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JOHN SPELLMAN
Governor

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

MEMORANDUM
May 18, 1983

To: Files

From: John Bernhardt and Tim Determan

Subject: Progress Report No. 2., Burley Lagoon and Minter Bay Survey

This is the second of a series of status reports on the Burley Lagoon/ Minter Bay bacteriological survey. These reports are completed every other month with the second being due on May 15, 1983.

Ambient Monitoring

Ambient monitoring, a major aspect of the overall survey with the purpose of describing existing conditions in the two estuaries, was initiated on January 10, 1983. This effort will continue until the end of the year. Results to date for the fecal coliform analyses are summarized in Table 1.

An adjustment to Table 1 should be noted. The fecal coliform standard for freshwater was reported in Progress Report No. 1 as 100 colonies per 100 mL for Class A waters. A recent review indicated the streams feeding Burley Lagoon and Minter Bay rightfully are Class AA waters which have a fecal coliform standard of 50 colonies per 100 mL. This change increases the number of violations reflected in the table which "boxes-in" all violations.

Sporadic violations of the water quality standard have continued in the streams which feed Burley Lagoon. Burley Creek continues to have the most frequent violations. The stream violations for the most part are considered moderate and generally not reflected in the lagoon where only one water quality violation has been documented since sampling began. Similarly, no oyster tissue violations have been documented. The marine waters during these first months appear at least at present to be adequately assimilating the incoming fecal coliform loads. Good flushing efficiency and the small size of the feeder streams relative to the size of the estuary contribute to the estuary's ability to self-purify.

Minter Bay on the whole appears to have more serious water quality problems than Burley, based on the ambient data. Minter Bay feeder streams have experienced fewer fecal coliform violations than Burley Lagoon, but the effects on the bay appear to be greater. About 50 percent of the marine water quality samples are violations of moderate magnitude. However, this is not reflected in the oyster tissue fecal coliform counts which have been about the same for both estuaries.

A graph showing the relationship between rainfall and oyster tissue fecal coliform counts for Burley Lagoon and Minter Bay is shown in Figure 1. Generally, this shows that tissue counts tend to correspond with rainfall. There have been no tissue violations when rainfall for several days prior to the sampling has been less than about one inch per day. The only documented violation (Minter Bay) occurred during the first sampling run which followed a severe storm.

Storm Event Monitoring

The first progress report included information on a storm event monitored in Minter Bay. A storm event was monitored in the Burley Watershed during March. Outcomes of this effort were:

1. Maximum pollutant loading into Burley Lagoon occurs during rain events. Storm flows and fecal coliform densities are closely associated with daily rainfall;

2. There is evidence that the Bear Creek basin contributes a larger load per unit acre than the Purdy or Burley creeks basins; and

3. Loads from several undeveloped subbasins within the watershed had a negligible effect on water quality compared to the developed basins.

A detailed report by Tim Determan is given in Appendix I.

Source Surveys

The first major source survey has been completed. Results of this effort which identifies several specific land-use problems are given in Appendix II. The report is authored by Dale Norton.

Future Activities

A quarterly sampling run is scheduled for late May which includes a number of specialized analyses.

The ambient monitoring task will continue as scheduled with sampling performed twice per month.

Several quality assurance efforts will be performed to determine: (1) comparability of WDOE and DSHS laboratory results for oyster tissues using the MPN method for the fecal coliform test; (2) whether the mid-bay ambient stations used by WDOE are representative of the oyster fecal coliform counts for the two estuaries in general; and (3) whether oyster samples collected from the waters when analyzed have fecal coliform results comparable to those collected during different stages after being harvested but before being processed.

JB:cp

Attachments

Table 1. Summary of Burley Lagoon and Minter Bay fecal coliform sampling data.

Sampling Location	Sampling Results: January 10-11	January 17-18	February 7-8	February 21-22	March 21-22	April 4-5	April 18-20	May 2-3
BURLEY LAGOON								
Burley Creek								
Headwaters (BU 5.2)	--	--	--	21	1	7	2	12
Lower Creek (BU 0.6)	--	--	--	/379/	17	46	/58/	/85/
Near Mouth (BU 0.3)	36	--	/89/	/184/	25	/202/	/69/	/71/
Unnamed Trib. (X 0.2)	--	--	--	<1	<1	1	<1	2
Purdy Creek								
Headwaters (P 3.6)	--	--	--	4	2	1	<1	2
Near Mouth (P 0.1	/122/	14	5	/255/	6	46	9	/95/
Unnamed Trib. (V 0.0)	--	--	--	3	1	9	<1	2
Bear Creek								
Headwaters (BR 1.8)	--	--	--	3	1	4	49	17
Near Mouth (BR 0.0)	--	/53/	--	/58/	40	/76/	7	22
Marine Waters								
Mid-lagoon (BES)	10	3	14	5	3*	<1*	6*	5*
Lagoon Outlet (BEX)	5	4	6	<1	4*	6*	/20*/	7*
Oyster Tissue	--	230	130	50	70	50	11	130
MINTER BAY								
Minter Creek								
Headwaters (M 4.4)	46	5	3	34	71	4	1	2
Lower Creek (M 1.3)	/88/	21	15	41	/54/	12	23	32
Near Mouth (M 0.0)	48	42	12	24	24	15	12	28
Huge Creek								
Headwaters (H 3.1)	11	2	1	4	1	<1	<1	<1
Near Mouth (H 0.1)	14	25	9	16	24	15	7	21
Unnamed Creek								
Headwaters (UN 2.0)	/114/	16	2	29	2	4	51	35
Near Mouth (UN 0.0)	/78/	15	5	7	3	/64/	/63/	22
Marine Waters								
Mid-bay (MES)	/63/	10	5	9	/62*/	12*	/17*/	/71*/
Bay Outlet (MEX)	/75/	3	3	/17/	/43*/	13*	2*	10*
Oyster Tissue	/1,300/	230	20	15	130	80	11	5

/ / means either a water or tissue standard was violated.

NOTE: All of the analyses are Membrane Filter (MF) except for the marine samples which are Most Probable Number (MPN).

*Most Probable Number water sample.

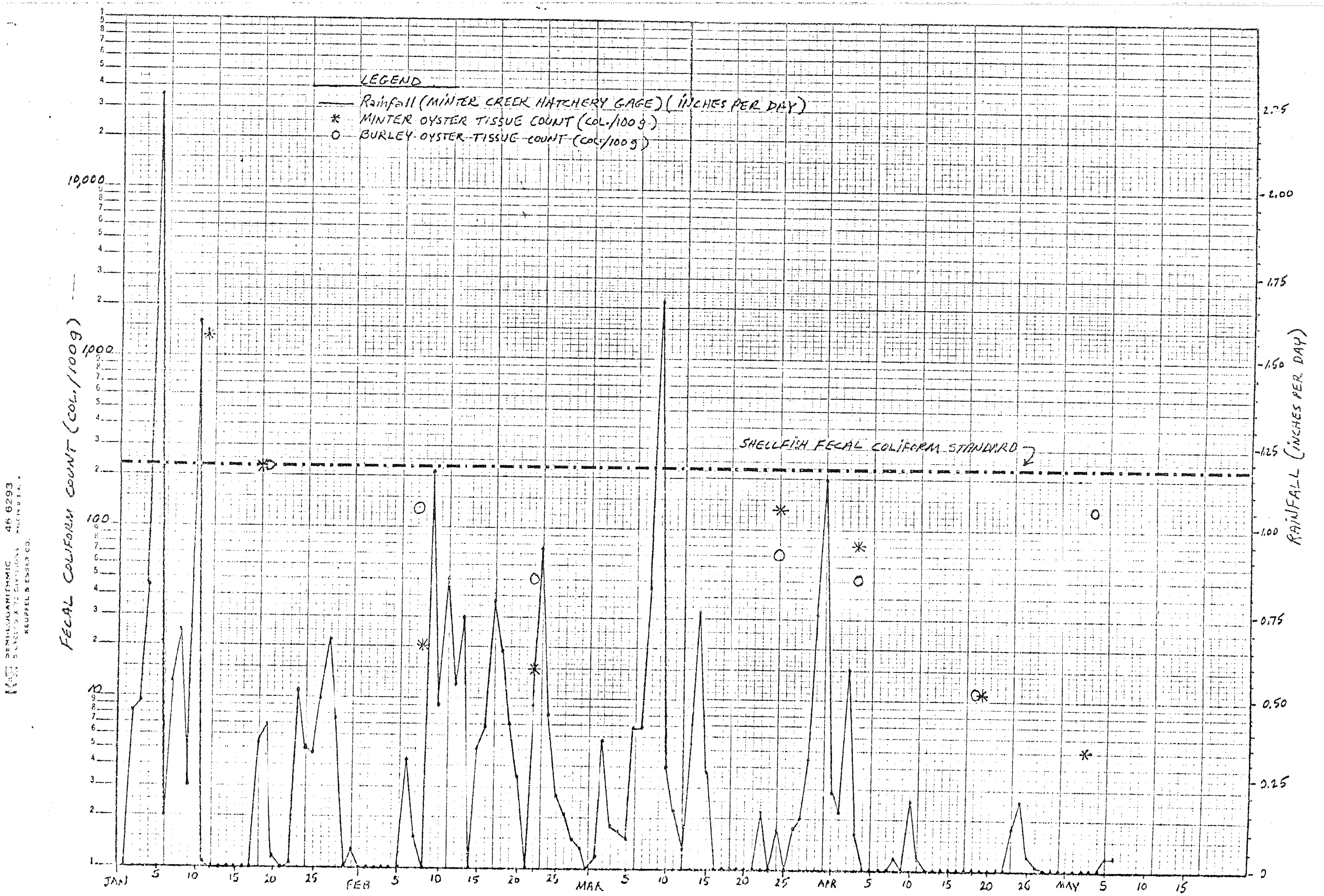

Figure 1. SUMMARY OF OYSTER TISSUE AND RAINFALL SAMPLING DATA COLLECTED FROM BURLEY LAGOON AND MINTER BAY DURING 10 JANUARY 1983 THROUGH 7 MAY 1983.

APPENDIX I

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

MEMORANDUM
May 13, 1983

To: John Bernhardt

From: Tim Determan TQD

Subject: The Effects of a Rainfall Event on Water and Shellfish Quality in Burley Watershed

Introduction

Numerous past studies have shown that the effects of pollution within a developed watershed tend to be greatly amplified during periods of intense rainfall. Typically, pollution levels increase rapidly when excess runoff enters streams after watershed soils become saturated. In some watersheds, pollution levels tend to rise and fall rapidly after wastes lying on the ground are initially washed into the streams and river flows reach their maximal dilution potential. In others, elevated pollutant levels persist during a rain event due to continual high rate of waste generation within the watershed.

In order to characterize rainfall-related pollutant loading potential of Burley Watershed streams, intensive monitoring was performed during a period of heavy rainfall from March 7 to March 10, 1983. In addition, pollutant levels in the Burley Lagoon estuary were measured.

The Burley Watershed consists of three major drainage basins. The largest is drained by the Burley Creek from its headwaters to its confluence with Bear Creek. Bear Creek drains a small basin on the west side of the watershed. The Purdy Creek basin forms the east side of the watershed (Figure 1). Burley and Purdy basins are composed of several other smaller subbasins, some of which are undeveloped.

Methods

A number of sampling points for the routine background monitoring program were used during the rainfall event. Each station is located at the mouth of the stream draining each of the three major basins and two undeveloped subbasins (Figure 1). The subbasins were used as controls to evaluate the effects of rain-generated runoff from developed versus undeveloped watersheds on stream quality. In addition to watershed stations, the regular estuarine sampling stations were also used. One point is located over a mid-bay shoal used for oyster culture and the other is located at the mouth of Burley Lagoon (Figure 1).

Sampling was performed during a rain event that occurred from March 6 through March 10, 1983. Samples were taken and river flow measured during daylight hours. Three sampling runs were made on March 7; 2 runs on March 8 and 9, and one run on March 10. Each day, two sets of observations were taken in the estuary. One set was taken at the estuary mouth during incoming tide and an additional set at mid-lagoon during falling tide.

The water quality parameters included fecal coliform densities, temperature, total suspended solids, turbidity, nutrients, conductivity, and stream flow. Fecal coliform samples were taken during each run. The other variables were measured once a day. Shellfish were sampled for fecal coliform densities on the first day of the rain event.

Stream flows were obtained using a Marsh-McBirney portable water current meter using U.S. Geological Survey methods. pH was determined in the field using an Orion 339A pH meter. A Beckman induction salinometer was used to determine salinity/temperature gradients at each estuarine station. All other samples were returned to the WDOE environmental laboratory and analayzed according to procedures in APHA (1980) and USEPA (1979). Daily total rainfall data were collected at a National Weather Service rain gauge located at the Department of Fisheries hatchery on Minter Creek, three miles WSW of Burley Lagoon.

For the purposes of this summary, discussion will center on rainfall (inches per day), fecal coliform densities (water and shellfish), and stream flows. The data are compared to data obtained during routine background sampling performed on March 21, 1983.

Carr Inlet, Henderson Bay, and associated inlets such as Burley Lagoon and Minter Bay, are classified as Class AA (Extraordinary) marine waters by the Washington State Water Quality Standards. The freshwater streams discharging into Burley Lagoon and Minter Bay are not specifically classified. However, under terms of the regulations, the creeks are considered to be Class AA also.

Water quality criteria for Class AA (Extraordinary) waters are as follows:

> Marine Water - Fecal coliform organisms shall not exceed a geometric mean value of 14 organisms/100 mL, with not more than 10 percent of samples exceeding 43 organisms/100 mL.
>
> Freshwater - Fecal coliform organisms shall not exceed a geometric mean value of 50 organisms/100 mL, with not more than 10 percent of samples exceeding 100 organisms/100 mL.

The DSHS shellfish program uses these water quality criteria to determine suitability of a shellfish-growing area for commercial harvest. In addition, fecal coliform densities in shellfish tissue that exceed 230 fc/100 gr of tissue may lead to decertification of a harvesting area (U.S. Public Health Service, 1965).

The area of each basin or subbasin was estimated by a gravimetric method. The boundaries of each basin were determined from a U.S. Geological Survey topographic map. The boundaries were then traced onto photocopy paper, carefull cut out together with a square with dimensions taken from the map. All pieces were then weighed on a mettler HK 160 analytical balance. Areas were calculated by ratio and proportions.

Results and Discussion

Figure 2 summarizes rainfall data and stream flows during the rain event. Stream flow units are cubic feet per second, abbreviated as cfs. The vertical scales of the undeveloped subbasins are exaggerated 20 times relative to the major basins in order to clearly show flow behavior of the smaller streams. In all cases, a definite correlation of stream flows with rainfall is readily apparent. There is little evidence of a lag time between peak rainfall and streamflows, although there are substantial daily variations at higher streamflows in Purdy and Burley creeks.

Elevated flows are also associated with increased levels of fecal coliform bacteria in developed and undeveloped streams. The undeveloped Burley subbasin reached peak fecal coliform levels very early and achieved lower fc densities than its counterpart in the Purdy Basin (Figures 3 and 4). This may be due to smaller size and lesser degree of development. Both undeveloped tributaries showed decreasing fc densities as the rain event continued. In all cases, fc levels were well within the state water quality freshwater standards.

Fecal coliform densities in the streams draining developed basins showed substantial violation of freshwater standards during the rain event. The geometric mean of all samples equalled 110 fc/100 mL. Eight of nine samples exceeded 100 fc/100 mL. The geometric means for Burley Creek and Bear Creek were 346 fc/100 mL and 758 fc/100 ml, respectively. One hundred percent of samples from both creeks exceeded 100 mL. However, none of the main streams violated the geometric mean component of the standard on March 21, following a period of relatively little rainfall.

It is unclear, by applying fc results alone, which stream contributes the greatest contamination potential to the estuary. It appears that the Purdy Creek basin is less important than either Burley or Bear creeks (Figure 3, Table 1). Burley Creek reached levels of about 1700 fc per 100 ml (Figure 4, Table 1), but values at other times were substantially less. Maximum Bear Creek values were somewhat lower than Burley Creek, but much higher at other times during the study (Figure 5, Table 1). Thus, one might conclude that Bear Creek may be more important than Burley Creek. However, stream flows must be considered. A highly polluted small creek (high fc densities) with a very small flow may be as important a source as a slightly polluted river of much larger flow. In order to account for the different flows of the three creeks, instantaneous fc loads were calculated as follows (Figure 6, Table 1).

$$\text{fc load (fc per sec)} = [\text{fc}] \times \frac{28{,}329 \text{ ml}}{1 \text{ cu. ft.}} \times Q$$

where:

[fc] = fecal coliform densities (fc/100 ml)
and Q = stream flow (cubic feet/sec.)

Among the developed basins, the Burley Creek Basin generally contributed the greatest load during any particular sampling run, Purdy Creek contributed the least, and Bear Creek roughly intermediate between the two.

An additional refinement of the analysis is shown in Figure 7 and Table 1. In this case, the instantaneous fecal coliform loads are divided by the area of each basin as an estimate of the load contributed per unit area. On this basis, the Bear Creek basin exceeded the Burley Creek basin in loading importance during six of nine runs during the rain event and again during dry weather (March 21). This analysis may tend to exaggerate the role of the Bear Creek system, however. Since the Bear Creek basin is smaller, stream time of travel is less than Burley Creek and less bacteria may be lost through death in the environment.

The pattern of fecal coliform changes at both estuary sites (Figure 8) are quite similar to responses in the watershed during the rain event. On each day, the fc level in incoming tidal flow was substantially lower than outgoing estuarine water over the shellfish beds. Violations of the water quality standards for marine waters occurred during peak rainfall periods.

Although strong correlation exists between watershed conditions and estuarine fc levels, it is not logical to conclude that the one is necessarily the cause of the other. Contaminated watershed flows may account for part of the pattern. However, there may be other rain-generated sources such as small streams, storm culverts, ponds, and individual disposal systems that are immediately adjacent to the estuary. The pattern demonstrated by the incoming tidal flow may be partly due to the return of water taken out during the previous tide change. However, rainfall-induced discharges from the eastern shore of Henderson Bay may also be a factor.

An initial sample collected on March 7 was within the market standard. A second sample collected two weeks later also was within the standard (Figure 8). No additional samples were taken during the two-week period.

Conclusions

1. Maximum pollutant loading into Burley Lagoon occurs during rain events. Streamflows, fecal coliform densities are closely associated with daily rainfall.

2. There is evidence that Bear Creek basin contributes a larger load per unit area than Purdy or Burley creek basins.

3. Loads from several undeveloped subbasins within the watershed had negligible effect on water quality violations compared to the developed basins.

TD:cp

Attachments

References

American Public Health Association, 1980. *Standard Methods for the Examination of Water and Wastewater*. 15th Ed. Washington, D.C. 1193 pp

Environmental Protection Agency, 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020. Cincinnati, OH

U.S. Public Health Service, 1965. National shellfish sanitation program manual of operations. *Part 1. Sanitation of Shellfish Growing Areas*. U.S. Dept. Health, Ed. and Welfare, Washington, D.C.

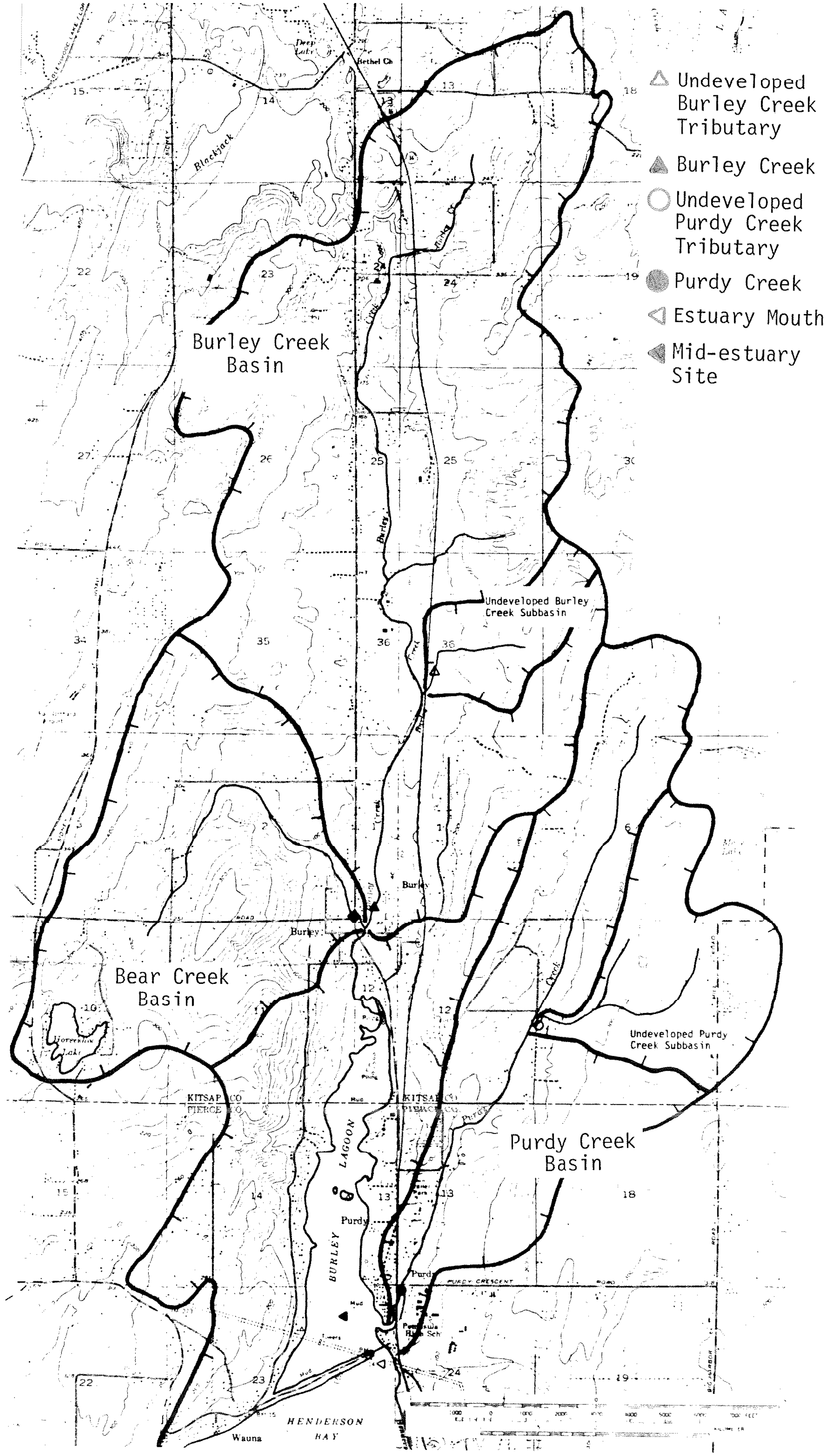

Figure 1. Burley Watershed showing rain event sampling station locations.

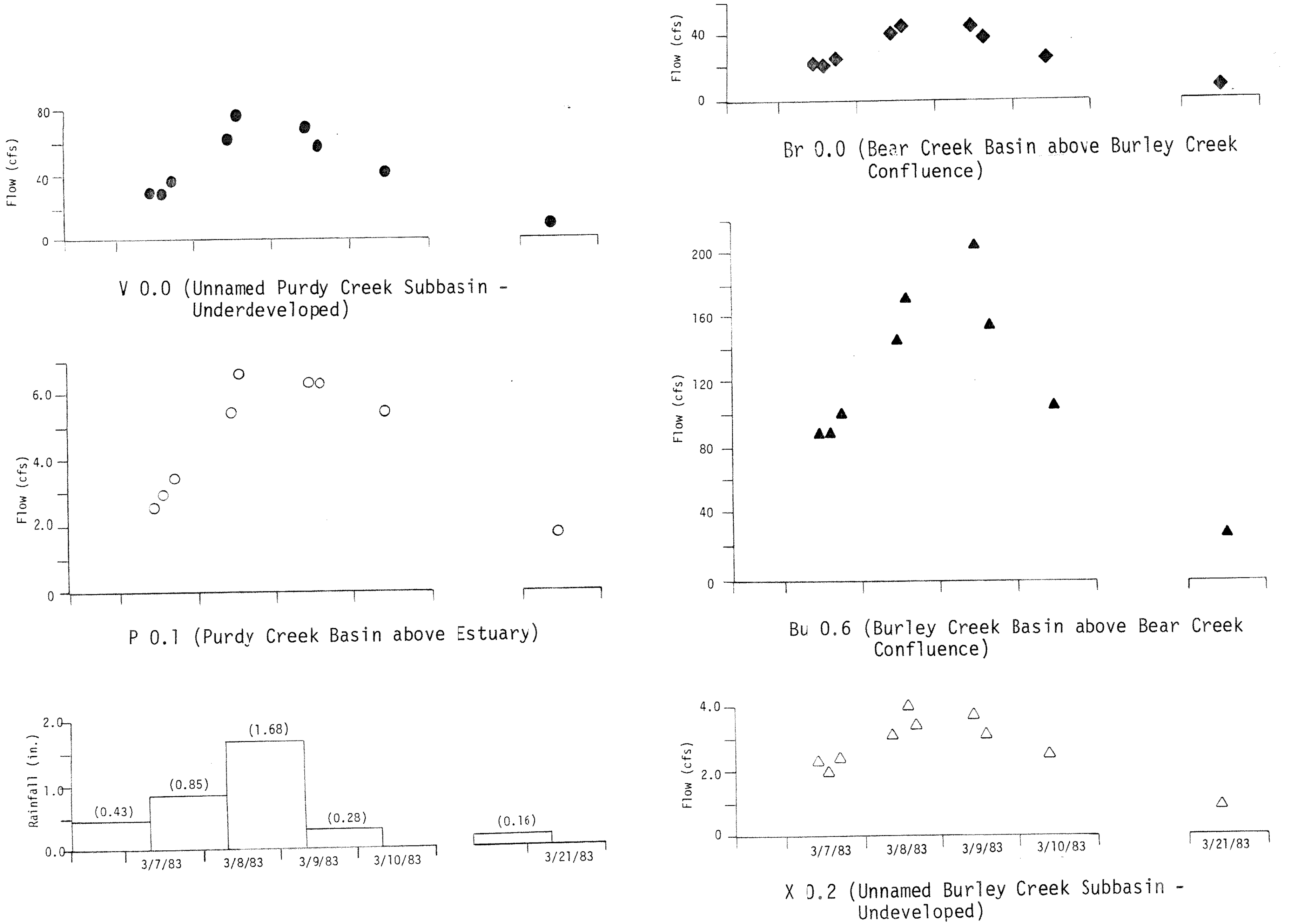

Figure 2. Daily rainfall and streamflows in several Burley Watershed streams during a rain event (March 7 - March 10, 1983). Data from March 21, 1983, are included for a dry-period comparison.

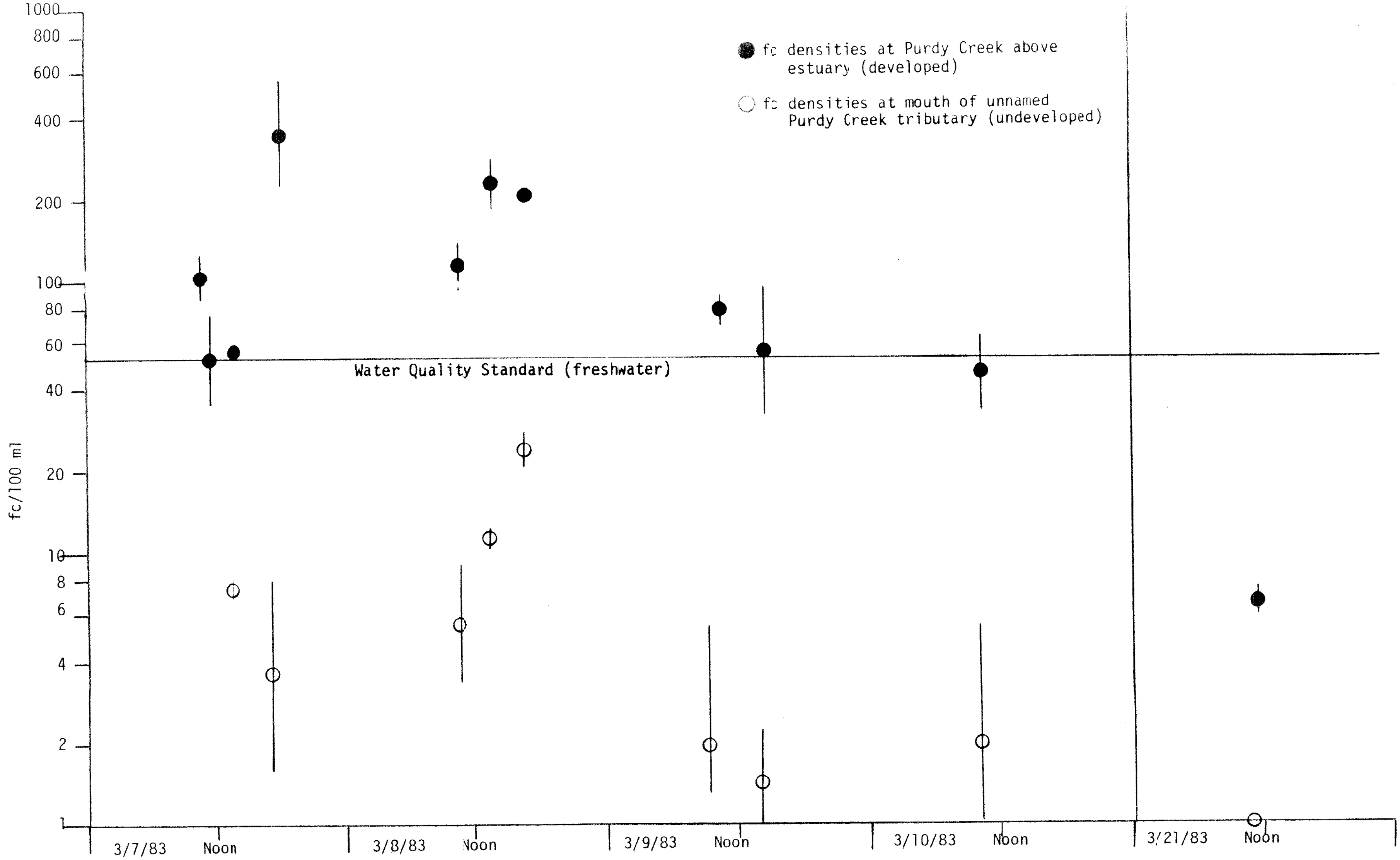

Figure 3. Summary of fecal coliform densities from Purdy Creek and an undeveloped Purdy Creek tributary during a rain event from March 6 through March 10, 1983. Data from March 21, 1983, are included for a dry-period comparison. (Each data point and vertical bar represent a geometric mean and an estimate of the range of cuplicate samples.)

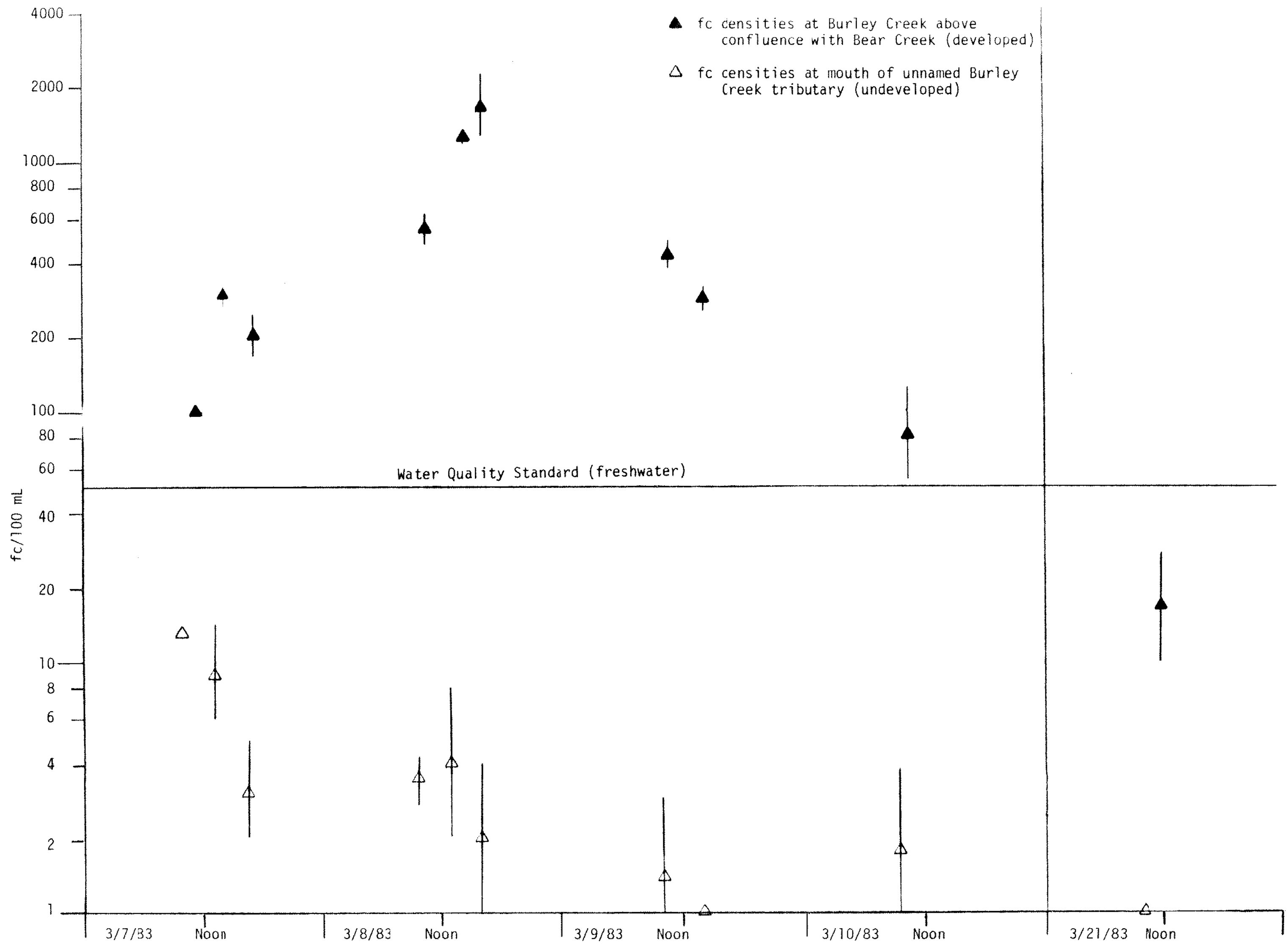

Figure 4. Summary of fecal coliform densities from Burley Creek and an undeveloped Burley Creek tributary during a rain event from March 6 through March 10, 1983. Data from March 21, 1983, are included for a dry-period comparison. (Each data point and vertical bar represent a geometric mean and an estimate of the range of duplicate samples.)

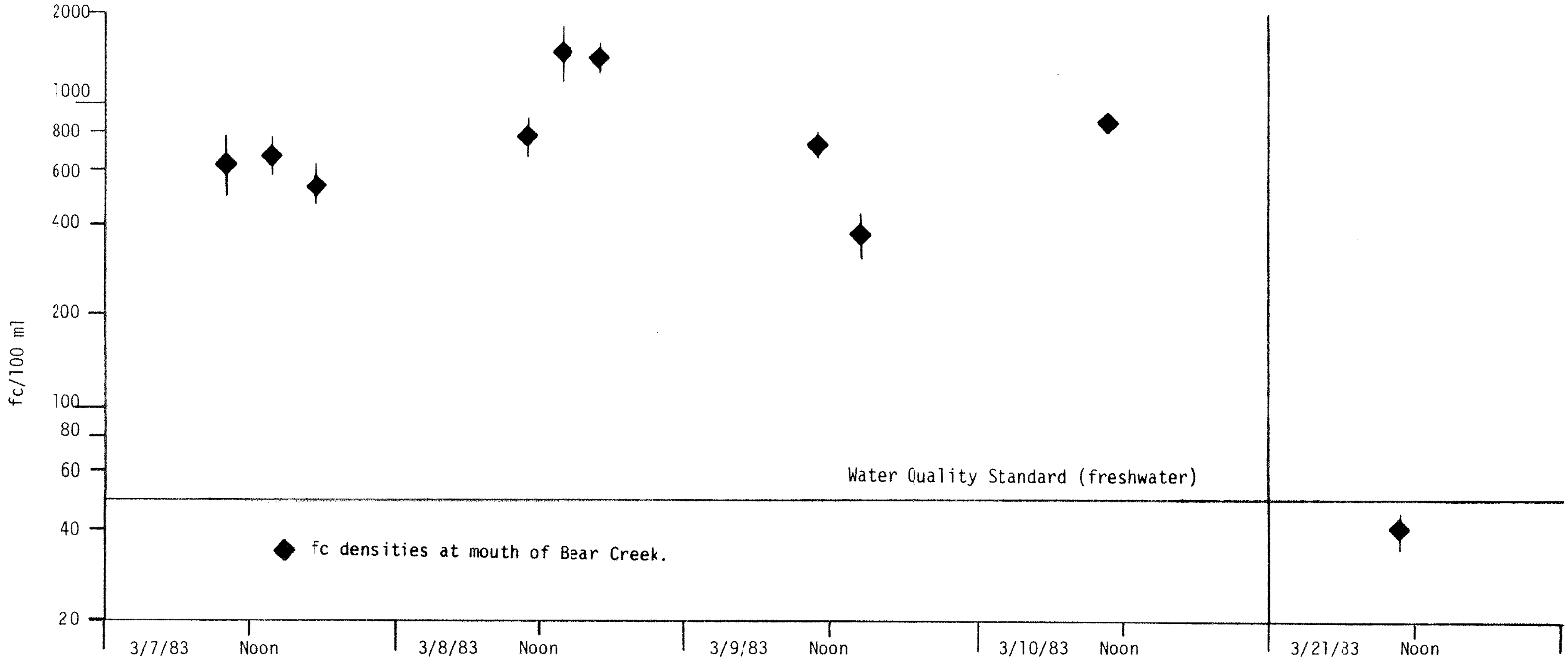

Figure 5. Summary of fecal coliform densities from Bear Creek during a rain event from March 6 through March 10, 1983. Data from March 21, 1983, are included for a dry-period comparison. (Each data point represents a geometric mean and an estimate of the range of duplicate samples.)

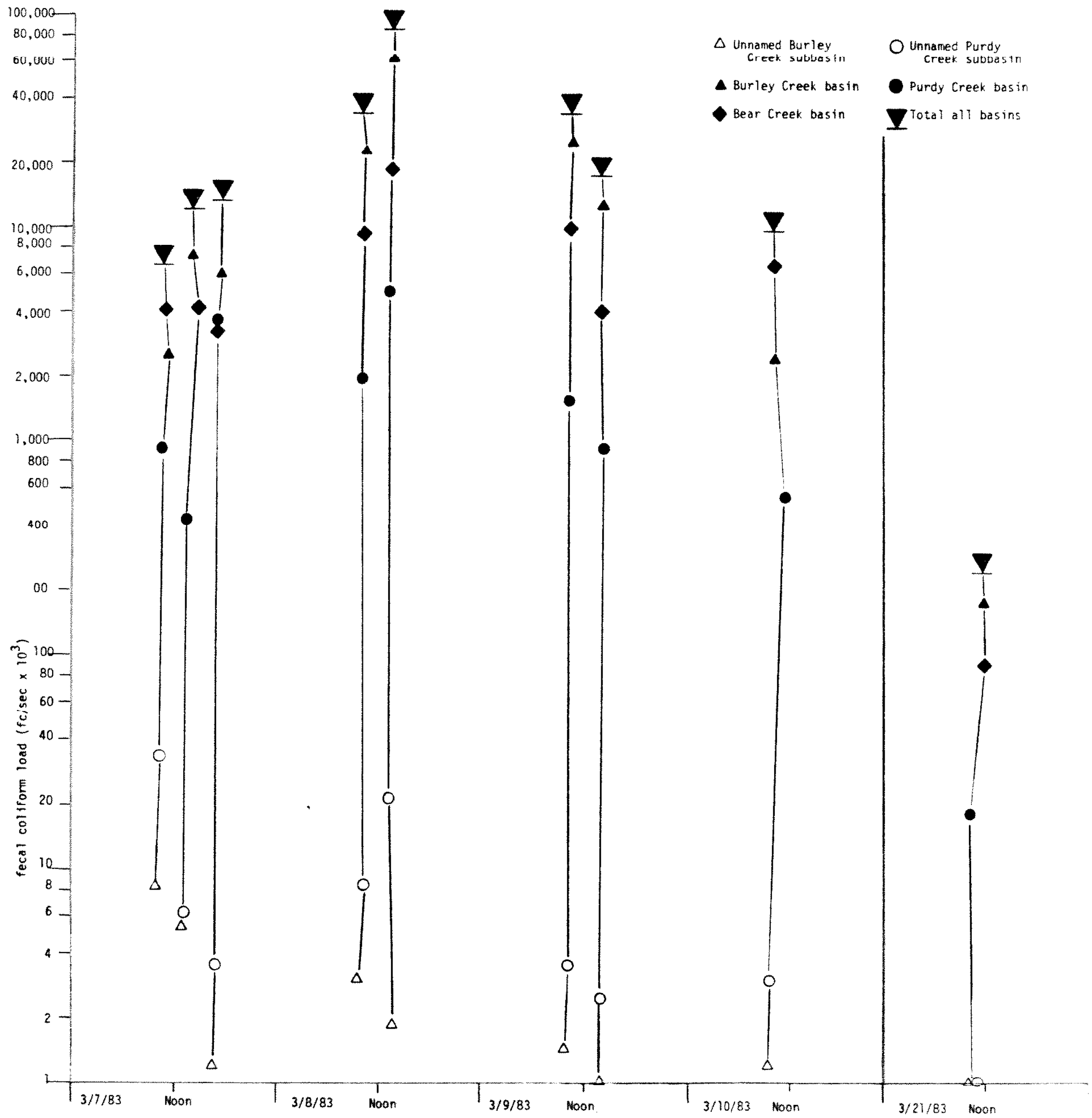

Figure 6. Instantaneous fecal coliform loads for several tributary and main-stem streams in the Burley Watershed during a rain event from March 7 through March 10, 1983. March 21 data are included for a dry-period comparison (results from each stream during each run are joined by vertical lines).

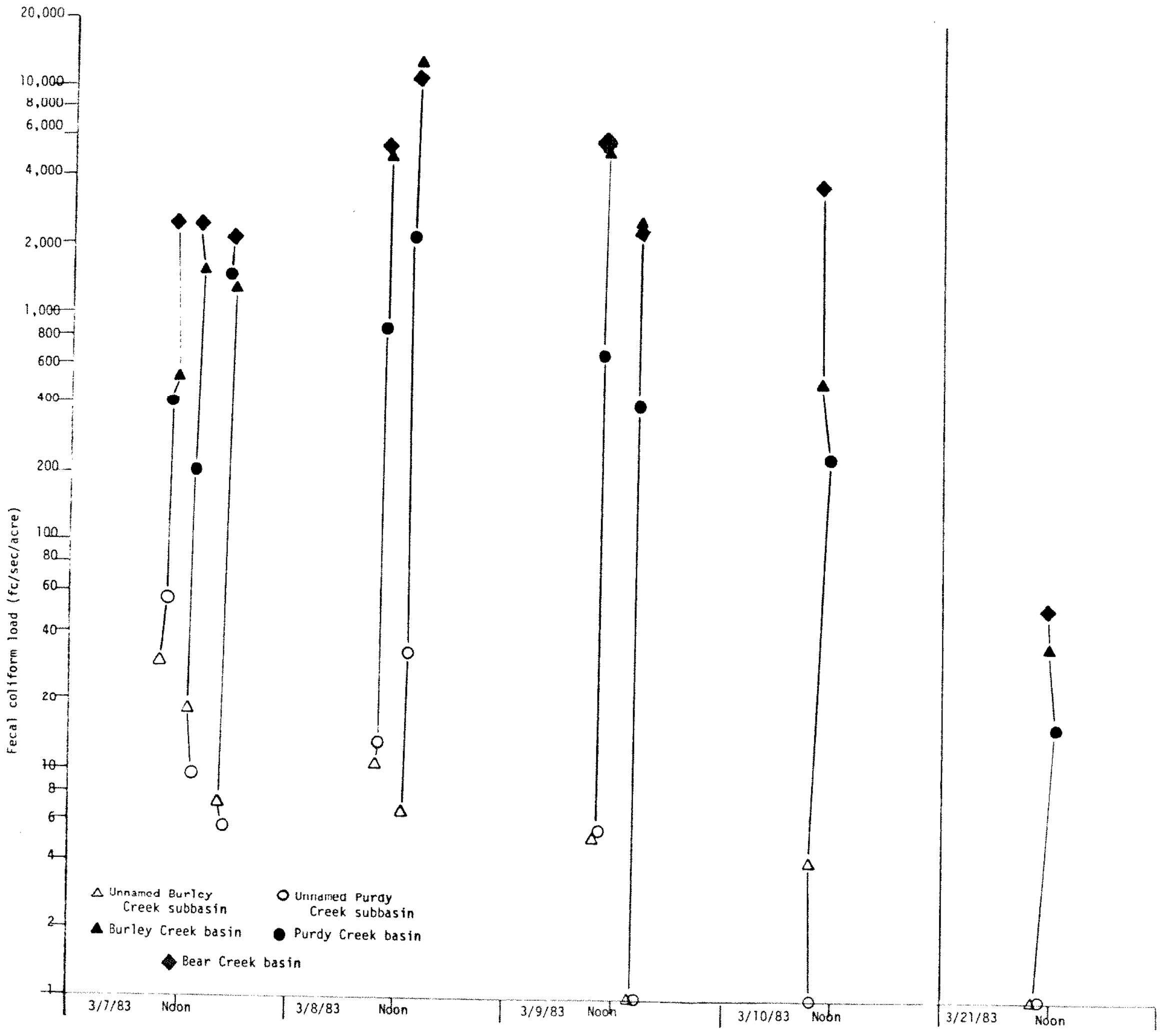

Figure 7. Instantaneous fecal coliform loads per unit area for several tributary and main-stem streams in the Burley Watershed during a rain event from March 7 through March 10, 1983. March 21 data are included for a dry-period comparison. (Results from each stream during each run are joined by vertical lines.)

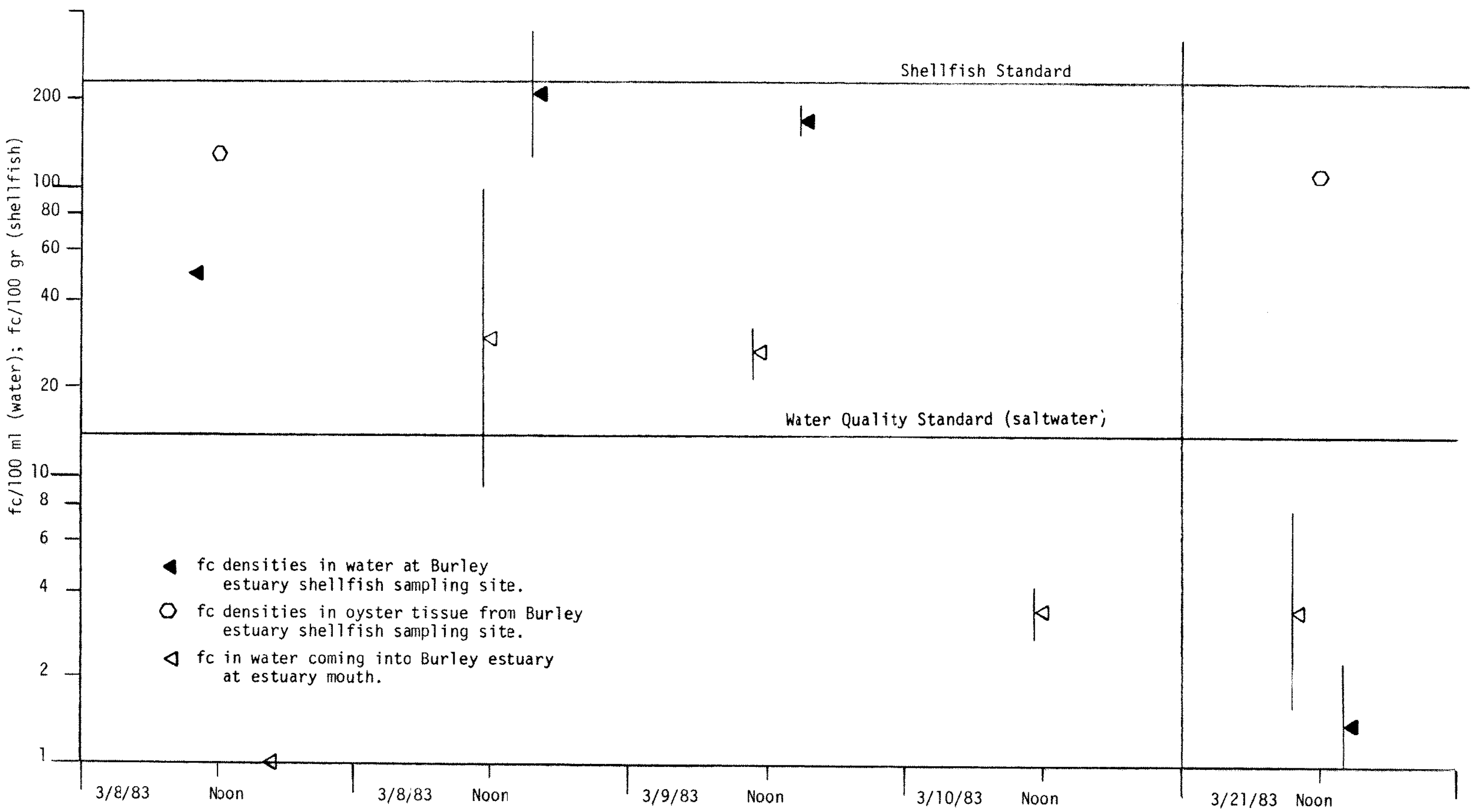

Figure 8. Fecal coliform densities in water and shellfish from the Burley estuary during a rain event from March 7 through March 10, 1983. Data from March 21, 1983, are included for a dry-period comparison. (Each data point and vertical bar represent a grometric mean and an estimate of the range of duplicate samples.)

Table 1. Flow, fecal coliform densities, and loads from several Burley subbasins determined during rain event sampling in March, 1983.

Station (date)-time	Flow (cfs)	fc/100 ml (geo. means)	Load (fc/sec x 10^3)	Rel. Load per Run (Percent)	Subbasin Area (acres)	Load/acre (fc/sec/acre)
X 0.2 (Unnamed Burley Creek Subbasin - Undeveloped)						
(3/07)-0955	2.3	13	8.50	0.11	288	29.51
-1300	2.0	9	5.12	0.04		17.78
-1630	2.4	3	2.10	0.01		7.29
(3/08)-0945	3.1	3.5	3.06	0.01		10.62
-1255	4.0	4	1.89	0.002		6.56
-1555	3.4	2	1.92	N/C		6.67
(3/09)-0955	3.7	1.4	1.47	0.004		5.10
-1350	3.1	0	0	0		0
(3/10)-0925	2.5	1.7	1.19	0.013		4.13
(3/21)-1011	0.9	0	0	0		0
Bu 0.6 (Burley Creek Basin above Bear Creek Confluence)						
(3/07)-1130	89.5	100	2,532.8	33.23	4,742.4	534.1
-1420	88.0	295	7,346.0	61.46		1,549.1
-1750	100.3	204	5,970.5	43.92		1,259.0
(3/08)-1050	146.6	550	22,818.3	67.22		4,811.8
-1405	172.8	1,258	61,519.2	72.21		12,972.7
-1645	N/T	1,698	N/C	N/C		N/C
(3/09)-1100	205.2	426	24,738.5	68.75		5,216.7
1430	154.3	282	12,314.1	71.26		2,596.7
(3/10)-1030	104.9	81	2,404.6	25.57		507.1
(3/21)-Noon	35.5	17	170.8	61.48		36.0
Br 0.0 (Bear Creek Basin above Burley Creek Confluence)						
(3/07)-1105	23.1	631	4,125.0	54.13	1,689.6	2,441.4
-1400	21.6	676	4,132.2	34.57		2,445.7
-1730	24.7	537	3,573.7	28.47		2,115.1
(3/08)-1040	41.7	776	9,157.7	26.98		5,420.0
-1350	44.8	1,479	18,751.3	22.01		11,098.1
-1640	N/T[1/]	1,412	N/C[2/]	N/C[2/]		N/C[2/]
(3/09)-1050	46.3	741	9,709.2	26.98		5,746.4
-1430	38.6	371	4,052.7	23.45		2,398.6
(3/10)-1025	26.2	870	6,450.7	68.61		3,817.9
(3/21)-1150	7.9	40	89.4	32.18		52.9
V 0.0 (Unnamed Purdy Creek Subbasin - Undeveloped)						
(3/07)-1020	2.5	52	36.3	0.48	646.4	56.2
-1320	2.9	7.5	6.2	0.05		9.6
-1700	3.4	3.7	3.6	0.03		5.6
(3/08)-1010	5.4	5.6	8.6	0.02		13.3
-1315	6.6	11.5	21.6	0.025		33.4
-1620	N/T	24	N/C	N/C		N/C
(3/09)-1015	6.3	2	3.6	0.01		5.6
-1405	6.3	1.4	2.5	0.014		0.4
(3/10)-0950	5.4	2	3.0	0.032		0.5
(3/21)-1105	1.7	0	0	0		0
P 0.1 (Purdy Creek Basin above Estuary)						
(3/07)-1045	30.9	105	918.0	12.04	2,252.8	407.5
-1345	29.3	56	464.0	3.88		206.0
-1715	37.0	347	3,633.4	27.56		1,493.0
(3/08)-1025	60.2	115	1,959.2	5.77		869.7
-1330	75.6	229	4,899.4	5.75		2,174.8
-1630	N/T	204	N/C	N/C		N/C
(3/09)-1035	69.4	78	1,531.9	4.26		680.0
-1435	58.6	55	912.1	5.28		404.9
(3/10)-1120	41.7	46	542.8	5.77		240.9
(3/21)-1010	9.6	6.5	17.6	6.45		7.8

1/ Flow meter failed; data not available

2/ Values not calculated; flow data unavailable

APPENDIX II

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

MEMORANDUM
May 13, 1983

To: John Bernhardt

From: Dale Norton D.N.

Subject: Status Report - Minter/Burley Source Survey

Introduction

The purpose of this work is to identify specific sources of coliform bacteria and characterize land-use activities in the Minter and Burley watersheds. A status report on accomplishments for April and May of this year is given below.

Methods

For each watershed - (1) Minter - Huge and Minter creeks and unnamed Minter Creek tributary and (2) Burley - Purdy, Bear, and Burley creeks; each stream was divided into one-half mile segments and walked for its entire length. For each segment, boundary samples were collected and analyzed for pH, specific conductivity, turbidity, total suspended solids, and fecal coliforms. In addition, samples for fecal coliform analysis were collected from any potential coliform sources. Any land-use activities considered to be a possible problem were noted.

With the exception of Huge Creek, all sampling occurred during dry weather under intermediate flow conditions.

Results

Figure 1 presents fecal coliform results from samples collected on March 29-30, April 6, and April 11, 1983, during the Minter Watershed source survey.

Fecal coliform levels were generally low throughout the watershed with the exception of stations H-6 through H-10 which drain forested-pasture areas on upper Huge Creek. Station H-7, which drains a forested gulley near a residence, had an estimated fecal coliform count of 110,000 org/100 mL, indicating a nearby source. Station UN-3, located below a small hobby farm on the upper portion of the unnamed tributary to Minter Creek, also had a relatively high coliform count of 800 org/100 mL.

Figure 2 presents the results of fecal coliform samples collected April 25 and April 27, 1983, during the Burley Watershed source surveys. At the time of this writing, results from the Burley Creek survey are not yet available, consequently the creek will not be discussed here.

Relatively high coliform counts were present in the upper Bear Creek drainage (Station BR-1 through BR-4). Land use in this area consists of a small dairy farm, a junkyard, and two duck ponds surrounded by several residences in close proximity. Erosion and evidence of intensive livestock usage was present throughout this area. One local resident indicated that the dairy in the evening frequently dumps excess manure wastes directly into Bear Creek.

In summary, the stream in this area appeared to be both physically and aesthetically degraded.

A six-inch pipe behind the Purdy shopping center was sampled as an adjunct to the stream surveys. A coliform count of ≥ 240,000 org/100 mL resulted, suggesting a problem.

Discussion

Since the results presented here only represent single observations, caution must be exercised in interpreting the data. While the results indicate specific problems may exist in both Minter and Burley watersheds, additional samples need to be collected to confirm whether water quality violations actually exist. Followup sampling of each problem area is currently scheduled by our staff.

A second sanitary survey will be performed on each stream at some future time. The purpose is to reflect conditions during wet weather. This work will most likely occur during the fall of this year since our major spring storms have passed.

DN:cp

Attachments

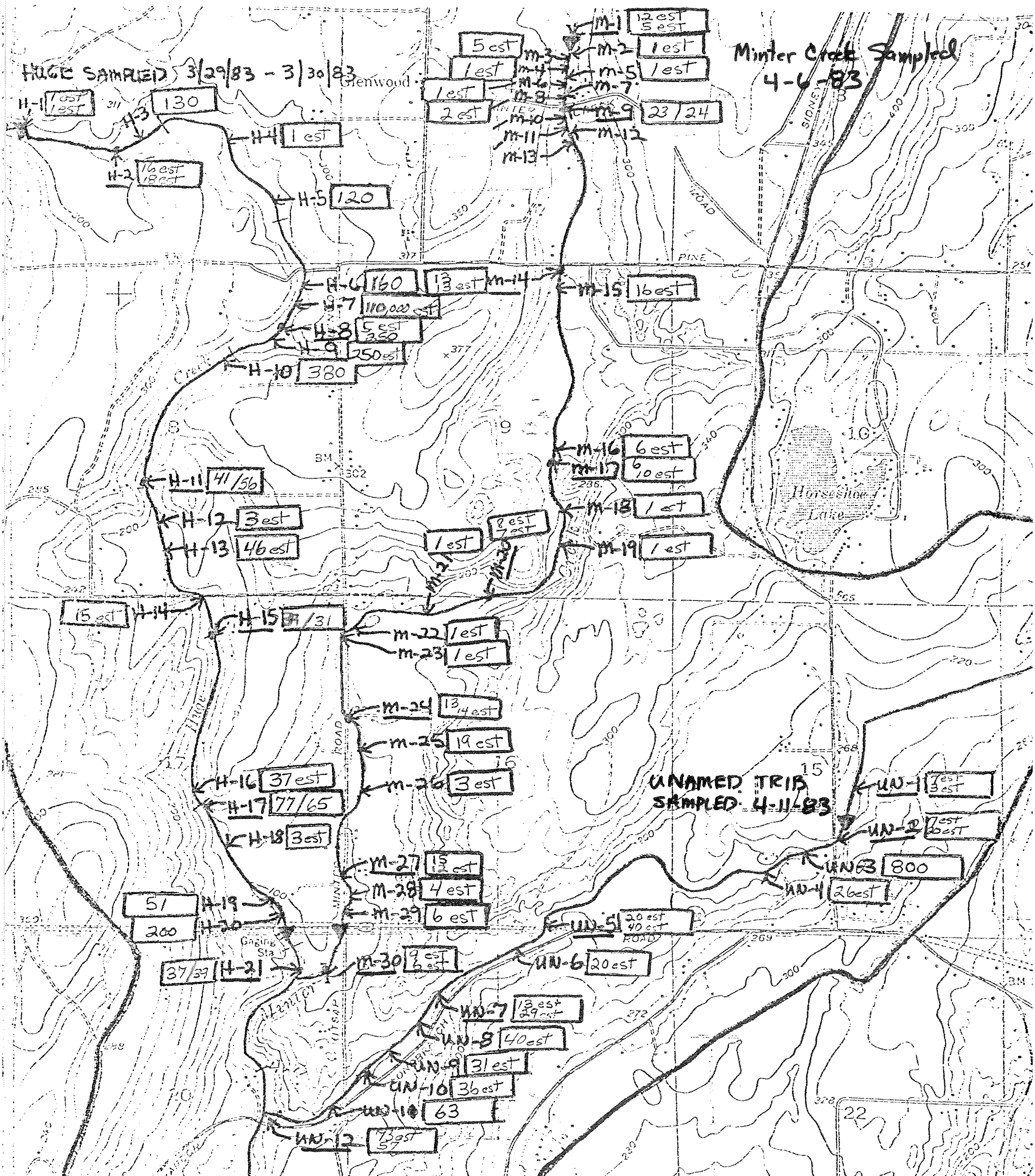

Figure 1. Fecal coliform results from samples collected March 29-30, 1983, April 6, 1983, and April 11, 1983, during the Minter Watershed sanitary source survey. (values reported as org/100 ml)

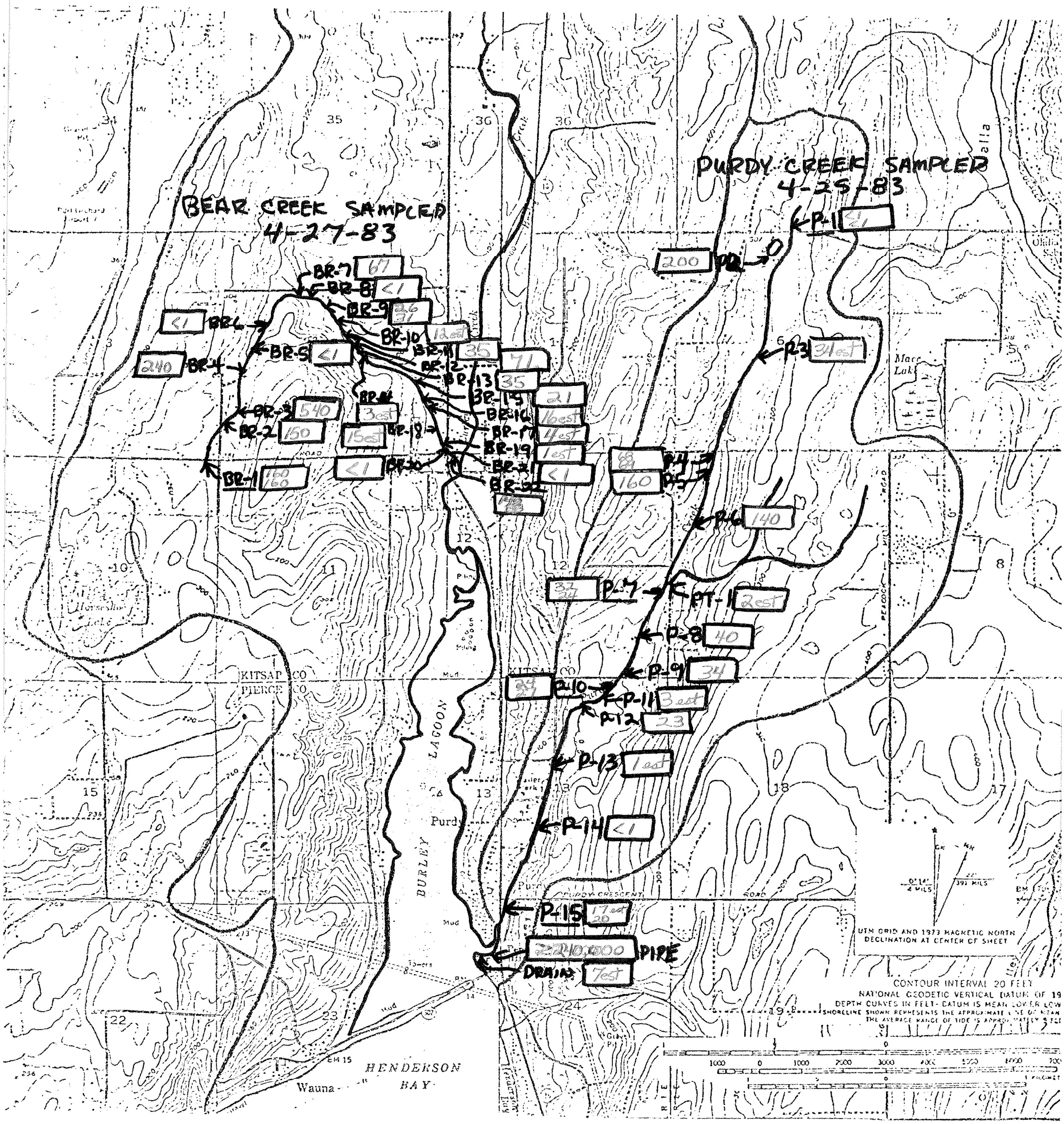

Figure 2. Fecal coliform results from samples collected April 25, 1983, and April 27, 1983, during Purdy Creek and Bear Creek sanitary source survey. (values reported as org/100 ml)