STATE OF WASHINGTON
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DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, Olympia, Washington 98504

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MEMORANDUM
October 7, 1980

To: Dave Wright

From: Bill Yake

Subject: Granite Falls Class II

Introduction

A Class II and receiving water study was conducted at the Granite Falls wastewater treatment plant on August 26-27, 1980. The sampling inspection was conducted by Bill Yake and Sharon Chase (Water and Wastewater Section, Ambient and Compliance Monitoring Unit, DOE). Dave Wright represented the Northwest Regional Offices of DOE, while the town was represented by Barbara Alexander (Mayor) and Jerry Burke and Joe Poplin (operators). The receiving water study was coordinated by John Bernhardt and will be reported in a separate memorandum.

Setting

The Granite Falls wastewater treatment plant is a conventional primary plant constructed in the late 1950's. Figure 1 shows the plant and sampling points. Points of design which deserve particular mention are the previously unknown bypass from the comminutor chamber to the sludge beds, the lack of continuous flow recording equipment at the plant, and an underground chlorine contact chamber which appears to be a pipe with a weir at the effluent manhole which keeps water backed up into the pipe. Dye tests indicated this contact chamber does not have an adequate detention time.

The interceptor to the plant is very old (early 1900's) and in poor condition, allowing substantial infiltration. During high runoff periods, the interceptor leaks to a small creek. This condition will be described in the receiving water report.

The plant discharges to the Pilchuck River (segment number 03-07-19). The "1980 Analysis of Receiving Water Segments" (L. Singleton), gives the following water quality indices for this segment:

Table 1. Water Quality Indices* for Pilchuck River.

Temp.	Oxygen	pH	Bact.	Trophic	Aesth.	S. Solids	Ammonia Tox.	Overall Index Rating
25.3	7.6	6.6	22.3	7.2	9.2	(22.6)	2.6	13.7

*0-20, good; 20-60, marginal; > 60, unacceptable

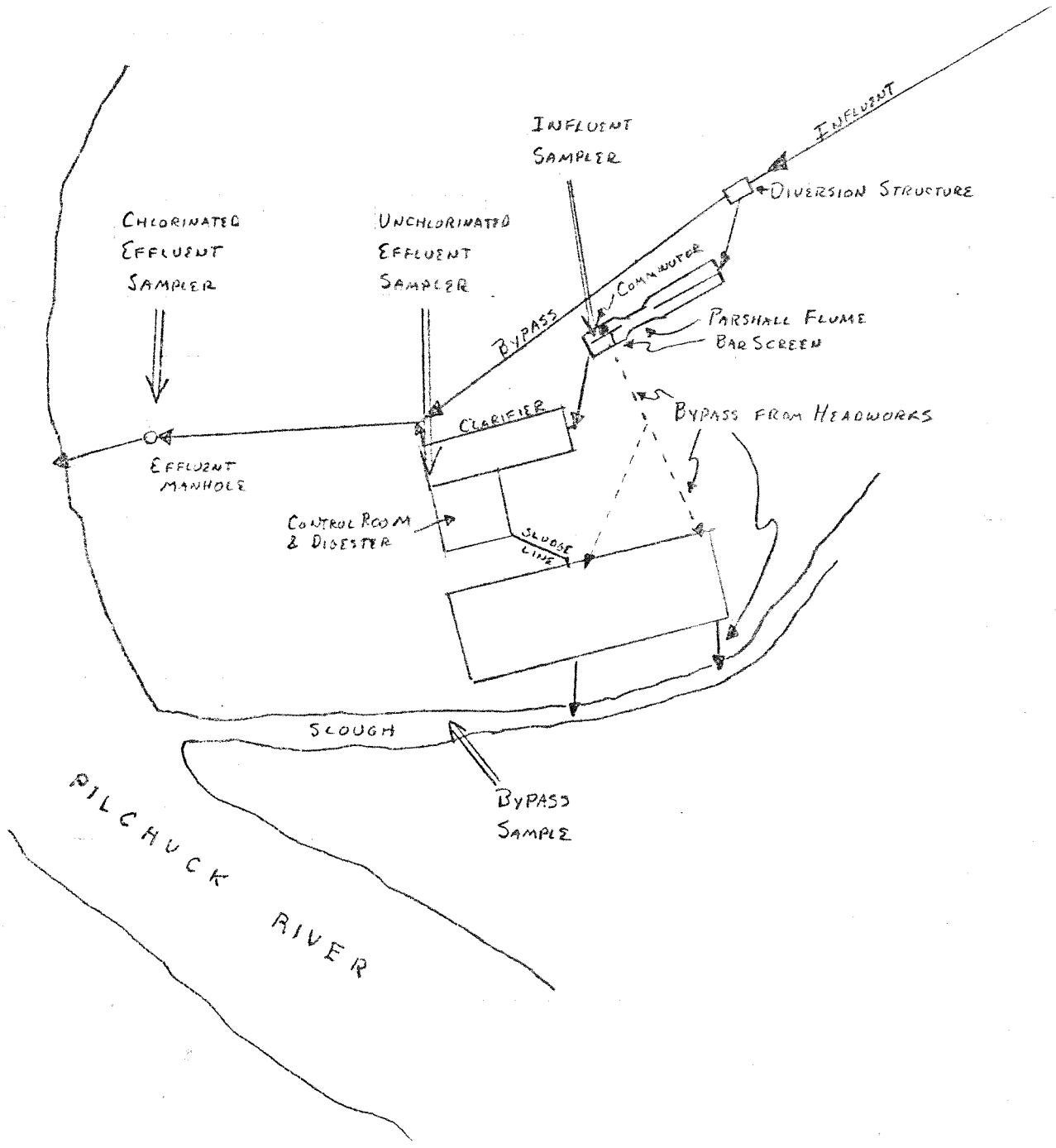

FIGURE 1. GRANITE FALLS STP AND SAMPLING LOCATIONS

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These indices are based on data collected at the Department's ambient monitoring station on the Pilchuck River at Snohomish (07B055).

Based on the overall WQI (13.7), this segment is ranked 41 in the state. Temperature problems are attributed to summer low flows and bacterial problems due to agricultural practices. The receiving water study will address in detail the effluent's impact on the river. Based on the facility inspection, it is probable that the plant substantially increases in-stream fecal coliform counts when bypasses occur. Based on the data collected during an observed bypass, one would expect in-stream fecal coliform counts to increase by about 1000 organisms/100 mls.

Sampling Inspection

A Manning "dipper" flow meter and totalizer was placed at the Parshall flume to obtain a record of plant flow. The script chart from this meter is shown in Figure 2. Heavy rains occurred during the afternoon of August 25 and the early morning of August 27.

These composite samplers were placed as noted in Figure 1. Samples from these compositors are not perfectly representative of plant waste flows during the 24-hour inspection primarily due to an unusual plant bypass which occurred in the early morning hours of August 27, 1980 (between about 0130 and 0915). On arrival at the plant on the morning of August 27, no flow was passing through the plant. The comminutor was stopped and influent flow was disappearing from the comminutor chamber. Investigation revealed that the entire plant flow was bypassing (by way of underground piping) to the sludge bed and then to a small (previously dry) slough which drains to the Pilchuck River. A grab sample of this bypass was obtained from the slough.

Under the bypass conditions, the influent sampler intake was dry, allowing no sample collection. The two effluent sample uptakes were located behind weirs; they continued to sample, but the water sampled was dead water because there was no through-plant flows. Therefore, the influent sample was probably somewhat stronger than the 24-hour average while the effluent samples could have been based slightly in either direction. It is probable that the efficiency of the plant (in BOD and TSS removal) is somewhat less than that indicated by the results.

When Terry and Joe (plant operators) arrived, they went to work on the comminutor and removed a rat from the blades. The failure of the communitor also caused flow to back up into the Parshall flume, making part of the flow record inaccurate. The estimated flow line (Figure 2, 1 a.m. to 9 a.m.) was used in concert with the rest of the record to estimate 24-hour flow.

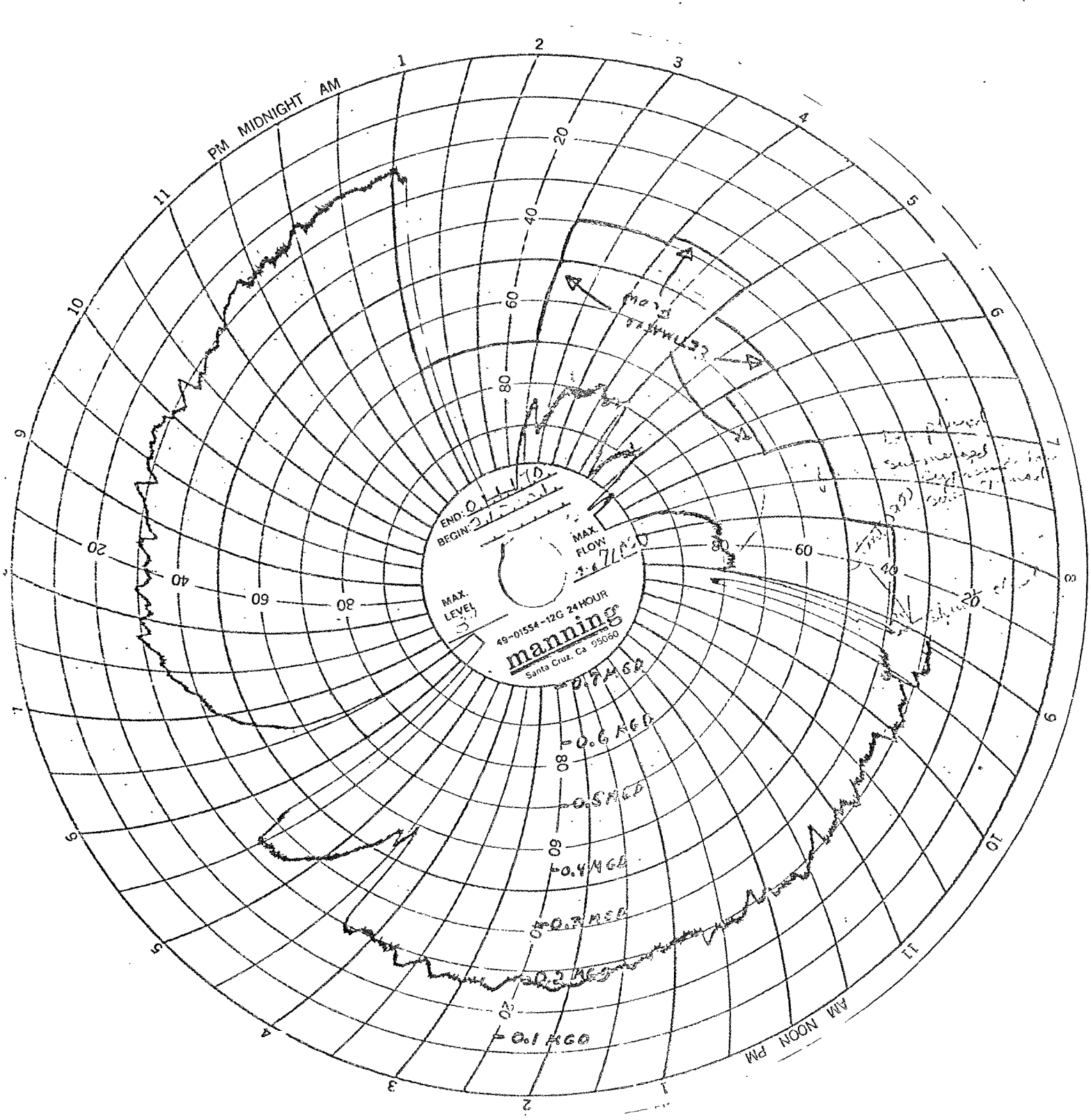

Figure 2. Flow Script Chart - 3/26-27/80

Class II Field Review and Sample Collection

24-hour Composite Sampler Installations

Sampler	Date and Time Installed	Location
1. Influent	8/26/80 - 0920	Immed. downstream of comminutor
sample aliquot: 250 mls/30 min.		
2. Unchlor. effluent	8/26/80 - 0945	In primary clarifier, as surface, near outfall weir
sample aliquot: 250 mls/30 min.		
3. Chlor. effluent	8/26/80 - 1000	In outfall manhole, immed. upstream of weir
sample aliquot: 250 mls/30 min.		
4.		
sample aliquot:		
5.		
sample aliquot:		

Field Data

Parameter(s)	Date and Time	Sample Location
Temp., Cond., pH	8/26/80 - 0920	Influent grab
Temp., Cond., pH	8/27/80 - 1105	Influent grab
Temp., Cond., pH	8/27/80 - 1105	Influent composite
Temp., Cond., pH	8/26/80 - 0945	Unchlor. effluent grab
Temp., Cond., pH	8/27/80 - 1040	Unchlor. effluent grab
Temp., Cond., pH	8/27/80 - 1040	Unchlor. effluent composite
Temp., Cond., pH	8/26/80 - 1000	Chlor. effluent grab
Temp., Cond., pH	8/27/80 - 0940	Chlor. effluent grab
Temp., Cond., pH	8/27/80 - 0940	Chlor. effluent composite
Temp., Dissolved O_2, Cond.	8/25/80 - 1530	Effluent

Grab Samples

Lab Analysis	Date and Time	Sample Location
Fecal coliform, T. Chl. Res. (field)	8/26/80 - 1605	Chlor. effluent manhole
Fecal coliform, T. Chl. Res. (field)	8/27/80 - 0940	Chlor. effluent manhole
Metals (sludge)	8/27/80 - 1000	Sludge "drying" beds
Fecal coliform	8/27/80 - 0915	Bypass (from slough)

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Findings

The analytical results of this sampling inspection are given in Table 2. Based on these results, the plant effluent met present permit limitations for BOD and suspended solids. Percent reduction for both of these constituents was 48%; however, as noted above, actual efficiency was probably somewhat less. The plant was in compliance with pH limitations, but the results of effluent fecal coliform analyses were 12 and 1460 organisms/100 mls as compared to a monthly average permit requirement of 700 organisms/100 mls.

During the bypass described above, the water quality of the plant discharge was degraded. The effluent was not passing through the plant, but was being discharged to the sludge drying beds. This effluent then flowed through the slough and into the Pilchuck River. The fecal coliform concentration of this effluent was 142,000 org/100 mls which is approximately 200 times the monthly permit limitation for the plant. As this flow was bypassing the plant entirely, it received no chlorination. The bypass effluent had BOD and organic nitrogen concentrations higher than the plant influent. This degradation probably reflects pollutants picked up from the sludge beds.

The sludge beds were in poor condition with clear indications of erosion to the slough. During periods of high rainfall or during bypass incidents similar to the one we observed, the negative impact on the water quality of the Pilchuck River is significant. This impact must be corrected by either preventing bypass flow through the sludge beds or altering the present method of handling, drying, and disposing of digested solids.

The main interceptor to the plant is inadequate. Visual inspection and the excessive flows monitored at the plant clearly indicate excessive infiltration. The interceptor is located in a creek bottom for much of its length and direct inflow from this creek is the apparent major infiltration source. The interceptor is old (early 1900's) with holes and joint separations where both infiltration and exfiltration (at high flows) are apparent. Plant flow during the inspection was about four times that expected from the service population. Upgrade plans call for a new interceptor and use of the old interceptor as a storm drain.

The chlorine contact structure appears to have inadequate retention time. A dye test conducted during the inspection showed a retention time of 9 to 13 minutes with most of the dye passing after 11 minutes. During this test, plant flow was approximately 0.2 MGD. This means that the chamber volume is about 1500 gallons which yields the retention times given in Table 3.

Table 2. Granite Falls: Analytical Results

	Influent	Primary Effluent	Bypass	Chlor. Effluent	NPDES Permit Limits
Flow (MGD)	(.31 est)		.28 (inst.)		
BOD_5 (mg/l)	50	34	58**	26	165
(lbs/day)	130	(88)	135 (inst.)	(67)	250
TSS (mg/l)	103	76	46**	54	115
(lbs/day)	266	(196)	107 (inst.)	(140)	170
Fecal Coliform (org/100 ml)			142,000 est.	12 est.[1]	700
				1460[2]	
Total Chl. Residual (mg/l)				3.4[1]	
				2.7[2]	
pH (S.U.)	7.2	7.3	7.0**	7.1	6.0-9.0
	7.4***	7.4***		7.0***	
	7.3*	7.4*		7.2*	
	7.3*	7.1*		6.7*	
Spec. Cond. (µmhos/cm)	189	261	230**	240	
	192***	277***		242***	
	290**	238**		240*	
	325**	200		170*	
Turbidity (NTU's)	32	18	38**	40	
COD (mg/l)	141	104	102**	141	
NH_3-N (mg/l)	6.2	9.8	8.8**	8.4	
NO_2-N (mg/l)	<.01	<.01	<.01**	<.01	
NO_3-N (mg/l)	.8	.6	1.8**	.6	
T. Inorganic-N (mg/l)	7.0	10.4	10.6**	9.0	
Organic-N (mg/l)	3.8	1.7	5.7**	0.4	
Total Nitrogen (mg/l)	10.8	12.1	16.3**	10.0	
O-PO_4-P (mg/l)	1.0	1.8	1.2**	1.6	
T-PO_4-P (mg/l)	2.1	3.6	2.8**	3.1	
Total Solids (mg/l)	245	254	207**	230	
TNVS (mg/l)	131	147	132**	142	
TSS (mg/l)	103	76	46**	54	
TNVSS (mg/l)	33	25	25**	21	
Temperature (°C)	14.3*	13.8*		13.9*	
	15.1*	14.9*		15.0*	

[1] 8/26/80 - 1605

[2] 8/27/80 - 0940

( ) loadings based on no bypass - are probably underestimates

*Grab sample - field analysis

**Grab sample - lab analysis

***Composite sample - field analysis

Table 3. Chlorine Contact Time - Granite Falls.

Plant Flow	Contact Time
.05 MGD	43.2 min.
.1 MGD	21.6 min.
.15 MGD	14.4 min.
.2 MGD	10.8 min.
.3 MGD	7.2 min.
.5 MGD	4.3 min.
.7 MGD	3.1 min.

The Department of Ecology "Criteria for Sewage Works Design" recommends a minimum detention time of 20 minutes (p. 187). Under current flow conditions, the Granite Falls STP probably achieves 20-minute contact time rarely, if ever. At high flows (flows in excess of 0.7 MGD were observed during the inspection) contact time is very low and probably results in poor disinfection and excessive effluent fecal coliform counts. For instance, although effluent chlorine residual was about 2.5 mg/l when both effluent fecal coliform samples were taken, flows (and thus contact times) were different. A concentration of 12 organisms/100 mls was associated with a contact time of 10.3 minutes while a count of 1460 organisms/100 mls occurred when contact time dropped to 7.8 minutes.

The inadequacy of the contact chamber places the operators in a difficult position. High chlorine residuals are required to meet permit limitations for fecal coliforms, but excess chlorine poses a threat to aquatic organisms (particularly Salmonid fishes) in the Pilchuck River. The Pilchuck River below the plant is an anadromous fish spawning reach and is used for both fishing and swimming; thus both beneficial uses must be protected. This difficulty will be addressed in the receiving water report.

The condition of the plant is marginal. Although all units (with the exception of the sludge drying beds and the temporary comminutor problem) were operating adequately, the plant is showing its age. Cracks are developing in concrete structure and the operators indicated that finding parts for some of the original equipment (particularly the clarifier flights) was becoming difficult. The operating room roof leaked badly and corrosion was evident throughout this building.

Sampling and Analytical Procedures

The sampling requirements in the permit have been modified in discussions between Dave Wright and the town of Granite Falls. Present

requirements are daily instantaneous determinations of flow, pH, and chlorine residual. Weekly determination of fecal coliform and bi-monthly determination of BOD and suspended solids from grab samples. Flow, pH, and chlorine residual are determined on site by plant personnel while fecal coliform, BOD, and suspended solids samples are collected and transported to Everett labs for analysis. Field tests were reviewed with plant personnel and samples split for laboratory analysis. Findings and recommendations are listed below:

Flow

Flow was not being determined because operating personnel did not have a conversion table. We gave them a conversion table and explained the procedure for determining flows.

pH

pH paper is being used for pH determination. This paper was checked against our buffers and it responded well; however, when pH paper was compared against a pH meter using wastewater samples, agreement was not good. The pH paper indicated a pH of 5 to 6 while the pH meter registered a pH of 7.2. DMR's from the plant consistently report pH's of 5 or 6 - a permit violation. However, these reported values are probably inaccurate. An alternate method should be instituted. One possibility would be having the Everett lab run pH's on samples sent there for other analysis.

Chlorine Residual

The Granite Falls plant uses a Hellige DPD kit with color wheel. The color wheel only indicates values up to 2.0 mg/l, while values detected during the survey ran 2.5 to 3.4 mg/l. An easy solution to this problem would be to dilute the effluent sample 50:50 with river water, then multiply the result by 2. We suggest operating personnel use this or another method to get reportable results.

A comparison of split sample results is given below. The fecal coliform sample was not obtained from a split. Samples were obtained from the effluent about 1/2 hour apart.

Comparison of Analytical Results

	DOE Lab	Everett Lab
BOD (mg/l)	26	38
TSS (mg/l)	54	38
Fecal Coliform (org/100 ml)	1460	20

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BOD and suspended solids results are reasonably close. There is a substantial discrepancy in fecal coliform results. Because Granite Falls DMR's generally report low fecal coliforms, we were concerned that a dechlorinating agent (sodium thiosulfate) might not have been added to the sample bottles. For this reason, an aliquot of the plant coliform sample was removed from the sample bottle and checked for chlorine residual. A residual of 2.5 mg/l was detected indicating that no thio had been added to the bottle. Subsequently, I contacted Carl Baird of the Everett lab. He stated that it was lab policy to put thio in fecal coliform sample bottles prior to sterilization but that it was possible that there had been a slip-up.

We suggested that plant personnel ensure that this has been added by runing an aliquot of water from the sample bottle for chlorine residual. If chlorine is present, the analytical results will not be valid.

Dave, I would be interested in any responses or actions which are taken as a result of our findings. We appreciate your help in sending down the background material and information passed along in subsequent conversations.

BY:cp

cc: Stew Messman
Sharon Chase
Unit Files
Section Files
Central Files