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STATE OF WASHINGTON
Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY
Olympia, Washington 98504 206/753-2800

MEMORANDUM

August 22, 1978

To: Dave Wright

From: Bill Yake and John Bernhardt

Re: Bremerton (Manette)
Class II Inspection and
Receiving Water Survey

INTRODUCTION

A Class II inspection was carried out at the Bremerton (Manette) STP on July 18-19, 1978, by Bill Yake and John Bernhardt of the Water and Wastewater Monitoring Section of the Department of Ecology. Simultaneously, a receiving water study was conducted on Port Washington Narrows on July 18 by John Bernhardt, Shirley Prescott and Bill Yake. Roy Giroux, head operator of the Manette plant, was present on the second day of the inspection. This report includes two parts. Part I presents results of the Class II Inspection while results of the Receiving Water Survey are given in Part II.

Part I - Class II Inspection

Findings and Conclusions:

The Manette plant is an older primary treatment plant. It is often hydraulically overloaded and experiences acute operating problems due primarily to overloading and disrepair of equipment. The operator indicated that just prior to the inspection the contact chambers had been dredged out, yielding approximately 40 cubic feet of solids. Much of this material was dense sand and grit. This clearly indicates the inability of the plant to effectively remove settleable solids during periods of high flow.

Based on estimated flow, the plant was meeting NPDES limitations for BOD_5 and suspended solids during the sampling period. Flow at the time of inspection was moderate and well below peak flows experienced by the plant. Deficiencies were found in the following areas.

1) Flow Measurement and Recording: Plant flow is determined by an automatic flow recorder and totalizer linked to a Parshall flume. Although the flume is adequately designed, the flow recorder was out of calibration. Recorder accuracy was checked on July 18 and found to be 39% low. During the evening the recorder failed when a linkage arm disengaged. The arm was reset about 12 hours later, and accuracy checks

at three flows on July 19 revealed recorded flows 10 to 29% higher than actual flows. Much of the plant's flow is routed from pump stations. This results in constantly fluctuating flows and makes flow recorder calibration difficult. It is suggested that the system be calibrated by someone intimately familiar with the recorder and that plant personnel be trained in calibration procedures. Flows reported on previous DMR's are probably questionable. The flow during the sampling period was estimated by the head operator and is probably accurate within ± 30%.

2) Chlorine disinfection: Chlorine residual was measured three times during the inspections with the following results:

Date	Time	Chlorine Residual mg/l	Fecal Coliforms #/100 ml	Total Coliforms #/100 ml
7/18/78	1050	0.7	No data	No data
7/18/78	1657	0.0	> 1,400,000	> 1,400,000
7/19/78	0915	0.0	> 1,500,000	> 1,400,000

The chlorine canister ran dry during the inspection (probably during the afternoon of July 18). The plant was therefore discharging waste waters with no disinfection for a period of at least 12-14 hours. This occurred because the scales used in weighing the chlorine canisters were inaccurate and in need of repair. This should be immediately remedied. In addition, plant records indicate that chlorine residuals of 0.0 mg/l are often recorded in the afternoon. The operator's explanation was that this was due to supernatant wasting to the contact chambers. Prolonged contact times may also be partially responsible. None-the-less, the problem observed during this inspection may not be an isolated instance. The effect of discharging unchlorinated wastewaters to Port Washington Narrows is illustrated by the attached receiving water study.

Additionally, the conductivity and chloride concentration of the wastewaters treated at the Manette plant are high and appeared to fluctuate widely throughout the inspection period. This may indicate substantial saltwater infiltration to the sewer system serving the plant. The fact that the relationship between increased conductivity and chloride concentrations closely approximated that of diluted seawater supports this conjecture.

Sampler	Date and Time Installed	Location
1. Influent aliquot - 250 mls/30 min.	7/18/78 - 1015	Chamber between sewer line discharge and grit chamber
2. Unchlorinated effluent aliquot - 250 mls/30 min.	7/18/78 - 1040	Channel outflow of settling basins.
3. Chlorinated effluent aliquot - 250 mls/30 min.	7/18/78 - 0958	End of #2 contact chamber (numbered south to north)

Grab Samples

	Date and Time	Analysis	Sample Location
1.	7/18/78 1657	Fecal and total coliform	Chlorinated effluent
2.	7/19/78 0915	Fecal and total coliform	Chlorinated effluent
3.			
4.			
5.			
6.			

Flow Measuring Device

1. Type - Parshall flume
2. Dimensions - 9 inch throat

a. Meets standard criteria [X] Yes
[ ] No Explain:

b. Accuracy check

	Actual Instan. Flow	Recorder Reading	Recorder Accuracy (% of inst. flow)
1.	1.97 MGD	1.20 MGD	61%[1]
2.	3.00 MGD	3.30 MGD	110%[2]
3.	2.59 MGD	2.95 MGD	114%[2]
4.	1.43 MGD	1.85 MGD	129%[2]

[ ] is within accepted 15% error limitations

[X] is in need of calibration, see text.

Field Data

Parameter	Date and Time	Sample Location	Result
Chlorine Residual	7/18/78 - 1050	Chlorinated effluent	0.7 ppm
Chlorine Residual	7/18/78 - 1657	Chlorinated effluent	0.0 ppm
Chlorine Residual	7/19/78 - 0915	Chlorinated effluent	0.0 ppm
pH, Spec. Cond., Temp.	7/18/78 - 1015	Influent	See Results
pH, Spec. Cond., Temp.	7/18/78 - 1040	Unchlorinated effluent	See Results
pH, Spec. Cond., Temp.	7/18/78 - 0958	Chlorinated Effluent	See Results

[1]. 7/18/78 [2]. 7/19/78

Review of Laboratory Procedures and Techniques

Laboratory techniques were reviewed with Roy Giroux, head operator and lab man. BOD_5, suspended solids, and chlorine residual are determined at the plant. Fecal coliform analyses are performed at the Charleston plant. The following observations were made regarding collection and laboratory procedures.

Collection: Flow proportional grab composites are collected hourly during the 8 hour work shift. Effluent composites are collected prior to chlorination. Supernatant is wasted downstream of this location, thus effluent values do not reflect supernatant additions. Collection of chlorinated effluent would correct this problem but would require dechlorination and reseeding of BOD_5 samples which would make BOD_5 analyses more complicated and might not be warranted because of marginal laboratory facilities.

BOD_5 1) The BOD dilutions are incubated in a heated water bath. This bath is built out of translucent plexiglass and is located in a room with both artificial lighting and windows. Increases in blank dissolved oxygen concentrations after incubation are noted 30-40% of the time, indicating the likelihood of algal growth. The incubator should be painted or protected from light in some other manner.

2) The water bath has no provisions for cooling to maintain temperatures no greater than 20°C + 1/2°C. It is likely that bath temperatures occasionally exceed 20°C. It was suggested that the bath temperatures be recorded daily in the late afternoon. If excessive temperatures are noted the bath should be insulated and/or provided with cooling capability.

3) Blank dissolved oxygen concentrations show changes ranging from an increase of 0.8 mg/l to a decrease of 1.4 mg/l indicating possible algal growth, dilution water contamination, and/or varying sodium thiosulfate strength. It is suggested that dilution water be made at Manette as used, or that phosphate buffer be added to a premixed solution immediately prior to use. Additionally the sodium thiosulfate should be standardized weekly.

4) A single influent and a single effluent dilution are used. Not infrequently 5 day D.O.'s are reported as 0 mg/l, or values less than 2 mg/l. The BOD_5 values calculated from these results should be reported as values greater than BOD_5 calculated were there 2 mg/l remaining at the end of the 5-day incubation. The use of at least two dilutions for influent and effluent would minimize this problem.

Suspended Solids: Suspended solids analysis is generally well performed. The only apparent problem with the analysis is the use of 2.1 cm diameter filters in gooch crucibles. The small filter size makes the processing of adequate sample volumes impractical. At least 50 ml aliquots of sample should be processed to achieve reliable values. The present configuration can pass only about 30 ml of sample. This difficulty could be overcome by processing 2 aliquots per sample and summing both volumes and both weight changes prior to calculation. Alternatively, the laboratory could purchase filtering apparatus to accommodate a larger filter size.

Chlorine Residual. A DPD colorometric kit is used and results appear accurate.

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			Manette Laboratory			NPDES (Monthly average)
	Influent	Unchl. Eff.	Chl. Eff.				
BOD_5 mg/l	146	128	124	225	148	- -	165
Lbs/day	2920	2560	2480	4503	2960	- -	3700
TSS mg/l	184	48	36	154	30	- -	115
Lbs/day	3680	960	720	3080	600	- -	2600
Total Plant Flow MGD	- -	- -	2.4†	- -	- -	2.4†	3.5
COD (mg/l)	610	324	422				
Spec. Cond. (umhos/cm)	1320* 3500** 3610	2050* 1675** 1660	2100* 2800* 1700** 1680				
pH	7.2* 7.2** 7.4	7.1* 7.0** 7.2	6.5* 6.8* 7.4** 7.1				6.5-8.5
Turbidity (JTU's)	53	50	52				
NH_3-N (mg/l)	18.6	20.8	18.4				
NO_2-N (mg/l)	< 0.02	< 0.02	0.02				
NO_3-N (mg/l)	< 0.02	< 0.02	< 0.02				
D-PO_4-P (mg/l)	2.6	5.8	5.5				
T-PO_4-P (mg/l)	6.1	7.5	7.2				
Total Coliforms (#/100 ml)	- - - -	- - - -	>1,400,000[1] >1,400,000[2]				700
Fecal Coliforms	- - - -	- - - -	>1,400,000[1] >1,500,000[2]				
Chlorine Residual (mg/l)	- -	- -	0[1] 0[2] 0.7[3]				
Chloride (mg/l)	1010	333	326				

* Field Analysis -grab "<" is "less than" and ">" is "greater than"
** Field Analysis - composite
[1] Grab sample - 1657, 7/18/78
[2] Grab sample - 0915, 7/19/78
[3] Field analysis - 1050, 7/18/78
† Flow based on rough estimate, totalizer inaccuracy and breakdown precluded accurate flow determination.

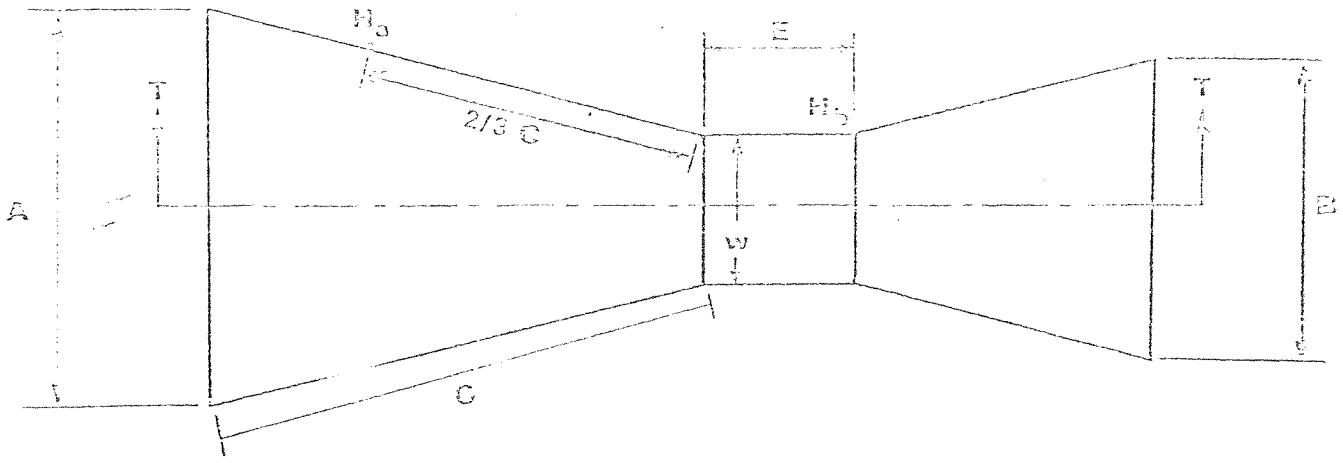
	Influent	DOE Unchlorinated Effluent	Chlor. Effluent	NPDES (Monthl Averag
Total Solids (mg/l)	2143	927	889	
Total Non-Vol. Solids (mg/l)	1748	745	710	
Total Sus. Solids (mg/l)	184	48	36	
Total Non.-Vol. Sus. Solids (mg/l)	30	18	11	
	Digested Sludge			
Percent Solids	8.6%			
Trace Metals				
Copper (mg/Kg dry wt)	600			
Zinc (mg/Kg dry wt)	1760			
Chromium (mg/Kg dry wt)	67			
Cadmium (mg/Kg dry wt)	13			
Lead (mg/Kg dry wt)	550			

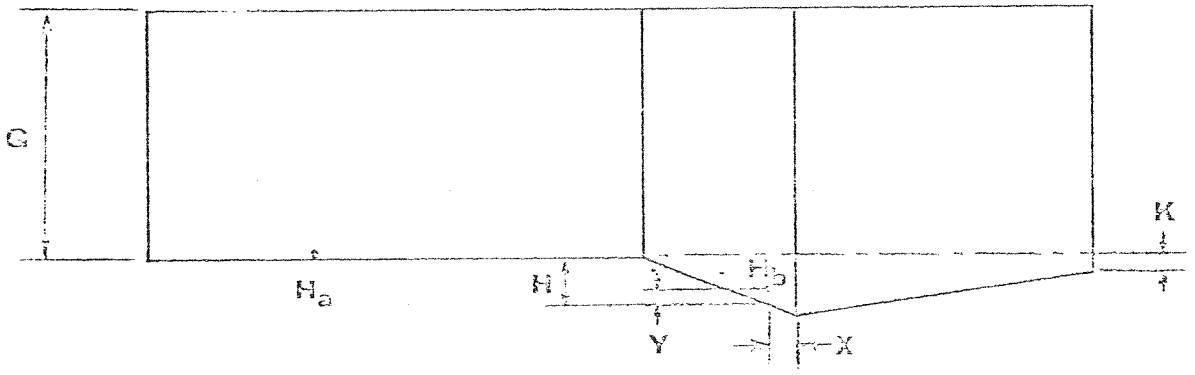
* Field Analysis

"<" is "less than" and ">" is "greater than"

PARSHALL FLUME: Bremerton (Manette)

Dimensions & Flow





Code	Spec's	Measured
A	22 5/8"	24"
B	15"	14½+"
C	34 5/8"	38"
2/3 C		
E	12"	11 7/8"
G	24"	34½"
H		
K		
W	9"	9"
X		
Y		

Time	H_a	H_b	Theoretical Flow		Recorded Flow
7/18/78	11¼"		45%	1.80 MGD	
"	13"		50%	2.23 MGD	
			47%		1.20 MGD
"	11 15/16"			1.97 MGD	1.20 MGD
7/19/78	15 3/4"			3.00 MGD	3.30 MGD
"	14 3/8"			2.59 MGD	2.95 MGD
"	9 3/4"			1.43 MGD	1.85 MGD

PART II - RECEIVING WATER SURVEY

Description

Port Washington Narrows is an arm of Puget Sound which connects outer Sinclair Inlet with Dynes Inlet. It measures about one mile long by 1/4 mile wide with an average depth of about 15 feet during MLL tide (Figure 1). Tidal currents reach 3 to 4 feet per second during peak exchange.

Manette sewage treatment plant is situated on the bank of the Narrows about 1/3 mile west of the Highway 303 Bridge between west and east Bremerton. Wastewaters are discharged from a submerged outfall located several hundred feet from shore in about 20 feet of water.

This report documents results of an 18 July 1978 survey conducted to evaluate impacts of Manette wastes on the receiving waters of Port Washington Narrows. A Class II inspection was performed on the facility during the same period.

Methods

Water quality samples were collected at nineteen (19) stations spaced at intervals along the one-mile section of the narrows between the Highway 303 Bridge and Phinney Point (Figure 1). Two sampling runs were made, one during morning low slack tide (1030 Seattle tide) and the second during afternoon high slack (1730). Sampling commenced about one hour before slack tide and terminated one hour after the change.

Eleven parameters were measured for each station sampled. Transparency (secchi disc) and temperature (°C) were determined in the field. Samples were collected and transported to the DOE Tumwater laboratory for the remaining analyses:

1. Dissolved oxygen
2. pH
3. Specific conductance
4. Turbidity (NTU)
5. Total coliforms
6. Fecal coliforms
7. Ammonia (NH_3-N)
8. Nitrites (NO_2-N)
9. Nitrates (NO_3-N)
10. Ortho-Phosphates (O-PO_4-P)
11. Total phosphates (T-PO_4-P)

Temperature and dissolved oxygen profiles were measured at two stations. All other samples were taken at the surface.

Results

The total and fecal coliform data was the most significant. Figure 1 shows the graphic distribution of the coliform counts during the low tide sampling. There were no clear trends during this period other than a possible source of contamination was indicated at stations 6 and 7 near Phinney Point.

Manette's chlorinator malfunctioned during the afternoon of July 18 providing an opportunity to sample the receiving waters without disinfection. Even with an extremely high dilution ratio the wastewaters significantly increased bacterial levels in the receiving waters (Figure 2). The value of disinfection is evident. As would be expected, bacterial counts were high near and west of the outfall due to tidal influence. The increase at station 3 probably was due to a known break in the discharge pipe near this site. Also, as with the low tide sampling, a contamination source was indicated near Phinney Point.

Low tide sampling data for the remaining parameters are given in Table 1 while the high tide data are summarized in Table 2. Wastewaters discharged from Manette did not appear to have a measurable impact on any of these water quality indicators other than ammonia and, possibly nitrates, increased near the outfall during low slack.

Results for the profile sampling are given below:

Station 20 at Low Slack			Station 8 at High Slack	
Depth	Temp.	D. O.	Temp.	D. O.
0	17.0	13.4	15.5	13.7
5	17.0	12.8	15.2	13.2
10	16.5	12.5	15.2	12.9
15	16.0	12.5	15.0	12.6
20	16.0	13.0	15.0	12.5
25	- -	- -	15.0	12.3
28	- -	- -	14.8	12.1

Temperature and D.O. declined slightly from surface to bottom but stratification was not evident during either tide stage.

Comments

It would have been beneficial to collect some coliform samples at depth; however, this was not possible due to excessive laboratory load at the time of the survey. If possible, this should be included in any future bacteriological surveys relating to Manette STP.

WY:JB:ee

cc: Dick Cunningham
Central Files through Skip Harlan

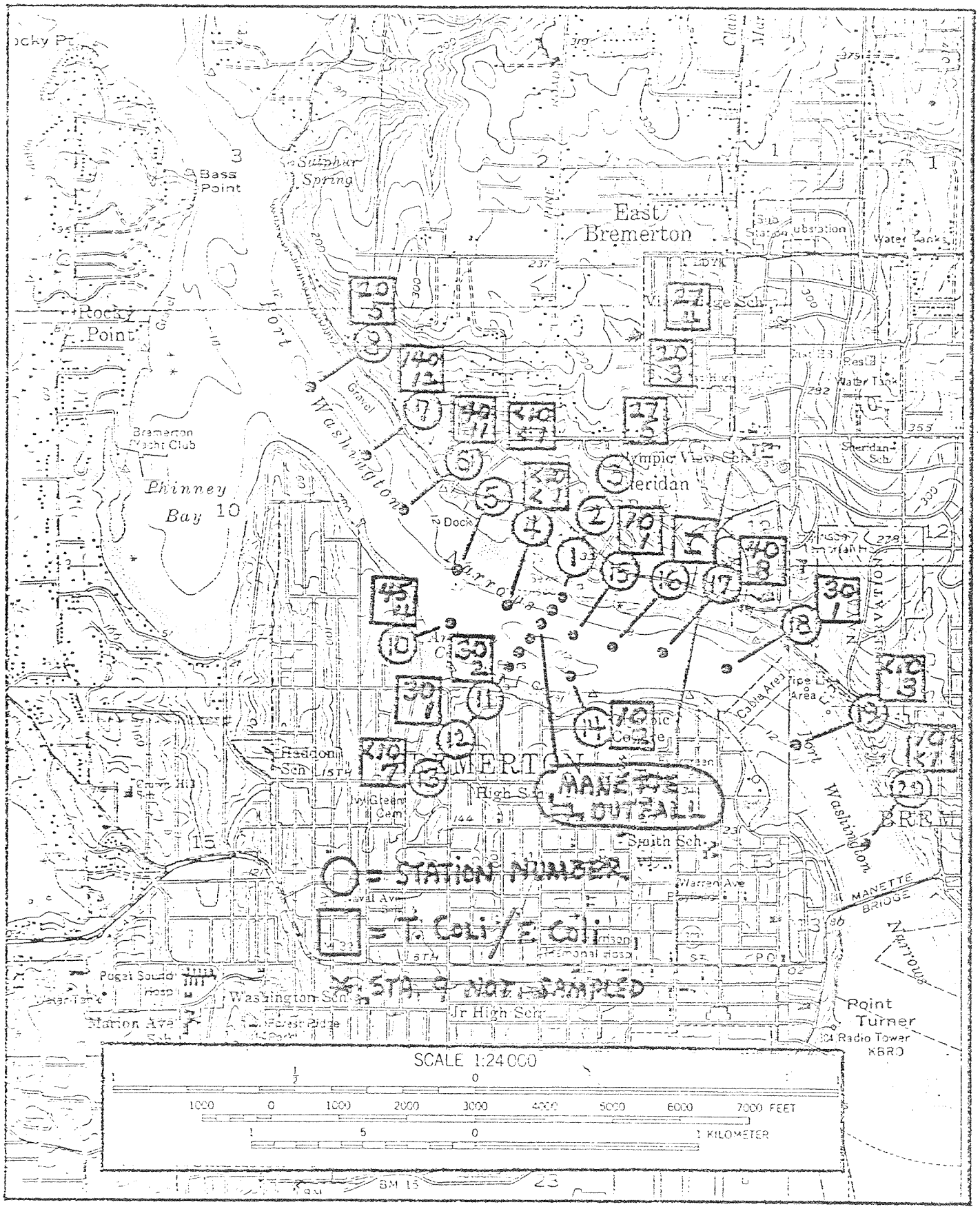


Figure 1. Map showing DOE stations sampled during Manette Water Quality Survey and results of bacteriological sampling conducted during low slack tide, July 18, 1978.

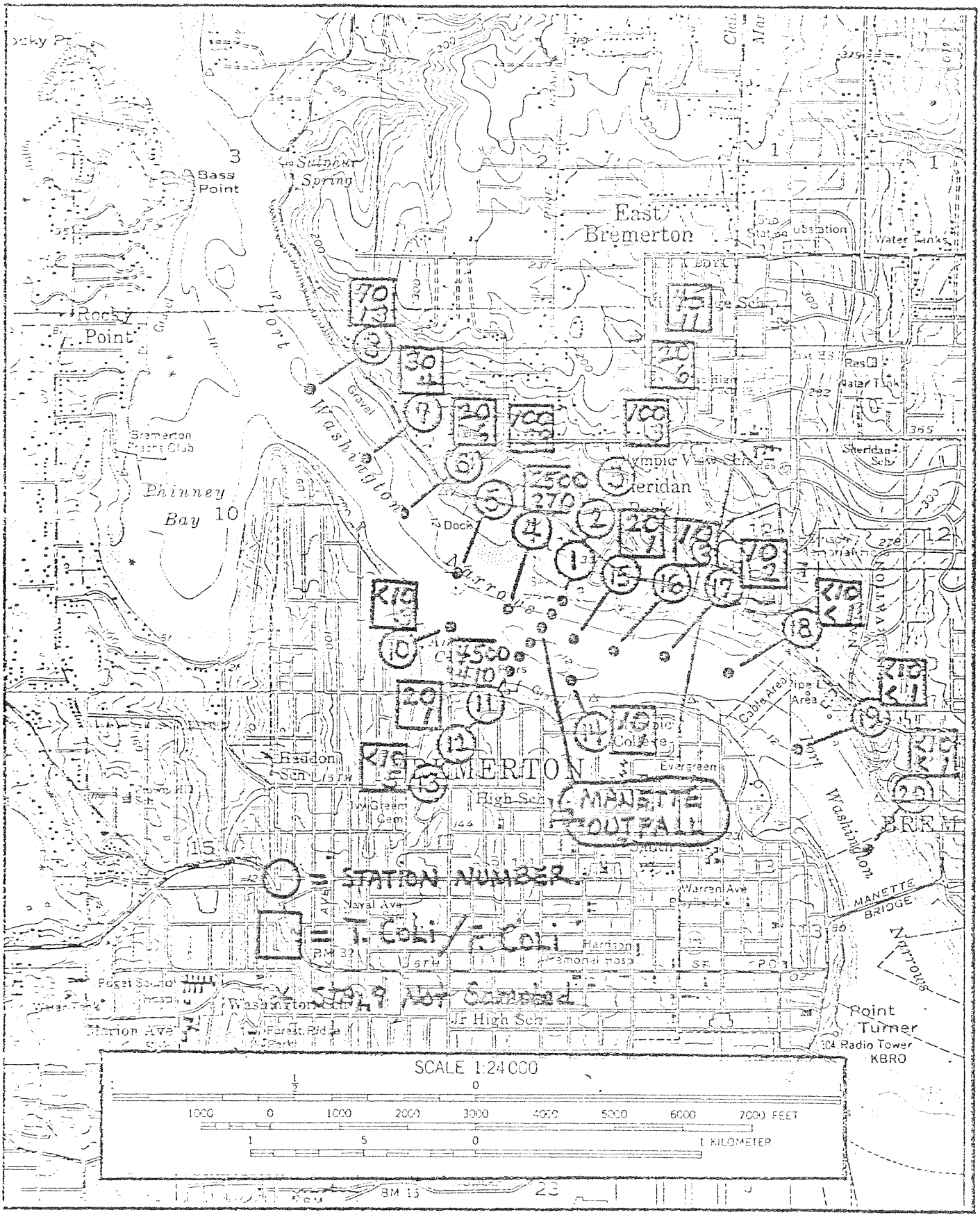


Figure 2. Map showing DOE stations sampled during Manette Water Quality Survey and results of bacteriological sampling conducted during high slack tide, July 18, 1978.

Table 1. DOE water quality sampling data collected from Port Washington Narrows during low slack tide, July 18, 1978

Station Number	Parameter											
	Temp (°C)	D.O.	pH	Turbidity (NTU)	Sp. Cond. (X 100)	Total Coli	Fecal Coli	NH_3-N	NO_2-N	NO_3-N	O-PO_4-P	T-PO_4-P
8	14.8	9.1	8.1	2	355	20	5	.02	<.01	.07	.03	.05
7	14.9	9.2	8.1	2	355	140	12	.03	<.01	.07	.03	.06
6	14.9	9.5	8.1	1	356	40	11	.03	<.01	.07	.02	.06
5	14.9	9.3	8.1	1	354	< 10	< 1	.02	<.01	.07	.02	.06
4 (Inner Narrows)	15.0	8.9	8.1	2	355	< 10	< 1	.02	<.01	.07	.03	.06
10	14.9	9.4	8.1	2	366	45	4	.03	<.01	.08	.04	.05
3	14.2	9.3	8.1	2	357	27	5	.04	<.01	.08	.03	.05
2	14.6	9.3	8.1	2	362	20	3	.03	<.01	.08	.03	.06
1	14.7	9.3	8.0	1	365	27	4	.06	<.01	.09	.02	.06
11	14.3	9.6	8.1	1	366	30	2	.04	<.01	.07	.03	.06
12	14.7	9.3	8.1	1	363	30	1	.03	<.01	.07	.03	.06
13 (Near Outfall)	14.7	9.4	8.1	2	357	< 10	7	.03	<.01	.07	.03	.05
14	14.8	9.3	8.0	1	366	10	2	.03	<.01	.08	.03	.05
5	14.7	9.4	8.1	1	384	10	1	.03	<.01	.07	.03	.06
6	14.8	9.3	8.1	1	380	-	-	.04	<.01	.07	.03	.06
7	14.8	9.6	8.1	2	375	40	8	.04	<.01	.07	.02	.05
8	14.8	9.4	8.1	1	374	30	1	.03	<.01	.07	.02	.05
9	14.8	9.6	8.1	1	376	< 10	3	.04	<.01	.08	.04	.06
10 (Outer Narrows)	14.8	9.4	8.1	1	382	10	< 1	.03	<.01	.07	.03	.06

Table 2. DOE water quality sampling data collected from Port Washington Narrows during high slack tide, July 18, 1978

Station Number	Parameter									
	Temp (°C)	pH	Sp. Cond. (X 100)	Total Coli	Fecal Coli	NH_3-N	NO_2-N	NO_3-N	O-PO_4-P	T-PO_4-P
8	13.5	8.0	418	70	13	.03	<.01	.16	.04	.06
7	13.5	8.0	413	30	4	.01	<.01	.15	.03	.06
6	13.5	8.0	413	20	6	.02	<.01	.16	.03	.07
5	13.5	8.0	401	100	29	.02	<.01	.15	.03	.05
4 (Inner Narrows)	13.5	8.1	409	2500	270	.02	<.01	.15	.03	.07
10	13.6	8.0	421	< 10	3	.02	<.01	.15	.03	.07
3	13.5	8.0	415	100	3	.02	<.01	.15	.03	.07
2	13.5	8.1	415	20	6	.02	<.01	.15	.03	.07
1 (Near Outfall)	13.5	8.0	442	45	11	.01	<.01	.15	.03	.06
11	13.5	8.0	419	4500	410	.03	<.01	.15	.03	.07
12	13.5	8.0	411	20	1	.02	<.01	.14	.03	.07
13	13.7	8.1	413	< 10	5	.03	<.01	.12	.03	.07
14	14.0	8.1	413	10	1	.03	<.01	.12	.03	.05
15	13.5	8.0	411	20	1	.01	<.01	.15	.03	.06
16	13.5	8.0	411	10	3	.03	<.01	.15	.03	.06
17	13.5	8.0	411	10	2	.02	<.01	.15	.03	.06
18	13.5	8.0	414	< 10	< 1	.03	<.01	.15	.03	.05
19	13.5	8.0	417	< 10	< 1	.02	<.01	.14	.03	.07
20 (Outer Narrows)	13.5	8.0	424	< 10	< 1	.03	<.01	.13	.03	.07