Shellfish Growing Water Sanitary Survey of Campbell River, Quadra Island, Cortes Island and West Redonda Island, British Columbia, 1973

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SHELLFISH GROWING WATER SANITARY SURVEY

OF

CAMPBELL RIVER, QUADRA ISLAND, CORTES ISLAND

AND WEST REDONDA ISLAND

by

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Environmental Protection Service

Pacific Region

Vancouver, B.C.

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ABSTRACT

A sanitary survey of the Campbell River area on the east coast of Vancouver Island from Duncan Bay south to Miracle Beach and of suspect areas on Quadra Island, Cortes Island and West Redonda Island was conducted over the period July 4 to July 31, 1973, by personnel of the Environmental Protection Service, Pacific Region.

The purpose of the survey was to identify the sources of domestic sewage pollution, assess the bacteriological quality of the shellfish growing waters and classify the area surveyed respecting the health risk to the consumer of shellfish harvested from the areas indicated.

Unacceptably high total coliform counts in the water were found in the vicinity of the Crown Zellerbach pulp mill treated sewage discharge, the Town of Campbell River raw sewage outfall, at two marinas with heavy recreational boat moorage and in two creeks discharging to shellfish growing waters.

Recommendations are made to declare certain portions of the study area as "contaminated areas" and to include them in Schedule J of the British Columbia Fishery Regulations.

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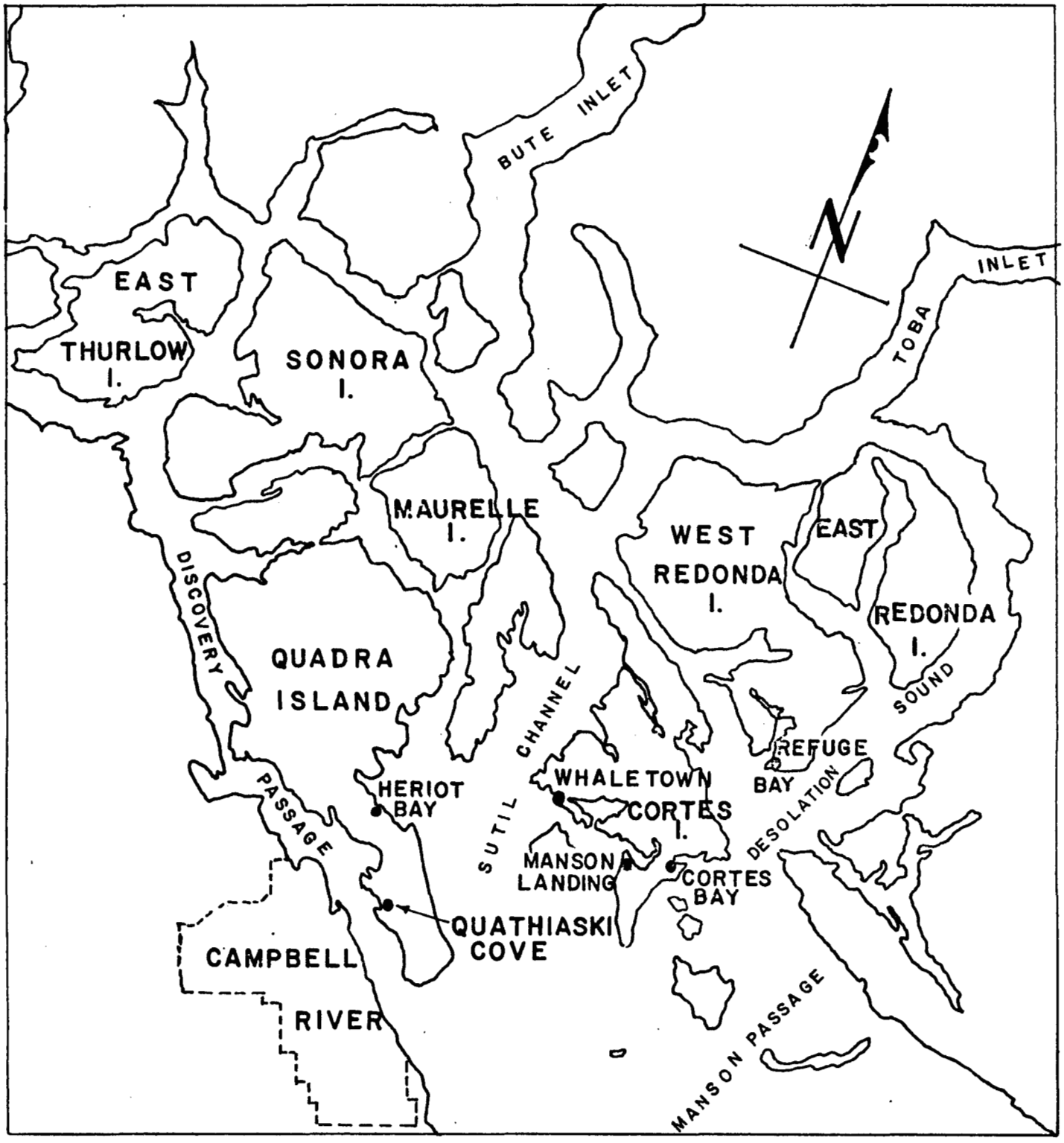
1. INTRODUCTION

The geographical location of the study area is shown in Figure 1. Campbell River is the largest commerical centre in the area with a population exceeding 10,000. Small communities and Indian Reserves make up the majority of the Discovery Islands population. Among the Discovery Islands, Quadra Island, Cortes Island and West Redonda Island were selected for a bacteriological water quality survey of shellfish growing waters.

The study area, Fisheries Statistical Area 13, has a commercially productive oyster and clam fishery. The annual harvest of clams in 1972 was 582,000 pounds. No record of the oyster harvest is available, but it is known to be substantial. The Discovery Islands are a popular recreational area catering to summer residents, yachtsmen and campers. Existing marine parks include the Rebecca Spit Marine Park on Cortes Island, the Thurston Bay Marine Park on Sonora Island, and the Mitlenatch Island Nature Park. Proposed marine parks at Von Donop Inlet on Cortes Island, at Walsh Cove on West Redonda Island plus proposed marine parks in Desolation Sound will further increase the recreational activity in this area.

The present commercial value of the shellfish resource in this area combined with the popular use of shellfish by the recreationalist made it necessary to identify sources

Figure 1



Northern Strait of Georgia showing some areas mentioned in the text.

of domestic sewage polluton and to set up a sampling program to assess the bacteriological quality of the shellfish growing waters.

2. SAMPLING AREA AND STATION SELECTION

The only suspect contaminated areas in the Discovery Islands will be the tidal waters fronting small settlements, marinas and sheltered harbourages. Accordingly, survey sample stations were established at Refuge Cove on West Redonda Island, at Squirrel Cove, Cold Mountain Institute, Smelt Bay, Mansons Lagoon and Gorge Harbour on Cortes Island and at Drew Harbour and Heriot Bay on Quadra Island. Sample stations located in Refuge Cove included the area proposed for oyster raft culture. Mansons Lagoon is presently seeded with oysters. Schedule J contaminated areas in the Discovery Island group i.e. Quathiaski Cove, Quadra Island and Whaletown, Cortes Island were omitted from the survey due to the bacteriological processing limitations of the field laboratory. Shellfish growing areas such as Burdwood Bay and Evans Bay on Read Island and Von Donop Inlet on Cortes Island were not subjected to bacteriological examination since there are no known sources of pollution in these areas.

Along the east coast of Vancouver Island sample stations were located in the vicinity of sewage outfalls at Duncan Bay and Campbell River. Other sample stations were located at Oyster Bay, Salmon Point, and Miracle Beach.

The freshwater stations were tested to assess their contribution of bacterial contamination to the receiving waters. These stations included Simms Creek south of Campbell River and a creek on Cortes Island draining the area behind the Hacienda Marina, Gorge Harbour.

3. FIELD PROCEDURES AND METHODS

Sample stations were selected and a bacteriological water testing program developed to assess the shellfish growing water quality and the sources of sewage pollution.

3.1 Bacteriological Sampling and Analyses

Samples were collected using sterile 6 ounce wide-mouth bottles at a depth of 6 to 12 inches below the surface. The samples were stored in coolers (temperature not exceeding $10^{o}C$) until processed. Analyses were carried out in the Environmental Protection Service mobile field laboratory located in Campbell River and were performed within five hours of collection. The total confirmed and fecal coliform MPN was obtained using the multiple-tube fermentation technique (3 decimal dilutions of 5 tubes each) as described in the 13th Edition of Standard Methods for the Examination of Water and Wastewater, Parts 407A (p.664 and 407C (p. 669).

3.2 Physical (Elemental) Conditions

Water temperature was recorded using a standard centigrade thermometer. Wind readings were recorded using a Casella hand windmill calibrated in miles per hour. In addition, wind direction and local sea conditions were recorded. Tide data is for the Campbell River reference port. Precipitation data was that recorded by Pacific Western Airlines, Campbell River Airport.

3.3 Recreational Boat Count

At sample stations located near marinas, the number of boats with toilet facilities were counted at the time the sample was taken in that area. Boats not tied up at a marina but moored within approximately 400 feet of the marina, and boats leaving but presumed to have been overnighters were also added to the total boat count.

4. DISCUSSION OF RESULTS

For each sample location a daily station record of total coliform MPN per 100 ml, total fecal coliform MPN per 100 ml and elemental conditions are given in Table A. Standard total confirmed and fecal coliform MPN per 100 ml for the seawater samples are given in Table B and a summary of the total confirmed and fecal coliform results are given in Table C and Table D respectively. Standard total confirmed

and fecal coliform MPN per 100 ml for the freshwater samples are given in Table B-1 and a summary of the total confirmed and fecal coliform results are given in Table C-1 and Table D-1 respectively. A daily recreational boat count for each marina is given in Table E. Tide condition and total coliform MPN per 100 ml for the Hacienda Marina are given in Table E.

In order that an area can be considered safe for the harvesting of shellfish, the coliform median MPN of the water must not exceed 70 per 100 ml, and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 ml for a 5-tube decimal dilution test in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions. The foregoing limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard (1).

4.1 West Redonda Island

Sample station locations for Refuge Cove are shown in Figure 5. During the course of the survey sample station 12 had a total coliform median MPN of 540 per 100 ml and 83.3% of the samples exceeded a total confirmed MPN of 230 per 100 ml (Table C). Sample station 7 had a total coliform median MPN of 27 per 100 ml and 15.4% of the samples exceeded a total confirmed

REFUGE COVE

Figure 5.

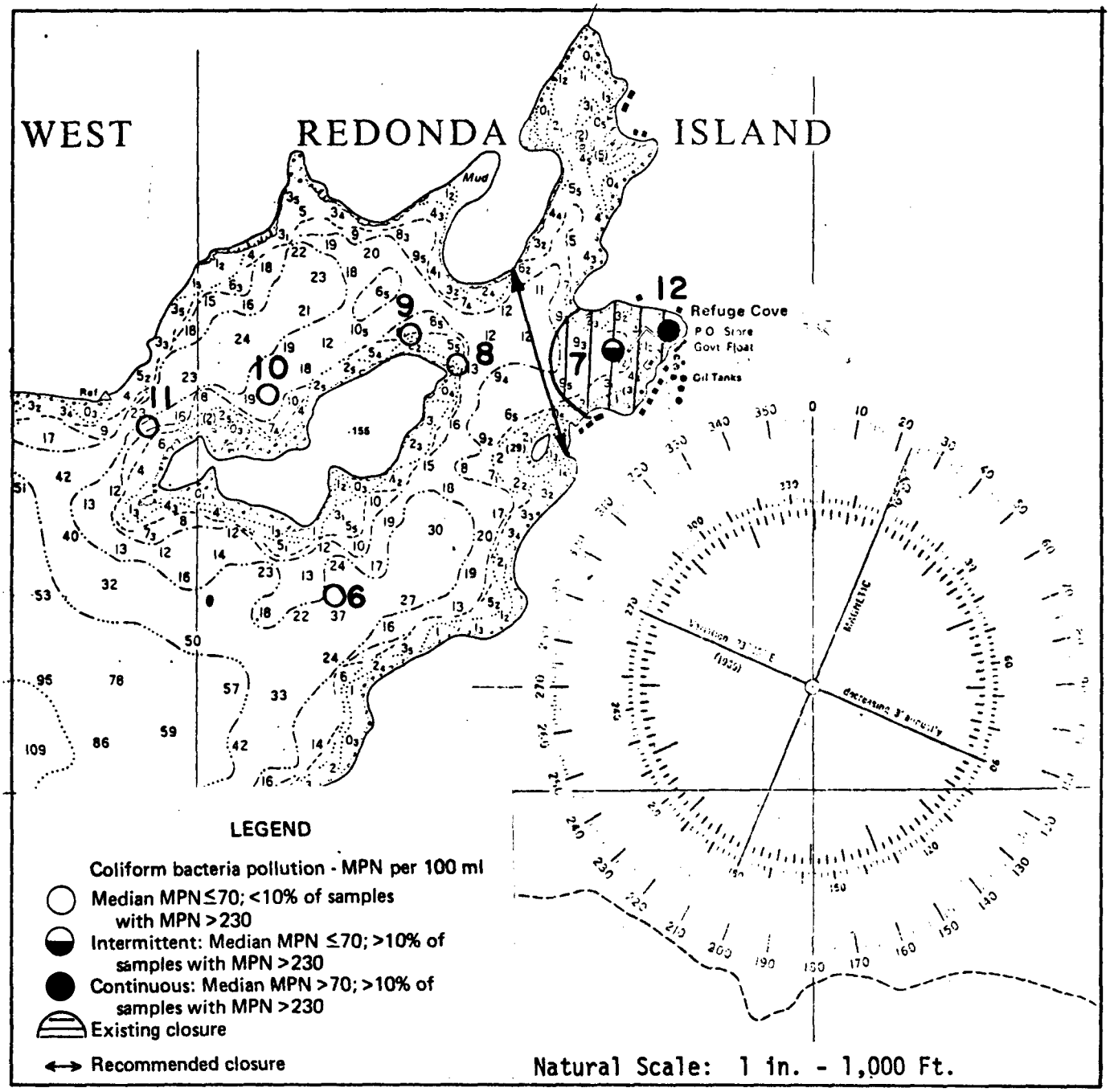


TABLE C

SUMMARY OF BACTERIOLOGICAL DATA FROM SEAWATER SAMPLES:

STANDARD TOTAL CONFIRMED COLIFORM MPN per 100 ml.

Sample Station	Number of Samples	Range	Median MPN per 100 ml	% Over 230 MPN/100 ml
1	13	17->1600	240	61.5
2	13	<1.8 - 79	13	0.0
3	13	<1.8 - 49	13	0.0
4	10	<1.8 - 23	6.2	0.0
5	10	4.5 - 920	59.5	20
6	13	<1.8 -170	7.8	0.0
7	13	<1.8 - 920	27	15.4
8	14	<1.8 - 140	20	0.0
9	14	<1.8 - 79	5.6	0.0
10	14	<1.8 - 49	4.1	0.0
11	14	<1.8 - 110	2.0	0.0
12	6	<7.8->1600	540	83.3
13	13	<1.8 - 33	2.0	0.0
14	10	<1.8 - 2.0	<1.8	0.0
15	10	<1.8 - 2.0	<1.8	0.0

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SUMMARY OF BACTERIOLOGICAL DATA FROM SEAWATER SAMPLES:

STANDARD TOTAL CONFIRMED COLIFORM MPN per 100 ml.

Sample Station	Number of Samples	Range	Median MPN per 100 ml	% Over 230 MPN/100 ml
16	13	<1.8-23	4.5	0.0
17	13	<1.8 - 7.8	2.0	0.0
18	13	<1.8 - 350	2.0	15.4
19	13	<1.8 - 1600	2.0	7.7
20	11	<1.8 - 240	6.8	9.1
21	13	<1.8 - 49	11	0.0
22	13	<1.8 - 21	<1.8	0.0
23	14	<1.8 - 13	2.0	0.0

TABLE C - 1

SUMMARY OF BACTERIOLOGICAL RESULTS FROM FRESHWATER SAMPLES

STANDARD TOTAL CONFIRMED COLIFORM MPN per 100 ml.

Sample Station	Number of Samples	Range	Median MPN per 100 ml	% Over 230 MPN/100 ml
S1	10	22 - 1600	315	70
S2	10	220->1600	540	90
S3	10	110- 1600	350	80

MPN of 230 per 100 ml (Table C). Sample station 7 was located approximately 300 feet from sample station 12 and indicates bacterial contamination occurs in the boat moorage area. Sample station 8 located approximately 1200 feet from the boat moorage area had a total coliform median MPN of 20 per 100 ml (Table C) and met the shellfish growing water standards. Sample station 10 taken off the proposed oyster raft culture area had a total coliform median MPN of 4.1 per 100 ml (Table C) and met the shellfish growing water standards.

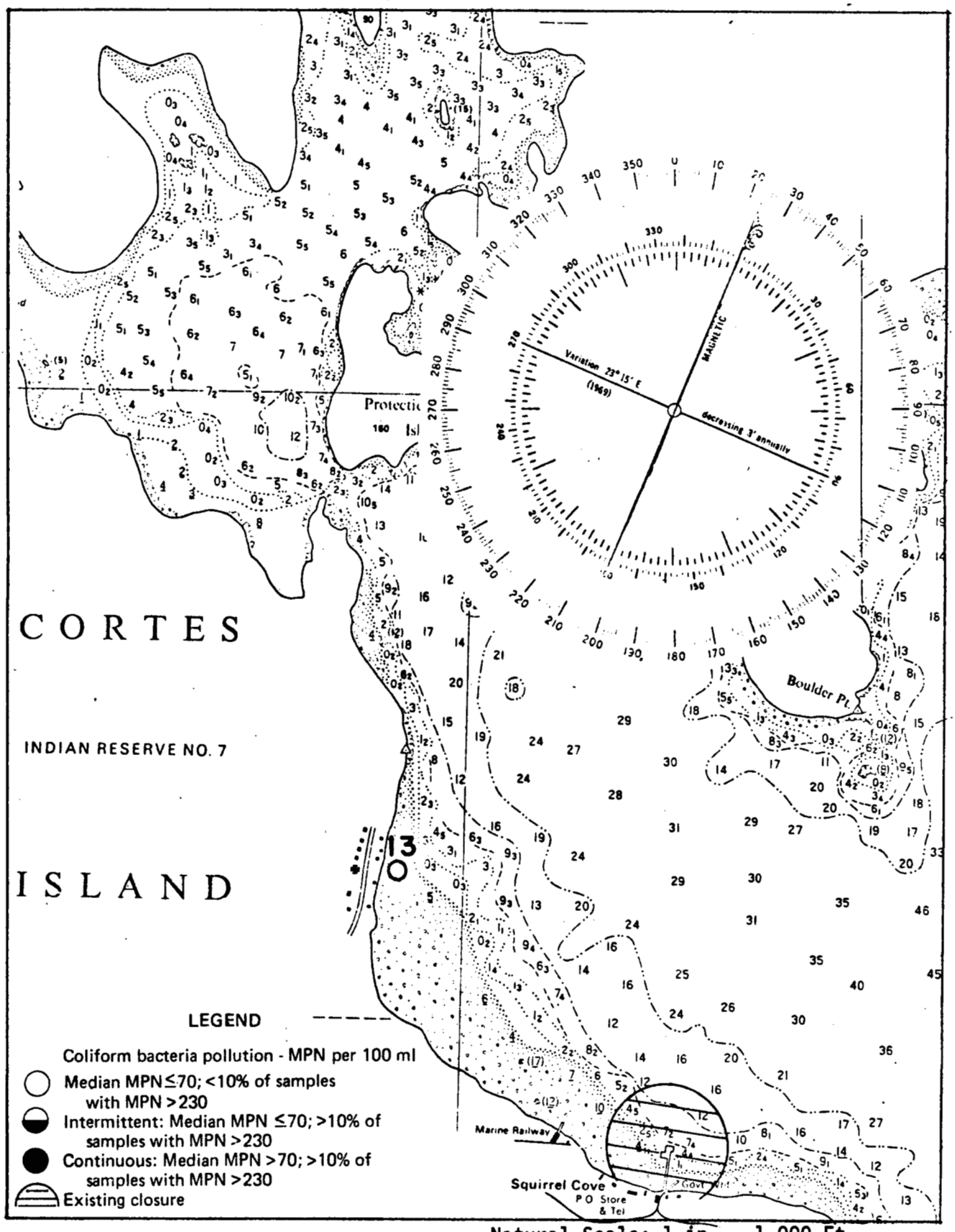
The principal sources of bacterial contamination are raw sewage discharges from the laundromat toilets, from residences in the vicinity of the Marina and from boats moored at the Marina. The laundromat sewer outfall is located close to sample station 12. With few exceptions, the boats using Refuge Cove moor at the Marina or in the sheltered moorage north of the Marina. Refuge Cove is subject to year round bacterial contamination from permanent residences. Recreational boating activity and increased residential occupancy during the summer increases the quantity of raw sewage discharged.

4.2 Cortes Island

In Squirrel Cove, sample station 13 fronting Indian Reserve #7 is shown in Figure 6. During the course of the survey, results from this sample station gave a total coliform

SQUIRREL COVE

Figure 6.



Natural Scale: 1 in. - 1,000 Ft.

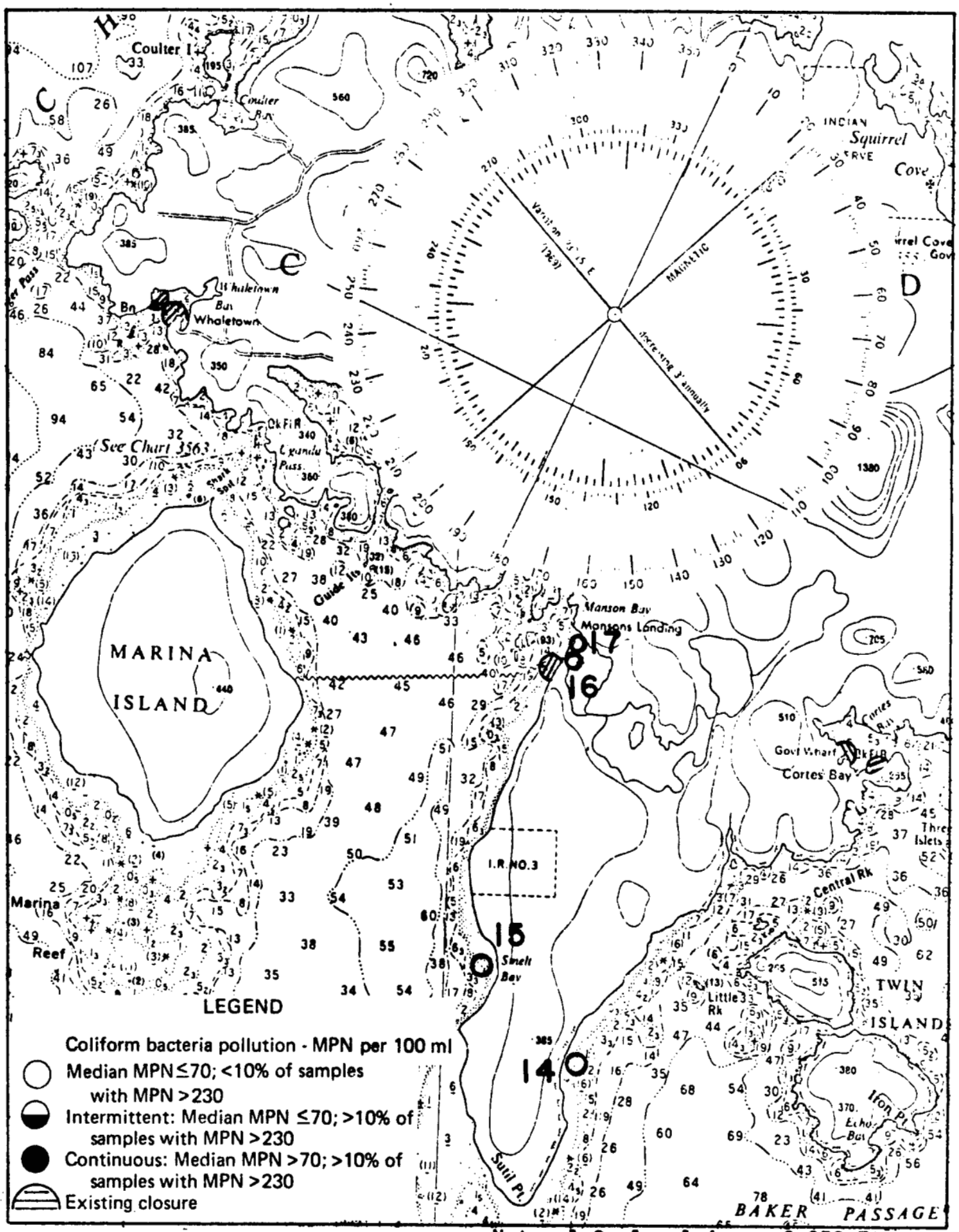
median MPN of 2.0 per 100 ml (Table C) and met the shellfish growing water standards. According to the Department of Indian Affairs, Vancouver Region, pit privies are used on Indian Reserve #7.

Respecting the 6 homes located beyond the Government Wharf, it is felt that the Schedule J 400 foot general wharf closure provides adequate protection against bacterial contamination from that source. The sheltered moorage area located north of Protection Island and south of Indian Reserve #8, used by pleasure craft during the summer, is not considered to be a significant health hazard due to offshore distance and good tidal flushing.

Sample station locations for the Cold Mountain Institute, Smelt Bay and Mansons Lagoon are shown in Figure 7. Sample station 14 fronting the Cold Mountain Institute had a total coliform median MPN of less than 1.8 per 100 ml (Table C) and met the shellfish growing water standards. The Cold Mountain Institute buildings are connected to a biological package sewage treatment plant. After treatment the effluent is passed through a series of absorption fields located at the base of the hill on which the Institute is situated.

COLD MOUNTAIN, SMELT BAY, MANSONS LANDING

Figure 7.



Natural Scale: 1 in. - 6,250 Ft.

Sample station 15 located opposite the community of Smelt Bay had a total coniform median MPN of less than 1.8 per 100 ml (Table C) and met the shellfish growing water standards. The houses in this community are serviced by septic tanks and absorption fields which appeared to be giving satisfactory service.

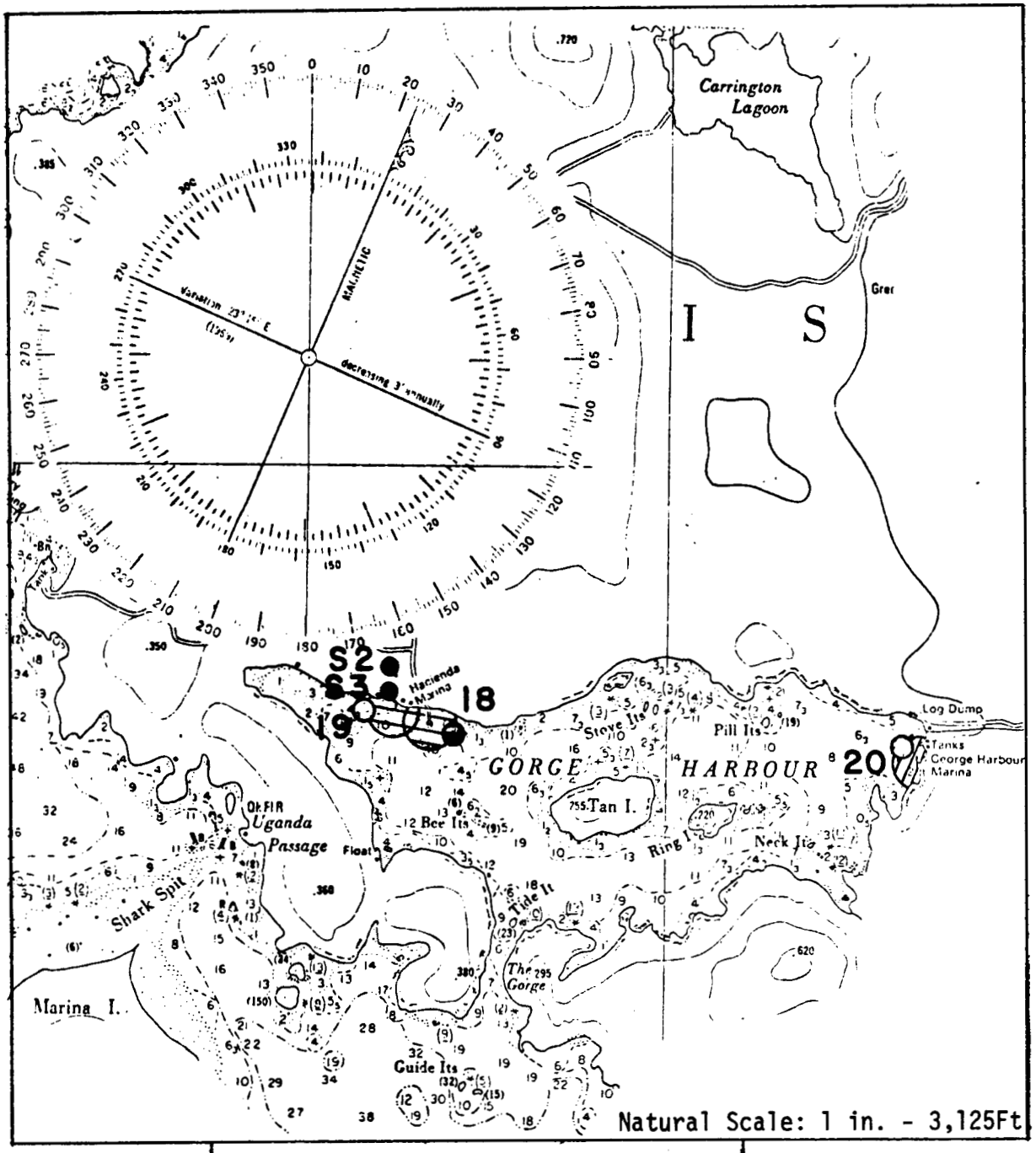
Mansons Lagoon sample stations 16 and 17 had total coliform median MPNs of 4.5 per 100 ml and 2.0 per 100 ml respectively (Table C) and met the shellfish growing water standards. These stations were established to determine the water quality of the lagoon area which had been commercially seeded with oysters. The seeded area is located well away fromthe Mansons Landing Wharf and the strong tidal flow from the lagoon thoroughly flushes the seeded area.

The Mansons Landing store and restaurant are serviced by septic tank and the absorption field system drains away from the lagoon. The Schedule J 400 foot general wharf closure encloses the Mansons Landing moorage area where boat toilet discharges occur and is felt to be adequate. The number of boats recorded at Manson Landing is given in Table E.

Sample station locations in Gorge Harbour are shown in Figure 8. Sample station 20 taken at the Gorge Harbour Marina had a total coliform median MPN of 6.8 per 100 ml and 9.1% of the samples exceeded a total confirmed

GORGE HARBOUR

Figure 8.



LEGEND

Coliform bacteria pollution - MPN per 100 ml

- Median MPN≤70; <10% of samples with MPN >230
- Intermittent: Median MPN ≤70; >10% of samples with MPN >230
- Continuous: Median MPN >70; >10% of samples with MPN >230
- Existing closure

MPN of 230 per 100 ml (Table C). The marina house and store domestic sewage disposal facilities consist of pit privies. A source of bacterial contamination is boat toilet discharges to the moorage area as indicated by the intermittently high coliform counts. Boat counts for the Gorge Harbour Marina are moderate (Table E) with the peak boating season being July 1 to September 4. The Schedule J 400 foot general wharf closure is felt to be adequate.

Sample stations 18 and 19 were taken in the vicinity of the Hacienda Marina located at the west end of Gorge Harbour. Freshwater sample stations S2 and S3 were taken from the creek running through the Hacienda Marina property. Sample station 19 taken approximately 400 feet west of the Hacienda Marina had a total coliform median MPN of 2.0 per 100 ml and met the shellfish growing water standards. Sample station 18 taken approximately 1000 feet east of the Hacienda Marina had a total coliform MPN of 2.0 per 100 ml but 15.4% of the samples exceeded a total confirmed MPN of 230 per 100 ml indicating intermittent contamination occurs in this area (Table C). Sample station S3 had a total confirmed median MPN of 250 per 100 ml and station S2 indicates that the contamination occurs before the creek enters the marina property (Table C-1).

TABLE E

MARINA RECREATIONAL BOAT COUNT

Date July 1973	Refuge Cove	Mansons Landing	Hacienda Marina	Gorge Harbour	Heriot Bay	Drew Harbour
12	8	1	4		2	1
13	5	4	17		5	1
14						
15						
16	15	1	15		1	0
17	20	5	11	5	3	4
18	14	2	14	4	1	2
19	11	1	9	7	4	0
20	18	3	9	10	4	0
21						
22						
23	25		8	8		0
24	24	10	20	7	11	1
25	26	0	26	10	5	0
26	19	5	14	13	4	1
27	11	2	18	12	3	0
28						
29						
30	16	0	16	11	1	0
31	15	4	18	11	1	0

NOTES:- Counts are based on boats with toilet facilities and moored at the marina.
- Boats moored within approximately 400 feet of the marina and those boats just leaving but assumed to be overnighters are added to the total.
- For Drew Harbour, boats within 800 feet of the sample point were counted.
- For Heriot Bay, boats at the Government Wharf and Hotel Wharf were combined.

The Hacienda Marina toilet facilities (house, store, laundromat) are connected to a central holding tank located on the shoreline below the store. The sewage is pumped from here to a drain field located west of the store.

The marina had a consistently high boat count (Table E) and is busiest from July 1 to September 4. Sources of bacterial contamination into the Hacienda Marina moorage area include the creek running through the Hacienda Marina property, possible absorption field seepage and boat toilet discharges. The Government Wharf, east of the Hacienda Marina, has moorage space for only a few boats.

During the course of the survey strong tidal flows were noted at the Gorge Harbour mouth. Bacteria contaminated water in the vicinity of the Hacienda Marina will be transported in a south-east direction toward the Gorge Harbour mouth on an ebb tide and is the probable cause of the high total confirmed MPN observed at sample station 18 (Table F). On a flood tide the reverse action will occur as indicated by the high total coliform MPN of 1600 per 100 ml obtained at sample station 19 on July 25 while sample station 18 had a total coliform MPN of less than 1.8 per 100 ml (Table F). Continuous bacterial contamination occurs from the creek running through the Hacienda Marina property and increased bacterial contamination from boat toilet discharges

TABLE F

TIDE CONDITION AND TOTAL COLIFORM
MPN per 100 ml FOR THE HACIENDA MARINA

Date July	Sample Time Station 18	TC MPN Station 18	Sample Time Station 19	TC MPN Station 19	TIDE CONDITION		
					Time	Height (feet)	Tide
17	1040	34	1050	2.0	0605 1320	12.2 3.3	Ebb
18	1145	350	1152	79	0640 1340	11.9 4.0	Ebb
25	1137	<1.8	1145	1600	0815 1545	3.0 12.5	Flood
26	1207	<1.8	1214	33	0910 1635	2.2 13.2	Flood
27	1215	33	1220	2.0	1010 1715	1.5 13.8	Early Flood
30	1040	350	1045	<1.8	0500 1240	13.7 1.7	Ebb

occurs in the summer.

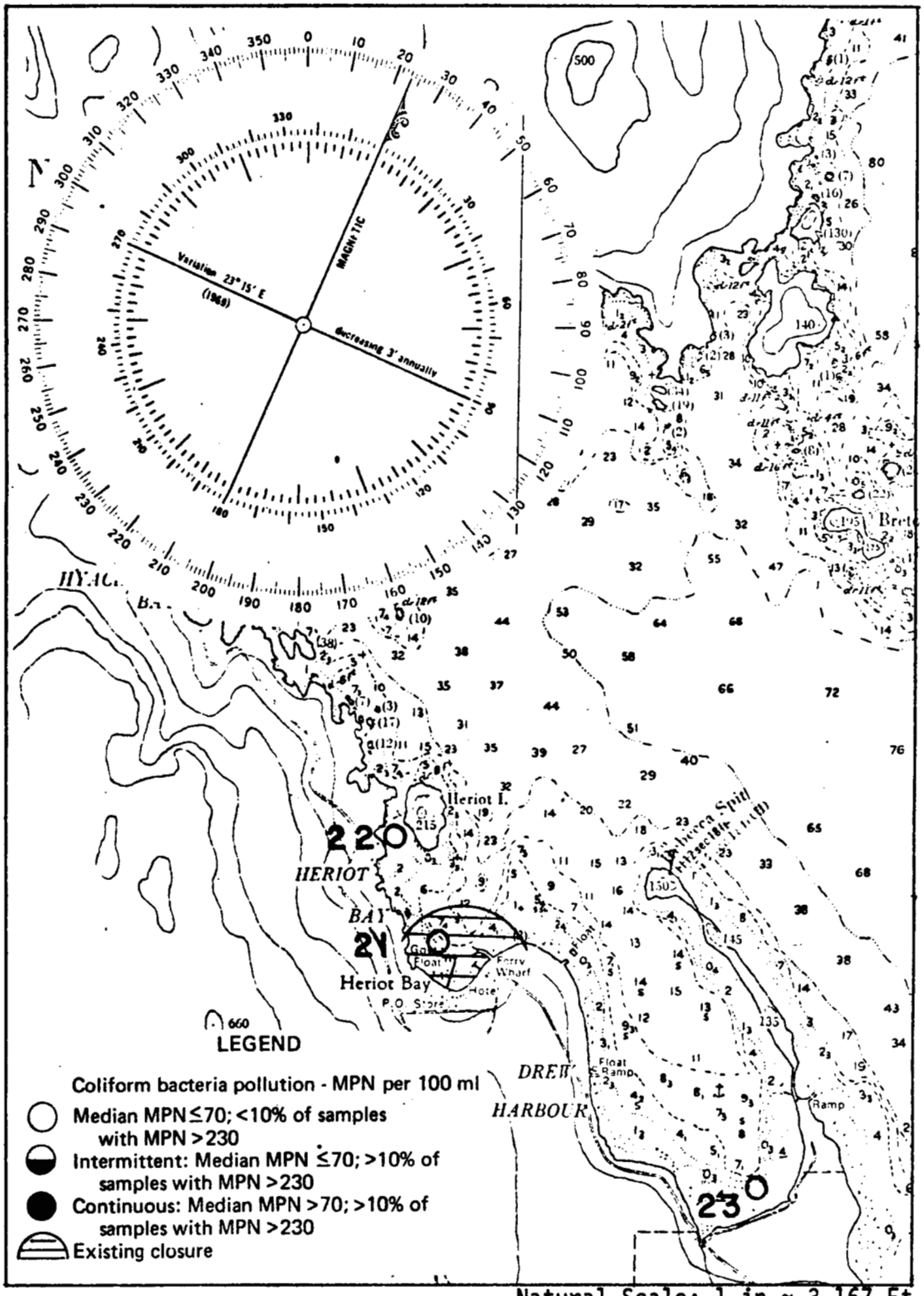
4.3 Quadra Island

Sample station 23 at the south end of Drew Harbour (Figure 9) had a total coliform median MPN of 2.0 per 100 ml (Table C) and met the shellfish growing water standards. Sources of bacterial contamination in the vicinity of Drew Harbour include the Provincial Ferry to Cortes Island and some recreational boat moorage at the north-east corner of the harbour. The ferry route is sufficiently distant from the north end of Rebecca Spit not to be considered a significiant health hazard. Due to the small numbers of boats using the moorage and the considerable tidal flushing of this area the degree of bacterial contamination will also be minimal. There is relatively little housing along the west shore of the harbour.

Sample station 21 at the south end of Heriot Bay had a total coliform MPN of 11 per 100 ml (Table C) and met the shellfish growing water standards. Recreational boat counts at the Government Wharf were small (Table E) but a large number of commerical fishing vessels were tied up at the wharf during the survey. The existing Schedule J 800 foot closure encloses the residential area, the Government Wharf, the Provincial Ferry Wharf, and the Heriot Bay Hotel Wharf. Sample station 22, at the north end of Heriot Bay had a low coliform median MPN of

HERIOT BAY AND DREW HARBOUR

Figure 9.



Natural Scale: 1 in.≈ 3,167 Ft.

1.8 per 100 ml (Table C) and met the shellfish growing water standards. There were no apparent sources of bacterial contamination in this area.

4.4 East Vancouver Island

Along the east coast of Vancouver Island water samples were taken at Duncan Bay, Campbell River, Simms Creek, Oyster Bay, Salmon Point and Miracle Beach.

Sample station 1, off the Crown Zellerbach pulp mill, in Duncan Bay, had a total coliform median MPN of 240 per 100 ml and 61.5% of the samples exceeded a total confirmed MPN of 230 per 100 ml (Table C). This station was near the log boom contained area into which the mill industrial and domestic sewage effluents discharge as shown in Figure 2. The estimated volume of pulp and paper mill waste effluent discharged is 56,000,000 imperial gallons per day. The estimated volume of secondary treated sewage discharged is 25,000 gallons per day.

Sample station 5 off the Town of Campbell River sewage outfall had a total coliform median MPN of 59.5 per 100 ml and intermittent bacterial contamination with 20% of the samples exceeding a total confirmed MPN of 230 per 100 ml (Table C). The sample station is shown in Figure 3. The quantity of sewage which may be discharged averages

DUNCAN BAY

OYSTER BAY

CAMPBELL RIVER

SALMON POINT

SIMMS CREEK

MIRACLE BEACH

Figure 2.

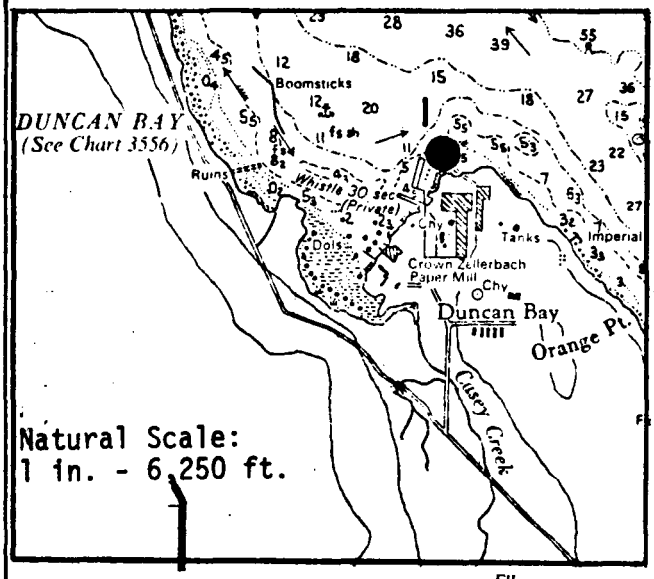


Figure 3.

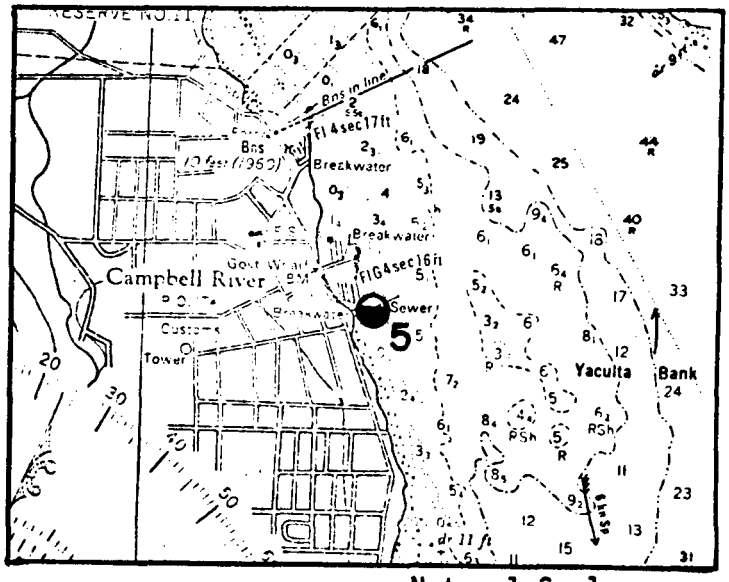
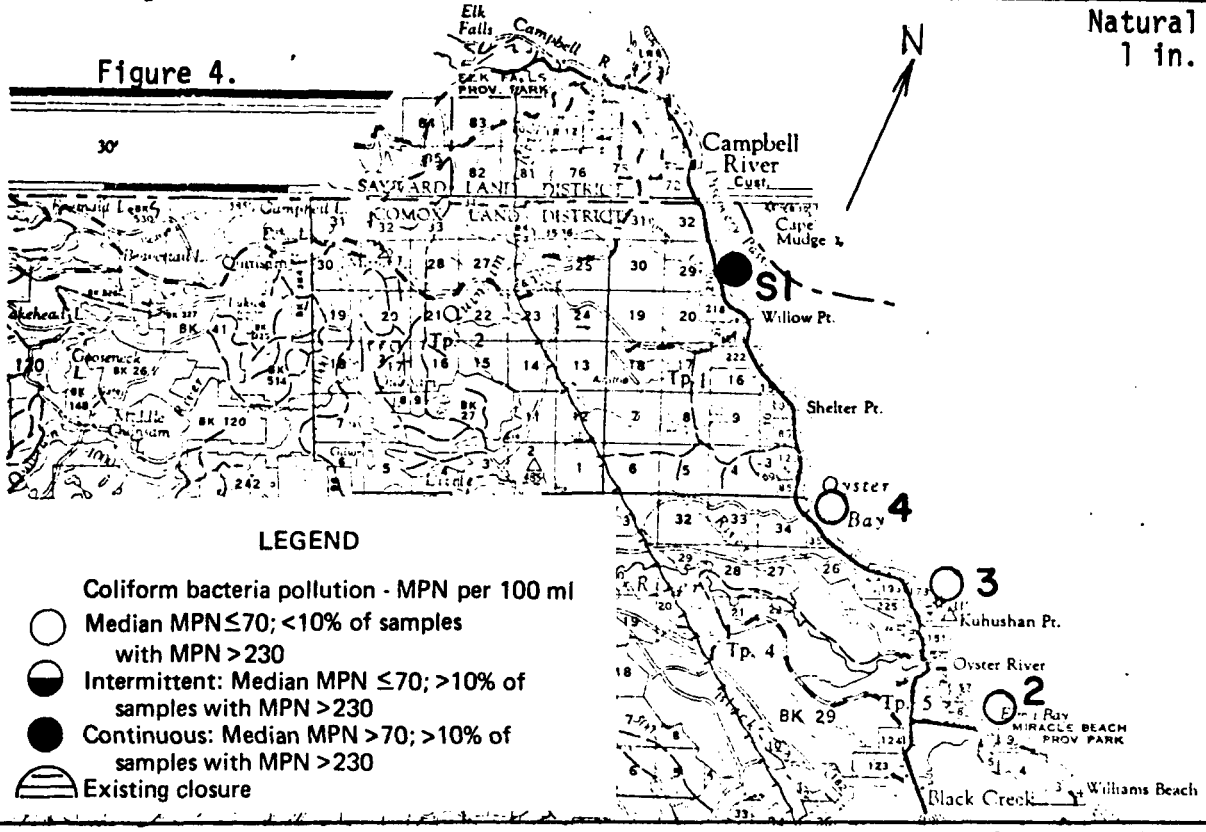


Figure 4.



Natural Scale: 1 in. ≈ 4 miles.

1,100,000 gallons per day. At present the District of Campbell River discharges untreated sewage but a secondary treatment plant is under construction with an operational date planned for early 1974.

Sample station S1 on Simms Creek south of Campbell River is shown in Figure 4. The creek had a total coliform median MPN of 215 per 100 ml (Table C-1). The major source of bacterial contamination is from a trailer home park at the foot of Rockland Road. The trailer home park is serviced by a sewage holding tank with an overflow into Simms Creek.

Sample stations 2, 3, and 4 are shown in Figure 4. Sample station 2 at the Miracle Beach Provincial Park had a total coliform median MPN of 13 per 100 ml (Table C) and met the shellfish growing water standards. The possible source of bacterial contamination in this area include the Miracle Beach Provincial Park sewage disposal facilities and the Miracle Beach Resort sewage disposal facilities. Both the park and the resort are serviced by septic tank with absorption fields located well away from the shoreline and are not considered to be significant health hazards. Sample station 3 at Salmon Point had a total coliform median MPN of 13 per 100 ml (Table C) and met the shellfish growing water standards. A possible source of bacterial contamination in this area, is the Salmon Point Resort and trailer park sewage

disposal facility consisting of a septic tank with an absorption field located well away from the shoreline. This source is not considered to be a significant health hazard. Sample station 4 at the Oyster Bay picnic site had a total coliform median MPN of 6.2 per 100 ml (Table C) and met the shellfish growing water standards. The picnic site is serviced by pit privies.

As a result of domestic sewage discharges into the receiving waters adjacent to Campbell River, a significant health hazard is present. A listing of Pollution Control Branch permits effective in the Campbell River area is given in Appendix 4. In addition to those sources listed and the high coliform levels found in Simms Creek, an emergency overflow from the sewage pump station north of Willow Point presents a possible source of bacterial contamination to the receiving waters.

5. CONCLUSIONS

(a) The foreshore waters adjacent to the Town of Campbell River are subject to fecal contamination from the Crown Zellerbach pulp mill treated domestic sewage discharge, the Town of Campbell River raw domestic sewage discharge, Simms Creek and in the event of a pump failure from a sewage pump station north of Willow Point. Other possible sources include storm water from both sewered and unsewered areas and sewage discharges and landwash entering the Campbell River.

(b) The foreshore waters adjacent to the Hacienda Marina, Gorge Harbour, Cortes Island, are subject to fecal contamination. Sources of contamination include the creek draining into the Hacienda Marina moorage area, possible absorption field seepage and boat toilet discharges during the summer months.

(c) The foreshore waters adjacent to the Refuge Cove Marina, West Redonda Island, are subject to fecal contamination. Sources of contamination include domestic sewage discharges from resident housing, Marina toilet facilities, and boat toilet discharges during the summer months.

(d) The proposed oyster raft culture area in Refuge Cove, West Redonda Island, met the shellfish growing water standards.

(e) The commercially oyster seeded area of Mansons Lagoon, Cortes Island, met the shellfish growing water standards.

(f) On the east coast of Vancouver Island, the foreshore waters off the Oyster Bay picnic site, Miracle Beach Provincial Park and Salmon Point Resort met the shellfish growing water standards.

6. RECOMMENDATIONS

It is recommended that the following areas be declared contaminated and included in Schedule J of the British Columbia Fishery Regulations.

(a) That portion of the tidal foreshore, Area 13, from Middle Point north of Duncan Bay south to Shelter Point north of Oyster Bay.

(b) The water and tidal foreshore of Refuge Cove, Area 13, lying inside a line, drawn across the head of the cove, between Lat. 50°07.53'N, Long. 124°50.5'W and Lat. 50°07.35'N, Long. 124°N50.4'W.

(c) That portion of the tidal foreshore of Gorge Harbour, Area 13, lying between a point located 1000 feet west of the Hacienda Marina Wharf and a point located 1000 feet east to the Government Wharf.

7. REFERENCES

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2. Standard Methods for the Examination of Water and Wastewater. 1971. 13th ed. Amer. Public Health Assoc. N.Y.

3. Pond, S._____ . Estuary Data Compilation. In progress. Environment Canada, Environmental Protection Service.

ACKNOWLEDGEMENTS

Mr. B. Kay, Bacteriologist, conducted the Bacteriological Analyses in the Environmental Protection Service mobile laboratory and compiled all the bacteriological data.

Mr. M. Nider, Student Technician, assisted in the bacteriological analyses.

Mr. G. Derksen, Biological Technician, conducted the Field survey, compiled all other data and assembled the report for printing.

A P P E N D I X I

Description of Sample Station Locations

Freshwater Stations

Seawater Stations

Description of Sample Station Locations

Freshwater Stations

Number	Description
S1	Located on the east side of Highway 19 at Simms Creek south of Campbell River. The sample was taken from the stream close to the highway culvert located at the foot of Forberg Road.
S2	Located in a creek west of the Hacienda Marina store on Cortes Island. The sample was taken at the treeline before the creek reaches the intertidal zone.
S3	Located in the same creek as S2 but taken behind the Hacienda Marina campsite.

NOTE:

All compass bearings are magnetic.

Description of Sample Station Locations

Seawater Stations

Number	Description
1	Located in Duncan Bay and positioned approximately 100 feet north-west of the Crown Zellerbach pulp mill industrial and domestic sewage effluent discharge.
2	Located at Miracle Beach and positioned fifteen feet offshore in front of the picnic ground toilet facilities. This station is approximately 500 feet north of the Miracle Beach Resort.
3	Located at Salmon Point Resort and positioned offshore in line with the resort gas pumps.
4	Located in Oyster Bay and positioned offshore in line with the picnic ground pit privies.
5	Located approximately 75 feet offshore and positioned directly in line with the Campbell River sewage outfall warning sign.
6	Located in the southern channel of Refuge Cove and positioned in midchannel of the mouth.
7	Located in Refuge Cove and positioned twenty feet off the south end of the Refuge Cove Marina ESSO station.
8	Located in Refuge Cove and positioned twenty feet off the northern tip of the Island and in line with a white marker on a tree.
9	Located in Refuge Cove and positioned twenty feet off the north-west corner of the Island and in line with a green marker on a tree.
10	Located in the northern channel of Refuge Cove and positioned approximately 300 feet offshore of the bay where an oyster raft culture is to be located. This area was occupied with log booms during the study.
11	Located in the northern channel of Refuge Cove and positioned in midchannel of the mouth between the fishing boundary markers.

12 Located in Refuge Cove and positioned off the wharf corner nearest the laundromat drain pipes.

13 Located in Squirrel Cove and positioned approximately 75 feet offshore and in line with the church on Indian Reserve #7.

14 Located approximately 100 feet offshore of the Cold Mountain Institute, Cortes Island.

15 Located in Smelt Bay and positioned approximately 100 feet offshore and in line with a small float.

16 Located in Mansons Lagoon and positioned offshore below the Post Office at high tide or in a tide pool west of the large rock near the oyster seed area at low tide.

17 Located in Mansons Lagoon entrance and positioned off a fish boat wreck. This station is a tidal stream draining the oyster seed area.

18 Located in Gorge Harbour and positioned 30 feet offshore and 400 feet east of the Government Wharf.

19 Located in Gorge Harbour and positioned 30 feet offshore and 400 feet west of the Hacienda Marina.

20 Located in Gorge Harbour and positioned 40 feet offshore and 20 feet due west of the Gorge Harbour Marina.

21 Located in Heriot Bay and positioned approximately 20 feet from the northern most corner of the Government Wharf.

22 Located in Heriot Bay, west of Heriot Island, and positioned approximately 100 feet offshore and in line with a log spar.

23 Located in Drew Harbour and positioned approximately 100 feet offshore and in line with the boat lauching ramp at the head of the harbour.

NOTE:

(1) Distances are in relation to high tide water level.

(2) All compass bearings are magnetic.

A P P E N D I X 2

Table A-1 to A-23. Bacteriological and Elemental Data for Seawater Samples.

TABLE A - 1

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 1

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
11	1201	1005 1720	3.4 12.9	15 - 18	0.0			Clear	17	<1.8
12	0935	0220 1045	12.5 3.1	"	0.0			Clear	1600	22
13	1102	0255 1125	12.5 2.8	"	0.0			Clear	350	4.5
16	1045	0510 1250	12.4 2.9	"	0.0	NW @ 7 gusts to 12	Choppy	Clear	240	2.0
17	0834	0605 1320	12.2 3.3	"	0.0	Slight	Calm	Clear	240	4.5
18	0940	0640 1340	11.9 4.0	"	0.0	Slight	Slight Ripple	Clear	350	2.0
19	0937	0730 1400	11.4 4.0	"	0.0	W @ 2	Calm	Clear	21	2.0

TABLE A - 1

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 1

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	0910	0835 0420	10.9 8.0	15 - 18	0.0	Slight	Rippled	Clear	33	4.5
23	1328	1300 1615	10.8 10.0	"	0.0		Slight Chop	Clear	>1600	14
25	1048	0915 1645	3.0 12.5	15.0	0.01			Overcast, Rain	79	4.0
26	1017	1010 1735	2.2 13.3	15.5	0.0	NW @5-7	Choppy	Clear	240	7.8
27	1030	0150 1010	13.9 1.5	17.5	0.0	NW @5-7	Choppy	Clear	170	11
30	1000	0500 1240	13.7 1.7		0.0	NW @2-3	Rippled	Clear	240	4.0

TABLE A - 2

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 2

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
11	1440	1005 1720	3.4 12.9	15 - 18	0.0			Clear	<1.8	<1.8
12	1030	0220 1045	12.5 3.1	"	0.0			Clear	2.0	<1.8
13	0922	0255 1125	12.5 2.8	"	0.0			Clear	2.0	<1.8
16	1130	0510 1250	12.4 2.9	"	0.0	NW @ 7 gusts to 12	Choppy	Clear	2.0	<1.8
17	0910	0605 1320	12.2 3.3	"	0.0	Slight	Calm	Clear	13	7.8
18	0835	0640 1340	11.9 4.0	"	0.0	Slight	Slight Ripple	Clear	23	4.5
19	0835	0730 1400	11.4 4.0	"	0.0	W @ 2	Calm	Clear	79	11

TABLE A - 2

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 2

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	0800	0835 0420	10.9 8.0	15 - 18	0.0	Slight	Rippled	Clear	33	33
23	1447	1300 1615	10.8 10.0	"	0.0		Slight Chop	Clear	11	<1.8
25	0935	0915 1645	3.0 12.5	"	0.01			Overcast, Rain	4.5	2.0
26	0900	1010 1735	2.2 13.3	"	0.0	NW @5-7	Choppy	Clear	13	<1.8
27	0905	0150 1010	13.9 1.5	"	0.0	NW @5-7	Choppy	Clear	49	33
30	0835	0500 1240	13.7 1.7	"	0.0	NW @2-3	Rippled	Clear	23	7.8

TABLE A - 3

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 3

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
11	1500	1005 1720	3.4 12.9	15 - 18	0.0			Clear	<1.8	<1.8
12	1100	0220 1045	12.5 3.1	"	0.0			Clear	<1.8	<1.8
13	0943	0255 1125	12.5 2.8	"	0.0			Clear	33	2.0
16	1200	0510 1250	12.4 2.9	"	0.0	NW @ 7 gusts to 12	Choppy	Clear	7.8	4.5
17	0940	0605 1320	12.2 3.3	"	0.0	Slight	Calm	Clear	4:5	<1.8
18	0850	0640 1340	11.9 4.0	"	0.0	Slight	Slight Ripple	Clear	13	<1.8
19	0850	0730 1400	11.4 4.0	"	0.0	W @ 2	Calm	Clear	<1.8	<1.8

TABLE A - 3

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 3

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	0820	0835 0420	10.9 8.0	15 - 18	0.0	Slight	Rippled	Clear	46	<1.8
23	1510	1300 1615	10.8 10.0	"	0.0		Slight Chop	Clear	<1.8	<1.8
25	0950	0915 1645	3.0 12.5	"	0.01			Overcast, Rain	49	49
26	0923	1010 1735	2.2 13.3	"	0.0	NW @5-7	Choppy	Clear	17	2.0
27	0930	0150 1010	13.9 1.5	"	0.0	NW @5-7	Choppy	Clear	49	33
30	0852	0500 1240	13.7 1.7	"	0.0	NW @2-3	Rippled	Clear	23	7.8

TABLE A - 4

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 4

DATE 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
13	0957	0255 1125	12.5 2.8		0.0			Clear	<1.8	<1.8
17	0948	0605 1320	12.2 3.3		0.0	NW@4-6	Rippled	Clear	4.5	<1.8
18	0900	0640 1340	11.9 4.0		0.0	W @4-6	Rippled	Clear	2.0	2.0
19	0856	0730 1400	11.4 5.0		0.0	W @ 2	Rippled	Clear	13	4.5
20	0830	0835 0420	10.9 8.0		0.0	NW@ 4-6	Heavy Ripple	Clear	11	4.5
23	1522	1300 1615	10.8 10.0		0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
25	1000	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	23	<1.8
26	0935	0910 1635	2.2 13.2	15.5	0.0	W @4-6	Rippled	Clear	2.0	<1.8
27	0940	0150 1010	13.9 1.5	15.5	0.0	W @ 3	Rippled	Clear	7.8	<1.8
30	0900	0500 1240	13.7 1.7		0.0	W@ 4-6	Heavy Ripple	Clear	23	<1.8

TABLE A - 5

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 5

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
16	1452	1250 1950	2.9 13.5	10.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	49	6.8
17	1500	1320 2015	3.3 13.6	10.0	0.0	NW @4-6	Rippled	Clear	540	220
18	1430	1340 2045	4.0 13.7	10.5	0.0	W @4-6	Rippled	Clear	170	23
19	1434	0730 1400	11.4 5.0	12.0	0.0	W @ 2	Rippled	Clear	23	7.8
20	1303	0835 1420	10.9 6.1	12.0	0.0	NW @4-6	Heavy Ripple	Clear	79	14
23	1515	1300 1615	10.8 10.0	12.0	0.0	NW @ 5	Ripple	Clear	4.5	<1.8
25	1348	0815 1545	3.0 3.0	11.0	0.01	Nil	Calm	Overcast, Rain	34	6.8
26	1415	0810 1635	2.2 13.2	11.5	0.0	W @4-6	Ripple	Clear	49	22
27	1420	1010 1715	1.5 13.8		0.0	W @ 3	Ripple	Clear	70	92
30	1453	1240 1910	1.7 14.5		0.0	W @4-6	Heavy Ripple	Clear	920	6.8

TABLE A-6

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 6

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1100	1045 1800	3.1 13.2		0.0			Clear	<1.8	<1.8
13	0900	1125 1830	2.8 13.3		0.0			Clear	33	13
16	0905	0510 1250	12.4 2.9	15.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	49	4.0
17	0900	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	0900	0640 1340	11.9 4.0	17.0	0.0	W @4-6	Rippled	Clear	11	<1.8
19	1050	0730 1400	11.4 5.0	18.0	0.0	W @ 2	Rippled	Clear	<1.8	<1.8

TABLE A - 6

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 6

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1017	0835 1420	10.9 6.1	17.0	0.0	NW@ 4-6	Heavy Ripple	Clear	7.8	<1.8
23	1135	0630 1300	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	49	3.0
24	1150	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast Rain	<1.8	<1.8
25	1108	0815 1545	3.0 12.5	14.5	0.01	Nil	Calm	Overcast Rain	7.8	7.8
26	0923	0910 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	1.8	<1.8
27	1100	1010 1715	1.5 13.8	17.0	0.0	W @ 3	Ripple	Clear	11	<1.8
30	0850	1240 0500	1.7 13.7	17.0	0.0	W @ 4-6	Heavy Ripple	Clear	170	46

TABLE A - 7

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 7

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1050	1045 1800	3.1 13.2		0.0			Clear	23	4.5
13	0905	1125 1830	2.8 13.3		0.0			Clear	23	7.8
16	0915	0510 1250	12.4 2.9	16.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	140	4.5
17	0905	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	11	2.0
18	0905	0640 1340	11.9 4.0	18.0	0.0	W @4-6	Rippled	Clear	27	4.0
19	0908	0730 1400	11.4 5.0	18.5	0.0	W @ 2	Rippled	Clear	23	4.5

TABLE A - 7

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 7

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	0840	0835 1420	10.9 6.1	18.0	0.0	NW@ 4-6	Heavy Ripple	Clear	110	6.8
23	1004	0630 1300	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	170	49
24	0955	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	<1.8	<1.8
25	0937	0815 1545	3.0 12.5	15.5	0.01	Nil	Calm	Overcast, Rain	79	79
26	0930	0910 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	13	4.5
27	0904	1010 1715	1.5 13.8	17.0	0.0	W @ 3	Ripple	Clear	920	540
30	0855	1240 0500	1.7 13.7	17.0	0.0	W @ 4-6	Heavy Ripple	Clear	540	220

TABLE A - 8

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 8

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1053	0220 1045	12.5 3.1		0.0				2.0	<1.8
13	0910	0255 1125	12.5 2.8		0.0				17	<1.8
16	0919	0510 1250	12.4 2.9	16.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	33	<1.8
17	0926	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	4.0	<1.8
18	0926	0640 1340	11.9 4.0	18.0	0.0	W @4-6	Rippled	Clear	23	<1.8
19	0910	0730 1400	11.4 5.0	18.0	0.0	W @ 2	Rippled	Clear	17	2.0
20	0900	0835 0420	10.9 6.1	17.0	0.0	NW @4-6	Heavy Ripple	Clear	4.5	<1.8

TABLE A - 8

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 8

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
23	1014	0630 1200	5.0 10.8	15.0	0.0	NW @ 5	Ripple	Clear	49	22
24	1012	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	<1.8	<1.8
25	0942	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	33	13
26	0936	0910 1635	2.2 13.2	16.5	0.0	W @4-6	Ripple	Clear	4.5	<1.8
27	0910	0150 1010	13.9 1.5	17.0	0.0	W @ 3	Ripple	Clear	33	<1.8
30	0902	0500 1240	13.7 1.7	17.0	0.0	W @4-6	Heavy Ripple	Clear	<1.8	<1.8
31	0931	0600 1320	13.3 2.7		0.0	NW @ 5	Ripple	Clear	140	46

TABLE A - 9

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 9

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1045	0220 1045	12.5 3.1		0.0				<1.8	<1.8
13	0911	0255 1125	12.5 2.8		0.0				4.5	<1.8
16	0922	0510 1250	12.4 2.9	16.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	33	6.8
17	0920	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	0920	0640 1340	11.9 4.0	18.0	0.0	W @4-6	Rippled	Clear	33	2.0
19	0930	0730 1400	11.4 5.0	18.0	0.0	W @ 2	Rippled	Clear	6.8	2.0
20	0912	0835 0420	10.9 6.1	17.0	0.0	NW @4-6	Heavy Ripple	Clear	4.5	<1.8

TABLE A - 9

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 9

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
23	1016	0630 1200	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	7.8	7.8
24	1015	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast Rain	<1.8	<1.8
25	0945	0815 1545	3.0 12.5	15.5	0.01	Nil	Calm	Overcast Rain	49	33
26	0938	0910 1635	2.2 13.2	16.5	0.0	W @4-6	Ripple	Clear	2.0	<1.8
27	0911	0150 1010	13.9 1.5	17.0	0.0	W @ 3	Ripple	Clear	33	4.5
30	0903	0500 1240	13.7 1.7	17.0	0.0	W @4-6	Heavy Ripple	Clear	1.8	<1.8
31	0934	0600 1320	13.3 2.7		0.0	NW @ 5	Ripple	Clear	79	7.8

TABLE A - 10

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 10

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1056	0220 1045	12.5 3.1		0.0				<1.8	<1.8
13	0911	0255 1125	12.5 2.8		0.0				<1.8	<1.8
16	0924	0510 1250	12.4 2.9	16.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	4.5	<1.8
17	0922	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	0932	0640 1340	11.9 4.0	18.0	0.0	W @4-6	Rippled	Clear	23	<1.8
19	0915	0730 1400	11.4 5.0	18.0	0.0	W @ 2	Rippled	Clear	11	<1.8
20	0905	0835 0420	10.9 6.1	16.5	0.0	NW @4-6	Heavy Ripple	Clear	<1.8	<1.8

TABLE A - 10

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 10

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
23	1018	0630 1200	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	23	13
24	1017	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast Rain	<1.8	<1.8
25	0947	0815 1545	3.0 12.5	15.5	0.01	Nil	Calm	Overcast Rain	13	4.5
26	0940	0910 1635	2.2 13.2	16.0	0.0	W @4-6	Ripple	Clear	3.7	<1.8
27	0914	0150 1010	13.9 1.5	17.0	0.0	W @ 3	Ripple	Clear	49	1.8
30	0904	0500 1240	13.7 1.7	17.0	0.0	W @4-6	Heavy Ripple	Clear	<1.8	<1.8
31	0935	0600 1320	13.3 2.7		0.0	NW @ 5	Ripple	Clear	22	2.0

TABLE A - 11

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 11

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1058	0220 1045	12.5 3.1		0.0				<1.8	<1.8
13	0913	0255 1125	12.5 2.8		0.0				7.8	4.5
16	0927	0510 1250	12.4 2.9	16.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	4.5	<1.8
17	0924	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	0934	0640 1340	11.9 4.0	17.0	0.0	W @4-6	Rippled	Clear	23	<1.8
19	0918	0730 1400	11.4 5.0	18.0	0.0	W @ 2	Rippled	Clear	13	<1.8
20	0908	0835 0420	10.9 6.1	17.0	0.0	NW @4-6	Heavy Ripple	Clear	6.8	<1.8

TABLE A - 11

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 11

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
23	1020	0630 1200	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	2.0	<1.8
24	1020	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	2.0	<1.8
25	0950	0815 1545	3.0 12.5	15.5	0.01	Nil	Calm	Overcast Rain	<1.8	<1.8
26	0942	0910 1635	2.2 13.2	16.5	0.0	W @4-6	Ripple	Clear	1.8	<1.8
27	0915	0150 1010	13.9 1.5	16.5	0.0	W @ 3	Ripple	Clear	2.0	<1.8
30	0906	0500 1240	13.7 1.7	16.5	0.0	W @4-6	Heavy Ripple	Clear	<1.8	<1.8
31	0935	0600 1320	13.3 2.7		0.0	NW @ 5	Ripple	Clear	110	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 12

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	0850	0420 0835	8.0 10.9	17.5	0.0	NW@ 4-6	Heavy Ripple	Clear	7.8	<1.8
25	0939	0815 1545	3.0 12.5	15.5	0.01	W @ 2	Calm	Overcast, Rain	920	240
26	0934	0910 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	540	240
27	0905	0150 1010	13.9 1.5		0.0	W @ 3	Ripple	Clear	280	49
30	0900	0500 1240	13.7 1.7	17.0	0.0	W @ 4-6	Heavy Ripple	Clear	>1600	>1600
31	0927	0600 1320	13.3 2.7		0.0	NW @ 5	Ripple	Clear	540	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS13

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1110	1045 1800	3.1 13.2		0.0			Clear	2.0	<1.8
13	0920	1125 1830	2.8 13.3		0.0			Clear	2.0	2.0
16	0937	0510 1250	12.4 2.9	15.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	2.0	2.0
17	0930	0605 1320	12.2 3.3	15.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	1000	0640 1340	11.9 4.0	17.5	0.0	W @4-6	Rippled	Clear	4.5	4.5
19	0932	0730 1400	11.4 5.0	17.0	0.0	W @ 2	Rippled	Clear	4.5	4.5

TABLE A - 13

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 13

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	0917	0835 1420	10.9 6.1	16.5	0.0	NW@ 4-6	Heavy Ripple	Clear	<1.8	<1.8
23	1037	0630 1300	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	4.0	4.0
24	1026	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	2.0	<1.8
25	0958	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	2.0	<1.8
26	0950	0910 1635	2.2 13.2	17.0	0.0	W @ 4-6	Ripple	Clear	6.8	<1.8
27	0958	1010 1715	1.5 13.8	17.0	0.0	W @ 3	Ripple	Clear	11	1.8
30	0915	1240 0500	1.7 13.7	17.0	0.0	W @ 4-6	Heavy Ripple	Clear	33	7.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 14

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
16	1006	0510 1250	12.4 2.9	13.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	<1.8	<1.8
17	1000	0605 1320	12.2 3.3	15.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	1030	0640 1340	11.9 4.0	15.0	0.0	W @ 4-6	Rippled	Clear	<1.8	<1.8
19	1000	0730 1400	11.4 5.0	15.0	0.0	W @ 2	Rippled	Clear	<1.8	<1.8
20	0942	0835 1420	10.9 6.1	14.5	0.0	NW@ 4-6	Heavy Ripple	Clear	<1.8	<1.8
23	1055	0630 1300	5.0 10.8	15.0	0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
25	1123	0815 1545	3.0 12.5	14.5	0.01	Nil	Calm	Overcast, Rain	2.0	2.0
26	1015	0810 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1021	1010 1715	1.5 13.8	17.0	0.0	W @ 3	Ripple	Clear	<1.8	<1.8
30	0937	0500 1240	13.7 1.7	16.0	0.0	W @ 4-6	Heavy Ripple	Clear	2.0	2.0

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 15

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
16	1023	0510 1250	12.4 2.9	11.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	2.0	<1.8
17	1010	0605 1320	12.2 3.3	11.5	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	1045	0640 1340	11.9 4.0	15.0	0.0	W @ 4-6	Rippled	Clear	<1.8	<1.8
19	1024	0730 1400	11.4 5.0	16.0	0.0	W @ 2	Rippled	Clear	<1.8	<1.8
20	0952	0835 1420	10.9 6.1	14.0	0.0	NW@ 4-6	Heavy Ripple	Clear	<1.8	<1.8
23	1115	0630 1300	5.0 10.8	15.0	0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
25	1040	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	<1.8	<1.8
26	1030	0810 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1039	1010 1715	1.5 13.8	16.0	0.0	W @ 3	Ripple	Clear	2.0	<1.8
30	0958	0500 1210	13.7 1.7		0.0	W @ 4-6	Heavy Ripple	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 16

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1202	1045 1800	3.1 13.2		0.0			Clear	<1.8	<1.8
13	1315	1125 1830	2.8 13.3		0.0			Clear	13	4.5
16	1045	0510 1250	12.4 2.9	21.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	1.8	1.8
17	1020	0605 1320	12.2 3.3	19.0	0.0	NW @4-6	Rippled	Clear	4.5	2.0
18	1100	0640 1340	11.9 4.0	19.5	0.0	W @4-6	Rippled	Clear	1.8	1.8
19	1045	0730 1400	11.4 5.0	19.0	0.0	W @ 2	Rippled	Clear	13	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 16

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1014	0835 1420	10.9 6.1	15.5	0.0	NW@ 4-6	Heavy Ripple	Clear	<1.8	<1.8
23	1130	0630 1300	5.0 10.8	18.5	0.0	NW @ 5	Ripple	Clear	4.5	4.5
24	1145	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	4.5	<1.8
25	1100	0815 1545	3.0 12.5	15.5	0.01	Nil	Calm	Overcast, Rain	<1.8	<1.8
26	1046	0910 1635	2.2 13.2	18.5	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1055	1010 1715	1.5 13.8	20.0	0.0	W @ 3	Ripple	Clear	13	13
30	1010	1240 0500	1.7 13.7		0.0	W @ 4-6	Heavy Ripple	Clear	23	2.0

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 17

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1237	1045 1800	3.1 13.2		0.0			Clear	2.0	2.0
13	1225	1125 1830	2.8 13.3		0.0			Clear	14	2.0
16	1052	0510 1250	12.4 2.9	15.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	2.0	<1.8
17	1032	0605 1320	12.2 3.3	17.0	0.0	NW @4-6	Rippled	Clear	4.5	2.0
18	1107	0640 1340	11.9 4.0	18.5	0.0	W @4-6	Rippled	Clear	<1.8	<1.8
19	1050	0730 1400	11.4 5.0	17.5	0.0	W @ 2	Rippled	Clear	4.5	4.5

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 17

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1017	0835 1420	10.9 6.1	15.5	0.0	NW@ 4-6	Heavy Ripple	Clear	4.5	4.5
23	1135	0630 1300	5.0 10.8	15.0	0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
24	1150	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	7.8	7.8
25	1108	0815 1545	3.0 12.5	15.5	0.01	Nil	Calm	Overcast, Rain	2.0	2.0
26	1052	0910 1635	2.2 13.2	18.5	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1100	1010 1715	1.5 13.8	19.0	0.0	W @ 3	Ripple	Clear	4.5	2.0
30	1015	1240 0500	1.7 13.7		0.0	W @ 4-6	Heavy Ripple	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 18

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1315	1045 1800	3.1 13.2		0.0			Clear	2.0	<1.8
13	1145	1125 1830	2.8 13.3		0.0			Clear	<1.8	<1.8
16	1107	0510 1250	12.4 2.9	15.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	2.0	<1.8
17	1040	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	34	12
18	1145	0640 1340	11.9 4.0		0.0	W @4-6	Rippled	Clear	350	6.8
19	1127	0730 1400	11.4 5.0	16.0	0.0	W @ 2	Rippled	Clear	7.8	4.5

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 18

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1045	0835 1420	10.9 6.1	14.0	0.0	NW@ 4-6	Heavy Ripple	Clear	<1.8	<1.8
23	1155	0630 1300	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	4.0	<1.8
24	1237	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	<1.8	<1.8
25	1137	0815 1545	3.0 12.5	14.0	0.01	Nil	Calm	Overcast, Rain	<1.8	<1.8
26	1207	0910 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1215	1010 1715	1.5 13.8	17.0	0.0	W @ 3	Ripple	Clear	33	4.5
30	1040	1240 0500	1.7 13.7		0.0	W @ 4-6	Heavy Ripple	Clear	350	2.0

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 19

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1318	1045 1800	3.1 13.2		0.0			Clear	<1.8	<1.8
13	1155	1125 1830	2.8 13.3		0.0			Clear	4.5	<1.8
16	1114	0510 1250	12.4 2.9	15.0	0.0,	NW @ 7 gusts to 12	Rippled	Clear	<1.8	<1.8
17	1050	0605 1320	12.2 3.3	15.0	0.0	NW @4-6	Rippled	Clear	2.0	<1.8
18	1152	0640 1340	11.9 4.0	16.0	0.0	W @4-6	Rippled	Clear	79	14
19	1134	0730 1400	11.4 5.0	18.0	0.0	W @ 2	Rippled	Clear	2.0	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 19

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1055	0835 1420	10.9 6.1	14.0	0.0	NW@ 4-6	Heavy Ripple	Clear	17	2.0
23	1200	0630 1300	5.0 10.8	16.0	0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
24	1240	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	23	13
25	1145	0815 1545	3.0 12.5	14.5	0.01	Nil	Calm	Overcast, Rain	1600	350
26	1214	0910 1635	2.2 13.2	16.0	0.0	W @ 4-6	Ripple	Clear	33	4.5
27	1220	1010 1715	1.5 13.8	16.5	0.0	W @ 3	Ripple	Clear	2.0	<1.8
30	1045	1240 0500	1.7 13.7		0.0	W @ 4-6	Heavy Ripple	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 20

DATE 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
17	1140	0605 1320	12.2 3.3	18.0	0.0	NW@4-6	Rippled	Clear	4.5	<1.8
18	1137	0640 1340	11.9 4.0	19.0	0.0	W @ 4-6	Rippled	Clear	2.0	<1.8
19	1119	0730 1400	11.4 5.0	19.0	0.0	W @ 2	Rippled	Clear	4.5	<1.8
20	1038	0835 1420	10.9 6.1	17.0	0.0	NW@4-6	Heavy Ripple	Clear	4.5	<1.8
23	1230	0630 1300	5.0 10.8	16.0	0.0	NW @5	Ripple	Clear	<1.8	<1.8
24	1230	0720 1420	4.0 11.6		0.36	Nil	Calm	Overcast, Rain	49	23
25	1130	0815 1545	3.0 12.5	14.0	0.01	W @ 2	Calm	Overcast, Rain	23	4.5
26	1200	0810 1635	2.2 13.2	18.5	0.0	W @ 4-6	Ripple	Clear	240	33
27	1210	1010 1715	1.5 13.8	18.0	0.0	W @ 3	Ripple	Clear	6.8	2.0
30	1030	0500 1240	13.7 1.7		0.0	W @4-6	Heavy Ripple	Clear	130	11
31	1110	0600 1320	13.3 2.7		0.0	NW @5	Ripple	Clear	95	49

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 21

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1500	1045 1800	3.1 13.2		0.0			Clear	11	<1.8
13	1310	1125 1830	2.8 13.3		0.0			Clear	7.8	<1.8
16	1355	0510 1250	12.4 2.9	16.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	33	2.0
17	1210	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	17	<1.8
18	1300	0640 1340	11.9 4.0	17.0	0.0	W @4-6	Rippled	Clear	7.8	2.0
19	1250	0730 1400	11.4 5.0	16.0	0.0	W @ 2	Rippled	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 21

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1152	0835 1420	10.9 6.1	15.0	0.0	NW@ 4-6	Heavy Ripple	Clear	2.0	<1.8
23	1430	0630 1300	5.0 10.8	15.0	0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
24	1325	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	<1.8	<1.8
25	1256	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	49	23
26	1330	0910 1635	2.2 13.2	17.0	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1330	1010 1715	1.5 13.8	18.0	0.0	W @ 3	Ripple	Clear	14	6.1
30	1405	1240 0500	1.7 13.7		0.0	W @ 4-6	Heavy Ripple	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 22

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1510	1045 1800	3.1 13.2		0.0			Clear	<1.8	<1.8
13	1315	1125 1830	2.8 13.3		0.0			Clear	<1.8	<1.8
16	1400	0510 1250	12.4 2.9	15.0	0.0,	NW @ 7 gusts to 12	Rippled	Clear	<1.8	<1.8
17	1215	0605 1320	12.2 3.3	16.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	1304	0640 1340	11.9 4.0	18.0	0.0	W @4-6	Rippled	Clear	<1.8	<1.8
19	1300	0730 1400	11.4 5.0	17.0	0.0	W @ 2	Rippled	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 22

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
20	1155	0835 1420	10.9 6.1	15.0	0.0	NW@ 4-6	Heavy Ripple	Clear	<1.8	<1.8
23	1435	0630 1300	5.0 10.8	15.0	0.0	NW @ 5	Ripple	Clear	<1.8	<1.8
24	1328	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	<1.8	<1.8
25	1302	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	21	17
26	1332	0910 1635	2.2 13.2	17.0	0.0	W @ 4-6	Ripple	Clear	<1.8	<1.8
27	1334	1010 1715	1.5 13.8	17.5	0.0	W @ 3	Ripple	Clear	<1.8	<1.8
30	1410	1240 0500	1.7 13.7		0.0	W @ 4-6	Heavy Ripple	Clear	<1.8	<1.8

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BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 23

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
12	1455	0220 1045	12.5 3.1		0.0				2.0	2.0
13	1300	0255 1125	12.5 2.8		0.0				<1.8	<1.8
16	1407	0510 1250	12.4 2.9	17.0	0.0	NW @ 7 gusts to 12	Rippled	Clear	2.0	<1.8
17	1220	0605 1320	12.2 3.3	17.0	0.0	NW @4-6	Rippled	Clear	<1.8	<1.8
18	1314	0640 1340	11.9 4.0	17.5	0.0	W @4-6	Rippled	Clear	<1.8	<1.8
19	1308	0730 1400	11.4 5.0	19.0	0.0	W @ 2	Rippled	Clear	4.0	<1.8
20	1204	0835 0420	10.9 6.1	15.0	0.0	NW @4-6	Heavy Ripple	Clear	2.0	<1.8

TABLE A - 23

BACTERIOLOGICAL AND ELEMENTAL DATA FOR SAMPLE STATIONS 23

DATE July 1973	TIME OF COLLECTION	TIDE CONDITIONS		WATER TEMPERATURE °C	DAILY TOTAL PRECIPITATION (IN)	WIND (MPH)	LOCAL SEA CONDITIONS	LOCAL SKY CONDITIONS	MPN per 100 ml	
		TIME	HEIGHT IN FEET						TOTAL	FECAL
23	1443	0630 1200	5.0 10.8	14.5	0.0	NW @ 5	Ripple	Clear	2.0	<1.8
24	1335	0720 1420	4.0 11.6		0.36	W @ 2	Calm	Overcast, Rain	6.1	4.0
25	1309	0815 1545	3.0 12.5	15.0	0.01	Nil	Calm	Overcast, Rain	13	2.0
26	1349	0910 1635	2.2 13.2	17.0	0.0	W @4-6	Ripple	Clear	<1.8	<1.8
27	1340	0150 1010	13.9 1.5	17.5	0.0	W @ 3	Ripple	Clear	4.5	4.5
30	1415	0500 1240	13.7 1.7		0.0	W @4-6	Heavy Ripple	Clear	<1.8	<1.8
31	1422	0600 1320	13.3 2.7		0.0	NW @ 5	Ripple	Clear	<1.8	<1.8

APPENDIX 3

Table B	Standard Total Confirmed and Fecal Coliform MPN per 100 ml. (Seawater Samples).
Table B-1	Standard Total Confirmed and Fecal Coliform MPN per 100 ml. (Freshwater Samples).
Table D	Summary of Fecal Coliform MPN per 100 ml. (Seawater Samples).
Table D-1	Summary of Fecal Coliform MPN per 100 ml. (Freshwater Samples).

TABLE B

STANDARD TOTAL CONFIRMED AND FECAL COLIFORM

MPN/100 ml FOR SEAWATER SAMPLES.

SAMPLE STATIONS

Date	1		2		3		4		5		6	
	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC
July 11	17	<1.8	<1.8	<1.8	<1.8	<1.8						
12	1600	22	2.0	<1.8	<1.8	<1.8					<1.8	<1.8
13	350	4.5	2.0	<1.8	33	2.0	<1.8	<1.8			33	13
16	240	2.0	2.0	<1.8	7.8	4.5			49	6.8	49	4.0
17	240	4.5	13	7.8	4.5	<1.8	4.5	<1.8	540	220	<1.8	<1.8
18	350	2.0	23	4.5	13	<1.8	2.0	2.0	170	23	11	<1.8
19	21	2.0	79	11	<1.8	<1.8	13	4.5	23	7.8	<1.8	<1.8
20	33	4.5	33	33	46	<1.8	11	4.5	79	14	7.8	<1.8
23	>1600	14	11	<1.8	<1.8	<1.8	<1.8	<1.8	4.5	<1.8	49	3.0
24											<1.8	<1.8
25	79	4.0	4.5	2.0	49	49	23	<1.8	34	6.8	7.8	7.8
26	240	7.8	13	<1.8	17	2.0	2.0	<1.8	49	22	1.8	<1.8
27	170	11	23	2.0	49	33	7.8	<1.8	70	9.2	11	<1.8
30	240	4.0	23	7.8	23	7.8	23	<1.8	920	6.8	170	46
31												

TC - total confirmed coliform MPN/100 ml.

FC - fecal coliform MPN/100 ml.

... con't

TABLE B

STANDARD TOTAL CONFIRMED AND FECAL COLIFORM

MPN/100 ml FOR SEAWATER SAMPLES.

SAMPLE STATIONS

Date	7		8		9		10		11		12	
	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC
11												
12	23	4.5	2.0 <	1.8	1.8 <	1.8 <	1.8 <	1.8 <	1.8 <	1.8		
13	23	7.8	17 <	1.8	4.5 <	1.8 <	1.8 <	1.8 <	1.8	4.5		
16	140	4.5	33 <	1.8	33	6.8	4.5 <	1.8	4.5 <	1.8		
17	11	2.0	4.0 <	1.8 <	1.8 <	1.8 <	1.8 <	1.8 <	1.8 <	1.8		
18	27	4.0	23 <	1.8	33	2.0	23 <	1.8	23 <	1.8		
19	23	4.5	17	2.0	6.8	2.0	11 <	1.8	13 <	1.8		
20	110	6.8	4.5 <	1.8	4.5 <	1.8 <	1.8 <	1.8	6.8 <	1.8	7.8 <	1.8
23	170	49	49	22	7.8	7.8	23	13	2.0 <	1.8		
24	< 1.8	< 1.8	< 1.8	< 1.8 <	1.8 <	1.8 <	1.8 <	1.8	2.0 <	1.8		
25	79	79	33	13	49	33	13	4.5 <	1.8 <	1.8	920	240
26	13	4.5	4.5 <	1.8	2.0 <	1.8	3.7 <	1.8	1.8 <	1.8	540	240
27	920	540	33 <	1.8	33	4.5	49 <	1.8	2.0 <	1.8	280	49
30	540	220	< 1.8 <	1.8	1.8 <	1.8 <	1.8 <	1.8 <	1.8 <	1.8	> 1600	> 1600
31			140	46	79	7.8	22	2.0	110 <	1.8	540 <	1.8

TC - total confirmed coliform MPN/100 ml.

FC - fecal coliform MPN/100 ml.

....con't

TABLE B

STANDARD TOTAL CONFIRMED AND FECAL COLIFORM

MPN/100 ml FOR SEAWATER SAMPLES.

SAMPLE STATIONS

Date	13		14		15		16		17		18	
	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC
July 11												
12	2.0	<1.8					<1.8	<1.8	2.0	2.0	2.0	<1.8
13	2.0	2.0					1.3	4.5	14	2.0	<1.8	<1.8
16	2.0	2.0	<1.8	<1.8	2.0	<1.8	1.8	1.8	2.0	<1.8	2.0	<1.8
17	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	4.5	2.0	4.5	2.0	34	12
18	4.5	4.5	<1.8	<1.8	<1.8	<1.8	1.8	1.8	<1.8	<1.8	350	6.8
19	4.5	4.5	<1.8	<1.8	<1.8	<1.8	13	<1.8	4.5	4.5	7.8	4.5
20	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	4.5	4.5	<1.8	<1.8
23	4.0	4.0	<1.8	<1.8	<1.8	<1.8	4.5	4.5	<1.8	<1.8	4.0	<1.8
24	2.0	<1.8					4.5	<1.8	7.8	7.8	<1.8	<1.8
25	2.0	<1.8	2.0	2.0	<1.8	<1.8	<1.8	<1.8	2.0	2.0	<1.8	<1.8
26	6.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
27	11	1.8	<1.8	<1.8	2.0	<1.8	13	13	4.5	2.0	33	4.5
30	33	7.8	2.0	2.0	1.8	1.8	23	2.0	<1.8	<1.8	350	2.0
31												

TC - total confirmed coliform MPN/100 ml.

FC - fecal coliform MPN/100 ml.

.... con't

TABLE B

STANDARD TOTAL CONFIRMED AND FECAL COLIFORM

MPN/100ml FOR SEAWATER SAMPLES

Date	SAMPLE STATION 19		20		21		22		23	
	TC	FC	TC	FC	TC	FC	TC	FC	TC	FC
July 11										
12	<1.8	<1.8			11	<1.8	<1.8	<1.8	2.0	2.0
13	4.5	<1.8			7.8	<1.8	<1.8	<1.8	<1.8	<1.8
16	<1.8	<1.8			33	2.0	<1.8	<1.8	2.0	<1.8
17	2.0	<1.8	4.5	<1.8	17	<1.8	<1.8	<1.8	<1.8	<1.8
18	79	14	2.0	<1.8	7.8	2.0	<1.8	<1.8	<1.8	<1.8
19	2.0	<1.8	4.5	<1.8	<1.8	<1.8	<1.8	<1.8	4.0	<1.8
20	17	2.0	4.5	<1.8	2.0	<1.8	<1.8	<1.8	2.0	<1.8
23	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	2.0	<1.8
24	23	13	49	23	<1.8	<1.8	<1.8	<1.8	6.1	4.0
25	1600	350	23	4.5	49	23	21	17	13	2.0
26	33	4.5	240	33	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
27	2.0	<1.8	6.8	2.0	14	6.1	<1.8	<1.8	4.5	4.5
30	<1.8	<1.8	130	11	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
31			95	49					<1.8	<1.8

TC - total confirmed coliform MPN/100 ml.

FC - fecal coliform MPN/100 ml.

TABLE B - 1

STANDARD TOTAL CONFIRMED AND FECAL COLIFORM

MPN/100 ml FOR FRESHWATER SAMPLES.

SAMPLE STATION

Date	S1		S2		S3	
	TC	FC	TC	FC	TC	FC
July 16	22	2.0	220	130	920	40
17	350	170	540	31	920	79
18	240	7.8	540	49	1600	79
19	280	33	240	33	110	49
20	220	33	540	33	350	320
23	1600	170	1600	540	350	240
24						
25	1600	1600	>1600	280	350	240
26	49	23	920	130	220	70
27	350	120	540	110	350	130
30	350	49	350	21	920	21

TC - total confirmed coliform MPN/100 ml.
FC - fecal coliform MPN/100 ml.

TABLE D

SUMMARY OF BACTERIOLOGICAL DATA FROM SEAWATER SAMPLES:

FECAL COLIFORM MPN per 100 ml.

Sample Number	Number of Samples	Range	Median MPN per 100 ml
1	13	<1.8 - 22	4.5
2	13	<1.8 - 33	2.0
3	13	<1.8 - 33	<1.8
4	10	<1.8 - 4.5	<1.8
5	10	<1.8 - 220	8.5
6	13	<1.8 - 46	<1.8
7	13	<1.8 - 540	4.5
8	14	<1.8 - 46	<1.8
9	14	<1.8 - 33	2.0
10	14	<1.8 - 13	<1.8
11	14	<1.8 - 4.5	<1.8
12	6	<1.8->1600	145
13	13	<1.8 - 7.8	1.8
14	10	<1.8 - 2.0	<1.8
15	10	<1.8 - 1.8	<1.8

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SUMMARY OF BACTERIOLOGICAL DATA FROM SEAWATER SAMPLES

FECAL COLIFORM MPN per 100 ml

Sample Station	Number of Samples	Range	Median MPN per 100 ml
16	13	<1.8 - 13	1.8
17	13	<1.8 - 7.8	2.0
18	13	<1.8 - 12	<1.8
19	13	<1.8 - 350	<1.8
20	11	<1.8 - 49	2.0
21	13	<1.8 - 23	<1.8
22	13	<1.8 - 17	<1.8
23	14	<1.8 - 4.5	<1.8

TABLE D - 1

SUMMARY OF BACTERIOLOGICAL RESULTS FROM FRESHWATER SAMPLES:

FECAL COLIFORM MPN per 100 ml

Sample Station	Number of Samples	Range	Median MPN per 100 ml
S1	10	2.0-1600	41
S2	10	21 - 540	79
S3	10	21 - 320	79

APPENDIX 4

Campbell River Estuary,

Present Uses and Future Development

CAMPBELL RIVER ESTUARY

Present Uses

Estuary Proper

- Government Wharf.
- Standard Oil dock for pleasure craft
- Ferry terminal (to Quadra Island).
- Standard Marina.
- Campbell River Indian Reservation (No. 11).
- Western Mines Ltd. Oil storage and wharf facilities
- Island Ready-Mix concrete operation (includes gravel dredging).
- Seaplane Base. (Trans-mountain, Island Air, etc.)
- Public pleasure craft launching ramp.
- Silver King trailer park.
- Tyee Trailer Park and Marina.
- Raven Lumber - dry land and wet sorting facilities, two causeways, diversion channel, log storage, sawmill.
- Crown Zellerbach - log storage, sorting, scow loading.
- Freshwater Marina.
- Bulk oil dock. Esso and Chevron. Total of 17 oil tanks (with retainers).
- Crown Zellerbach (Elk Falls Division) Duncan Bay.
- Raw sewage is being discharged through an outfall south of Fishermans Wharf. The area north of the Campbell River, Quinsam area and the Indian Reserve, including Tyee Spit located enterprises and Raven Lumber Ltd., sawmill are not included in the District sewerage. North Campbell River and Quinsam area use septic tanks and adsorption fields. Other enterprises, depending on location, discharge untreated sewage to Campbell River or to Discovery Passage.

  The District of Campbell River is constructing a secondary treatment plant south of Fishermans Wharf. It should be in operation early 1974.

Upstream Influences

B.C. Hydro dam and power installation. (John Hart Dam) - presently have a controlled outflow to the river of between 1,500 and 4,000 CFS. There is a proposal in the works to modify this dam for supplying peaking power only. If this were done, outflows would range from 0 - 9 CFS, with two four-hour maximum flow periods. Another proposal recommends that peaking power be provided by diverting the necessary water through an underground station to Duncan Bay. This could pose significant homing problems for salmonids and therefore a study has been commissioned by B.C. Hydro to assess the developments.

Elk Falls Pulp and Paper draws its water from the Campbell River lakes.

Western Mines, located at the south end of Buttle Lake, discharges all of its mill tailings to the lake (at a depth of 180 feet).

The majority of the Campbell River Watershed has been logged off. Some logging continues, and considerable new stands of timber are growing in the area.

Fisheries Service is constructing a fish hatchery on the Quinsam River, a tributary of the Campbell River.

J.P. Geasson Mobile Home Park discharges treated sewage to Nunn Creek which flows through the Indian Reserve and into the Campbell River mouth behind Tyee Spit.

One trailer home park discharges treated sewage to Simms Creek entering Discovery Passage near Willow Point.

Future Development

The freshwater marina would like to have the approaches to their marina dredged in order to enhance accessibility at all tidal phases rather than just at high tide.

The Indian Reservation would like to dredge out a marina beside the spit, and would like to commence a gravel dredging and processing operation on their portion of the spit.

Mercury Marina and Trailer Park, and Painter Barclay Land Co. Ltd., have proposed a Mobile Home Park. Proposed treatment consists of an oxidation ditch and a 40 ft. deep discharge.

CAMPBELL RIVER ESTUARY 1

PCB ID Number	Discharger	I Gal/day	Present Effluent Quality	Comments
PE 435	Mercury Marina and Trailer Park	12,000	Domestic Wastes not characterized.	Outfall a minimum of 100' from low water mark Park - not yet constructed
PE 422	Painter Barclay Land Co. Ltd. (Mobile Home Park)	24,000	Domestic Wastes not characterized.	Proposed oxidation ditch for treatment. Park - not yet constructed.
PE 320	J.P. Geason Mobile Home Park (mouth of Campbell River)	15,000	Typical of Primary treated domestic sewage.	Sewage is discharged to Nunn Creek, which flows to Campbell River.
PE 109	District of Campbell River (Discharge south of Government Wharf).	1,100,000	Typical of raw domestic sewage.	A secondary treatment plant is under construction south of Fishermans Wharf. Operational by 1974.
PE 360	Crown Zellerbach Canada Ltd. - Elk Falls Division (Duncan Bay)	25,000	Domestic Discharge BOD 160 mg/ℓ S.S. 200 mg/ℓ Coliform 4×10^5 MPN/mℓ pH 6.5-7.5 Temp. 40-60°F	Primary treatment, with digestion and removal of sludge.

CAMPBELL RIVER ESTUARY 2

PCB ID Number	Discharger	I Gal/day	Present Effluent Quality	Comments
PE 1164	Crown Zellerbach Canada Ltd. - Elk Falls Division (Duncan Bay)	56,000,000	Pulp and Paper mill wastes BOD 270 mg/ℓ S.S 600 mg/ℓ T.S. 2000 mg/ℓ Sulphides <2 mg/ℓ Coliform 5,000/mℓ pH 2-11	Screening, filtering and recovery of steam plant ashes, groundwood coarse rejects, barker wastes and green liquor dregs. Lime mud overflow to be lagooned.
PR 1602	Crown Zellerbach Canada Ltd. - Elk Falls Division (Duncan Bay)	N/A-	Industrial by products (not including toxic or hazardous wastes) 100 cu. yards.	Compaction and covering in landfill area.