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ASSESSMENT OF NONPOINT SOURCE POLLUTION IN TRIBUTARIES ENTERING GREAT BAY

A Final Report to

The New Hampshire Office of State Planning, New Hampshire Coastal Program

Submitted by

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NH OFFICE OF STATE PLANNING COASTAL PROGRAM

EXECUTIVE SUMMARY

The results from the 1995-96 study have provided a valuable third year of information on key water quality parameters. Temporal trends for most parameters are not clearly definable, although elevated levels at some sites this past year raise some concerns. The Cocheco River still appears to be a key problem area for both nutrients and bacteria. In fact, there are numerous concerns at most of the freshwater sites, possibly with the exception of the Lamprey River site. Despite the lack of consistent effects of storm events on most parameters, the consistently and often statistically significant adverse impact of storms on bacterial levels shows the importance of identifying and preventing future contamination from the presently unidentified sources.

INTRODUCTION

The third year of a project designed to determine the effect of rainfall on contaminant levels in tributaries to Great Bay was conducted from July 1995 to June 1996. The project was a cooperative effort between the NH Office of State Planning, NH Coastal Program, NH Department of Environmental Services, NH Fish and Game and the Jackson Estuarine Laboratory. The project was similar in design to the two prior years conducted in 1993-1994 and 1994-1995, however, several changes were made. Based on the results of the previous two years, several stations were eliminated. These included upstream stations in the Exeter and Cocheco Rivers (14 EXT and 22 CCH) and the Portsmouth Harbor station (GB 13). Several analyses were eliminated because they shed little light onto the effect of rainfall and runoff. The analyses that were eliminated in 1995-1996 included total phosphorus and particulate nitrogen. Chlorophyll analysis was added for 1995-1996. Similar to 1994-1995 project year, four storm events were monitored for two consecutive days, rather than eight storm events sampled one day each as was done in year one.

The purpose of the study was to: (1) add to the water quality database established in 1993-1995 for Great Bay tributaries; (2) determine the effects of > 0.5 inches of rainfall the day of and the day before sampling on the concentrations of indicator bacteria, total suspended solids, and nutrients; (3) identify problem areas in the estuary (i.e. those which are contributing greater amounts of contamination). (4) identify temporal trends in water quality parameters

METHODS

Fourteen sites in the Great Bay watershed were sampled and analyzed following four rainfall events by JEL personnel, and four times between October 1995 and June 1996 during dry (random meteorological) conditions by DES and OSP personnel. The sites consisted of one freshwater site and one tidal site each in the Exeter, Lamprey, Oyster, Bellamy, Cocheco and Salmon Falls Rivers. One additional upstream freshwater site each was included on Oyster and Cocheco Rivers. (Fig. 1). A description of the site locations is as follows:

<u>Exeter/Squamscott River</u>

9 EXT, downstream of 14 EXT, is located at the upstream side of the Rte. 108 bridge in downtown Exeter;

GB 80 is located in the Squamscott River at the railroad bridge crossing.

<u>Lamprey River</u>

5 LMP is located at the upstream side of the Rte. 108 bridge in downtown Newmarket;

GB 15 is located at the mouth of the Lamprey River as it enters Great Bay.

<u>Oyster River</u>

8 OYS is located near the Durham/Lee town line where the Oyster River crosses Rte 155A;

5 OYS, downstream of 8 OYS, is located near the fish ladder in the mill pond, above the dam in Durham;

GB 50 is located at the mouth of the Oyster River as it enters Great Bay, adjacent to Wagon Hill Farm.

Bellamy River

5 BLM is located upstream of the Rte. 108 Bridge in Dover, upstream of the Sawyer's Mill Apartment complex;

GB 2 is located just upstream of the Scammel Bridge crossing on the Bellamy River.

Cocheco River

11 CCH is located in Dover at the Watson Road Dam;

7 CCH, downstream of 11 CCH, is located just upstream of the dam in downtown Dover;

GB 21 is located approximately 150 meters upstream of the tidal junction of the Cocheco and Piscataqua Rivers.

Salmon Falls River

5 SFR is located just upstream of the Rte. 4 bridge in Rollinsford;

GB 22 is located approximately 150 meters upstream of the tidal junction of the Salmon Falls and Piscataqua Rivers.

Measurements of temperature, salinity (conductivity), dissolved oxygen, pH and observations of weather conditions were recorded at the sampling times. Separate containers were used for collection of water samples for microbial, suspended solids chlorophyll and nutrient analyses. Storm sample collection and processing methods were conducted according to JEL SOP's 1.05 and 1.06. Nutrient analyses for JEL samples were done using Lachat Method 11-107-06-1-C for ammonium, method 30-107-04-1-A for nitrite/nitrate and the wet chemistry method of Parsons et al (1981) for orthophosphate. Dissolved organic nitrogen was analyzed using Shimadzu ion specific chromatography with an ANTEK Nitrogen detector on filtered samples. Chlorophyll a analysis was conducted using acetone extraction from glass fiber filters and spectrophotometry. Microbial analysis of JEL samples involved standard membrane filtration methods using mTEC agar for detection of fecal coliforms and *Escherichia coli* and mE agar for detection of enterococci.

Rainfall records were examined to determine whether 1995-1996 sampling dates fit the criterion for either "dry" or "storm" sampling. Sample dates were then regrouped as either dry or storm samples. Means were established for all parameters and graphed to determine differences between stations and between dry and storm samples. Differences were tested for significance using one way ANOVA ($P \leq 0.05$), and t-tests for samples with unequal variance ($P \leq 0.05$). Data collected in 1995-96 were compared to 1994-95 and 1993-94 data for common stations and parameters, using the same graphic and statistical methods used for 1995-96 data. Data from the three years of the study were used to construct a cumulative database for the common sites and parameters. The three year means were established for all parameters and graphed to determine differences between stations and between dry and storm samples. Observed differences between dry and storm samples were tested for significance using one way ANOVA ($P \leq 0.05$) and t-tests for samples with unequal variance. Combined dry and storm data for 1993-1994, 1994-1995 and 1995-1996 were compared to determine if there were interannual differences for specific parameters. Observed differences were tested for statistical significance using t-tests for samples with unequal variance ($P \leq 0.05$).

RESULTS

Rainfall conditions on sampling dates for 1995-1996 are shown in Table 1. All sampling dates met the designated criterion for the dry and storm groupings. Results of field measurements and laboratory analyses for all parameters except indicator bacteria for dry weather samples are listed in Table 2 and these same data for storm samples are listed in Table 3. Means calculated for each of the stations and parameters are included in the tables as well.

Dry vs Storm Samples: 1995-1996

Dissolved Oxygen

Mean dissolved oxygen concentrations were not directly comparable for dry and storm samples due to seasonal and temperature differences at time of collection, however the range of values and means were similar on storm and dry sampling dates. Lowest measurements were detected at the freshwater sites (Tables 2 and 3).

Percent Oxygen Saturation

Very little difference in mean percent oxygen saturation was found between dry and storm samples at all stations (Tables 2 and 3, Fig. 2), and none of the differences were statistically significant (Table 4). Mean of storm measurements at the tidal sites (except GB 80) had a higher % saturation than the mean of dry sampling dates. Violations of the NH DES Water Quality Standard of 75% O_2 saturation will be discussed in another section.

pH

At all sample sites, the mean pH for dry weather samples was similar to storm sample pH. Lowest pH was measured at 11 CCH and some unusually high pH measurements were taken at 5 SFR and GB 22 during a storm in September 1995 (Tables 2 and 3).

Total Suspended Solids (TSS)

With the exception of sites GB 80, GB 15 and GB 2, the TSS mean was higher for storm samples (Fig. 3). Though some of these differences in means appear to be considerable when viewed graphically (9 EXT, 7 CCH, GB 21, GB 22), only GB 21 was found to be statistically significant (Table 4).

Suspended Particulate Organic Material (SPOM)

Rather than expressing the suspended organic material as a percent of the TSS, the actual weight was used for comparison. Marked differences were observed between dry and storm samples for 11 CCH, GB 21, 5 SFR, and GB 22 with storm samples higher than dry (Fig 4). The higher mean suspended organic material at these sites was due to extremely high values in samples taken during a storm in September 1995. Chlorophyll content for the sample sites indicate that a plankton bloom was responsible for the high the organic content (Figs 26 and 27). Because the higher storm concentrations were due to two sample dates (9/18 and 9/19), the differences were not statistically significant (Table 4).

Chlorophyll a

Mean chlorophyll a concentrations were similar at most stations in dry and storm samples, though much higher in storm samples at 5 OYS, 11 CCH, GB 21, 5 SFR and GB 22 (Figure 5). An As mentioned above, the means were greatly influenced by the September 18 and 19 storm samples, and showed no difference statistically (Figs. 26 and 27; Table 4).

Ammonium ion concentration (NH_4)

Mean ammonium ion concentrations were lower following storms for sites GB 80, GB 50, 11CCH, GB 21, and GB 22: slightly higher following storms for sites 9 EXT, 5 LMP, GB 15, 7 CCH, and 5 SFR; and were similar at 5 OYS, 5 BLM and GB 2 (Fig. 6). None of the observed differences were statistically significant (Table 4).

Nitrate concentration (NO_3)

Mean storm and dry concentrations of NO3 were similar at GB 80, 5 LMP, GB 15, 5

OYS, GB 21 and GB 22, and higher in storm samples at 9 EXT, 8 OYS, GB 50, 5 BLM, GB 2, 11 CCH, 7 CCH and 5 SFR (Figure 7). However, only at site 9 EXT were the concentrations statistically higher in storms than dry weather samples (Table 4).

Dissolved inorganic nitrogen (DIN = NH_4 +NO_3)

Mean dissolved inorganic nitrogen (NH_4 +NO_3) was higher in storm samples than dry weather samples at 9 EXT, 5 LMP, GB 15, 8 OYS, GB 2, 11 CCH, 7 CCH, and 5 SFR and lower in storm samples at GB 80, GB 50, GB 21 and GB 22. The greatest difference, though not statistically so, was observed at 9 EXT (Figure 8).

Dissolved Organic Nitrogen (DON)

The individual site mean for dissolved organic nitrogen (DON) was lower in storm samples at all sites except 5 OYS, 5 BLM, 11CCH GB 21, 5 SFR and GB 22 where storm sample means were higher. The greatest differences in means between dry and storm samples were found at sites 11 CCH and GB 22. Though it appears that DON concentration decreases at some sites following rainfall and increases at others, none of the observed differences were statistically significant (Fig 9; Table 4).

Total Dissolved Nitrogen (TDN=DON+DIN)

Total dissolved nitrogen was similar at most sites and slightly higher in storm samples at 11 CCH, 7 CCH, 5 SFR and GB 22 (Fig. 10). None of the differences were statistically significant.

Orthophosphate (PO_4)

Mean PO_4 concentration was higher in storm samples at eleven of fourteen sites. Except for sites 11 CCH, 7 CCH and 5 SFR, the storm sample mean was higher than the dry weather mean. The greatest differences in means were observed at 9 EXT GB 80, GB 15 and GB 50, 5 BLM and GB 22 (Fig. 11). No statistically significant differences were found, however (Table 4).

Bacterial Indicators

Results of laboratory analyses for all three bacterial indicators of water samples collected during dry weather conditions are listed in Table 10. The results for storm event samples are listed in Table 11. Geometric means calculated for each of the stations and indicators are included as well as the ratio of geometric mean values for freshwater (FW) sites to their corresponding estuarine water (SW) site. There were four sample dates for dry weather and eight for storms.

The comparisons of geometric means for dry weather and storm event samples are shown in Figures 27a-c for all three indicators. Generally, the geometric means for storm events were higher than those for dry weather. For fecal coliforms (FC), 12 of 14 sites had higher means for storm events (Figure 27a). The comparisons show 14 of 14 sites had higher *E. coli* (Ec) (Figure 27b) and 13 of 14 had higher enterococci (Figure 27c) during storm events. The sites where storm event means were lower than dry weather were GB80 and 11CCH for FC and GB2 for enterococci, although for all three exceptions the means were virtually identical. Statistical comparisons of the dry and storm results were made using paired t tests, and the results are shown in Table 12. FC were significantly different at 4 sites, Ec at 6 sites and enterococci at 6 sites. Storm event data were greater than dry weather in every case. Three sites, 9 EXT, GB 80 and 7CCH, had significant differences for all three indicators. At 5OYS and 5 BLM, both Ec and enterococci were significantly different. In addition, Ec were significantly different at GB 50 and FC were significantly different at GB 21. The sites where there were no significant differences for any indicator are GB 80, GB 15, 8 OYS, GB 2, 11 CCH, 5 SFR and GB 22.

The State of New Hampshire has adopted different bacterial indicators for water quality classification in different environments and for different purposes. Enterococci is the standard for marine and estuarine recreational waters, fecal coliforms are for shellfish-growing waters and

Escherichia coli is used to classify recreational freshwaters. Geometric means and frequency of relatively high levels for each indicator, condition and site are critical to classification protocols, and were compared to State standards in this study.

In tidal waters, the limit for fecal coliforms to prevent a prohibited classification is <88 FC/100 ml and 10% of samples not over 260/100 ml. The geometric mean limit was violated during dry weather in four of the six tidal sites, GB 80, GB 15, GB 21 and GB 22, all sites that are presently classified as prohibited. FC were <14/100 ml, the standard for approved classification, at GB 50, and just over the approved limit at 15/100 ml at GB 2 (Table 10). These results are also consistent with present classification of these sites, although GB 50 is actually just outside of a nearby approved area. The same trend held for storm event results (Table 11), except that the geometric means for the two lowest sites, GB 50 and GB 2, were both >14/100 ml, although still <88/100 ml. For recreational use, swimming in tidal waters requires a geometric mean to be <35 enterococci/100 ml in three successive samples in 60 days with no sample >104/100 ml. The geometric mean and high value limits were not violated at any of the tidal sites during dry weather (Table 10). The geometric mean limit was violated at GB 21 only during storm events, but values >104/100 ml occurred at least once in four sample dates for all six tidal sites. Again, GB 50 and GB 2 had the lowest values for enterococci following storms, as seen for FC.

In freshwaters, the limit for Class A waters is <47 *E. coli*/100 ml, with no sample over 153/100 ml in three consecutive samples. For Class B waters, the limits are 126 and 406/100 ml, respectively. Swimming waters requires limits of <47/100 ml for a geometric mean with no sample >88/100 ml. During dry weather, sites 11 CCH, 7 CCH and 5 SFR had geometric means >47/100 ml, but <126/100 ml, thus meeting Class B but not Class A requirements. The other sites, 9 EXT, 5 LMP, 8 OYS, 5OYS and 5 BLM all had geometric means <47/100 ml, although at least one of four samples were >88/100 ml at 9 EXT, 5 OYS and 8 OYS. Following storms, six of the eight freshwater sites had geometric means >126/100 ml, and the other two sites, 5 LMP and 11 CCH, had geometric means >47/100 ml. Thus, conditions are cleanest at 5 LMP and 5 BLM during dry weather, with adverse effects of storms at both, especially 5 BLM.

Differences Between the Day of the Storm and the Following Day Samples

Samples were collected for bacterial indicator analysis on both the first day of storm events and the following day. This was a follow-up to last year's study where the concern was to determine when to best detect the flush of contaminants that may be washed into surface waters during storms. Without detailed assessments at each river-estuary site, the hydrology and contamination response was not known. In last year's study, the only instance of significant difference was for enterococci at 11 CCH, although the second day results were generally higher that the first day. For this study, the first day geometric means were higher than the second day means in 11 of 14 sites for FC (Figure 28a), 8 of 14 sites for Ec (Figure 28b), and 7 of 14 sites for enterococci (Figure 28c). The only instance where a significant difference was calculated was for enterococci at GB15, where the first day mean was significantly greater than the second day mean (Table 12). Thus, it appears that either day gives similar results, probably as contaminants continue to be washed by sampling sites from upper portions of the respective watersheds.

Between Site Differences as Indicated by 1995-96 Data

Analysis of the concentrations of the contaminants of concern (i.e. TSS, nutrients, bacteria) and water column condition (D.O.) was conducted to determine which sites appear to be "problem areas" with respect one or more contaminants. Particular attention was paid to differences between upstream and downstream freshwater sites in those rivers with more than one freshwater site (Exeter, Oyster and Cocheco Rivers) and between the downstream freshwater site and its tidal counterpart.

Total suspended solids (TSS)

Means for TSS at all freshwater sites were generally low in both dry weather and storm samples (≈5 mg/L). Occasional higher TSS concentrations (10 mg/L or greater) were measured at 11 CCH and 5 SFR due to plankton blooms and at 7 CCH under particularly windy conditions. TSS concentration at site 8 OYS was higher than 5 OYS during dry weather and storms, so it appears as though some of the suspended load settles out before the freshwater endpoint in the Oyster River. In comparison to their freshwater counterparts, the tidal sites each show elevated concentrations in TSS. Sites GB 80 in the Squamscott River, followed by GB 15 (Lamprey), GB 21 and GB 22 (Salmon Falls) have the highest concentrations under both sampling conditions. GB 50 (Oyster) and GB 2 (Bellamy) are similar, and lower than the previously mentioned sites. Statistically, GB 80 and GB 15 were higher than all other sites in dry weather and higher than all sites except GB 21 and GB 22 in storms (Table 5). When dry and storm data are combined GB 80 is significantly higher than all other stations and GB 15 is higher than all stations except GB 80 (Table 5).

Suspended Particulate Organic Material (SPOM)

SPOM appeared elevated in storms at GB 22, 5 SFR, GB 21, 11 CCH and GB 21 in Storms and at GB 80 and GB 15 in both dry weather and storms. This parameter is a measure of both living (plankton) and nonliving (detritus) organic material. The station differences observed for SPOM in the 1995-1996 data at GB 22, 5 SFR, GB 21, 11 CCH and GB 21 were primarily the result a plankton blooms in the Salmon Falls, Cocheco and Oyster Rivers following a rain storm in September. The higher concentrations observed in the tidal Squamscott and Lamprey Rivers are likely due to resuspension of detrital material from the marshes surrounding these river mouths.

Chlorophyll a

Elevated chlorophyll a was measured in storm samples at GB 22, 5 SFR, GB 21, 11 CCH, and 5 OYS and in dry weather samples at GB 22. Though the means appear extraordinarily high by comparison, they are greatly influenced by the 9/18 and 9/19 storm sampling. Heavy rains following an extended hot dry period resulted in ideal conditions for a plankton bloom at these sites. Nutrient concentrations were high as well, therefore the magnitude of the bloom may have been light limited. The bloom did not result in anoxic or hypoxic conditions, and oxygen was > 100% saturation at GB 21 and GB 22 (Table 3; Figs 2 &5).

Nitrogen

With regard to nitrogen, a great deal of variation was observed in the form or "species" of nitrogen between sites, as well as within sites between dry weather and storms was observed. Natural processes and transformations of the different forms of nitrogen, such as plant and animal excretion, detrital decomposition, uptake and assimilation, make it difficult to view nitrogen concentrations as a more conservative component such as salinity can be viewed. Some general trends were observed, however, and some identifiable problem areas can be determined.

Highest mean NH_4 concentrations at the freshwater sites, in descending order, were measured at 11 CCH and 7 CCH in both dry and storm samples and at 5 SFR, 5 LMP and 9 EXT in storm samples. Highest mean NH_4 concentrations at the tidal sites were measured at GB 21, GB 15 and GB 80 in both storm and dry samples, and GB 21 in dry weather samples (Fig. 6). Statistically 11 CCH was significantly greater than all other sites in dry weather, greater than all except 7 CCh and 5 SFR in storm samples and > than all except 7 CCH in storm and dry samples combined. The only other statistically significant difference for ammonium was in combined samples where 7 CCH > 8 OYS (Table 5).

Mean nitrate (NO_3) concentrations were highest at the freshwater sites

11 CCH, 7 CCH,5 SFR, 8 OYS and 5 OYS (dry and storms). In the tidal sites, mean NO_3 was highest at GB 21, GB 22 and GB 80 (dry and storms) (Fig. 7). When NH_4 and NO_3 are combined as DIN, the sites with the highest concentration of dissolved inorganic nitrogen in both dry weather and storms are 11 CCH, 7 CCH, and 5 SFR. Tidal sites with elevated mean DIN are GB 21 and GB 22 (Fig. 8).

Mean concentrations of dissolved organic nitrogen (DON) were highest in the Exeter (9 EXT) Salmon Falls (5 SFR), and Oyster Rivers (5 OYS), though differences between sites were not as great as they were for DIN. DON concentration at the tidal sites were similar, though highest at GB 22 in storms (Fig. 9). No statistical differences were found between sites under any conditions for DON concentration (Table 5).

Mean total dissolved nitrogen concentration at each freshwater site was compared with its tidal counterpart, as well as with the "upstream " freshwater sites in those rivers with multiple sites (Oyster and Cocheco Rivers). Though no significant differences between freshwater and tidal sites were found, graphic presentation of the data (Fig. 10) suggests that all the freshwater portions of the rivers contribute some nitrogen to the estuary, and the Cocheco (upstream site 11 CCH in particular) and Salmon Falls make significant freshwater nitrogen contributions.

PO_4

Highest concentrations of PO_4 were measured at each of the tidal sites and at 11 and 7 CCH in the Cocheco River. Comparison of the concentrations at these two sites to GB 21 indicate that there is a freshwater source of PO_4 in the Cocheco River (Fig. 11). Results of statistical analyses indicate that PO_4 concentrations under all conditions combined at GB 80 are significantly higher than all freshwater sites except 11 and 7 CCH (Table 5).

Dissolved Oxygen

On numerous sampling dates both dry and storm at many sites, percent O_2 saturation fell below the NH water quality criteria of 75% saturation (Table 2 and 3). All but one violation (a dry weather measurement at GB 22) occurred in the freshwater sites. Mean percent saturation was higher at half the sites in storm samples, and lower in the others (Tables 2 and 3, Figure 2). No statistically significant differences were found in dry weather, however, in storm samples, O_2 saturation was significantly lower at 11 CCH than at all tidal sites and at 5 SFR. Site 5 OYS was significantly lower than all tidal sites except GB 80 and lower than 5 SFR. Site 5 BLM was lower than GB 2, 15, 21, 22 and 50; site 5 LMP was lower than GB 15, 21 and 22 and 9 EXT was lower than GB 15, 21, and 22. These same sites (in descending order 11 CCH, 5 OYS, 9 EXT, 5 BLM, 5 LMP) were also significantly lower in % saturation in combined storm and dry weather samples (Table 5).

Bacterial Indicators

There were many differences between sites for all three bacterial indicators for the different conditions sampled (Figures 27-28). Statistical comparisons were made of wet and dry condition results to determine which sites might be the worst sites, and which sites might be the least contaminated. The results of the statistical analyses are shown in Table 13, which shows which pairs of sites are significantly different. To determine which site is greater in each case, Figures 27a-c and Tables 10 and 11 should be reviewed. The highest FC geometric mean was at GB21 during both dry and storm events, and was significantly higher than GB 50, GB 2 and 5 LMP for both conditions, 5 BLM and 8 OYS during dry weather and GB 80 and 11 CCH following storms. Other sites that were significantly higher than other sites during dry weather were 5 SFR and 11 CCH compared to GB 50, GB 2 and 5 LMP. GB 50 and GB 2 were the least contaminated sites, both being significantly lower than the GB 21, 5 SFR, 11 CCH, 7 CCH, and GB 15, with GB 50 lower than GB 80 and GB 22. Only 5 OYS and 9 EXT were not significantly different than any other site. For storm events, 7 CCH, 9 EXT, 8 OYS and 5 SFR had significantly higher levels of FC that 5 LMP, GB 50 and GB 2. Again, GB 50 and GB 2 were the least contaminated sites and were significantly lower than GB 21, 7 CCH, 9 EXT, 8 OYS, 5 SFR, 5 BLM, 5 OYS, GB 22 and GB 15, while GB 2 was also significantly lower than 11 CCH.

Like the FC data, the highest Ec geometric mean was at GB 21 during both dry and storm events, and was significantly higher than GB 50, GB 2 and 5 LMP for both conditions, 5 BLM during dry weather and GB 80 and 11 CCH following storms. Another site that was significantly higher than other sites during dry weather was 5 SFR, compared to GB 50, GB 2 and 5 LMP. GB 2 was the least contaminated sites, being significantly lower than the GB 21, 5 SFR, 11 CCH, 7 CCH, GB 15, GB 80, GB 22 and 9 EXT. Only 5 OYS and 8 OYS were not significantly different than any other sites. For storm events, 9 EXT and 8 OYS had significantly higher levels of FC that 5 LMP, GB 50 and GB 2. Again, GB 50 and GB 2 were the least contaminated sites and were significantly lower than GB 21, 7 CCH, 9 EXT, 8 OYS, 5 SFR, 5 BLM, 5 OYS, GB 22 and GB 15, while GB 2 was also significantly lower than 11 CCH and GB 80.

The enterococci results were somewhat different from the FC and Ec results. The highest geometric mean was at 8 OYS for storm events and 7 CCH during dry weather. For dry weather, both 7 CCH and GB 21 were significantly higher than 5 LMP and GB 50, while 5 SFR was significantly higher than gb 50, the least contaminated site. Many sites were statistically the same as all other sites. For storm events, * OYS was significantly higher than GB 2, GB 50, GB 15, GB 22 and GB 80. Sites 9 EXT, 5 OYS, 7 CCH and 5 BLM were significantly higher than GB 50 and GB2, which were again the least contaminated sites. GB 21 also had significantly higher levels than GB 2. Only 5 SFR, 11 CCH and 5 LMP were not significantly different than any other sites.

Overall, the sites that were most consistently high were GB21, 7 CCH and 5 SFR under both conditions, 9 EXT and 8 OYS during storms, and 11 CCH during dry weather. The least contaminated sites were by far GB 50 and GB2 under both conditions.

Interannual Comparison

<u>Dissolved Nutrients and Other Abiotic Parameters</u>

Combining dry and storm sample data for each of the three project years provided an opportunity to assess interannual variation in the water quality parameters and possible water quality trends at the sites under all conditions. DON and % oxygen saturation were calculated for project years two and three only.

For ammonium, concentrations were higher in the 93-94 and 95-96 than the 94-95 year at nine of the twelve sites sampled for the three year period, however none of the 93-94 to 94-95 to 95-96 PO_4 concentrations (Figs. 13 and 14). Concentrations in 1994-95 were for the most part lower than the preceding and succeeding years, and the 93-94 to 95-96 comparisons were inconsistent as which years had greater or lower concentrations of NO_3 and PO_4. Significant differences were found for NO_3 at GB 15 (95-96>94-95) and GB 22 (95-96 >94-95) (Table 8). No significant differences were found for PO_4 (Table 6). The three year comparisons for TSS concentrations indicate that TSS was similar for the three project years (Fig 15). No statistically significant differences were found (Table 8), however, TSS appears to have increased at GB 15 and decreased at GB 80 and GB 50 throughout the period.

DON Concentrations were similar in the two years, with only GB 22 showing a noticeable increase over the previous year (Fig 16). Percent oxygen saturation was slightly higher in the 1995-96 samples at twelve of fourteen sites and slightly lower at two. The interannual change, however, was minor (Fig. 17).

<u>Bacterial Indicators</u>

Dry weather and storm event weather results from all three project years were compared to determine if there were any observable trends at any sites. The geometric means from all three years are shown in Figures 29a-c for dry weather and Figures 30a-c for storm events. In particular, the results show how contaminants are this last year compared to previous years. For 5 sites, 9 EXT, 5 LMP, GB 21, 5 SFR and GB 22, the geometric means of the different indicators were highest in 1995-96 compared to both other years in 5 of the 6 indicator/conditions presented in the 6 figures (Figures 29 and 30 a-c). ANOVA was run to determine any significant differences between years for the indicators at different sites. The results of the statistical analyses are shown in Table 14. There were no clear trends amongst the sites for significant differences between years. In the comparison of 1995-96 to the second study year 1994-95, indicator geometric means were higher in 1995-96 for FC at GB 80 and 5 SFR, for Ec at GB 80, and for enterococci at 5 LMP and GB 50 (Table 14). In the comparison of 1995-96 to the first year 1993-94, the geometric means for indicators during 1995-96 were significantly higher than 1993-94 in 9 cases and the opposite was true in two cases. In the comparison of the fist year 1993-94 to the second year 1994-95, the first year was greater than the second in three cases, and less that the second year in two cases (Table 14). In general, the first two years did not show consistent differences for sites and indicators under dry and wet weather. The past year has shown numerous cases where indicator levels were higher than in both of the previous years.

Cumulative Database Comparison of Storm vs Dry Samples: 1993-96

Dissolved Nutrients and Other Abiotic Parameters

Dry weather and storm data for the three project years were combined to establish a cumulative three year database (Table 9; Figs. 18-23). The cumulative data shows a pattern similar to the individual project year data in terms of the sites which appear to exhibit water quality problems and the effects of storms on concentrations of specific parameters. Sites 11 CCH, 7 CCH, 5 SFR, and 5 OYS have the highest mean concentrations of ammonium and nitrate of the freshwater sites and sites 7 CCH, 11 CCH and 5 SFR show elevated concentrations of nitrate in storm samples (Fig. 19). Sites 7 and 11 CCH and 5 SFR have elevated ammonium concentrations in storm samples (Fig 18). The storm vs dry differences for nitrate and ammonium at these sites are statistically significant for nitrate 9 EXT only, where storm samples are significantly higher than dry weather. The concentrations under both conditions, however, are relatively low (≈ 0.10 mg/L) and much lower than the Oyster, Cocheco and Salmon Falls Rivers. Of the tidal sites GB 21 and GB 22, and to a lesser extent GB 15 and GB 80, show elevated concentrations of ammonium and nitrate (Figs. 18 and 19).

Orthophosphate concentrations are highest at GB 80, GB 50, GB 21, GB 22, and 11 and 7 CCH, however storm sample means are only slightly greater than dry weather means at the tidal sites (Fig 20). TSS concentrations are highest at GB 80 and GB 15 and do appear to increase slightly in storm samples (Fig. 21).

For Dissolved organic nitrogen (DON) no consistent pattern of difference was observed between the two year dry vs storm comparison (Fig 22). The same was true for oxygen saturation as well (Fig. 23).

Bacterial Indicators

An evaluation of all sites using the combined results for all three years was made as a basis to make general statements about the effects of storm events on water quality using a large database. Data are summarized in Tables 15, 16 and 17 for FC, Ec and enterococci, respectively. The geometric means of the 3-year databases for all three indicators for dry weather and storm events are shown in Figures 31a-c. The geometric means for all three indicators following storm events were always greater than for dry weather (Figures 31a-c). Statistical analysis (ANOVA) of these results strikingly shows that this effect is significant in every case (Table 14). Thus, the large databases for the indicators over the three year time period of the project allow for more robust analysis of the effect of storms, and show that in every case, storm events appear to be contaminating the surface waters at the study sites. The adverse effects on water quality are seen in all tidal and all freshwater sites.

DISCUSSION

Analysis the data collected in tributaries to Great Bay over the three project years indicates appears that 1) rainfall has an impact on the concentrations of some contaminants at some sites; 2) some sites (rivers) exhibit more severe water quality problems than others; 3) violations of bacterial water quality standards are widespread, especially following storms; 4) oxygen saturation seasonally is below NH water quality standards for all of the tributaries in their freshwater portion regardless of weather conditions; 5) there is considerable interannual variation in nutrient concentrations and therefore no clearly observable trends in these parameters over the three year period, and 6) sources of contamination cannot be clearly identified as either point or nonpoint from this data.

Rainfall impacts and problem areas

The bacterial data are strong evidence of the significantly adverse effects that storm events have on the water quality at all sites. Some favorable water quality results were observed during dry weather. However, bacterial water quality standards for Class A and shellfish-growing waters were violated at virtually all sties following storms. Estuarine sites also had questionable data relative to the recreational water standard following storms.

Though few statistically significant differences in nutrient concentrations were found between dry and storm samples, the differences in concentrations following rainfall cannot be ignored. Both the dry weather and storm data exhibit a great deal of "within treatment" variation. This amount of variation in a relatively small data set makes obtaining significant differences between treatments using ANOVA ($P \leq 0.05$) or t-tests very difficult, even if there is an obvious difference in means. The concentrations of ammonium, and in some cases nitrate (8 OYS, 5 OYS, GB 21 and GB 22) are higher in storm samples than in dry weather, particularly at the sites that exhibit more severe water quality problems. These sites include 7 and 11 CCH and GB 21 in the Cocheco River, sites 5 SFR and GB 22 in the Salmon Falls River, 8 OYS, 5 OYS , and GB 80 in the Squamscott River. Sources of nutrient contamination in these rivers appear to be:

<u>Cocheco River:</u> The freshwater portion of the Cocheco (upstream of 11 CCH) appears to be a major source of nutrient (both nitrogen and phosphorus) contamination to Great Bay, though additional input of contaminants directly into the tidal portion cannot be ruled out. Site 11 CCH (downstream of downtown Rochester) had nutrient concentrations that were significantly higher than all other sites except 7 CCH, indicating that there are significant sources of contamination in the Cocheco River upstream of this site. Sources of nutrient contamination in the freshwater Cocheco sites are probably a combination of point sources (Rochester POTW) and nonpoint sources (urban and agricultural runoff).

The freshwater sites showed different trends for bacteria. 11 CCH had relatively low levels of bacterial contaminants while 7 CCH had relatively high levels of indicators, especially following storms. The associated tidal site, GB 21, had by far the highest levels of FC and Ec, both during dry and storm events. The area around the dam and below it to GB 21 appear to have relatively high levels of bacterial contamination, implying urban-Dover related sources could be important.

<u>Salmon Falls River</u>: A combination of point source (Berwick, Rollinsford, Sommersworth POTW's), and nonpoint source in the form of urban runoff from Rollinsford and Sommersworth,

agricultural runoff in Rollinsford (several large dairy farms) are likely contributing to the nutrient load and high concentrations of nitrogen and phosphate measured at 5 SFR. This input no doubt affects the tidal portion of the river, though there are both point (South Berwick POTW) and nonpoint sources directly to the tidal portion that impact site GB 22 as well. Based on bacterial indicators, the freshwater and estuarine sites in this watershed were not the cleanest or the dirtiest. A consistent and relatively strong adverse impact of storms is apparent for last year, with a solid effect based on the three year database. Solving the problem of storm contamination could markedly improve water quality in this river.

Oyster River: Problem areas appear to be in the freshwater portion of the Oyster River (8 OYS and 5 OYS). Since little difference in nutrient concentrations was found between 5 OYS and 8 OYS, the upstream site (which receives runoff from agricultural fields) and downtown area (urban runoff) probably both contribute to nutrient loading to the tidal portion of the river. The clean downstream water at GB 50 also points to the freshwater stretches of the river as sources bacterial contaminants. The significantly higher levels of Ec at 5 OYS following storms last year and the long-term effect at GB 50 and both freshwater sites suggests that the freshwater portion could be having adverse effects on water quality at a site that is in close proximity to a recently classified approved shellfish-growing area. Further improvements in water quality, especially following storms, will be needed for any expansion of approved sites for shellfish harvesting in that area.

Exeter/Squamscott River: The data for 1995-1996 once again indicate that the freshwater portion of the Exeter River does not appear to have an impact on the tidal Squamscott River with regard to nutrients and suspended sediments. Even though storm sample concentrations of NO_3 were significantly greater than dry weather samples, the concentrations under both conditions were among the lowest measured. Nutrient concentrations at site GB 80 in the Squamscott are affected by point sources (Exeter and Newfields POTW's) and nonpoint sources (agricultural runoff, septic systems) in the tidal portion of the river. The strong effect of storms suggests that some nonpoint sources of bacteria exist in the freshwater portion of the river. The lack of effect of storms this last year at GB 80 is probably related to the observed higher levels of bacteria during dry weather. The source of this contamination is not known, although the Newfields POTW is located just upstream from GB 80, and the agriculturally-active Stuart Farm is just past that.

Bellamy and Lamprey Rivers: By comparison to other rivers, the data indicates that neither the Bellamy nor the Lamprey Rivers appear to be contributing excessive nutrients to Great Bay. The same is essentially true for bacteria, although the Bellamy at 5 BLM is severely affected by storm events, with both Ec and enterococci being significantly higher during storm events compared to dry weather.

Parameters

Oxygen Saturation: Though the data indicates that oxygen saturation was frequently below NH DES water quality standards (75% saturation) in the freshwater portions of all the tributaries, the dissolved oxygen measurements (most $\approx$ 5 mg/L) do not indicate severe biological problems. Furthermore, these saturation assessments were based on point samples, mostly taken in the early morning when O_2 saturation would be at its lowest point in the day. Additionally, the lowest measurements were observed in early fall following an extraordinarily hot and dry summer. Depressed oxygen would be expected due to the lack of flow and stagnation of shallow water that is enriched with nutrients.

Dissolved organic nitrogen: DON appears to be an important component of the total nitrogen and exceeds or equals dissolved inorganic nitrogen ($NH4 + NO_3$) at some sites. The constituents of

DON can be a variety of proteins, free amino acids as well as other substances, and the interpretation of the concentration of DON without fractionation and identification of its composition is rather vague. There are however, several interesting observations that can be made with regard to DON concentration. Those sites which exhibit more severe water quality problems (for nutrients such as total N, PO_4) , such as in the Cocheco, Salmon Falls and Oyster Rivers had lower concentrations of DON relative to DIN.

$\underline{NH_4 \text{ and } NO_3}$: The inorganic species of nitrogen should continue to be measured. They are the forms of N most readily assimilated by plant species and are therefor most likely to be associated with nitrogen enrichment. Also, at the sites (rivers) that appear to have the most severe water quality problems, total N is composed to a great extent of DIN.

TSS: The freshwater portions of the tributaries do not appear to be contributing to the total suspended sediment load in Great Bay. Though it appears that rainfall may increase suspended sediments slightly at tidal sites, the effect of wind driven waves on resuspension of sediments that are already in the estuarine system can confound the interpretation of the results. There is no doubt that heavy rains (>2" in 24 hrs) will wash sediments from the land into the rivers and the estuary, however, it is widely accepted that wind driven resuspension is the most important cause of water column sediment load and sediment transport in shallow estuaries.

SPOM: Measurement of the suspended particulate organic material is a useful and inexpensive water quality parameter. Done in conjunction with water column chlorophyll and nutrient concentrations, it helps explain processes that occur in turbid heterotrophic estuaries such as Great Bay (Fig 26).

Chlorophyll a: Water column chlorophyll is a useful measurement when trying to determine the impact of nutrient loading in estuaries. Processes such as plankton blooms that involve the transformation of free inorganic nitrogen into the living form play a critical role in determining estuarine water quality. Measurement of water column chlorophyll also helps interpret TSS and SPOM data (Figs 26-28).

Bacterial Indicators

The use of the three indicators in this study has provided some key information on the effects of storm events on water quality throughout the estuary. There is increasing pressure in coastal New Hampshire and surrounding towns to have clean, usable waters, both fresh and estuarine, for a variety of purposes. Clearly stated standards provide invaluable references for bacterial results from this study, and suggest that determining the effects of storm events on whatever unidentified sources of contaminants ar present is extremely important.

Table 1. Rainfall conditions relative to sampling dates and classification based on the following criteria:

Wet>0.25" cumulative rain on of and day prior to sampling date
Dry =<0.25" rain.

DATE	Sampling Agency	Cumulative rainfall on sample date & prior day	Condition classification
9/18/95	JEL	.06/1.21	Wet
9/19/95	JEL	0/0.06	2nd d wet
10/17/95	DES	0.01/0.01	Dry
11/2/95	JEL	1.89/1.98	Wet
11/3/95	JEL	0.02/1.91	2nd d wet
4/9/96	DES	0.01/0.26	Dry*
5/7/96	DES	0/0.13	Dry
5/17/96	JEL	0.82/0.83	Wet
5/18/96	JEL	0/0.82	2nd d wet
6/4/96	DES	0.08/0.17	Dry
6/23/96	JEL	0.18/0.31	Wet
6/24/96	JEL	0/0.18	2nd d wet

* Rainfall could have occurred 2 days before sampling occurred.

Table 2. Dry weather data for Great Bay tributaries 1995-1996

NH 4 CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	0.02	0.19	0.02	0.14	0.05	0.02	0.10	0.03	0.03	0.75	0.24	0.12	0.03	0.07
4/9/96	0.04	0.12	0.04	0.06	0.03	0.05	0.10	0.14	0.05	0.70	0.22	0.23	0.08	0.10
5/7/96	0.04	0.10	0.05	0.06	0.02	0.04	0.36	0.06	0.16	0.12	0.11	0.12	0.09	0.14
6/4/96	0.09	0.13	0.06	0.11	0.06	0.15	0.03	0.05	0.03	0.34	0.27	0.12	0.18	0.17
mean	0.05	0.14	0.04	0.09	0.04	0.06	0.15	0.07	0.07	0.48	0.21	0.15	0.09	0.12
NO3 CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	0.03	0.39	0.09	0.23	0.19	0.23	0.05	0.18	0.07	0.86	0.54	0.39	0.55	0.50
4/9/96	0.06	0.14	0.14	0.08	0.12	0.21	0.09	0.13	0.02	0.19	0.21	0.17	0.14	0.13
5/7/96	0.02	0.13	0.09	0.11	0.11	0.15	0.09	0.01	0.13	0.13	0.12	0.16	0.12	0.16
6/4/96	0.09	0.04	0.16	0.07	0.21	0.23	0.06	0.06	0.01	0.26	0.36	0.16	0.23	0.09
Mean	0.05	0.17	0.12	0.12	0.16	0.21	0.07	0.09	0.06	0.36	0.31	0.22	0.26	0.22
DON CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/96	0.39	0.18	0.19	0.06	0.16	0.15	0.17	0.11	0.14	0.00	0.08	0.25	0.16	0.00
4/9/96	0.42	0.27	0.33	0.42	0.30	0.38	0.32	0.17	0.31	0.00	0.30	0.31	0.44	0.39
5/7/96	0.27	0.25	0.20	0.15	0.16	0.24	0.06	0.21	0.09	0.14	0.07	0.15	0.17	0.16
6/4/96	0.26	0.32	0.17	0.29	0.20	0.16	0.28	0.22	0.34	0.04	0.04	0.05	0.16	0.24
Mean	0.33	0.25	0.22	0.23	0.20	0.23	0.21	0.18	0.22	0.05	0.12	0.19	0.23	0.20
PO4 CONCENTRATION mg/L														
DATE														
	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	0.012	0.098	0.006	0.042	0.007	0.006	0.061	0.007	0.035	0.107	0.066	0.050	0.034	0.032
4/9/96	0.002	0.018	0.002	0.008	0.002	0.003	0.012	0.002	0.004	0.011	0.011	0.011	0.004	0.007
5/7/96	0.003	0.024	0.002	0.021	0.003	0.003	0.012	0.002	0.048	0.009	0.009	0.017	0.008	0.011

Table 2. Dry weather data for Great Bay tributaries 1995-1996

6/4/96	0.003	0.020	0.008	0.025	0.002	0.005	0.017	0.001	0.011	0.058	0.025	0.017	0.003	0.013
Mean	0.005	0.040	0.005	0.024	0.003	0.004	0.025	0.003	0.025	0.046	0.028	0.024	0.012	0.015
TSS CONCENTRATION mg/l														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	1.60	10.00	2.40	18.20	4.80	3.80	8.20	5.80	7.40	11.40	2.80	6.80	2.00	6.20
4/9/96	1.40	28.60	1.40	44.60	4.20	3.20	5.80	1.60	3.80	2.60	2.80	5.00	1.40	6.00
5/7/96	2.00	38.80	1.60	8.60	4.80	4.40	8.60	2.60	11.20	2.40	2.60	8.40	1.60	9.00
6/4/96	2.80	70.86	1.60	38.25	8.60	5.20	10.40	1.80	11.40	4.60	2.60	8.40	3.80	16.00
Mean	1.95	37.07	1.75	27.41	5.60	4.15	8.25	2.95	8.45	5.25	2.70	7.15	2.20	9.30
% Organic														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	87.50	24.00	50.00	23.08	33.33	36.84	17.07	41.38	29.73	19.30	50.00	47.06	30.00	64.52
4/9/96	57.14	13.99	85.71	13.00	28.57	3.20	27.59	75.00	31.58	38.46	57.14	28.00	85.71	23.33
5/7/96	50.00	13.40	50.00	15.12	29.17	31.82	20.93	53.85	16.07	33.33	38.46	23.81	37.50	17.78
6/4/96	50.00	15.32	37.50	13.73	20.93	30.77	13.46	44.44	19.30	39.13	46.15	23.81	52.63	13.75
Mean	61.16	16.68	55.80	16.23	28.00	25.66	19.76	53.67	24.17	32.56	47.94	30.67	51.46	29.85
SPOM mg/L														
10/17/96	1.40	2.40	1.20	4.20	1.60	1.40	1.40	2.40	2.20	2.20	1.40	3.20	0.60	4.00
4/9/96	0.80	4.00	1.20	5.80	1.20	0.10	1.60	1.20	1.20	1.00	1.60	1.40	1.20	1.40
5/7/96	1.00	5.20	0.80	1.30	1.40	1.40	1.80	1.40	1.80	0.80	1.00	2.00	0.60	1.60
6/4/96	1.40	10.86	0.60	5.25	1.80	1.60	1.40	0.80	2.20	1.80	1.20	2.00	2.00	2.20
Mean	1.15	5.61	0.95	4.14	1.50	1.13	1.55	1.45	1.85	1.45	1.30	2.15	1.10	2.30
SALINITY ppt/ Conductivity														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22

Table 2. Dry weather data for Great Bay tributaries 1995-1996

10/17/95	180.00	15.00	75.00	10.00	170.00	230.00	25.00	95.00	22.00	245.00	90.00	6.00	104.00	6.00
4/9/96	80.00	0.00	58.00	2.00	85.00	109.00	10.00	54.00	10.00	71.00	62.00	2.00	51.00	5.00
5/7/96	100.00	2.00	82.00	2.00	101.00	122.00	14.00	61.00	10.00	70.00	69.00	2.00	61.00	2.00
6/4/96	130.00	12.00	111.00	10.00	155.00	180.00	20.00	90.00	20.00	111.00	110.00	6.00	96.00	8.00
Mean	122.50	7.25	81.50	6.00	127.75	160.25	17.25	75.00	15.50	124.25	82.75	4.00	78.00	5.25
Temp														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	14.00	12.50	13.50	12.60	11.00	13.00	11.90	13.50	11.70	18.00	13.00	13.20	14.50	12.60
4/9/96	6.00	7.70	6.00	6.20	5.00	5.90	6.20	5.00	6.30	6.50	5.00	7.60	5.90	7.60
5/7/96	12.00	12.50	10.00	12.30	10.00	11.80	10.60	11.20	10.00	11.50	11.00	11.30	13.00	12.10
6/4/96	18.50	20.90	18.00	19.80	16.00	17.00	16.10	18.20	16.30	18.00	16.50	17.00	17.50	17.00
Mean	12.63	13.40	11.88	12.73	10.50	11.93	11.20	11.98	11.08	13.50	11.38	12.28	12.73	12.33
D.O. mg/l														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	4.80	8.20	8.30	9.80	7.80	6.70	5.20	6.70	9.40	5.60	8.80	5.20	8.20	5.30
4/9/96	9.80	11.20	10.60	12.40	11.20	11.00	11.60	11.40	12.40	9.80	11.20	11.90	10.80	11.90
5/7/96	9.20	9.20	10.10	12.30	10.60	9.80	9.60	10.10	9.60	9.90	10.50	11.30	10.20	9.80
6/4/96	6.20	6.80	7.20	6.90	8.10	6.40	7.20	7.40	6.80	7.10	6.90	8.00	8.00	7.40
Mean	7.50	8.85	9.05	10.35	9.43	8.48	8.40	8.90	9.55	8.10	9.35	9.10	9.30	8.60
% Oxygen saturation														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	46%	84%	80%	98%	69%	63%	56%	64%	97%	59%	82%	50%	79%	51%
4/9/96	77%	93%	84%	100%	86%	87%	98%	88%	105%	79%	86%	99%	85%	101%
5/7/96	84%	86%	88%	98%	93%	90%	94%	90%	91%	91%	94%	95%	96%	93%
6/4/96	66%	80%	76%	80%	82%	66%	82%	78%	77%	75%	71%	84%	84%	80%

Table 2. Dry weather data for Great Bay tributaries 1995-1996

Mean	68%	86%	82%	94%	83%	77%	83%	80%	93%	76%	83%	82%	86%	81%
pH														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	6.70	7.75	7.00	8.11	6.50	6.70	8.16	6.70	8.20	6.80	6.80	8.04	6.90	8.00
4/9/96	7.10	8.16	7.30	8.16	7.30	7.20	8.04	7.10	8.17	6.40	6.80	8.08	6.90	8.00
5/7/96	6.86	8.12	6.87	8.44	7.10	7.12	7.76	6.84	7.78	6.74	6.92	8.31	6.77	8.63
6/4/96	6.85	7.73	6.94	7.89	7.08	7.12	7.67	7.04	7.64	6.69	7.03	7.87	6.94	7.63
Mean	6.88	7.94	7.03	8.15	7.00	7.04	7.91	6.92	7.95	6.66	6.89	8.08	6.88	8.07
Chlorophyll µg/L														
	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	6.65	5.51	2.64	10.55	6.41	1.40	3.08	1.94	5.29	1.66	1.62	14.24	1.04	32.16
4/9/96	0.76	6.29	0.98	6.43	1.40	0.78	3.16	1.82	2.50	3.68	3.62	3.08	1.18	1.26
5/7/96	0.82	4.21	1.30	1.50	1.50	1.52	1.48	2.10	1.46	1.42	1.50	1.24	0.98	1.06
6/4/96	2.88	2.80	3.24	4.71	1.44	4.67	2.18	3.62	2.56	6.05	3.36	1.80	9.67	0.72
Mean	2.78	4.70	2.04	5.80	2.69	2.09	2.48	2.37	2.95	3.20	2.53	5.09	3.22	8.80
Phaeopigments														
	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	1.72	3.18	1.93	7.38	3.47	0.95	2.00	2.09	1.88	3.16	2.34	3.83	2.04	1.71
4/9/96	0.4	4.90	0.55	5.56	0.95	1.49	1.76	1.35	1.28	0.60	1.21	1.65	0.53	1.82
5/7/96	1.04	11.59	0.91	4.72	1.48	1.98	2.56	1.75	2.55	1.26	1.41	3.31	0.98	3.41
6/4/96	2.23	5.06	0.93	7.38	3.14	3.69	2.85	2.56	2.40	2.95	2.73	3.97	6.42	6.43
Mean	1.35	6.18	1.08	6.26	2.26	2.03	2.29	1.94	2.03	1.99	1.92	3.19	2.49	3.34

Table 3. Storm sample data for the Great Bay tributaries 1995-1996

NH 4 CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	0.07	0.11	0.12	0.08	0.02	0.08	0.10	0.08	0.02	0.78	0.09	0.00	0.01	0.01
9/19/95	0.34	0.10	0.39	0.02	0.02	0.06	0.05	0.09	0.01	0.17	0.22	0.02	0.01	0.00
11/2/95	0.12	0.15	0.05	0.45	0.02	0.08	0.12	0.03	0.04	0.54	0.41	0.24	0.09	0.12
11/3/95	0.04	0.07	0.19	0.07	0.01	0.03	0.03	0.04	0.33	0.15	0.68	0.27	0.75	0.10
5/17/95	0.09	0.10	0.05	0.04	0.04	0.04	0.15	0.05	0.06	0.32	0.14	0.11	0.11	0.09
6/23/96	0.09	0.13	0.09	0.05	0.15	0.09	0.05	0.11	0.05	0.31	0.10	0.07	0.27	0.07
Mean	0.13	0.11	0.15	0.12	0.04	0.07	0.08	0.07	0.09	0.38	0.27	0.12	0.21	0.07
NO3 CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	0.12	0.04	0.02	0.26	0.09	0.05	0.08	0.03	0.08	1.08	0.35	0.10	0.66	0.28
9/19/95	0.07	0.29	0.02	0.15	0.45	0.05	0.11	0.03	0.46	1.05	0.35	0.30	0.66	0.24
11/2/95	0.22	0.39	0.24	0.27	0.20	0.32	0.29	0.30	0.11	0.30	0.34	0.13	0.28	0.11
11/3/95	0.21	0.13	0.22	0.12	0.21	0.55	0.13	0.32	0.17	0.25	0.45	0.16	0.27	0.29
5/17/96	0.08	0.13	0.09	0.09	0.10	0.19	0.06	0.11	0.05	0.15	0.15	0.16	0.13	0.16
6/23/96	0.11	0.03	0.14	0.05	0.28	0.21	0.02	0.09	0.03	0.74	0.68	0.31	0.36	0.21
Mean	0.14	0.17	0.12	0.16	0.22	0.23	0.12	0.15	0.15	0.60	0.39	0.19	0.39	0.22
DON CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	0.35	0.19	0.27	0.04	0.24	0.28	0.07	0.32	0.27	0.00	0.30	0.37	0.67	1.86
9/19/95	0.00	0.10	0.00	0.12	0.23	0.28	0.02	0.31	0.00	0.39	0.24	0.15	0.65	0.23
11/2/95	0.07	0.21	0.05	0.00	0.23	0.33	0.09	0.08	0.16	0.00	0.08	0.15	0.06	0.23
11/3/95	0.32	0.49	0.10	0.32	0.30	0.34	0.53	0.33	0.09	0.36	0.00	0.37	0.00	0.22
5/17/96	0.22	0.24	0.14	0.19	0.23	0.27	0.16	0.14	0.19	0.04	0.16	0.18	0.18	0.19
6/23/96	0.27	0.25	0.26	0.32	0.09	0.34	0.29	0.29	0.23	0.12	0.02	0.31	0.12	0.30
Mean	0.20	0.25	0.14	0.16	0.22	0.31	0.19	0.24	0.16	0.15	0.13	0.25	0.28	0.51
PO4 CONCENTRATION mg/L														
DATE														
	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	0.039	0.075	0.007	0.073	0.007	0.009	0.072	0.011	0.045	0.027	0.022	0.053	0.005	0.189

Table 3. Storm sample data for the Great Bay tributaries 1995-1996

9/19/95	0.009	0.082	0.008	0.078	0.009	0.010	0.053	0.012	0.041	0.025	0.023	0.057	0.009	0.064
11/2/95	0.012	0.084	0.011	0.040	0.014	0.019	0.079	0.010	0.032	0.038	0.038	0.035	0.026	0.028
11/3/95	0.012	0.061	0.015	0.027	0.024	0.014	0.034	0.015	0.027	0.035	0.040	0.034	0.016	0.027
5/17/95	0.009	0.028	0.006	0.029	0.007	0.010	0.017	0.008	0.036	0.015	0.014	0.020	0.010	0.014
6/23/96	0.004	0.010	0.004	0.008	0.002	0.003	0.009	0.004	0.009	0.025	0.017	0.006	0.007	0.005
Mean	0.014	0.057	0.009	0.043	0.010	0.011	0.044	0.010	0.032	0.027	0.025	0.034	0.012	0.054
TSS CONCENTRATION mg/l														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	5.60	15.00	2.40	11.60	8.40	9.00	5.60	4.20	6.40	13.00	3.60	19.00	9.60	44.67
9/19/95	3.20	8.20	1.20	21.00	5.80	6.40	5.60	2.40	3.80	4.00	2.60	23.00	10.00	24.00
11/2/95	3.20	31.00	2.60	32.80	6.80	3.80	5.80	3.40	5.60	3.40	2.80	11.20	2.00	4.20
11/3/95	4.20	31.00	3.80	17.80	6.60	19.67	10.00	5.60	7.60	9.00	40.67	29.67	2.80	9.80
5/17/96	1.60	42.67	1.20	17.60	8.60	5.80	9.40	5.20	8.80	3.60	2.80	7.40	2.80	6.80
5/18/96	15.80	60.67	2.20	19.20	9.00	4.60	19.20	2.80	6.80	3.60	4.20	9.00	2.40	7.20
6/23/96	1.80	23.80	1.40	16.40	12.20	4.00	5.80	3.20	6.80	4.60	2.80	11.00	2.60	9.60
6/24/96	2.60	16.00	2.20	27.40	9.60	5.20	8.40	2.80	9.60	4.20	5.20	6.80	2.20	5.00
Mean	4.75	28.54	2.13	20.48	8.38	7.31	8.73	3.70	6.93	5.68	8.08	14.63	4.30	13.91
Storm Day 1	3.05	28.12	1.90	19.60	9.00	5.65	6.65	4.00	6.90	6.15	3.00	12.15	4.25	16.32
Storm Day 2	6.45	28.97	2.35	21.35	7.75	8.97	10.80	3.40	6.95	5.20	13.17	17.12	4.35	11.50
% Organic														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	42.86	22.67	66.67	34.48	26.19	42.22	32.14	52.38	18.75	58.46	44.44	63.16	81.25	80.60
9/19/95	50.00	29.27	50.00	25.71	27.59	34.38	25.00	41.67	31.58	55.00	53.85	72.46	86.00	88.89
11/2/95	43.75	17.20	53.85	11.59	23.53	36.84	24.14	35.29	25.00	35.29	35.71	21.43	60.00	33.33
11/3/95	47.62	16.13	42.11	16.85	24.24	19.67	14.00	32.14	21.05	20.00	10.66	13.48	50.00	22.45
5/17/96	50.00	14.84	50.00	18.80	27.91	27.59	21.28	38.46	22.73	44.44	46.15	24.32	57.14	29.41
5/18/96	11.39	14.29	54.55	13.54	24.44	39.13	14.71	64.29	23.53	38.89	38.10	24.44	41.67	25.00
6/23/96	55.56	13.45	28.57	18.29	19.67	17.24	17.24	31.25	11.76	43.48	35.71	18.18	61.54	20.83
6/24/96	61.54	17.50	72.73	16.79	16.67	46.15	16.67	35.71	14.58	38.10	38.46	29.41	54.55	36.00
Mean	45.34	18.17	52.31	19.51	23.78	32.90	20.65	41.40	21.12	41.71	37.89	33.36	61.52	42.06
Storm Day 1	48.04	17.04	49.77	20.79	24.33	30.97	23.70	39.35	19.56	45.42	40.50	31.77	64.98	41.04
Storm Day 2	42.64	19.30	54.85	18.22	23.24	34.83	17.60	43.45	22.69	38.00	35.27	34.95	58.06	43.09

Table 3. Storm sample data for the Great Bay tributaries 1995-1996

SPOM mg/L	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/96	2.40	3.40	1.60	4.00	2.20	3.80	1.80	2.20	1.20	7.60	1.60	12.00	7.80	36.00
9/19/95	1.60	2.40	0.60	5.40	1.60	2.20	1.40	1.00	1.20	2.20	1.40	16.67	8.60	21.33
11/2/95	1.40	5.33	1.40	3.80	1.60	1.40	1.40	1.20	1.40	1.20	1.00	2.40	1.20	1.40
11/3/95	2.00	5.00	1.60	3.00	1.60	3.87	1.40	1.80	1.60	1.80	4.34	4.00	1.40	2.20
5/17/96	0.80	6.33	0.60	3.31	2.40	1.60	2.00	2.00	2.00	1.60	1.29	1.80	1.60	2.00
5/18/96	1.80	8.67	1.20	2.60	2.20	1.80	2.82	1.80	1.60	1.40	1.60	2.20	1.00	1.80
6/23/96	1.00	3.20	0.40	3.00	2.40	0.69	1.00	1.00	0.80	2.00	1.00	2.00	1.60	2.00
6/24/96	1.60	2.80	1.60	4.60	1.60	2.40	1.40	1.00	1.40	1.60	2.00	2.00	1.20	1.80
Mean	1.57	4.64	1.13	3.71	1.95	2.22	1.65	1.50	1.40	2.42	1.78	5.38	3.05	8.57
Day 1	1.40	4.57	1.00	3.53	2.15	1.87	1.55	1.60	1.35	3.10	1.22	4.55	3.05	10.35
Day 2	1.75	4.72	1.25	3.90	1.75	2.57	1.76	1.40	1.45	1.75	2.33	6.22	3.05	6.78
SALINITY ppt														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	121.00	24.00	140.00	26.00	250.00	295.00	27.00	180.00	27.00	202.00	182.00	21.00	251.00	21.00
9/19/95	167.00	23.20	138.00	25.00	222.00	240.00	28.00	172.00	28.00	201.00	185.00	21.00	180.00	22.00
11/2/95	122.00	3.50	80.00	3.50	103.00	130.00	19.50	82.00	19.50	222.00	172.00	4.50	172.00	5.50
11/3/95		4.50		7.20	132.00	201.00	12.00	150.00	9.00	135.00	130.00	0.00	140.00	0.00
5/17/96		0.00		0.00			10.00		11.20			0.00		0.00
5/18/96		0.00		0.00			8.00		7.00			0.00		0.00
6/23/96	144.00	23.00	123.00	16.00	199.00	213.00	23.00	148.00	22.00	137.00	130.00	7.00	142.00	9.00
6/24/96	170.00	11.00	120.00	11.00	203.00	209.00	23.00	89.00	23.00	145.00	142.00	4.00	111.00	5.00
Mean	144.80	11.15	120.20	11.09	184.83	214.67	18.81	136.83	18.34	173.67	156.83	7.19	166.00	7.81
Storm Day 1	121.50	9.17	110.00	14.75	176.50	212.50	23.25	131.00	23.25	212.00	177.00	12.75	211.50	13.25
Storm Day 2	167.00	9.23	138.00	16.10	177.00	220.50	20.00	161.00	18.50	168.00	157.50	10.50	160.00	11.00
Temp														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	17.00	18.00	18.00	18.20	13.50	13.00	17.00	17.00	17.00	17.50	17.00	18.00	17.90	18.00
9/19/95	16.00	18.20	17.20	19.10	15.00	15.20	17.00	17.00	16.80	16.00	16.20	18.90	16.00	18.50
11/2/95	8.20	9.50	9.00	9.00	7.90	7.90	10.00	9.50	9.50	7.00	6.80	8.70	8.40	9.20

Table 3. Storm sample data for the Great Bay tributaries 1995-1996

11/3/95	8.50	9.00	8.40	9.00	8.10	6.10	9.60	10.00	9.90	8.20	9.00	8.30	9.00	8.70
5/17/96	12.50	13.00	13.00	12.90	12.20	12.90	11.70	12.90	12.00	13.00	12.20	12.00	12.90	12.20
5/18/96	14.20	14.00	13.80	13.90	13.40	13.70	12.00	14.30	11.80	13.00	13.10	12.80	13.00	13.00
6/23/96	21.90	21.50	22.90	21.50	18.90	21.80	20.00	21.70	20.00	21.80	20.40	21.50	22.10	22.00
6/24/96	22.90	22.00	21.50	22.00	18.50	19.50	20.00	20.30	20.00	19.80	20.60	22.00	21.10	22.00
Mean	15.15	15.65	15.48	15.70	13.44	13.76	14.66	15.34	14.63	14.54	14.41	15.28	15.05	15.45
Storm Day 1	12.57	13.50	13.33	13.37	11.20	11.27	12.90	13.13	12.83	12.50	12.00	12.90	13.07	13.13
Storm Day 2	12.90	13.73	13.13	14.00	12.17	11.67	12.87	13.77	12.83	12.40	12.77	13.33	12.67	13.40

D.O. mg/l

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	6.20	6.40	4.40	8.60	7.80	6.40	8.20	4.00	8.20	5.20	6.20	9.20	9.20	7.80
9/19/95	5.50	6.30	5.20	9.50	7.40	4.80	8.90	5.80	8.60	4.50	6.20	10.70	11.60	11.90
11/2/95	8.80	9.20	10.40	10.00	8.40	8.40	8.50	9.30	8.60	10.20	10.40	9.80	10.10	9.30
11/3/95	10.28	9.40	11.10	10.40	9.20	9.90	9.38	9.70	9.63	10.30	11.30	12.14	10.90	11.76
5/17/96	8.20	10.27	9.60	11.35	9.20	9.00	8.89	9.00	9.17	9.20	9.40	10.64	9.60	10.63
5/18/96	9.60	9.40	9.80	10.60	9.70	8.40	8.95	9.00	9.20	9.05	9.35	10.30	10.20	10.20
6/23/96	7.49	6.80	5.33	7.00	7.30	5.90	7.60	5.64	7.40	4.10	6.90	7.00	6.77	7.10
6/24/96	6.57	7.60	6.77	8.20	6.70	7.45	7.70	6.60	7.90	4.97	6.33	7.80	7.38	7.90
Mean	7.83	8.17	7.83	9.46	8.21	7.53	8.52	7.38	8.59	7.19	8.26	9.70	9.47	9.57
Storm Day 1	7.67	8.17	7.43	9.24	8.18	7.43	8.30	6.99	8.34	7.18	8.23	9.16	8.92	8.71
Storm Day 2	7.99	8.18	8.22	9.68	8.25	7.64	8.73	7.78	8.83	7.21	8.30	10.24	10.02	10.44

% Oxygen saturation

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	63%	78%	46%	104%	75%	49%	100%	41%	100%	54%	63%	108%	96%	115%
9/19/95	55%	76%	53%	117%	72%	47%	109%	59%	105%	45%	62%	128%	116%	140%
11/2/95	73%	81%	88%	88%	70%	70%	84%	81%	85%	84%	84%	86%	84%	82%
11/3/95	87%	83%	94%	93%	76%	82%	89%	85%	90%	86%	96%	104%	93%	102%
5/17/96	76%	98%	90%	108%	84%	84%	87%	84%	91%	86%	86%	99%	89%	99%
5/18/96	93%	90%	94%	102%	92%	81%	87%	88%	90%	88%	88%	96%	96%	96%
6/23/96	83%	86%	60%	88%	83%	66%	100%	62%	97%	46%	77%	86%	76%	86%
6/24/96	76%	91%	77%	98%	71%	81%	97%	72%	99%	54%	70%	91%	82%	92%

Table 3. Storm sample data for the Great Bay tributaries 1995-1996

Mean	76%	85%	75%	100%	78%	70%	94%	72%	95%	68%	78%	100%	92%	102%
Storm Day 1	74%	86%	71%	97%	78%	67%	93%	67%	93%	68%	77%	95%	86%	96%
Storm Day 2	78%	85%	80%	103%	78%	73%	96%	76%	96%	68%	79%	105%	97%	108%
pH														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	7.10	7.74	6.91	8.11	7.22	7.29	8.18	7.12	7.94	6.88	7.24	7.73	9.12	8.34
9/19/95	7.11	7.66	6.94	8.06	7.26	7.38	8.16	7.09	7.83	6.84	7.11	8.09	9.67	8.32
11/2/95	6.79	7.23	6.82	7.18	6.90	7.03	7.76	6.88	7.78	6.71	7.10	7.26	6.91	7.27
11/3/95	6.64	6.97	6.75	7.14	6.54	6.86	7.31	6.88	7.32	6.64	7.08	6.85	6.89	6.69
5/17/96	6.77	7.11	6.86	7.00	6.91	7.04	7.35	6.99	7.40	6.71	7.01	7.00	6.85	6.76
5/18/96	6.97	7.02	6.96	7.02	7.08	7.18	7.35	6.92	7.39	6.81	7.03	6.94	6.96	6.84
6/23/96	7.27	7.55	7.09	7.68	7.40	7.30	7.76	7.06	7.71	6.90	7.11	7.41	7.21	7.61
6/24/96	6.91	7.32	6.84	7.63	7.07	7.23	7.72	7.04	7.70	6.59	7.12	7.31	6.93	7.72
Mean	6.95	7.33	6.90	7.48	7.05	7.16	7.70	7.00	7.63	6.76	7.10	7.32	7.57	7.44
Chlorophyll µg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	3.48	3.90	8.01	11.11	3.54	22.05	3.14	6.03	1.94	89.87	6.49	29.94	116.12	170.86
9/19/95	4.73	4.75	2.60	11.69	1.64	10.55	3.00	4.23	2.62	20.13	8.51	73.89	106.57	56.97
11/2/95	4.83	3.07	1.06	0.94	0.84	1.76	1.20	0.98	1.62	1.32	1.06	2.96	0.88	2.90
11/3/95	1.88	1.16	1.30	1.48	0.62	1.74	0.88	0.92	0.90	0.98	1.37	1.34	0.94	1.28
5/17/96	1.72	2.07	1.16	0.94	1.66	1.84	1.34	1.56	1.20	2.74	2.14	1.42	1.14	1.04
5/18/96	3.82	1.40	1.28	1.52	1.32	0.72	1.06	1.34	1.24	2.68	2.54	2.10	1.28	1.06
6/23/96	4.69	7.09	2.84	6.23	1.80	14.24	2.82	2.86	2.04	5.59	5.91	2.72	7.41	3.40
6/24/96	10.73	7.61	15.08	5.45	1.78	37.03	3.98	3.20	2.28	4.99	5.77	4.13	2.00	4.09
Mean	4.48	3.88	4.17	4.92	1.65	11.24	2.18	2.64	1.73	16.04	4.22	14.81	29.54	30.20
Storm Day 1	3.68	4.03	3.27	4.81	1.96	9.97	2.13	2.86	1.70	24.88	3.90	9.26	31.39	44.55
Storm Day 2	5.29	3.73	5.07	5.04	1.34	12.51	2.23	2.42	1.76	7.20	4.55	20.37	27.70	15.85
Phaeopigments µg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22

Table 3. Storm sample data for the Great Bay tributaries 1995-1996

9/18/95	1.91	2.16	2.38	4.52	2.41	7.89	1.45	4.08	0.27	15.71	3.45	6.31	12.52	34.21
9/19/95	2.84	3.58	1.06	5.21	1.58	5.01	1.47	2.74	1.25	13.71	3.38	8.95	7.64	8.39
11/2/95	3.40	7.98	9.85	3.21	0.44	1.22	0.72	1.00	0.73	1.20	1.74	1.75	1.04	1.11
11/3/95	2.01	3.48	1.42	3.12	1.94	2.00	0.87	1.42	0.98	2.00	4.05	3.52	1.81	3.08
5/17/96	1.18	8.19	1.24	4.40	2.80	2.15	1.70	1.94	2.72	0.99	1.17	3.43	1.51	2.59
5/18/96	2.99	7.30	1.66	3.08	2.07	2.22	1.90	2.29	1.49	1.87	1.75	2.66	1.34	2.61
6/23/96	1.68	5.70	1.74	3.92	2.81	6.16	2.35	2.21	1.52	8.33	3.76	3.12	7.32	3.86
6/24/96	0.56	6.93	0.21	2.84	2.45	6.18	1.68	0.10	1.17	2.78	3.99	1.86	2.44	1.54
Mean	2.07	5.67	2.45	3.79	2.06	4.10	1.52	1.97	1.27	5.82	2.91	3.95	4.45	7.17
Storm Day 1	2.04	6.01	3.80	4.01	2.12	4.36	1.55	2.31	1.31	6.56	2.53	3.65	5.60	10.44
Storm Day 2	2.10	5.32	1.09	3.56	2.01	3.85	1.48	1.64	1.22	5.09	3.29	4.25	3.31	3.91

Table 4. Comparison of storm vs dry weather samples 1995-1996 for selected stations and parameters using Welches t-test for samples with unequal sd

Parameter	Station	Significance	Interpretation
NH4	11 CCH	NS	
	5 SFR	NS	
	7CCH	NS	
	9 EXT	NS	
NO3	11 CCH	NS	
	5 SFR	NS	
	7 CCH	NS	
	9 EXT	P= .041	STORM > DRY
DON	GB 22	NS	
PO4	GB 80	NS	
	GB 15	NS	
	GB 50	NS	
	GB 21	NS	
	GB 22	NS	
	11 CCH	NS	
	9EXT	NS	
TSS	7CCH	NS	
	5 OYS	NS	
	9 EXT	NS	
	GB 21	P=.042	STORM > DRY
	GB 22	NS	
	5SFR	NS	
SPOM	11 CCH	NS	
	GB 21	NS	
	GB 22	NS	
	5 SFR	NS	
CHL A	5 OYS	NS	
	11 CCH	NS	
	GB 21	NS	
	5 SFR	NS	
	GB 22	NS	
% O2 SAT	5 BLM	NS	
	11CCH	NS	
	GB 21	NS	
	GB 22	NS	
	9 EXT	NS	

Table 5. Station comparisons using ANOVA for dry weather, storm and all samples combined 1995-1996

Data	Parameter	Significance (P)	Pairs
Dry Weather	NH4	<.0001	11 CCH >all other stations
	NO3	NS	
	DON	NS	
	PO4	NS	
	TSS	<.0001	GB 15 and 80 > all other stations
	SPOM	<.0001	GB 15 and 80 > 9 EXT, 5 Imp, 5 OYS
			GB80 >5 SFR, 7CCH, 5 BLM, 11 CCH, GB 2
			GB 50, GB 21, GB 22
	% O2 SAT	NS	
	CHL A	NS	
Storm samples	NH4	<.005	11 CCH > all except 7 CCH and 5 SFR
	NO3	<.0001	11 CCH > all except 7CCH
	DON	NS	
	PO4	NS	
	TSS	<.0001	GB 80 > all except GB 21, 22, 15
			GB 15 > all except GB 21, 22, 80
	SPOM	0.0193	GB 22> all except GB 21, 15, 80
			NS if 9/18 and 9/19 elimanated
	% O2 SAT	<.0001	11 CCH < all tidal except GB 80
			11 CCH< 5SFR
			5 OYS < all tidal except GB 80
			5 OYS < 5 SFR
			5 BLM < GB 2, 15, 21, 22, 50
			5 LMP < GB 15, 21, 22
			9 EXT < Gb 15, 21, 22

Table 5. Station comparisons using ANOVA for dry weather, storm and all samples combined 1995-1996

			8 OYS < GB 15, 21, 22
			7 CCH < Gb 15, 21, 22
	CHL A	NS	
95-96 D &S	NH4	<.0001	11 CCH > all except 7 CCH
			7 CCh > 8 OYS
	NO3	<.0001	5 SFR . GB 50 and 9 EXT
			7 CCH > GB 2, 5 LMP and 5 BLM
			11 CCH >all except 5 SFR and 7 CCH
	DON	NS	
	PO4	<.0001	GB 80 > all fw except 7 and 11 CCH
	TSS	<.0001	GB 80 > all other stations
			GB 15 > all except GB 80
	SPOM	0.0017	GB 22. all except GB 15, GB 80, GB 21
	% O2 SAT	< .0001	11 CCH < 5 SFR, GB 2, 15, 21, 22, 50
			5 OYS < GB 2, 15, 21, 22, 50 and 5 SFR
			9 EXT< GB 2, 15, 21
			5 BLM < GB 2, 15, 21
			5 LMP < GB 15
	CHL A	NS	

Table 6. Interannual comparison of storm and dry data combined for the three project years using Welch's t-test for samples with unequal sd

Data	Parameter	Station	Significance	Interpretation
Dry and Storm combined				
93-94 vs 94-95 vs 95-96	NH4	5 LMP	NS	
		GB 15	NS	
		7 CCH	NS	
		11 CCH	NS	
	NO3	GB 80	NS	
		GB 15	P= .0184	95-96 > 94-95
		8 OYS	NS	
		11 CCH	NS	
		5 SFR	NS	
		GB 22	P= .0342	95-96>94-95
	DON	GB 22	NS	
	PO4	GB 80	NS	
		GB 15	NS	
		GB 2	NS	
		GB 21	NS	
		GB 22	NS	
	TSS	GB 21	NS	
		9 EXT	NS	

Table 7. Cumulative Database for selected parameters for dry weather samples 1993-1996

NH4 Concentration mg/L													
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
8/24/93	0.090	0.090	0.090	0.090		0.090	0.090	0.090	0.090		0.090	0.090	0.090	0.090
9/7/93	0.090	0.090	0.090	0.090		0.090	0.090	0.090	0.090		0.090	0.090	0.090	0.090
10/5/93	0.090	0.200	0.090	0.090		0.090	0.090	0.090	0.090		0.090	0.090	0.400	0.100
11/2/93	0.090	0.090	0.090	0.090		0.090	0.100	0.090	0.090		0.110	0.100	0.130	0.110
12/20/93	0.090	0.210	0.090	0.090		0.090	0.090	0.090	0.090		0.240	0.190	0.110	0.130
4/19/94	0.090		0.090	0.090		0.090	0.090	0.090	0.090		0.090		0.090	0.090
5/17/94	0.090		0.090	0.090		0.090	0.090	0.090	0.090		0.200	0.100	0.200	0.090
6/14/94	0.090	0.100	0.090	0.090		0.090	0.090	0.090	0.090		0.100	0.090	0.300	0.200
7/26/94	0.062	0.053	0.181	0.101	0.076	0.059	0.062	0.124	0.044	0.086	0.062	0.034	0.092	0.127
8/30/94	0.027	0.063	0.019	0.033	0.031	0.021	0.064	0.060	0.012	0.048	0.033	0.056	0.013	0.043
10/24/94	0.007	0.055	0.020	0.019	0.016	0.018	0.087	0.016	0.001	0.237	0.113	0.113	0.114	0.137
11/8/94	0.249	0.076	0.024	0.077	0.022	0.062	0.091	0.087	0.076	0.180	0.122	0.064	0.169	0.106
3/21/95	0.019		0.042		0.016	0.021	0.010	0.025	0.029	0.222	0.168	0.125	0.138	0.050
4/18/95	0.042	0.093	0.015	0.047	0.053	0.139	0.265	0.654	0.144	0.281	0.189	0.166	0.260	0.118
5/2/95	0.032	0.150	0.031	0.014	0.084	0.043	0.135	0.035	0.068	0.244	0.132	0.134	0.150	0.142
6/6/95	0.050	0.182	0.052	0.107	0.081	0.245	0.325	0.033	0.015	0.410	0.202	0.124	0.203	0.160
10/17/95	0.032	0.386	0.085	0.230	0.047	0.232	0.050	0.176	0.066	0.754	0.545	0.385	0.547	0.499
4/9/96	0.062	0.138	0.135	0.076	0.034	0.211	0.089	0.127	0.018	0.699	0.205	0.166	0.142	0.130
5/7/96	0.021	0.128	0.086	0.113	0.025	0.152	0.094	0.010	0.133	0.117	0.123	0.155	0.119	0.155
6/4/96	0.090	0.035	0.161	0.067	0.057	0.231	0.062	0.065	0.014	0.338	0.362	0.155	0.229	0.094
Mean NH4 Dry	0.071	0.126	0.079	0.084	0.045	0.108	0.103	0.107	0.067	0.301	0.163	0.128	0.179	0.133

NO3 Concentration mg/L													
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
8/24/93	0.078	0.120	0.018	0.050		0.018	0.040	0.018	0.018		0.870	0.120	0.630	0.060

Table 7. Cumulative Database for selected parameters for dry weather samples 1993-1996

9/7/93	0.018	0.018	0.018	0.018		0.018	0.020	0.018	0.018		0.570	0.018	1.200	0.018
10/5/93	0.030	0.190	0.260	0.130		0.180	0.070	0.360	0.060		0.780	0.400	1.350	0.420
11/2/93	0.060	0.360	0.070	0.100		0.330	0.070	0.120	0.080		0.360	0.260	0.310	0.260
12/20/93	0.180	0.060	0.100	0.110		0.230	0.240	0.120	0.210		0.170	0.160	0.170	0.160
4/19/94	0.080		0.090	0.080		0.160	0.120	0.045	0.140		0.140	0.150	0.130	0.140
5/17/94	0.050		0.060	0.060		0.130	0.130	0.080	0.070		0.160	0.130	0.150	0.120
6/14/94	0.080	0.140	0.100	0.140		0.130	0.100	0.060	0.100		0.560	0.370	0.460	0.310
7/26/94	0.016	0.033	0.000	0.003	0.325	0.000	0.000	0.003	0.003	0.745	0.459	0.020	0.714	0.087
8/30/94	0.026	0.115	0.000	0.031	0.347	0.019	0.024	0.017	0.025	0.581	0.767	0.008	0.646	0.001
10/24/94	0.090	0.111	0.025	0.011	0.154	0.192	0.047	0.025	0.051	0.458	0.490	0.295	0.166	0.103
11/8/94	0.099	0.111	0.053	0.048	0.134	0.248	0.078	0.059	0.074	0.401	0.474	0.182	0.235	0.098
3/21/95	0.105		0.071		0.058	0.234	0.110	0.110	0.140	0.102	0.149	0.160	0.075	0.113
4/18/95	0.020	0.143	0.066	0.108	0.065	0.145	0.044	0.088	0.074	0.157	0.155	0.175	0.101	0.130
5/2/95	0.054	0.076	0.064	0.007	0.106	0.165	0.014	0.133	0.033	0.195	0.292	0.188	0.199	0.139
6/6/95	0.093	0.252	0.136	0.076	0.225	0.188	0.011	0.071	0.025	0.521	0.635	0.272	0.242	0.148
10/17/95	0.032	0.386	0.085	0.230	0.188	0.232	0.050	0.176	0.066	0.863	0.545	0.385	0.547	0.499
4/9/96	0.062	0.138	0.135	0.076	0.120	0.211	0.089	0.127	0.018	0.194	0.205	0.166	0.142	0.130
5/7/96	0.021	0.128	0.086	0.113	0.113	0.152	0.094	0.010	0.133	0.130	0.123	0.155	0.119	0.155
6/4/96	0.090	0.035	0.161	0.067	0.210	0.231	0.062	0.065	0.014	0.260	0.362	0.155	0.229	0.094
Mean NO3 Dry	0.064	0.142	0.080	0.077	0.171	0.161	0.071	0.085	0.068	0.384	0.413	0.189	0.391	0.159
PO4 Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
8/24/93	0.004	0.041	0.004	0.059		0.008	0.055	0.005	0.038		0.018	0.041	0.007	0.045
9/7/93	0.001	0.056	0.001	0.068		0.001	0.049	0.001	0.033		0.001	0.030	0.017	0.034
10/5/93	0.001	0.066	0.002	0.075		0.002	0.044	0.004	0.021		0.045	0.024	0.031	0.022
11/2/93	0.007	0.034	0.009	0.020		0.003	0.032	0.002	0.023		0.033	0.022	0.019	0.023
12/20/93	0.032	0.069	0.025	0.025		0.034	0.052	0.042	0.081		0.061	0.036	0.026	0.036
4/19/94	0.001		0.006	0.004		0.002	0.007	0.001	0.002		0.029	0.008	0.012	0.010
5/17/94	0.004		0.001	0.007		0.001	0.022	0.001	0.011		0.018	0.014	0.007	0.013

Table 7. Cumulative Database for selected parameters for dry weather samples 1993-1996

6/14/94	0.004	0.030	0.009	0.027		0.006	0.032	0.010	0.023		0.039	0.020	0.024	0.026
7/26/94	0.006	0.030	0.008	0.044	0.008	0.003	0.051	0.004	0.040	0.010	0.005	0.040	0.010	0.039
8/30/94	0.007	0.052	0.004	0.044	0.008	0.006	0.047	0.012	0.042	0.046	0.027	0.041	0.011	0.034
10/24/94	0.012	0.059	0.007	0.033	0.011	0.014	0.043	0.006	0.028	0.050	0.046	0.033	0.012	0.034
11/8/94	0.014	0.052	0.008	0.033	0.010	0.012	0.049	0.038	0.031	0.048	0.044	0.028	0.016	0.036
3/21/95	0.004	0.000	0.004	0.000	0.020	0.006	0.016	0.006	0.009	0.019	0.019	0.015	0.006	0.006
4/18/95	0.002	0.020	0.002	0.011	0.003	0.025	0.011	0.001	0.006	0.026	0.025	0.015	0.005	0.010
5/2/95	0.005	0.026	0.003	0.010	0.006	0.006	0.014	0.003	0.002	0.038	0.050	0.024	0.004	0.014
6/6/95	0.018	0.045	0.013	0.022	0.011	0.014	0.010	0.009	0.009	0.087	0.071	0.026	0.008	0.019
10/17/95	0.012	0.098	0.006	0.042	0.007	0.006	0.061	0.007	0.035	0.107	0.066	0.050	0.034	0.032
4/9/96	0.002	0.018	0.002	0.008	0.002	0.003	0.012	0.002	0.004	0.011	0.011	0.011	0.004	0.007
5/7/96	0.003	0.024	0.002	0.021	0.003	0.003	0.012	0.002	0.048	0.009	0.009	0.017	0.008	0.011
6/4/96	0.003	0.020	0.008	0.025	0.002	0.005	0.017	0.001	0.011	0.058	0.025	0.017	0.003	0.013
Mean PO4 Dry	0.007	0.041	0.006	0.029	0.008	0.008	0.032	0.008	0.025	0.042	0.032	0.026	0.013	0.023
TSS Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB 2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
8/24/93	1.50	41.50	0.09	24.50		2.50	40.00	1.50	8.00		7.00	20.50	9.00	19.00
9/7/93	4.00	8.50	3.00	6.00		1.00	8.00	5.50	25.00		7.00	11.00	1.00	13.50
10/5/93	3.00	57.00	5.00	37.00		6.00	52.00	5.00	51.00		3.00	30.00	3.00	36.00
11/2/93	2.00	36.00	0.90	43.00		0.09	70.00	1.00	14.00		1.00	19.00	3.00	87.00
12/20/93	4.50	17.00	4.00	19.00		4.00	5.00	3.20	5.00		4.80	5.00	4.40	6.00
4/19/94	1.00		0.90	12.00		1.00	4.00	1.00	3.00		2.00	3.00	0.90	1.00
5/17/94	2.00		1.00	12.50		4.50	5.50	2.00	5.50		4.00	6.00	4.00	7.00
6/14/94	2.00	35.00	3.00	7.00		9.00	4.50	2.00	5.50		2.00	5.50	3.00	3.50
7/26/94	2.00	27.80	3.20	6.00	8.40	3.20	22.80	1.40	9.00	5.00	3.80	6.60	7.80	13.60
8/30/94	1.80	6.80	1.60	18.20	7.11	4.40	5.40	2.80	4.60	6.80	3.80	19.00	12.40	7.00
10/24/94	1.80	10.80	1.20	6.20	2.80	3.80	4.60	2.33	6.60	1.80	1.60	5.60	0.80	2.60
11/8/94	1.20	30.20	1.60	16.20	2.20	2.40	9.60	3.20	15.40	2.80	1.80	3.00	1.20	4.80
3/21/95	1.20		1.60		5.00	3.20	4.60	2.20	5.60	3.20	3.80	6.40	1.60	10.40

Table 7. Cumulative Database for selected parameters for dry weather samples 1993-1996

4/18/95	1.00	80.00	1.20	37.40	3.40	3.60	5.00	2.00	5.60	2.60	2.40	6.20	1.80	29.20
5/2/95	2.40	23.40	3.20	18.20	4.20	4.60	8.00	2.60	4.40	3.80	3.00	4.80	2.60	9.40
6/6/95	1.80	24.40	1.40	10.00	10.80	5.40	9.00	2.20	14.20	6.60	2.60	4.80	2.80	9.60
10/17/95	1.60	10.00	2.40	18.20	4.80	3.80	8.20	5.80	7.40	11.40	2.80	6.80	2.00	6.20
4/9/96	1.40	28.60	1.40	44.60	4.20	3.20	5.80	1.60	3.80	2.60	2.80	5.00	1.40	6.00
5/7/96	2.00	38.80	1.60	8.60	4.80	4.40	8.60	2.60	11.20	2.40	2.60	8.40	1.60	9.00
6/4/96	2.80	70.86	1.60	38.25	8.60	5.20	10.40	1.80	11.40	4.60	2.60	8.40	3.80	16.00
Mean TSS Dry	2.05	32.16	1.99	20.15	5.53	3.76	14.55	2.59	10.81	4.47	3.22	9.25	3.41	14.84
DON CONCENTRATION mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
7/26/94	0.242	0.254	0.149	0.266	0.029	0.221	0.198	0.193	0.183	0.159	0.129	0.346	0.364	0.186
8/30/94	0.527	0.412	0.371	0.396	0.372	0.390	0.501	0.453	0.000	0.650	0.610	0.386	0.871	0.406
10/24/94	0.342	0.464	0.185	0.341	0.160	0.270	0.556	0.239	0.188	0.036	0.077	0.252	0.120	0.251
11/8/94	0.172	0.413	0.232	0.375	0.314	0.290	0.141	0.235	0.120	0.250	0.194	0.394	0.296	0.366
3/21/95	0.130		0.240		0.250	0.360	0.470	0.330	0.400	0.400	0.420	0.410	0.290	0.330
4/18/95	0.168	0.115	0.069	0.045	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.032
5/2/95	0.215	0.194	0.184	0.209	0.101	0.152	0.211	0.082	0.079	0.141	0.096	0.188	0.191	0.160
6/6/95	0.548	0.158	0.357	0.433	0.282	0.126	0.244	0.074	0.052	0.225	0.020	0.043	0.000	0.188
10/17/96	0.391	0.180	0.189	0.059	0.155	0.151	0.174	0.115	0.141	0.000	0.084	0.245	0.155	0.000
4/9/96	0.418	0.271	0.329	0.422	0.296	0.381	0.325	0.169	0.311	0.000	0.303	0.312	0.438	0.393
5/7/96	0.267	0.250	0.197	0.150	0.162	0.237	0.059	0.209	0.090	0.143	0.070	0.148	0.172	0.159
6/4/96	0.261	0.319	0.172	0.286	0.203	0.162	0.284	0.224	0.338	0.042	0.042	0.048	0.155	0.243
Mean DON dry	0.307	0.275	0.223	0.271	0.200	0.228	0.264	0.193	0.159	0.171	0.170	0.231	0.255	0.226
% Oxygen Saturation														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
7/26/94	43%	92%	48%	75%	49%	52%	97%	65%	95%	91%	80%	69%	98%	78%
8/30/94	43%	84%	46%	90%	42%	58%	97%	54%	101%	50%	58%	88%	73%	91%

Table 7. Cumulative Database for selected parameters for dry weather samples 1993-1996

10/24/94	54%	101%	70%	95%	58%	58%	123%	68%	117%	55%	73%	92%	66%	89%
11/8/94	52%	73%	68%	83%	64%	60%	97%	64%	97%	59%	65%	80%	67%	102%
3/21/95	87%		85%		91%	95%	93%	91%	78%	87%	91%	70%	94%	84%
4/18/95	75%	81%	80%	95%	80%	78%	117%	79%	118%	74%	77%	86%	77%	90%
5/2/95	78%	85%	82%	111%	80%	78%	106%	82%	109%	74%	79%	83%	80%	92%
6/6/95	49%	52%	63%	67%	60%	29%	112%	70%	113%	44%	63%	64%	64%	62%
10/17/95	46%	84%	80%	98%	69%	63%	56%	64%	97%	59%	82%	50%	79%	51%
4/9/96	77%	93%	84%	100%	86%	87%	98%	88%	105%	79%	86%	99%	85%	101%
5/7/96	84%	86%	88%	98%	93%	90%	94%	90%	91%	91%	94%	95%	96%	93%
6/4/96	66%	80%	76%	80%	82%	66%	82%	78%	77%	75%	71%	84%	84%	80%
Mean O2 Sat Dry	63%	83%	72%	90%	71%	68%	98%	74%	100%	70%	77%	80%	80%	84%

Table 8. Cumulative database for selected parameters for storm samples 1993-1996

NH4 Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2		7 CCH	GB 21	5 SFR	GB 22
9/9/93	0.044	0.181	0.043	0.246		0.037	0.169	0.023	0.118		0.102	0.009	0.336	0.030
9/27/93	0.045	0.177	0.036	0.051		0.053	0.093	0.075	0.057		0.083	0.058	0.181	0.061
11/2/94	0.090	0.090	0.090	0.090		0.090	0.100	0.090	0.090		0.110	0.100	0.130	0.110
11/18/93	0.019	0.057	0.005	0.058		0.008	0.173	0.013	0.026		0.233	0.472	0.420	0.385
12/6/93	0.017	0.109	0.029	0.045		1.051	0.117	0.035	0.001		0.281	0.334	0.167	0.141
5/17/94	0.090	0.000	0.090	0.090		0.090	0.090	0.090	0.090		0.200	0.100	0.200	0.090
5/26/94	0.073	0.158	0.070	0.063		0.152	0.086	0.069	0.073		0.203	0.124	0.527	0.113
6/13/94	0.033	0.160	0.090	0.168		0.073	0.071	0.049	0.065		0.108	0.132	0.434	0.286
6/14/94	0.090	0.100	0.090	0.090		0.090	0.090	0.090	0.090		0.100	0.090	0.300	0.200
8/22/94	0.073	0.161	0.236	0.088	0.124	0.078	0.077	0.086	0.054	0.066	0.030	0.067	0.067	0.086
9/26/94	0.035	0.080	0.035	0.077	0.029	0.054	0.057	0.014	0.005	0.193	0.271	0.167	0.057	0.133
11/1/94	0.054	0.081	0.038	0.017	0.015	0.065	0.060	0.043	0.027	0.167	0.219	0.117	0.162	0.113
11/2/94	0.032	0.060	0.029	0.028	0.020	0.025	0.098	0.050	0.068	0.172	0.125	0.107	0.239	0.111
4/13/95	0.020	0.153	0.043	0.048	0.032	0.069	0.064	0.052	0.006	0.312	0.290	0.109	0.432	0.101
4/14/95	0.009	0.059	0.053	0.083	0.021	0.036	0.048	0.049	0.029	0.276	0.298	0.147	0.484	0.134
5/12/95	0.113	0.086	0.032	0.040	0.039	0.073	0.057	0.027	0.097	0.278	0.151	0.101	0.263	0.123
5/16/95	0.033	0.127	0.028	0.094	0.049	0.071	0.253	0.027	0.059	0.251	0.197	0.116	0.264	0.150
5/17/95	0.041	0.111	0.024	0.113	0.024	0.081	0.357	0.039	0.068	0.301	0.395	0.174	0.223	0.130
9/18/95	0.072	0.113	0.118	0.075	0.015	0.084	0.097	0.082	0.021	0.782	0.091	0.000	0.007	0.013
9/19/95	0.336	0.099	0.392	0.023	0.025	0.058	0.046	0.088	0.008	0.166	0.217	0.021	0.010	0.004
11/2/95	0.124	0.146	0.049	0.445	0.018	0.082	0.118	0.031	0.044	0.543	0.405	0.235	0.091	0.119
11/3/95	0.042	0.065	0.191	0.068	0.012	0.034	0.030	0.042	0.334	0.152	0.675	0.268	0.747	0.103
5/17/95	0.089	0.097	0.051	0.042	0.041	0.041	0.146	0.045	0.063	0.319	0.140	0.114	0.112	0.089
6/23/96	0.093	0.127	0.086	0.048	0.146	0.092	0.052	0.110	0.046	0.306	0.098	0.068	0.274	0.073
Mean NH4 Storms	0.069	0.108	0.081	0.091	0.041	0.108	0.106	0.055	0.064	0.286	0.209	0.135	0.255	0.121

Table 8. Cumulative database for selected parameters for storm samples 1993-1996

NO3 Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
9/9/93	0.101	0.115	0.025	0.058		0.056	0.023	0.005	0.021		0.463	0.012	1.096	0.031
9/27/93	0.087	0.056	0.014	0.090		0.058	0.034	0.009	0.030		1.044	0.100	1.304	0.075
11/2/94	0.060	0.360	0.070	0.100		0.330	0.070	0.120	0.080		0.360	0.260	0.310	0.260
11/18/93	0.147	0.399	0.068	0.145		0.362	0.101	0.139	0.071		0.392	0.313	0.309	0.174
12/6/93	0.070	0.167	0.102	0.228		0.100	0.117	0.210	0.144		0.235	0.220	0.324	0.303
5/17/94	0.050	0.000	0.060	0.060		0.130	0.130	0.080	0.070		0.160	0.130	0.150	0.120
5/26/94	0.100	0.114	0.049	0.078		0.236	0.055	0.077	0.058		0.334	0.137	0.218	0.080
6/13/94	0.065	0.087	0.065	0.060		0.181	0.049	0.062	0.056		0.637	0.606	0.504	0.191
6/14/94	0.080	0.140	0.100	0.140		0.130	0.100	0.060	0.100		0.560	0.370	0.460	0.310
8/22/94	0.061	0.090	0.007	0.037	0.216	0.198	0.049	0.059	0.050	1.246	1.351	0.198	0.906	0.152
9/26/94	0.056	0.081	0.073	0.052	0.050	0.437	0.061	0.017	0.001	0.217	0.173	0.211	0.164	0.139
11/1/94	0.125	0.253	0.055	0.041	0.206	0.205	0.072	0.039	0.118	0.272	0.305	0.296	0.173	0.147
11/2/94	0.114	0.160	0.037	0.055	0.150	0.233	0.034	0.028	0.051	0.314	0.360	0.364	0.236	0.100
4/13/95	0.113	0.166	0.124	0.071	0.140	0.249	0.098	0.151	0.041	0.158	0.175	0.157	0.062	0.092
4/14/95	0.075	0.081	0.132	0.029	0.106	0.204	0.082	0.107	0.018	0.176	0.182	0.072	0.119	0.083
5/12/95	0.074	0.107	0.075	0.117	0.141	0.206	0.015	0.059	0.028	0.349	0.348	0.126	0.289	0.093
5/16/95	0.083	0.057	0.067	0.149	0.133	0.194	0.123	0.069	0.087	0.327	0.421	0.327	0.261	0.215
5/17/95	0.096	0.155	0.109	0.052	0.122	0.167	0.033	0.086	0.073	0.343	0.413	0.234	0.255	0.186
9/18/95	0.122	0.039	0.024	0.258	0.050	0.050	0.084	0.031	0.076	1.084	0.347	0.101	0.656	0.282
9/19/95	0.074	0.293	0.021	0.146	0.051	0.051	0.108	0.033	0.457	1.054	0.347	0.301	0.662	0.242
11/2/95	0.224	0.387	0.242	0.271	0.321	0.321	0.287	0.300	0.114	0.295	0.338	0.133	0.275	0.108
11/3/95	0.211	0.134	0.224	0.123	0.547	0.547	0.132	0.323	0.168	0.253	0.446	0.157	0.267	0.288
5/17/96	0.085	0.128	0.086	0.093	0.186	0.186	0.062	0.112	0.045	0.151	0.154	0.162	0.126	0.155
6/23/96	0.113	0.028	0.143	0.047	0.207	0.207	0.018	0.092	0.032	0.741	0.685	0.312	0.361	0.215
Mean NO3 Storms	0.099	0.150	0.082	0.104	0.175	0.210	0.081	0.095	0.083	0.465	0.426	0.221	0.395	0.168

Table 8. Cumulative database for selected parameters for storm samples 1993-1996

PO4 Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2		7 CCH	GB 21	5 SFR	GB 22
9/9/93	0.008	0.065	0.005	0.094		0.009	0.083	0.011	0.045		0.012	0.096	0.031	0.046
9/27/93	0.010	0.050	0.007	0.029		0.006	0.055	0.012	0.035		0.042	0.025	0.024	0.029
11/2/94	0.007	0.034	0.009	0.020		0.003	0.032	0.002	0.023		0.033	0.022	0.019	0.023
11/18/93	0.011	0.049	0.006	0.030		0.015	0.047	0.020	0.023		0.058	0.031	0.046	0.034
12/6/93	0.019	0.032	0.021	0.023		0.019	0.033	0.025	0.017		0.039	0.045	0.014	0.018
5/17/94	0.004	0.000	0.001	0.007		0.001	0.022	0.001	0.011		0.018	0.014	0.007	0.013
5/26/94	0.014	0.042	0.012	0.020		0.014	0.027	0.012	0.018		0.033	0.020	0.019	0.020
6/13/94	0.013	0.031	0.012	0.037		0.009	0.035	0.010	0.021		0.048	0.033	0.038	0.031
6/14/94	0.004	0.030	0.009	0.027		0.006	0.032	0.010	0.023		0.039	0.020	0.024	0.026
8/22/94	0.012	0.079	0.002	0.035	0.009	0.011	0.057	0.011	0.046	0.0308	0.014	0.035	0.006	0.039
9/26/94	0.017	0.040	0.008	0.019	0.008	0.012	0.051	0.006	0.024	0.0334	0.036	0.035	0.011	0.021
11/1/94	0.026	0.077	0.010	0.012	0.009	0.010	0.056	0.014	0.021	0.0414	0.034	0.033	0.015	0.027
11/2/94	0.010	0.065	0.006	0.012	0.010	0.011	0.073	0.009	0.030	0.0358	0.034	0.031	0.017	0.027
4/13/95	0.002	0.015	0.002	0.012	0.002	0.003	0.022	0.002	0.009	0.0190	0.017	0.012	0.005	0.012
4/14/95	0.002	0.015	0.002	0.012	0.002	0.003	0.022	0.002	0.009	0.0190	0.017	0.012	0.005	0.012
5/12/95	0.006	0.019	0.007	0.009	0.007	0.007	0.013	0.005	0.007	0.0584	0.049	0.012	0.009	0.012
5/16/95	0.008	0.033	0.006	0.016	0.005	0.008	0.026	0.007	0.014	0.0464	0.045	0.026	0.006	0.016
5/17/95	0.005	0.032	0.003	0.009	0.005	0.007	0.018	0.004	0.008	0.0508	0.033	0.027	0.002	0.011
9/18/95	0.039	0.075	0.007	0.073	0.007	0.009	0.072	0.011	0.045	0.027	0.022	0.053	0.005	0.189
9/19/95	0.009	0.082	0.008	0.078	0.009	0.010	0.053	0.012	0.041	0.025	0.023	0.057	0.009	0.064
11/2/95	0.012	0.084	0.011	0.040	0.014	0.019	0.079	0.010	0.032	0.038	0.038	0.035	0.026	0.028
11/3/95	0.012	0.061	0.015	0.027	0.024	0.014	0.034	0.015	0.027	0.035	0.040	0.034	0.016	0.027
5/17/95	0.009	0.028	0.006	0.029	0.007	0.010	0.017	0.008	0.036	0.015	0.014	0.020	0.010	0.014
6/23/96	0.004	0.010	0.004	0.008	0.002	0.003	0.009	0.004	0.009	0.025	0.017	0.006	0.007	0.005
Mean PO4 Storms	0.011	0.044	0.008	0.028	0.008	0.009	0.040	0.009	0.024	0.033	0.031	0.031	0.016	0.031

Table 8. Cumulative database for selected parameters for storm samples 1993-1996

TSS Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB 2		7 CCH	GB 21	5 SFR	GB 22
9/9/93	0.80	7.80	0.20	3.20		1.20	2.20	3.40	3.80		7.20	12.80	0.60	1.60
9/27/93	3.40	30.60	1.20	18.60		2.40	3.40	2.60	1.60		5.00	1.60	3.00	2.40
11/18/93	3.00	31.00	1.00	10.00		9.00	5.40	7.80	6.00		4.60	5.80	0.80	4.00
12/6/93	5.00	28.20	7.80	24.60		9.20	5.00	4.00	3.40		7.60	8.40	1.20	4.80
5/26/94	1.00	106.67	0.80	18.40		3.40	6.60	2.00	6.80		2.20	6.80	2.00	7.80
6/13/94	2.00	40.00	3.40	9.60		8.80	5.80	2.20	5.40		3.00	7.00	4.40	7.60
6/14/94	2.00	35.00	3.00	7.00		9.00	4.50	2.00	5.50		2.00	5.50	3.00	3.50
8/22/94	1.80	29.00	1.80	6.80	10.00	3.40	5.40	4.20	4.20	4.40	6.20	7.20	13.00	5.80
9/26/94	2.00	19.00	1.20	3.80	8.00	5.00	8.20	3.00	4.20	4.40	5.40	7.00	2.60	5.00
11/1/94	3.00	14.20	1.60	5.60	2.40	2.40	2.80	6.40	19.60	2.40	2.80	4.40	1.60	10.60
11/2/94	0.60	17.40	0.80	12.60	3.20	5.60	31.40	5.80	35.20	2.40	4.00	11.00	1.00	107.67
4/13/95	2.00	34.80	1.40	14.50	11.80	7.80	21.80	2.20	3.70	2.80	3.00	8.50	1.40	10.40
4/14/95	1.60	27.60	1.80	14.00	6.60	5.40	4.80	2.40	5.60	7.80	4.60	5.60	2.20	6.80
5/12/95	2.20	40.00	1.60	21.40	5.20	6.40	6.40	3.20	8.00	4.40	2.80	5.60	3.40	10.80
5/16/95	2.00	67.00	1.80	78.00	9.40	6.20	11.80	3.20	9.60	3.60	2.60	10.60	2.40	12.00
5/17/95	1.80	91.00	1.00	96.00	6.80	5.80	8.80	3.00	10.20	4.40	2.60	10.20	2.00	17.80
9/18/95	5.60	15.00	2.40	11.60	8.40	9.00	5.60	4.20	6.40	13.00	3.60	19.00	9.60	44.67
9/19/95	3.20	8.20	1.20	21.00	5.80	6.40	5.60	2.40	3.80	4.00	2.60	23.00	10.00	24.00
11/2/95	3.20	31.00	2.60	32.80	6.80	3.80	5.80	3.40	5.60	3.40	2.80	11.20	2.00	4.20
11/3/95	4.20	31.00	3.80	17.80	6.60	19.67	10.00	5.60	7.60	9.00	40.67	29.67	2.80	9.80
5/17/96	1.60	42.67	1.20	17.60	8.60	5.80	9.40	5.20	8.80	3.60	2.80	7.40	2.80	6.80
5/18/96	15.80	60.67	2.20	19.20	9.00	4.60	19.20	2.80	6.80	3.60	4.20	9.00	2.40	7.20
6/23/96	1.80	23.80	1.40	16.40	12.20	4.00	5.80	3.20	6.80	4.60	2.80	11.00	2.60	9.60
6/24/96	2.60	16.00	2.20	27.40	9.60	5.20	8.40	2.80	9.60	4.20	5.20	6.80	2.20	5.00
Mean	3.01	35.32	1.98	21.16	7.67	6.23	8.50	3.63	7.84	4.82	5.43	9.79	3.29	13.74

Table 8. Cumulative database for selected parameters for storm samples 1993-1996

DON Concentration mg/L														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
8/22/94	0.440	0.570	0.070	0.350	0.270	0.300	0.160	0.430	0.170	0.440	0.410	0.310	1.050	0.410
9/26/94	0.405	0.369	0.430	0.332	0.317	0.764	0.226	0.261	0.165	0.000	0.000	0.168	0.367	0.345
11/1/94	0.311	0.516	0.237	0.142	0.159	0.210	0.108	0.238	0.075	0.210	0.000	0.106	0.255	0.000
11/2/94	0.424	0.470	0.253	0.216	0.080	0.363	0.348	0.362	0.221	0.000	0.206	0.000	0.326	0.449
4/13/95	0.078	0.000	0.083	0.072	0.108	0.002	0.048	0.008	0.283	0.000	0.000	0.104	0.000	0.178
4/14/95	0.166	0.110	0.000	0.097	0.063	0.110	0.120	0.063	0.143	0.000	0.000	0.151	0.000	0.163
5/12/95	0.153	0.227	0.202	0.134	0.240	0.151	0.188	0.185	0.155	0.000	0.181	0.233	0.128	0.194
5/16/95	0.184	0.385	0.155	0.087	0.148	0.165	0.000	0.144	0.123	0.072	0.002	0.207	0.036	0.185
5/17/95	0.303	0.214	0.107	0.135	0.174	0.182	0.000	0.136	0.129	0.086	0.000	0.000	0.172	0.054
9/18/95	0.346	0.188	0.268	0.036	0.239	0.276	0.070	0.317	0.273	0.000	0.302	0.369	0.667	1.864
9/19/95	0.000	0.099	0.000	0.121	0.227	0.281	0.016	0.310	0.000	0.390	0.236	0.148	0.648	0.233
11/2/95	0.073	0.207	0.049	0.000	0.229	0.327	0.086	0.079	0.161	0.000	0.077	0.152	0.064	0.233
11/3/95	0.318	0.491	0.095	0.319	0.304	0.339	0.529	0.325	0.088	0.355	0.000	0.365	0.000	0.218
5/17/96	0.217	0.245	0.142	0.195	0.228	0.273	0.162	0.143	0.191	0.039	0.156	0.185	0.182	0.186
6/23/96	0.274	0.254	0.261	0.316	0.086	0.342	0.290	0.288	0.231	0.123	0.017	0.310	0.125	0.302
Mean	0.246	0.290	0.157	0.170	0.191	0.272	0.157	0.219	0.161	0.114	0.106	0.187	0.268	0.334

% Oxygen Saturation														
DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
8/22/94	48%	50%	46%	62%	59%	62%	84%	50%	80%	54%	64%	53%	84%	55%
9/26/94		74%		77%			95%		95%			77%		75%
11/1/94	47%	75%	67%	72%	65%	62%	94%	54%	93%	65%	75%	70%	69%	66%
11/2/94	49%	90%	72%	79%	67%	68%	99%	59%	100%	71%	76%	66%	71%	74%
4/13/95	79%	104%	86%	105%	85%	86%	135%	82%	132%	80%	76%	104%	81%	105%
4/14/95	81%	101%	88%	99%	83%	85%	113%	81%	123%	85%	84%	89%	84%	89%
5/12/95	56%	74%	69%	86%	79%	72%	115%	69%	114%	64%	72%	80%	67%	84%

Table 8. Cumulative database for selected parameters for storm samples 1993-1996

5/16/95	56%	77%	59%	82%	71%	70%	103%	65%	97%	60%	69%	76%	62%	77%
5/17/95	65%	78%	65%	83%	71%	67%	98%	62%	100%	58%	67%	75%	73%	75%
9/18/95	63%	78%	46%	104%	75%	49%	100%	41%	100%	54%	63%	108%	96%	115%
9/19/95	55%	76%	53%	117%	72%	47%	109%	59%	105%	45%	62%	128%	116%	140%
11/2/95	73%	81%	88%	88%	70%	70%	84%	81%	85%	84%	84%	86%	84%	82%
11/3/95	87%	83%	94%	93%	76%	82%	89%	85%	90%	86%	96%	104%	93%	102%
5/17/96	76%	98%	90%	108%	84%	84%	87%	84%	91%	86%	86%	99%	89%	99%
5/18/96	93%	90%	94%	102%	92%	81%	87%	88%	90%	88%	88%	96%	96%	96%
6/23/96	83%	86%	60%	88%	83%	66%	100%	62%	97%	46%	77%	86%	76%	86%
6/24/96	76%	91%	77%	98%	71%	81%	97%	72%	99%	54%	70%	91%	82%	92%
Mean	68%	83%	72%	91%	75%	71%	99%	68%	99%	68%	75%	88%	83%	89%

Table 9. Comparison of Dry vs Storm data for the cumulative 93-96 database using Welch's test for unequal sd

DATA	PARAMETER	STATION	SIGNIFICANCE	INTERPRETATION
CUMULATIVE 1993-1996	NH4	5 SFR	NS	
DRY VS STORM				
	NO3	11 CCH	NS	
		5 OYS	NS	
		9 EXT	P=.0086	STORM > DRY
	DON	GB 50	NS	
		GB 22	NS	
	P04	9 EXT	NS	
		GB 50	NS	
		GB 22	NS	

Table 10. Bacterial indicator concentrations at all sites during dry weather conditions.

FECAL COLIFORMS

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	140	156	22	230	70	305	20	135	71.5	340	165	480	760	425
4/9/96	20	54	7	87.5	2	8	0.5	6.5	1	12	65	140	36	35
5/7/96	51	118	27.5	94	47	61.5	17.5	20.5	17	790	112	320	153	204
6/4/96	66	110	29	104	455	66	30	98	40	190	196	365	630	35
Geo. Ave.	**55**	**102**	**19**	**118**	**42**	**56**	**9**	**36**	**15**	**157**	**124**	**298**	**227**	**102**
FW:SW	0.9		0.1		3.5	15.3		1.9		0.7	0.3		1.8	

E. coli

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	90	96	12	145	65	115	11	55	58.5	90	130	360	400	370
4/9/96	17.5	38	5	17.5	2	8	0.5	6	1	9.5	30	100	14.5	25
5/7/96	46.5	78	23.5	76	44.5	51	14.5	18	15	460	74	170	88	118
6/4/96	56	90	24	94	430	66	23	94	35	80	114	295	460	15
Geo. Ave.	**45**	**71**	**14**	**65**	**40**	**42**	**7**	**27**	**13**	**75**	**76**	**206**	**124**	**64**
FW:SW	0.9		0.1		5.9	10.5		0.9		0.3	0.4		1.1	

Enterococci

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
10/17/95	95	10	20	37	155	110	0.5	118	16.5	95	58	23	90	38
4/9/96	5	8	4	4	0.5	17.5	2.5	4	27.5	4	17	27	12	2
5/7/96	4.5	18	1.5	6.5	9	4	3.5	0.5	1.5	17.5	36	24.5	4.5	9
6/4/96	7	13.5	1.5	26.5	24	11.5	8.5	18	48.5	2	65	54	22	9
Geo. Ave.	**11**	**12**	**4**	**13**	**11**	**17**	**2**	**8**	**13**	**11**	**39**	**30**	**18**	**9**
FW:SW	0.9		0.3		4.6	7.0		0.6		0.4	1.3		2.0	

Table 11. Bacterial indicator concentrations at all sites on the 1st and 2nd days of storm events.

FECAL COLIFORMS

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	3900	34	252	100	770	5300	28	410	4	42	1000	1300	130	820
9/19/95	520	28	145	25	600	900	8	290	2	26	360	160	140	60
11/2/95	400	1740	55	1260	340	60	70	60	124	52	190	840	65	124
11/3/95	380	2160	285	1280	460	940	410	390	565	950	1150	2000	885	1350
5/17/96	72	100	35	84	208	162	57	160	53	240	44	320	595	210
5/18/96	522	40	48	96	56	56	24	20	31	135	106	330	40	85
6/23/96	68	32	16	350	250	102	26	9350	20	120	1500	1400	3200	320
6/24/96	78	24	36	186	290	88	5	330	8	315	140	640	710	345
Geo. Ave.	**298**	**101**	**70**	**195**	**297**	**262**	**32**	**269**	**25**	**127**	**306**	**653**	**295**	**252**
1st day	**296**	**117**	**53**	**247**	**342**	**269**	**41**	**438**	**27**	**89**	**335**	**836**	**356**	**288**
2nd day	**299**	**87**	**92**	**155**	**259**	**254**	**25**	**165**	**23**	**180**	**280**	**510**	**244**	**221**
1st:2nd day	**1.0**	**1.3**	**0.6**	**1.6**	**1.3**	**1.1**	**1.6**	**2.6**	**1.2**	**0.5**	**1.2**	**1.6**	**1.5**	**1.3**
FW:SW	**2.9**		**0.4**		**9.2**	**8.1**		**10.8**		**0.2**	**0.5**		**1.2**	

E.coli

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	3800	32	190	85	770	700	10	300	2	42	850	1000	130	580
9/19/95	380	22	125	20	480	220	8	200	2	24	320	125	110	50
11/2/95	380	1420	55	1160	300	60	68	50	215	43	140	560	40	102
11/3/95	380	1440	285	400	420	880	358	390	520	690	910	1200	785	1300
5/17/96	55	100	26	52	204	104	39	92	34	150	16	150	425	195
5/18/96	476	40	44	96	56	56	24	20	28	95	70	215	40	75
6/23/96	62	30	15	350	220	94	26	9350	17	115	1400	1200	3200	320
6/24/96	78	24	34	152	290	78	4	266	8	235	140	550	480	310
Geo. Ave.	**268**	**90**	**62**	**146**	**276**	**156**	**26**	**219**	**22**	**102**	**229**	**453**	**242**	**220**
1st day	**265**	**108**	**45**	**206**	**319**	**142**	**29**	**337**	**22**	**75**	**227**	**563**	**290**	**246**
2nd day	**271**	**74**	**85**	**104**	**239**	**171**	**23**	**143**	**22**	**139**	**231**	**365**	**202**	**197**
1st:2nd day	**1.0**	**1.5**	**0.5**	**2.0**	**1.3**	**0.8**	**1.3**	**2.4**	**1.0**	**0.5**	**1.0**	**1.5**	**1.4**	**1.3**
FW:SW	**3.0**		**0.4**		**10.8**	**6.1**		**9.9**		**0.2**	**0.5**		**1.1**	

ENTEROCOCCI

DATE	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCh	7 CCH	GB 21	5 SFR	GB 22
9/18/95	2160	10	331	14	360	625	4	400	2	21	392	6	145	22
9/19/95	234	0	97	2	323	144	1	110	2	24	165	3	13	5
11/2/95	240	580	105	1035	950	150	42	128	375	46	135	485	58	36
11/3/95	380	590	380	420	350	1020	960	345	260	1080	2580	595	148	222
5/17/96	55	37	2	15	52	50	32	61	34	23	30	111	32	18
5/18/96	62	33	7	10	116	126	15	24	20	30	31	54	20	20
6/23/96	31	24	13	23	76	59	3	34	1	35	81	147	87	32
6/24/96	27	8	33	5	22	15	2	139	1	58	53	49	112	25
Geo. Ave.	**137**	**27**	**41**	**26**	**157**	**129**	**12**	**104**	**11**	**49**	**131**	**62**	**56**	**27**
1st day	**172**	**47**	**31**	**47**	**191**	**129**	**11**	**101**	**12**	**30**	**106**	**83**	**69**	**26**
2nd day	**110**	**16**	**54**	**14**	**130**	**129**	**12**	**106**	**9**	**82**	**162**	**47**	**46**	**27**
1st:2nd day	**1.6**	**3.0**	**0.6**	**3.3**	**1.5**	**1.0**	**0.9**	**1.0**	**1.3**	**0.4**	**0.7**	**1.8**	**1.5**	**1.0**
FW:SW	**5.0**		**1.6**		**13.5**	**11.0**		**9.7**		**0.8**	**2.1**		**2.1**	

Table 12. Summary of statistical analyses of bacterial indicator data using paired t tests.

Comparison	Results of statistical analysis and explanation		
	Fecal coliforms	*E. coli*	Enterococci
		1994-1995 DATA	
Dry vs Storms			
9 EXT	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
GB 80	NS	NS	NS
5 LMP	storm > dry (P < 0.05)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
GB 15	NS	NS	NS
8 OYS	NS	NS	NS
5 OYS	NS	storm > dry (P < 0.05)	storm > dry (P < 0.05)
GB 50	NS	storm > dry (P < 0.05)	NS
5 BLM	NS	storm > dry (P < 0.05)	storm > dry (P < 0.05)
GB 2	NS	NS	NS
11 CCH	NS	NS	NS
7 CCH	storm > dry (P < 0.05)	storm > dry (P < 0.01)	storm > dry (P < 0.05)
GB 21	storm > dry (P < 0.05)	NS	NS
5 SFR	NS	NS	NS
GB 22	NS	NS	NS
1st vs 2nd day storm samples			
GB15	NS	NS	1d > 2d (P<0.05)
All other sites	NS	NS	NS
Between site differences for all sites and conditions: see Table 15.			
Between site differences: Freshwater (FW) compared to paired saltwater (SW) sites			
9 EXT vs GB 80 wet&dry	NS	NS	NS
5LMP vs GB 15 wet	NS	NS	NS
5LMP vs GB 15 dry	FW<SW (P < 0.05)	FW<SW (P < 0.05)	NS
8 OYS vs GB 50 wet	FW>SW (P<0.01)	FW>SW (P<0.01)	FW>SW (P<0.05)
8 OYS vs GB 50 dry	FW>SW (P<0.05)	FW>SW (P<0.05)	NS
5 OYS vs GB 50 wet	FW<SW (P < 0.05)	FW<SW (P < 0.05)	FW<SW (P < 0.01)
5 OYS vs GB 50 dry	FW>SW (P<0.05)	FW>SW (P<0.05)	NS
5 BLM vs GB 2 wet	FW>SW (P<0.05)	NS	FW>SW (P<0.05)
11CCH vs GB 21 wet	FW<SW (P<0.01)	FW<SW (P<0.01)	NS
7 CCH vs GB 21 dry	FW<SW (P<0.01)	FW<SW (P<0.01)	NS
All other site/conditions	NS	NS	NS

Table 13. Statistically significant differences between bacteria at all sites.
Bottom left matrix = wet conditions; Top right matrix = dry conditions.

Fecal coliforms (ANOVA: *P<0.05; **P<0.01)

	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
9 EXT	wet\dry													
GB 80		wet\dry					**							
5 LMP	*		wet\dry							*		**	**	
GB 15				wet\dry			**		*					
8 OYS			*		wet\dry							*		
5 OYS						wet\dry								
GB 50	**			*	**	**	wet\dry			**	**	**	**	**
5 BLM							**	wet\dry				*		
GB2	**			**	**	**		**	wet\dry	*	*	**	**	
11 CCH									*	wet\dry				
7 CCH			*				**		**		wet\dry			
GB 21		**	**				**		**	*		wet\dry		
5 SFR			*				**		**				wet\dry	
GB 22							**		**					wet\dry

E. coli

	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
9 EXT	wet\dry						*							
GB 80		wet\dry					*							
5 LMP	*		wet\dry									**	*	
GB 15				wet\dry			*							
8 OYS			**		wet\dry									
5 OYS						wet\dry								
GB 50	**			*	**	*	wet\dry			*	*	**	**	*
5 BLM							**	wet\dry				*		
GB2	**	*		**	**	**		**	wet\dry			**	*	
11 CCH									*	wet\dry				
7 CCH							**		**		wet\dry			
GB 21		*	**				**		**	*		wet\dry		
5 SFR							**		**				wet\dry	
GB 22							**		**					wet\dry

Enterococci

	9 EXT	GB 80	5 LMP	GB 15	8 OYS	5 OYS	GB 50	5 BLM	GB2	11 CCH	7 CCH	GB 21	5 SFR	GB 22
9 EXT	wet\dry													
GB 80		wet\dry												
5 LMP			wet\dry								*	*		
GB 15				wet\dry										
8 OYS		*		*	wet\dry									
5 OYS						wet\dry								
GB 50	**				**	**	wet\dry				**	*	*	
5 BLM							*	wet\dry						
GB2	**				**	**		*	wet\dry					
11 CCH										wet\dry				
7 CCH							**		**		wet\dry			
GB 21									*			wet\dry		
5 SFR													wet\dry	
GB 22					*									wet\dry

Table 14. Summary of statistical analyses of bacterial indicator data using 1-way ANOVA.

INTERANNUAL COMPARISONS	Fecal coliforms	*E. coli*	Enterococci
		1994-95 vs 1995-96	
Wet conditions	NS	NS	NS
Dry conditions			
GB80	94-5<95-6 (P<0.01)	94-5<95-6 (P<0.01)	NS
5SFR	94-5<95-6 (P<0.05)	NS	NS
5LMP	NS	NS	94-5>95-6 (P<0.05)
GB50	NS	NS	94-5>95-6 (P<0.01)
		1993-94 vs 1995-96	
Wet conditions			
5SFR	93-4<95-6 (P<0.05)	NS	NS
GB2	NS	NS	93-4>95-6 (P<0.05)
Dry conditions			
GB80	93-4<95-6 (P<0.01)	93-4<95-6 (P<0.01)	NS
5SFR	93-4<95-6 (P<0.05)	NS	NS
5LMP	NS	NS	93-4>95-6 (P<0.01)
GB15	93-4<95-6 (P<0.01)	NS	NS
GB21	93-4<95-6 (P<0.01)	93-4<95-6 (P<0.05)	NS
GB22	NS	93-4<95-6 (P<0.05)	NS
GB50	NS	NS	93-4<95-6 (P<0.05)
		1993-94 vs1994-95	
Wet conditions			
GB 2	NS	NS	93-4 > 94-5 (P < 0.05)
GB 13	NS	NS	93-4 > 94-5 (P < 0.05)
Dry conditions			
5 BLM	93-4 < 94-5 (P < 0.05)	NS	NS
GB 50	NS	93-4 > 94-5 (P < 0.05)	NS
5 SFR	NS	NS	93-4 < 94-5 (P < 0.05)
		ALL 1993-96 DATA: STORM VS. DRY CONDITIONS	
9 EXT	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
GB 80	storm > dry (P < 0.05)	storm > dry (P < 0.05)	storm > dry (P < 0.05)
5 LMP	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.05)
GB 15	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
5 OYS	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
GB 50	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.05)
5 BLM	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
GB 2	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.05)
7 CCH	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)
GB 21	storm > dry (P < 0.05)	storm > dry (P < 0.05)	storm > dry (P < 0.01)
5 SFR	storm > dry (P < 0.05)	storm > dry (P < 0.05)	storm > dry (P < 0.01)
GB 22	storm > dry (P < 0.01)	storm > dry (P < 0.01)	storm > dry (P < 0.01)

Table 15. Fecal coliform concentrations (per 100 ml) at all sites: 1993-96.

DRY	9-EXT	GB80	5-LMP	GB15	5-OYS	GB50	5-BLM	GB2	7-CCH	GB21	5-SFR	GB22
8/24/93	6	7	4	60	6	1	3	5	220	54	4	11
9/7/93	51	5	5	15	5	4	7	1	133	74	2	8
10/5/93	8	6	2	50	13	0.8	6	8	166	91	4	41
12/20/93	16	46	6	49	9	4	2	5	22	177	23	47
4/19/94	26		4	20	8	0.8	7	2	12	29	29	30
5/3/94	77	56	19	14	100	86	53	27	59	2.25	73	27
6/22/94	32.5	5.5	15	6.25	75	70	220	55	72.5	11.25	217.5	100
7/26/94	30	17	10	210	40	10	100	9	80	58	20	10
8/30/94	12	20	1	37	14	9	210	9	70	40	210	9
10/24/94	90	32	20	104	50	10	800	9	108	400	55	60
11/8/94	25	14	30	80	70	9	1140	30	330	160	44	34
3/21/95	30		10		25	9	30	20	14	24	10	16
4/18/95	20	12	9	13	21	9	9	9	180	57	10	20
5/2/95	26	9	9	30	18	9	10	9	155	140	10	9
6/6/95	70	30	14	99	24	9	48	10	67	117	200	20
10/17/95	140	156	22	230	305	20	135	71.5	165	480	760	425
4/9/96	20	54	7	87.5	8	0.5	6.5	1	65	140	36	35
5/7/96	51	118	27.5	94	61.5	17.5	20.5	17	112	320	153	204
6/4/96	66	110	29	104	66	30	98	40	196	365	630	35
Geo.Ave.	**31**	**23**	**9**	**48**	**26**	**7**	**33**	**10**	**87**	**79**	**39**	**30**
1993-94	**22**	**12**	**6**	**23**	**15**	**5**	**11**	**7**	**66**	**33**	**17**	**28**
1994-95	**31**	**17**	**10**	**59**	**29**	**9**	**84**	**12**	**92**	**87**	**35**	**18**
1995-96	**55**	**102**	**19**	**118**	**56**	**9**	**36**	**15**	**124**	**298**	**227**	**102**
WET	9-EXT	GB80	5-LMP	GB15	5-OYS	GB50	5-BLM	GB2	7-CCH	GB21	5-SFR	GB22
9/9/93	1240	17.5	40	160	660	4.5	103	10.5	3110	1180	10	258
9/27/93	820	280	30	3040	1160	2.5	36	19.5	2800	140	14	100
11/2/93	105	14	16	220	122	183	168	43	48	5	220	60
11/18/93	460	160	50	200	1520	54.5	180	210	3600	645	132	405
12/6/93	260		328	360	420	58	90	75	360	540	120	110
5/17/94	220	31	46	36	183	146	71	55	112	11	98	20
5/26/94	115	60	16	165	210	55	85	47	102	295	143	111
6/13/94	210	22.5	70	355	3200	52.5	130	35	325	5500	40	5700
6/14/94	57	22	24	106	158	330	133	70	200	2	200	28
8/22/94	66	60	34	305	720	18	8000	22	760	380	183	260
9/26/94	440	2000	600	720	750	220	190	270	1650	1920	1350	1880
11/1/94	2100	85	17	675	29	9	99	32	280	1375	65	70
11/2/94	40	55	55	947	2000	182	430	74	340	545	1330	480
4/13/95	440	23	10	8	90	1	20	3	19600	180	48	33
4/14/95	60	28	15	24	28	8	22	13	4140	78	90	49
5/12/95	100	36	9	40	2320	40	73	22	10200	40	18	21
5/16/95	80	22	13	75	140	26	81	22	1000	148	52	40
5/17/95	70	54	34	50	110	12	61	22	59	126	62	41
9/18/95	3900	34	252	100	5300	28	410	4	1000	1300	130	820
9/19/95	520	28	145	25	900	8	290	2	360	160	140	60
11/2/95	400	1740	55	1260	60	70	60	124	190	840	65	124
11/3/95	380	2160	285	1280	940	410	390	565	1150	2000	885	1350
5/17/96	72	100	35	84	162	57	160	53	44	320	595	210
5/18/96	522	40	48	96	56	24	20	31	106	330	40	85
6/23/96	68	32	16	350	102	26	9350	20	1500	1400	3200	320
6/24/96	78	24	36	186	88	5	330	8	140	640	710	345
Geo.Ave.	**221**	**64**	**43**	**173**	**312**	**31**	**149**	**31**	**550**	**272**	**133**	**150**
1993-94	**250**	**42**	**42**	**229**	**472**	**46**	**101**	**46**	**419**	**130**	**72**	**143**
1994-95	**149**	**63**	**28**	**117**	**242**	**20**	**130**	**26**	**1216**	**261**	**120**	**99**
1995-96	**298**	**101**	**70**	**195**	**262**	**32**	**269**	**25**	**306**	**653**	**295**	**252**

Table 16. E. coli concentrations (per 100 ml) at all sites: 1993-96.

DRY	9-EXT	GB80	5-LMP	GB15	5-OYS	GB50	5-BLM	GB2	7-CCH	GB21	5-SFR	GB22
8/24/93	12	6	3	115	21	4	4	4	1390	63	6	6
9/7/93	98	6	4	18	20	7	10	2	240	137	1	27
10/5/93	10	13	3	131	41	2	3	15	330	108	6	88
12/20/93	19	51	15	61	23	11	6	4	25	140	46	44
4/19/94	16		8	34	10	3	8	4	21	22	21	8
5/3/94	67	56	18	3.25	59	64	43	15	47	1.25	47	27
6/22/94	27.5	5	14	6.25	75	62.5	220	45	37.5	8.75	127.5	100
7/26/94	30	17	5	210	40	5	100	7	64	58	20	2
8/30/94	12	16	1	37	14	1	210	1	70	40	210	7
10/24/94	33	32	11	104	33	3	800	1	108	219	55	34
11/8/94	25	14	23	39	66	6	610	19	330	123	44	34
3/21/95	16		4		25	1	10	6	14	24	5	16
4/18/95	20	12	2	13	21	1	3	3	171	57	10	6
5/2/95	26	6	7	21	18	1	2	1	155	71	4	7
6/6/95	52	21	14	99	24	7	48	10	67	117	200	12
10/17/95	90	96	12	145	115	11	55	58.5	130	360	400	370
4/9/96	17.5	38	5	17.5	8	0.5	6	1	30	100	14.5	25
5/7/96	46.5	78	23.5	76	51	14.5	18	15	74	170	88	118
6/4/96	56	90	24	94	66	23	94	35	114	295	460	15
Geo.Ave.	**28**	**21**	**7**	**42**	**30**	**5**	**26**	**6**	**90**	**66**	**31**	**22**
1993-94	**25**	**14**	**7**	**27**	**29**	**10**	**13**	**7**	**100**	**32**	**15**	**28**
1994-95	**24**	**15**	**6**	**51**	**27**	**2**	**48**	**4**	**89**	**72**	**28**	**10**
1995-96	**45**	**71**	**14**	**65**	**42**	**7**	**27**	**13**	**76**	**206**	**124**	**64**
WET	9-EXT	GB80	5-LMP	GB15	5-OYS	GB50	5-BLM	GB2	7-CCH	GB21	5-SFR	GB22
9/9/93	480	12	25	110	310	4.5	53	9	1300	820	4	186
9/27/93	640	270	20	2990	880	2.5	18	19.5	2200	120	7	100
11/2/93	190	30	40	200	140	230	280	50	80	10	280	90
11/18/93	440	150	44	200	1300	41	172	198	3200	625	53	320
12/6/93	240		323	340	420	53	90	60	240	350	108	90
5/17/94	240	32	52	47	360	190	79	64	90	7	130	28
5/26/94	112.5	20	15	142	130	54	83	16.5	9	200	98	43
6/13/94	195	17.5	60	425	3000	52.5	115	33.8	305	4200	35	500
6/14/94	62	14	30	97	133	220	110	105	189	5	280	4
8/22/94	58	40	25	165	540	15	8000	18	660	300	135	260
9/26/94	350	2000	510	560	570	220	190	270	1650	1200	1250	1850
11/1/94	630	65	13	445	26	8	46	31	170	895	45	60
11/2/94	50	55	54	867	1920	167	330	62	310	420	1310	385
4/13/95	220	23	7	6	84	1	20	2	150	110	16	25
4/14/95	50	26	15	21	24	7	20	13	120	53	71	36
5/12/95	100	32	8	20	440	31	60	18	800	25	16	19
5/16/95	50	22	13	65	120	23	62	16	800	114	50	35
5/17/95	70	44	34	40	100	11	54	16	49	92	42	5
9/18/95	3800	32	190	85	700	10	300	2	850	1000	130	580
9/19/95	380	22	125	20	220	8	200	2	320	125	110	50
11/2/95	380	1420	55	1160	60	68	50	215	140	560	40	102
11/3/95	380	1440	285	400	880	358	390	520	910	1200	785	1300
5/17/96	55	100	26	52	104	39	92	34	16	150	425	195
5/18/96	476	40	44	96	56	24	20	28	70	215	40	75
6/23/96	62	30	15	350	94	26	9350	17	1400	1200	3200	320
6/24/96	78	24	34	152	78	4	266	8	140	550	480	310
Geo.Ave.	**188**	**56**	**39**	**140**	**229**	**28**	**125**	**27**	**272**	**210**	**104**	**103**
1993-94	**233**	**35**	**42**	**220**	**418**	**44**	**89**	**42**	**272**	**123**	**56**	**79**
1994-95	**111**	**56**	**25**	**85**	**176**	**18**	**107**	**22**	**317**	**181**	**90**	**68**
1995-96	**268**	**90**	**62**	**146**	**156**	**26**	**219**	**22**	**229**	**453**	**242**	**220**

Table 17. Enterococci concentrations (per 100 ml) at all sites: 1993-96.

DRY	9-EXT	GB80	5-LMP	GB15	5-OYS	GB50	5-BLM	GB2	7-CCH	GB21	5-SFR	GB22
8/24/93	9	9	10	9	9	9	10	9	70	10	10	9
9/7/93	20	9	20	9	10	9	60	10	50	9	10	9
10/5/93	9	10	9	50	20	9	9	10	80	40	9	20
12/20/93	9	40	50	40	10	9	9	10	20	50	10	30
4/19/94	10		20	9	9	9	10	9	9	10	9	10
5/3/94	4	8	9	0.5	50	14	12	14	5	10	3	10
6/22/94	20	1	11.5	9	50	0.8	14	3	39	3	3	10
7/26/94	20	70	10	50	50	9	20	9	40	40	9	9
8/30/94		9		9		9		9		9		9
10/24/94	30	9	20	30	70	9	20	9	20	80	20	10
11/8/94	9	9	9	20	50	9	30	20	20	20	20	9
3/21/95	30	10	10		10	9	30	9	10	20	9	20
4/18/95	9	9	9	9	9	9	10	9	9	30	9	9
5/2/95	9	9	9	9	20	9	9	9	30	9	9	9
6/6/95	9	9	9	10	9	9	9	9	50	10	40	9
10/17/95	95	10	20	37	110	0.5	118	16.5	58	23	90	38
4/9/96	5	8	4	4	17.5	2.5	4	27.5	17	27	12	2
5/7/96	4.5	18	1.5	6.5	4	3.5	0.5	1.5	36	24.5	4.5	9
6/4/96	7	13.5	1.5	26.5	11.5	8.5	18	48.5	65	54	22	9
Geo.Ave.	**12**	**10**	**10**	**12**	**19**	**6**	**13**	**10**	**27**	**19**	**11**	**11**
1993-94	**10**	**8**	**15**	**9**	**17**	**7**	**13**	**9**	**27**	**13**	**7**	**13**
1994-95	**14**	**12**	**10**	**16**	**22**	**9**	**16**	**10**	**22**	**20**	**14**	**10**
1995-96	**11**	**12**	**4**	**13**	**17**	**2**	**8**	**13**	**39**	**30**	**18**	**9**
WET	9-EXT	GB80	5-LMP	GB15	5-OYS	GB50	5-BLM	GB2	7-CCH	GB21	5-SFR	GB22
9/9/93	100	92	80	60	28	72	10	74	85	52.5	8.5	68.5
9/27/93	80	30	17.5	4180	262	0.8	10	98	268	14	8	24
11/2/93	250	20	70	90	390	100	270	60	60	20	110	40
11/18/93	233	400	84	200	1930	70	700	240	120	265	13.5	190
12/6/93	505		403	350	1020	196	240	260	210	345	52	265
5/17/94	80	20	9	20	170	90	70	60	20	10	20	30
5/26/94	16	135	3	112.5	102	59	43.5	17	37	124	30.5	16
6/13/94	7.5	5	155	60	75	10	22	19	90	257.5	46	60
6/14/94	60	9	9	40	110	240	20	50	130	9	70	20
8/22/94	79	77	23	86	245	17	33	32	50	50	25	28
9/26/94	150	400	230	190	260	40	80	40	260	140	190	350
11/1/94	46	85	17	660	11	4	550	21	39	550	6	38
11/2/94	258	48		440	1745	69	257	96	279	301	145	121
4/13/95				116					100			
4/14/95	18	8	8	6	30	10	12	8	5	24	15	18
5/12/95	5	8	2	8	124	1	20	12	50	28	8	10
5/16/95	24	15	1	16	132	30	75	46	35	68	20	24
5/17/95	27	18	6	28	48	9	18	5	20	32	32	14
9/18/95	2160	10	331	14	625	4	400	2	392	6	145	22
9/19/95	234	0	97	2	144	1	110	2	165	3	13	5
11/2/95	240	580	105	1035	150	42	128	375	135	485	58	36
11/3/95	380	590	380	420	1020	960	345	260	2580	595	148	222
5/17/96	55	37	2	15	50	32	61	34	30	111	32	18
5/18/96	62	33	7	10	126	15	24	20	31	54	20	20
6/23/96	31	24	13	23	59	3	34	1	81	147	87	32
6/24/96	27	8	33	5	15	2	139	1	53	49	112	25
Geo.Ave.	**77**	**32**	**26**	**60**	**148**	**19**	**69**	**26**	**82**	**64**	**35**	**37**
1993-94	**80**	**36**	**37**	**127**	**210**	**46**	**57**	**67**	**87**	**54**	**28**	**50**
1994-95	**41**	**35**	**10**	**61**	**113**	**11**	**57**	**22**	**51**	**80**	**27**	**36**
1995-96	**137**	**27**	**41**	**26**	**129**	**12**	**104**	**11**	**131**	**62**	**56**	**27**

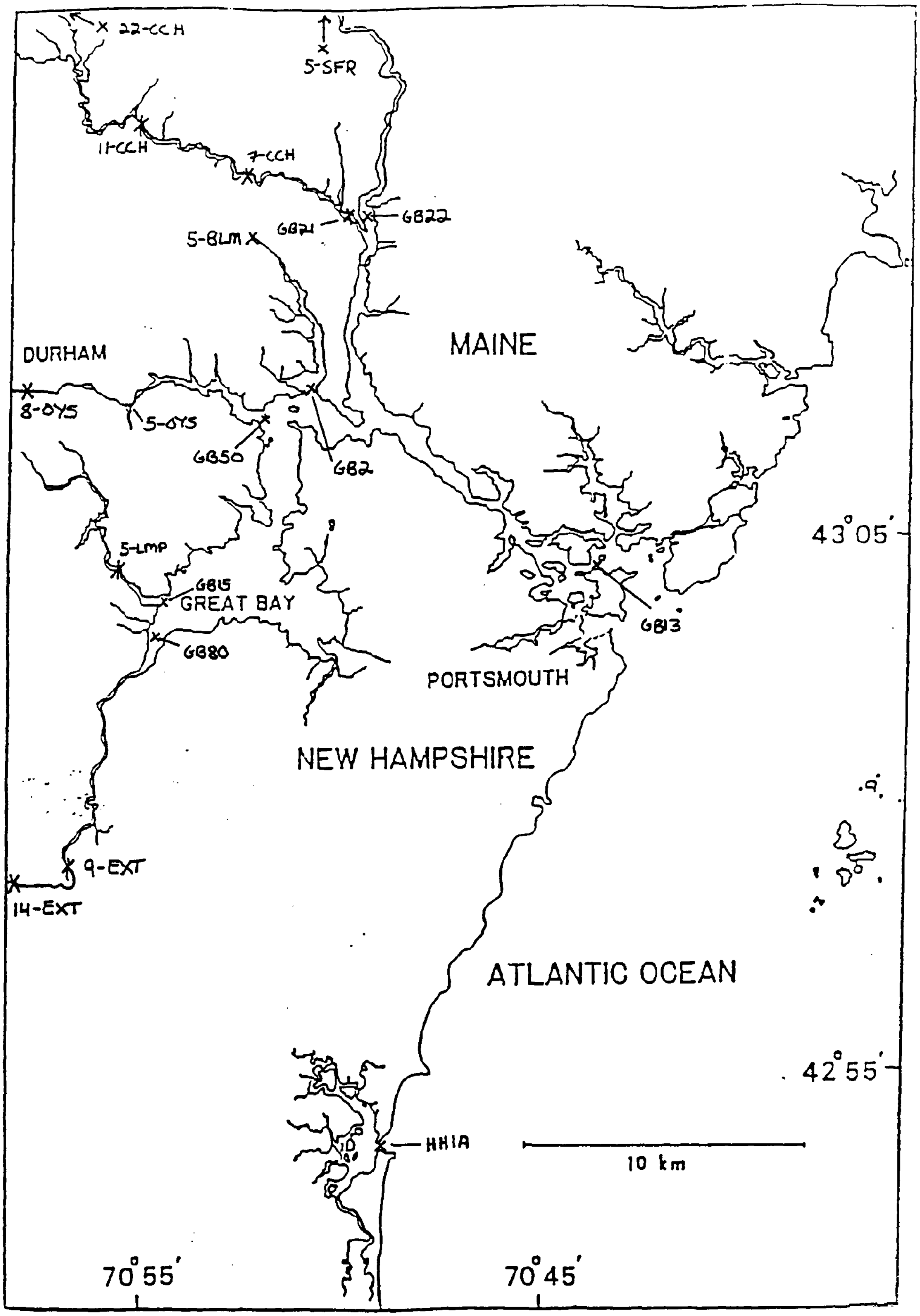

Figure 1. A map of the Great Bay Estuary and its tributaries showing freshwater and tidal sampling sites for the 1993-1994, 1994-1995 and 1995-1996 NPS studies

Figure 2. Mean percent oxygen saturation in 1995-1996 dry weather vs storms

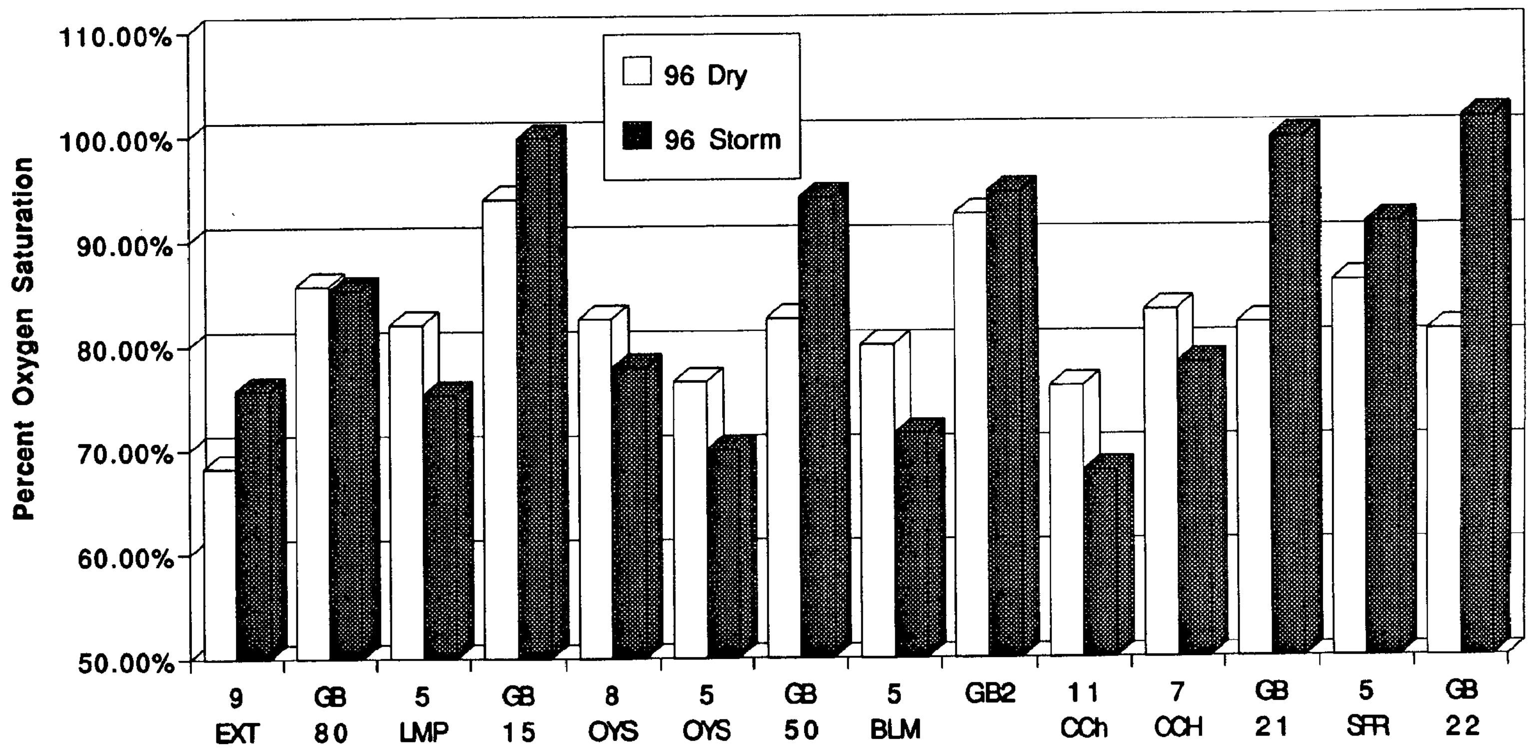

Figure 3. Mean TSS concentration in 1995-1996 dry weather vs storms

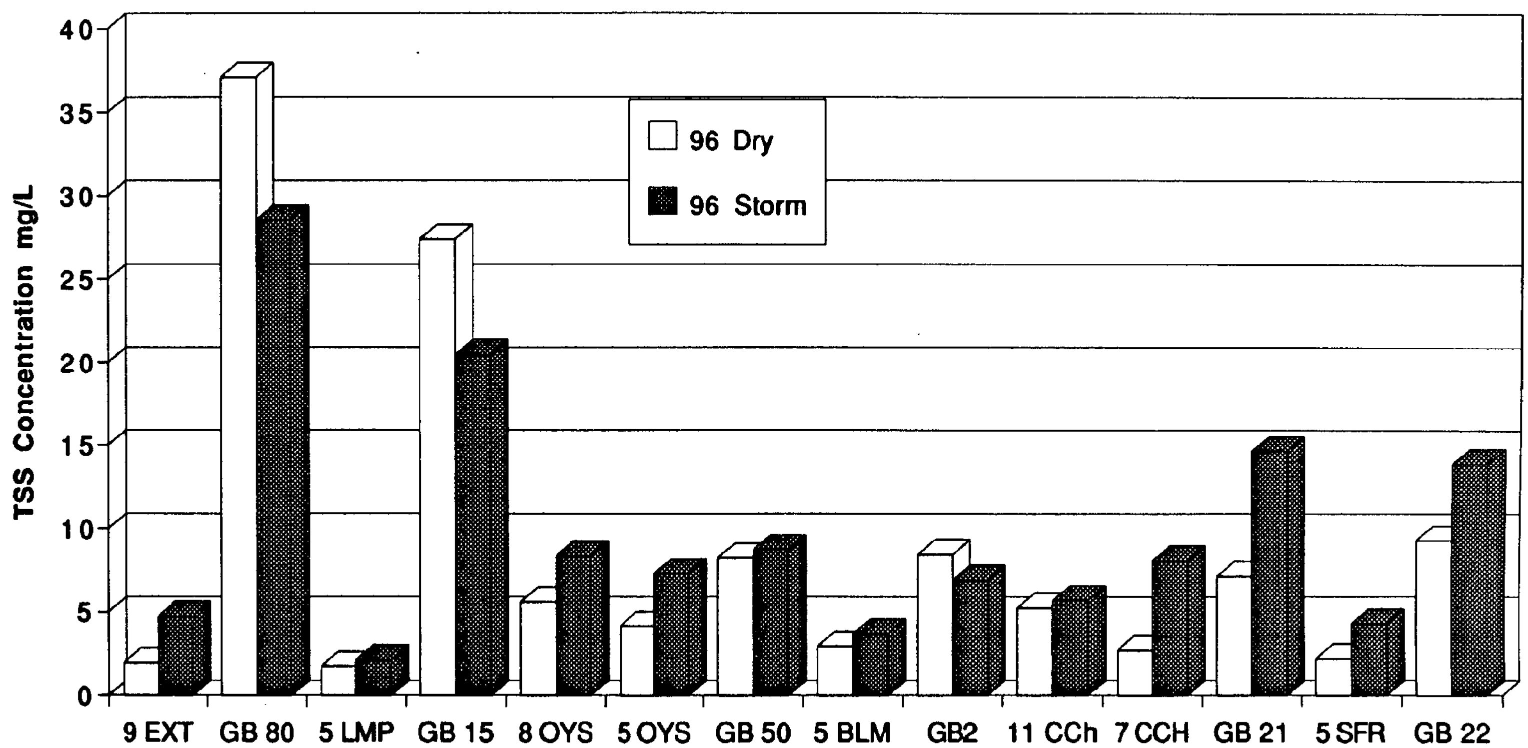

Figure 4. Mean suspended particulate organic material in 1995-1996 dry weather vs storms

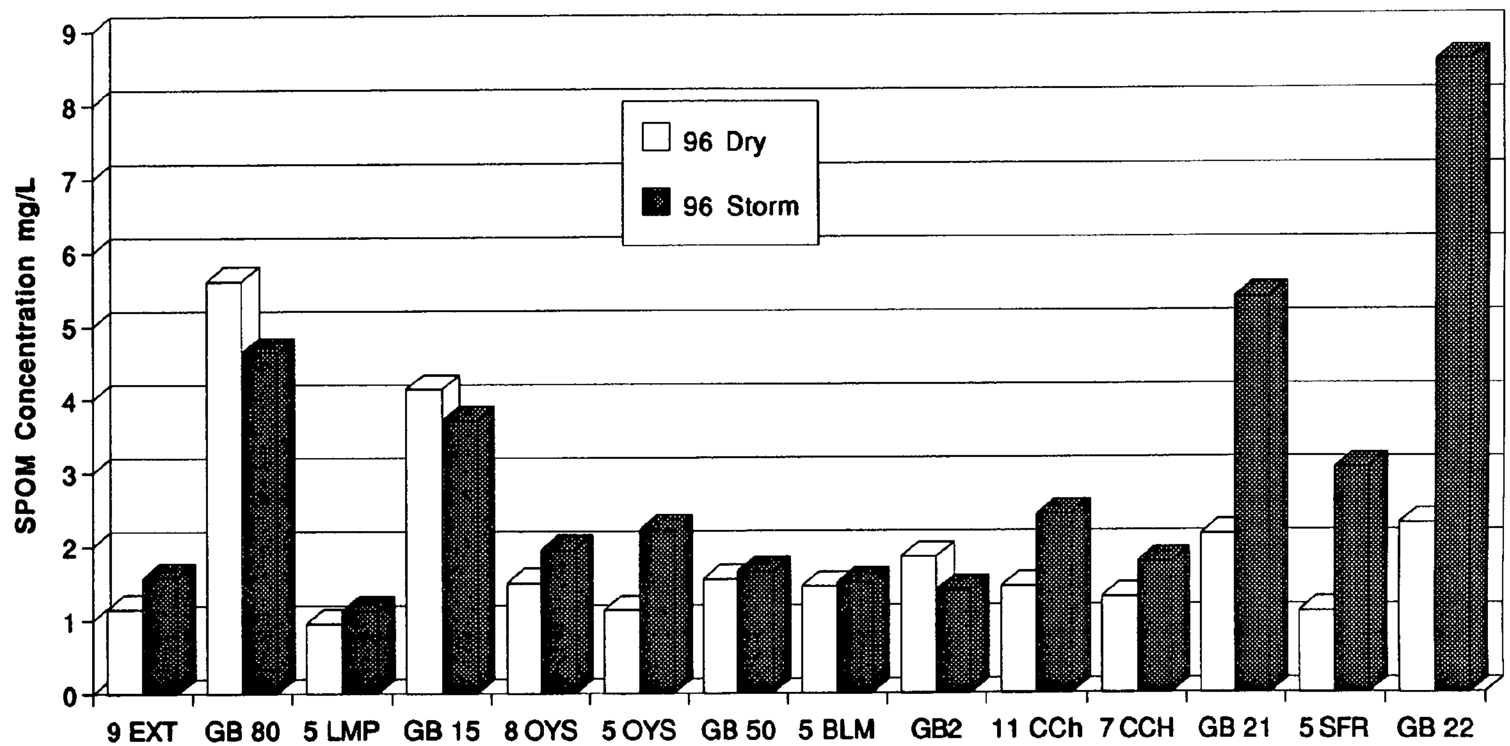

Figure 5. Mean chlorophyll a concentration in 1995-1996 dry weather vs storm

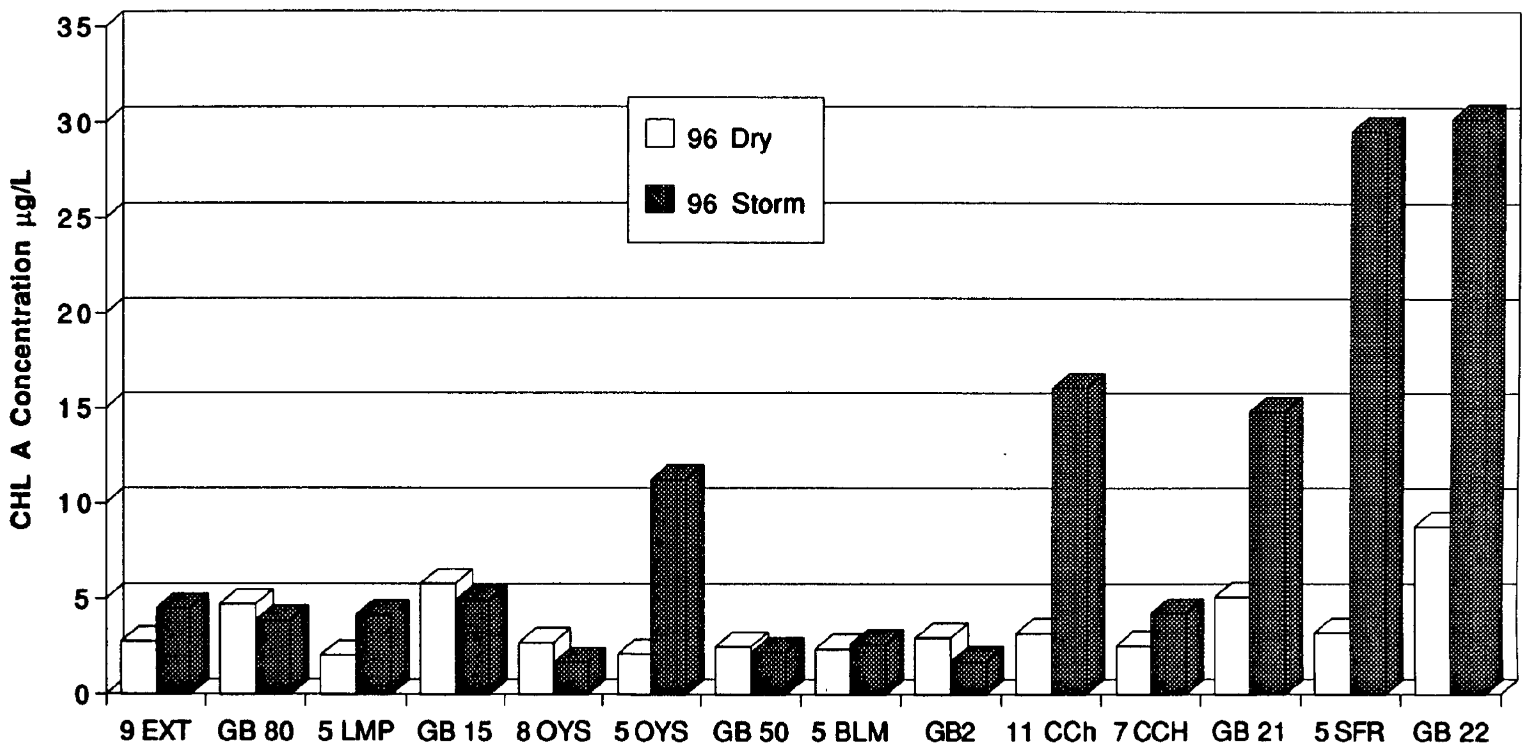

FIGURE 6. Mean NH4 Concentration in 1995-1996 dry weather vs storm

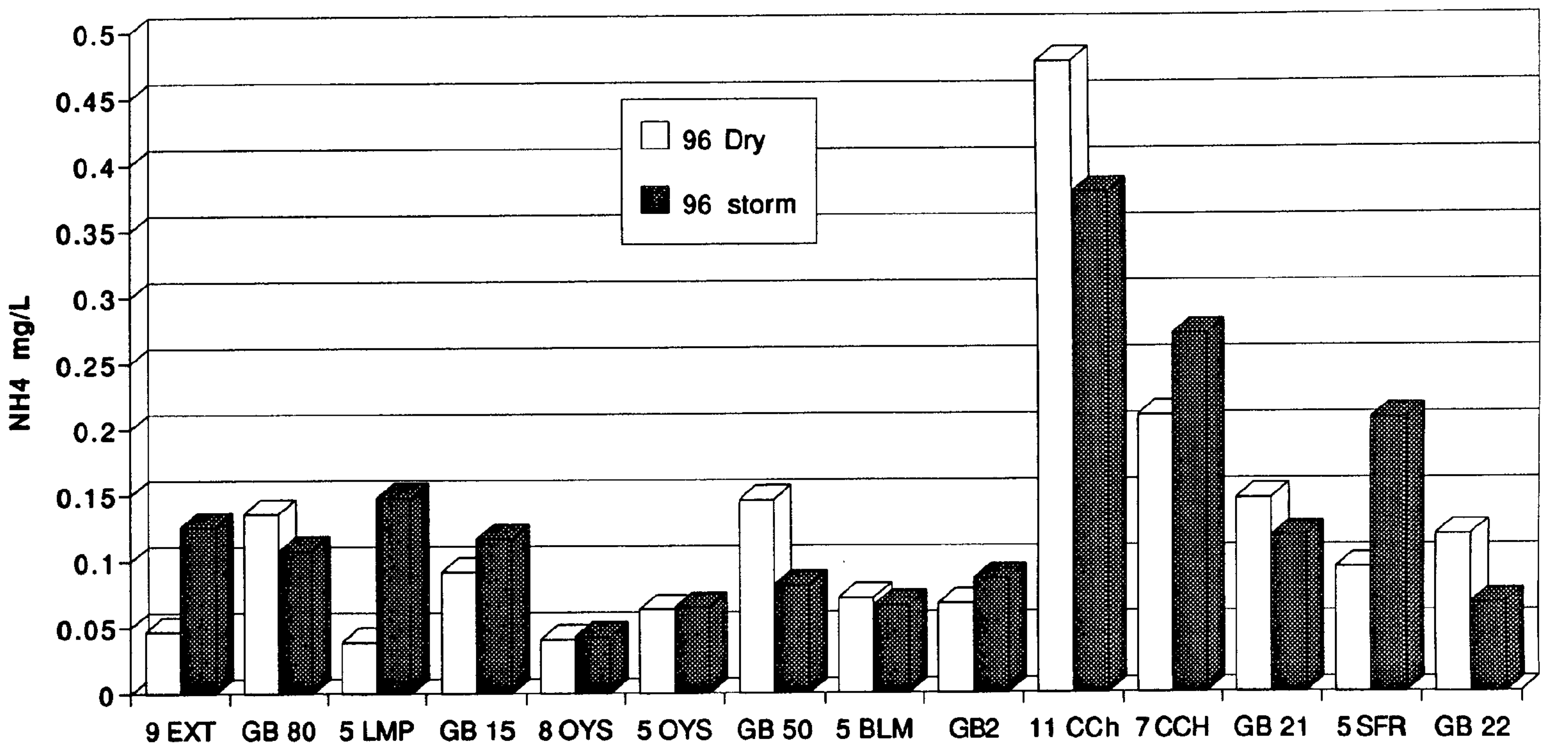

Figure 7. NO3 Concentration in 1995-1996 dry weather vs storm

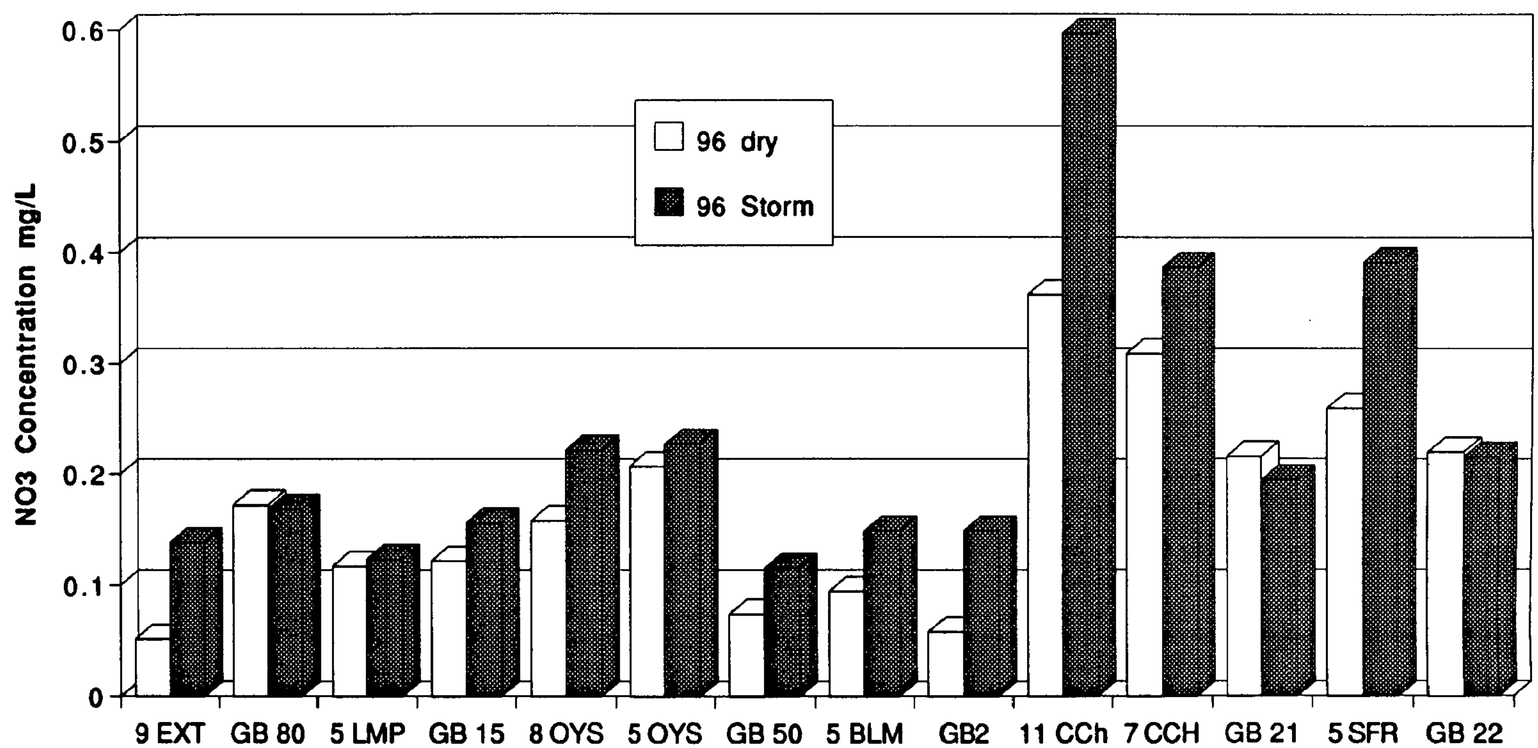

Figure 8. Dissolved inorganic nitrogen in 1995-1996 dry weather vs storm

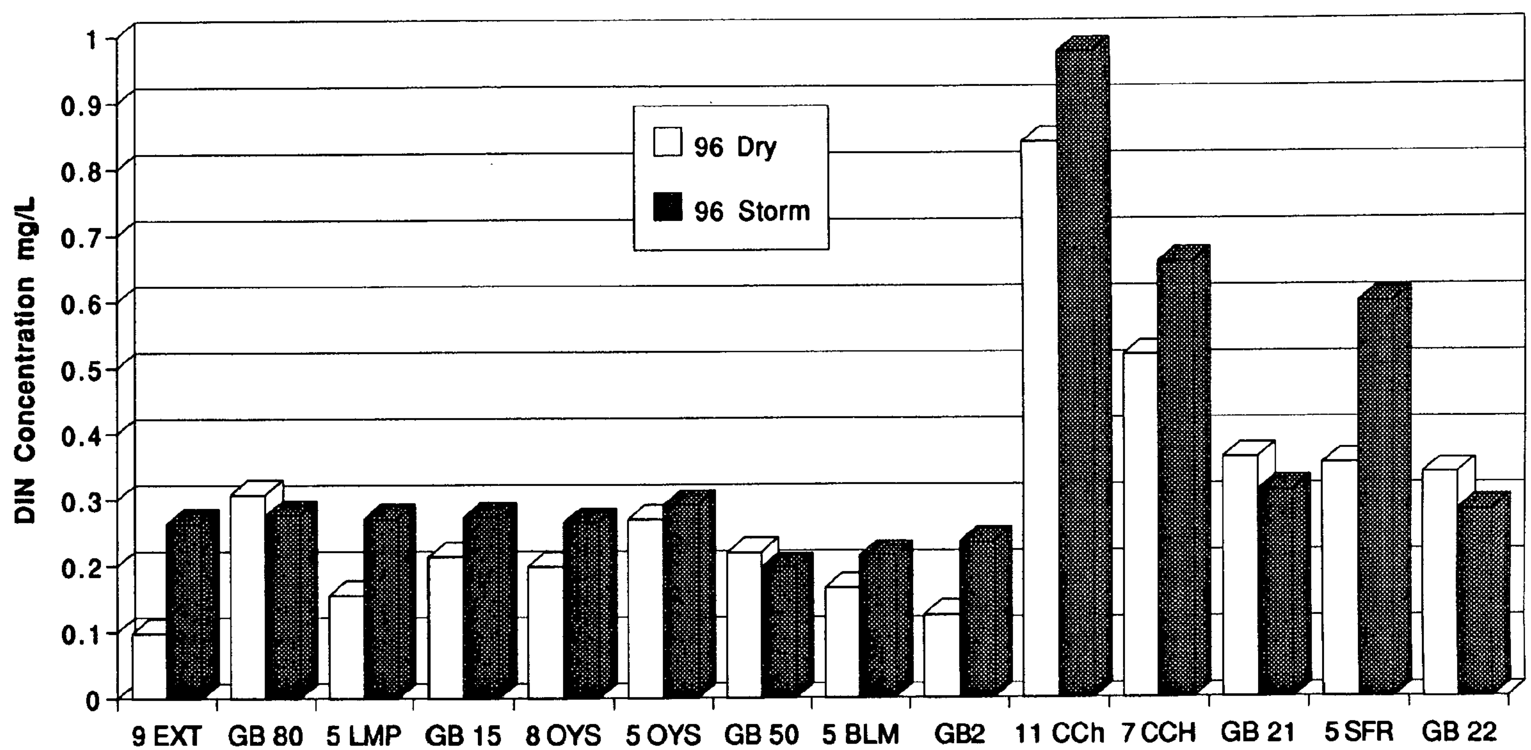

Figure 9. Mean dissolved organic nitrogen in 1995-1996 dry weather vs storm

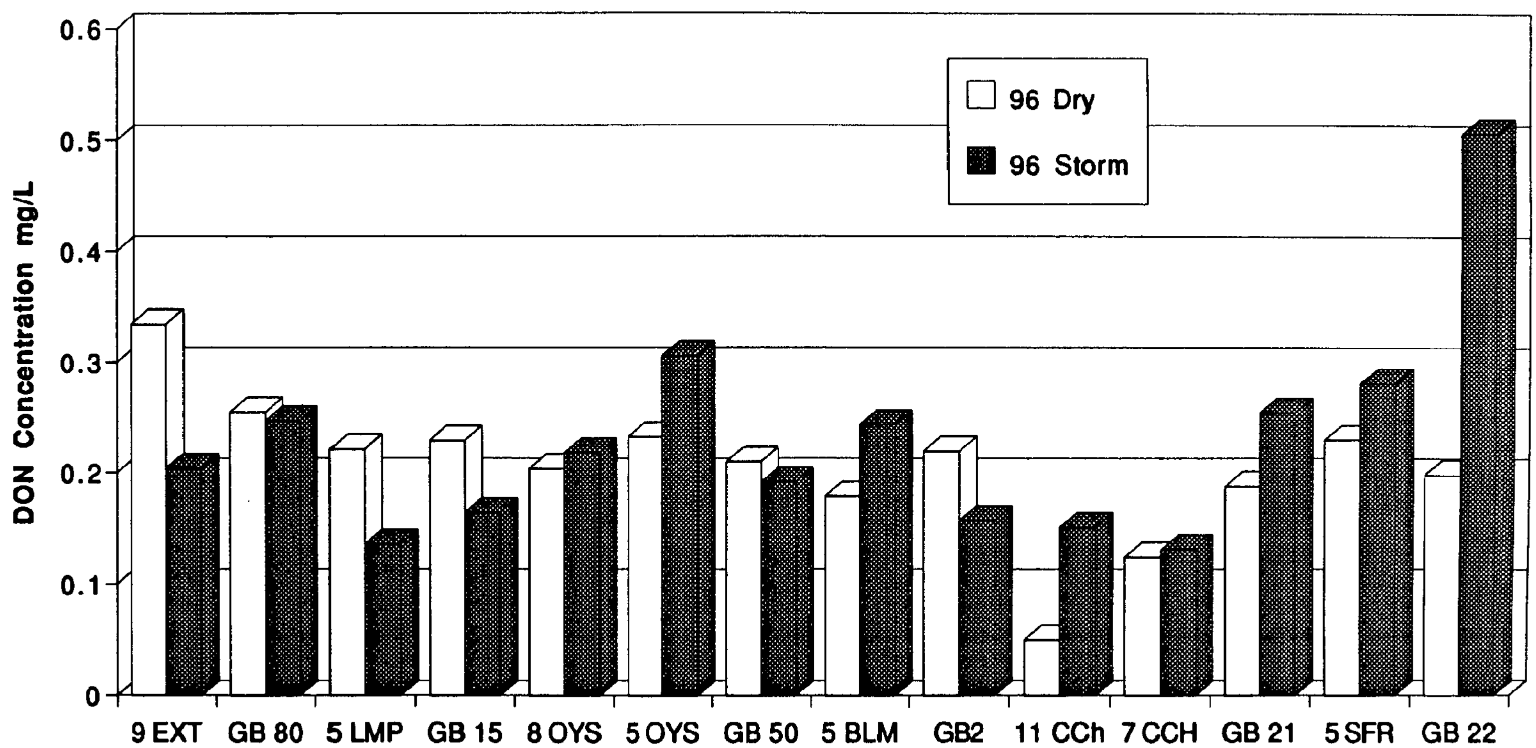

Figure 10. Mean total dissolved nitrogen in 1995-1996 dry weather vs storms

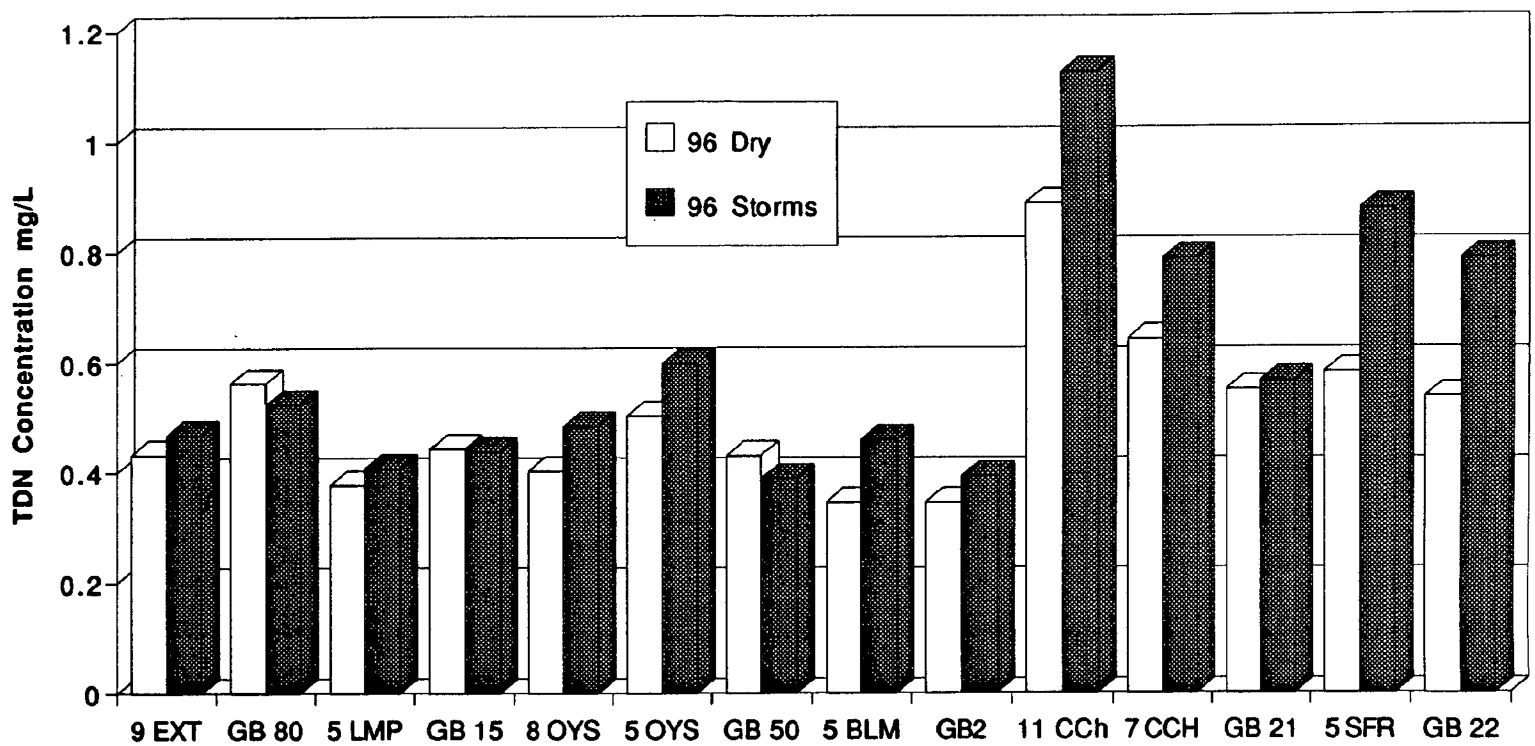

Figure 11. Mean PO4 concentration in 1995-1996 dry weather vs storms

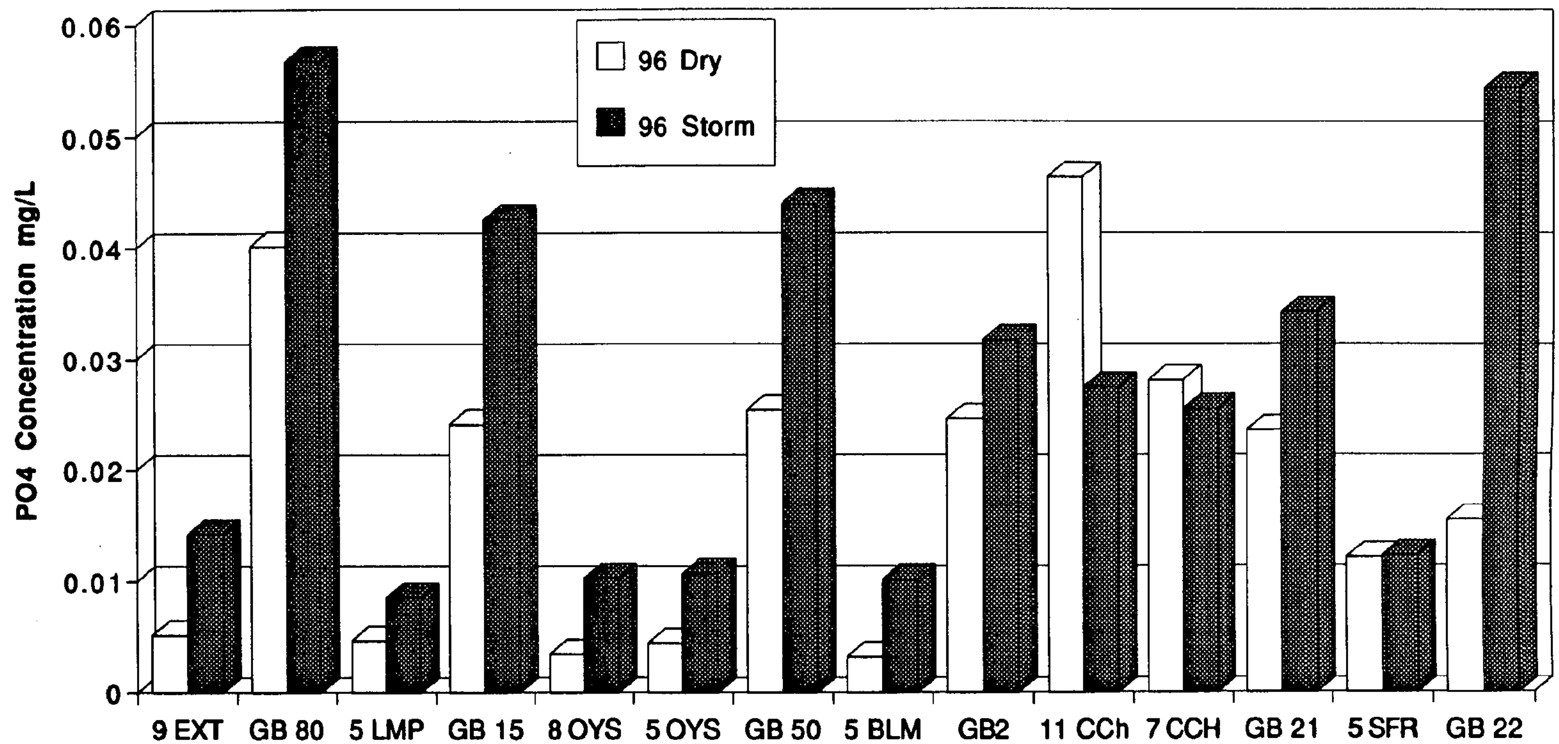

Figure 12. Interannual comparison of mean NH4 concentrations for dry and storm data combined

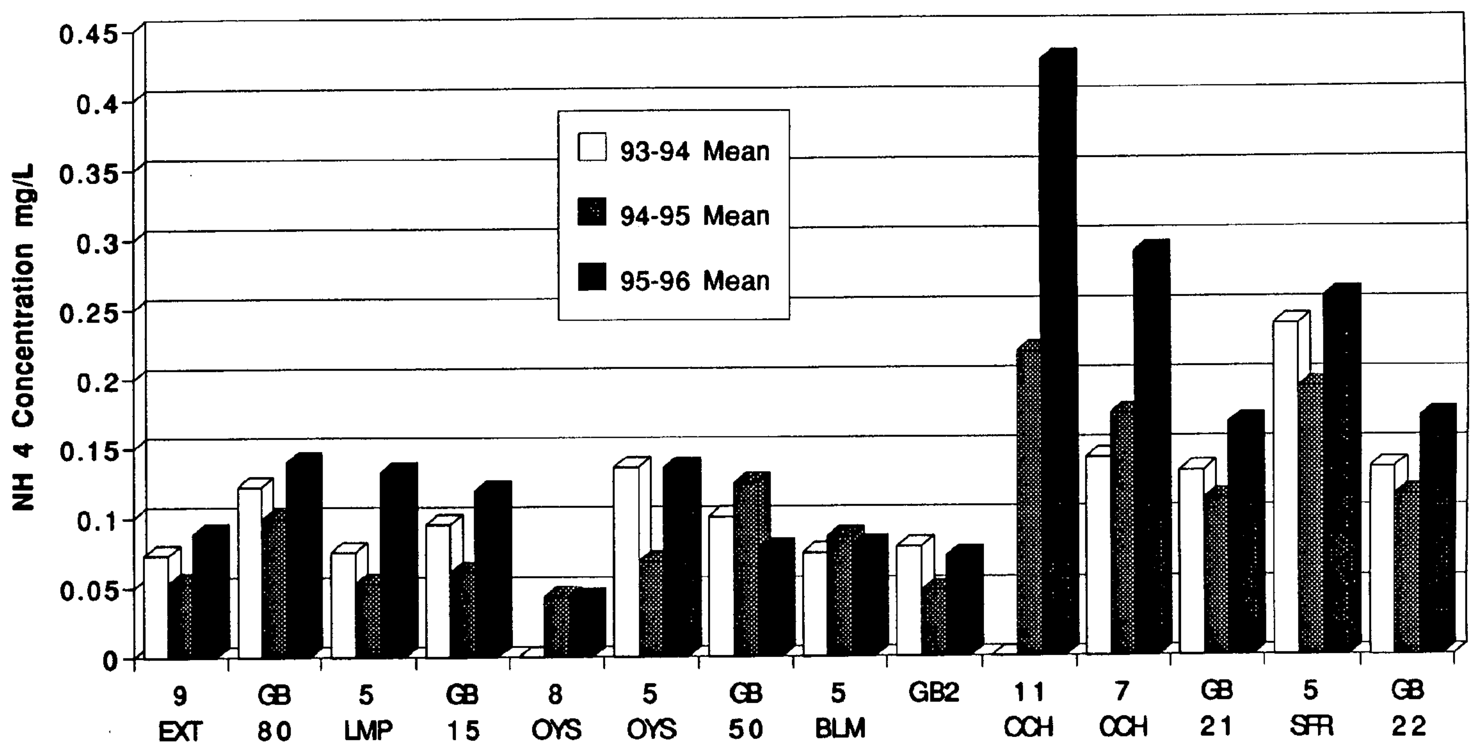

Figure 13. Interannual comparison of mean NO3 concentration for dry and storm samples combined

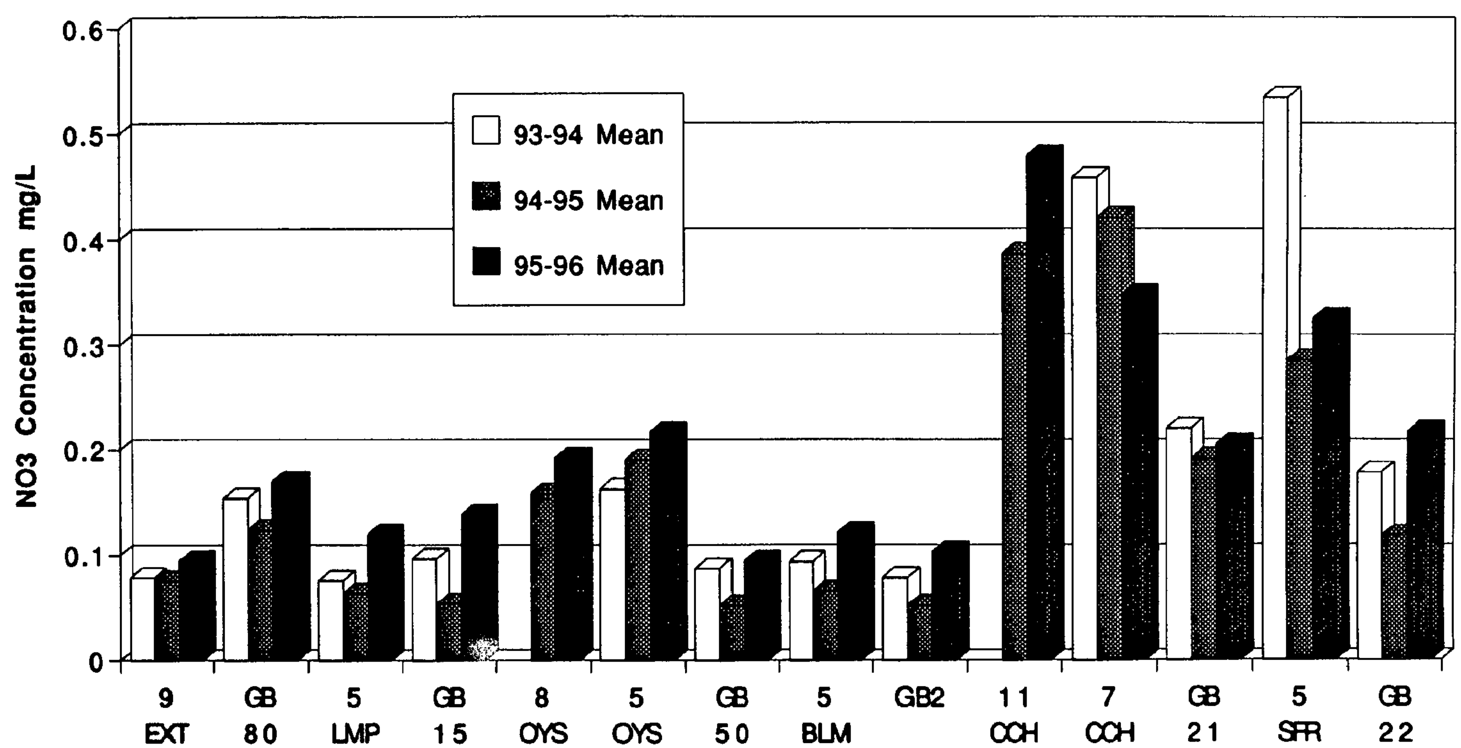

Figure 14. Interannual comparison of mean PO4 concentration in dry and storm samples combined

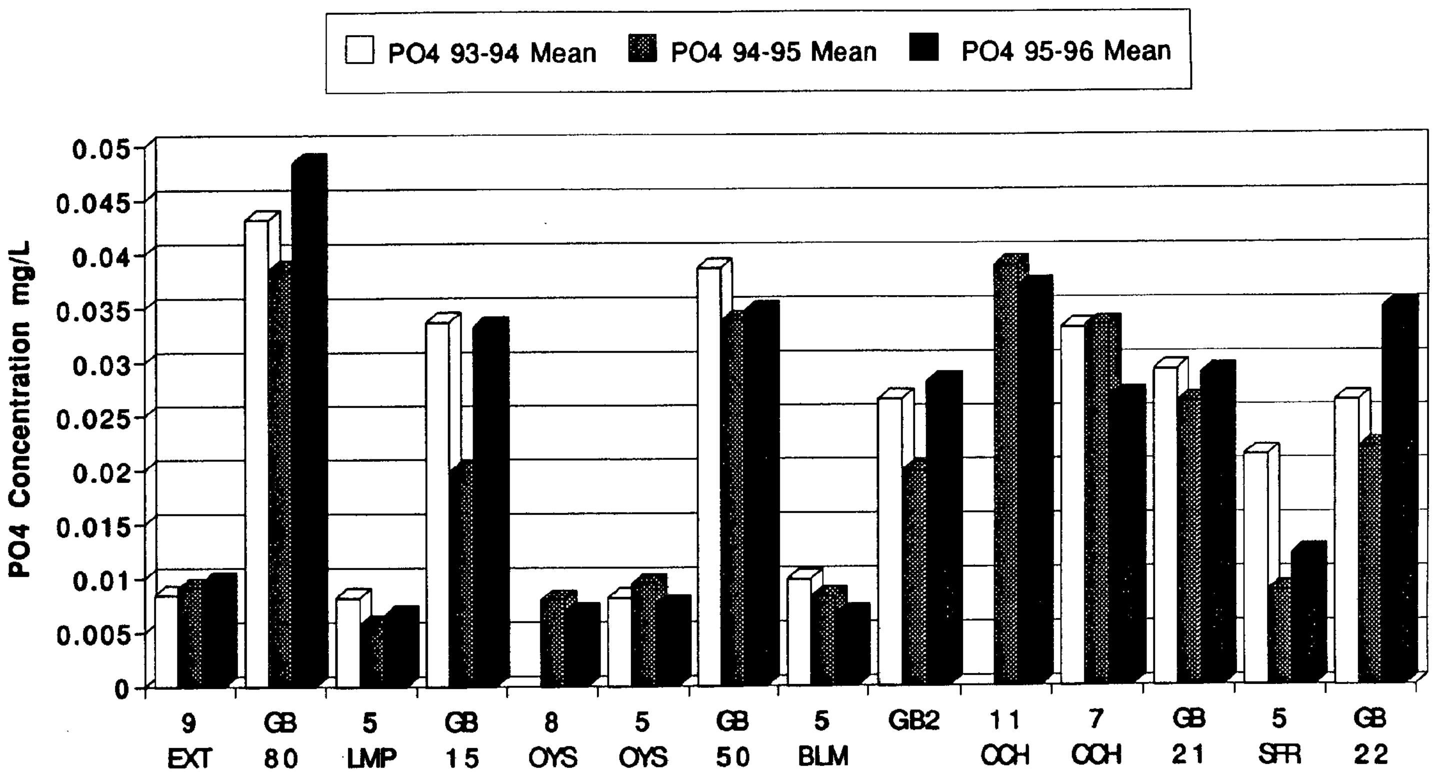

Figure 15. Interannual comparison of mean TSS concentration in dry and storm samples combined

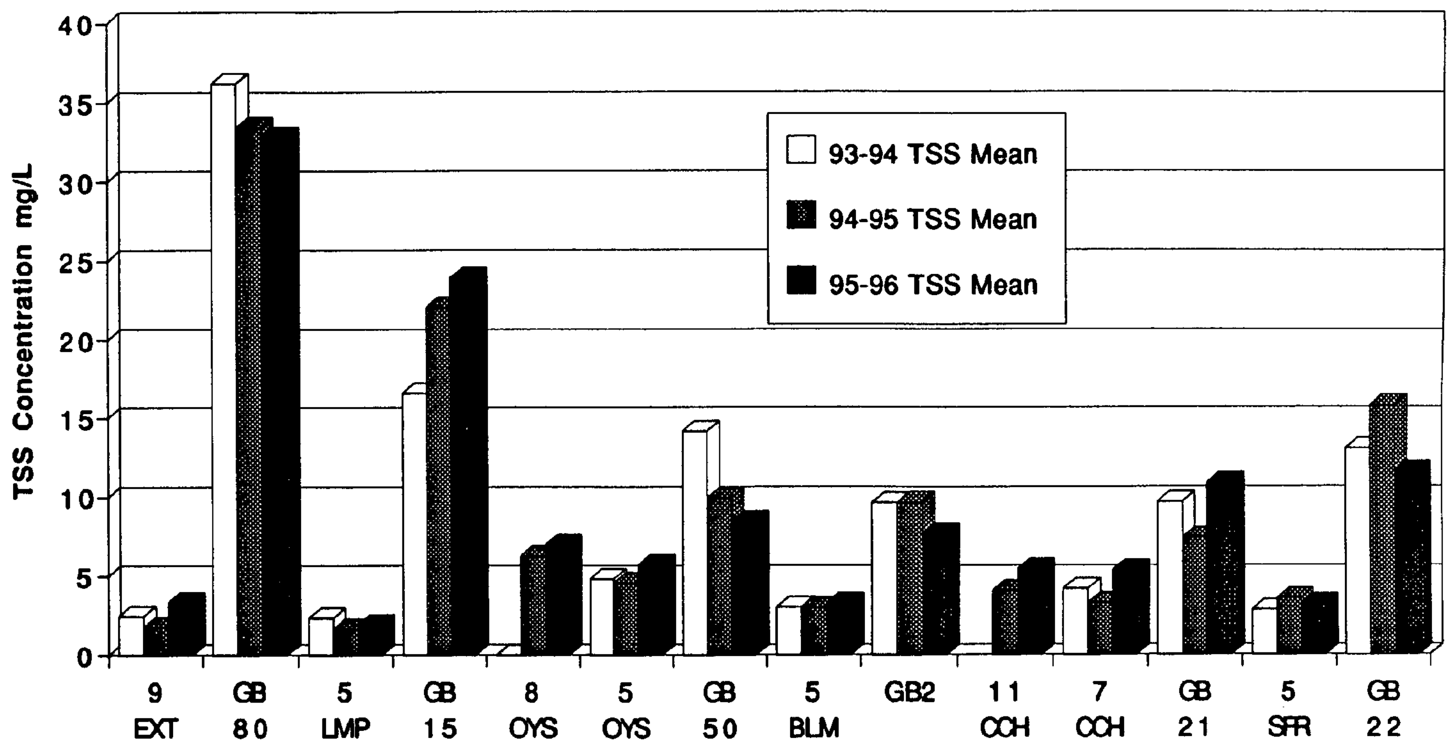

Figure 16. Interannual comparison of mean dissolved organic nitrogen in dry and storm samples combined

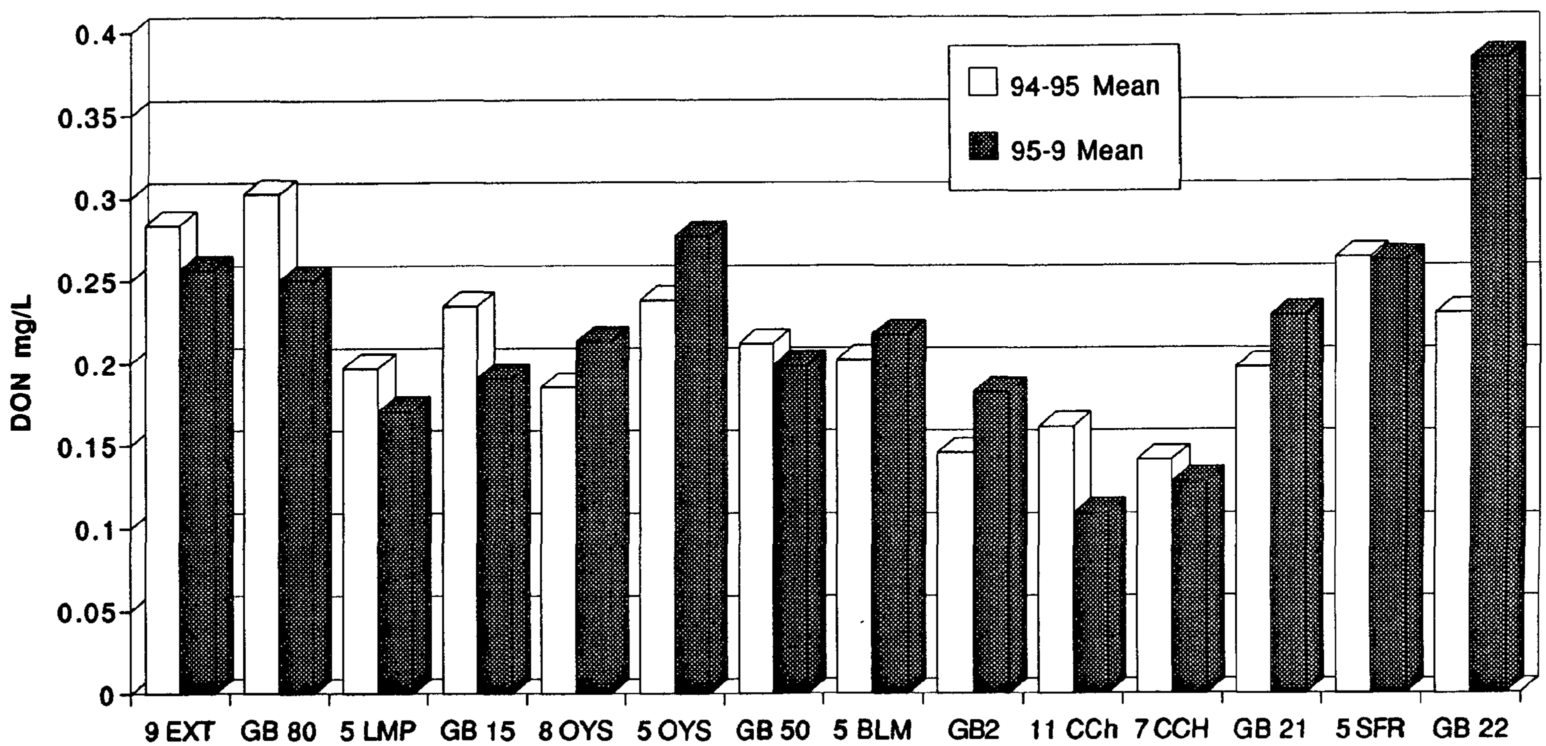

Figure 17. Interannual comparison of mean percent oxygen saturation for dry and storm samples combined

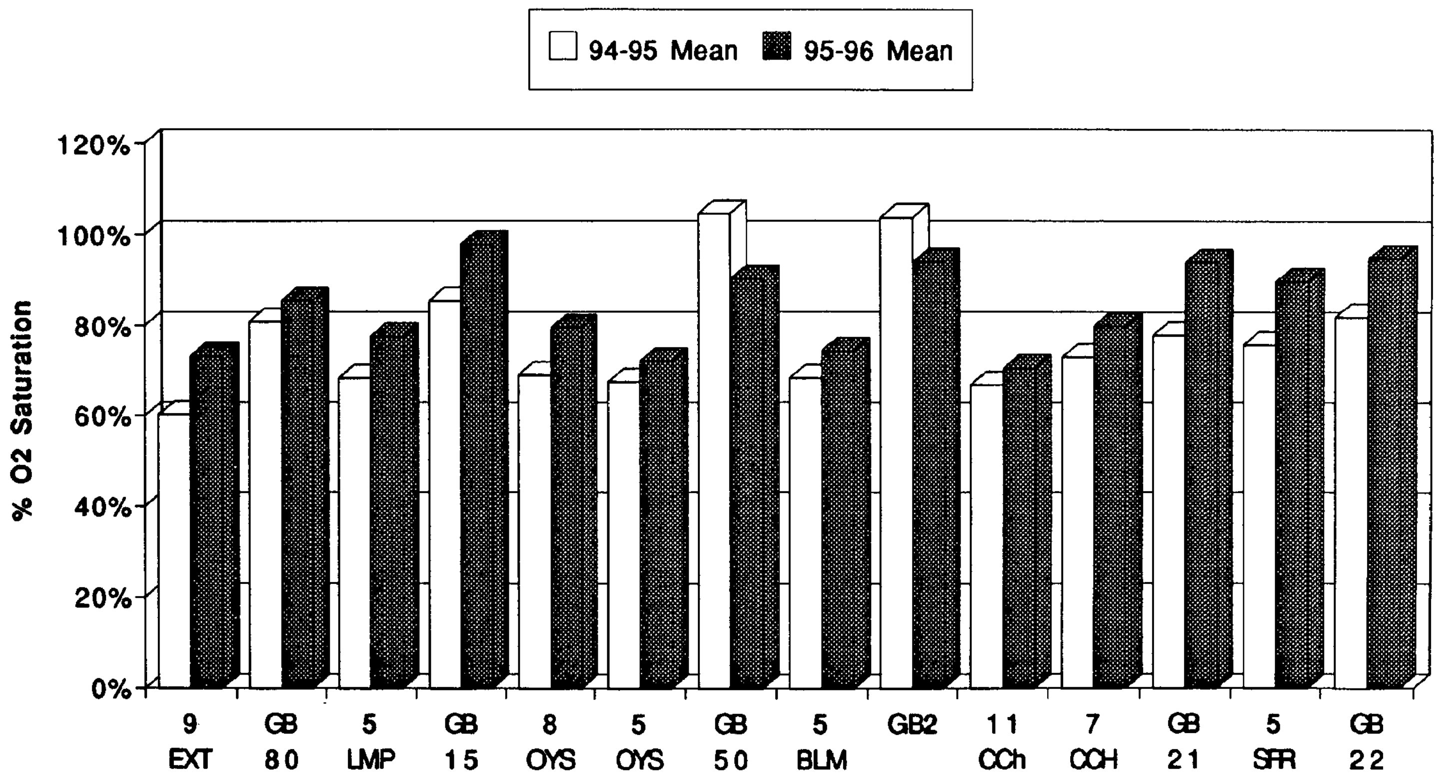

Figure 18. Comparison of mean NH4 concentration in dry vs storm samples for the cumulative database

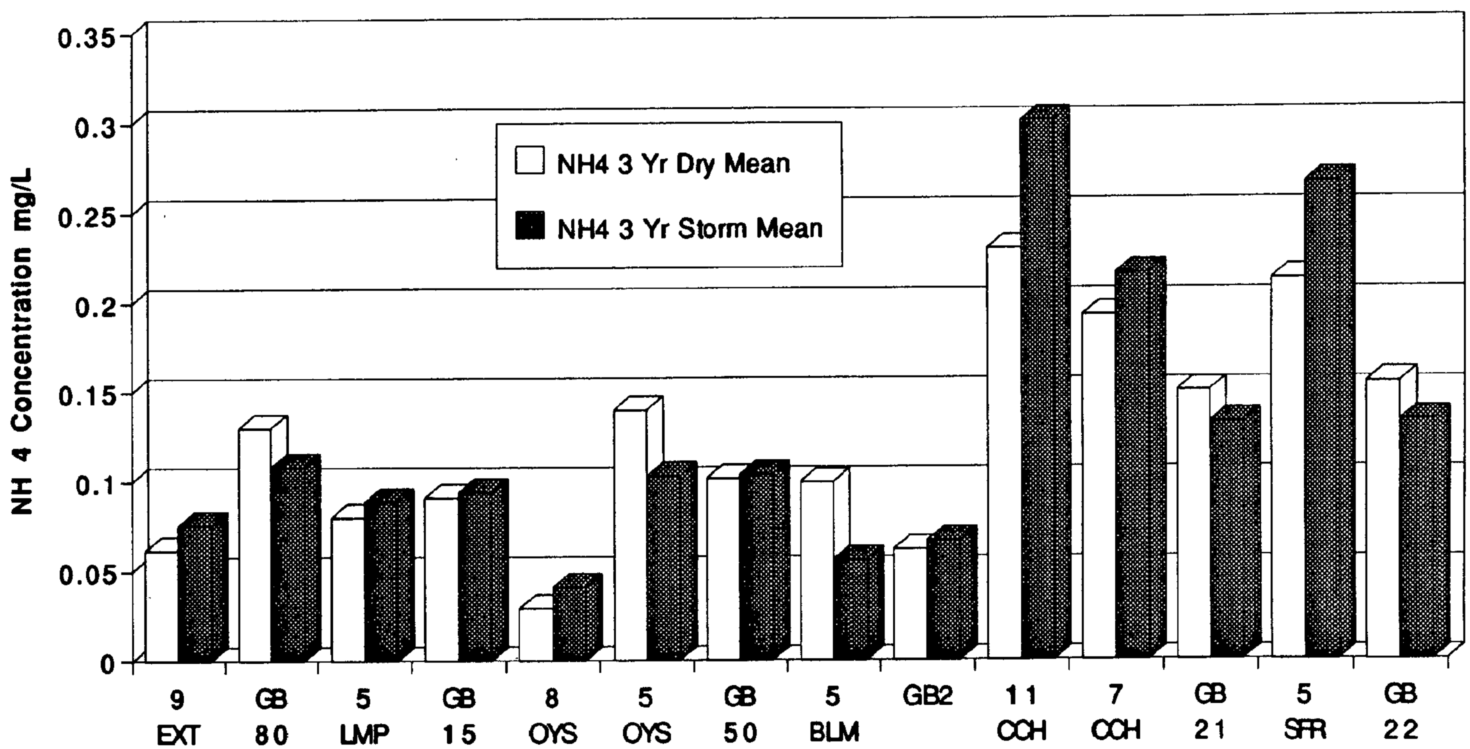

Figure 19. Comparison of mean NO3 concentration in dry vs storm samples for the cumulative database

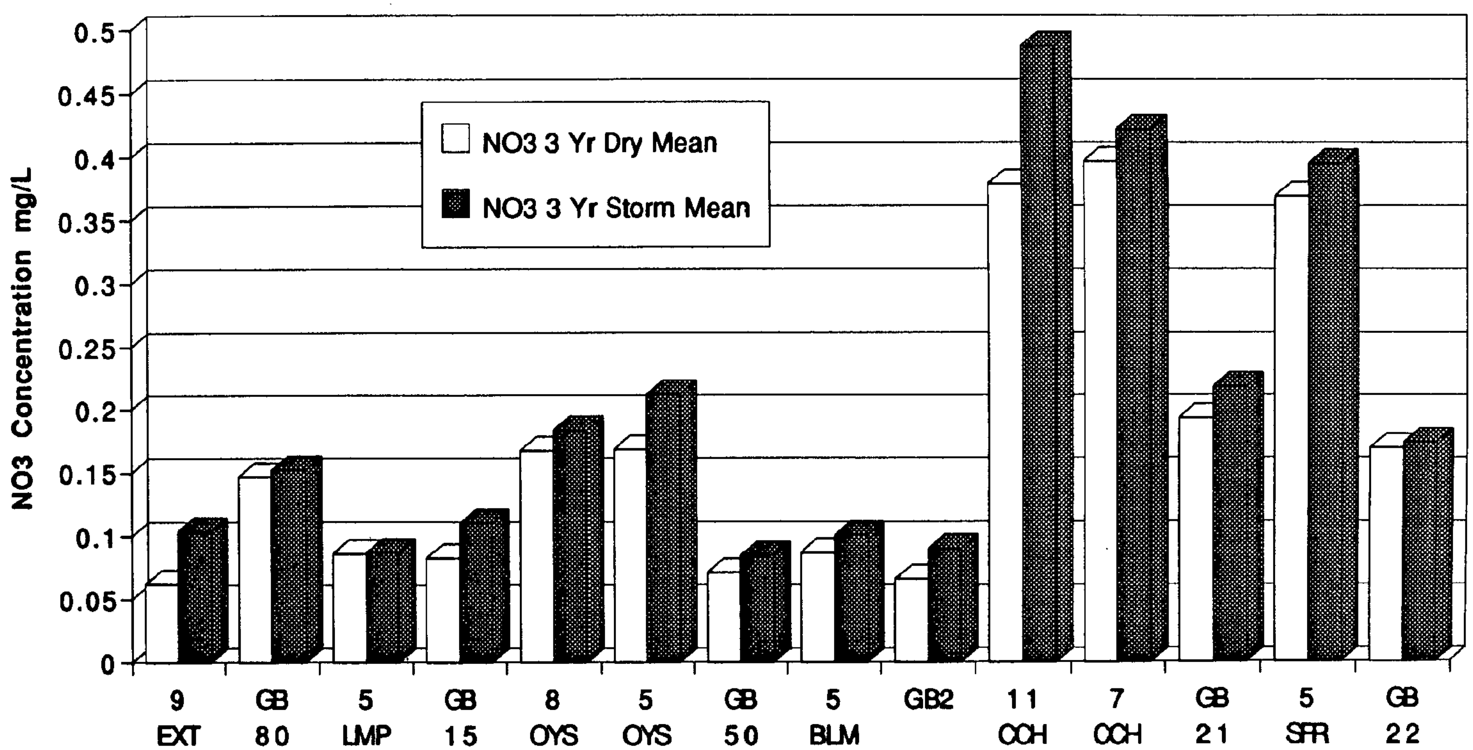

Figure 20. Comparison of the mean PO4 concentration in dry vs storm samples for the cumulative database

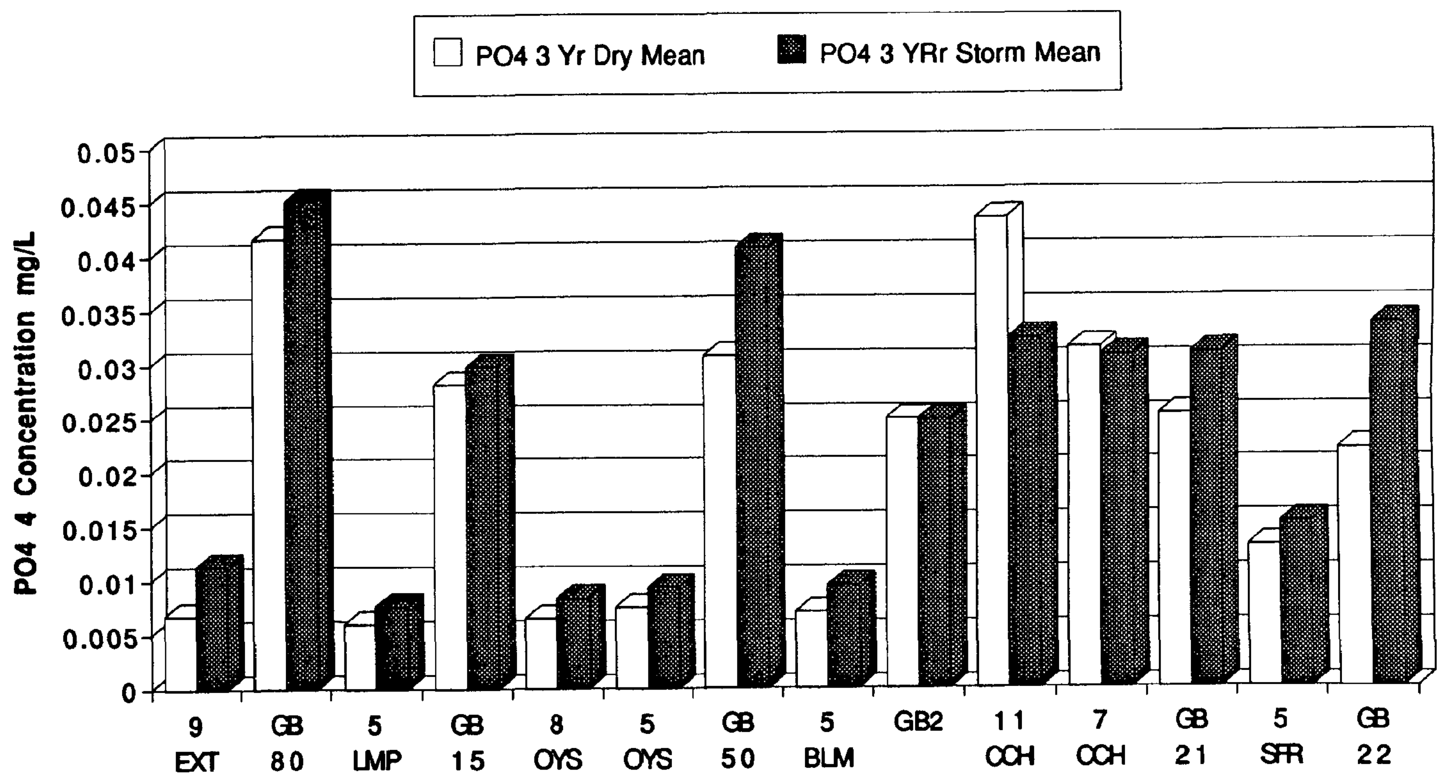

Figure 21. Comparison of the mean TSS concentration in dry vs storm samples for the cumulative database

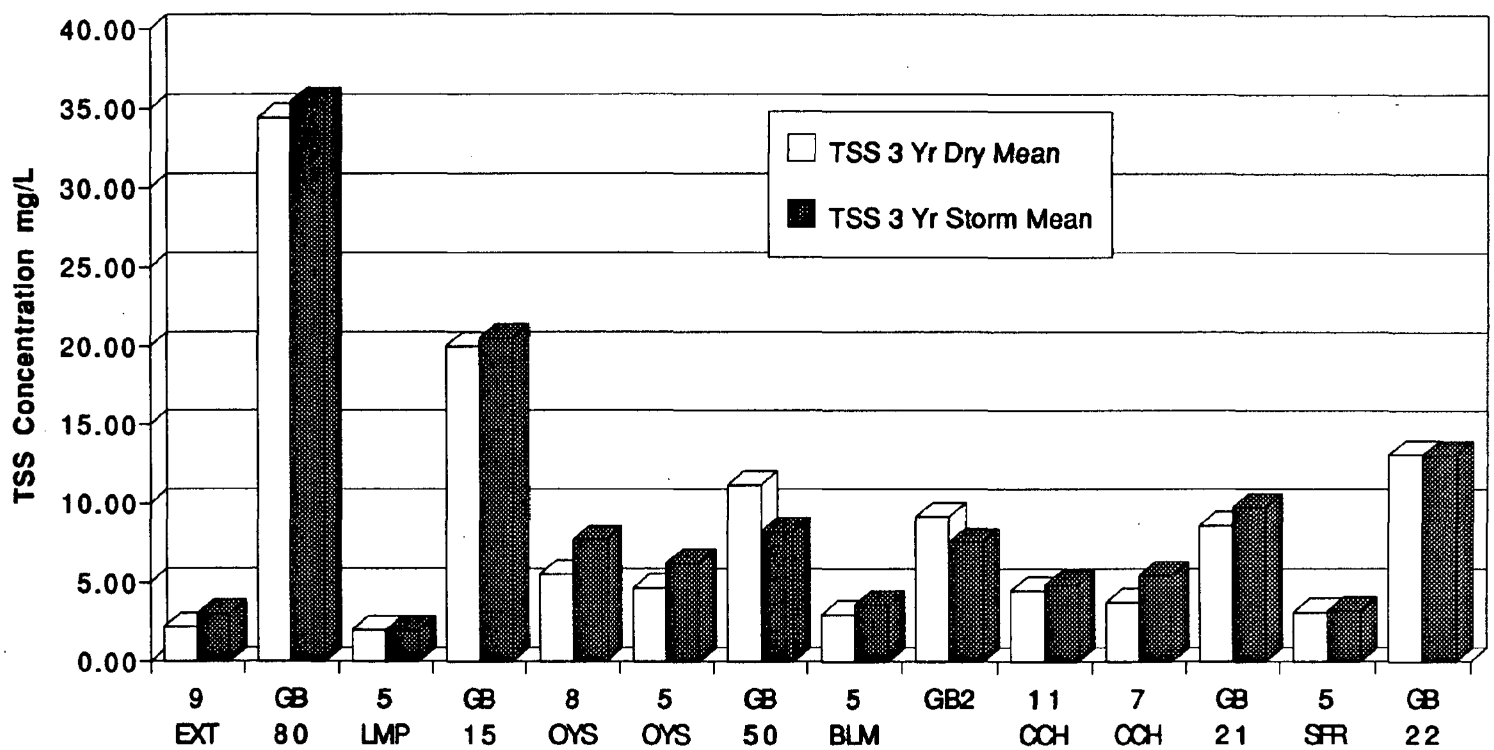

Figure 23. Comparison of meanpercent oxygen saturation for dry vs storm samples for the cumulative database

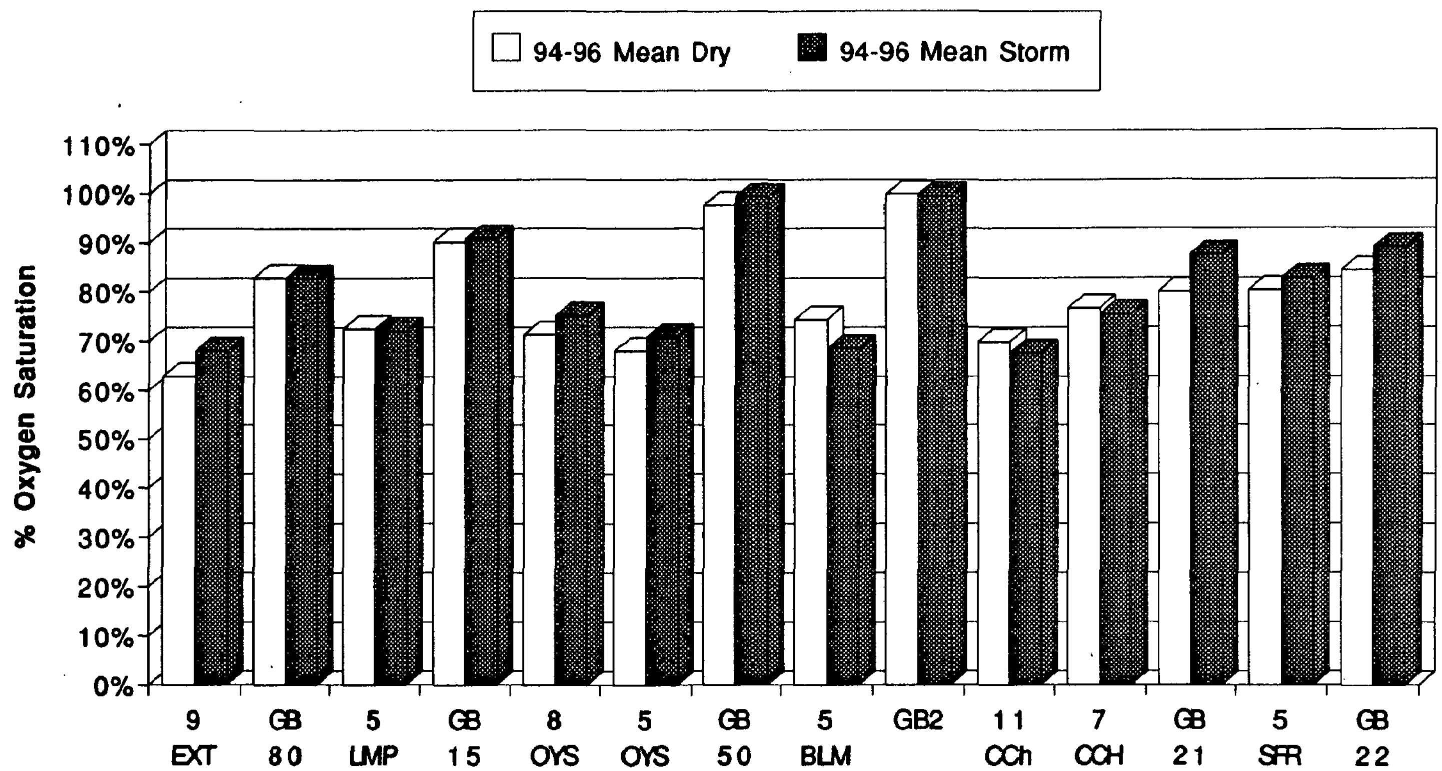

Figure 24. The relationship of TSS, SPOM and CHL a during the 9/18/95 storm sampling date

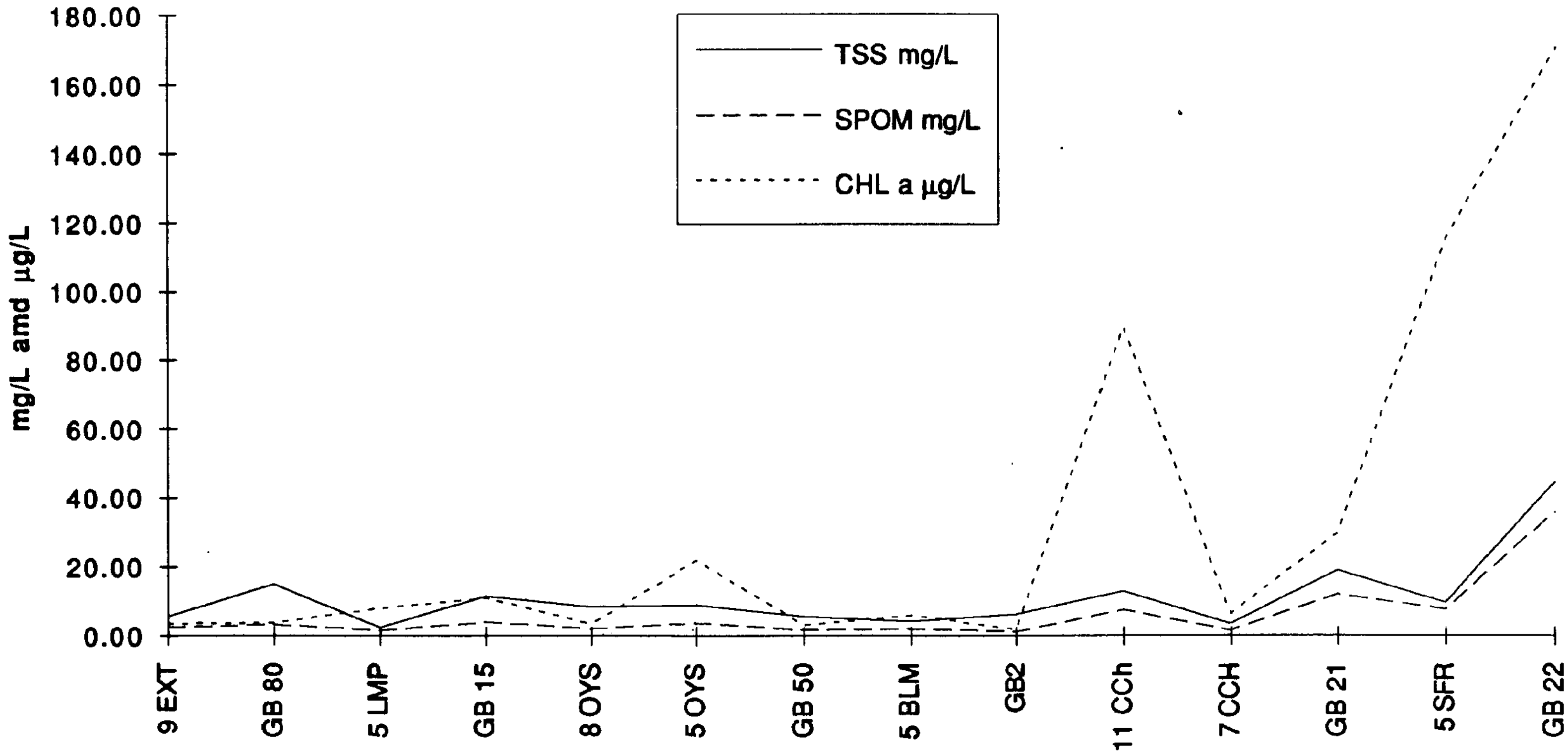

Figure 25. The relationship of TSS, SPOM and CHL a during the 9/19/96 storm sampling date

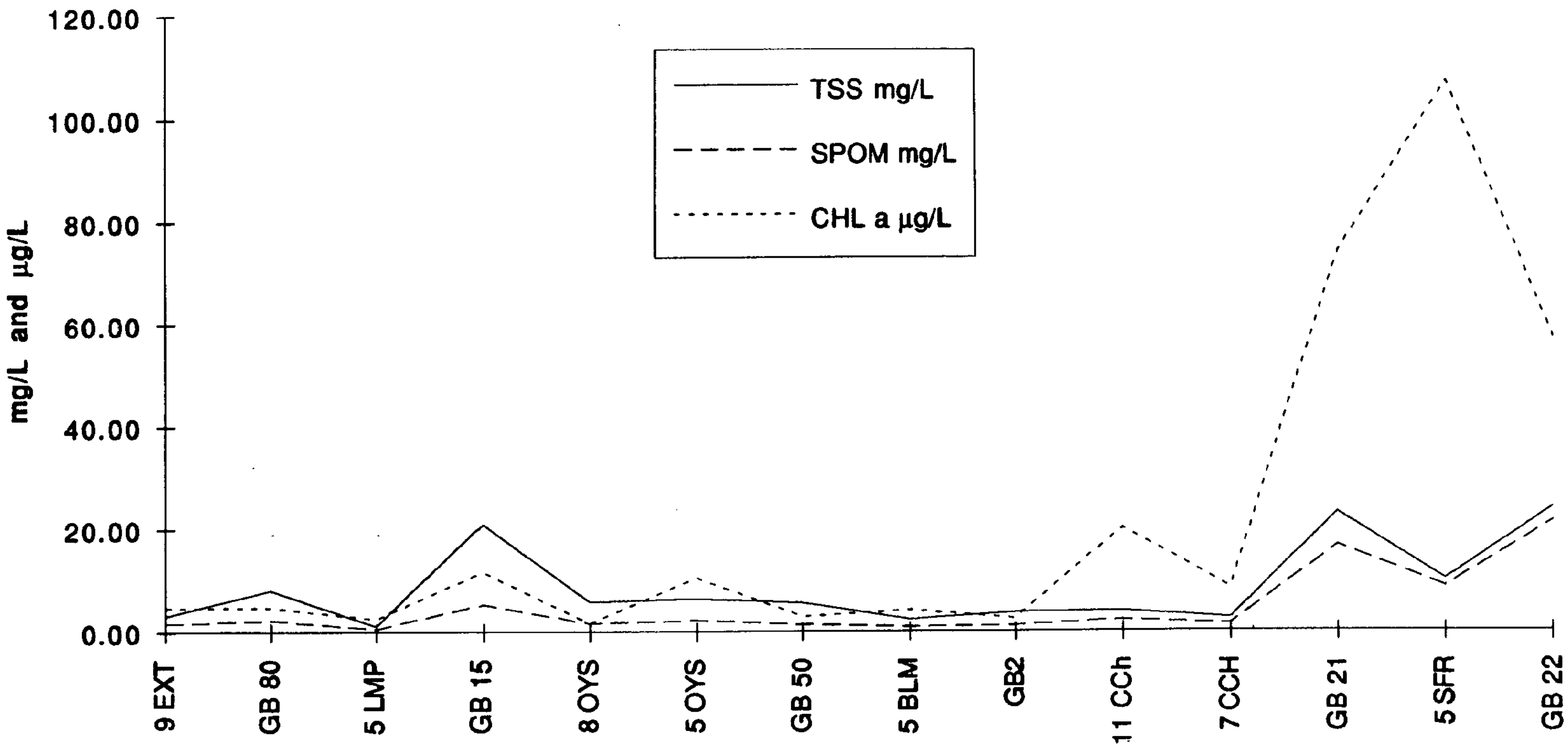

Figure 26. Comparison of mean TSS, Chlorophyll a and suspended particulate organic material for storm samples 1995-1996

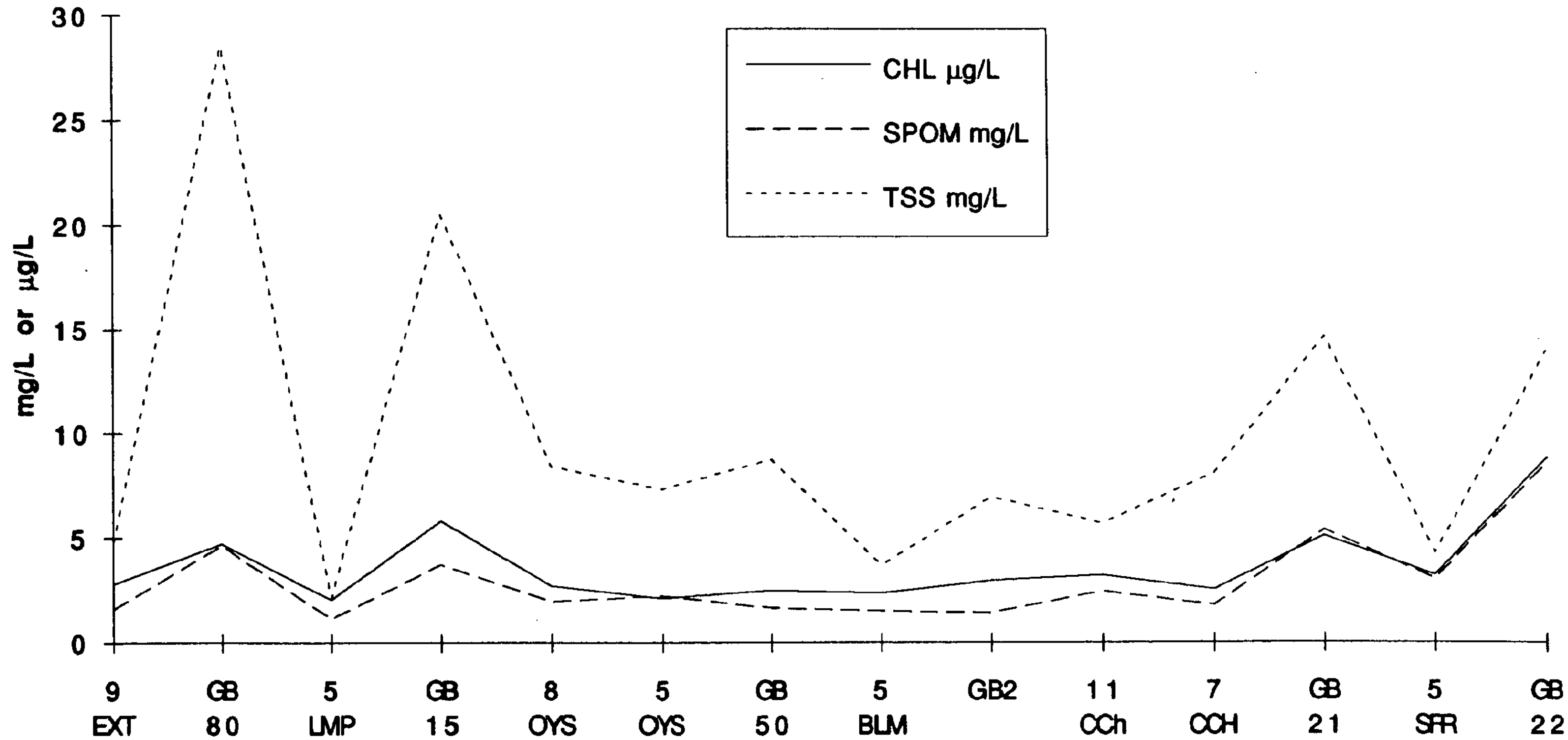

Figure 27a. Geometric mean fecal coliform concentrations under wet and dry conditions in tributaries to Great Bay Estuary: 1995-96.

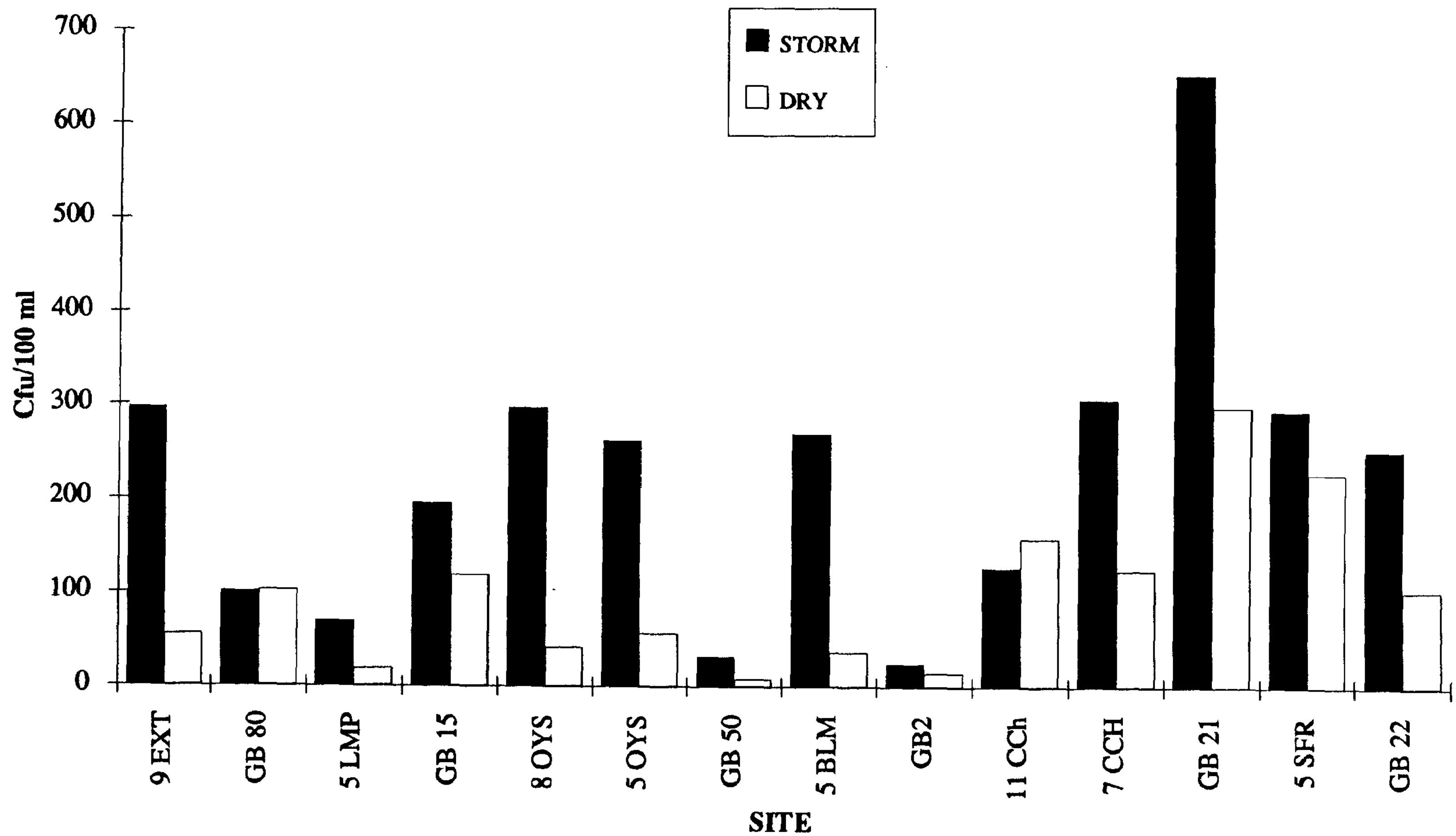

Figure 27b. Geometric mean E. coli concentrations under wet and dry conditions in tributaries to Great Bay Estuary: 1995-96.

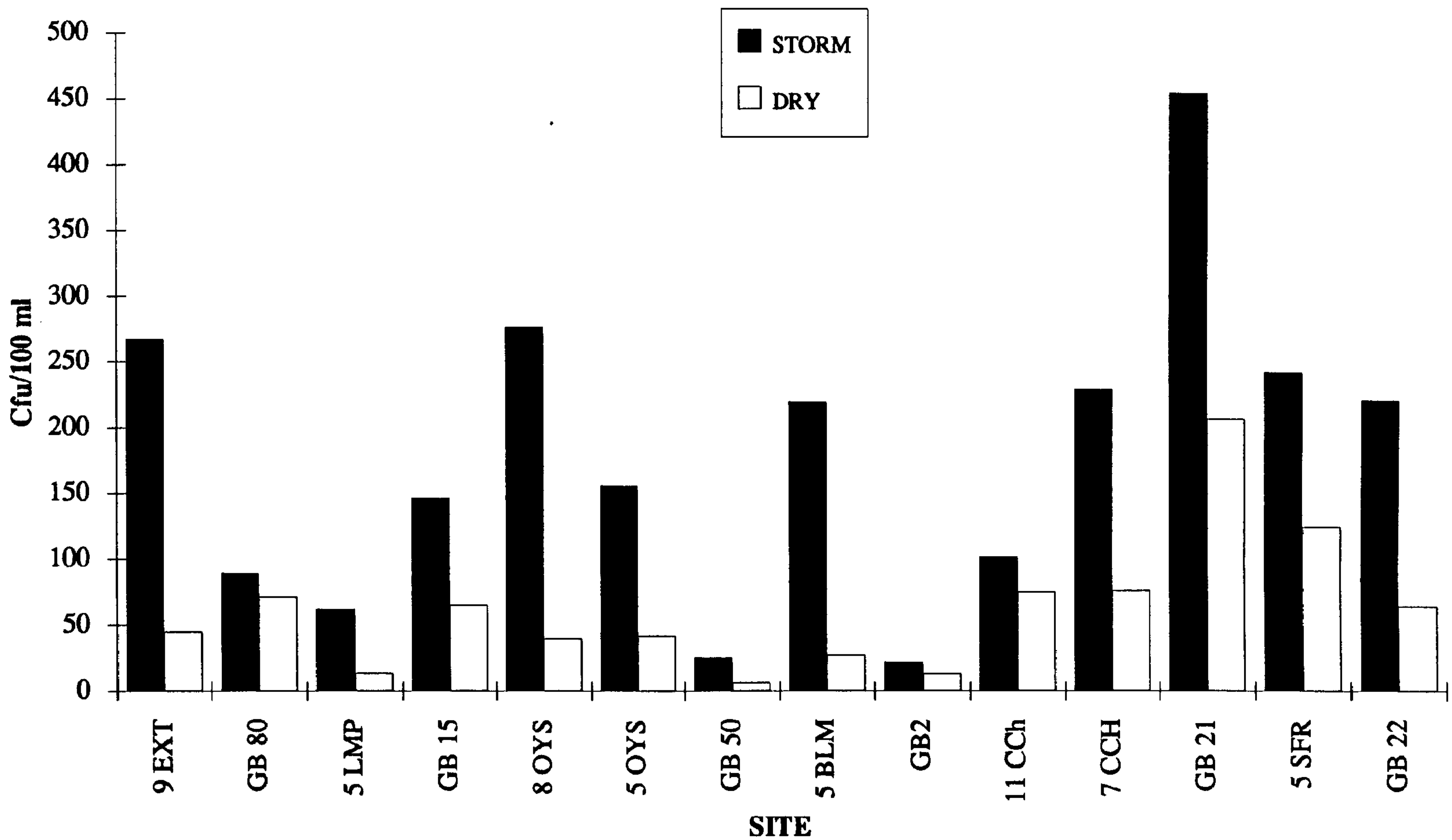

Figure 27c. Geometric mean enterococci concentrations under wet and dry conditions in tributaries to Great Bay Estuary: 1995-96.

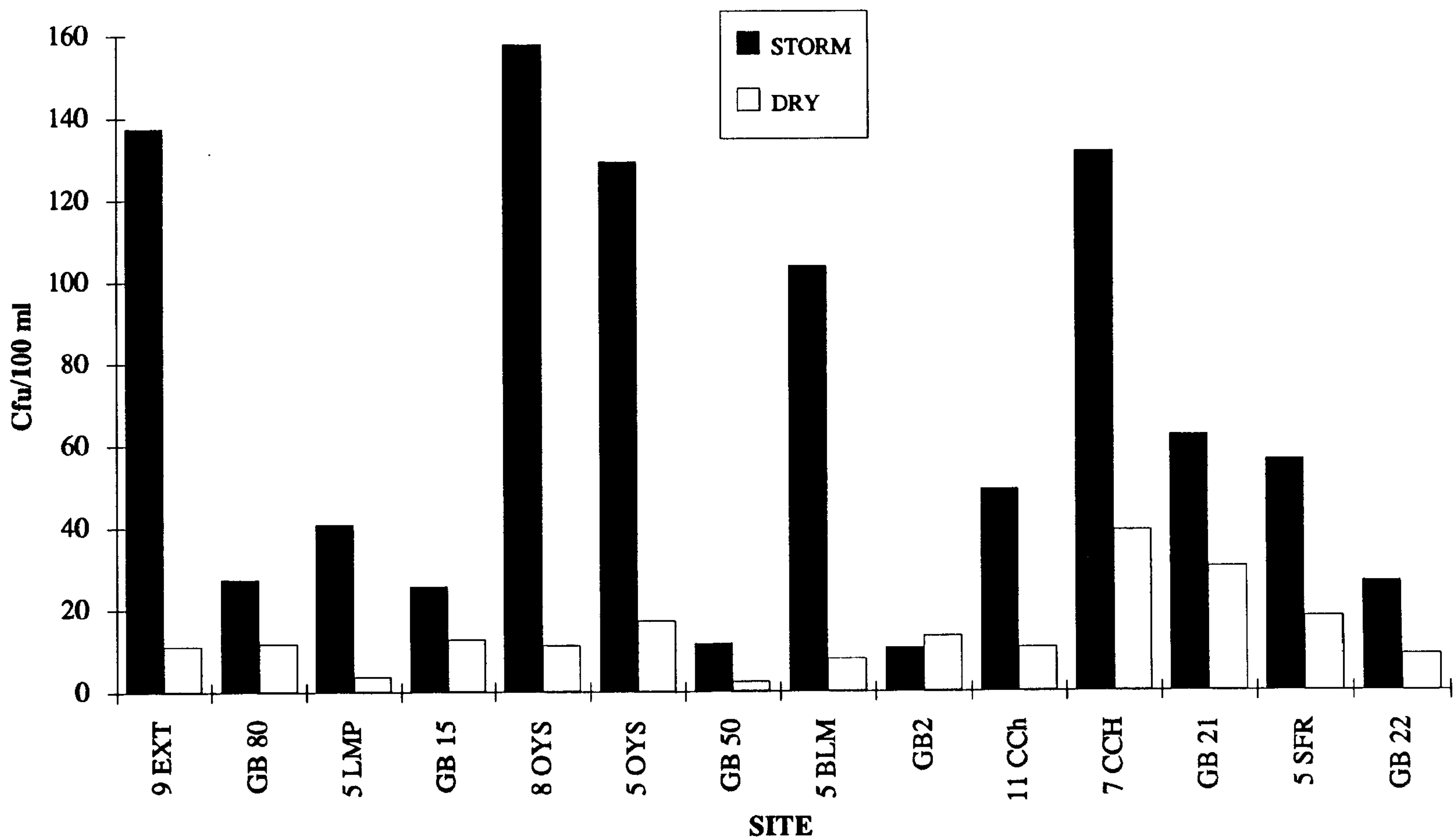

Figure 28a. Geometric mean fecal coliform concentrations in water collected during the first or second day of significant sotrm events in tributaries to Great Bay Estuary: 1995-96.

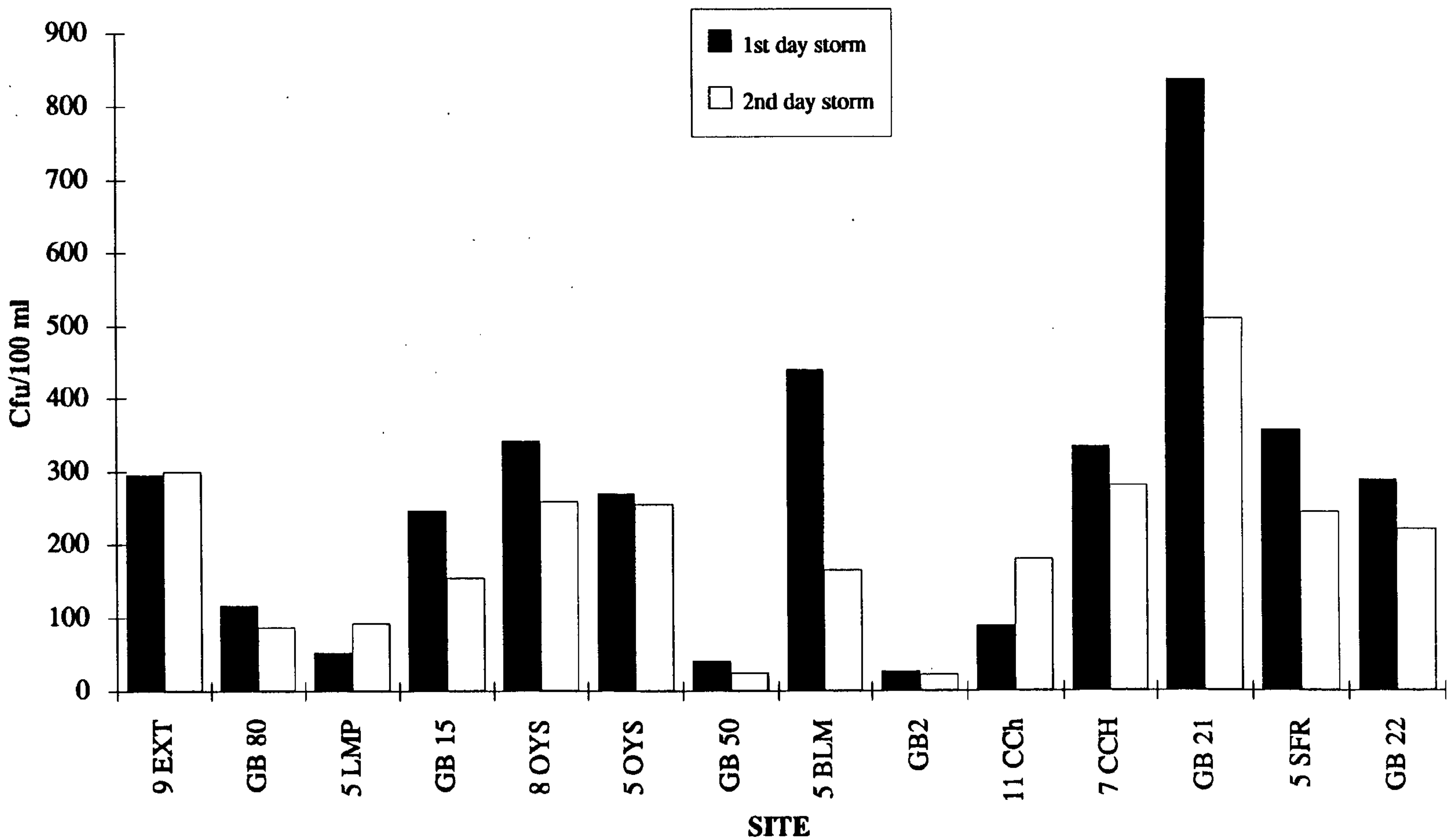

Figure 28b. Geometric mean E. coli concentrations in water collected during the first or second day of significant sotrm events in tributaries to Great Bay Estuary: 1995-96.

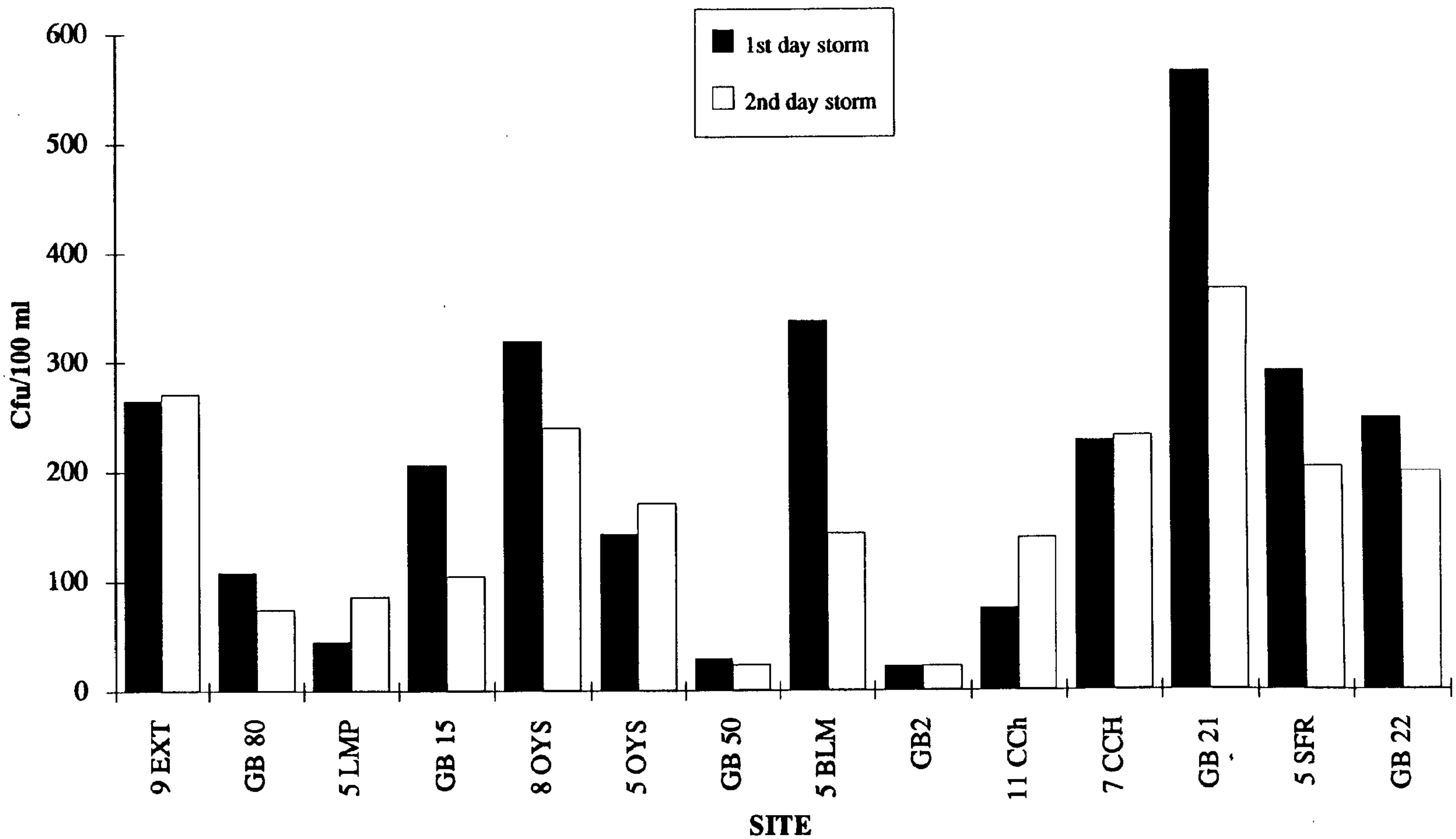

Figure 28c. Geometric mean enterococci concentrations in water collected during the first or second day of significant sotrm events in tributaries to Great Bay Estuary: 1995-96.

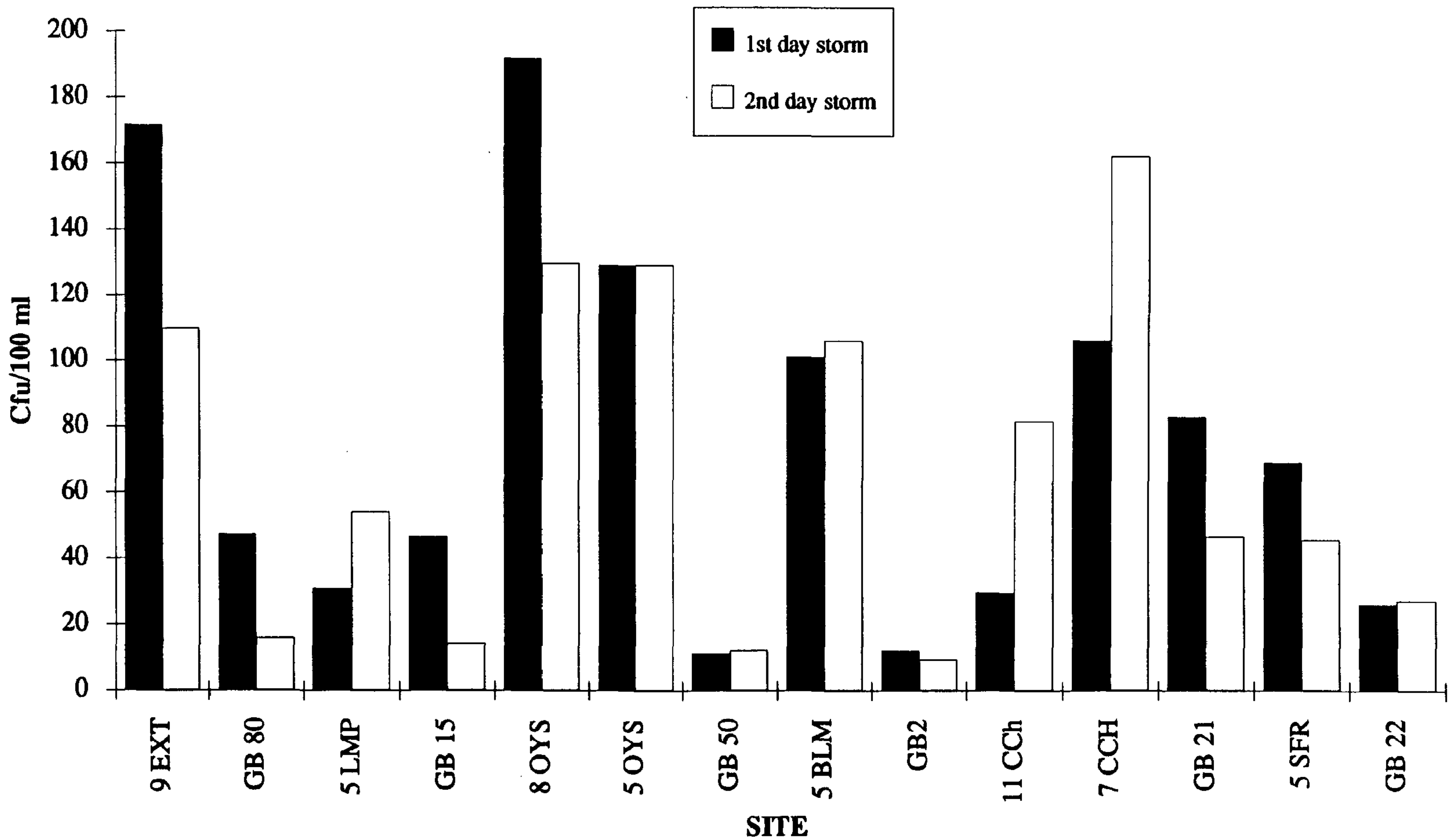

Figure 29a. Geometric mean fecal coliform concentrations in water collected during dry weather for three consecutive years in tributaries to Great Bay Estuary: 1993-96.

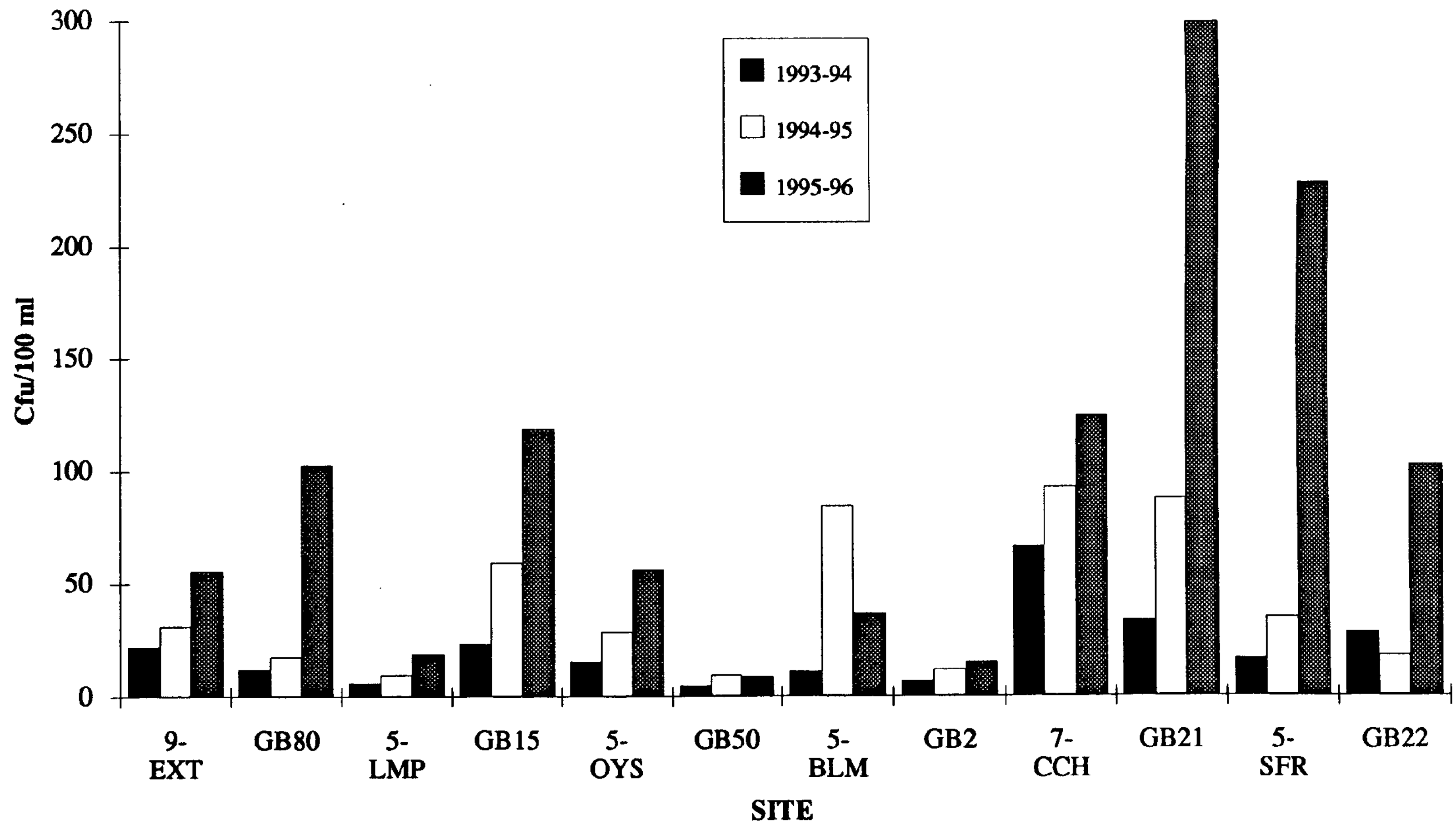

Figure 29b. Geometric mean E. coli concentrations in water collected during dry weather for three consecutive years in tributaries to Great Bay Estuary: 1993-96.

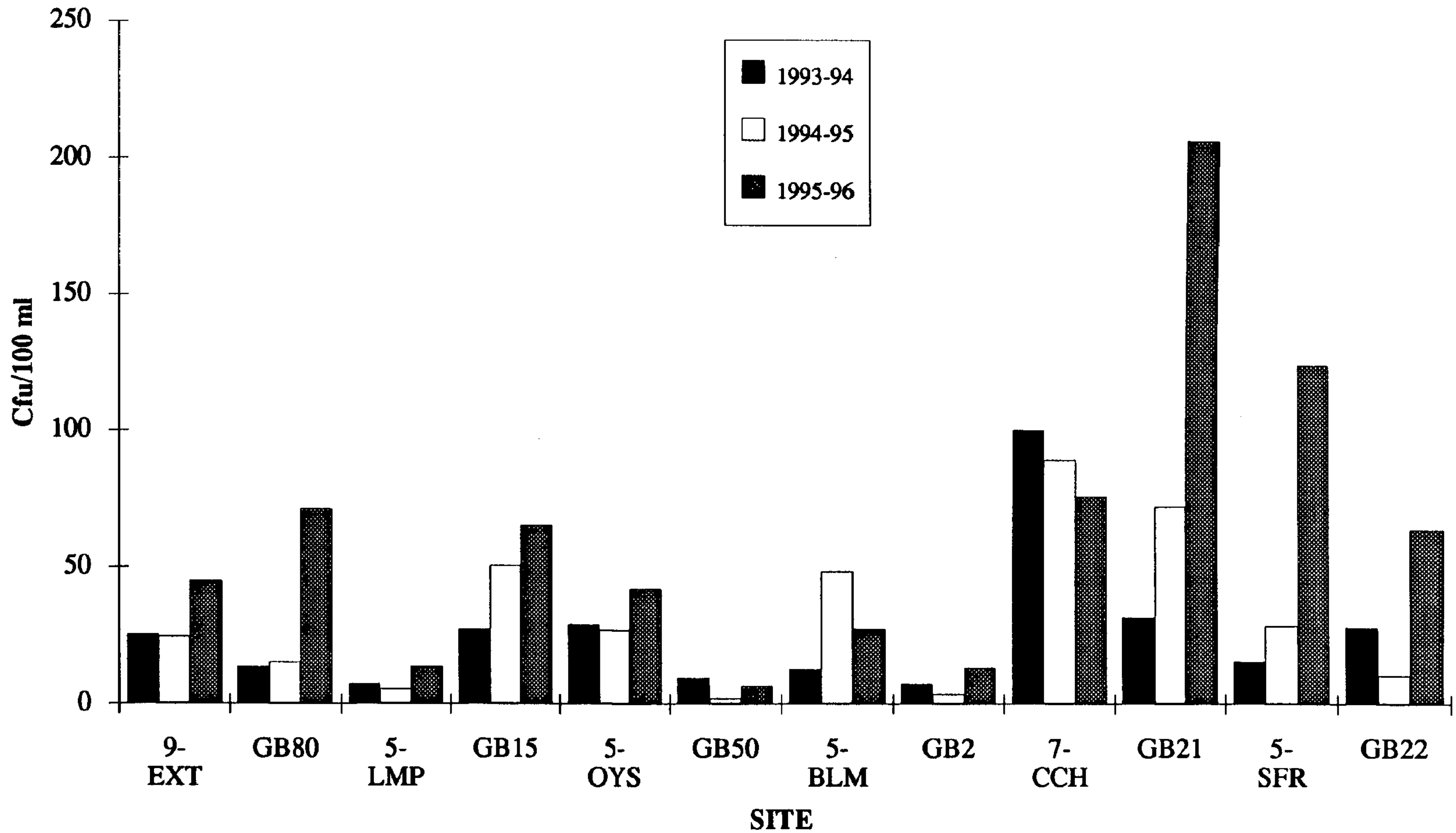

Figure 29c. Geometric mean enterococci concentrations in water collected during dry weather for three consecutive years in tributaries to Great Bay Estuary: 1993-96.

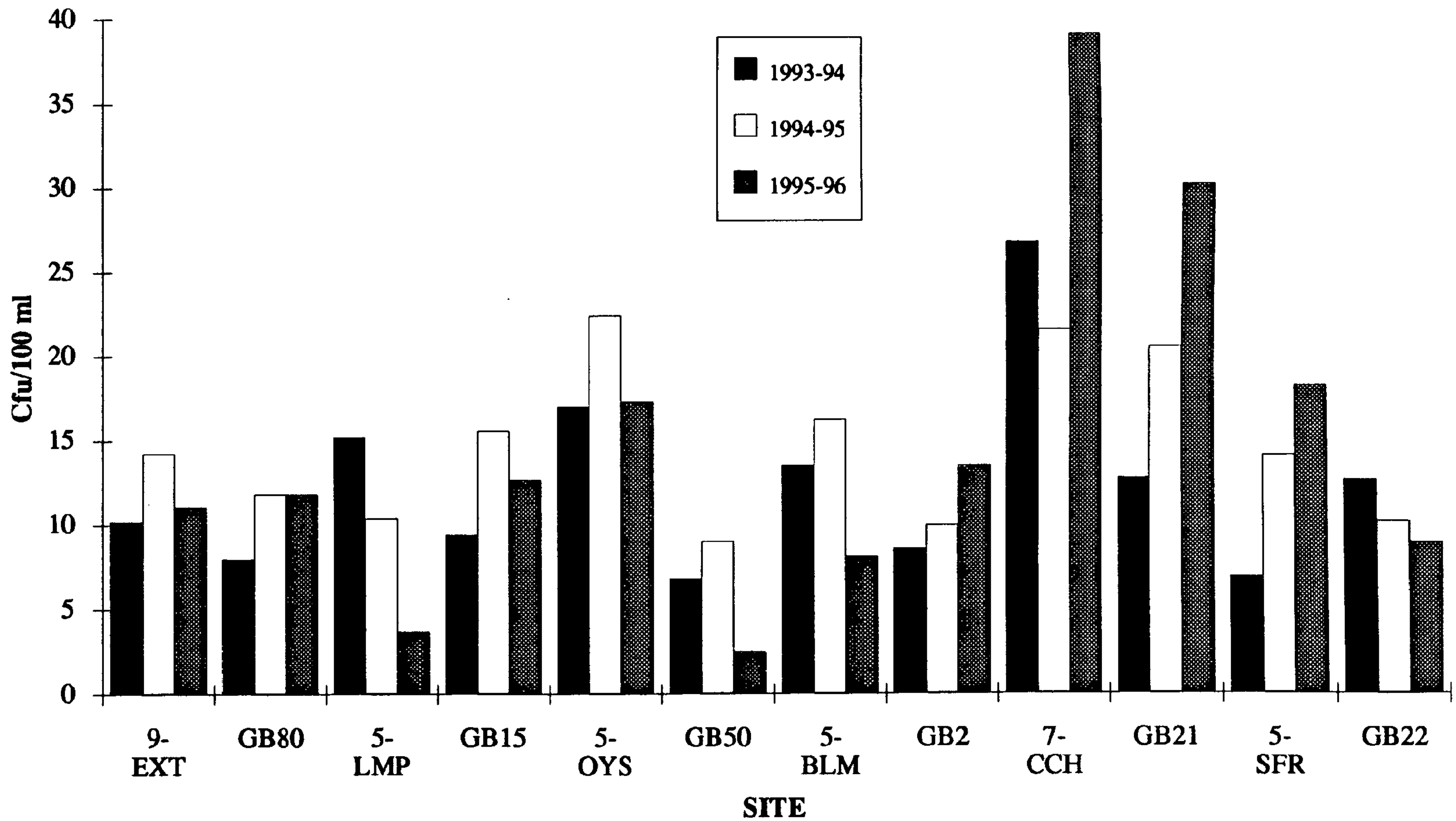

Figure 30a. Geometric mean fecal coliform concentrations in water collected during storm events for three consecutive years in tributaries to Great Bay Estuary: 1993-96.

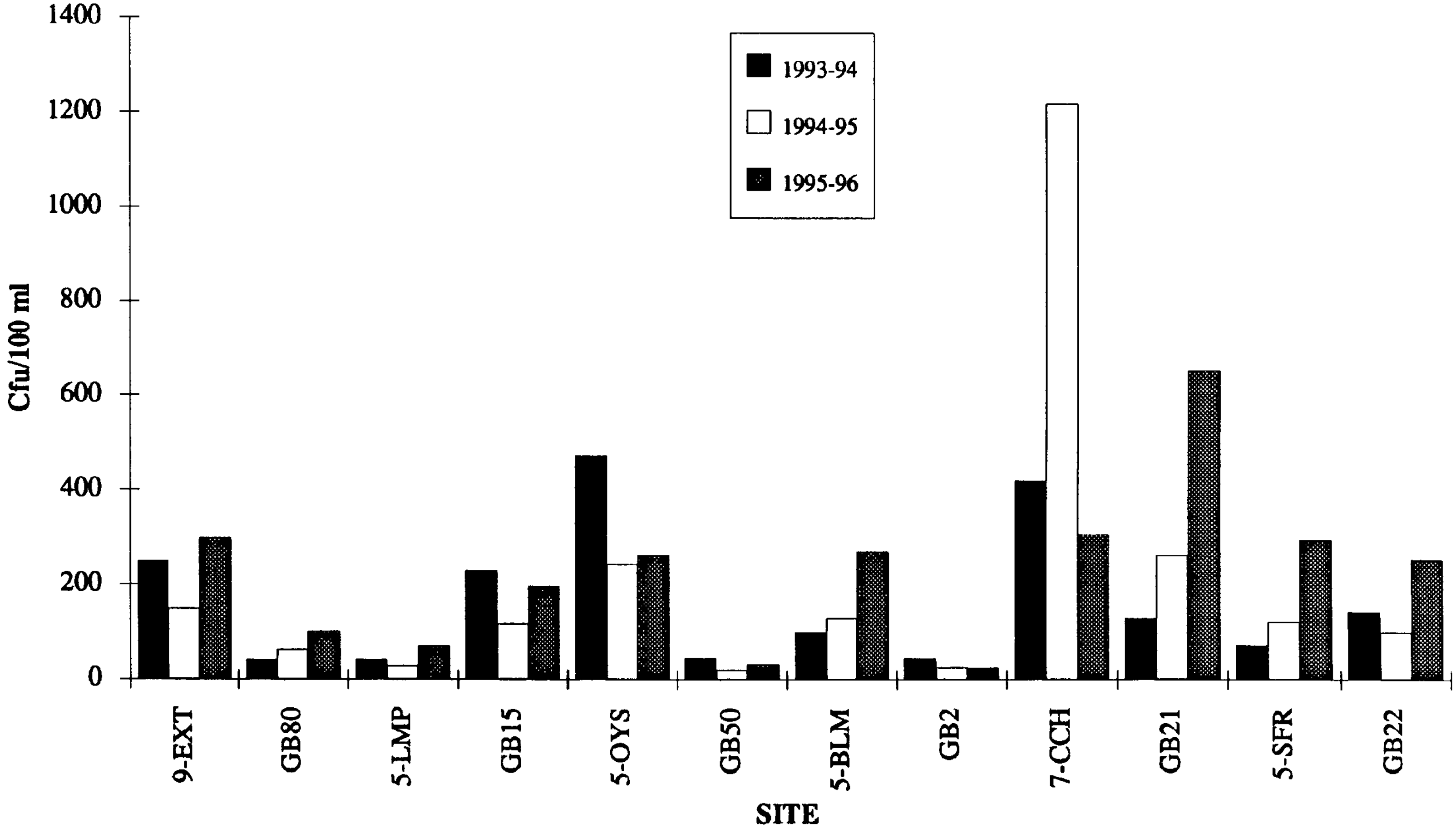

Figure 30b. Geometric mean E. coli concentrations in water collected during storm events for three consecutive years in tributaries to Great Bay Estuary: 1993-96.

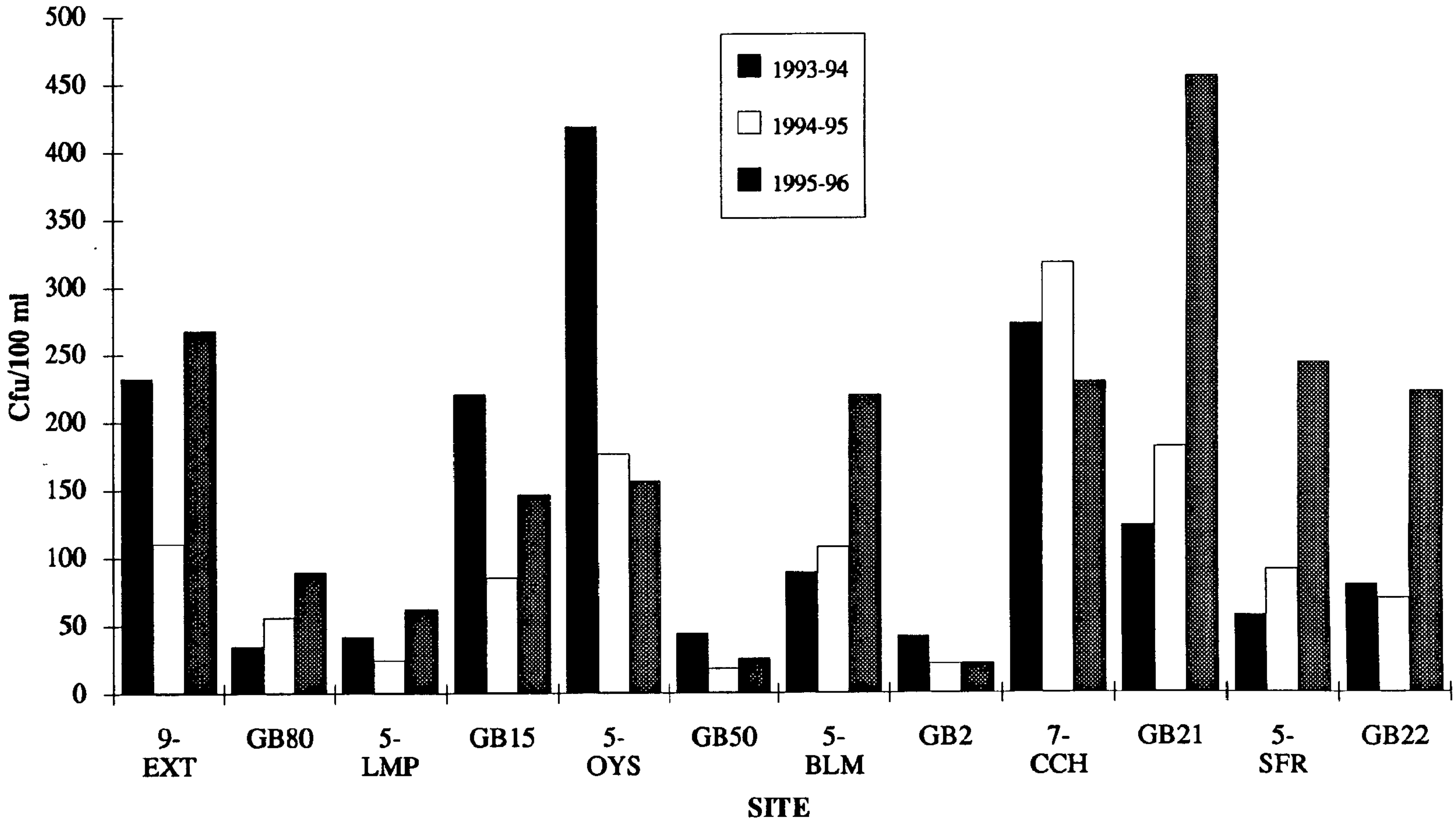

Figure 30c. Geometric mean enterococci concentrations in water collected during storm events for three consecutive years in tributaries to Great Bay Estuary: 1993-96.

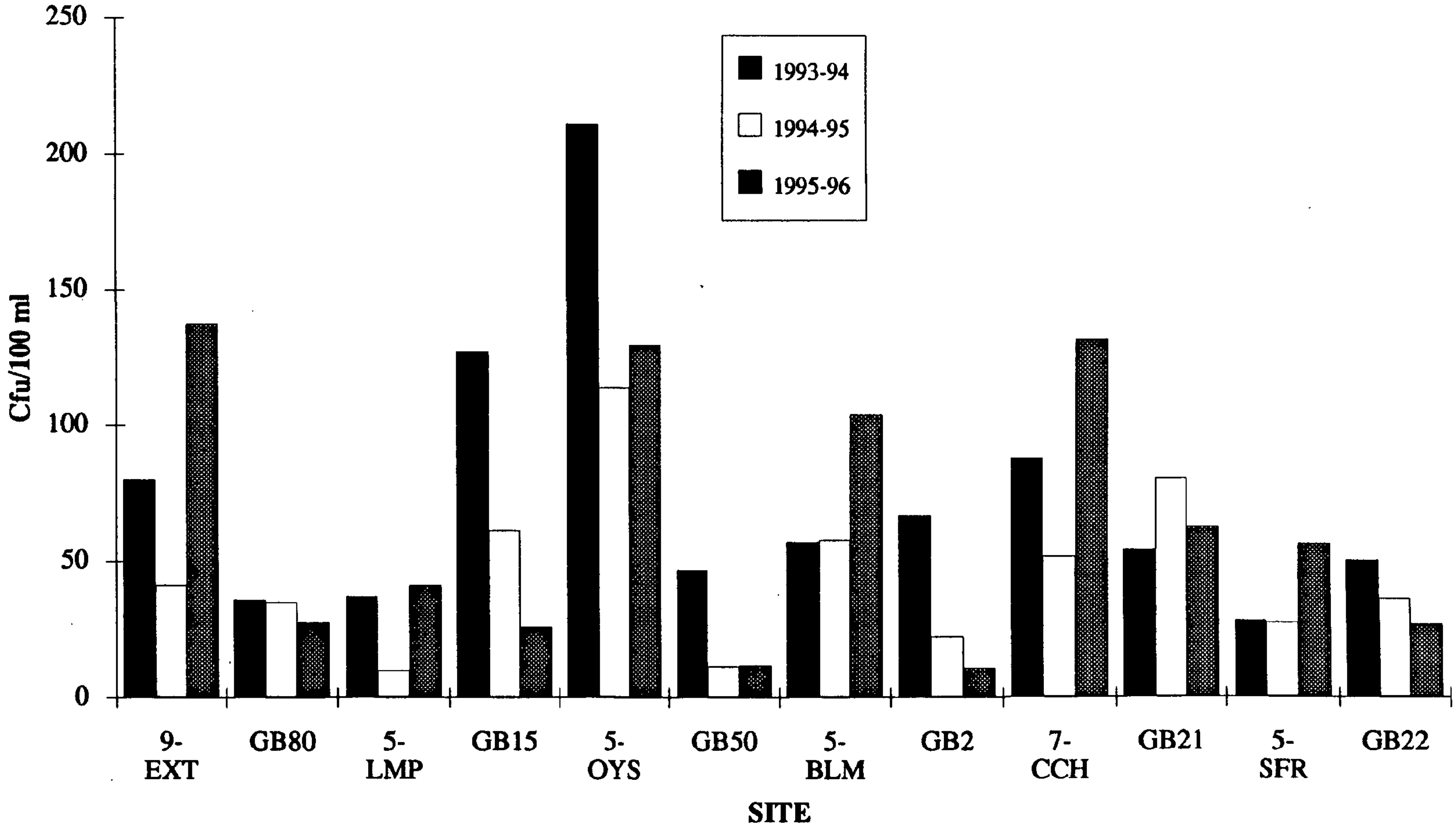

Figure 31a. Geometric mean fecal coliform concentrations in water collected during dry weather and storm events for three consecutive years in tributaries to Great Bay Estuary: 1993-96, cumulative.

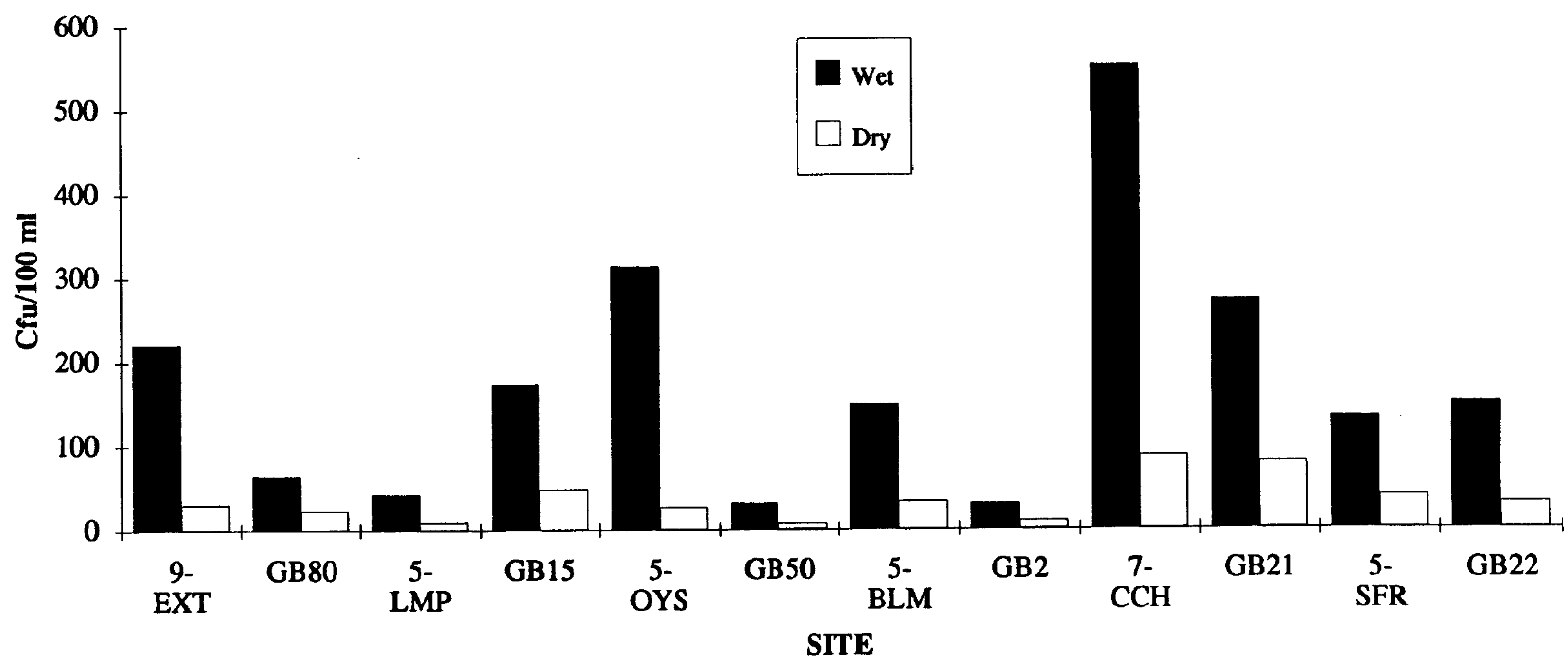

Figure 31b. Geometric mean E. coli concentrations in water collected during dry weather and storm events for three consecutive years in tributaries to Great Bay Estuary: 1993-96, cumulative.

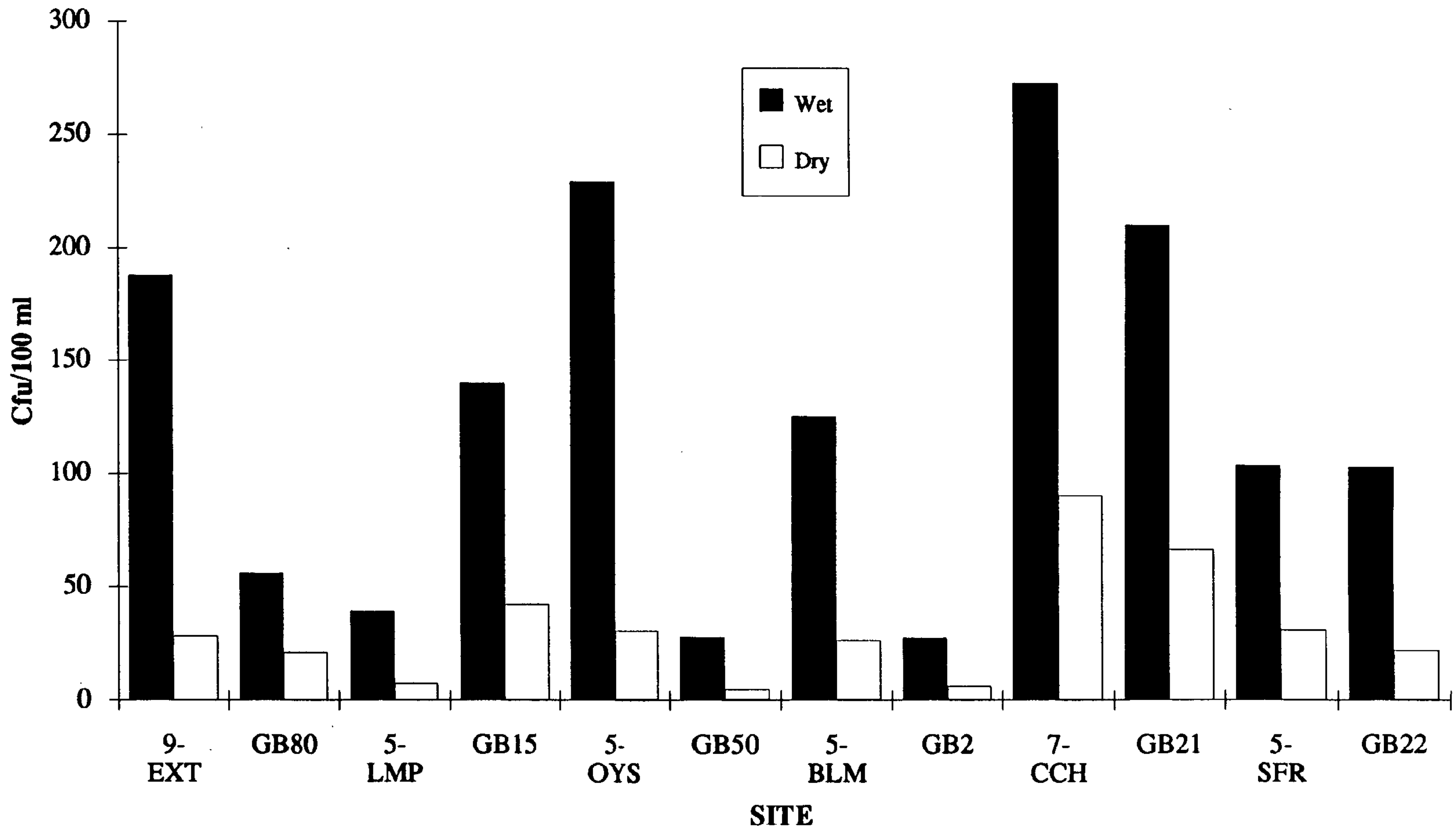

Figure 31c. Geometric mean enterococci concentrations in water collected during dry weather and storm events for three consecutive years in tributaries to Great Bay Estuary: 1993-96, cumulative.