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DEPARTMENT OF ECOLOGY
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John Spellman
Governor

M E M O R A N D U M
January 30, 1981

To: Claude Sappington

From: Sharon Chase and Dick Cunningham

Subject: Dayton Class II Inspection and Touchet River Receiving Water Study

On November 10 and 11, 1980 a Class II inspection was performed at the Dayton sewage treatment plant (STP). A receiving water study was conducted on the Touchet River on November 11, 1980, the results of which are included in this memorandum.

Personnel involved in the inspection included Wes Maier (Headquarters Office, Department of Ecology [DOE]), Sharon Chase and Dick Cunningham (Water and Wastewater Monitoring Section, DOE). The plant operator, Glen Hinchliff, was present during the inspection. The receiving water work was done by Sharon Chase and Dick Cunningham.

Phil Williams (Eastern Region, DOE) requested the inspection in order to aid appropriate placement of the plant on the state grant priority list.

The Dayton STP is a trickling filter plant with circular primary and secondary clarifiers, an anaerobic sludge digestor, and a single cell rectangular chlorine contact chamber (See Figure 1). (The plant also has a flocculator which was installed to aid settling of waste from Green Giant Co. Green Giant no longer discharges to the STP.) The STP's effluent is discharged to a slough which flows into the Touchet River (waterway segment no. 15-32-03).

The National Pollution Discharge Elimination System (NPDES) Waste Discharge Permit for this plant (Number WA-002-072-9) places limits on effluent biochemical oxygen demand (BOD), suspended solids (TSS), fecal coliforms, pH, and flow. During this inspection period the Dayton plant was meeting permit limitations.

General Description of Plant Conditions

Although the plant is meeting effluent limitation, it is over 40 years old and needs some structural repairs and new equipment to keep functioning well. The plant's operations and maintenance requirements, as outlined by Wes Maier, include the following:

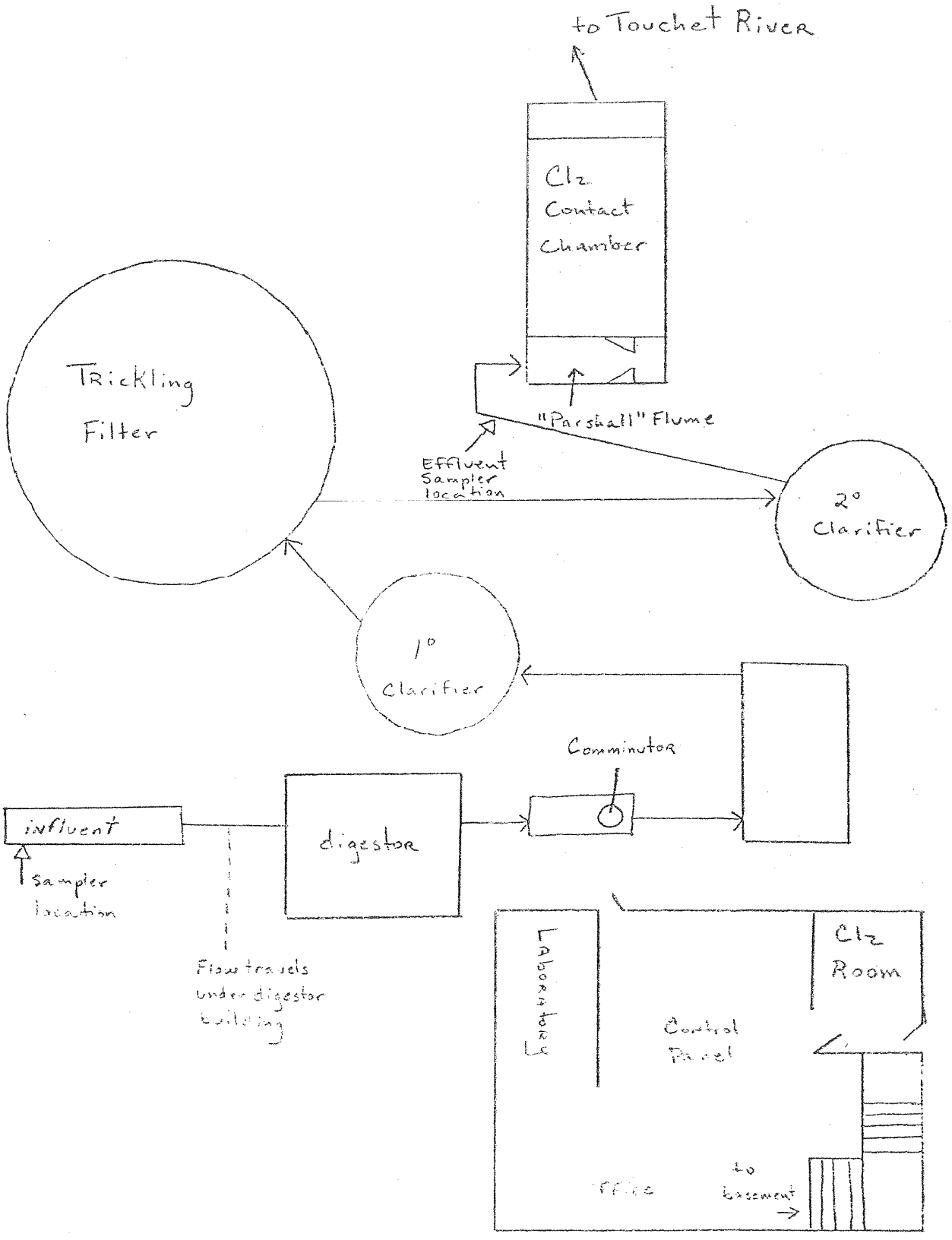

Figure 1. Schematic of Dayton STP.

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1. Chlorination System - Currently the chlorinator has to be set manually, resulting in overchlorination which is wasteful and potentially harmful to the receiving water. The chlorine room needs a ventilation fan and should be sealed off from the lab/control rooms.

2. Flow Measuring Equipment - None of the plant's flow measuring equipment works. The operator estimates flows for the DMR's. The flow meter and script chart need to be repaired and the Parshall flume recalibrated.

3. Structural Repairs or Replacements - Some of the guard rails and most of the shear gates need to be replaced. Concrete in some areas is crumbling and should be repaired or replaced. The plant needs an additional sludge bed and the control panel needs to be upgraded. Two of the primary sludge pumps and one of the secondary sludge pumps need to be overhauled or replaced. New 24-hour timers for the primary sludge pumps would cut down on boiler fuel consumption and result in better digestor operation. The pump and pipe area in the basement needs a better ventilation system to reduce corrosion. The PVC pipe used for methane gas should be replaced with black pipe. The lab area should be redone and more counter space added.

4. Miscellaneous - The plant has no standby power.

Procedure

On November 10, 1980 two composite samplers were placed and grab samples taken for temperature, pH, and conductivity. The compositors were removed and samples split with the operator on November 11. Fecal coliforms and chlorine residual samples were taken on the 11th. The lab procedural survey and receiving water work were completed on the 11th as well. Tables 1 and 2 summarize the sampling schedules and locations for the Class II and the receiving water survey, respectively.

The plant's effluent flow was measured using a Manning dipper flow meter and totalizer. Stream flows were determined using a magnetic flow meter with a top-setting rod. A velocity profile and depth measurements were used to calculate flow.

Compliance with NPDES Permit

A comparison of DOE lab results from the 24-hour composite sample with both the operator's split and the NPDES permit is shown in Table 3. (Table 4 summarizes all field and lab data.) At the time of the inspection, the Dayton STP was in compliance with the effluent limitations. (The plant may or may not have been achieving 85 percent removal

Table 1. Class II Sampling Schedule and Locations.

Composite Sampler	Sample Aliquot	Date & Time Installed	Location	Field Data Collected
Influent	250 ml/30 min.	11/10/80 @ 1325	Influent channel above comminutor	pH and Temp.
Effluent	250 ml/30 min.	11/10/80 @ 1335	Above chlorine contact chamber	pH and Temp.
Grab Samples				
Fecal coliforms		11/11/80 @ 1400	End of chnorine contact chamber	TCR

Table 2. Receiving Water Sampling Schedule and Station Locations.

Stations	Date and Time	Location	Field Parameters
Number 1	11/11/80 @ 1000	5 yards above effluent	pH, Cond., Temp., Flow
Number 2	11/11/80 @ 1100	150 yards below effluent	pH, Cond., Temp., Flow
Number 3	11/11/80 @ 1200	300 yards below effluent	pH, Cond., Temp., Flow, TCR

Table 3. Comparison of Laboratory Results from 24-hour Composites with NPDES Permit Limitation.

Parameter	DOE Analysis Influent	DOE Analysis Effluent	Percent Removal	STP Analysis Influent	STP Analysis Effluent	Percent Removal	NPDES Monthly Average	NPDES Percent Removal
BOD (mg/l)	120	22	82%	154	17	89%	30	85%
(lbs/day)	390	72		500	55		123	
TSS (mg/l)	150	22	85%	64	11	83%	30	85%
(lbs/day)	488	72		208	36		123	
Fecal Coliform[1] (#/100 mls)	---	32			402[2] 98[3]		200	
pH	7.2	7.6		---			6.5-8.5	
	7.4	7.4		7.4	7.2			
Flow		.39			.3[4]		.49	

[1]Fecal coliforms were grab samples.

[2]November 13, 1980.

[3]November 15, 1980.

[4]Estimated flow. Loadings are calculated using DOE's measured flow of .39 MGD.

Table 4. Summary of Laboratory and Field Data from STP.

Parameter	Influent	Effluent	Dayton Laboratory Influent	Dayton Laboratory Effluent
Flow (MGD)	---	.39[1]	---	--
BOD_5 (mg/l)	120	22	154	17
COD	220	76		
Fecal Coliform (col/100 mls)	---	32[2]		
TCR (mg/l)	---	.8[3]		
Temp. (°C)	16.7[3]	11.6[3]		
Conductivity	510[3] 500[3]	445[3] 440[3]		
pH	7.2[3] 7.4[3]	7.6[3] 7.5[3]		
Turbidity	33	13		
TS	450	380		
TNVS	280	250		
TSS	150	22	64	11
TNVSS	24	8		
NH_3-N	13.0	1.4		
NO_3-N	2.0	17.0		
NO_2-N	<0.25	0.30		
O-PO_4-P	3.0	5.2		
T-PO_4-P	4.8	6.4		

[1]From Manning dipper flow measuring device.

[2]Estimated count.

[3]Field data, all other data from 24-hour composite samples.

at the time of the inspection. The DOE results showed percent removal compliance for TSS but not BOD. The STP laboratory results showed the reverse (Table 3). In both cases the percent removal figures were so close to 85 percent that to call this evidence of non-compliance would be unreasonable. The operator reported a fecal count of 402 on the 13th of November which is in violation of permit limitations; however, DOE's sample, taken on the 11th of November, and the operator's sample on the 15th were both well within permit limitations. The violation on the 13th probably resulted from a chlorine setting that was too low. The chlorine residual was quite high, .8, when the DOE sample was taken on the 11th. It is difficult to maintain an appropriate level of chlorine when the amount has to be adjusted manually.

The agreement between the treatment plant and the DOE lab results was not good, but we believe the error was caused by insufficient mixing of the sample prior to splitting.

The flow at the Dayton plant was below the effluent limitation of .49 MGD, but was higher than expected for the population served. Table 5 compares the expected values for flow and BOD with those measured. Higher than expected flows (expected flow = 100 gal/day/capita) and lower than expected BOD concentrations are indicative of infiltration and inflow.

Table 5. Expected Versus Measured Flow and BOD.

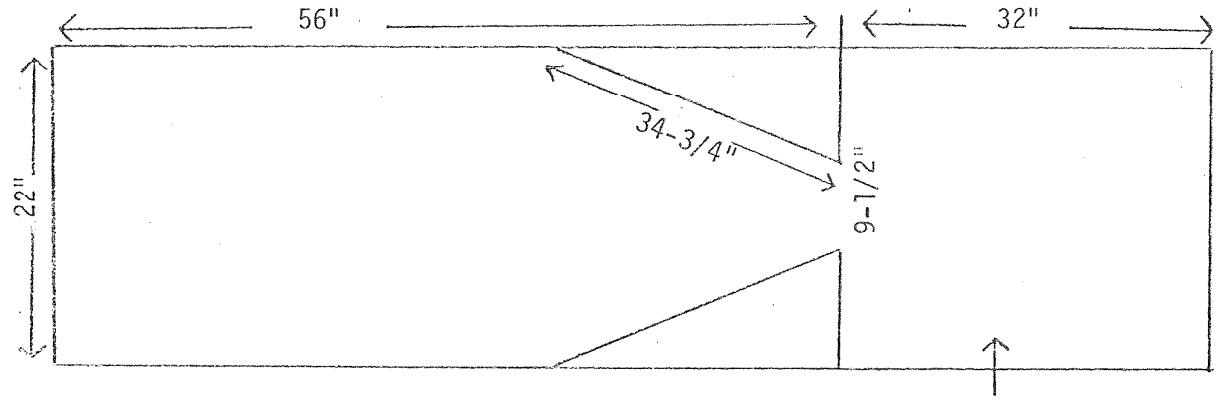
	Expected* (for pop. 2,600)	STP Measured	DOE Measured
MGD	.26	---	.39
BOD (mg/l)	239	154	120
BOD (lbs/day)	520	500	390

*Expected flow = 100 gal/day/capita
Expected BOD = .2 lbs/day/capita

The flow measuring device (Figure 2) is a modified Parshall flume. The yardstick at 2/3 C is inaccurate, measuring 3/4 inch less head than we measured. The plant operator also has been using a flow chart for a 9-inch Parshall flume whereas we measured the throat of the flume at 9-1/2 inches. A new curve should be developed for this flume and the yard-stick should be adjusted.

Laboratory Procedural Survey

Overall, the operator's lab technique appeared to be good. Recommendations for improvements were as follows:



C = 34-3/4"
2/3 C = 22"

water slopping back and forth in this chamber

Yardstick at 2/3 C OFF (low) by 3/4"

Figure 2. Modified Parshall flume.

BOD

1. Samples should be allowed to reach 20°C before the BOD test is run.

2. Reagent water for the BOD test should be aged 1 to 5 days in the dark.

3. Operator should learn how to calibrate his pH meter. He reported checking the meter against 4, 7, and 10 buffers but indicated that he was unclear on how to calibrate the meter when it drifts.

4. pH of BOD sample should be taken and adjusted if outside the 6.5 to 8.5 range.

5. Titrant used for Winkler dissolved oxygen determination should be standardized every two weeks using methods outlined in Standard Methods or DOE's BOD manual.

TSS

1. The correct drying temperature for filters is 103 to 105°C. The operator was drying samples at 60°C.

2. Filters should be cooled after drying in the dessicator, not on the counter top.

3. The STP should buy and use the approved type of filters (Gelman A/E or 934AH Reeve Angel) when his present supply runs out.

Fecal Coliforms

1. The thermometer in the waterbath measures 1° increments. The plant must have a thermometer in .1° increments. The temperature of the incubator was 44 to 45°C. The correct temperature is 44.5°C ± 0.2°C.

Impact on Receiving Water

Figure 3 shows the location of the Dayton STP and the Touchet River stations. The "update of the 1980 analysis of state waterway segments: Water Quality Index (WQI); Trend Analyses" (Singleton, 1980) ranks the Touchet River third in the overall index rating of segments with a rating of 10 or more WQI points. The water quality indices for the Touchet are summarized in Table 6. The index is based on water quality data from the Touchet River station at Touchet (Number 32B070) which is a considerable distance downstream from Dayton.

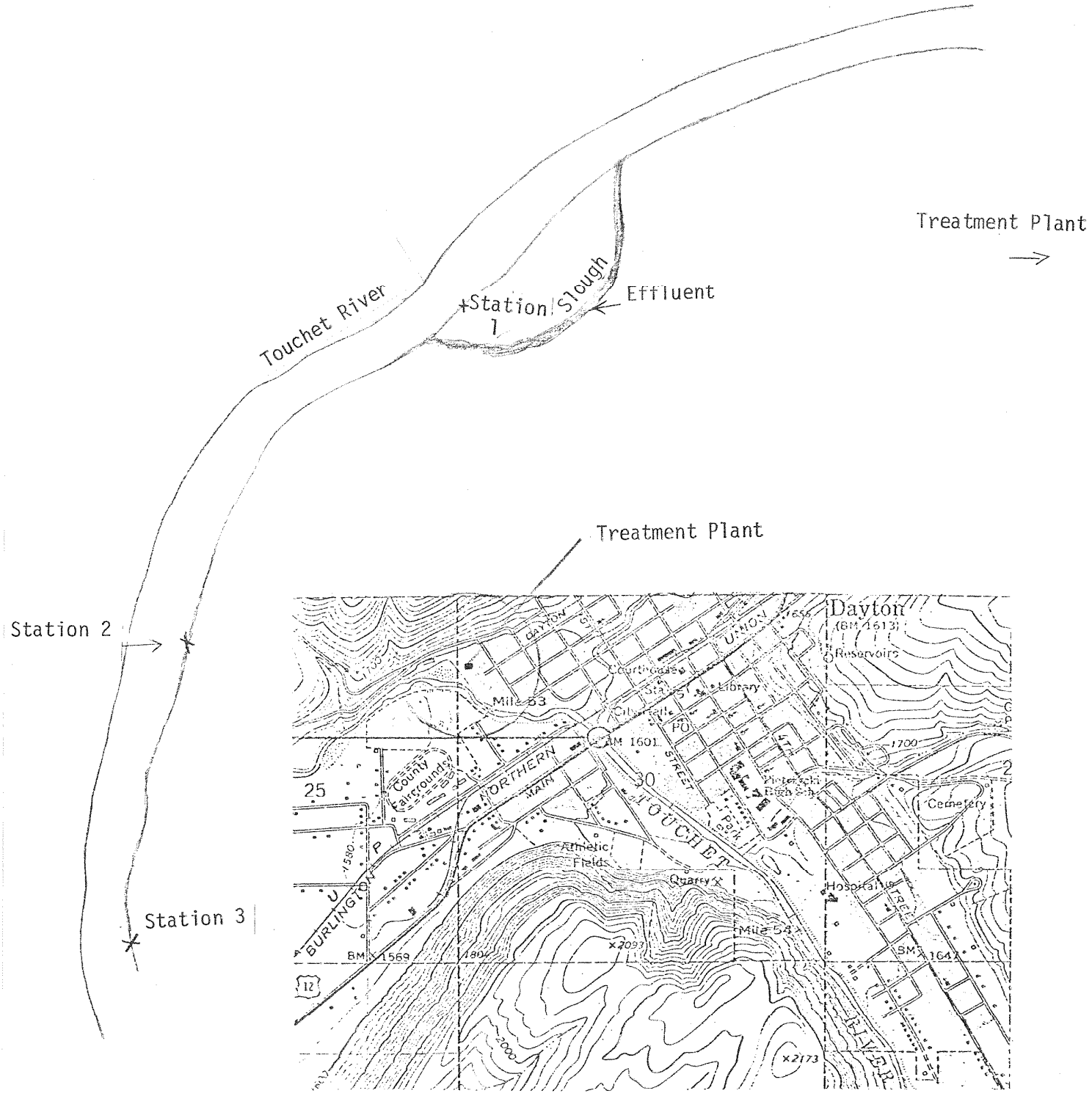


Figure 3. STP Location and Touchet River Stations.

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Table 6. Water Quality Indices* for the Touchet River and its Tributaries.

Temp.	D.O.	pH	Bact.	Trophic	Aesth.	TSS	Ammonia Tox.	Overall Rating Index
50.3	14.4	8.6	27.7	38.7	55.9	(65.0)	11.0	51.3

*Scores falling below 20 meet the goals of the federal Water Pollution Control Act. Scores between 20 and 60 are considered marginal, and values higher than 60 are unacceptable.
( )Indicate that parameter was not used in calculation of overall index rating.

The report indicated probable causes for the high index ratings as follows: aesthetic and trophic due to agricultural runoff; trophic and bacteriological due to the Waitsburg STP; temperature due to lack of sufficient bank vegetation and low flows.

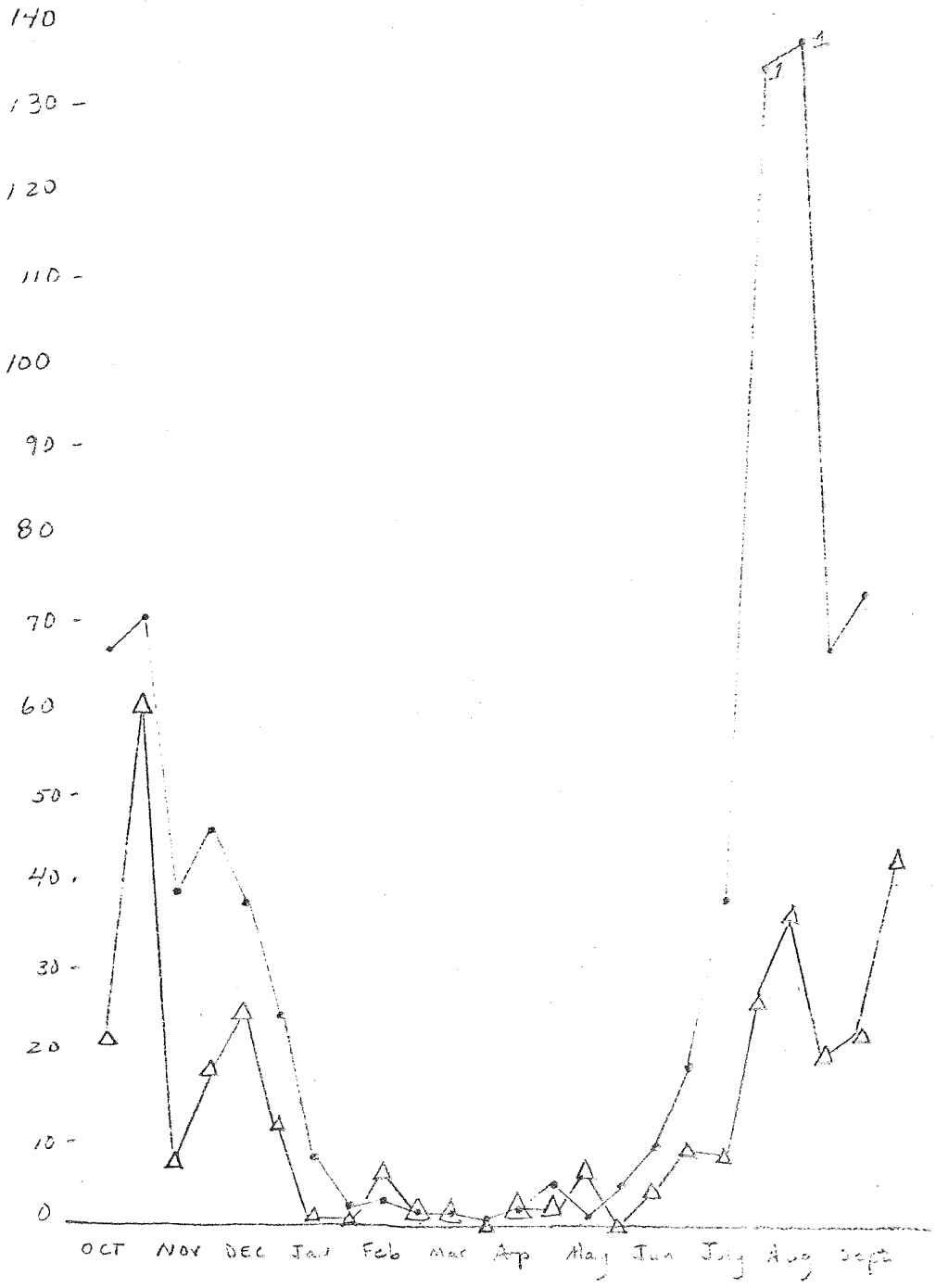
The Touchet is a Class A river. At the time of this inspection the river was within the Class A standards (Table 7). During water year 1975 USGS compiled data for a station 3.2 miles southwest of Dayton (DOE station No. 32B120), a short distance downstream from the Dayton STP (USGS, 1975). Using the flows and nutrient concentrations from Water Year 1975, loadings were calculated for the Touchet station at Dayton. The theoretical percent contribution of the Dayton STP to the nutrient loading of the Touchet River is shown in Figures 4 and 5. These figures represent a rough measure of the STP's trophic impact on the river. In some cases the percent contribution of the plant exceeds 100 percent. This error is due to simplifying assumptions necessary to these calculations. The nutrient loading from the plant was assumed to be equal to the loading at the time of the Class II inspection as this is the only nutrient information available for the plant. Nutrients were assumed to be conserved in the system which is generally, but not absolutely, true. It also was assumed that there were no withdrawals of water for irrigation between the STP and the USGS station. In fact, there is a water right allowing the withdrawal of 5.1 cfs between Dayton and the USGS station. This withdrawal probably accounts substantially for the calculated percent contributions of greater than 100 percent in July and August. Also, the plant flows and concentrations represent the average conditions. Both the composition and quantity of plant flow vary over a 24-hour period. The river samples and flows were instantaneous and were taken during the day when the plant would be expected to have a higher flow and a stronger effluent.

Taking these assumptions into account, it is legitimate to draw the general conclusion that the Dayton STP contributes significantly to the nutrient load of the Touchet River at Dayton and while the nutrient concentrations in the river are highest during the winter months, the plant makes a sizable percent contribution during the summer and fall which coincides with the algal growth season.

Table 7. Summary of Touchet River Data Compared to Class A Standards.

Parameter	Station #1	Station #2	Station #3	Class A Standards
Dissolved Oxygen	12.7	12.7	12.5	>8.0
Temperature	4.8	5.5	5.4	≤18.0
pH	7.6	7.3	7.4	6.5-8.5
Conductivity	75	110	100	--
Flow	(74.68 cfs) 48.18 MGD		(86.75 cfs) 55.97 MGD	--
Chlorine Resid.	<.1*	<.1*	<.1*	--
Fecal Coliform	--	--	8 estimate	100
Turbidity	3	4	3	5
COD	14	16	16	--
NO_3-N	0.17	1.2	0.55	--
NO_2-N	<0.01	<0.01	<0.01	--
NH_3-N	<0.01	0.01	<0.01	--
O-PO_4-P	0.01	**	0.14	--
T-PO_4-P	0.02	**	0.58	--
TSS	7	9	7	--
TS	120	120	150	--
TNVS	79	91	100	--
TNVSS	7	9	6	--

*Chlorine residual was below the .1 detection limit of the DPD kit.
**Invalid data. O-PO_4-P value higher than T-PO_4-P value. Reason unknown.

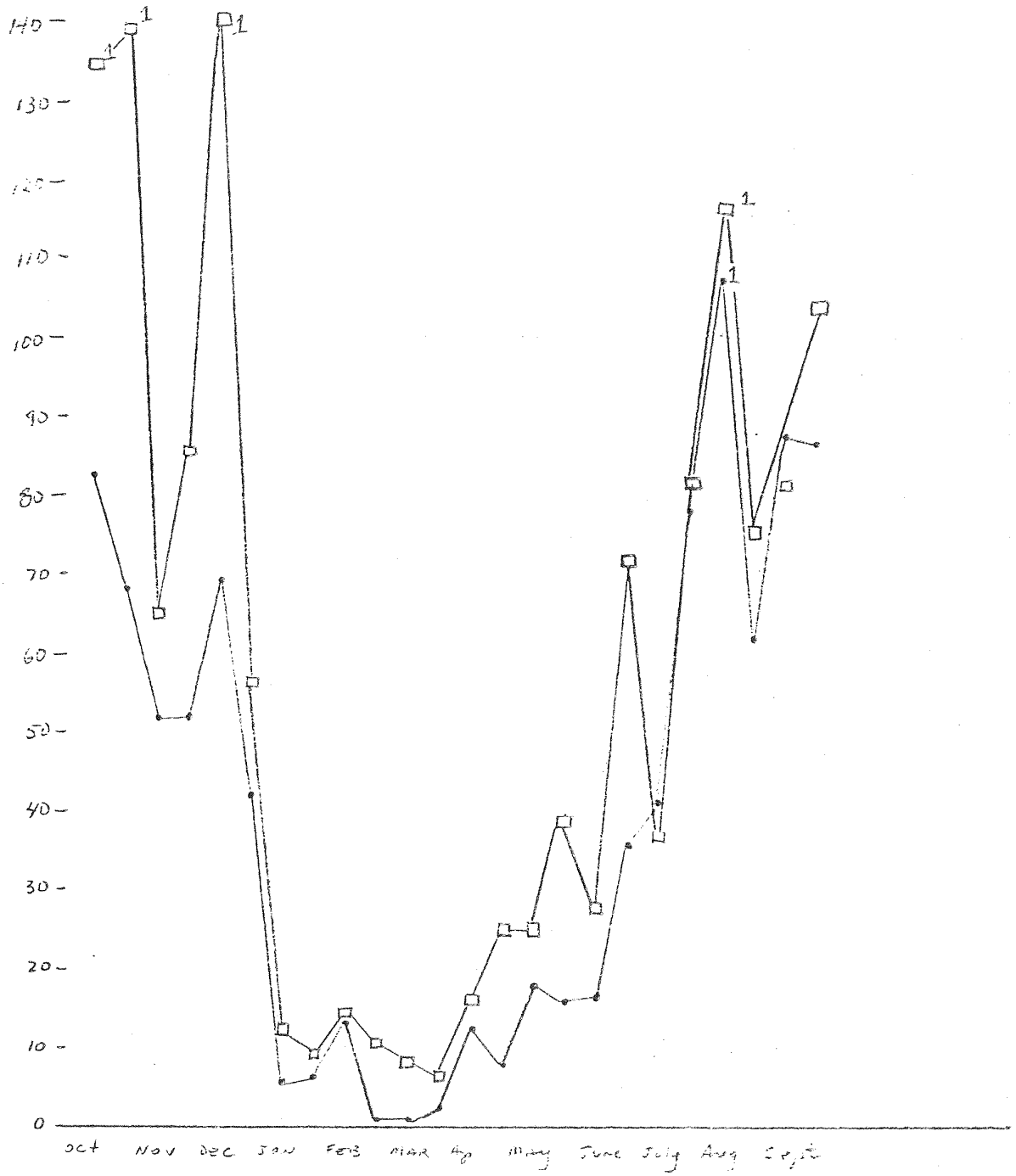


• $NO_2 + NO_3$

△ NH_3

[1] for percent >100, see text for explanation.

Figure 4. Theoretical percent contribution of nitrogen from Dayton STP to Touchet River.



• T-PO_4-P
□ O-PO_4-P

[1] for percent >100, see text for explanation.

Figure 5. Theoretical percent contribution of phosphorus from Dayton STP to Touchet River.

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Recommendations

The Dayton STP was meeting permit limitations at the time of this inspection. Our recommendations consist of points already made in the Laboratory Procedure section of this report. In summary, the operator needs to: (1) get an accurate thermometer for fecal incubation; (2) maintain the drying oven for TSS between 103 and 105°C; (3) cool the TSS filters in a dessicator; (4) calibrate his pH meter daily; and (5) age his BOD reagent water 1 to 5 days in the dark.

The structural problems that need attention are summarized in the General Description of Plant Conditions section. Wes Maier's O&M reports also detail these problems. Continued operation with broken or marginal equipment is likely to result in either violations of effluent limitations or adverse impacts on the receiving water, or both. An example would be the high (.8) chlorine residual which is the inevitable result of attempting to adjust the level of chlorine manually.

SC:cp

Attachments

LITERATURE CITED

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