGAD	346 - 4155 lbs/D 0.64 - 2.6 MGD	850 lbs/D 1.46 MGD**
Secondary Clarifier (A)	diameter = 26 feet depth = 9.5 feet surface area = 530 ft^2	600 gpd/ft^2	0.32 MGD	0.3 MGD
Secondary Clarifier (B)	diameter = 30 feet depth = 9.5 feet surface area = 707 ft^2	600 gpd/ft^2	0.42 MGD	0.3 MGD

*From plant design data - Ecology field measurements corresponded closely to design data sizes - see Table 4.
**300 gpm (0.43 MGD) recycle to each trickling filter plus 0.6 MGD influent flow.

Table 12. Sludge metals data - College Place, 6/87.

Metal	College Place Sludge		Data from Previous Inspections*		
	Digester+ (mg/kg dry wt)	Drying Bed** (mg/kg dry wt)	Range (mg/kg dry wt)	Geometric Mean (mg/kg dry wt)	Number of Samples
Cadmium	3.1	3.1	0.01 - 16	5.6	16
Chromium	53.1	67	0.4 - 313	40	16
Copper	507	477	28 - 3100	500	16
Lead	118	123	100 - 1140	300	16
Nickel	21.2	3.3	12 - 46	29	14
Zinc	1960	1680	680 - 2500	1600	16

*Data collected during previous Class II inspections at trickling filter and RBC plants statewide.
**Percent solids = 92%.
+Percent solids = 4.2%

Laboratory Review

The STP laboratory methods were reviewed with Marty Binghan, the laboratory technician. The following recommendations were made to keep procedures in conformance with approved techniques.

Sampling:

Sampling procedures were acceptable. Use of compositors for influent and effluent samples had only been recently instituted. Sample lines should be cleaned regularly with a strong chlorine solution. The lagoon effluent samples were taken from the side of the lagoon rather than at the outlet structure. Because of the central location of the outlet structure, the location sampled is an acceptable practical alternative.

BOD_5:

1. Collection and handling of the effluent composite sample should be modified. The effluent sample is collected after chlorination. Sodium thiosulfate has been routinely placed in the composite jug prior to sample collection so the sample is dechlorinated as it is collected. The recommended procedure is to collect the sample and check for chlorine residual prior to setting up the BOD_5 test (APHA, 1985, p.529, 5.e.2). If chlorine residual is detected at that time, the sample should be dechlorinated prior to BOD_5 test set-up. The recommended procedure prevents excess dechlorination reagent from interfering with the test. All samples collected from a chlorinated source should be seeded (ibid.).
2. BOD_5 results should be calculated by averaging all test results in the acceptable range of depletions (APHA, 1985, p.531, 6.). Use of a 60 percent depletion rule is not suggested unless one of the dilutions is obviously unreliable.
3. The D.O. meter should be calibrated each day it is used to assure accurate test measurements are made.

TSS:

1. When determining both total and volatile suspended solids the crucible and filter should be fired in the muffle furnace prior to starting the test (APHA, 1985, p.96, 3.a.).
2. Redrying and reweighing filters until a constant weight is attained (0.5 mg weight loss between reweighings) is a suggested quality assurance technique. Quarterly checks of proper solids drying using the redry/reweigh technique are recommended.

Coliforms:

A brief review of the coliform procedures suggested appropriate techniques were being used.

RECOMMENDATIONS AND CONCLUSIONS

Laboratory results for the inspection were one of the concerns. The College Place laboratory procedures were generally acceptable. Several recommendations were made in the discussion to bring techniques into conformance with approved methods. Both Ecology and College Place results were inconsistent for several samples, so data for discussion had to be screened prior to use.

Sampling by College Place appeared good with the exception of the influent sample which was suspect. The influent automatic sampler was flow paced in conjunction with a malfunctioning flow meter.

Overall plant efficiency appeared acceptable. The mechanical portion of the plant was operating less efficiently than expected. Operational problems that could cause reduced efficiency were not apparent. Measuring influent and mechanical plant effluent soluble BOD_5 concentrations in addition to the regular BOD_5 test is suggested to help discern if wastewater treatability may be the cause of reduced efficiency.

Partial nitrification was occurring in the second lagoon cell. $CBOD_5$ is often a better indicator of organic characteristics of the effluent for partially nitrifying systems and is recommended for College Place.

Operational problems during the inspection included inaccurate flow meters and malfunctioning chlorinators. The operator reported that both problems have been corrected since the inspection.

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