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M E M O R A N D U M
November 6, 1979

To: Phil Williams

From: Bill Yake

Subject: Waitsburg Class II Inspection

Introduction

On September 11 and 12, 1979 a Class II inspection was performed at the Waitsburg sewage treatment plant (STP). During the same time period, a receiving water study was conducted on Coppei Creek and the Touchet River. Personnel involved in the inspection and receiving water study included Phil Williams (Eastern Region, DOE), Wes Maiers (Roving Operator, DOE), and Greg Cloud, Anne Haines and Bill Yake (Water and Wastewater Monitoring Section, DOE). Pat Nelson (Personnel, DOE) also aided with the field work. Elmer Hayes, head plant operator, was present during the inspection.

Problems which initiated this inspection included marginal plant design, the absence of any recent plant performance data (effluent sampling and testing data had not been submitted by Waitsburg), generally deteriorated plant condition, and lack of data delineating the effect of the treatment plant effluent on the receiving water. The collection of receiving water data was requested by the Eastern Regional Office to provide an improved basis for prioritizing the plant upgrade grant. The results of the receiving water study are attached (see *The Effects of Waitsburg Wastewater Treatment Effluent on Coppei Creek and the Touchet River*, Yake and Cloud, 1979).

The Waitsburg STP is a trickling filter plant. The design of the plant is unusual because a single clarifier serves as both primary and secondary clarifier. This allows a certain portion of the influent to pass through the plant with only primary treatment. Influent wastewater is screened, comminuted, and routed to a wet well in the control house. Wastewater is then pumped to a circular, center-feed clarifier. This pumping system results in unit flows which fluctuate dramatically and constantly. At the clarifier outfall, there are two weirs which split the flow. Flow over the lower of the two weirs goes to the trickling filter. The excess flow passes over the higher weir to the outfall. After passing through the trickling filter, flow is routed back to the influent wet well and thus back to the clarifier. The remainder of the clarifier effluent is routed to a Parshall flume, is chlorinated, and then passes through a conduit three feet in diameter and 45 feet in length which serves as a contact chamber.

The effluent is discharged to Coppei Creek about 1/4 mile above its confluence with the Touchet River (waterway segment 15-32-03). At the time of inspection, the instream dilution ratio was about 8:1. The afore-mentioned segment is identified in the 5-year strategy among segments which "do not meet the state and federal water quality goals, due primarily to non-point sources of wastewater, and it is unknown whether the goal will be achieved with the application of best management practices." Parameters not meeting the water quality goals are fecal coliform concentrations and turbidity. As noted in the receiving water study, the plant effluent substantially raised fecal coliform concentrations in Coppei Creek and the Touchet River. Counts in lower Coppei Creek far exceeded Class A water standards. Counts in the Touchet River were increased by 5 to 20 times, but did not exceed Class A standards. Additionally, the effluent was responsible for decreasing dissolved oxygen concentrations in lower Coppei Creek to 5.7 to 6.1 mg/l (below the water quality standard of 8 mg/l).

Findings and Conclusions

During the inspection period, the Waitsburg STP was meeting the effluent requirements of the order (Docket No. DE 77-300) presently in force. This order places limits on effluent BOD_5, TSS, Chlorine Residual, and pH. Fecal coliform concentrations in the effluent are not limited by the order, but were high (>6000 and 26,000 per 100 ml). The plant was achieving a 69% BOD reduction and a 68% suspended solids reduction. Considering the design and conditions of the plant, these treatment levels are about as good as one could expect.

Several design deficiencies limit treatment efficiency. The use of a single clarifier precludes secondary treatment of all incoming wastewaters. Secondly, there is no way to monitor or control recirculation around the trickling filter with the present design configuration. There is, therefore, little possibility for operational flexibility or control.

Another set of design deficiencies severely limit the effectiveness of the chlorination system. Effluent flow (see Figure 1) fluctuates dramatically because of the intermittent operation of the wet well pumps. The chlorination system is not flow proportional. The operator is, therefore, caught between two evils. Either he sets the chlorine feed high enough to achieve adequate disinfection at peak effluent flows (minimum contact time and maximum volume) and creates chlorine toxicity problems in the creek, or he sets the chlorine feed low enough to prevent receiving water toxicity and fails to disinfect the majority of the effluent. The Eastern Region has chosen, probably wisely, to limit effluent chlorine at the expense of adequate disinfection. Thus the order limits chlorine residual rather than fecal coliform concentration.

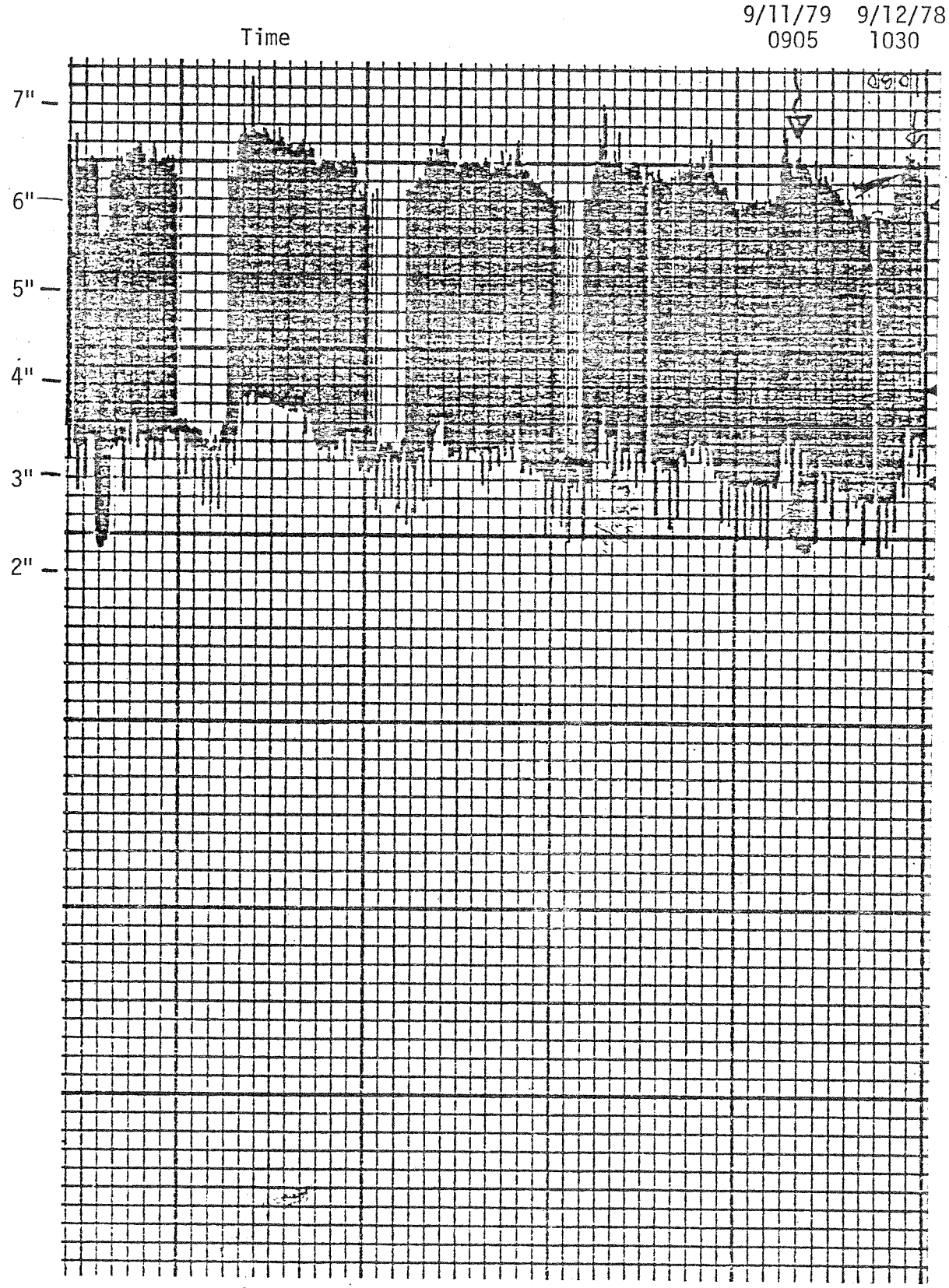

Figure 1. Waitsburg STP flow chart

The flow measuring equipment at the plant is marginal. The walls of the Parshall flume are not plumb and the plate steel placed against the throat walls has pulled away from the concrete walls, making the effective throat width a non-standard 2-3/8". The plant personnel use a flow table developed for flumes with a 3" throat. In addition, the head-height staff gage is incorrectly placed. The 0" level of the staff gage is 1" off the flume bottom, making actual head heights 1" greater than those read on the gage. To obtain more accurate flows, it is suggested that the staff gage be placed correctly and that flows be determined using Table 1.

Table 1. Flows through a 2-3/8" Parshall Flume

$$\text{Flow in cfs} = .785\ H^{1.55}$$
$$\text{Flow in MGD} = .507\ H^{1.55}$$
where H = head height in feet

Head Height in Inches	Flow in MGD	Flow in cfs
1.0"	.011	.017
1.5"	.020	.031
2.0"	.032	.049
2.5"	.045	.069
3.0"	.059	.092
3.5"	.075	.116
4.0"	.092	.143
4.5"	.111	.172
5.0"	.131	.202
5.5"	.151	.234
6.0"	.173	.268
6.5"	.196	.303
7.0"	.220	.340

An additional difficulty with the flow measuring system is caused by the lack of a totalizer on the recording device, the constant variation in flows due to the pumping system, and the slow chart advance. As a result, flow must be determined by estimating the mean flow from a trace like the one shown in Figure 1.

The design of the contact chamber may also be partially responsible for receiving water problems. The chamber itself is constructed of a single large pipe. Solids accumulate in the contact chamber and gradually decrease contact time. Periodically the operators remove the effluent weir and flush the accumulated solids to the creek. This is probably

partially responsible for the apparent sludge deposits below the outfall. The operators have few options to the present procedures both because the contact chamber is not accessible and because the contact chamber is not paired so that one unit could be closed down while the other was being pumped or cleaned in some other manner.

In conclusion, deficient plant design is limiting the efficiency of the plant and it is unlikely that operational changes could significantly improve plant effluent quality.

The main area where improvement is possible is in the collection and analysis of waste water samples for compliance with the requirements of their NPDES permit. The Eastern Region has made arrangements for Waitsburg sample to be analyzed at the Walla Walla STP. Tracking these results should provide more information on the year around efficiency of the plant.

If, Phil, during your follow-up inspection, you could review sample collection procedures and check to see if they are checking the normality of their PAO correctly (and making appropriate calculation changes, or replacing the PAO) and note your observations in a short memo to us, it would be much appreciated. We would also be interested in any apparent discrepancies in results reported through Walla Walla and will be glad to discuss questions with either the operators at Waitsburg or the lab people at Walla Walla.

In the long term, the following observations may be helpful in assessing the adequacy of an upgrade design:

1. The flow pulses caused by the present wet well/pumping system will make unit design difficult as most design criteria assume approximate steady-state conditions. This will make design of an adequate disinfection (and possibly dechlorination system) particularly difficult and expensive. Equalizing flow (perhaps by downsizing the pumps) would make the solution of downstream unit design easier and probably less expensive.

2. With low flow dilution ratios of 8:1 or less, it may well be impossible for the water quality criteria of .002 mg chlorine residual/l to be met without dechlorination.

3. Unless in-plant nitrification is promoted, it is likely that low dissolved oxygen concentrations in lower Coppei Creek will not be substantially improved by an upgrade which focuses on 30/30 standards and 85% removal.

4. Receiving water quality degradation could be substantially decreased by foregoing discharge to Coppei Creek. Possible

alternatives include routing the discharge to the Touchet River, using a non-overflow or seepage lagoon, land application (irrigation), or discharge to a subsurface drain field. Any of these solutions would solve most of the problems listed above. Surface water discharge to the Touchet would, however, still be likely to result in increasing eutrophication in the Touchet River.

Review of Laboratory Procedures and Techniques

Prior to the inspection the town of Waitsburg had not been regularly reporting BOD, suspended solids, or fecal coliforms on their DMR's due to laboratory deficiencies. Sample splits were analyzed by the Walla Walla STP and arrangements have been made to have the required analyses conducted at Walla Walla regularly. The only analyses conducted at Waitsburg are residual chlorine and dissolved oxygen.

Total Residual Chlorine

The Waitsburg plant is using a DPD kit and analyses appears to be accurate.

Dissolved Oxygen

The plant uses the Winkler method for determination of dissolved oxygen. They use PAO as a titrant for a 300 ml sample. This PAO should be .0375 normal for 1 ml of titrant to be equivalent to 1 mg D.O./l. Effluent dissolved oxygen was measured using DOE's IBC D.O. meter, DOE's Winkler apparatus (with sodium thiosulfate), and the plant's Winkler equipment. The results are shown below.

Method	Result
IBC D.O. Meter	3.60 mg/l
DOE Winkler	3.75 mg/l
STP Winkler	4.7 mg/l

It is apparent that the plant's PAO was weak. It is suggested that plant personnel standardize their PAO weekly and replace it or alter calculations appropriately to improve the accuracy of this test.

BY:cp

Attachments

Class II Field Review and Sample Collection

24-hour Composite Sampler Installations

Sampler	Date and Time Installed	Location
1. Influent	9/11/79 - 0905	Between bar screen & comminutor
sample aliquot: 250 ml/30 min.		
2. Clarifier Effluent	9/11/79 - 0925	In clarifier outfall
sample aliquot: 250 ml/30 min.		
3. Chlorinated Effluent	9/11/79 - 0940	End of contact chamber, directly upstream of outfall weir
sample aliquot: 250 ml/30 min.		
4.		
sample aliquot:		
5.		
sample aliquot:		

Field Data

Parameter(s)	Date and Time	Sample Location
pH, Spec. Cond., Temp.	9/11/79 - 0905	Influent grab
pH, Spec. Cond., Temp.	9/11/79 - 0925	Clarifier Effluent Grab
pH, Spec. Cond., Temp.	9/11/79 - 0940	Chlroinated Effluent Grab
Total Chlorine Residual	9/11/79 - 1040,1120	Chlorinated Effluent
Dissolved Oxygen	9/11/79 - 1050	Effluent
pH, Spec. Cond., Temp.	9/12/79 - 0910	Influent Grab & Composite
pH, Spec. Cond., Temp.	9/12/79 - 0920	Clarifier Eff. Grab & Composit
pH, Spec. Cond., Temp.	9/12/79 - 0945	Chlor. Eff. Grab & Composite
Total Chlorine Residual	9/12/79 - 1015	Chlor. Eff. Grab

Grab Samples

Lab Analysis	Date and Time	Sample Location
Fecal Coliform	9/11/79 - 1120	Chlorinated Effluent
Fecal Coliform	9/12/79 - 1015	Chlorinated Effluent

Class II Field Review and Sample Collection - Continued

Flow Measuring Device

Type: Parshall Flume

Dimensions: 2-3/8" Throat

a. Meets standards criteria? No Explain: Non-standard throat width (caused by plate steel sides pulling away from concrete walls), walls not vertical, staff gage miss-set by one inch (must add one inch to staff gage reading to get actual head height).

b. Accuracy check: See text.

Actual Instantaneous Flow	Recorder Reading ( )	Recorder Accuracy (% of Instan. Flow)	Percent Error
1.			
2.			
3.			

____ Is within acceptable 15% error limitation.

X Is in need of calibration.

The following table is a comparison of laboratory results from 24 hour composite(s) together with NPDES permit effluent limitations. Additional results pertinent to this inspection have also been included.

	DOE			Waitsburg STP		NPDES (Monthly average
	Influent	Clarifier Effluent	Chlor. Effluent	Influent	Chlor. Effluent	
BOD_5 mg/l	140	55	44	173	47	60
lbs/day	145	57	46	159	43	125
TSS mg/l	120	35	22	†	†	75
lbs/day	124	36	23			156
Total Plant Flow MGD			0.124		0.11	
Fecal Coliform (#/100 ml)			> 6,000[1]			
			26,000 Est[2]			
Total Chlorine Res. (mg/l)			0.4*[1]			0.1-0.5
			< 0.1*[1]			
			0.3*[1]			
COD (mg/l)	270	120	120			
Spec. Cond. (μmhos/cm)	610*	1020*	1010*			
	550*	660*	650*			
	600**	800**	900**			
	557	754	793			
pH (S.U.)	8.0*	7.6*	7.6*			6.5-8.5
	8.2*	7.7*	7.6*			
	7.7**	7.5**	7.8**			
	7.3	7.5	7.7			
Total Solids (mg/l)	560	540	560			
TNVS (mg/l)	300	400	420			
Total Sus. Solids (mg/l)	120	35	22			
TNVSS (mg/l)	30	5	1			
Turbidity (NTU's)	50	20	50			
O-PO_4-P (mg/l)	5.2	5.3	6.4			
T-PO_4-P (mg/l)	8.2	6.4	8.4			
NH_4-N (mg/l)	15.0	8.9	11.2			
NO_2-N (mg/l)	< 0.2	0.6	0.6			
NO_3-N (mg/l)	< 0.2	<0.1	<0.2			
Org-N (mg/l)	23	16.1	16.3			
Temp. (°C)	23.0*	20.4*	20.2*			
	22.4*	20.4*	20.4*			

* Field Analysis grab "<" is "less than" and ">" is "greater than"
**Field Analysis - composite
1) 1120 - 9/11/79 2) 1015 - 9/12/79
† Lab error, samples discarded prior to analysis.