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TREETOP, WENTACHEE WASTEWATER TREATMENT PLANT
CLASS II INSPECTION

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ABSTRACT

A Class II inspection was conducted at the Treetop, Wenatchee wastewater treatment plant on March 15-16, 1988. The plant was in compliance with all permitted parameters at the time of the inspection. Flows and loadings were well below designed limits, and effluent loadings also far below NPDES permit limits. Intermediate process sampling procedures, as required in the permit, were found to be helpful in understanding process dynamics. Some of the sample splits did not compare well. Based on this, and the findings of the laboratory procedures survey, several recommendations are made, including further lab sample comparisons. Other recommendations include a review of Treetop's preventive maintenance program and spare parts inventory.

INTRODUCTION

A Class II inspection was conducted at the Treetop, Wenatchee wastewater treatment plant on March 15-16, 1988. The inspection was requested by Harold Porath of Ecology's Central Regional Office. Conducting the inspection were Don Reif and Caroline Abshire of the Environmental Investigations Section (EI), formerly the Water Quality Investigations Section. Assisting were Glen Sagdal and Chuck Chapton of Treetop wastewater operations; Jeff Davis, Treetop engineer; and Harold Porath.

The objectives were:

1. Collect samples and measure flows to determine plant loadings and efficiencies.

2. Perform a laboratory evaluation, including sample splits, for accuracy and adherence to accepted analytical protocol.

3. Determine NPDES compliance.

4. Perform intermediate process sampling to assess appropriateness of the permit's process sampling requirements.

LOCATION AND DESCRIPTION

Wenatchee is located in Central Washington, in southern Chelan County. The Treetop, Wenatchee plant is slightly north of town, near Olds Station and the Chelan Industrial Area (Figure 1).

At Wenatchee, Treetop produces dehydrated and frozen apple products from the processing of low grade apples. Washing, cutting, slicing, and cooking of the apples results in a high BOD, high suspended solids waste. Processing solids are screened, dewatered, and removed for cattle feed. The remaining wastewater is treated in an extended aeration activated sludge system (Figure 2) after adding nutrients: nitrogen (as a urea/ammonia mixture) and phosphorus (ammonium polyphosphate). Final effluent is discharged to the Columbia River

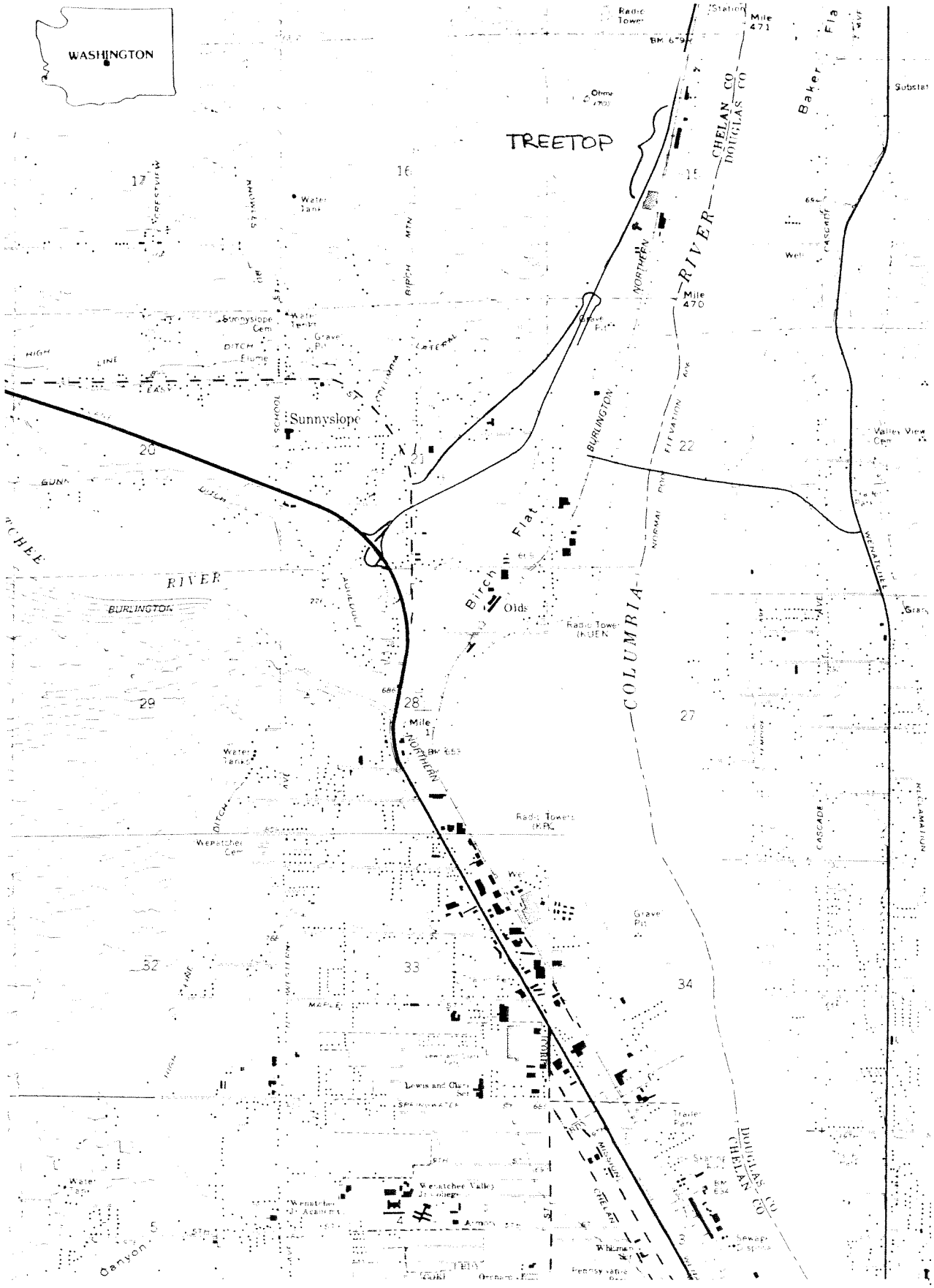

Figure 1. Location of Facilities: Treetop, Wenatchee Class II Inspection-March 15-16, 1988.

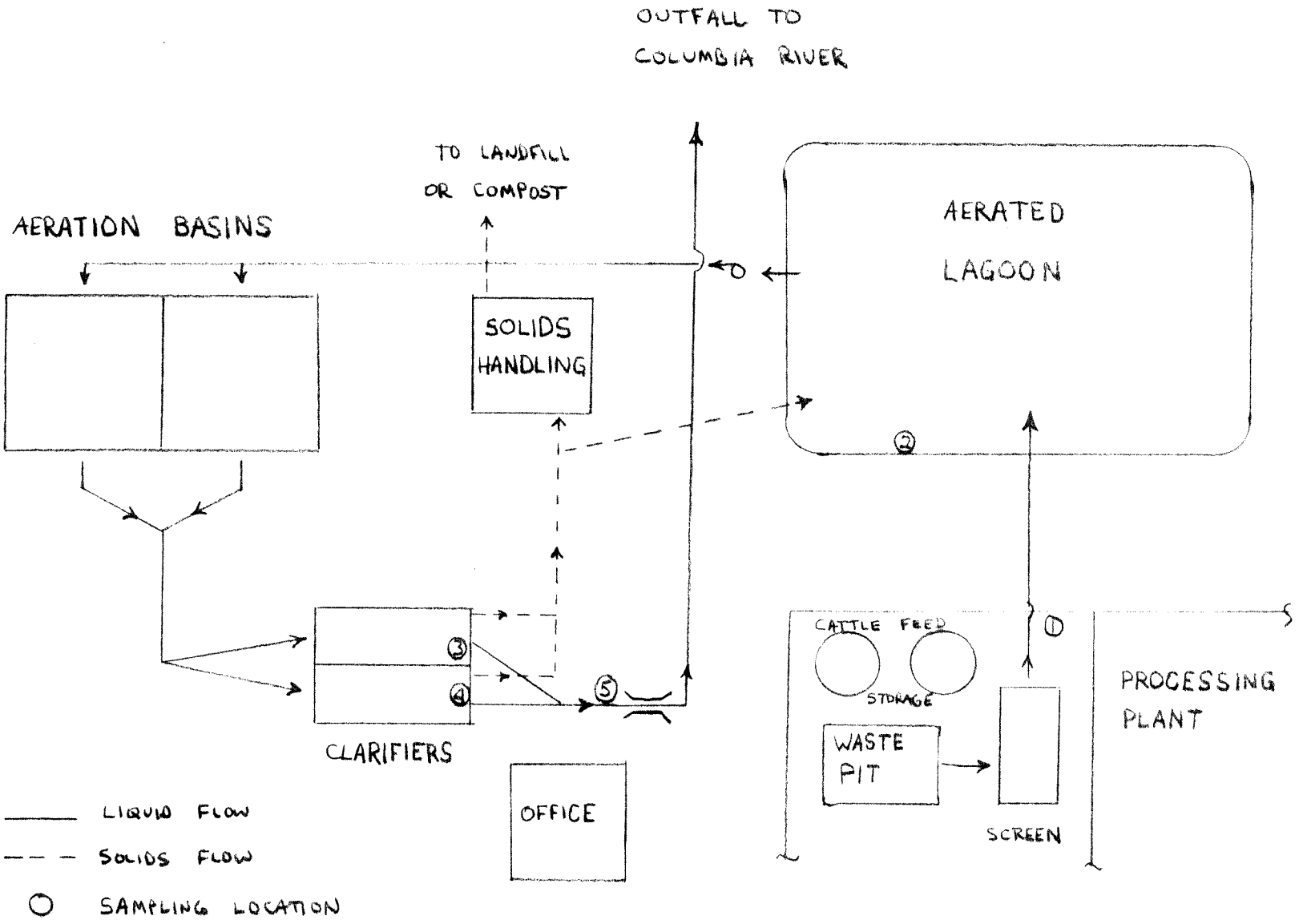

Figure 2. Treatment Plant Schematic with sampling locations:
Treetop, Wenatchee Class II Inspection- March 15-16, 1988.

via an outfall diffuser. Only apple processing wastewater is treated by this system. Sanitary wastes are routed to a septic tank/drainfield system for disposal. At the time of the inspection, waste activated sludge was dewatered on a belt press, then used as a fill material locally. Presently, part of the sludge is dewatered and used locally as a fertilizer. The remainder is trucked in liquid form to a land application site in Douglas County.

The current processing plant has been in operation about nine years. This was the first EI Class II inspection of the wastewater facilities.

METHODS

Twenty-four hour composited samples were collected from the influent and effluent. Approximately 200 mLs of sample were collected at 30 minute intervals. Grab samples were collected from the influent, aerated lagoon, effluent of each clarifier, and final effluent. Table 1 lists the sampling schedule. All samples were placed on ice and shipped to Ecology's Manchester Laboratory by overnight delivery.

RESULTS

General Conditions

The plant experienced two mechanical problems during the inspection. The east clarifier drive motor failed and was down for two hours on Tuesday. That night, the sludge return line plugged on the same clarifier. An upgrade of Treetop's preventive maintenance program and spare parts inventories may help minimize these types of problems in the future. Also, Treetop's effluent compositor did not collect a sufficient volume to allow splits to be conducted.

Ecology's sampling results are listed in Table 2. Several observations concerning the character of Treetop's treatment process can be made. The influent has a high COD content, much of which is in the form of dissolved solids. The influent also has a particularly high volatile (organic) content. A slight increase in non-volatile content occurs with the onset of biological treatment, as the bacteria have a higher non-volatile content than the influent stream. Nutrients, prior to addition, are quite low. Effluent nutrient concentrations were also quite low, indicating good application rates by plant personnel. The ortho-phosphorus content of the effluent was very low. However, the samples were very hard to digest, probably due to the high carbohydrate content (D. Thompson, 1988). Therefore, the total phosphorus results are considered only rough estimates.

Permit Compliance

Treetop was well within all permitted parameters at the time of the inspection. As shown in Table 3, the effluent daily load of BOD and TSS was only two and five percent, respectively, of the permitted amounts. The mechanical malfunctions during the inspection resulted in a

Table 1. Sampling Schedule: Treetop, Wenatchee Class II Inspection. March 15-16, 1988.

			Field			Laboratory Analyses													
										Nutrients					Solids				
Station	Date	Time	T	pH	Cond	pH	Turb	Cond	Alk	NH3	NO3	Tot-P	O-P	TS	TNVS	TSS	TNVSS	COD	BOD5
Grabs:																			
Influent	3/15	am	X	X	X	X	X	X	X	X	X	X				X	X	X	
	3/15	pm	X	X	X	X	X	X	X	X	X	X				X	X	X	
	3/16	am	X	X	X	X	X	X	X	X	X	X				X	X	X	
Lag.Eff.	3/15	am	X	X	X				X	X	X	X	X			X		X	X
	3/15	pm	X	X	X				X	X	X	X	X					X	X
	3/16	am	X	X	X				X	X	X	X	X			X	X	X	
Clar.Eff.E	3/15	am														X	X		
	3/15	pm														X	X		
	3/16	am														X	X		
Clar.Eff.W	3/15	am														X	X		
	3/15	pm														X	X		
	3/16	am														X	X		
Effluent	3/15	am	X	X	X	X	X	X	X	X	X	X				X	X	X	
	3/15	pm	X	X	X	X	X	X	X	X	X	X				X	X	X	
	3/16	am	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Composites:																			
Inf. Eco.	3/15-16		X	X	X	X	X	X	X					X	X	X	X	X	X
Inf. TTOP	3/15-16		X	X	X	X	X	X	X					X	X	X	X	X	X
Eff. Eco.	3/15-16		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eff. TTOP	3/15-16		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 2. Ecology Sampling Results: Treetop, Wenatchee Class II Inspection. March 15-16, 1988.

			Field			Laboratory Analyses													
										Nutrients, mg/L				Solids, mg/L				mg/L	
Station	Date	Time	Temp. (°C)	pH (Std. Units)	Cond. (Umhos/cm)	pH (Std. Units)	Turb. (NTU)	Cond. (Umhos/cm)	Alk. ($CaCO_3$)	NH_3	NO_3	O-P	Tot. Phos*	TS	TNVS	TSS	TNVSS	COD	BOD5
Grabs:																			
Influent	3/15	1030	16.3	-	-	6.4	150	2150	510	0.19	0.12		14			470	<1	18000	
	3/15	1520	16.6	-	-	6.7	120	2680	520	0.13	0.09		18			270	<1	16000	
	3/16	0905	16.1	-	-	6.8	210	3950	820	0.08	0.05		25			740	10	23000	
Lag.Eff.	3/15	1040	14.3	-	-				420	0.34	0.01	0.09	240			13000	910	14000	1500
	3/15	1515	14.3	-	-				430	0.31	0.01	0.10	230			12000	710	14000	1400
	3/16	0915	14.2	-	-				440	0.32	0.01	-	260			12000	930	14000	
Clar.Eff.E	3/15	1100	-	-	-											71	3		
	3/15	1540	-	-	-											74	4		
	3/16	0925	-	-	-											38	3		
Clar.Eff.W	3/15	1100	-	-	-											57	10		
	3/15	1540	-	-	-											57	4		
	3/16	0930	-	-	-											72	4		
Effluent	3/15	1110	12.1	-	-	7.1	14	2610	230	0.01	0.01		1.7			81	4	180	
	3/15	1550	12.1	-	-	7.2	13	2660	240	0.01	0.01		2.7			82	<1	210	
	3/16	0945	12.0	-	-	7.4	20	2610	220	0.01	0.01		1.2	1800	1500	50	<1	180	
Composites:																			
Inf. Eco.	3/15 -16	0850-0820	5.6	-	-	5.9	220	3110	360	3.2	0.011	5.2	12	15000	2000	380	20	16000	11000
Eff. Eco.	3/15 -16	0840-0810	3.1	-	-	7.5	14	2650	230	0.01	0.01	0.02	3.0	1900	1600	78	4	200	21

* - total phosphorus results are considered estimates only.

Table 3. Comparison of Ecology results to NPDES permit limitations: Wenatchee, Treetop Class II Inspection - March 15-16, 1988.

	NPDES permit limitations				
parameter:	Daily Maximum	30 Day Average	Annual Average	Ecology Results	% below annual average permit limits
Flow, mgd	0.15	0.15	0.15	0.0369+	75
BOD, lbs/day	1239	753	286	6.5	98
TSS, lbs/day	2224	1558	530	24	95
pH	between 6.0 to 9.0			-(*)	

+ - Treetop flowmeter reading
* - pH meter malfunctioned during inspection

visible deterioration of effluent quality. However, they did not cause Treetop to approach violation of any permit parameters.

Treetop's influent flow, TSS, and BOD loadings were also well below design criteria for the inspection period. As shown in Table 4, influent BOD and TSS loadings to the aeration basin were 34 and 9 percent, respectively, of the system's design criteria. A review of past discharge monitoring reports (DMRs) indicates that these loadings are below normal, but do occur at times during this part of the year.

Flow

Treetop measures their plant flow via a Palmer-Bowles flume in the effluent channel near the control building. The accuracy of this meter was checked with a Sigma bubbler meter, which proved to be poorly applicable to Palmer-Bowles flumes. The results were inconclusive. Treetop's flowmeter is professionally calibrated at regular intervals. Therefore, Treetop's recorded flow value was used in this report.

Laboratory Review/Comparison of Sample Splits

Several items were noted during the on-site laboratory inspection that needed attention. Those needing prompt attention were listed in a previous memo to Harold Porath (Reif, 1988). These items were: 1) installation of refrigerated composite samplers, influent and effluent; 2) repair or replacement of the laboratory pH meter, which had malfunctioned during the inspection; and 3) replacement of the dessicator dessicant to allow proper drying of suspended solids filters. Items 2 & 3 were taken care of by treatment system personnel soon after the inspection. A refrigerated effluent compositor has been installed, and one for the influent is planned in the near future (Davis, J., 1989).

In addition, several other items were noted during the inspection. Compositor sample lines should be cleaned with a chlorine solution at least every three months to prevent buildup of bacterial growth and/or solids deposition. For the BOD test, the blank's D.O. depletion was being subtracted from the sample's depletion. The blank functions as a check of dilution water quality and cleaning methods, and should not enter into the BOD calculations. Also, D.O. depletion of the sample should be at least 2.0 mg/L and have at least 1.0 mg/L remaining.

For analysis of suspended solids, filters should be pre-washed and dried before use. This step should be mandatory for permit parameters, but is optional for process control analyses. Last, dried filters should be removed from the drying oven after one hour and stored in the dessicator until used. These suggestions are compiled from Standard Methods (APHA-AWWA-WPCF, 1985).

As stated earlier, Treetop's compositors did not collect sufficient sample to allow splits to be be taken with Treetop. Any comparison of the two influent and two effluent samples (e.g., Ecology influent versus Treetop influent) is difficult. Since Treetop's compositors did not sample throughout the same period as did Ecology's sampler, no basis of comparison exists. Only Ecology's samples were available for split sample comparisons (Table 5). The split of

Table 4. Comparison of Ecology results to design criteria: Treetop, Wenatchee Class II Inspection - March 15-16, 1988.

Parameter:	Raw Waste(1)	Ecology Results	% below design
Flow, mgd	0.5	0.0369+	75
BOD, lbs/day	10,000	3,385	66
TSS, lbs/day	1,300	117	91

+ - Treetop flow meter reading

(1) - Design criteria from Treetop's O&M Manual

Table 5. Comparison of laboratory results - Treetop, Wenatchee Class II Inspection: March 15-16, 1988.

Composite Sample:	Sampler	Laboratory	pH	BOD5 (mg/L)	COD (mg/L)	TSS (mg/L)	TVSS (mg/L)
Influent	Ecology	Ecology	-	11,000	16,000	380	360
		Treetop	5.76	7,400	15,080	656	630
	Treetop	Treetop	4.61	3,200	6,900	1,248	948
Effluent	Ecology	Ecology	-	21	200	78	74
		Treetop	7.32	19	188	206	175
	Treetop	Treetop	7.6	23	226	242	220

Ecology's sample did not show good interlaboratory correlation for TSS and influent BOD. BODs on Ecology's influent sample differed by 33 percent. Suspended solids varied by 42 percent (influent) and 62 percent (effluent).

Due to these differences, further checks of Treetop's lab are recommended. First, adherence to Standard Methods should be verified. Then, evaluation of split samples and/or EPA performance samples is suggested.

Process Sampling

Based on results of this survey and review of past DMRs, most intermediate treatment process sampling seems to be justified. A correlation appears to exist between COD and BOD results in the ratio of 10 COD/1 BOD. If further testing verified this, CODs might by used in lieu of BODs to monitor strength of the lagoon effluent, and to supplement effluent BODs as well.

SUMMARY AND RECOMMENDATIONS

Treetop's wastewater treatment plant met all permit parameters at the time of the inspection. Effluent BOD and TSS were only two and five percent, respectively, of the annual average permitted amounts, and only 0.5 and 1.1 percent of the allowed daily maximum. Influent loadings were also light--BOD and TSS were only 34 and 8 percent, respectively, of the design criteria. Flowrate was 25 percent of design. Two mechanical problems occurred during the inspection. One consequence of these was that Treetop's composite samplers did not collect enough sample to allow laboratory splits. During the lab inspection, several cases were noted where Treetop's procedures varied from Standard Methods. Results of Ecology's sample split showed poor correlation of TSS and influent BOD.

Recommendations include:

1. An upgrade of Treetop's preventive maintenance program and spare parts inventory to minimize downtime of mechanical units.

2. Further checks of Treetop's lab for adherence to Standard Methods. This could include on-site visits as well as sample splits and EPA performance sample evaluations. Several specific lab recommendations are listed in the Laboratory Review section.

3. Verification of consistent COD/BOD ratio for lagoon and final effluent. If consistent, COD could be used for process control and supplement to effluent BOD, since it is a much faster and easier test.

REFERENCES

APHA-AWWA-WPCF, 1985. Standard Methods for the Examination of Water and Wastewater, 16th Edition.

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