FINAL REPORT

Contract Title:

Mattawoman Creek Watershed: Nutrient and Sediment Dynamics

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EXECUTIVE SUMMARY

The Smithsonian Environmental Research Center (SERC) was contracted in July, 1997 by Charles County Government to conduct a research project to define nonpoint (diffuse) sources of nutrients and sediments. The project was designed to assess current conditions and to provide information for projections of future conditions under different development scenarios. SERC has conducted nonpoint source research in other nearby areas with similar objectives for a number of years.

The project was focused on the watershed of Mattawoman Creek, but for technical reasons, we felt that the project would be more successful, if we included selected other watershed areas within Charles County. These areas were selected to be the best examples of various land use categories, such as row cropping or housing. Three sampling strategies were used. The first looks at dissolved constituents in 37 streams during base-flow (non-storm conditions) to examine the chemistry of groundwater as it emerges from the aquifers. The second sampling strategy looks continuously at all discharges of groundwater and storm flows in 11 streams using automated stream gauging/sampling stations that continuously sample stream water at a rate proportional to stream flows so that storm events will be sampled representatively. The third sampling strategy looks at discharges from a selected urban storm sewer, including toxic materials to meet the EPA and MDE NPDES requirements. Sampling discharges from the storm sewer includes automatic collection of discrete samples during different stages of storm flows. To complement sampling of storms at the storm sewer, similar storm samples were collected from another highly developed watershed.

We began seasonal samplings of base-flow at 36 sites in March, 1997 and have now sampled each season for three years, ending in May, 2000. Ten automated stations were completed and began taking samples and data in mid-April, 1998. A site for the urban storm sewer monitoring was approved by MDE in March, 1998. The selected storm sewer drains storm water from part of Saint Charles. In the spring of 1999 we equipped this site with an automated storm water sampler to collect discrete samples at different flow stages during storm events. We delivered storm samples to the Charles County laboratory for analysis of toxic materials, and we analyzed the storm samples for sediments and nutrients. We also used an automated sampler to collect flow proportional composite sample at the storm sewer, as at the other 10 automated stream monitors.

The two years during which we continuously monitored watershed discharges represented low and high extremes in annual precipitation. Total annual water discharge increased linearly with the percentage of developed land in the watershed in both years we studied, but the effect was strongest in the year with the most precipitation. Increased runoff from developed land is probably due to presence of impervious surfaces such as roofs and pavement.

Comparing stream water draining watersheds with different land use compositions, we found that concentrations of total phosphate and various forms of N increased and concentrations of silicate decreased with increases in the percentage of developed land. Concentrations of nitrate and silicate increased and the concentration of total organic carbon decreased as the percentage of cropland increased.

The discharges of total organic C and all forms of N and P increased significantly with increasing proportions of developed land in both the wet and dry years. The effects on discharges are partly due to the effects of developed land on water flow and partly due to effects on concentrations. Discharge of nitrate increased significantly with the proportion of cropland as well as with the proportion of developed land.

Concentrations of particulate materials tended to increase as the flow rate increased, due to the increase in turbulence and erosion associated with increasing water flow. In contrast, concentrations of dissolved materials (e.g., nitrate, silicate, chloride, conductivity) often decrease with increases in water flow, reflecting a dilution of emergent ground water with surface runoff. The predominance of dissolved forms differed among nutrients. Generally forms of N were mostly dissolved, while forms of P were mostly particulate.

Differences in the effects of water flow on concentration lead to differences in the temporal variability of discharge. Materials such as nitrate and silicate that decrease in concentration with increasing water flow will be discharged more evenly over time than materials such as particulate matter that increase in concentration with increases in water flow. Discharges of particulate materials such as forms of P occur very irregularly during short periods of high flow. The temporal variability of discharge of total P illustrates the importance of continuous automated sampling to capture unpredictable episodes of high discharge.

Our results suggest that conversion of forested land to developed land will increase the discharges of water, N, P, and organic C, while conversion of forested land to cropland will increase the discharges of nitrate. Our results also suggest that conversion of cropland to developed land will decrease the discharge of nitrate, while increasing the discharges of water, P, ammonium, and organic N and C. It is not clear from the present study how the discharge of total N would be altered by conversion of cropland to developed land, but previous studies suggest that developed land generally discharges less total N than does cropland.

Predicting discharges in future years may be complicated by inter-annual variation in rainfall. This is dramatically illustrated by comparing the results of the two years we studied, which coincidently included dry and wet conditions representing extremes occurring over decades. Discharges of water and nutrients will generally fall between the extremes we observed in this study. Usually the discharge of water varies over a wider range than do the concentrations of nutrients. In this study, we found no significant systematic effect of year on the annual flow-weighted mean concentrations of any substance. Therefore, nutrient discharges could be estimated by multiplying the flow-weighted mean concentrations measured in one year by the water flow of another year. Nutrient discharges can also be estimated with models that relate nutrient concentrations to water flow rates. However, our studies of storm events suggest that estimates of concentrations based on water flow rates will be very imprecise.

Predicting the effects of developed land on watershed discharges presents particular problems. Unlike cropland, developed land includes a wide range of land uses; such as residential, commercial, and industrial; which may differ in nutrient discharge. The effects of discharges from developed land on estuarine receiving waters will be related to changes in the discharge of water as well as the discharge of nutrients.

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INTRODUCTION

When receiving waters such as Mattawoman Creek become “over enriched” with nutrients, adverse effects will result. These include excessive algal populations, low dissolved oxygen, fish kills, and the production of nuisance blooms of blue-green cyanophytes and dinoflagellates such as *Pfiesteria*. Anticipated further land development in Charles County could either reduce or greatly increase the inputs of nutrients and sediments from the watershed, depending upon the manner of development. The main focus of this research project is to define nonpoint source (diffuse) watershed discharge rates that result from various types of land development. For comparison to developed lands, we also measured discharge rates from other important land uses, primarily forest, croplands, and housing areas on other watersheds in Charles County.

Land discharges move via two major hydrologic pathways: overland flows during storm events and the percolation of groundwater to stream channels. Groundwater is recharged by rainwater that infiltrates through the soils to the water table. In the inner Coastal Plain region, which includes Charles County, both of these hydrologic pathways account for a significant portion of the total land discharge. Our sampling strategy was designed to address the adequate sampling of both of these pathways (see Methods).

The Mattawoman Creek watershed is located in the inner Coastal Plain physiographic province. This region characteristically has layers of sedimentary soils with impervious clay layers interspersed between more porous coarser-grained soil layers. Rainwater on a given watershed infiltrates only to the first clay layer then moves laterally to a stream and emerges as surface water. Thus, stream discharges of both overland storm flows and groundwater can be related rather directly back to source areas on subwatersheds.

METHODS

Discharges of Dissolved Nutrients in Groundwater

Each season, during times of base flow of emerging groundwater (i.e., several days after any significant rainfall event), we sampled all 16 of the accessible tributaries draining subwatersheds of tidal Mattawoman Creek and four stations along reaches of the mainstem of Mattawoman Creek. We also sampled 16 tributaries of other watersheds in Charles County, selected to give a better representation of important land uses, such as urban, suburban, agricultural, and forest.

Altogether we sampled 36 stations each season from spring of 1997 through spring of 2000 (see Tables 1 and 2 for descriptions and Figs. 1 and 2 for a maps of the watersheds and their land uses) and one additional station (the station 96 storm sewer) from spring of 1999 through spring 2000. The samples were analyzed for the following parameters (all dissolved): conductivity, pH, alkalinity, alkaline cations (Na^+, K^+, Ca^{++}, Mg^{++}), nitrate, sulfate, chloride, dissolved silicate, total organic carbon, phosphate, organic phosphorus, ammonium, and organic nitrogen. Samples were filtered through pre-rinsed Millipore HA (0.45 μm pore size) filters in the field and put on ice until analyzed in the laboratory.

Total Discharges of Water, Nutrients, and Sediments

We installed ten automated, continuous monitoring and sampling stations on selected stream sites in the spring of 1998 and an eleventh automated station at the storm sewer in spring of 1999 (see Tables 1 and 2, Figs. 1 and 2). The stations were run through July 2000. The automated stations monitored stream stage height, converted stage height to rate of water discharge, and sampled stream water at a frequency proportional to stream flow rates. Thus, they sampled both overland storm flows during storm events and groundwater discharges at rates representative of total flow in the stream. These samples were truly representative of total watershed discharges from all upstream areas. The automated stations consisted of a stilling well, usually attached to a highway bridge abutment, and an instrument enclosure. The enclosure contained a data logger/computer, batteries, pumps, valves, sample containers, etc. The stations were solar powered. Samples were withdrawn directly from the middle of the stream channel and sampling hoses were flushed prior to sampling. We determined rating curves by measuring stream discharges manually at these eleven sites with current meters at times when the streams are at various stage heights. Each automated station had a Campbell CR-10 data logger to monitor stream stage heights, calculate discharge based on rating curves, integrate discharge over time, and control the samplers. Stage heights were stored in the data logger and transferred to a computer for further analysis.

Two sets of flow-proportional samples were collected each week at each station for laboratory analyses, one set of samples with and one set without sulfuric acid added as a preservative. The samples without preservative were analyzed for total suspended solids and dissolved silicate. The samples with preservative were analyzed for total phosphorus, total phosphate, nitrate, total ammonium, total nitrogen, and total organic carbon. Because the acid preservative dissolves particulate phosphate and ammonium, we measured the sums of the dissolved and particulate fractions of these substances. Nitrate is essentially all dissolved.

Concentrations of Dissolved and Particulate Nutrients at Different Stream Stages

To characterize the nutrient content of suspended solids, we also took discrete samples at known stream stage heights at the automated sampling stations. These samples were collected by hand and brought to the laboratory for immediate analysis. Because no preservative was used, we were able to measure the dissolved fractions of nutrients in filtered portions of the samples as well as the totals of dissolved and particulate fractions in unfiltered portions. From these measurements we calculated concentrations of particulate fractions by subtraction.

Storm Discharges of Water, Sediments, Nutrients, and Toxic Materials

To help Charles County meet the requirements of NPDES, we met with officials of MDE and Charles County and selected an appropriate storm sewer to monitor. The sewer selected was Number 96 at Saint Charles Parkway. It collects storm water from part of Saint Charles City and delivers it to Jordan Swamp (a tributary of Zekiah Swamp), which we sampled with automated station number 162.5 (Table 1, Fig. 1) at

Highway 5. We installed a stream stage height staff at site 96 when the site was approved in the spring of 1998 and began taking grab samples of groundwater flow emerging in the storm sewer. In the spring of 1999 we installed automated storm samplers at site 96 and station 162.5. At different stages of storm flow events, the storm samplers pumped water into separate bottles without preservatives. The samples were retrieved immediately after storms and analyzed for dissolved and total nutrients. Portions of the storm samples were delivered to the Mattawoman Treatment Plant for analyses of trace metals. Monthly grab samples of base flow were delivered to the Mattawoman Treatment Plant for analysis of coliform bacteria. To complement our storm sampling at site 96, we installed an automated sampler that collected flow-proportional composite samples the same as the samplers at the other 10 monitored watersheds (including 162.5).

Sample and Data Analyses

Reduced nitrogen was determined as total Kjeldahl N (TKN) with a Tecator block digestor, Tecator steam distillation of ammonia, and ammonium determination on a Dionex, model 500, Ion Chromatograph. Ammonium was also determined on undigested samples by oxidation to nitrite and colorimetric determination of nitrite. Organic N was calculated as TKN minus ammonium. Total P was determined by perchloric acid digestion and colorimetric determination of phosphate. Phosphate in undigested samples was also determined colorimetrically and organic-P is calculated as total P minus phosphate. Whole water samples and filtered water were analyzed separately and particulate nutrient fractions were calculated as whole water concentrations minus dissolved concentrations. Organic and inorganic Carbon were determined with a Shimadzu, model TOC-5050, carbon analyzer. Nitrate, chloride, and sulphate were determined on a Dionex, model 500, ion chromatograph. Alkaline cations (Na, K, Ca, Mg) were determined with a Perkin Elmer, Model 3000, ICP emission spectrometer. Silicate was determined colorimetrically on an API model 300 automated colorimeter system.

Geographic Analysis

We used the ArcInfo geographic information system (GIS) software to organize and analyze geographic data on the watersheds draining to our 37 stream sampling sites. The location of each station was digitized from the USGS 7.5 minute topographic maps used to place the sampling sites in the field (Fig. 1). Drainage boundaries were defined from contour lines on the same maps then digitized (Fig. 1). The drainage boundaries were intersected with a digital land cover database (Fig. 2) to derive land cover proportions for each watershed (Table 2). The EPA land cover data were derived from Landsat-TM satellite imagery and classified into 19 land cover categories (USEPA 1994). Some of the categories were not well resolved (USEPA 1994), so we aggregated the 19 categories to 7 (Table 2). We also calculated the proportion of total developed land (low intensity developed plus high intensity developed) and summed cropland and grassland to derive a category that we called cleared land.

To investigate the effects of land use on watershed discharges, we used regression analysis to relate water flow and nutrient concentrations to the proportions of three land covers: cropland, total developed land, and cleared land. We analyzed the effects of both cropland and cleared land (cropland plus grassland) because the land cover data set does not always accurately resolve cropland from grassland (USEPA 1994, Liu et al in press). Together with forest, total developed and cleared lands dominate the study watersheds, yet vary significantly in relative importance. Among the study watersheds, developed land ranges from 0-91%, cropland from 0-35%, and cleared land from 0-59% (Table 2). We did not include the forest as an explanatory variable because total developed land, cleared land, and forest sum to more than 98% of total land area for each of the 37 watersheds. Thus, forest is essentially 100%-(cleared land + developed land), and the inclusion of forest would be redundant with the other land cover categories. The drainage areas for watersheds 156 and 157.5 (Table 2) are primarily forested or grass with only a few percent present as low density developed or cropland. Some of the areas classified as "grass" were recently logged forest areas. Watersheds 163, 167, and 169 had the most cropland, but that was not the predominant land use for those watersheds or for Charles County in general. Watersheds 147 and 162.5 were dominated by developed land, especially by suburban housing.

Some or our sampling sites were selected to study the watershed of the Chapman's Landing housing development. Watershed 154 was selected because it is the only significant stream draining into the area of Chapman's Landing. Its watershed also had a fairly high amount of suburban development (Table 2). Sampling station 153 is on the same stream as station 154, but at the point where it leaves Chapman's Landing. There was very little development within the Chapman's Landing part of the watershed 154. Station 155 was selected because it is also on a stream draining part of Chapman's Landing. This portion of Chapman's Landing was mostly composed of forest and grass, with only about 6.5% low density developed areas.

Watershed 140.5 was selected because it was the point furthest downstream on the main stem of Mattawoman Creek that was readily accessible for installing and operating a station and was not tidally influenced. Thus, station 140.5 gives the best picture of the discharge of materials from the overall Mattawoman Creek watershed. The drainage area for station 140.5 was 63% forest, 15% developed, 1.5% cropland and 20% grass.

RESULTS

Effects of Land Use on Water Discharge

As the percentage of developed land increased, the amount of water discharge and the variability of discharge rate increased, due to impervious surfaces such as roofs and pavement in developed land. In watersheds with mostly developed land, rain events triggered pulses in water discharge that were more intense and shorter in duration than in watersheds with mostly undeveloped land. This is evident from the much more rapid changes in stream depth during storm runoff in highly developed watersheds compared to less developed watersheds (Fig. 3).

Total annual water discharge increased linearly with the percentage of developed land in the watershed in both years we studied, but the effect was strongest in the year with most precipitation (Fig. 4). The extra runoff from developed land is probably due to impervious surfaces. Using a regression of flow versus the percentage of developed land we predicted the amount of flow for watersheds with 0% and 100% developed land (Table 3). In both years undeveloped land discharged about one fourth of the water received from precipitation. In contrast, developed land discharged about 60% of 62.5 cm of precipitation in the dry year and about 80% of 127.1 cm of precipitation in the wet year (Table 3, Fig. 4). The two years represent extreme departures from the average precipitation of about 110 cm. Differences in water discharge that were not explained by the percentage of developed land (Fig. 4) may partly reflect the imprecision of measuring discharge using records of stream depths in open channels.

Effects of Land Use on Concentrations of Nutrients and Sediments

In some cases the concentrations of nutrients and sediments in stream water were correlated with the percentages of cropland or developed land in the watersheds. We examined the effects of land use for the continuously monitored watersheds by comparing annual flow-weighted mean concentrations from the dry and wet years separately. Flow-weighted means were calculated by multiplying the concentrations in weekly composite samples by the water flow during the week, adding these products, and dividing by the total flow. The flow-weighted means best represent the average concentrations of discharged materials.

As the percentage of cropland increased, the concentrations of nitrate and silicate increased significantly in both years (Table 4). In contrast, total organic carbon concentration decreased with increase in percentage of cropland during the second year (Table 4). To separately illustrate the effects of cropland and developed land, we plotted concentrations versus the percentage of cropland for watersheds with <10% developed land (Fig. 5) and versus the percentage of developed land for watersheds with <5% cropland (Figs. 6 and 7). Because EMAP land use classifications are sometimes inaccurate in distinguishing cropland from grassland, we also examined the effects of cleared land, which is the sum of cropland and grassland. Cleared land had effects similar to those of cropland (Table 4).

Concentrations of total phosphate and forms of N increased and concentrations of silicate decreased with increases in the percentage of developed land (Table 4, Figs. 6 and 7). Nitrate, total ammonium, and total N concentrations increased significantly with increases in developed land in both years, but total organic N increased significantly in the wet year only. Discharges from watershed 96, the most highly developed watershed we studied, had markedly elevated concentrations of total phosphate, total ammonium, and total N, compared to concentrations that would be predicted from the proportion of developed land (Figs. 6 and 7). These high concentrations associated with the highest proportion of developed land have a strong influence on the statistical relationship between developed land and concentration. Moreover, this influence is only represented in the second year of the study (the wet year), because watershed 96 was not monitored in the first year.

Besides comparing the 10-11 continuously monitored watersheds, we also examined the effects of land use on concentrations of dissolved nutrients in base flow from 37 watersheds. Concentrations in base flow reflect the composition of groundwater that emerges in the streams. We averaged the data from three years of seasonal base flow sampling for comparisons among watersheds. Nitrate concentrations in base flow increased as the cropland and developed land increased in the watersheds (Table 5), as we also observed for the flow-weighted mean concentrations (Figs. 5 and 6). However, concentrations of nitrate in base flow were generally higher than flow-weighted mean concentrations when measured at the same site (Figs. 5 and 6). This difference reflects the tendency for nitrate concentrations to be highest at low flow (see section on effects of stream flow rate below). Silicate concentrations in base flow increased significantly with increasing cropland, as found for flow-weighted mean concentrations of silicate (Fig. 5, Table 5). However, unlike the flow weighted mean concentrations, base flow concentrations of silicate were not significantly correlated with developed land (Fig. 7). Dissolved ammonium concentrations in base flow increased with increases in developed land (Table 5), as did flow-weighted means of total ammonium concentration in weekly composite samples (Fig. 6, Table 4). Increases in developed land also correlated with increases in dissolved inorganic C, conductivity, and concentrations of major anions (chloride, fluoride, and sulfate) and cations (sodium, potassium, magnesium, and calcium) (Table 5). Increasing cropland also increased conductivity, sulfate, potassium, and magnesium (Table 5). High concentrations of sodium and chloride in winter discharges from developed land probably came from applications of road de-icing salt.

Effects of Land Use on Discharges of Nutrients and Sediments

The effects of land use on both the water flow and on the material concentrations are reflected in the discharge of materials from watersheds. We calculated annual discharges by multiplying the annual flow-weighted mean concentrations (Table 6) by annual water discharge estimated from regressions against the percentage of developed land (Fig. 4, Table 3). We used these regression estimates of water flow rather than the measurements for individual watersheds because of the imprecision of measuring flow based on depth in open stream channels. Errors in measuring water flow may obscure underlying effects of land use on material discharges, so the regression predictions provide the best estimate of average water discharges for watersheds with given proportions of developed land.

The discharges of total organic C and all forms of N and P increased significantly with increasing developed land in both the wet and dry years (Table 7, Figs. 8, 9, and 10). The effects on discharges are partly due to the effect of developed land on water flow and partly due to effects on concentrations. Interestingly, the decrease in silicate concentration with increase in developed land (Fig. 7) was counteracted by the related increase in water flow (Fig. 4) resulting in no significant effect of developed land on silicate discharge (Table 7). Discharges of several nutrients, especially total ammonium and total phosphate, were especially elevated for the most developed watershed (96), reflecting the pattern of nutrient concentrations. The extreme data from watershed 96 had a strong influence on statistical relationships of nutrient discharges to developed land during the wet year, the only year when this watershed was monitored.

Discharge of nitrate increased significantly with the proportion of cropland as well as with the proportion of developed land (Table 7). However, the proportion of cropland did not have a significant effect on the discharges of other forms of N, forms of

P, or total organic C. Silicate discharges increased with increases in cropland, but the effect was only significant ($p<0.05$) in the dry year (Table 7).

We used linear regressions to estimate the amount of materials discharged from watersheds with 100% or 0% developed land. The regressions for nutrients other than nitrate use the percentage of developed land as the only independent variable, because for these nutrients only developed land was significantly related to discharge. For nitrate we used the percentages of both developed land and cropland as independent variables. Predicted discharges differed greatly between the wet and dry years because of the differences in water flow, which encompass extremes usually observed over decades (Table 8). For 100% developed land, predicted total P discharge ranged from 0.9-2.8 kg P/ha from the dry to the wet year, predicted total N discharge ranged from 6.5-19 kg N/ha, and predicted total organic C discharge ranged from 47-138 kg C/ha. Predicted nitrate discharge from 100% cropland was higher (5.9-14.0 kg N/ha) than predicted nitrate discharge from 100% developed land (2.1-5.3 kg N/ha). For mixtures of developed land, cropland, and other land types, predictions of discharge can be obtained by linear interpolation of the predictions for 0 and 100% of the relevant land use type.

Effects of Stream Flow Rate

Relationships between water flow rate and concentrations of materials were revealed by analysis of grab samples collected at various stages of flow at the continuously monitored streams. These grab samples were analyzed for dissolved and total nutrients, while the composite flow weighted samples were only analyzed for total nutrients. Thus, the grab samples provided data on the proportion of dissolved nutrients as well as on the effects of stream flow. After accounting for the effects of land use, concentrations of particulate materials tended to increase as the flow rate increased (Table 9), probably due to the increase in turbulence and erosion associated with increasing water flow. In contrast, concentrations of dissolved materials (e.g., nitrate, silicate, chloride, conductivity, Table 9) often decrease with increases in water flow, reflecting a dilution of emergent ground water with surface runoff. Alkalinity and pH also decreased with increasing water flow, suggesting that emergent ground water is more alkaline than surface runoff. Some dissolved materials increased in concentration with increasing flow (e.g., dissolved phosphate and dissolved organic P, N, and C). Dissolved organic substances may be more enriched in surface runoff than in emergent ground water because organic matter may become adsorbed in aquifers.

The predominance of dissolved forms differed among nutrients. The proportions of dissolved ammonium and dissolved phosphate were highly variable, but dissolved ammonium usually made up the majority of the total ammonium, while dissolved phosphate was usually the minority of the total phosphate (Fig. 12). The proportions of dissolved organic P, N, and C declined as the concentration of the total amounts of these nutrients increased, suggesting that particulate fractions increased disproportionately as the total concentrations increased (Fig. 13). However, dissolved organic N and C generally made up the majority of their total concentrations, while dissolved organic P was usually the minority of the total phosphate (Fig. 13). Nitrate was assumed to be essentially all dissolved. Thus, in general forms of N were mostly dissolved, while forms of P were mostly particulate.

Effects of Storms

Intensive sampling of discharges from watersheds 96 and 162.5 during storms showed effects of flow similar to the effects observed with the more extensive grab sampling at all the monitored sites. Concentrations of particulate materials increased with increases in water flow rate, while concentrations of many dissolved substances decreased (Fig. 14, Table 10). There were also significant differences among storms and significant differences related to whether the stream flow was rising or declining within a particular storm event. At moderate and high flows concentrations of particulate and dissolved materials were generally higher during the rising phase of the storm flow than during the declining phase. At low flows, concentrations of particulate matter were higher in the declining phase than in the rising phase, while concentrations of dissolved matter were higher in the rising phase. This suggests the following sequence during storm: As the storm flow begins, particulate matter is in low concentration because erosion and resuspension have not yet occurred; as flow later intensifies, erosion and resuspension elevate concentrations of suspended particles. As flow begins to subside, sources of readily suspended material have been depleted so concentrations are less than at similar flow rates early in the storm. Finally, at the end of the storm concentrations are somewhat enriched above levels at the beginning of the storm because suspended material has not had time to settle out. A different sequence is suggested for dissolved substances such as nitrate and silicate: At the beginning of the storm, there is an enrichment of these dissolved substances due to a flushing of soluble material from the watershed. Later in the storm, concentrations decrease as stores of soluble material are depleted. It is possible to produce a statistical model that predicts concentration from flow rate and the phase of the storm event. However, there is often an order of magnitude range in concentrations observed at particular flow rates and phases of the storm. The high variance suggests that predictions of concentrations based on flow and storm phase would be very imprecise.

Differences in the effects of water flow on concentration lead to differences in the temporal variability of discharge. Materials such as nitrate and silicate that decrease in concentration with increasing water flow will be discharged more evenly over time than will materials such as particulate matter that increase in concentration with increases in water flow. The temporal variability of discharges from watershed 157.5 provides a typical example. Weekly flow of water follows the typical seasonal pattern of water flow reflecting seasonal changes in evapotranspiration rates (Fig. 15). Water flow also reflects the drought from the summer of 1998 through the summer of 1999, and the high rainfall the subsequent year. Superimposed on these fluctuations are short-lived peaks in water flow caused by major storms, the largest peak coming from Tropical Storm Floyd in September 1999. The highest concentrations of total P generally occur during times of highest flow, because most P is associated with particulate matter. Because discharge is the product of flow and concentration, short-lived peaks in water flow are very important in the discharge of total P. Consequently much of the total discharge of total P occurred during only two weeks that included major flow events (Fig. 15). In contrast, the discharge of nitrate is spread out more evenly through time than the flow of water (Fig. 16), because nitrate concentrations decrease and water flow rate increases. The temporal variability of discharge of total P illustrates the importance of continuous automated sampling to capture unpredictable episodes of high discharge.

DISCUSSION

Our results suggest that conversion of forested land to developed land will increase the discharges of water, N, P, and organic C, while conversion of forested land to cropland will increase the discharges of nitrate. Our results also suggest that conversion of cropland to developed land will decrease the discharge of nitrate, while increasing the discharges of water, P, ammonium, and organic N and C. It is not clear from the present study how the discharge of total N would be altered by conversion of cropland to developed land, but previous studies suggest that developed land generally discharges less total N than does cropland. The Charles County study watersheds provided better information on the effects of developed land than on the effects of cropland, because more watersheds included high percentages of developed land than included high percentages of cropland. Our previous studies, elsewhere in the coastal plain, were better designed to address the effects of cropland than was the Charles County study (e.g., Jordan et al. 1997a). These studies showed a significant increase in the discharge of all forms of N with increasing proportions of cropland (Jordan et al. 1997a). Extrapolating from a regression of discharge versus percentage of cropland suggested that a watershed with 100% cropland discharges 18 kg total N/ha during a year of average runoff (Jordan et al. 1997a). By comparison, the Charles County study results suggest that 100% cropland discharges 6-14 kg nitrate-N/ha annually (ranging from dry-wet years). These rates are consistent with the broad ranges of N discharges from agricultural land found in other studies (e.g., see reviews by Beaulac and Reckhow 1982; and Frink 1991). Although other studies have shown increases in P discharge with increases in agricultural land (e.g., Rekolainen 1990; Correll et al. 1992; Nearing et al. 1993), P discharge may be more strongly influenced by the erodibility and P content of soils in the watershed than by agriculture (Jordan et al. 1997a). Our Charles County study suggests that watersheds with 100% developed land annually discharge 0.9-2.8 kg P/ha, and 6.5-19 kg N/ha (dry-wet year ranges). By comparison, other studies suggest annual discharges from developed or urban land of 0.3-2.8 kg P/ha and 4-28 kg N/ha, based on quartiles of studies reviewed by Beaulac and Reckhow (1982) and medians reviewed by Frink (1991).

Several caveats apply to extrapolating our results to different times, places, and mixtures of land use. For example, land use effects may differ among physiographic regions. This has been noted for the effect of cropland, which appears to release twice as much N in the Piedmont as it does in the Coastal Plain (Jordan et al. 1997a, b, c). The findings of our Charles County study will be most applicable to the Coastal Plain region in and near Charles County.

Caution must also be used in interpreting extrapolations of regressions of discharge versus land use. When we use regressions to predict discharges from watersheds with 100% of a given land use, we are ignoring possible interactions among different land use types. In a watershed with a mixture of land types, some areas such as cropland and developed land may act as nutrient sources while others areas such as wetlands and riparian buffers may act as nutrient sinks (e.g., Correll et al. 1992; Jordan et al. 1993; 1999). Thus, a watershed with only nutrient source areas would release more nutrients than might be projected from comparisons to watersheds that include both sources and sinks.

Predicting discharges in future years may be complicated by inter-annual variations in rainfall. This is dramatically illustrated by comparing the results of the two years we studied, which coincidently included dry and wet conditions representing extremes occurring over decades. Discharges of water and nutrients will generally fall between the extremes we observed in this study. For watersheds in this region, the inter-annual variability of water discharge generally exceeds inter-annual variability of nutrient concentrations (e.g., see long term studies of Correll et al. 1999a, b, c). In this study, we found no significant consistent effect of year on the annual flow-weighted mean concentrations of any substance (e.g., Figs. 5, 6, and 7). Therefore, nutrient discharges could be roughly estimated by multiplying the flow-weighted mean concentrations measured in one year by the water flow of another year. Water flows can be estimated with models that relate runoff to rainfall such as TOP model (Beven and Kirkby 1979; Quinn et al. 1995) and others (Haan 1982). Nutrient concentrations can be estimated with models that relate concentrations to water flow rates (Cohn et al. 1989; Gilroy et al. 1990; Cohn et al. 1992). However, our studies of storm events suggest that estimates of concentrations based on water flow rates will be very imprecise.

Predicting the effects of developed land presents particular problems. Unlike cropland, developed land includes a wide range of land uses, such as residential, commercial, and industrial, which may differ in nutrient discharge. Nutrient loads to these land types may be highly variable, depending on the application of fertilizers and the presence and efficacy of septic and sewage systems. Water discharges vary with the proportion of impervious surfaces. Erosion rates vary with disturbance to the soil. Because developed lands may differ in many important ways, the discharges from developed watersheds may be highly idiosyncratic. Thus the large differences between the two most developed study watersheds, 96 and 162.5, are not surprising. A nutrient source peculiar to watershed 96 may account for the discharges of ammonium and phosphate being much higher than expected from the percentage of developed land (91% developed, Figs. 8 and 9). In contrast, nutrient trapping lands or unusually low nutrient loads in watershed 162.5 may account for discharges of nutrients that are lower than expected from the percentage of developed land (70% developed, Figs. 8, 9, and 10). Predictions of the effects of developed land should be improved by studies of particular types of development, because efforts to reduce nutrient discharges from developed land must begin by identifying the most important nutrient sources from the wide range of possibilities.

The impacts of discharges from developed land are linked to increased discharges of both water and nutrients. Unlike cropland, which increases nutrient discharge without much change in water discharge, developed land significantly increases water discharge as well as nutrient discharge. Increased discharges of water alone could decrease salinity in estuarine receiving waters, thereby affecting biota adapted to particular salinities. On the other hand, the affects of increased nutrient discharge may be somewhat mitigated by accompanying increases in water discharge, because the increased discharge of water dilutes the nutrients and because biota respond to nutrient concentration rather than to nutrient flux. However, this dilution effect may not work as well for particulate nutrients because these may become concentrated by sedimentation. Subsequent releases of dissolved nutrients from deposited sediments could then increase nutrient concentrations in ambient water. Assessing the effects of local development on Mattawoman Creek will require knowledge of water circulation, exchanges with the Potomac River, and the present status of nutrients and biota within the estuary.

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FIGURE CAPTIONS

Fig. 1. Map of the study watersheds showing three categories of stream sampling stations and their drainage areas. The stream map is EPA's reach file 3 (USEPA 1994b), and the rectangular grid maps the boundaries of USGS 7.5' topographic quadrangles.

Fig. 2. Land cover of the study watersheds (black outlines) and surrounding region. Land cover data are from the EPA EMAP program (USEPA 1994a), and the rectangular grid maps the boundaries of USGS 7.5' topographic quadrangles.

Fig. 3. Stream depth (m) relative to an arbitrary reference versus time for 8 days showing the more rapid depth changes during storms at a stream draining a more developed watershed.

Fig. 4. Annual water flow (cm, 1 cm = 100 m^3/ha) during the dry (unfilled circles) and wet (filled circles) years versus percentage of developed land in watersheds. Lines fit by linear regression.

Fig. 5. Annual flow weighted mean concentrations for the dry (unfilled circles) and wet (filled circles) years; and mean concentrations in base flow (crosses) versus percentage of cropland in the watersheds with <10% developed land. Lines fit by linear regression.

Fig. 6. Annual flow weighted mean concentrations for the dry (unfilled circles) and wet (filled circles) years; and mean concentrations in base flow (crosses) versus percentage of developed land in the watersheds with <5% cropland. Lines fit by linear regression.

Fig. 7. Annual flow weighted mean concentrations for the dry (unfilled circles) and wet (filled circles) years; and mean concentrations in base flow (crosses) versus percentage of developed land in the watersheds with <5% cropland. Lines fit by linear regression.

Fig. 8. Annual discharges (kg P/ha) during the dry (unfilled circles) and wet (filled circles) years versus percentage of developed land in all the continuously monitored watersheds. Lines fit by linear regression.

Fig. 9. Annual discharges (kg N/ha) during the dry (unfilled circles) and wet (filled circles) years versus percentage of developed land. Discharges of nitrate are only for watersheds with <5% cropland, other discharges shown for all the continuously monitored watersheds. Lines fit by linear regression.

Fig. 10. Annual discharges (kg N or C/ha) during the dry (unfilled circles) and wet (filled circles) years versus percentage of developed land in all the continuously monitored watersheds. Lines fit by linear regression.

Fig. 11. Annual discharges of nitrate (kg N/ha) during the dry (unfilled circles) and wet (filled circles) years versus percentage of cropland in watersheds with <10% developed land. Lines fit by linear regression.

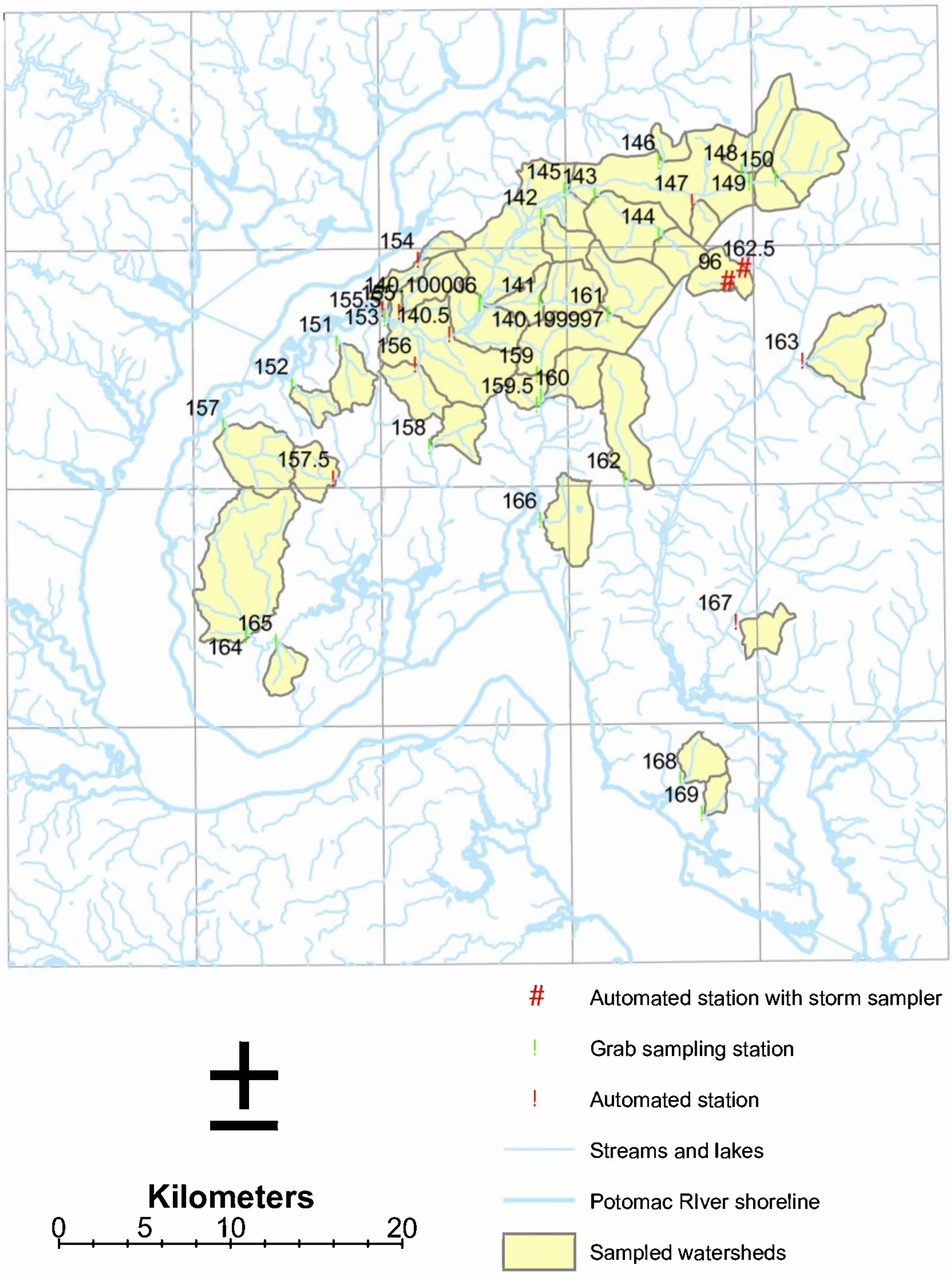


Figure 1. Map of the study watersheds showing three categories of stream sampling stations and their drainage areas. The stream map is EPA's reach file 3 (USEPA 1994b), and the rectangular grid maps the boundaries of USGS 7.5' topographic quadrangles.

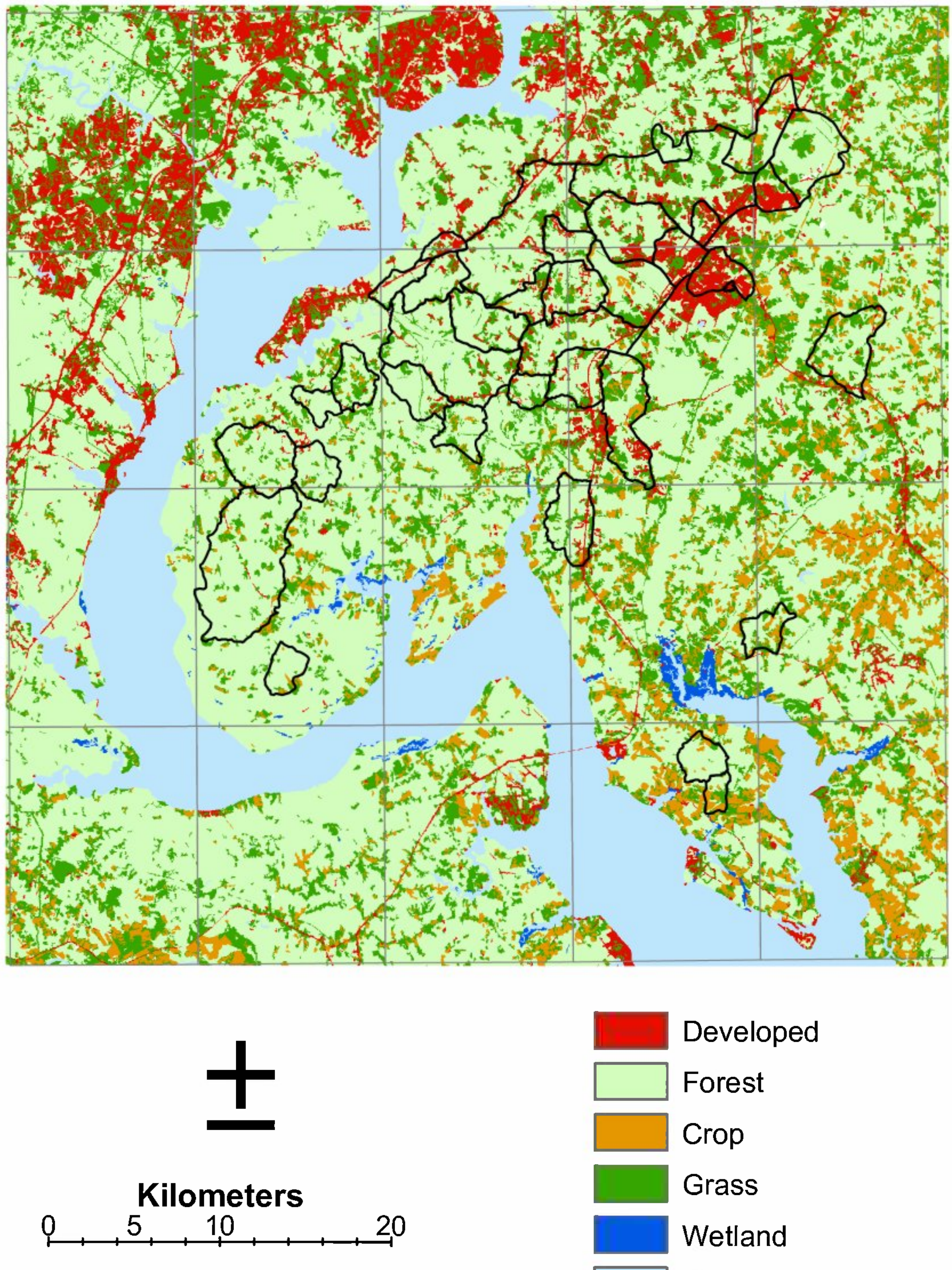
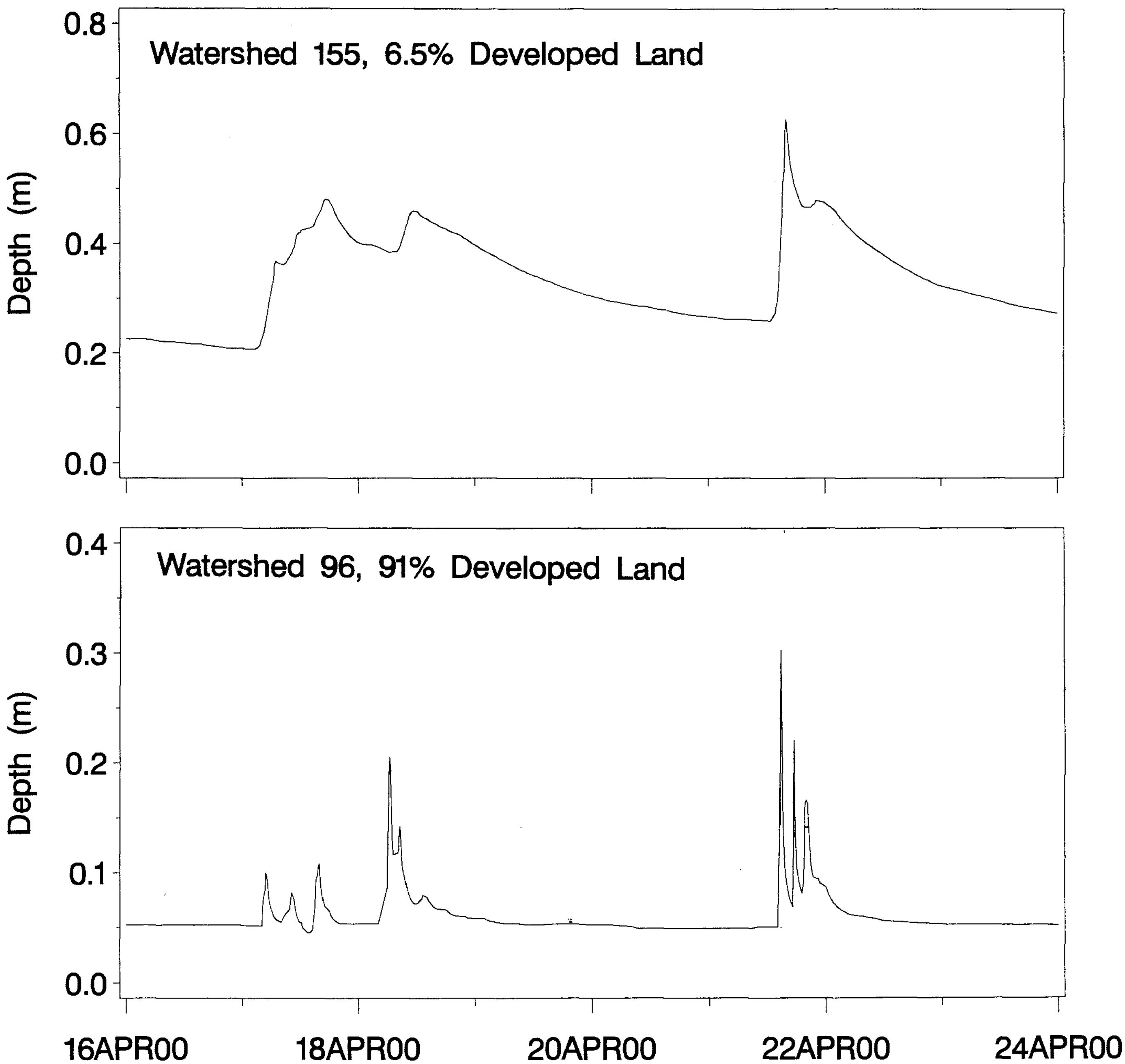
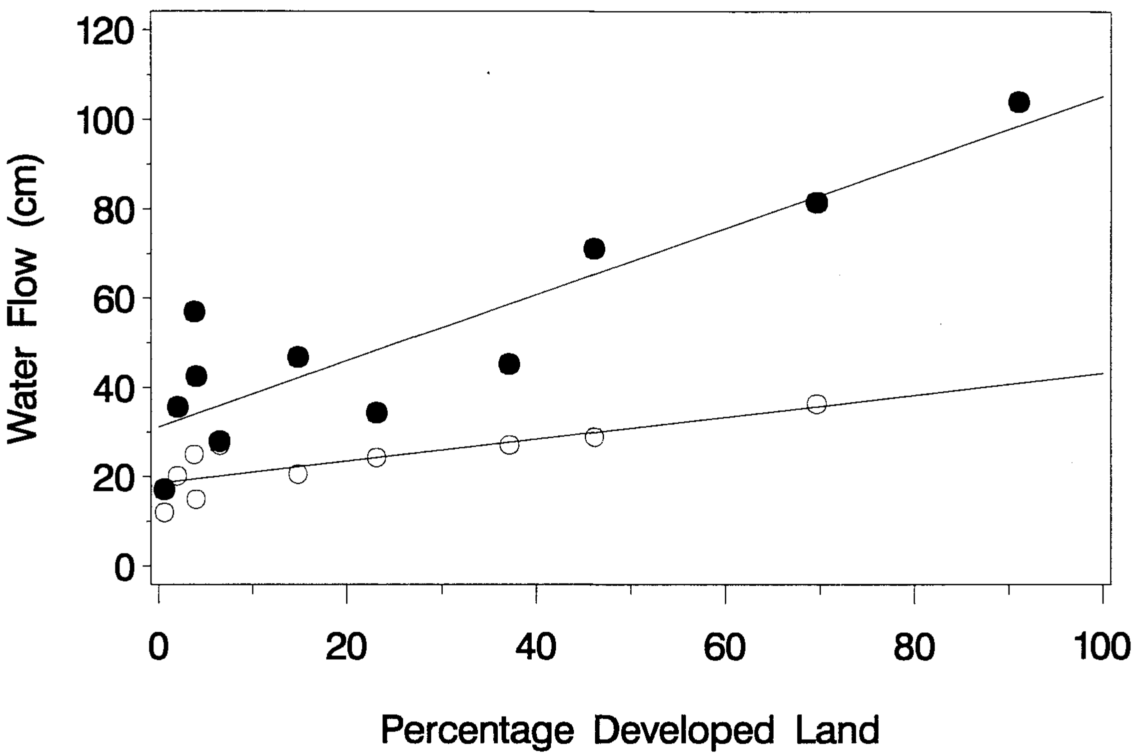


Figure 2. Land cover of the study watersheds (black outlines) and surrounding region. Land cover data are from the EPA EMAP program (USEPA 1994a), and the rectangular grid maps the boundaries of USGS 7.5' topographic quadrangles.



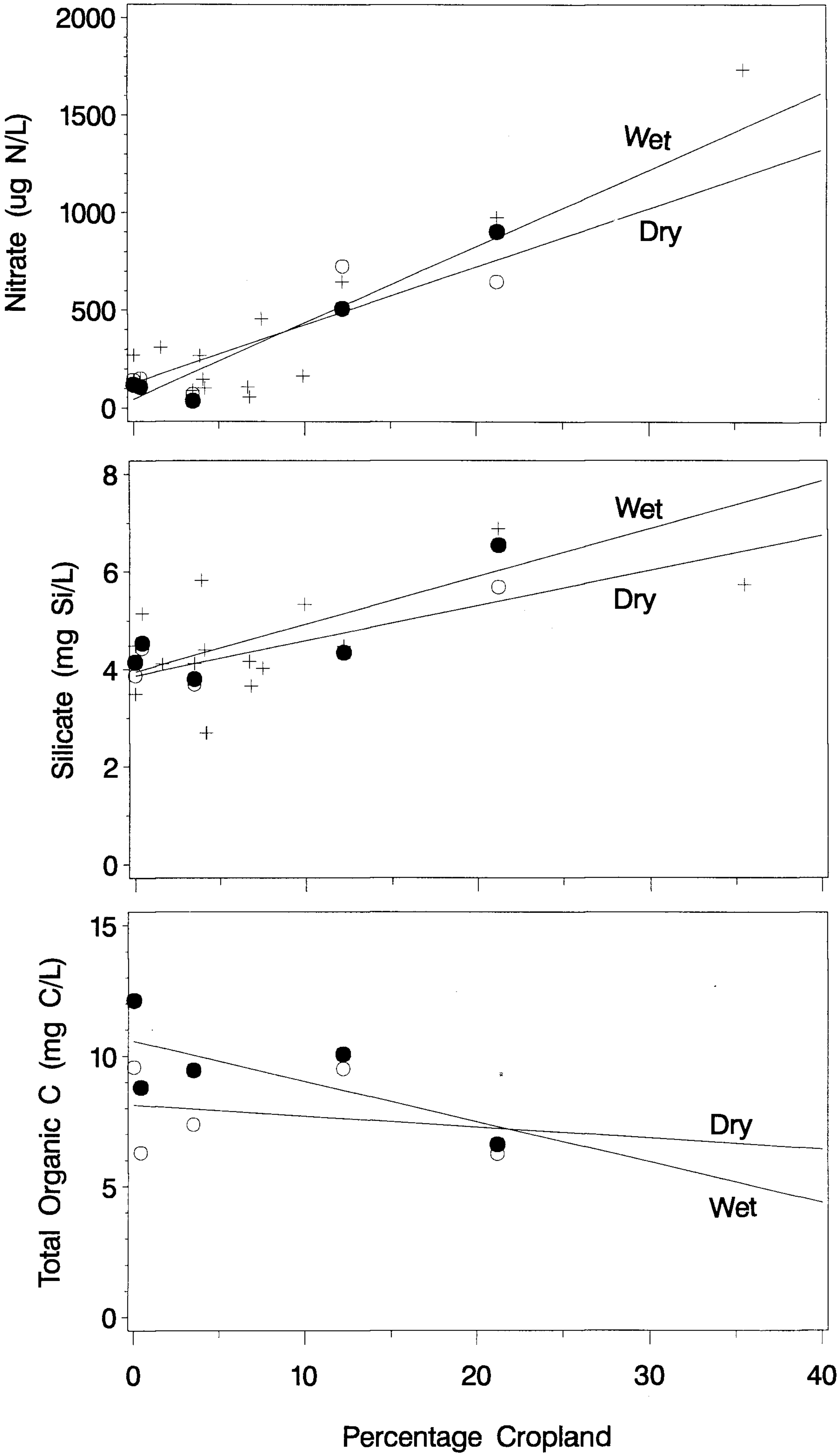
Watershed 155, 6.5% Developed Land
Watershed 96, 91% Developed Land
Depth (m)
0.8
0.6
0.4
0.2
0.0
0.4
0.3
0.2
0.1
0.0
16APR00
18APR00
20APR00
22APR00
24APR00

Fig. 3



120
100
80
60
40
20
0
Water Flow (cm)
0
20
40
60
80
100
Percentage Developed Land

Fig. 4



Nitrate (ug N/L)
2000
1500
1000
500
0
Wet
Dry
Silicate (mg Si/L)
8
6
4
2
0
Wet
Dry
Total Organic C (mg C/L)
15
10
5
0
Dry
Wet
0
10
20
30
40
Percentage Cropland

Fig. 5

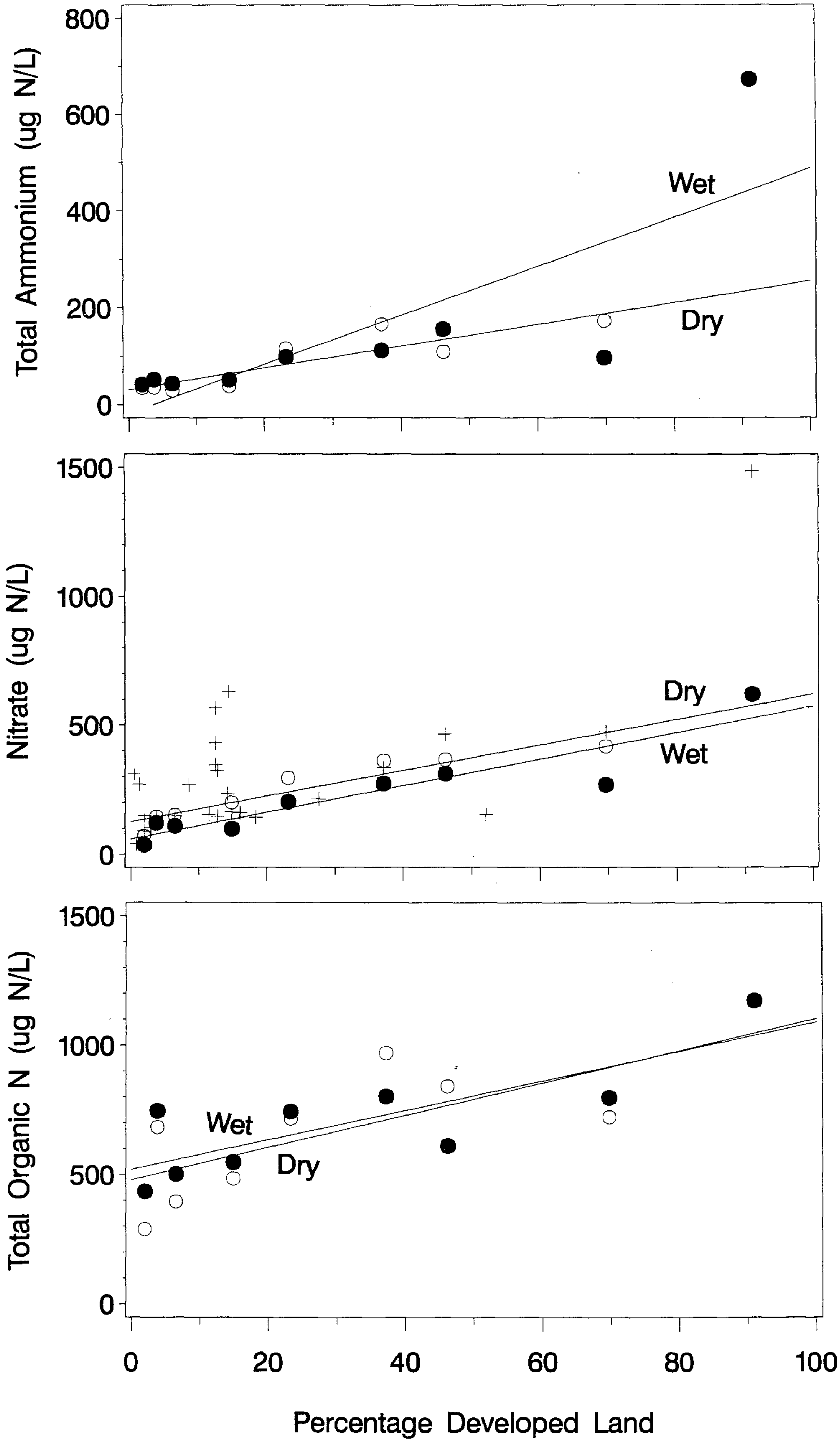
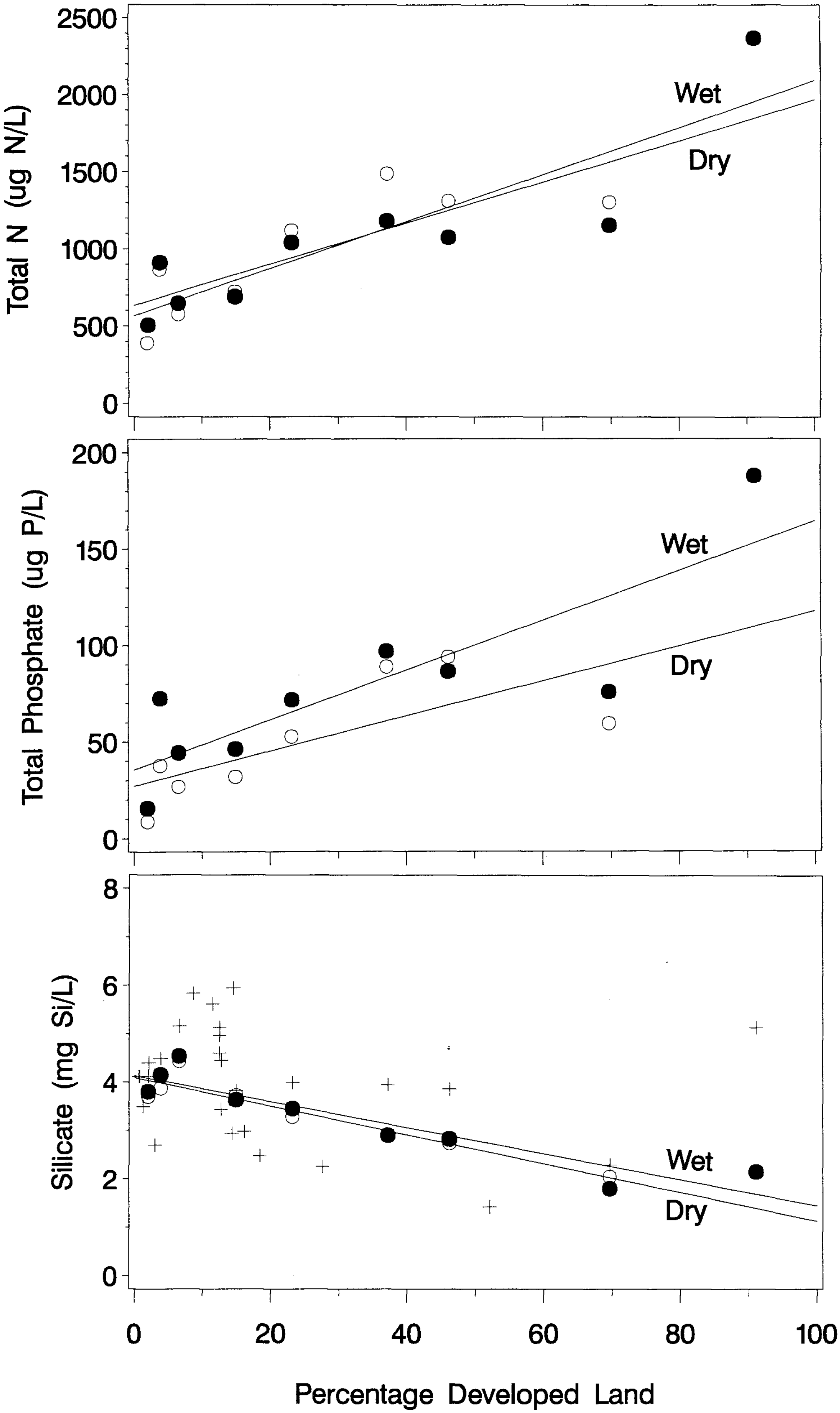
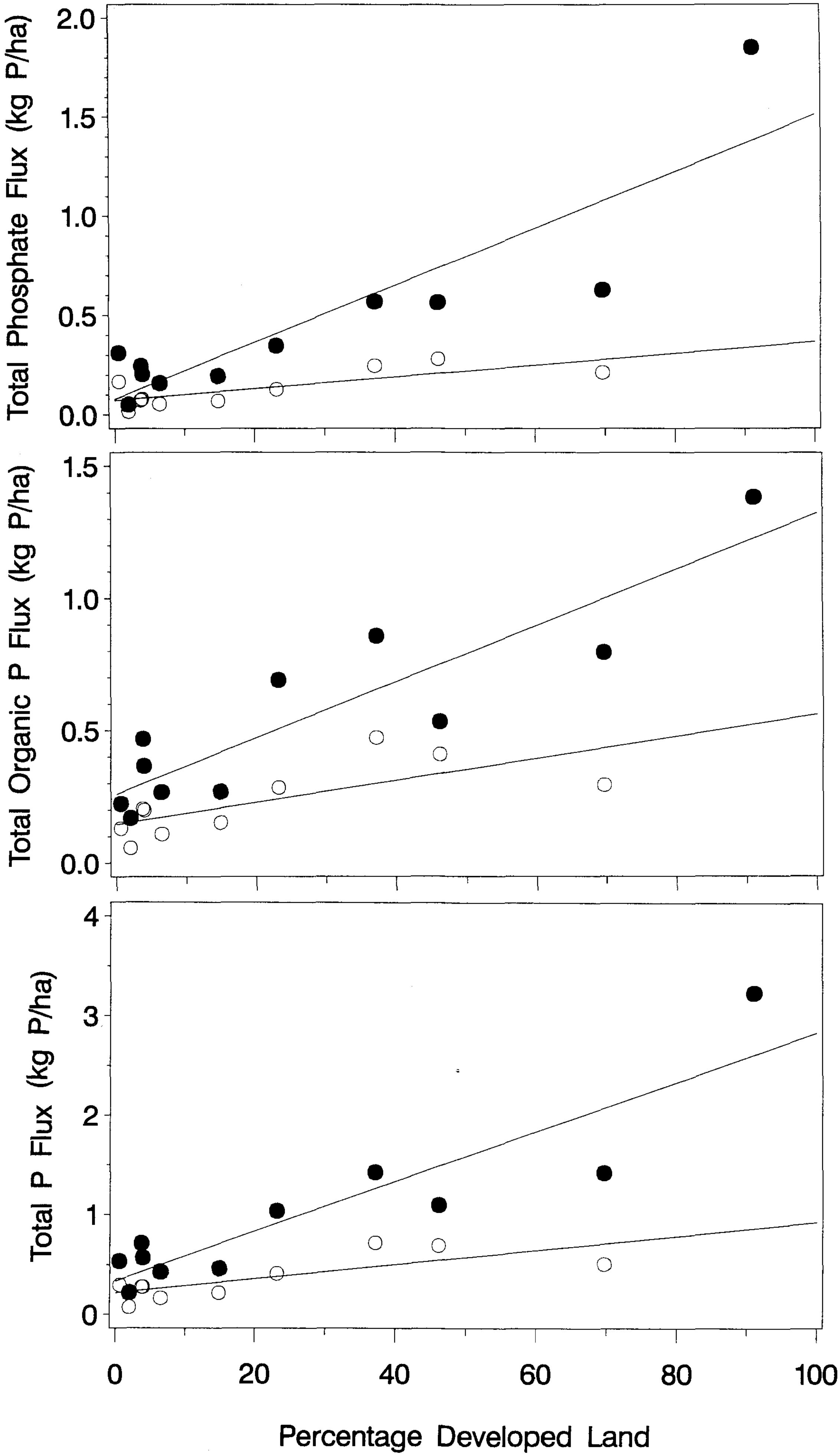

Total Ammonium (ug N/L)
800
600
400
200
0
Wet
Dry
Nitrate (ug N/L)
1500
1000
500
0
Dry
Wet
Total Organic N (ug N/L)
1500
1000
500
0
Wet
Dry
0
20
40
60
80
100
Percentage Developed Land

Fig. 6



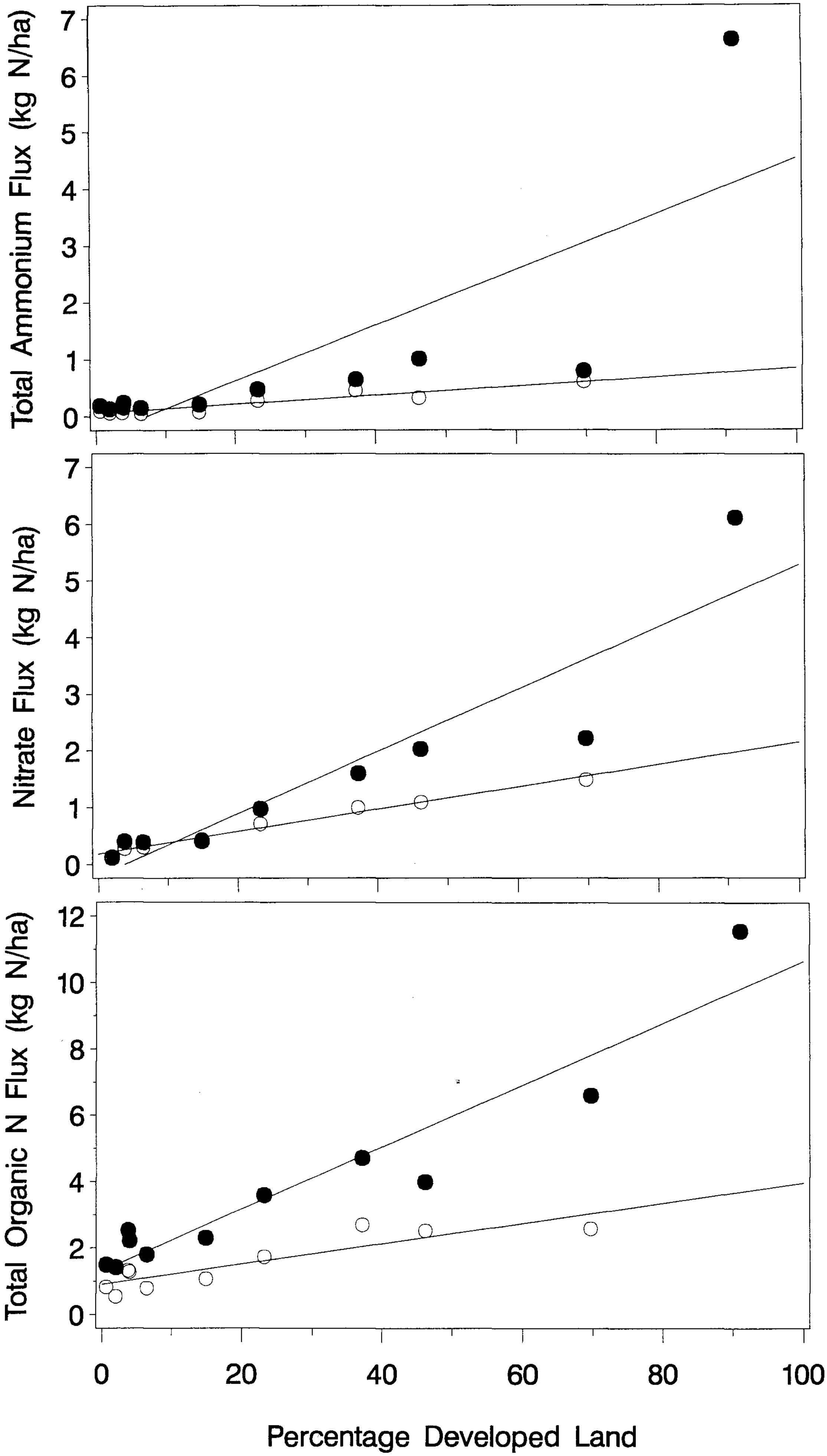
2500
2000
1500
1000
500
0
Total N (ug N/L)
Wet
Dry
200
150
100
50
0
Total Phosphate (ug P/L)
Wet
Dry
8
6
4
2
0
Silicate (mg Si/L)
Wet
Dry
0
20
40
60
80
100
Percentage Developed Land

Fig. 7



Total Phosphate Flux (kg P/ha)
0.0
0.5
1.0
1.5
2.0
Total Organic P Flux (kg P/ha)
0.0
0.5
1.0
1.5
Total P Flux (kg P/ha)
0
1
2
3
4
0
20
40
60
80
100
Percentage Developed Land

Fig. 8



Total Ammonium Flux (kg N/ha)
Nitrate Flux (kg N/ha)
Total Organic N Flux (kg N/ha)
0
20
40
60
80
100
Percentage Developed Land

Fig. 9

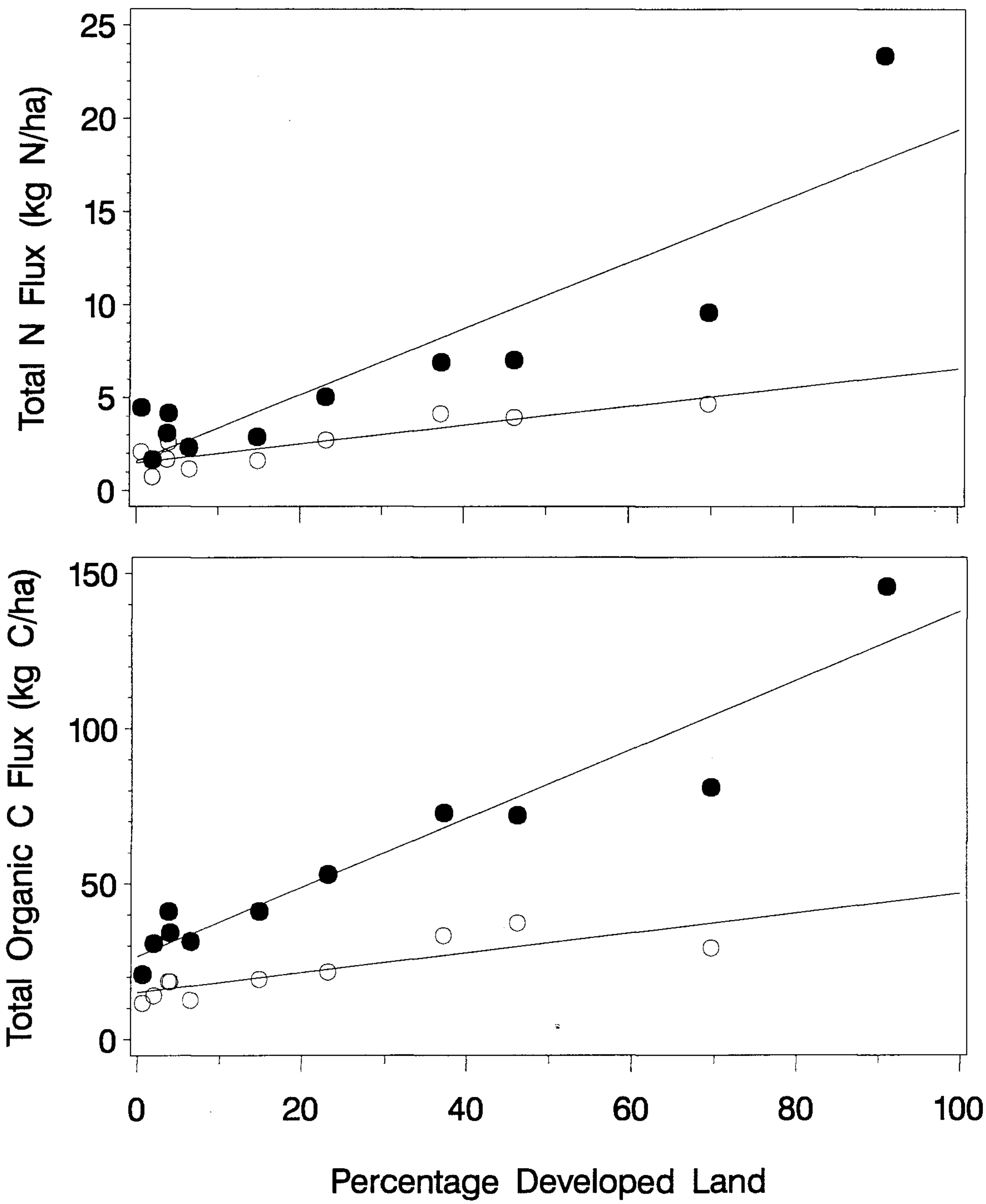

25
20
15
10
5
0
Total N Flux (kg N/ha)
150
100
50
0
Total Organic C Flux (kg C/ha)
0
20
40
60
80
100
Percentage Developed Land

Fig. 10

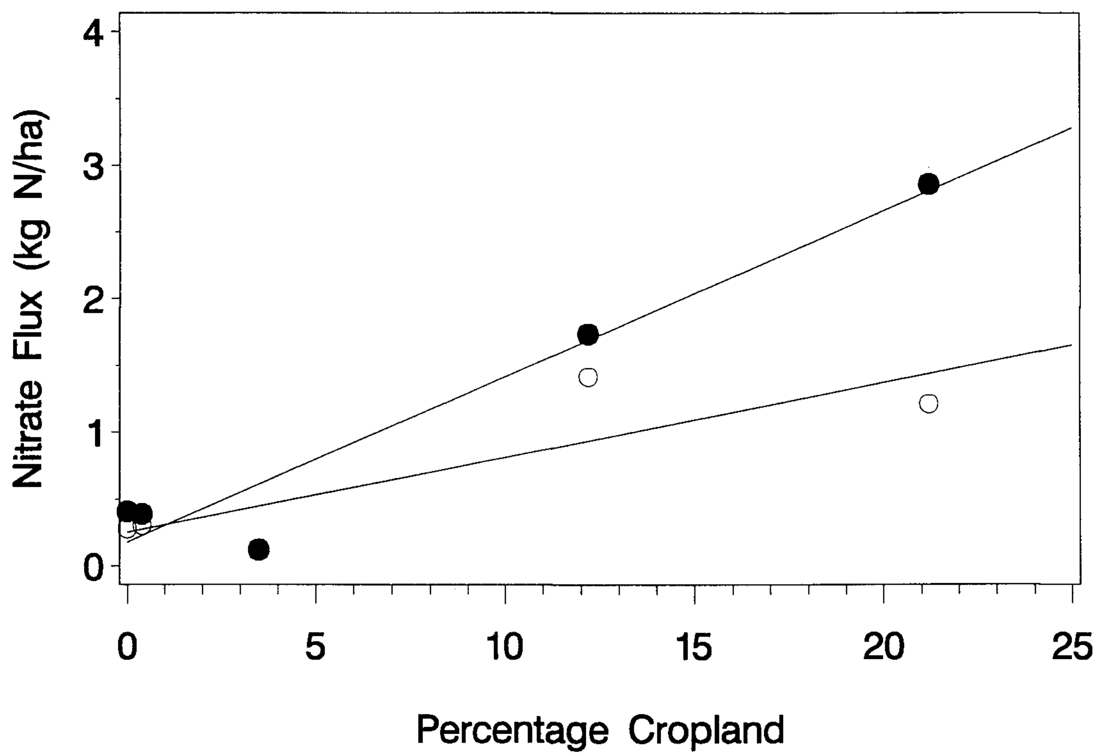


Fig. 11

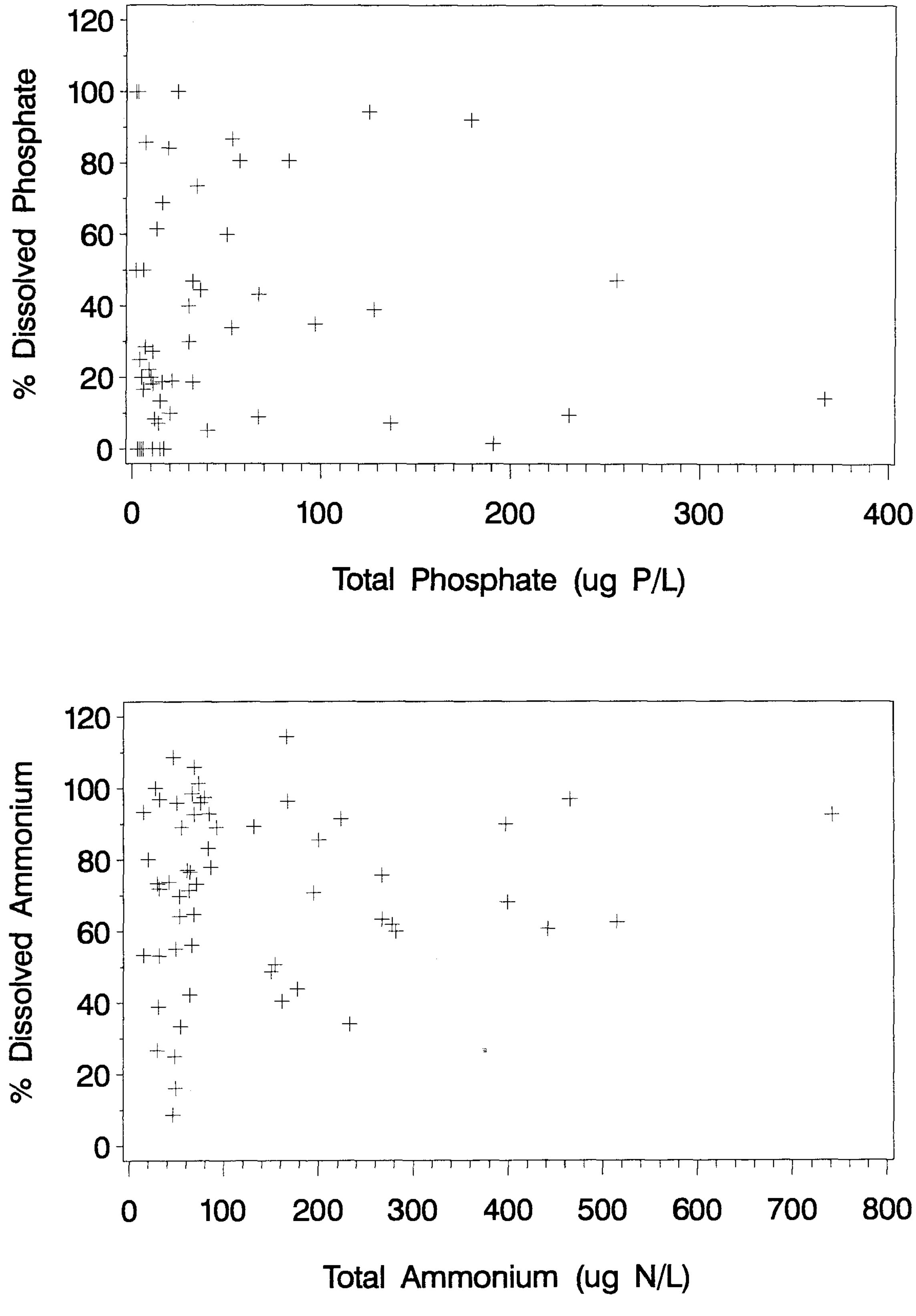

120
100
80
60
40
20
0
% Dissolved Phosphate
0
100
200
300
400
Total Phosphate (ug P/L)
120
100
80
60
40
20
0
% Dissolved Ammonium
0
100
200
300
400
500
600
700
800
Total Ammonium (ug N/L)

Fig. 12

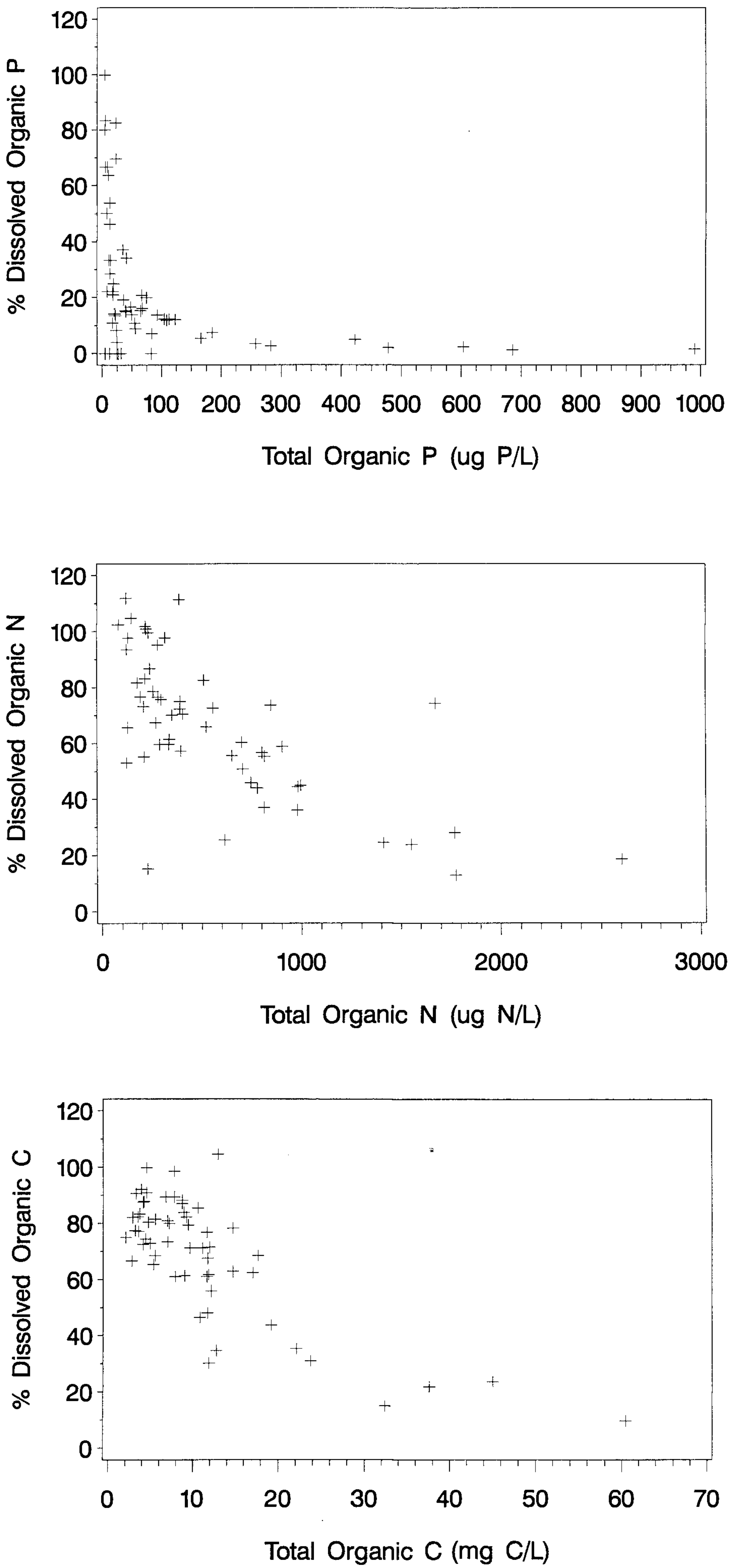
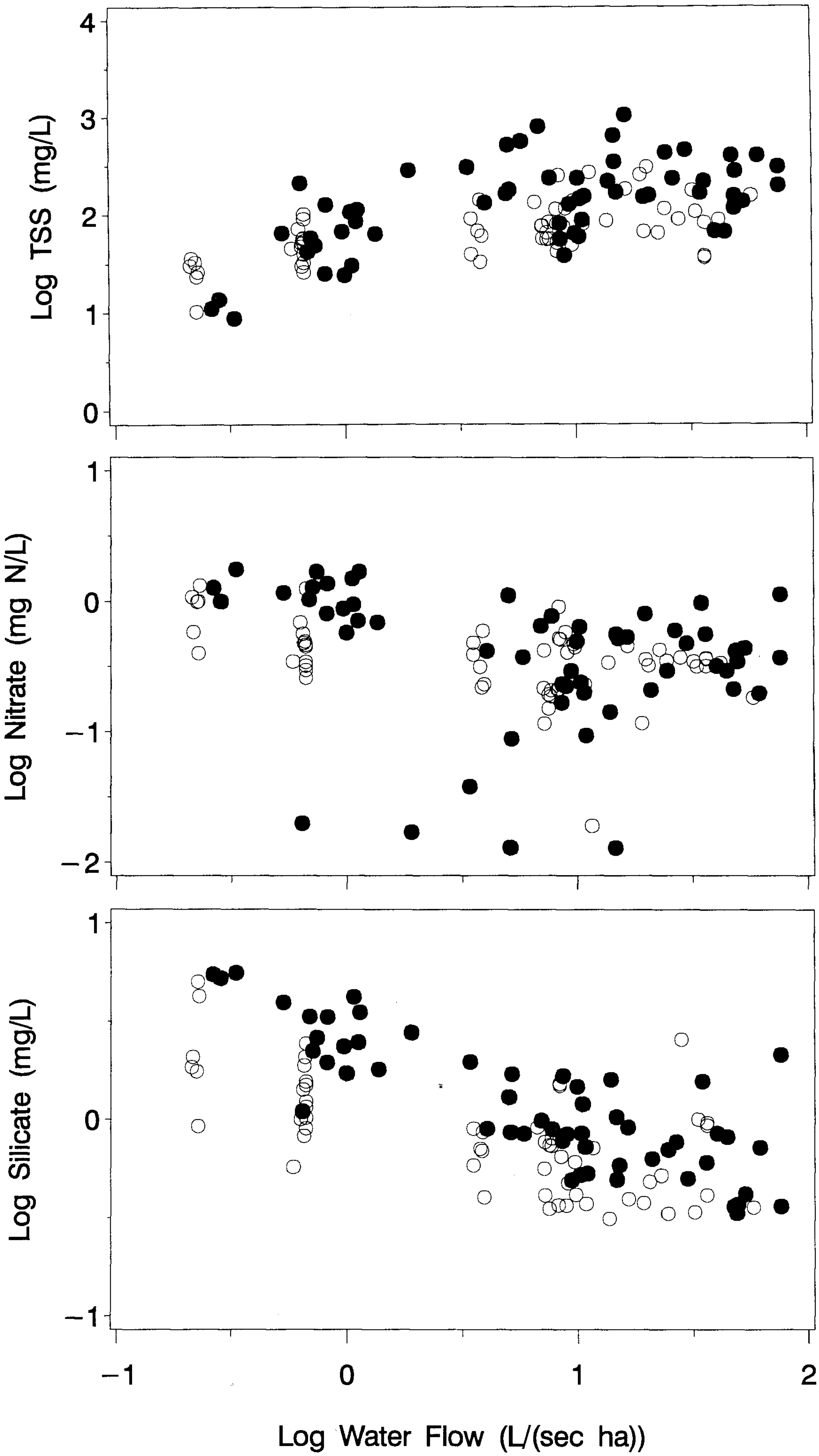
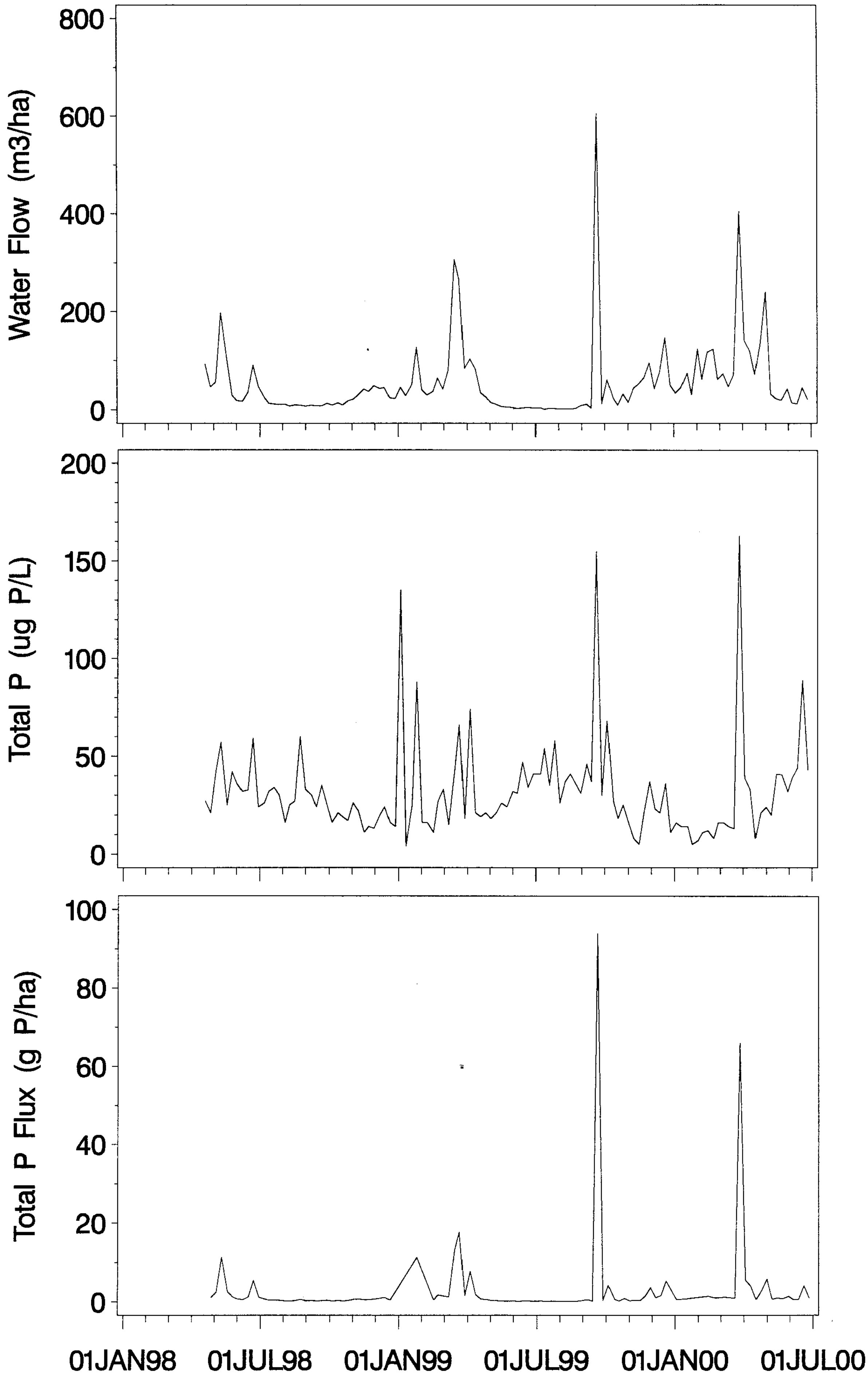

% Dissolved Organic P
Total Organic P (ug P/L)
% Dissolved Organic N
Total Organic N (ug N/L)
% Dissolved Organic C
Total Organic C (mg C/L)

Fig. 13



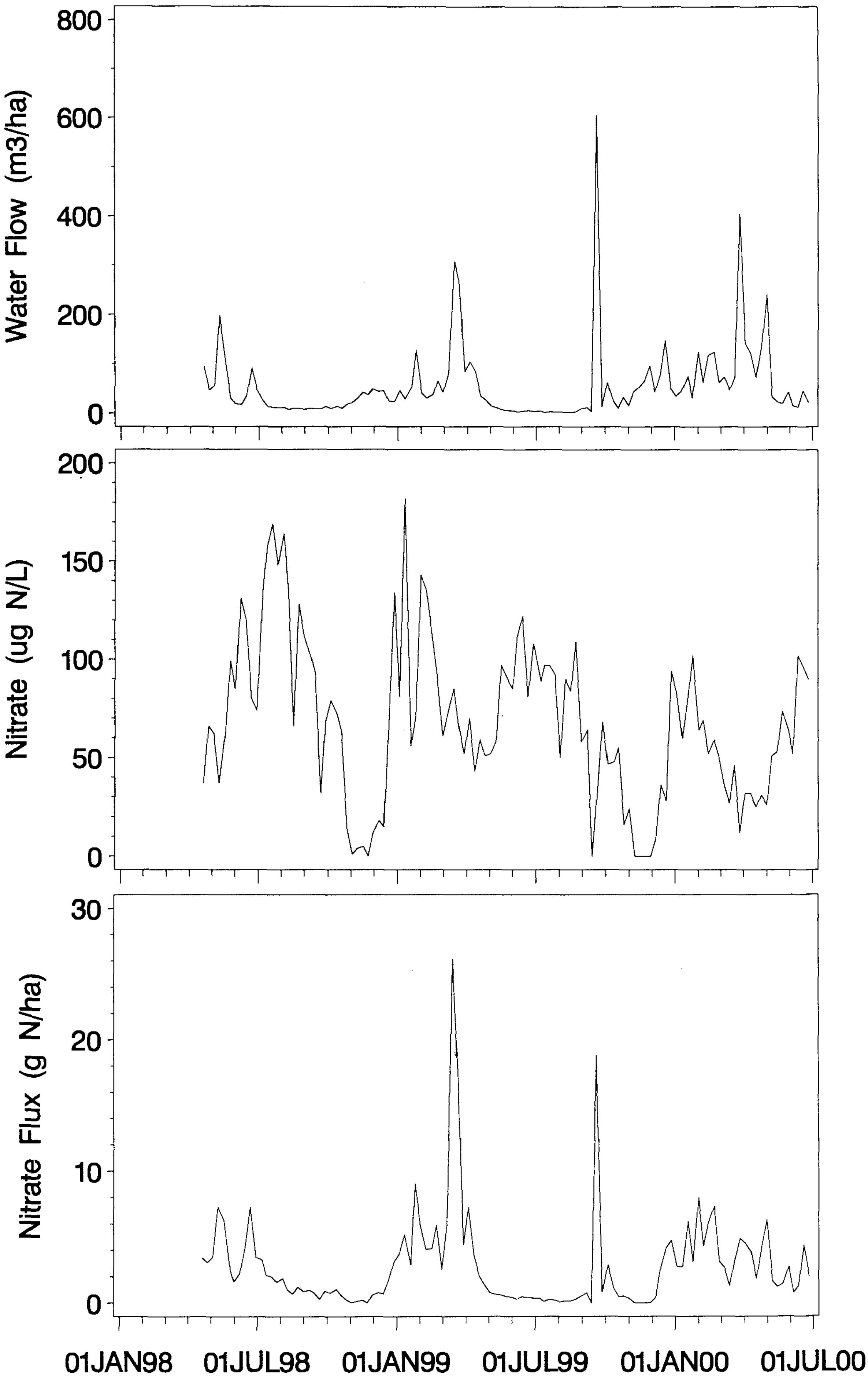
4
3
2
1
0
Log TSS (mg/L)
1
0
−1
−2
Log Nitrate (mg N/L)
1
0
−1
Log Silicate (mg/L)
−1
0
1
2
Log Water Flow (L/(sec ha))

Fig. 14



Water Flow (m3/ha)
800
600
400
200
0
Total P (ug P/L)
200
150
100
50
0
Total P Flux (g P/ha)
100
80
60
40
20
0
01JAN98
01JUL98
01JAN99
01JUL99
01JAN00
01JUL00

Fig. 15



800
600
400
200
0
Water Flow (m3/ha)
200
150
100
50
0
Nitrate (ug N/L)
30
20
10
0
Nitrate Flux (g N/ha)
01JAN98
01JUL98
01JAN99
01JUL99
01JAN00
01JUL00

Fig. 16

Table 1. Locations of the stream sampling stations. Stations in the Mattawoman Basin are in italics. Stations on lower Mattawoman Creek are in bold type.

Station Number	Longitude	Latitude	Location
Stations with automated weekly samplers and storm samplers			
96	-76.890930	38.606041	storm water drainage culvert
162.5	-76.879936	38.612877	trib. of Jordan Swamp at Hwy. 5, just east of Saint Charles Pkwy., drains N. St Charles
Stations with automated weekly samplers			
140.5	***-77.075691***	***38.579792***	***Mattawoman Ck. at Bumpy Oak Rd.***
147	*-76.912689*	*38.647919*	*unnamed trib. at Hamilton Rd.*
153	*-77.120407*	*38.593311*	*unnamed trib. at government railroad in Knotts Crossing*
154	*-77.096474*	*38.618950*	*unnamed trib. at Chapman Landing Rd. upstream of Hwy. 210 and planned*
155	*-77.109245*	*38.591755*	*unnamed trib. at Hwy. 224 and Buteaux Crossing, drains part of Chapman's Landing*
156	-77.098999	38.564156	unnamed at Hwy. 225
157.5	-77.154076	38.504803	Jane Berry Run, trib. of Nanjemoy Ck. at Hwy. 425
163	-76.840233	38.564278	Mill Dam Run, trib.of Zekiah Swamp, at Bryantown Rd.
167	-76.886253	38.427715	Oden Run, trib. of Gilbert Swamp Run and Wicomico River, at Old Sycamore Rd.
Stations with spot sampling only			
140.1	*-77.055313*	*38.595692*	*Old Womans Run at Hwy. 227 just above junction with Mattawoman Ck.*
140.2	***-77.055634***	***38.596634***	***Mattawoman Ck. at Hwy. 227***
141	*-77.015701*	*38.595276*	*Old Womans Run at Hwy. 228*
142	*-77.013985*	*38.641254*	*Laurel Br. at Hwy. 228*
143	*-76.977989*	*38.651978*	*Piney Br. at Berry Rd. (Hwy. 228)*
144	*-76.935379*	*38.630688*	*upper Piney Br. at Constitution Drive in N. St. Charles*
145	***-76.997963***	***38.654621***	***Mattawoman Ck. at Hwy. 228, just east of junction with Beale Hill Rd.***
146	*-76.934830*	*38.669430*	*unnamed trib. at Gardner Rd.*
148	*-76.879517*	*38.663559*	*Timothy Br. at McKendree Rd.*
149	*-76.874390*	*38.658188*	*Mattawoman Ck. at Hwy. 301+E59*

Table 1 continued.

Station Number	Longitude	Latitude	Location
Stations with spot sampling only			
150	*-76.856827*	*38.659893*	*Mattawoman Ck. at Cedarville Rd.*
151	*-77.151031*	*38.575485*	*Marbury Run at Hwy. 224*
152	*-77.181335*	*38.553574*	*unnamed trib. at Smallwood Rd.*
155.5	*-77.118790*	*38.588161*	*Mattawoman Ck. at Hwy. 225*
157	-77.227402	38.532127	Reeder Run, trib. E7of Chicamuxen Ck. at Hwy. 224, drains Doncaster St. Forest
158	-77.089958	38.521099	upper Mill Run at Poor House Rd.
159	-77.017494	38.558426	Port Tobacco Ck. by Community College, upstream of sewage outfall
159.5	-77.017693	38.542583	Port Tobacco Ck. at Hwy. 225
160	-77.015221	38.546852	Jennie Run, trib. of Port Tobacco Ck,. at Michell Rd.
161	-76.969978	38.589661	upper Port Tobacco Ck. at Pomfret Rd. (Hwy. 227)
162	-76.959740	38.502918	Clark Run, trib. of Zekiah Swamp, at Springhill Newtown Rd.
164	-77.212914	38.423016	Beaverdam Ck., trib. to Nanjemoy Ck., at Hancock Run Rd.
165	-77.193192	38.419037	unnamed trib. of Nanjemoy Ck. at Hwy. 6
166	-77.016296	38.482117	Wills Br. of Port Tobacco Ck. at Chapel Point Rd.
168	-76.924438	38.344913	Mill Run, trib. of Piccowaxen Ck. at Rock Point Rd. (Hwy. 257)
169	-76.910141	38.327499	trib. of Perry Br. on the Potomac at Rock Point Rd.

All sites spot sampled seasonally 13 times over 3 years: 3/19, 7/1, 9/29, and 12/29/1997; 3/30, 6/29, and 10/5/1998; 1/4, 4/14, 7/21, and 10/14/1999; and 2/23 and 5/18/2000 (station 96 added beginning 3/30/1998).

Automated stations (italic type) sampled weekly for 116 weeks from 4/20/1998 through 7/3/2000 (station 96 sampled 71 weeks beginning 8/16/1999).

Storm samplers operated from March 1999 through July 2000.

Table 2. Areas and land cover percentages for the study watersheds. Land cover data are from the EPA EMAP program (USEPA 1994a). Total developed and clear are sums of other categories (low plus high intensity developed and crop plus grass). Wetland is omitted because all watersheds had less than 0.1% mapped wetland.

		Land Cover Percentages								
			Developed							
Station Number	Drainage Area	Fores t	High Intensit	Low Intensit	Total	Crop	Grass	Clear	Wate r	Bare
96	0.23	0.5	0.0	91.1	91.1	0.0	8.3	8.3	0.0	0.0
140.1	14.71	63.4	0.0	12.5	12.5	2.6	21.4	24.1	0.0	0.0
140.2	127.99	62.0	1.6	14.5	16.1	1.5	20.2	21.6	0.1	0.2
140.5	153.98	63.2	1.3	13.7	14.9	1.5	20.2	21.7	0.1	0.2
141	9.61	64.1	0.0	12.5	12.5	2.6	20.8	23.4	0.0	0.0
142	5.66	70.7	0.0	11.5	11.5	2.4	15.3	17.7	0.0	0.0
143	20.92	55.3	4.6	22.9	27.6	0.0	16.8	16.8	0.3	0.0
144	6.60	32.5	10.3	41.8	52.1	0.0	15.0	15.0	0.4	0.0
145	90.64	57.8	2.2	16.2	18.4	1.9	21.6	23.4	0.1	0.3
146	2.91	73.5	0.0	1.3	1.3	0.0	25.2	25.2	0.0	0.0
147	3.07	35.9	9.5	36.6	46.2	0.0	17.9	17.9	0.0	0.0
148	10.76	61.7	1.9	10.5	12.4	8.2	17.7	25.9	0.0	0.0
149	20.00	59.9	0.7	13.6	14.3	4.0	20.5	24.5	0.1	1.2
150	15.32	71.0	0.9	2.1	3.0	4.2	20.1	24.2	0.1	1.6
151	6.77	61.0	0.0	1.3	1.3	7.5	30.1	37.7	0.0	0.0
152	3.61	93.7	0.0	0.6	0.6	1.6	4.2	5.7	0.0	0.0
153	6.20	67.5	2.2	21.0	23.2	0.0	9.3	9.3	0.0	0.0
154	2.53	49.2	5.3	31.9	37.2	0.0	13.5	13.5	0.0	0.0
155	7.30	81.6	0.0	6.5	6.5	0.4	11.6	12.0	0.0	0.0
155.5	196.12	66.7	1.0	11.8	12.8	1.3	19.1	20.3	0.1	0.1
156	7.73	81.6	0.0	3.8	3.8	0.0	14.6	14.6	0.0	0.0
157	14.40	81.9	0.0	2.1	2.1	4.1	11.8	15.9	0.0	0.1
157.5	6.71	83.6	0.0	2.0	2.0	3.5	10.7	14.1	0.3	0.0
158	6.64	73.1	0.0	0.7	0.7	6.7	19.4	26.2	0.0	0.0
159	29.80	63.6	0.8	12.0	12.8	4.4	19.2	23.6	0.0	0.0
159.5	42.73	64.6	0.8	11.8	12.5	3.3	19.6	22.9	0.0	0.0
160	8.85	67.0	1.0	13.5	14.5	0.1	18.4	18.5	0.0	0.0
161	13.62	65.2	1.4	11.1	12.5	6.1	16.2	22.3	0.0	0.0
162	16.06	48.2	0.5	14.0	14.4	8.9	27.7	36.6	0.4	0.4
162.5	7.12	14.9	4.6	65.2	69.7	1.6	13.2	14.8	0.2	0.4
163	13.41	55.8	0.0	4.0	4.0	12.2	27.7	39.9	0.3	0.0
164	36.56	84.1	0.0	0.8	0.8	3.5	11.5	15.1	0.0	0.0
165	4.88	86.1	0.0	0.2	0.2	6.8	6.8	13.7	0.0	0.0
166	10.84	68.0	0.1	8.4	8.6	3.9	19.3	23.2	0.1	0.0
167	5.28	53.8	0.0	0.6	0.6	21.2	24.3	45.5	0.0	0.0
168	5.83	83.9	0.0	0.0	0.0	9.9	6.1	16.0	0.0	0.1
169	2.71	40.4	0.0	0.2	0.2	35.5	24.0	59.4	0.0	0.0

Table 3. Annual precipitation (cm, 1 cm = 100 m^3 / ha) and water discharge (cm $\pm$ 95% confidence interval). Water discharges are based on extrapolating linear regressions of water discharge versus percentage of developed land ($r^2 = 0.67$, $r^2 = 0.79$, dry and wet years respectively).

Year	**Precipitation** (cm)	**Water Discharge (cm)** 0% Developed Land	100% Developed Land
July 98 – June 99	68.5	18.5 $\pm$ 4.4	43.2 $\pm$ 11.8
July 99 – June 00	127.1	31.1 $\pm$ 11.5	105.2 $\pm$ 22.5

Table 4. Regression analysis relating flow weighted mean concentrations to percentages of different land uses. Two models are used: one with percentages of cropland and developed land as independent variables and another with percentages of cleared land and developed land as independent variables. Type I *p* values shown if <0.1 (traditional cutoff for significance is $p<0.05$). The sign following *p* values indicates whether the concentration is positively or negatively correlated with the percentage of land use. NS (for not significant) denotes $p>0.1$.

	year	cropland		developed		r^2	cleared		developed		r^2
TOC	dry	NS		NS		.28	NS		NS		.22
	wet	.02	-	NS		.59	.03	-	NS		.54
TP	dry	NS		NS		.28	NS		NS		.31
	wet	NS		.04		.45	NS		.049		.44
TPO_4	dry	NS		.051	+	.47	NS		.055	+	.47
	wet	NS		.005	+	.65	NS		.0072	+	.62
TOP	dry	NS		NS		.21	NS		NS		.20
	wet	NS		NS		.19	NS		NS		.19
TNH_4	dry	NS		.0023	+	.77	NS		.0026	+	.76
	wet	NS		.0079	+	.63	NS		.0116	+	.61
NO_3	dry	.0056	+	.0502	+	.75	.0011	+	.0273	+	.84
	wet	.0003	+	.0018	+	.88	.0069	+	.0138	+	.74
TON	dry	NS		NS		.41	NS		NS		.43
	wet	NS		.008	+	.67	.06	-	.0094	+	.67
TN	dry	NS		.0296	+	.52	.33		.019	+	.59
	wet	NS	+	.0019	+	.73	.81		.0040	+	.67
TSS	dry	NS		NS		.17	NS		NS		.13
	wet	NS		NS		.20	NS		NS		.25
Si	dry	.0003	+	.0011	-	.91	.0011	+	.0015	-	.88
	wet	.0003	+	.0027	-	.87	.0020	+	.0087	-	.80

Table 5. Regression analysis relating concentrations in grab samples of base flow to percentages of cropland and developed land. Type I p shown if <0.1 (traditional cutoff for significance is $p<0.05$). All significant relationships between percentage of land use and concentration were positive. Abbreviation “ns” (for not significant) denotes $p>0.1$.

	Cropland	Dev. Land	r^2
Dissolved Phosphate	0.06	ns	.10
Dissolved Total P	ns	ns	0.057
Dissolved Ammonium	ns	0.0061	.20
Nitrate	0.0001	0.0001	.69
Dissolved Organic N	ns	ns	.003
Conductivity	0.02	0.0001	.46
Inorganic C	ns	0.0001	.42
Fluoride	ns	0.0014	.28
Chloride	ns	0.0001	.38
Sulfate	0.0002	0.0191	.41
Sodium	ns	0.0007	.31
Potassium	0.0014	0.0001	.52
Magnesium	0.0001	0.0001	.79
Calcium	ns	0.0001	.42
Silicate	0.012	ns	.19

Table 6. Total water flow and flow-weighted mean concentrations of forms of P, N, organic C, and total suspended solids for different watersheds in the dry and wet years of the study.

Watershed	Year	Water Flow (cm)	Total Phosphate (µg P/L)	Total Organic P (µg P/L)	Total P (µg P/L)	Total Ammonium (µg N/L)	Nitrate (µg N/L)	Total Organic N (µg N/L)	Total N (µg N/L)	Total Organic C (mg C/L)	Total Suspended Solids (mg/L)	Dissolved Silicate (mg Si/L)
96	wet	104	188.0	140	328	674	621	1173	2372	14.8	86	2.2
140.5	dry	21	32.0	68	100	38	200	484	722	8.7	62	3.7
140.5	wet	47	46.4	64	110	51	98	547	690	9.8	41	3.6
147	dry	29	94.0	137	231	109	366	841	1313	12.5	113	2.7
147	wet	71	86.5	82	168	156	311	611	1077	11.0	47	2.8
153	dry	24	52.7	117	170	116	295	717	1121	8.9	149	3.3
153	wet	34	72.0	143	215	99	202	744	1042	11.0	163	3.5
154	dry	27	89.0	171	260	166	361	971	1487	12.0	158	2.9
154	wet	45	97.2	146	244	112	273	803	1182	12.4	130	2.9
155	dry	27	26.9	54	81	30	152	395	577	6.3	65	4.4
155	wet	28	44.5	75	119	43	109	502	648	8.8	110	4.5
156	dry	25	37.8	105	143	36	144	683	865	9.6	153	3.9
156	wet	57	72.6	138	211	52	121	747	910	12.1	203	4.2
157.5	dry	20	8.8	31	39	35	71	290	390	7.4	33	3.7
157.5	wet	36	15.7	52	68	41	37	435	510	9.5	80	3.8
162.5	dry	36	59.4	82	142	173	417	723	1306	8.2	29	2.0
162.5	wet	82	75.9	96	172	97	270	799	1159	9.8	71	1.8
163	dry	15	40.6	102	143	75	727	660	1340	9.5	65	4.3
163	wet	43	59.9	108	168	72	509	653	1224	10.1	112	4.3
167	dry	12	89.4	70	159	52	650	446	1117	6.3	59	5.7
167	wet	17	98.6	71	169	61	905	475	1420	6.6	71	6.6

Table 7. Regression analysis relating discharges of materials in the dry and wet years to percentages of developed land and cropland. Type I p shown if <0.1 (traditional cutoff for significance is $p<0.05$). All significant relationships between discharge and the percentage of land use were positive. ns (for not significant) denotes $p>0.1$.

	Dry Year			Wet Year		
	Dev. Land	Cropland	r^2	Dev. Land	Cropland	r^2
Total Phosphate	0.0093	ns	0.67	0.0005	ns	0.80
Total Organic P	0.027	ns	0.53	0.0004	ns	0.81
Total P	0.016	ns	0.59	0.0002	ns	0.83
Total Ammonium	0.0001	ns	0.90	0.006	ns	0.63
Nitrate	0.011	0.0021	0.83	0.0008	0.0071	0.83
Total Organic N	0.001	ns	0.79	0.0001	ns	0.91
Total N	0.0006	ns	0.85	0.0002	ns	0.84
Total Organic C	0.0041	ns	0.72	0.0001	ns	0.92
Dissolved Silicate	ns	0.035	0.56	ns	0.086	0.47
Total Suspended Solids	ns	ns	0.23	0.084	ns	0.38

Table 8. Annual discharges (kg/ha ± 95% confidence interval) from watersheds with 0% and 100% developed land or cropland. Discharges were predicted from regressions of flux versus percentage of land use for the dry and wet years (Table 7).

	Year	0% developed kg/ha	100% developed kg/ha
Total Phosphate	dry	0.072 ± 0.062	0.37 ± 0.17
	wet	0.077 ± 0.305	1.51 ± 0.45
Total Organic P	dry	0.145 ± 0.098	0.56 ± 0.27
	wet	0.26 ± 0.16	1.32 ± 0.31
Total P	dry	0.22 ± 0.15	0.93 ± 0.40
	wet	0.34 ± 0.35	2.84 ± 0.68
Total Ammonium	dry	0.057 ± 0.068	0.85 ± 0.19
	wet	-0.36 ± 1.16	4.54 ± 2.27
Total Organic N	dry	0.90 ± 0.39	3.96 ± 1.05
	wet	1.30 ± 0.90	10.65 ± 1.77
Nitrate	dry	0.18 ± 0.31	2.08 ± 0.67
	wet	-0.33 ± 0.94	5.25 ± 1.49
Total N	dry	1.48 ± 0.66	6.54 ± 1.78
	wet	1.57 ± 2.68	19.40 ± 5.27
Total Organic C	dry	15.0 ± 5.1	46.9 ± 13.9
	wet	26.6 ± 10.2	138 ± 20
		0% cropland	100% cropland
Nitrate	dry	0.18 ± 0.31	5.94 ± 2.68
	wet	-0.33 ± 0.94	14.0 ± 22.7

Table 9. Multiple regression analysis testing the effect of water flow rate after accounting for the effects of the percentages of developed land and cropland. Concentrations and flow rates were log transformed for analysis. Type I *p* shown if <0.1 (traditional cutoff for significance is $p<0.05$). The sign following *p* values indicates whether the concentration is positively or negatively correlated with the water flow rate. Abbreviation "ns" (for not significant) denotes $p>0.1$.

	Dev. Land	Cropland	Flow	r^2
Particulate Phosphate	ns	ns	.0002 +	0.27
Dissolved Phosphate	.0007	0.035	.0001 +	0.56
Particulate Organic P	ns	ns	.0001 +	0.43
Dissolved Organic P	ns	ns	.0001 +	0.41
Particulate Ammonium	.09	ns	ns	0.063
Dissolved Ammonium	.0001	ns	ns	0.36
Particulate Organic N	.048	ns	.0001 +	0.42
Dissolved Organic N	.0093	.059	.0001 +	0.38
Nitrate	.019	.0001	.077 -	0.41
Particulate Organic C	.013	ns	.0001 +	0.44
Dissolved Organic C	ns	ns	.0001 +	0.31
Total Suspended Solids	ns	ns	.0001 +	0.65
Dissolved Silicate	.0001	ns	.0001 -	0.76
Conductivity	.0004	ns	.0003 -	0.35
pH	.0001	ns	.0011 -	0.38
Alkalinity	.0001	ns	.013 -	0.52
Chloride	.0012	ns	.0001 -	0.37

Table 10. Regression analysis of concentrations in storm fraction samples from watersheds 96 and 162.5. Concentrations were log transformed for analysis. Independent variables include the log of water flow rate, the phase of the storm (decline=D or rise=R of hydrograph), the interaction of flow rate and phase, and the storm event. Type I *p* shown if <0.1 (traditional cutoff for significance is $p<0.05$). Abbreviation "ns" denotes not significant ($p>0.1$). The signs after significant *p* values for log of flow indicate whether concentration is positively or negatively related to flow. The signs under D or R indicate whether concentration is positively or negatively related to flow during the declining phase of the hydrograph (D) or the rising phase of the hydrograph (R). There were always highly significant differences ($p<0.01$) among storm events after accounting for the other effects in the model. Therefore, to simplify the table, we left off the *p* values for the effect of storm event.

	Watershed 96							Watershed 162.5						
	LFlow		Phase	F*Phase	D	R	r^2	LFlow		Phase	F*Phase	D	R	r^2
Particulate Phosphate	.0001	+	.0001	ns	+	+	.53	.0001	+	.0001	ns	+	+	.87
Dissolved Phosphate	ns		.0001	.025	-	+	.58	.0001	+	ns	.066	+	+	.79
Particulate Organic P	.0001	+	.0041	.033	+	+	.80	.0001	+	.0001	.024	+	+	.82
Dissolved Organic P	ns		.0001	.022	-	+	.53	ns		ns	.014	-	+	.65
Particulate Ammonium	.070	-	ns	ns	-	-	.70	ns		ns	ns			.73
Dissolved Ammonium	ns		ns	.095	-	+	.72	.0013	+	.019	.024	+	+	.89
Nitrate	.0001	-	ns	ns	-	-	.61	.0069	-	.0001	ns	-	-	.67
Particulate Organic N	.0001	+	.0001	ns	+	+	.78	.0001	+	.0001	ns	+	+	.83
Dissolved Organic N	.0001	-	.081	.022	-	-	.60	ns		ns	ns			.63
Particulate Organic C	.0001	+	.0001	.031	+	+	.81	.0001	+	.0001	ns	+	+	.82
Dissolved Organic C	.0001	-	ns	.0012	-	-	.62	ns		.0005	ns			.75
Total Suspended Solids	.0001	+	.0001	.017	+	+	.79	.0001	+	.0001	ns	+	+	.86
Conductivity	.0001	-	.0001	.059	-	-	.81	.0001	-	.066	.0067	-	-	.87
pH	.0010	-	.012	ns	-	-	.57	.068	-	.0001	ns	-	-	.74
Alkalinity	.0001	-	.0004	ns	-	-	.79	.0017	-	.0043	ns	-	-	.64
Chloride	.0001	-	.0001	.0036	-	-	.84	.0001	-	ns	ns	-	-	.66
Dissolved Silicate	.0001	-	.0001	.013	-	-	.77	.0001	-	.018	.020	-	-	.76

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
140.1	19-Mar-1997	78	.	.	.	.	339	.	.	.	.	.	.	.	.	.	.	.	.	.	14.85	3.43
140.2	19-Mar-1997	78	.	.	.	.	176	.	.	.	.	.	.	.	.	.	.	.	.	.	16.69	3.27
140.5	19-Mar-1997	78	.	.	.	.	226	.	.	.	.	.	.	.	.	.	.	.	.	.	15.18	3.25
141	19-Mar-1997	78	.	.	.	.	461	.	.	.	.	.	.	.	.	.	.	.	.	.	10.69	4.39
142	19-Mar-1997	78	.	.	.	.	199	.	.	.	.	.	.	.	.	.	.	.	.	.	6.70	2.96
143	19-Mar-1997	78	.	.	.	.	369	.	.	.	.	.	.	.	.	.	.	.	.	.	17.04	3.67
144	19-Mar-1997	78	.	.	.	.	319	.	.	.	.	.	.	.	.	.	.	.	.	.	30.55	2.48
145	19-Mar-1997	78	.	.	.	.	281	.	.	.	.	.	.	.	.	.	.	.	.	.	20.08	3.55
146	19-Mar-1997	78	.	.	.	.	220	.	.	.	.	.	.	.	.	.	.	.	.	.	21.40	2.67
147	19-Mar-1997	78	.	.	.	.	431	.	.	.	.	.	.	.	.	.	.	.	.	.	15.52	2.82
148	19-Mar-1997	78	.	.	.	.	358	.	.	.	.	.	.	.	.	.	.	.	.	.	30.96	3.81
149	19-Mar-1997	78	.	.	.	.	390	.	.	.	.	.	.	.	.	.	.	.	.	.	10.11	2.67
150	19-Mar-1997	78	.	.	.	.	141	.	.	.	.	.	.	.	.	.	.	.	.	.	11.17	2.74
151	19-Mar-1997	78	.	.	.	.	359	.	.	.	.	.	.	.	.	.	.	.	.	.	9.02	5.25
152	19-Mar-1997	78	.	.	.	.	217	.	.	.	.	.	.	.	.	.	.	.	.	.	5.23	2.75
153	19-Mar-1997	78	.	.	.	.	286	.	.	.	.	.	.	.	.	.	.	.	.	.	14.25	2.84
154	19-Mar-1997	78	.	.	.	.	268	.	.	.	.	.	.	.	.	.	.	.	.	.	10.22	2.73
155	19-Mar-1997	78	.	.	.	.	233	.	.	.	.	.	.	.	.	.	.	.	.	.	9.21	3.25
155.5	19-Mar-1997	78	.	.	.	.	205	.	.	.	.	.	.	.	.	.	.	.	.	.	13.39	7.88
156	19-Mar-1997	78	.	.	.	.	177	.	.	.	.	.	.	.	.	.	.	.	.	.	4.64	3.16
157	19-Mar-1997	78	.	.	.	.	135	.	.	.	.	.	.	.	.	.	.	.	.	.	5.63	2.52
157.5	19-Mar-1997	78	.	.	.	.	79	.	.	.	.	.	.	.	.	.	.	.	.	.	6.67	3.14
158	19-Mar-1997	78	.	.	.	.	140	.	.	.	.	.	.	.	.	.	.	.	.	.	3.42	2.83
159	19-Mar-1997	78	.	.	.	.	369	.	.	.	.	.	.	.	.	.	.	.	.	.	13.69	3.86
159.5	19-Mar-1997	78	.	.	.	.	418	.	.	.	.	.	.	.	.	.	.	.	.	.	15.15	3.59
160	19-Mar-1997	78	.	.	.	.	505	.	.	.	.	.	.	.	.	.	.	.	.	.	20.51	3.71
161	19-Mar-1997	78	.	.	.	.	214	.	.	.	.	.	.	.	.	.	.	.	.	.	15.98	2.55
162	19-Mar-1997	78	.	.	.	.	404	.	.	.	.	.	.	.	.	.	.	.	.	.	13.67	2.82
162.5	19-Mar-1997	78	.	.	.	.	524	.	.	.	.	.	.	.	.	.	.	.	.	.	25.79	3.40
163	19-Mar-1997	78	.	.	.	.	460	.	.	.	.	.	.	.	.	.	.	.	.	.	6.59	3.99
164	19-Mar-1997	78	.	.	.	.	69	.	.	.	.	.	.	.	.	.	.	.	.	.	5.46	2.32
165	19-Mar-1997	78	.	.	.	.	128	.	.	.	.	.	.	.	.	.	.	.	.	.	4.65	2.20
166	19-Mar-1997	78	.	.	.	.	281	.	.	.	.	.	.	.	.	.	.	.	.	.	16.06	2.99
167	19-Mar-1997	78	.	.	.	.	658	.	.	.	.	.	.	.	.	.	.	.	.	.	7.39	4.17
168	19-Mar-1997	78	.	.	.	.	426	.	.	.	.	.	.	.	.	.	.	.	.	.	5.96	2.77
169	19-Mar-1997	78	.	.	.	.	1734	.	.	.	.	.	.	.	.	.	.	.	.	.	16.96	5.47
140.1	1-Jul-1997	182	25	33	74	391	261	5.04	.	5.40	7.16	100.9	8.94	1.61	1.81	5.88	53	604	76	0.074	15.45	2.81
140.2	1-Jul-1997	182	30	49	73	506	211	7.61	.	2.18	6.93	129.6	12.28	2.19	2.21	6.58	108	1128	354	0.119	19.32	3.39
140.5	1-Jul-1997	182	33	50	77	537	190	7.72	.	2.36	7.17	119.7	11.47	2.13	2.16	6.76	103	1239	221	0.104	18.02	3.25
141	1-Jul-1997	182	49	70	178	505	242	5.04	.	5.96	6.83	73.6	5.10	1.24	1.58	4.84	93	1480	197	0.071	9.25	1.70
142	1-Jul-1997	182	42	76	119	376	341	5.25	.	5.20	7.08	104.0	9.88	1.84	1.83	5.25	87	1245	178	0.074	16.49	2.46
143	1-Jul-1997	182	28	41	82	531	204	7.72	.	2.05	7.06	122.0	11.96	2.22	2.29	7.08	82	1602	202	0.137	17.93	1.77
144	1-Jul-1997	182	11	20	86	463	28	7.30	.	1.10	7.53	173.6	18.17	3.27	3.04	9.48	29	635	50	0.132	25.91	1.45
145	1-Jul-1997	182	26	43	101	636	112	8.64	.	1.98	7.45	128.3	12.45	2.22	2.36	7.14	69	1513	892	0.125	18.86	2.99
146	1-Jul-1997	182	30	45	206	679	256	9.98	.	3.10	6.51	76.7	8.47	1.13	1.53	2.48	204	2959	215	0.079	14.28	1.12
147	1-Jul-1997	182	90	92	117	522	411	7.92	.	4.24	7.41	138.9	12.45	2.22	2.53	8.74	60	1043	116	0.163	20.88	3.90
148	1-Jul-1997	182	25	42	209	748	121	11.93	.	2.71	7.30	165.6	19.28	1.84	2.73	7.20	96	2407	417	0.155	29.36	2.34
149	1-Jul-1997	182	58	84	229	853	252	11.93	.	3.18	6.89	107.1	7.44	2.01	2.24	7.48	114	3964	325	0.096	13.14	2.20
150	1-Jul-1997	182	23	41	289	1092	9	14.40	.	2.77	6.77	63.4	4.35	1.57	1.71	3.47	153	5897	534	0.078	5.87	1.45
151	1-Jul-1997	182	33	55	57	449	471	4.84	.	4.36	7.20	69.0	5.41	1.77	1.65	3.96	89	1294	75	0.046	8.77	1.04
152	1-Jul-1997	182	3	4	49	317	365	5.45	.	3.49	7.20	72.6	6.15	1.31	1.36	4.20	82	792	53	0.029	9.34	1.62
153	1-Jul-1997	182	13	17	32	287	128	5.76	.	4.60	7.58	160.2	16.60	2.11	2.34	10.01	71	993	205	0.096	22.95	2.34
154	1-Jul-1997	182	33	46	86	490	297	6.07	.	4.16	7.33	125.1	15.16	2.23	1.97	5.94	91	1431	118	0.093	18.91	2.17
155	1-Jul-1997	182	9	23	65	360	124	5.66	.	5.68	7.12	85.2	8.66	1.32	1.38	4.96	185	996	128	0.089	11.86	1.86
155.5	1-Jul-1997	182	31	53	107	602	179	7.20	.	3.00	7.10	110.9	10.48	2.03	2.01	6.26	123	1184	363	0.098	15.61	3.09
156	1-Jul-1997	182	7	10	68	339	59	4.12	.	4.96	6.97	60.3	4.24	1.07	1.10	4.37	70	911	113	0.057	5.83	2.22
157	1-Jul-1997	182	3	6	54	322	443	3.09	.	4.92	7.63	82.1	3.51	1.21	1.67	9.28	50	707	178	0.022	5.23	0.79

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
157.5	1-Jul-1997	182	3	12	89	323	206	4.94	.	4.16	6.98	47.6	4.53	1.07	0.78	2.01	107	998	76	0.037	7.98	0.47
158	1-Jul-1997	182	37	51	76	442	112	5.04	.	4.20	6.89	46.1	4.61	0.90	0.94	2.18	86	1850	98	0.070	5.88	0.96
159	1-Jul-1997	182	57	80	87	529	368	7.61	.	3.91	7.20	107.3	11.62	1.79	1.83	5.26	174	1725	205	0.106	17.34	2.34
159.5	1-Jul-1997	182	87	104	73	398	541	7.82	.	5.80	7.63	163.5	20.73	2.13	1.90	7.14	76	937	110	0.137	28.22	3.18
160	1-Jul-1997	182	58	71	63	343	465	6.58	.	7.12	7.43	219.0	28.55	2.34	2.06	8.84	48	391	83	0.149	40.58	3.77
161	1-Jul-1997	182	24	44	188	655	562	9.88	.	2.87	7.12	124.1	13.46	2.22	2.22	5.53	107	1969	188	0.084	20.79	2.57
162	1-Jul-1997	182	35	38	50	346	265	6.48	.	4.44	7.45	110.9	11.26	2.07	1.95	5.80	92	1099	179	0.111	16.38	2.18
162.5	1-Jul-1997	182	30	46	129	447	366	7.41	.	2.48	7.33	146.3	13.27	2.81	2.44	9.94	64	732	77	0.130	21.92	2.63
163	1-Jul-1997	182	20	32	105	514	780	6.58	.	4.60	7.00	86.9	5.51	2.14	2.26	6.01	106	1312	237	0.080	9.99	3.16
164	1-Jul-1997	182	10	18	69	452	41	7.82	.	4.48	7.47	71.4	5.04	1.29	1.72	5.72	79	1701	522	0.068	6.28	0.39
165	1-Jul-1997	182	8	17	141	596	16	7.82	.	3.98	6.87	41.7	3.33	1.03	0.93	2.21	141	2834	595	0.033	4.64	0.44
166	1-Jul-1997	182	51	51	47	239	297	4.22	.	6.72	7.03	91.8	9.98	1.28	1.52	3.82	35	457	86	0.138	15.59	2.09
168	1-Jul-1997	182	80	102	194	857	58	8.95	.	5.72	7.20	79.1	6.53	1.39	2.24	4.40	86	3117	893	0.170	8.76	0.79
169	1-Jul-1997	182	20	55	52	831	.	9.57	.	1.40	8.59	7300.0	1433.80	68.34	148.14	67.89	22	86	534	.	2357.37	79.52
140.5	29-Sep-1997	272	27	66	173	636	65	8.43	5.27	1.60	7.16	93.1	8.53	1.90	1.79	6.29	247	1876	803	.	11.48	1.32
141	29-Sep-1997	272	48	76	286	328	83	4.73	2.99	2.58	7.20	92.3	12.42	2.10	1.31	3.56	85	1037	57	.	16.00	1.58
142	29-Sep-1997	272	34	50	69	371	110	4.49	2.49	4.78	7.18	62.4	4.89	1.77	1.43	4.07	75	947	83	.	8.39	1.34
143	29-Sep-1997	272	10	34	73	462	71	6.29	6.65	1.30	7.39	116.2	12.25	2.47	2.49	7.48	73	859	124	.	14.38	2.03
144	29-Sep-1997	272	5	24	61	405	98	5.00	6.93	1.67	7.43	114.7	11.37	2.36	2.65	7.73	104	528	49	.	14.15	2.09
145	29-Sep-1997	272	12	30	68	499	62	6.65	4.55	2.12	7.41	112.4	11.85	2.34	2.13	6.41	75	941	380	.	14.17	3.70
146	29-Sep-1997	272	9	24	52	463	533	7.78	1.71	3.15	7.11	65.7	6.89	1.47	1.66	2.44	102	1152	28	.	10.37	1.09
147	29-Sep-1997	272	48	50	83	418	1057	4.32	5.17	4.11	7.50	108.9	7.70	2.49	2.78	8.51	16	338	28	.	11.67	3.08
148	29-Sep-1997	272	11	24	131	541	134	6.18	4.72	2.77	7.31	118.2	12.99	1.61	2.75	6.78	34	1412	133	.	19.00	2.20
149	29-Sep-1997	272	26	47	109	473	194	5.10	10.15	3.65	7.48	162.5	17.75	3.54	2.76	10.70	62	639	126	.	16.60	4.32
151	29-Sep-1997	272	33	49	98	525	586	6.79	2.17	3.71	7.26	65.3	5.58	3.23	1.57	3.14	139	700	23	.	8.68	1.50
152	29-Sep-1997	272	0	0	31	358	273	4.65	2.04	3.77	7.23	58.0	6.24	1.40	1.08	2.72	46	563	16	.	8.17	1.20
153	29-Sep-1997	272	10	28	85	546	223	6.44	3.59	2.26	7.39	84.4	10.29	2.04	1.21	4.67	412	476	29	.	9.24	2.82
154	29-Sep-1997	272	11	24	43	477	242	5.98	3.19	2.41	7.37	90.2	10.25	2.01	1.40	4.62	322	454	37	.	10.28	3.03
155	29-Sep-1997	272	6	16	47	505	202	7.06	1.86	3.14	7.06	68.1	8.27	1.77	1.02	2.99	624	609	26	.	9.69	2.18
155.5	29-Sep-1997	272	16	32	52	533	111	6.09	3.15	2.55	7.21	133.5	16.66	2.32	2.35	5.21	295	632	87	.	24.34	2.64
156	29-Sep-1997	272	7	9	50	454	139	7.33	1.20	3.33	6.95	50.4	4.66	1.64	0.83	2.89	179	461	62	.	5.45	2.05
157	29-Sep-1997	272	5	5	64	429	151	4.20	3.19	5.76	7.17	90.2	4.33	1.95	1.79	9.12	67	313	95	.	7.15	5.58
157.5	29-Sep-1997	272	7	7	69	489	64	6.24	0.99	4.29	6.90	37.2	4.18	1.35	0.63	1.37	100	419	22	.	6.03	0.72
158	29-Sep-1997	272	21	26	90	639	168	5.06	1.53	3.22	7.04	50.2	6.07	1.38	0.86	1.95	73	1023	30	.	6.58	1.33
159	29-Sep-1997	272	36	55	30	287	589	5.33	2.98	3.45	7.11	105.1	14.12	1.88	1.56	4.03	544	545	63	.	17.05	2.33
159.5	29-Sep-1997	272	171	248	78	377	2325	4.67	8.89	4.45	7.58	236.0	39.36	4.43	1.84	7.84	135	286	20	.	37.12	3.69
160	29-Sep-1997	272	51	55	69	360	763	4.76	5.31	4.16	7.58	202.0	31.99	3.36	1.74	7.69	140	323	25	.	39.68	3.55
161	29-Sep-1997	272	9	19	88	431	443	5.53	2.26	3.36	7.05	137.9	17.25	2.42	2.20	5.21	34	767	170	.	27.01	2.88
162	29-Sep-1997	272	10	42	33	472	0	6.61	4.79	1.98	7.39	104.8	10.43	3.55	1.89	5.12	143	965	458	.	14.12	2.41
162.5	29-Sep-1997	272	9	28	92	431	444	5.85	6.82	3.28	7.60	155.5	17.21	3.13	2.62	9.75	47	266	40	.	22.13	3.30
163	29-Sep-1997	272	4	17	46	443	763	4.18	2.18	4.17	7.15	90.5	6.59	2.70	2.14	5.51	29	240	61	.	11.92	3.48
164	29-Sep-1997	272	0	4	10	163	21	2.97	5.99	6.04	7.51	78.7	6.16	1.82	1.59	6.49	33	434	93	.	7.87	1.02
165	29-Sep-1997	272	0	6	50	352	23	7.29	0.83	3.51	6.72	38.7	3.52	1.45	0.75	1.46	93	715	132	.	5.09	1.16
166	29-Sep-1997	272	72	83	13	205	395	4.42	2.92	4.71	7.17	107.8	15.57	2.17	1.42	3.45	38	292	29	.	18.39	2.36
167	29-Sep-1997	272	46	68	46	340	606	4.29	4.32	6.19	7.39	92.2	6.04	2.61	3.23	5.52	15	208	10	.	10.99	2.23
168	29-Sep-1997	272	38	64	54	402	73	7.59	4.10	4.28	7.30	65.1	5.50	1.68	1.94	3.80	43	1628	138	.	7.08	0.61
169	29-Sep-1997	272	26	48	136	754	77	8.67	18.73	1.93	7.54	16100.0	3291.20	169.16	321.83	116.69	25	110	480	.	5264.56	299.62
140.1	29-Dec-1997	363	7	25	62	437	295	4.20	1.85	3.96	6.72	114.0	10.34	1.64	2.20	6.82	204	371	72	.	16.17	4.94
140.2	29-Dec-1997	363	9	26	75	504	131	5.19	1.68	3.33	6.85	109.3	10.18	1.86	2.29	6.94	248	571	96	.	16.18	5.02
140.5	29-Dec-1997	363	10	25	54	457	146	4.63	1.78	3.72	6.95	104.2	9.30	1.70	2.17	6.72	223	476	94	.	15.03	5.11
141	29-Dec-1997	363	7	16	54	357	425	3.22	1.75	4.63	6.72	100.6	10.14	1.44	2.04	5.44	245	342	95	.	15.40	4.53
142	29-Dec-1997	363	8	18	64	339	110	3.33	1.45	5.43	6.62	82.1	6.16	1.54	2.01	5.40	146	471	139	.	11.61	3.91
143	29-Dec-1997	363	9	27	102	483	215	4.71	3.08	2.20	7.11	98.2	8.40	1.97	2.05	6.70	246	654	87	.	12.73	3.90
144	29-Dec-1997	363	5	21	99	463	185	5.58	3.83	1.42	6.97	108.2	10.17	1.96	1.86	7.11	262	495	46	.	14.81	3.29
145	29-Dec-1997	363	11	29	69	432	155	5.22	1.97	2.69	6.81	110.7	10.15	1.88	2.29	6.63	235	651	85	.	15.85	4.71
146	29-Dec-1997	363	0	8	45	306	191	3.86	0.69	2.56	6.23	86.3	9.84	1.20	1.85	2.76	205	284	176	.	15.66	3.19
147	29-Dec-1997	363	19	32	119	550	264	6.45	2.60	2.79	6.91	123.3	11.55	1.95	2.43	8.89	276	622	99	.	17.81	5.03

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
148	29-Dec-1997	363	10	34	114	583	255	6.61	3.82	3.05	6.97	177.1	22.65	2.11	2.96	8.77	464	837	83	.	30.85	4.86
149	29-Dec-1997	363	10	26	146	610	154	6.62	1.27	3.06	6.63	86.6	7.25	1.66	1.99	5.46	230	792	99	.	10.83	4.49
150	29-Dec-1997	363	8	16	68	378	56	5.93	0.56	1.63	5.53	61.2	5.22	1.31	1.48	2.82	271	898	162	.	7.09	3.78
151	29-Dec-1997	363	10	20	75	429	492	3.91	2.13	3.75	6.87	85.3	7.47	1.81	1.93	5.16	171	611	80	.	10.70	3.33
152	29-Dec-1997	363	0	8	44	266	275	3.81	1.89	4.05	6.86	76.0	5.89	1.39	1.56	5.71	107	455	98	.	8.33	3.65
153	29-Dec-1997	363	5	14	51	366	186	3.19	4.73	3.95	7.24	133.4	14.00	1.66	2.33	9.30	180	510	154	.	17.64	4.82
154	29-Dec-1997	363	13	32	103	477	333	4.09	4.50	3.54	7.09	120.6	13.54	1.83	2.23	7.51	308	1083	146	.	14.69	4.50
155	29-Dec-1997	363	1	9	48	271	147	2.89	2.03	4.80	6.75	87.7	8.62	1.20	1.66	5.22	134	364	85	.	10.94	4.18
155.5	29-Dec-1997	363	9	21	43	344	122	4.48	1.83	3.56	6.80	106.3	9.80	1.72	2.17	6.94	206	522	106	.	14.89	5.06
156	29-Dec-1997	363	0	3	62	289	142	2.62	1.44	4.40	6.68	76.7	5.85	1.20	1.47	5.83	112	327	79	.	7.47	4.97
157	29-Dec-1997	363	0	5	55	311	123	3.83	3.31	4.52	7.12	75.6	4.40	1.29	1.15	8.29	113	724	100	.	6.51	3.39
157.5	29-Dec-1997	363	0	6	38	323	54	4.35	0.93	.	6.51	61.4	5.10	1.28	1.13	3.85	165	460	116	.	7.82	3.06
158	29-Dec-1997	363	8	20	32	268	182	2.56	0.98	3.42	6.43	53.8	4.33	1.04	1.34	2.95	172	622	95	.	5.63	2.92
159	29-Dec-1997	363	9	25	49	353	252	4.63	1.53	3.89	6.76	103.0	10.25	1.68	2.00	5.82	424	733	71	.	14.88	4.85
159.5	29-Dec-1997	363	13	36	66	496	341	4.23	1.97	4.47	6.84	122.2	14.51	1.82	2.20	6.92	315	597	81	.	17.94	5.19
160	29-Dec-1997	363	15	32	50	339	668	2.43	3.50	5.46	7.16	195.1	24.33	2.15	2.54	10.50	65	230	80	.	35.55	5.41
161	29-Dec-1997	363	6	36	101	498	268	5.72	1.37	2.75	6.69	97.7	10.41	1.84	2.07	4.58	670	1051	109	.	15.04	4.16
162	29-Dec-1997	363	17	34	67	492	942	2.93	4.37	6.03	7.05	175.3	16.41	2.67	3.24	12.40	265	1002	241	.	24.68	6.95
162.5	29-Dec-1997	363	0	14	62	432	377	3.97	3.52	2.35	7.07	122.7	11.30	2.17	2.36	9.23	195	425	56	.	17.90	4.31
163	29-Dec-1997	363	3	22	116	550	448	3.95	1.47	4.91	6.77	87.3	5.12	1.77	2.50	6.82	123	469	120	.	8.88	5.27
164	29-Dec-1997	363	0	24	36	370	0	7.48	0.75	2.34	6.29	59.5	4.52	1.46	1.35	3.46	258	746	258	.	6.05	3.50
165	29-Dec-1997	363	0	12	69	357	55	2.86	1.10	3.51	6.53	48.7	4.36	1.19	1.04	2.26	142	687	167	.	6.53	1.80
166	29-Dec-1997	363	18	32	40	330	268	2.50	1.86	5.30	6.69	113.4	13.34	1.51	2.13	5.02	102	566	87	.	18.67	3.62
167	29-Dec-1997	363	10	23	46	375	1146	2.39	2.56	7.06	6.97	109.1	5.92	1.69	4.23	8.39	61	230	84	.	9.66	6.13
168	29-Dec-1997	363	17	34	63	380	141	3.48	1.79	4.98	6.76	79.8	6.33	1.80	2.43	4.46	367	928	164	.	10.00	3.52
169	29-Dec-1997	363	22	42	152	700	1527	5.29	10.83	3.75	7.29	9410.0	1899.10	113.44	157.60	59.11	41	70	66	.	3080.59	137.17
96	30-Mar-1998	89	0	0	44	181	1611	1.31	3.43	8.11	6.57	121.7	7.52	1.79	3.50	7.51	16	305	121	.	13.82	4.79
140.1	30-Mar-1998	89	6	10	22	231	426	4.65	1.83	4.37	6.72	89.0	6.63	1.30	1.82	5.64	130	321	74	.	9.73	4.42
140.2	30-Mar-1998	89	9	20	29	307	72	6.33	2.28	2.47	6.84	83.5	5.85	1.35	1.89	5.47	185	604	74	.	9.34	3.94
140.5	30-Mar-1998	89	8	19	45	342	177	5.34	1.95	3.69	6.85	79.4	5.37	1.26	1.71	5.38	167	459	70	.	7.99	4.06
141	30-Mar-1998	89	5	5	26	326	694	2.90	1.73	5.11	6.64	90.3	7.75	1.29	1.76	5.14	75	140	99	.	11.48	4.38
142	30-Mar-1998	89	5	6	19	263	172	3.00	1.45	5.51	6.51	66.2	4.38	1.02	1.60	4.18	77	212	147	.	6.90	3.87
143	30-Mar-1998	89	10	24	38	330	137	4.82	2.40	2.76	6.85	82.9	5.68	1.40	1.85	5.19	148	539	97	.	8.72	3.88
144	30-Mar-1998	89	5	18	45	348	137	6.09	3.42	1.40	6.89	94.0	8.10	1.47	1.81	5.70	272	680	88	.	13.17	2.80
145	30-Mar-1998	89	11	17	59	440	85	6.47	2.59	2.13	6.88	85.8	6.05	1.42	1.98	5.45	140	666	136	.	9.39	3.79
146	30-Mar-1998	89	4	6	17	235	214	4.03	0.63	3.29	5.83	59.6	5.52	0.87	1.29	1.89	171	249	184	.	9.00	2.73
147	30-Mar-1998	89	17	27	50	420	335	7.75	2.46	3.52	6.65	114.8	8.88	1.67	2.33	7.51	245	700	97	.	15.22	4.89
148	30-Mar-1998	89	7	15	53	337	179	5.59	2.69	2.65	6.85	102.7	8.84	1.44	2.10	5.53	160	776	142	.	13.68	3.81
149	30-Mar-1998	89	8	22	51	460	147	8.27	2.16	1.50	6.74	81.3	5.59	1.29	1.94	5.44	170	867	144	.	8.47	3.65
150	30-Mar-1998	89	5	18	54	477	35	9.85	1.11	1.21	6.16	51.9	3.39	1.04	1.44	2.87	231	1118	216	.	4.50	2.80
151	30-Mar-1998	89	10	21	42	329	646	4.13	1.88	3.66	6.85	63.9	4.75	1.59	1.60	3.62	122	382	62	.	7.05	2.42
152	30-Mar-1998	89	1	5	28	238	379	3.83	1.98	4.09	6.86	65.5	4.68	1.32	1.31	4.64	95	469	93	.	6.48	3.14
153	30-Mar-1998	89	7	17	34	295	173	3.64	3.24	4.33	7.17	104.3	10.06	1.41	1.83	6.20	140	446	93	.	14.07	4.23
154	30-Mar-1998	89	18	30	23	289	239	4.47	3.64	4.46	7.02	98.3	11.13	1.44	1.76	4.74	129	783	111	.	11.87	4.06
155	30-Mar-1998	89	3	8	36	215	197	2.78	1.44	5.88	6.78	69.2	5.17	1.00	1.33	4.26	86	198	73	.	6.28	4.19
155.5	30-Mar-1998	89	11	25	57	382	140	5.47	1.91	3.35	6.64	81.1	5.74	1.28	1.66	5.15	170	535	76	.	8.49	4.22
156	30-Mar-1998	89	2	7	25	259	127	2.77	1.44	4.64	6.73	53.9	3.08	1.05	1.11	3.84	95	185	78	.	3.69	3.35
157	30-Mar-1998	89	2	9	45	265	139	4.57	3.66	3.94	7.13	67.2	2.81	1.11	1.05	7.51	112	580	103	.	4.03	2.87
157.5	30-Mar-1998	89	3	5	15	190	73	3.81	1.13	4.02	6.69	52.7	3.64	1.12	0.91	3.33	120	250	115	.	5.58	2.80
158	30-Mar-1998	89	10	10	17	191	128	3.17	0.86	5.26	6.35	47.5	3.12	0.83	1.03	2.48	84	351	162	.	3.74	3.07
159	30-Mar-1998	89	14	26	32	252	388	4.90	1.66	5.35	6.76	89.5	6.83	1.24	1.77	5.54	156	497	134	.	9.91	4.76
159.5	30-Mar-1998	89	23	30	59	331	535	4.05	2.15	6.04	6.91	102.3	8.43	1.35	1.81	6.18	128	365	104	.	12.01	4.99
160	30-Mar-1998	89	19	21	17	174	781	2.32	2.67	7.18	7.03	133.1	12.68	1.40	1.90	7.74	51	100	52	.	17.68	5.64
161	30-Mar-1998	89	7	15	57	369	569	6.05	1.25	2.94	6.64	80.4	6.28	1.51	1.70	4.15	220	764	143	.	9.70	3.79
162	30-Mar-1998	89	8	16	12	208	223	4.22	1.70	4.15	6.85	81.6	7.43	1.26	1.52	4.34	240	466	104	.	10.34	3.71
162.5	30-Mar-1998	89	4	4	37	324	572	5.07	2.82	2.45	7.09	138.5	11.88	2.01	2.32	9.10	104	305	53	.	19.44	5.07
163	30-Mar-1998	89	5	5	32	263	535	4.78	1.14	3.89	6.64	76.1	3.88	1.65	2.09	5.16	107	446	134	.	6.59	4.61

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
164	30-Mar-1998	89	1	13	44	450	14	9.41	1.63	1.60	6.60	50.2	3.39	1.22	1.09	3.29	193	889	246	.	4.21	2.04
165	30-Mar-1998	89	0	4	15	204	188	4.80	0.81	3.41	6.33	147.9	3.19	1.00	0.99	2.67	145	369	217	.	4.80	2.46
166	30-Mar-1998	89	17	21	14	178	249	2.34	1.40	6.46	6.57	70.8	5.12	1.08	1.67	3.95	69	156	70	.	7.23	4.15
167	30-Mar-1998	89	10	10	21	215	1399	2.68	1.62	6.64	6.86	93.6	4.09	1.45	3.51	6.07	71	156	59	.	7.25	5.57
168	30-Mar-1998	89	10	19	12	180	101	3.49	1.19	9.62	6.71	60.2	4.33	1.05	1.78	2.63	91	468	153	.	6.15	3.27
169	30-Mar-1998	89	22	27	51	383	1382	3.91	1.87	3.48	6.81	101.5	5.82	1.66	3.28	6.00	143	467	85	.	10.30	5.03
96	29-Jun-1998	180	0	0	88	.	1300	1.80	3.37	4.60	6.90	118.6	8.52	1.71	3.36	7.31	6	269	77	.	16.79	3.36
140.1	29-Jun-1998	180	15	26	64	354	360	5.00	3.43	5.60	7.08	94.7	7.40	1.47	1.74	6.03	85	783	60	.	11.14	3.26
140.2	29-Jun-1998	180	24	46	87	420	174	8.40	4.60	3.59	7.17	90.8	6.44	1.66	1.95	7.04	148	1617	78	.	9.65	2.30
140.5	29-Jun-1998	180	17	27	76	435	183	6.81	3.53	5.22	7.17	79.2	5.50	1.43	1.58	5.63	139	1028	90	.	7.77	2.70
141	29-Jun-1998	180	14	24	63	267	456	3.83	2.55	6.26	6.89	92.0	8.43	1.42	1.58	4.88	73	513	99	.	12.38	3.27
142	29-Jun-1998	180	15	28	66	248	146	4.69	2.14	6.03	6.87	67.3	4.85	1.13	1.41	3.97	79	736	111	.	8.06	2.55
143	29-Jun-1998	180	18	34	102	523	163	7.04	3.95	2.66	7.17	81.4	5.91	1.53	1.64	5.37	93	1581	90	.	8.81	2.17
144	29-Jun-1998	180	1	22	117	533	83	7.32	4.63	1.03	7.12	85.2	6.73	1.72	1.52	6.14	56	1093	59	.	9.63	1.68
145	29-Jun-1998	180	30	45	113	559	122	8.77	4.90	2.75	7.19	91.8	6.87	1.59	1.97	6.20	104	2057	350	.	10.32	1.83
146	29-Jun-1998	180	6	23	120	456	428	8.45	1.55	3.69	6.53	71.3	7.38	1.05	1.39	2.41	205	2260	100	.	11.80	1.46
147	29-Jun-1998	180	28	45	100	483	446	7.76	5.44	3.41	7.09	116.8	7.86	1.97	2.44	9.25	115	954	37	.	12.18	3.78
148	29-Jun-1998	180	6	19	142	545	196	7.23	5.26	2.64	7.12	123.2	11.20	1.62	2.60	7.02	106	1487	119	.	18.79	2.07
149	29-Jun-1998	180	28	38	198	774	285	11.13	4.96	3.10	7.07	100.8	7.03	1.78	2.22	7.58	93	2694	185	.	11.68	2.82
150	29-Jun-1998	180	7	28	181	900	32	15.71	3.08	2.72	6.69	53.2	3.72	1.04	1.49	3.34	177	5039	343	.	4.51	1.13
151	29-Jun-1998	180	8	31	83	433	313	8.79	2.09	4.04	6.87	57.3	3.94	1.74	1.33	3.78	246	736	111	.	5.02	2.39
152	29-Jun-1998	180	0	8	85	462	189	10.35	1.70	3.99	6.65	56.6	3.35	1.35	1.09	4.46	259	806	172	.	4.39	2.92
153	29-Jun-1998	180	2	20	52	299	221	5.43	5.99	4.98	7.48	117.7	9.72	1.68	1.97	8.89	112	822	158	.	14.38	2.90
154	29-Jun-1998	180	11	32	56	320	403	5.67	5.21	4.24	7.28	101.0	8.88	1.71	1.76	6.76	86	894	104	.	10.26	2.69
155	29-Jun-1998	180	0	7	50	219	179	3.99	2.19	6.48	6.95	67.5	5.05	1.12	1.23	4.42	84	345	76	.	6.42	3.19
155.5	29-Jun-1998	180	11	30	68	385	109	8.04	2.60	4.34	7.05	63.8	4.28	1.29	1.32	5.06	158	952	115	.	5.98	2.58
156	29-Jun-1998	180	0	9	60	338	69	6.57	0.95	4.78	6.33	42.0	2.36	0.98	0.88	2.75	210	337	200	.	2.63	2.71
157	29-Jun-1998	180	0	17	89	527	115	7.79	4.38	4.19	7.21	66.4	2.94	1.21	0.99	7.85	127	1394	165	.	4.11	1.66
157.5	29-Jun-1998	180	0	8	60	353	68	8.22	1.36	3.87	6.70	70.1	3.33	1.07	0.75	2.93	154	912	96	.	5.11	1.72
158	29-Jun-1998	180	1	14	54	299	95	5.90	0.94	4.50	6.32	38.6	2.14	0.90	0.63	0.00	54	329	62	.	2.61	2.62
159	29-Jun-1998	180	24	38	77	462	283	6.34	3.05	6.54	7.15	91.9	7.69	1.49	1.84	5.97	107	1150	103	.	10.72	3.26
159.5	29-Jun-1998	180	32	44	55	326	431	5.18	3.55	7.06	7.34	105.7	8.86	1.57	1.81	6.63	96	872	99	.	12.55	3.61
160	29-Jun-1998	180	28	35	69	311	689	3.06	3.70	7.81	7.45	134.6	12.81	1.86	1.89	8.12	49	189	5	.	18.34	4.73
161	29-Jun-1998	180	5	29	102	515	355	8.49	2.92	3.51	7.14	84.8	7.32	1.71	1.76	4.87	199	2338	157	.	10.98	2.29
162	29-Jun-1998	180	8	22	80	376	340	4.85	3.90	5.86	7.25	100.7	8.24	1.98	1.92	6.48	111	877	162	.	12.63	3.08
162.5	29-Jun-1998	180	0	29	159	588	390	5.84	4.92	2.12	7.26	122.6	9.20	2.40	2.14	9.52	68	693	50	.	16.44	3.13
163	29-Jun-1998	180	5	22	127	572	395	7.64	2.93	4.93	7.09	78.5	4.19	1.67	2.17	6.17	109	1556	164	.	7.82	2.64
164	29-Jun-1998	180	0	14	93	471	45	9.57	1.13	3.49	6.53	35.6	2.50	1.14	0.67	1.41	210	1690	324	.	3.60	1.17
165	29-Jun-1998	180	0	16	73	546	14	13.34	1.42	2.73	6.73	38.9	2.50	0.99	0.79	2.77	206	1810	214	.	2.79	1.49
166	29-Jun-1998	180	24	45	69	297	159	4.83	1.97	6.23	7.02	70.8	5.54	1.35	1.41	3.78	124	504	105	.	8.49	2.98
167	29-Jun-1998	180	16	29	102	370	954	4.00	3.36	7.81	7.27	94.9	4.23	1.63	3.40	6.76	57	298	58	.	8.72	3.83
168	29-Jun-1998	180	21	35	215	621	792	6.08	2.03	5.68	7.04	78.4	3.95	1.93	2.18	4.97	230	1013	207	.	7.84	3.22
96	5-Oct-1998	278	1	1	49	166	1076	1.04	4.10	5.04	7.14	117.7	8.83	1.69	3.26	7.30	0	102	60	.	19.05	2.36
142	5-Oct-1998	278	16	21	36	214	40	2.78	2.07	5.66	6.79	99.0	4.41	2.22	2.57	7.79	2	199	77	.	7.39	7.55
143	5-Oct-1998	278	10	21	42	376	33	5.26	2.30	1.94	6.75	119.3	9.20	2.54	2.16	7.60	28	330	49	.	13.87	7.27
144	5-Oct-1998	278	4	12	71	527	45	7.52	6.67	0.93	7.33	130.7	12.68	2.82	2.22	7.33	18	483	23	.	17.74	2.04
145	5-Oct-1998	278	4	11	78	583	214	4.20	4.30	2.30	6.79	139.5	8.18	2.96	2.71	10.85	24	201	6	.	12.42	8.97
146	5-Oct-1998	278	11	27	69	566	630	8.74	1.81	2.81	6.63	57.1	4.84	1.58	1.65	2.53	193	977	5	.	7.31	1.69
147	5-Oct-1998	278	47	59	66	374	369	3.89	4.43	4.67	7.23	100.1	5.50	2.27	2.79	8.09	5	100	4	.	11.13	3.63
148	5-Oct-1998	278	12	24	93	495	33	7.05	4.13	1.93	7.13	136.1	12.57	2.35	2.92	7.67	47	539	7	.	21.83	4.33
149	5-Oct-1998	278	16	26	125	585	300	6.04	3.84	2.22	7.01	118.7	6.99	3.48	2.60	9.17	22	389	96	.	12.49	6.54
150	5-Oct-1998	278	5	21	55	521	65	8.31	1.87	3.36	5.69	106.3	4.89	2.87	2.92	7.26	106	569	615	.	6.48	10.15
151	5-Oct-1998	278	23	26	74	386	766	2.98	2.05	3.70	6.93	63.3	5.38	1.98	1.48	2.59	28	313	42	.	9.30	1.01
152	5-Oct-1998	278	2	8	25	190	454	2.55	2.18	3.83	7.10	65.0	6.90	1.38	1.16	2.78	11	282	12	.	10.11	1.17
153	5-Oct-1998	278	5	13	51	345	47	4.14	6.24	3.16	7.50	122.1	13.32	2.35	1.78	7.09	16	157	19	.	13.32	4.25
154	5-Oct-1998	278	25	31	22	421	283	3.50	6.36	3.84	7.42	129.0	16.64	2.20	1.80	5.27	22	370	9	.	16.60	3.18
155	5-Oct-1998	278	4	12	31	201	14	3.06	2.83	4.22	7.05	77.6	8.28	1.50	1.07	3.82	10	230	28	.	12.61	1.93

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
156	5-Oct-1998	278	8	17	31	232	10	3.41	2.88	3.86	7.04	47.9	2.59	1.31	1.13	4.20	19	467	30	.	4.09	1.32
157	5-Oct-1998	278	0	13	28	249	195	4.06	4.50	3.67	7.25	69.7	4.39	1.73	1.15	6.82	16	1020	29	.	7.22	0.95
157.5	5-Oct-1998	278	0	9	33	195	103	3.59	1.23	4.18	6.76	42.6	4.84	1.21	0.72	1.33	49	348	19	.	8.61	0.27
158	5-Oct-1998	278	12	30	24	183	11	3.45	2.00	3.51	6.91	48.9	5.91	1.13	0.75	1.64	27	677	4	.	7.06	1.06
159	5-Oct-1998	278	85	117	74	262	148	3.16	4.53	3.50	6.92	112.2	13.35	1.56	1.71	4.87	12	1350	127	.	18.21	2.63
159.5	5-Oct-1998	278	159	195	72	364	5	4.83	8.46	3.08	7.49	145.0	18.78	2.29	1.76	6.76	24	1487	292	.	21.83	2.29
161	5-Oct-1998	278	8	18	53	349	356	4.29	2.61	3.00	7.13	116.5	12.56	2.41	2.03	4.95	12	548	25	.	19.83	3.56
162.5	5-Oct-1998	278	9	23	103	558	454	4.57	5.45	2.13	7.25	158.9	15.08	2.93	2.61	9.87	5	217	5	.	26.59	3.41
163	5-Oct-1998	278	5	11	37	264	582	2.70	1.63	3.30	6.76	88.3	5.57	2.80	2.07	5.43	9	133	32	.	11.34	4.36
164	5-Oct-1998	278	0	4	14	148	8	1.88	6.42	6.48	7.42	80.5	6.11	1.82	1.67	6.60	18	363	55	.	8.57	0.64
165	5-Oct-1998	278	1	10	88	332	32	4.31	2.11	3.87	7.02	41.2	3.17	1.33	0.90	2.34	53	1129	175	.	4.68	0.98
96	4-Jan-1999	4	2	15	114	421	1652	3.92	6.91	4.76	7.20	190.4	13.77	2.35	3.93	13.03	92	674	175	.	26.28	4.07
140.1	4-Jan-1999	4	9	26	42	365	452	7.59	1.21	2.91	6.69	231.0	24.02	3.96	3.30	9.47	356	340	419	.	46.14	7.04
140.2	4-Jan-1999	4	29	42	63	471	428	7.49	1.29	2.67	7.54	235.0	25.76	4.16	3.41	9.79	752	547	443	.	48.97	7.31
140.5	4-Jan-1999	4	14	25	76	467	388	7.96	1.28	3.05	6.54	219.0	23.42	3.88	3.23	9.50	378	357	415	.	43.60	7.44
141	4-Jan-1999	4	11	22	85	458	524	7.80	1.42	4.27	6.57	139.1	13.81	2.68	2.45	6.69	232	314	237	.	24.03	5.46
142	4-Jan-1999	4	4	14	43	273	201	5.01	1.43	4.92	6.62	106.2	8.05	2.05	2.43	6.66	99	307	243	.	15.44	5.62
143	4-Jan-1999	4	6	20	108	512	542	6.79	3.33	1.46	7.06	258.0	33.85	4.44	2.81	9.08	253	289	134	.	57.56	4.73
144	4-Jan-1999	4	10	18	113	419	361	6.57	4.99	0.72	7.24	361.0	50.42	5.62	2.73	10.48	209	233	59	.	86.36	3.45
145	4-Jan-1999	4	16	34	63	398	422	7.88	1.22	2.55	6.56	283.0	35.86	4.44	3.72	10.10	307	391	500	.	67.41	6.46
146	4-Jan-1999	4	3	17	100	363	314	5.73	1.05	3.77	6.19	201.0	26.39	2.64	3.05	5.64	344	498	274	.	45.43	7.78
147	4-Jan-1999	4	8	19	129	529	429	8.47	1.75	2.63	6.79	335.0	42.29	3.75	4.26	14.43	371	380	163	.	77.27	9.78
148	4-Jan-1999	4	10	16	87	425	324	7.87	2.06	3.52	6.60	400.0	52.48	3.90	4.49	13.18	240	353	348	.	100.17	6.63
149	4-Jan-1999	4	14	27	138	656	821	8.67	1.81	3.57	6.55	180.7	19.35	3.63	3.04	8.41	188	574	249	.	30.89	7.42
150	4-Jan-1999	4	6	17	130	640	650	8.82	1.26	3.47	5.95	90.6	5.31	2.74	2.60	5.03	260	585	348	.	8.31	6.55
151	4-Jan-1999	4	22	27	83	543	490	6.95	3.13	4.19	6.96	122.5	12.79	3.02	2.32	5.88	148	380	99	.	16.15	4.89
152	4-Jan-1999	4	0	4	101	307	287	6.83	0.82	4.26	4.07	135.4	6.96	1.97	1.93	6.17	133	420	115	.	10.76	6.98
153	4-Jan-1999	4	4	12	298	635	523	4.92	3.64	3.61	7.20	341.0	46.64	3.64	3.59	13.80	186	266	215	.	83.17	7.73
154	4-Jan-1999	4	9	12	633	974	594	5.00	3.41	3.59	7.08	596.0	94.91	4.61	4.11	14.58	190	481	296	.	160.20	8.85
155	4-Jan-1999	4	1	8	54	266	248	4.82	1.16	4.07	6.61	242.0	34.12	2.67	2.87	8.30	200	200	99	.	63.21	3.79
155.5	4-Jan-1999	4	9	18	47	333	285	6.69	1.36	2.85	6.72	234.0	28.30	3.68	3.11	9.50	235	297	327	.	48.27	7.35
156	4-Jan-1999	4	1	5	66	287	267	5.30	1.12	4.14	6.60	109.1	10.53	2.23	1.96	6.37	145	274	134	.	18.22	5.07
157	4-Jan-1999	4	1	8	75	324	230	7.06	2.55	3.91	7.08	78.8	4.40	2.19	1.20	7.81	110	459	127	.	7.55	4.07
157.5	4-Jan-1999	4	0	10	54	306	72	9.76	0.67	3.40	6.07	60.3	5.19	1.90	1.30	2.91	197	427	151	.	8.62	2.79
158	4-Jan-1999	4	3	21	83	345	240	6.29	1.18	3.73	6.52	56.8	4.49	1.58	1.41	3.17	160	511	158	.	5.72	3.29
159	4-Jan-1999	4	8	21	49	332	383	7.23	0.72	3.30	6.25	208.0	26.22	3.51	3.11	8.28	311	365	393	.	45.74	6.90
159.5	4-Jan-1999	4	16	22	61	413	408	7.20	1.32	3.44	6.64	234.0	29.86	3.54	3.00	8.74	267	340	329	.	49.80	6.85
160	4-Jan-1999	4	10	15	45	312	611	4.46	3.48	4.58	7.05	408.0	54.99	3.95	3.29	13.67	98	182	113	.	95.57	6.27
161	4-Jan-1999	4	5	14	99	425	396	7.27	1.46	2.27	6.52	268.0	37.50	3.85	3.07	7.73	443	503	272	.	63.96	5.05
162	4-Jan-1999	4	0	18	70	373	427	7.29	1.85	3.69	6.65	229.0	31.23	3.30	2.84	8.56	377	454	230	.	49.97	6.17
162.5	4-Jan-1999	4	0	12	163	512	438	5.32	2.82	1.86	7.08	361.0	53.35	3.72	2.53	10.13	280	285	98	.	91.11	4.83
163	4-Jan-1999	4	2	18	82	624	1422	8.00	0.74	4.69	6.15	137.6	6.47	3.08	3.99	10.97	212	243	401	.	10.94	10.73
164	4-Jan-1999	4	0	9	35	534	213	7.26	1.12	5.47	6.97	164.1	12.26	3.25	3.46	11.51	109	149	1277	.	19.94	12.23
165	4-Jan-1999	4	0	11	54	276	108	6.38	0.97	3.53	6.27	54.3	4.26	1.93	1.41	2.28	103	386	246	.	6.90	2.90
166	4-Jan-1999	4	22	32	119	383	346	4.91	2.43	4.68	6.73	152.9	21.19	2.30	2.28	5.06	101	1308	76	.	33.20	3.13
167	4-Jan-1999	4	7	16	51	278	782	4.62	2.58	6.04	6.96	134.7	7.40	2.91	4.84	8.95	48	139	48	.	13.91	8.01
168	4-Jan-1999	4	8	19	45	279	158	5.53	0.99	5.03	6.68	78.8	6.20	2.13	2.25	4.28	104	414	205	.	9.82	4.82
169	4-Jan-1999	4	47	63	110	445	593	8.57	2.19	5.98	6.78	644.0	91.47	7.12	13.36	8.61	180	318	241	.	168.13	10.64
96	14-Apr-1999	104	5	11	68	237	1605	2.44	4.35	4.13	6.30	135.8	9.41	1.72	3.71	8.16	69	66	118	.	17.67	4.44
140.1	14-Apr-1999	104	3	15	35	231	205	5.28	1.91	3.42	6.74	128.2	12.65	1.54	2.15	6.52	58	395	84	.	22.47	4.51
140.2	14-Apr-1999	104	6	23	36	332	16	7.58	1.92	2.28	6.78	145.0	15.25	1.68	2.27	6.83	90	705	117	.	27.81	4.55
140.5	14-Apr-1999	104	2	14	45	251	25	4.21	2.11	4.72	6.66	82.8	6.35	1.19	1.66	5.86	49	161	64	.	10.41	4.13
141	14-Apr-1999	104	5	15	42	261	409	4.28	1.90	4.90	6.59	109.0	11.37	1.40	1.84	5.09	46	166	75	.	18.08	4.13
142	14-Apr-1999	104	2	12	31	213	84	3.28	1.44	5.28	6.50	71.8	5.23	1.15	1.73	4.20	42	164	98	.	8.82	3.65
143	14-Apr-1999	104	3	15	44	286	83	5.82	3.05	1.08	6.96	150.9	16.91	1.84	2.26	6.94	59	623	125	.	29.03	3.89
144	14-Apr-1999	104	5	23	75	507	64	8.94	4.80	0.93	6.91	234.0	32.07	2.26	2.21	8.48	97	948	91	.	50.09	2.74
145	14-Apr-1999	104	7	24	73	424	16	9.71	2.50	1.94	6.73	152.8	18.01	1.76	2.38	7.02	75	818	181	.	31.46	4.05

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
146	14-Apr-1999	104	2	10	34	274	117	6.16	1.08	3.42	5.90	79.3	8.46	1.09	1.58	2.33	125	401	209	.	14.38	2.69
147	14-Apr-1999	104	3	23	64	336	230	6.82	2.85	3.65	6.64	188.7	21.62	1.96	2.68	9.15	96	404	104	.	38.36	5.61
148	14-Apr-1999	104	7	20	106	495	81	8.54	4.16	2.44	6.81	337.0	49.98	2.14	3.07	9.09	67	910	140	.	84.78	3.78
149	14-Apr-1999	104	6	24	103	563	60	10.42	1.90	2.05	6.49	76.9	7.07	1.24	1.77	4.47	142	935	113	.	11.10	3.27
150	14-Apr-1999	104	0	25	97	548	60	11.46	1.56	2.26	5.87	58.7	5.17	1.14	1.39	2.71	281	1091	178	.	7.03	3.00
151	14-Apr-1999	104	13	21	24	245	395	4.50	2.39	3.37	6.96	73.4	6.37	1.58	1.69	4.32	70	538	50	.	9.17	2.40
152	14-Apr-1999	104	2	9	31	227	285	4.37	2.55	4.13	6.90	73.1	5.94	1.36	1.44	5.67	65	514	93	.	8.28	3.26
153	14-Apr-1999	104	2	15	48	280	136	4.57	3.88	3.35	7.20	149.2	15.65	1.67	2.33	8.76	46	268	128	.	24.88	4.88
154	14-Apr-1999	104	7	20	41	282	231	5.12	3.82	3.48	7.04	140.5	15.80	1.69	2.18	6.39	59	594	172	.	22.46	4.28
155	14-Apr-1999	104	2	9	28	183	100	3.42	1.72	5.49	6.77	79.1	7.57	1.15	1.44	4.39	36	165	55	.	10.17	3.88
155.5	14-Apr-1999	104	8	23	47	278	48	5.93	1.90	3.01	6.85	122.9	12.67	1.53	2.05	6.53	70	557	108	.	21.45	4.48
156	14-Apr-1999	104	2	6	28	199	161	2.90	1.37	4.33	6.65	58.3	4.35	1.15	1.23	4.00	40	153	50	.	5.86	3.33
157	14-Apr-1999	104	4	12	51	270	71	5.73	3.67	3.82	7.09	74.4	4.05	1.23	1.18	7.67	75	845	137	.	5.78	3.13
157.5	14-Apr-1999	104	1	7	31	186	61	4.18	1.11	3.78	6.42	63.4	5.39	1.26	1.06	3.65	80	274	135	.	9.07	2.81
158	14-Apr-1999	104	10	17	31	206	39	3.94	1.19	3.67	6.27	48.8	3.97	0.95	1.14	2.54	68	494	84	.	4.83	2.78
159	14-Apr-1999	104	11	19	31	284	211	5.35	1.65	3.90	6.65	117.3	12.32	1.49	1.97	5.88	115	542	106	.	19.32	4.83
159.5	14-Apr-1999	104	23	30	35	291	338	5.19	2.15	3.74	7.01	128.1	14.87	1.64	2.01	6.74	75	396	76	.	22.78	4.95
160	14-Apr-1999	104	10	13	27	211	472	2.94	2.95	3.85	7.37	181.3	22.61	1.85	2.23	8.96	15	107	34	.	36.02	5.19
161	14-Apr-1999	104	10	22	47	403	489	3.48	1.75	2.75	6.76	122.0	14.48	1.75	1.92	4.84	158	793	82	.	22.69	3.68
162	14-Apr-1999	104	8	15	30	243	92	6.86	2.52	3.73	7.07	118.7	13.53	1.55	1.83	5.10	86	348	92	.	18.92	4.12
162.5	14-Apr-1999	104	8	22	50	428	408	2.65	3.37	1.53	7.26	189.1	22.67	2.30	2.38	9.69	78	418	65	.	37.03	4.77
163	14-Apr-1999	104	7	17	42	275	383	4.63	1.39	4.36	6.75	92.5	5.24	1.70	2.40	7.02	68	464	154	.	9.20	5.88
164	14-Apr-1999	104	5	22	40	474	6	11.45	1.28	2.14	6.32	64.6	5.72	1.24	1.19	3.76	162	956	419	.	8.37	2.88
165	14-Apr-1999	104	3	16	34	237	28	4.52	1.22	3.26	6.48	46.0	4.18	1.15	0.96	2.32	77	612	184	.	6.41	1.63
166	14-Apr-1999	104	18	25	39	266	137	3.32	1.59	5.11	6.62	89.4	7.91	1.39	1.84	4.52	40	244	69	.	11.99	3.98
167	14-Apr-1999	104	20	24	23	252	733	2.94	2.39	5.83	7.03	109.3	5.57	1.52	3.99	8.08	29	223	71	.	9.82	6.67
168	14-Apr-1999	104	17	34	39	281	4	4.84	1.33	4.73	6.61	78.9	7.05	1.41	2.14	3.76	64	835	114	.	11.73	3.57
169	14-Apr-1999	104	45	49	79	487	838	5.33	1.77	5.85	6.85	173.2	16.24	2.37	4.87	7.96	134	418	122	.	32.29	6.05
96	21-Jul-1999	202	0	0	38	191	1083	2.38	4.49	5.46	6.72	127.2	8.93	1.89	3.67	8.16	14	87	70	.	18.31	2.76
144	21-Jul-1999	202	18	49	125	535	164	9.56	7.11	1.53	6.94	170.4	20.21	2.48	2.31	8.05	53	2067	264	.	31.49	1.52
145	21-Jul-1999	202	7	30	48	673	18	12.82	6.58	2.00	6.96	156.9	16.57	2.28	2.81	8.68	39	2079	1318	.	26.95	1.75
148	21-Jul-1999	202	2	19	30	529	15	11.33	11.57	1.75	7.05	226.0	20.01	2.87	4.90	16.06	19	1181	809	.	35.17	3.19
149	21-Jul-1999	202	15	52	52	564	11	11.14	7.87	2.98	7.00	136.9	11.86	2.53	2.55	10.15	35	2450	714	.	18.28	1.95
151	21-Jul-1999	202	19	37	53	309	218	5.29	3.69	5.77	7.11	65.8	6.40	1.82	1.71	4.14	57	1319	97	.	8.94	1.07
152	21-Jul-1999	202	2	7	54	333	395	4.02	2.76	4.31	7.17	67.7	8.09	1.62	0.97	2.97	50	719	41	.	10.08	0.71
155.5	21-Jul-1999	202	5	18	66	481	0	4.16	1.59	0.68	7.34	1046.0	151.96	6.54	19.35	26.59	14	209	100	.	254.59	16.03
157	21-Jul-1999	202	3	10	70	437	46	.	.	4.48	7.12	95.4	5.73	2.06	1.63	11.27	30	1115	505	.	6.24	0.57
157.5	21-Jul-1999	202	4	8	74	315	136	.	.	4.21	6.79	56.1	6.87	1.56	0.99	2.10	84	822	92	.	11.01	0.39
161	21-Jul-1999	202	19	35	70	522	513	6.21	3.57	3.10	6.94	144.3	17.16	2.47	2.22	6.00	54	1575	167	.	26.78	2.77
162.5	21-Jul-1999	202	39	51	117	619	659	5.74	6.13	2.80	7.20	169.2	15.19	3.05	2.55	11.03	49	679	49	.	26.76	2.92
163	21-Jul-1999	202	15	17	76	432	656	4.52	1.90	3.81	6.80	95.6	7.04	3.13	2.31	6.36	55	608	134	.	13.34	3.57
164	21-Jul-1999	202	1	8	52	410	58	5.22	7.37	5.52	7.11	91.4	7.30	1.97	1.84	7.83	42	1012	727	.	7.94	0.86
165	21-Jul-1999	202	1	10	88	362	62	5.85	2.01	3.99	6.77	36.6	4.31	1.40	0.99	2.02	87	1541	444	.	4.41	0.40
96	14-Oct-1999	287	1	1	50	139	1745	1.74	4.39	5.00	6.74	126.4	7.79	1.89	3.45	8.23	7	169	93	.	15.50	3.25
140.1	14-Oct-1999	287	12	16	40	244	344	5.24	2.70	5.64	6.78	118.2	10.13	1.75	2.10	6.65	56	400	54	.	19.88	3.99
140.2	14-Oct-1999	287	20	33	40	388	43	9.74	3.04	3.76	6.95	104.8	8.73	1.87	2.09	6.59	142	1222	63	.	16.07	2.65
140.5	14-Oct-1999	287	14	22	40	248	32	6.97	2.99	5.98	6.77	91.8	6.52	1.57	1.82	6.38	94	632	96	.	11.24	3.40
141	14-Oct-1999	287	13	21	40	273	534	4.42	2.69	6.21	6.21	125.3	11.85	1.92	2.15	6.37	64	373	106	.	21.46	4.28
142	14-Oct-1999	287	9	11	31	188	132	4.18	1.98	6.80	6.46	87.8	6.18	1.48	1.94	5.51	48	299	144	.	12.58	3.78
143	14-Oct-1999	287	10	16	51	274	148	5.91	4.32	2.88	6.85	96.9	8.03	1.86	2.02	6.77	73	700	92	.	13.57	2.51
144	14-Oct-1999	287	9	27	87	457	114	7.65	4.12	1.85	6.47	104.6	9.23	1.79	1.83	6.35	95	818	88	.	15.60	2.86
145	14-Oct-1999	287	16	42	60	444	33	10.77	3.48	3.47	6.50	98.7	8.96	1.91	2.16	6.50	121	1216	147	.	16.36	2.50
146	14-Oct-1999	287	9	25	43	279	75	8.15	1.67	4.62	5.82	77.5	7.94	1.24	1.55	2.61	179	1238	299	.	14.79	2.05
147	14-Oct-1999	287	34	52	45	350	519	9.36	4.66	4.93	6.68	131.5	10.01	2.14	2.59	9.66	160	880	110	.	18.17	3.67
148	14-Oct-1999	287	9	25	70	416	276	8.18	6.78	3.74	6.69	179.3	16.39	2.37	3.66	11.31	92	1290	158	.	31.06	4.03
149	14-Oct-1999	287	21	34	78	642	123	18.32	2.44	3.78	6.27	77.2	5.89	1.46	1.64	4.96	273	2445	246	.	10.11	2.09
150	14-Oct-1999	287	13	35	58	655	20	20.65	1.66	3.45	5.53	52.1	4.31	1.13	1.07	2.33	379	2942	231	.	6.31	1.71

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
151	14-Oct-1999	287	14	23	44	257	388	5.05	3.26	4.59	6.92	76.9	5.97	1.85	1.73	4.48	51	637	51	.	10.00	1.85
152	14-Oct-1999	287	1	9	59	212	285	5.36	2.65	4.78	6.92	78.0	17.62	2.09	1.60	5.73	63	716	77	.	8.32	3.27
153	14-Oct-1999	287	3	12	36	194	134	4.84	7.38	4.81	7.25	168.3	15.21	2.16	2.83	12.15	24	308	111	.	25.22	4.74
154	14-Oct-1999	287	4	12	56	301	398	5.26	6.35	4.82	7.15	143.9	13.95	2.10	2.51	8.66	39	417	97	.	20.45	4.03
155	14-Oct-1999	287	4	10	38	148	50	3.71	2.74	5.62	6.93	82.2	8.32	1.34	1.36	4.24	31	189	38	.	12.82	2.61
155.5	14-Oct-1999	287	22	46	49	394	47	10.67	2.86	4.17	6.76	99.1	8.18	1.81	1.93	6.22	127	1182	92	.	15.16	2.89
156	14-Oct-1999	287	6	12	87	204	139	4.01	3.17	5.01	6.70	96.4	6.75	1.43	1.51	7.65	58	586	114	.	11.24	4.31
157	14-Oct-1999	287	1	9	43	244	92	7.23	5.07	5.08	7.11	83.3	3.86	1.46	1.33	9.31	56	818	143	.	5.96	2.50
157.5	14-Oct-1999	287	1	5	37	174	64	5.13	1.37	4.69	6.52	55.6	4.90	1.29	0.99	2.60	56	289	80	.	9.63	1.31
158	14-Oct-1999	287	16	30	46	179	50	4.69	1.89	4.98	6.36	50.2	3.81	1.01	1.04	2.44	49	692	100	.	5.15	1.82
159	14-Oct-1999	287	24	45	50	325	197	8.31	2.42	4.79	6.66	112.8	10.29	1.77	1.91	5.56	124	900	66	.	17.30	3.44
159.5	14-Oct-1999	287	55	63	69	367	482	6.54	3.48	5.46	6.84	143.9	14.54	2.05	1.99	6.84	85	618	67	.	23.41	3.97
160	14-Oct-1999	287	37	49	28	214	621	3.47	4.53	6.42	6.98	215.0	23.05	2.53	2.40	10.32	27	123	57	.	40.24	4.65
161	14-Oct-1999	287	14	27	80	498	537	9.50	2.86	3.85	6.59	106.4	10.11	1.95	1.89	5.20	139	1410	143	.	17.09	2.64
162	14-Oct-1999	287	23	30	40	272	405	4.97	3.88	6.23	6.94	132.5	11.16	2.37	2.50	8.18	60	332	96	.	19.36	4.30
162.5	14-Oct-1999	287	9	20	90	388	458	5.77	4.45	2.00	6.87	135.0	10.60	2.11	2.20	9.24	107	459	59	.	19.54	3.68
163	14-Oct-1999	287	6	17	49	391	706	6.97	2.26	5.21	6.70	94.4	5.01	2.14	2.45	7.25	87	746	111	.	28.31	4.44
164	14-Oct-1999	287	8	27	54	696	11	21.77	2.28	4.87	6.49	72.7	5.12	1.59	1.42	5.36	183	2392	362	.	8.11	2.05
165	14-Oct-1999	287	3	11	40	196	18	4.47	1.83	4.54	6.51	37.9	3.12	1.11	0.77	1.64	66	804	146	.	4.92	0.87
166	14-Oct-1999	287	41	54	57	235	389	4.10	2.85	6.16	6.81	113.9	11.84	1.89	1.88	4.78	26	226	91	.	19.63	2.93
167	14-Oct-1999	287	35	50	31	250	635	4.70	4.64	7.92	7.04	116.7	5.82	2.28	4.27	8.61	15	148	33	.	11.44	5.05
168	14-Oct-1999	287	27	47	42	293	6	7.97	1.90	4.09	6.34	89.6	5.70	1.87	2.35	4.98	63	1343	172	.	9.97	4.62
96	23-Feb-2000	54	0	1	73	198	1751	1.74	3.46	4.42	6.45	179.1	16.16	2.12	4.29	9.25	9	4	142	.	33.10	3.77
140.1	23-Feb-2000	54	0	10	58	327	366	3.49	1.05	4.13	6.60	176.6	21.01	1.84	2.30	6.80	32	116	79	.	37.32	4.05
140.2	23-Feb-2000	54	0	17	44	270	159	4.27	1.00	2.95	6.56	245.0	32.14	2.11	2.47	7.36	68	290	199	.	59.19	3.90
140.5	23-Feb-2000	54	0	14	49	479	164	3.99	1.08	3.63	6.60	188.0	23.95	1.86	2.25	6.82	53	228	153	.	44.62	3.93
141	23-Feb-2000	54	0	11	36	268	524	2.65	1.10	5.05	6.35	115.9	11.34	1.52	2.07	5.44	41	113	122	.	19.85	4.01
142	23-Feb-2000	54	0	7	29	196	151	2.63	0.84	5.49	6.30	80.6	6.41	1.40	1.89	4.54	38	142	103	.	12.07	3.45
143	23-Feb-2000	54	2	13	132	397	324	3.74	1.65	3.09	6.64	347.0	52.64	2.90	2.80	9.05	37	244	216	.	91.23	4.14
144	23-Feb-2000	54	0	13	201	517	260	4.79	2.41	1.98	6.71	625.0	110.09	4.06	3.16	11.57	55	440	280	.	175.03	3.70
145	23-Feb-2000	54	3	16	75	396	188	5.09	1.14	2.71	6.30	252.0	34.14	2.25	2.49	7.11	68	379	269	.	62.03	3.71
146	23-Feb-2000	54	0	12	52	260	203	4.07	0.77	3.85	5.25	124.5	15.52	1.34	1.78	2.57	185	221	337	.	27.39	2.70
147	23-Feb-2000	54	8	23	886	932	476	4.84	2.37	3.81	6.37	350.0	45.41	3.27	3.08	10.98	86	407	136	.	83.68	4.65
148	23-Feb-2000	54	1	11	50	236	251	4.60	1.35	3.59	6.16	245.0	32.55	2.13	2.62	7.00	117	501	224	.	59.53	4.02
149	23-Feb-2000	54	5	19	123	490	156	6.56	1.22	2.68	6.26	131.7	14.44	1.73	1.90	5.01	72	407	4	.	26.33	3.23
150	23-Feb-2000	54	3	16	100	406	41	6.41	0.81	2.82	5.53	70.5	6.62	1.35	1.44	2.85	173	532	165	.	11.17	2.66
151	23-Feb-2000	54	2	10	34	247	457	3.93	1.58	3.41	6.70	97.2	9.35	1.77	1.82	4.90	42	263	14	.	14.91	2.75
152	23-Feb-2000	54	0	4	39	183	331	2.94	1.82	4.32	6.69	83.5	6.93	1.47	1.48	6.53	44	232	54	.	9.72	3.89
153	23-Feb-2000	54	5	11	61	273	305	3.92	3.26	3.96	6.90	234.0	28.77	2.11	2.81	10.00	61	384	99	.	50.37	4.73
154	23-Feb-2000	54	9	21	62	318	392	5.16	2.77	3.82	6.72	237.0	30.38	2.37	2.76	8.10	104	716	204	.	51.59	4.39
155	23-Feb-2000	54	1	8	28	159	145	2.69	1.15	5.17	6.29	112.5	12.20	1.38	1.66	4.99	29	82	39	.	19.28	4.37
155.5	23-Feb-2000	54	3	14	36	238	164	4.21	1.10	3.40	6.50	204.0	25.80	1.91	2.26	6.87	60	255	134	.	47.55	3.97
156	23-Feb-2000	54	1	3	33	176	223	2.55	1.09	4.86	6.50	70.7	5.79	1.29	1.40	4.56	41	95	46	.	8.08	3.46
157	23-Feb-2000	54	2	8	42	178	86	3.67	3.22	4.03	6.92	102.5	7.57	1.44	1.34	8.61	48	385	113	.	12.92	3.15
157.5	23-Feb-2000	54	1	5	30	178	71	3.18	0.73	4.51	5.92	100.6	9.76	1.43	1.41	5.08	38	94	3	.	18.63	3.34
158	23-Feb-2000	54	6	12	27	195	81	3.15	0.73	4.61	5.93	52.6	4.40	1.15	1.27	2.82	63	263	112	.	5.56	3.00
159	23-Feb-2000	54	7	13	40	281	395	3.70	0.94	4.64	6.48	168.3	19.76	1.80	2.12	6.13	62	263	159	.	35.22	4.16
159.5	23-Feb-2000	54	12	22	51	302	496	3.31	1.47	5.18	6.56	190.8	22.15	1.93	2.31	7.44	51	200	133	.	39.91	4.51
160	23-Feb-2000	54	8	14	25	171	680	2.25	2.12	6.22	6.85	251.0	29.70	2.12	2.81	10.07	20	56	63	.	55.52	5.06
161	23-Feb-2000	54	5	11	70	360	407	4.09	0.65	3.55	5.90	190.4	24.22	2.01	2.00	5.00	111	305	202	.	44.94	3.36
162	23-Feb-2000	54	9	20	93	1142	1077	14.83	3.44	7.59	6.93	235.0	25.51	2.64	3.42	11.99	41	94	85	.	45.03	6.62
162.5	23-Feb-2000	54	2	13	199	490	692	4.15	2.41	2.60	6.76	741.0	128.24	5.61	3.13	12.90	66	310	182	.	207.79	4.91
163	23-Feb-2000	54	7	14	67	331	745	3.58	1.15	4.83	6.35	93.2	6.19	1.84	2.39	6.50	66	251	141	.	10.60	5.17
164	23-Feb-2000	54	3	11	32	252	12	5.53	0.73	2.39	6.10	87.3	8.99	1.56	1.44	4.14	101	350	375	.	17.23	2.64
165	23-Feb-2000	54	1	9	31	148	49	3.01	1.02	3.76	5.76	48.9	4.55	1.32	1.07	2.10	41	286	5	.	6.65	1.67
166	23-Feb-2000	54	9	19	45	198	221	2.58	1.35	5.67	6.06	132.2	14.45	1.58	2.05	4.83	26	104	41	.	24.63	3.88
167	23-Feb-2000	54	7	18	28	151	1464	2.73	1.86	6.78	6.88	130.1	6.62	1.80	4.40	9.09	29	99	60	.	11.87	6.96

SERC Mattawoman Watershed Study

Grab samples of dissolved nutrients in baseflow

Station	Date	Julian day	Dissolved phosphate ug P/l	Dissolved total phosphorus ug P/l	Dissolved ammonium ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Inorganic carbon mg C/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Sodium mg/l	Potasium mg/l	Magnesium mg/l	Calicum mg/l	Aluminum ug/l	Iron ug/l	Manganese ug/l	Fluoride mg/l	Chloride mg/l	Sulfate mg S/l
168	23-Feb-2000	54	7	15	41	200	31	3.99	1.00	4.90	6.39	110.2	10.29	1.71	2.47	4.18	46	303	171	.	19.82	3.74
169	23-Feb-2000	54	36	40	112	337	4127	4.44	2.80	7.64	6.69	358.0	27.94	3.55	10.37	17.58	75	192	129	.	66.44	10.28
96	18-May-2000	139	0	2	97	229	1567	1.61	3.62	4.72	5.82	157.1	11.65	2.06	4.05	8.22	14	20	148	.	25.62	3.41
140.1	18-May-2000	139	17	24	64	418	410	3.91	2.38	5.96	6.89	116.2	10.86	1.64	1.96	5.95	61	762	37	.	17.86	3.43
140.2	18-May-2000	139	29	54	91	621	198	9.64	3.68	3.60	7.08	132.8	12.98	1.94	2.41	7.14	126	2234	117	.	21.86	1.94
140.5	18-May-2000	139	30	40	110	582	197	8.20	3.39	4.32	7.10	121.1	11.42	1.87	2.18	6.76	113	1946	86	.	18.77	2.30
141	18-May-2000	139	19	33	54	356	375	4.42	2.38	6.33	6.62	112.1	10.69	1.63	1.91	5.52	70	1048	188	.	17.12	3.23
142	18-May-2000	139	14	23	57	286	152	3.94	1.67	6.72	6.66	84.9	6.81	1.46	1.89	4.78	64	619	121	.	11.90	2.86
143	18-May-2000	139	26	42	116	585	260	6.75	3.35	3.38	6.73	130.1	12.61	1.97	2.28	6.54	118	1913	176	.	21.36	2.85
144	18-May-2000	139	24	45	245	776	128	9.24	6.38	2.48	6.85	192.9	22.55	2.66	2.70	8.15	112	2462	180	.	34.51	1.81
145	18-May-2000	139	38	57	118	687	143	10.84	4.22	3.11	6.87	143.0	14.17	2.03	2.56	7.24	156	3187	626	.	24.57	1.80
146	18-May-2000	139	13	29	95	668	71	13.16	1.62	4.18	5.65	83.4	8.94	1.66	1.56	2.52	269	3351	444	.	14.87	1.69
147	18-May-2000	139	41	54	132	651	602	6.94	3.86	4.73	6.59	176.3	14.97	2.39	3.27	10.26	98	1344	165	.	30.36	3.58
148	18-May-2000	139	23	42	198	799	145	9.05	3.73	3.60	6.65	176.1	19.41	2.41	2.68	6.89	128	2495	318	.	33.21	2.60
149	18-May-2000	139	46	83	247	1125	145	16.15	3.38	3.51	6.62	116.5	10.49	1.76	2.25	6.43	187	5482	282	.	18.30	1.72
150	18-May-2000	139	25	47	164	1043	17	26.76	3.54	3.26	5.96	60.4	5.04	1.22	1.78	3.64	307	10671	473	.	5.72	0.58
151	18-May-2000	139	23	41	87	487	356	5.85	2.85	3.87	7.06	76.8	6.66	1.81	1.74	4.17	83	1556	59	.	9.41	1.19
152	18-May-2000	139	4	9	50	253	326	4.01	2.78	4.38	7.20	74.7	6.59	1.58	1.28	4.57	72	750	40	.	8.24	1.75
153	18-May-2000	139	7	20	69	379	185	5.07	5.16	4.90	7.27	167.3	16.77	2.15	2.55	9.37	69	1336	95	.	28.14	2.47
154	18-May-2000	139	15	35	56	378	326	5.38	4.61	5.11	6.95	139.3	14.55	2.19	2.26	6.58	57	1482	110	.	21.37	2.23
155	18-May-2000	139	6	16	46	275	131	3.61	2.40	6.12	7.01	83.5	7.97	1.49	1.41	4.43	49	531	7	.	10.21	2.62
155.5	18-May-2000	139	39	73	123	596	197	8.57	3.27	4.07	6.98	119.2	11.15	1.85	2.15	6.55	151	2301	157	.	18.00	2.15
156	18-May-2000	139	2	10	58	246	162	3.38	2.13	5.07	6.82	60.6	4.41	1.36	1.25	4.49	68	634	83	.	5.16	2.33
157	18-May-2000	139	0	19	110	501	109	8.39	6.04	4.52	7.24	89.0	4.52	1.61	1.43	10.64	81	2591	164	.	5.40	1.17
157.5	18-May-2000	139	0	14	46	323	106	4.25	1.47	4.28	6.70	56.6	5.57	1.47	0.98	2.96	73	556	7	.	8.43	1.12
158	18-May-2000	139	36	74	110	523	59	7.44	2.02	4.68	6.31	50.1	4.48	1.26	1.08	2.79	151	3089	283	.	4.43	1.52
159	18-May-2000	139	44	61	101	483	303	6.75	2.57	5.67	6.81	139.8	14.44	1.85	2.22	6.44	130	2175	129	.	23.54	3.17
159.5	18-May-2000	139	68	90	82	491	490	5.46	2.87	5.89	6.93	160.4	17.47	2.00	2.18	7.26	74	1173	30	.	27.91	3.87
160	18-May-2000	139	29	34	66	309	682	2.53	3.32	6.69	7.08	216.0	24.51	2.26	2.51	9.75	21	183	51	.	42.05	4.10
161	18-May-2000	139	26	46	125	678	423	10.23	2.44	3.54	6.65	126.3	13.52	2.13	2.15	5.22	192	3456	186	.	22.37	2.32
162	18-May-2000	139	27	33	72	369	415	3.79	2.82	5.42	7.01	146.0	14.43	2.13	2.46	6.98	42	619	80	.	24.87	3.40
162.5	18-May-2000	139	16	29	140	510	382	6.37	4.21	1.92	7.03	184.6	18.19	2.85	2.62	10.09	83	996	74	.	32.49	3.43
163	18-May-2000	139	16	32	103	566	575	7.16	2.08	4.97	6.75	88.7	5.69	2.01	2.36	6.16	124	1606	179	.	9.45	3.15
164	18-May-2000	139	13	33	100	1016	23	25.51	4.19	4.63	6.81	83.4	6.40	1.71	2.15	6.94	209	5741	1091	.	7.15	0.50
165	18-May-2000	139	6	21	64	328	24	6.75	1.57	3.92	6.55	38.4	3.84	1.20	0.95	1.85	133	2383	235	.	4.59	0.77
166	18-May-2000	139	43	49	50	243	206	2.71	1.98	7.32	6.82	92.9	8.98	1.53	1.79	4.04	36	358	55	.	13.73	2.78
167	18-May-2000	139	37	46	67	350	1399	3.75	3.29	7.71	7.29	111.5	5.65	1.73	4.22	7.44	32	277	20	.	9.44	4.13
168	18-May-2000	139	54	90	107	600	30	10.37	2.46	4.35	6.65	76.4	6.70	1.74	2.02	3.76	135	3336	16	.	9.94	1.48
169	18-May-2000	139	34	57	80	736	857	11.88	14.34	0.78	9.15	4190.0	861.14	50.86	74.80	36.33	31	50	4	.	1213.08	42.45

SERC Charles County Watershed Study
Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	20-Apr-1998	110	0.00	110.2	I	18.5	30	93	43	542	94	8.33	3.63	6.76	144	69.0
147	20-Apr-1998	110	.	175.7	I	85.7	70	195	96	1034	222	16.15	2.71	6.64	222	87.8
153	20-Apr-1998	110	0.00	139.4	I	79.1	49	145	63	710	150	8.13	3.49	7.05	265	90.6
154	20-Apr-1998	110	.	149.5	I	73.9	64	137	83	747	202	11.32	3.09	6.85	263	81.7
155	20-Apr-1998	110	.	140.5	I	20.6	30	66	37	342	120	5.66	5.30	6.68	107	60.7
156	20-Apr-1998	110	0.00	96.5	S	8.2	3	24	18	220	61	4.42	4.61	6.52	67	48.0
157.5	20-Apr-1998	110	0.00	92.9	S	14.4	2	27	17	273	37	6.38	3.90	6.17	44	46.8
162.5	20-Apr-1998	110	0.00	179.2	I	59.9	29	167	84	1052	341	8.74	2.07	6.76	262	99.5
163	20-Apr-1998	110	.	184.4	I	178.3	56	179	66	885	325	10.39	3.25	6.43	88	69.4
167	20-Apr-1998	110	.	125.1	I	1464.7	2227	3496	104	2008	694	14.61	6.23	6.69	124	87.3
140.5	27-Apr-1998	117	0.00	74.8	I	16.6	25	38	70	396	114	5.35	4.05	6.81	171	78.1
147	27-Apr-1998	117	.	80.5	I	16.9	42	65	83	459	287	9.05	3.39	6.71	206	116.8
153	27-Apr-1998	117	0.00	78.5	I	8.5	17	33	54	265	170	4.32	4.35	7.15	297	116.7
154	27-Apr-1998	117	.	68.9	I	8.9	38	55	72	389	261	6.07	4.41	7.05	359	118.4
155	27-Apr-1998	117	.	110.6	I	6.8	11	20	30	164	139	2.98	5.97	6.84	115	69.7
156	27-Apr-1998	117	0.00	31.7	S	290.3	4	11	14	176	87	2.88	4.88	6.64	90	52.1
157.5	27-Apr-1998	117	0.00	46.6	I	9.4	9	21	20	231	66	4.32	4.03	6.53	76	50.7
162.5	27-Apr-1998	117	0.00	83.9	I	23.1	27	100	98	870	274	8.54	2.60	6.80	258	144.3
163	27-Apr-1998	117	.	125.2	I	14.0	22	48	69	438	248	4.94	4.10	6.53	110	74.4
167	27-Apr-1998	117	.	91.8	I	59.2	24	33	28	237	1113	1.85	7.21	6.90	139	93.3
140.5	4-May-1998	124	3.80	54.5	I	20.3	63	106	344	751	244	6.58	4.25	6.70	187	82.2
147	4-May-1998	124	.	75.9	I	23.9	61	118	164	715	412	9.77	3.38	6.64	255	97.3
153	4-May-1998	124	4.72	111.5	I	48.8	48	158	114	771	215	8.54	3.84	7.20	304	97.7
154	4-May-1998	124	.	98.6	I	61.1	76	184	181	961	265	11.73	3.62	6.95	328	93.4
155	4-May-1998	124	.	109.5	I	17.6	6	36	31	294	125	4.12	5.78	6.82	128	62.9
156	4-May-1998	124	4.72	25.0	S	28.5	0	19	37	283	62	4.01	4.85	6.57	101	52.4
157.5	4-May-1998	124	4.33	56.5	I	11.2	6	42	54	353	62	5.66	3.96	6.73	265	48.7
162.5	4-May-1998	124	2.75	108.6	I	25.3	29	109	100	785	194	7.30	2.30	6.25	59	110.2
163	4-May-1998	124	.	114.1	I	13.4	24	76	101	533	353	5.25	4.13	6.42	103	69.2
167	4-May-1998	124	.	70.0	I	7.6	22	50	40	250	1210	2.26	7.38	6.80	144	83.1
140.5	11-May-1998	131	3.10	551.7	I	128.2	80	559	109	2754	143	35.80	4.03	6.82	147	70.9
147	11-May-1998	131	.	315.1	I	280.4	150	582	136	2431	218	36.42	3.02	6.62	234	97.6
153	11-May-1998	131	3.26	151.4	I	60.5	48	112	79	669	187	12.76	3.90	7.10	328	109.0
154	11-May-1998	131	.	157.5	I	41.8	64	129	118	872	253	14.51	3.69	6.91	369	102.0
155	11-May-1998	131	.	138.8	I	29.3	18	145	40	330	121	7.30	5.20	6.79	297	65.8
156	11-May-1998	131	3.26	121.3	I	125.2	40	136	54	336	41	13.27	4.36	6.55	83	55.8
157.5	11-May-1998	131	5.18	198.1	I	14.0	14	57	44	440	37	11.42	3.80	6.30	64	49.0
162.5	11-May-1998	131	4.46	265.7	I	59.4	73	226	108	1431	142	17.49	2.20	7.01	337	108.9
163	11-May-1998	131	.	152.0	I	26.0	39	89	119	567	334	10.19	4.06	6.60	123	74.5
167	11-May-1998	131	.	76.2	I	8.4	41	57	80	323	1012	6.07	6.58	6.99	163	90.9
140.5	19-May-1998	139	1.46	183.7	I	13.3	39	76	179	558	219	6.17	5.06	6.63	115	82.0
147	19-May-1998	139	.	169.9	I	21.8	58	103	133	726	238	12.04	3.34	6.58	225	118.8
153	19-May-1998	139	1.82	163.8	I	34.2	35	69	94	514	171	9.05	4.28	7.40	370	123.2
154	19-May-1998	139	.	149.4	I	29.4	51	103	119	668	205	9.77	4.07	7.09	404	122.4
155	19-May-1998	139	.	130.7	I	35.7	15	38	70	280	134	3.70	5.76	6.96	133	71.8
156	19-May-1998	139	1.54	57.6	I	65.3	39	53	48	435	33	6.79	4.84	6.74	106	52.9
157.5	19-May-1998	139	1.38	101.8	I	15.2	10	25	57	301	62	6.07	4.25	6.57	81	50.8
162.5	19-May-1998	139	1.86	170.2	I	36.3	51	120	108	917	134	9.36	2.49	7.16	387	136.1
163	19-May-1998	139	.	126.5	I	15.5	18	63	140	508	351	6.07	4.52	6.86	143	78.0
167	19-May-1998	139	.	75.6	I	10.1	38	44	83	353	981	4.12	7.10	7.08	161	92.5
140.5	26-May-1998	146	1.64	34.9	I	88.5	51	92	87	480	243	5.25	4.57	7.00	196	81.0
147	26-May-1998	146	.	67.5	I	106.3	137	245	225	1237	525	9.88	3.51	6.60	210	100.2
153	26-May-1998	146	2.22	68.5	I	112.3	103	243	170	1128	429	9.16	4.31	7.28	411	118.9
154	26-May-1998	146	.	73.7	I	102.3	127	260	327	1240	599	8.54	3.84	6.98	375	111.7
155	26-May-1998	146	.	65.3	I	16.4	10	40	34	301	234	3.50	5.81	6.90	143	71.7
156	26-May-1998	146	1.47	4.7	I	39.5	16	68	38	511	34	9.05	5.00	6.67	136	53.5
157.5	26-May-1998	146	1.24	29.3	I	17.1	11	42	42	441	99	6.28	4.30	6.56	85	48.8
162.5	26-May-1998	146	2.56	98.9	I	35.5	49	133	70	968	46	9.67	2.45	7.00	324	122.2
163	26-May-1998	146	.	44.7	I	47.7	34	68	138	574	498	6.28	4.85	6.68	142	77.2
167	26-May-1998	146	.	35.0	I	5.8	36	52	67	322	1260	2.78	7.32	7.00	168	94.2
140.5	1-Jun-1998	152	0.70	20.4	S	59.6	39	84	41	462	250	4.94	4.57	6.95	215	86.1
147	1-Jun-1998	152	.	38.6	I	102.2	116	248	208	1286	499	10.70	3.51	6.79	344	101.2
153	1-Jun-1998	152	1.00	37.4	I	199.7	110	352	100	1223	299	11.21	4.18	6.97	269	85.9
154	1-Jun-1998	152	.	47.0	I	207.0	165	440	142	1366	415	11.01	4.23	6.75	251	80.2
155	1-Jun-1998	152	.	42.4	I	9.4	14	34	22	232	186	2.98	5.89	6.88	129	64.9
156	1-Jun-1998	152	0.53	2.3	S	83.3	8	31	58	353	87	3.91	4.74	6.58	348	56.1
157.5	1-Jun-1998	152	0.44	19.0	I	21.6	11	36	35	376	85	6.07	4.07	6.50	82	48.4
162.5	1-Jun-1998	152	0.90	55.9	I	27.1	41	110	71	1130	8	8.74	2.30	6.96	280	125.5
163	1-Jun-1998	152	.	31.1	I	27.9	32	68	137	553	453	6.07	4.67	6.65	163	74.5
167	1-Jun-1998	152	.	26.3	I	7.5	35	52	47	296	1115	2.37	7.28	7.10	195	89.5
140.5	8-Jun-1998	159	1.22	18.8	I	9.6	48	85	48	512	164	8.64	3.76	7.01	226	86.5
147	8-Jun-1998	159	.	23.0	I	41.3	64	117	82	531	438	8.95	4.07	6.62	246	120.6
153	8-Jun-1998	159	0.60	35.7	I	43.3	51	112	85	556	283	7.10	3.93	7.41	397	130.8
154	8-Jun-1998	159	.	44.1	I	35.4	55	123	138	624	408	7.27	3.69	7.14	426	128.9
155	8-Jun-1998	159	.	43.8	I	10.9	15	36	37	304	185	3.50	5.57	6.97	144	73.6
156	8-Jun-1998	159	0.43	1.0	S	2.2	12	45	69	340	60	5.86	4.46	6.69	131	54.4
157.5	8-Jun-1998	159	0.00	16.8	I	13.1	11	32	41	293	131	5.45	4.13	6.46	59	43.9
162.5	8-Jun-1998	159	0.14	41.1	I	16.2	27	92	72	721	15	7.41	4.47	6.97	400	140.1
163	8-Jun-1998	159	.	21.6	I	47.1	38	59	103	506	484	6.89	1.61	6.82	140	81.9
167	8-Jun-1998	159	.	23.7	I	5.6	38	57	42	305	1094	2.57	6.63	7.07	176	93.6
140.5	15-Jun-1998	166	4.16	32.8	I	16.6	44	87	79	391	229	7.41	4.18	6.93	202	86.6
147	15-Jun-1998	166	.	92.2	I	67.2	106	259	167	976	402	13.37	2.39	6.90	376	112.0
153	15-Jun-1998	166	4.72	53.6	I	27.0	48	105	69	508	292	7.20	4.11	7.09	363	108.8
154	15-Jun-1998	166	.	62.5	I	33.2	61	132	113	556	443	6.17	3.71	7.21	549	125.5
155	15-Jun-1998	166	.	50.5	I	6.3	13	23	74	215	164	3.40	5.42	6.88	152	71.6
156	15-Jun-1998	166	4.72	5.7	I	123.7	141	234	595	1801	28	13.58	4.52	6.63	137	54.5
157.5	15-Jun-1998	166	4.68	35.7	I	10.3	2	33	66	325	119	5.86	3.81	6.42	71	45.8
162.5	15-Jun-1998	166	4.40	70.5	I	32.1	40	71	82	874	43	7.92	1.58	6.90	261	107.7
163	15-Jun-1998	166	.	38.2	I	24.0	36	85	127	480	541	3.40	4.68	6.61	137	70.7
167	15-Jun-1998	166	.	43.1	I	10.4	53	130	82	368	1052	9.57	6.96	6.99	222	91.9

SERC Charles County Watershed Study

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Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	22-Jun-1998	173	9.22	290.7	I	917.3	232	1339	151	2901	188	19.03	3.20	6.87	197	76.9
147	22-Jun-1998	173	.	509.2	I	690.5	101	834	212	3452	211	32.72	1.33	6.67	266	109.5
153	22-Jun-1998	173	7.74	183.0	I	382.4	124	530	124	1762	230	16.87	2.70	7.25	422	117.6
154	22-Jun-1998	173	.	272.4	I	332.6	170	480	138	1502	285	16.15	2.49	7.01	396	108.5
155	22-Jun-1998	173	.	185.3	I	157.5	74	186	81	984	151	11.52	4.35	6.81	145	71.2
156	22-Jun-1998	173	7.74	265.5	I	313.6	104	363	71	1364	177	13.37	3.34	6.53	104	54.1
157.5	22-Jun-1998	173	5.16	91.3	I	10.2	22	59	73	387	80	8.85	3.57	6.45	79	48.9
162.5	22-Jun-1998	173	5.74	298.8	I	70.1	60	164	94	1324	104	15.33	1.57	6.98	310	113.1
163	22-Jun-1998	173	.	108.5	I	144.8	133	273	157	1267	291	20.68	3.69	6.77	179	80.4
167	22-Jun-1998	173	.	45.7	I	35.5	95	142	130	678	887	7.51	7.08	7.25	243	95.6
140.5	29-Jun-1998	180	7.86	88.7	S	10.0	41	34	94	403	177	7.61	4.12	6.79	238	78.2
147	29-Jun-1998	180	.	29.0	I	119.5	219	217	175	805	484	9.98	3.65	6.73	381	117.8
153	29-Jun-1998	180	8.02	160.0	I	274.9	94	195	121	913	200	14.95	2.49	7.12	446	120.5
154	29-Jun-1998	180	.	241.3	I	156.8	121	331	75	1129	286	19.44	2.38	6.88	384	101.7
155	29-Jun-1998	180	.	319.0	I	210.0	128	363	119	966	127	16.15	4.09	6.74	145	68.6
156	29-Jun-1998	180	8.72	418.7	I	220.5	53	191	91	833	97	12.96	3.23	6.10	46	41.8
157.5	29-Jun-1998	180	5.24	46.8	I	15.1	12	24	90	451	74	8.85	3.40	6.32	68	45.8
162.5	29-Jun-1998	180	2.10	57.9	I	25.0	33	59	133	733	43	9.88	1.81	7.00	345	121.7
163	29-Jun-1998	180	.	27.3	I	78.6	92	182	177	772	419	10.39	4.15	6.81	208	78.3
167	29-Jun-1998	180	.	52.1	I	13.2	58	103	217	433	1025	4.63	6.92	7.01	238	94.8
140.5	7-Jul-1998	188	0.22	21.4	S	3.6	38	42	64	251	182	3.40	4.79	6.86	224	83.1
147	7-Jul-1998	188	.	20.1	I	95.1	135	152	92	475	563	5.25	4.48	6.57	225	114.1
153	7-Jul-1998	188	0.27	38.1	I	202.9	29	36	50	263	202	4.01	4.07	7.39	463	136.7
154	7-Jul-1998	188	.	45.1	I	107.2	25	54	53	269	167	4.22	4.52	7.25	448	124.5
155	7-Jul-1998	188	.	60.2	I	64.3	50	33	62	216	342	2.78	5.95	6.94	145	70.5
156	7-Jul-1998	188	0.24	68.5	I	227.5	56	171	44	838	59	10.91	4.87	6.57	109	49.9
157.5	7-Jul-1998	188	0.14	24.5	I	17.4	15	26	76	353	135	5.97	3.97	6.52	68	46.3
162.5	7-Jul-1998	188	0.20	32.8	I	16.4	28	72	84	688	74	6.58	2.07	7.00	327	141.5
163	7-Jul-1998	188	.	13.7	I	43.6	45	511	97	497	524	7.61	4.44	6.83	150	86.5
167	7-Jul-1998	188	.	29.8	I	7.6	60	57	91	371	1189	2.78	7.34	7.09	228	99.3
140.5	13-Jul-1998	194	0.68	9.3	S	1.2	31	60	63	369	144	4.22	4.38	7.02	228	85.6
147	13-Jul-1998	194	.	17.7	I	58.4	90	161	130	552	530	6.79	3.82	6.72	278	115.8
153	13-Jul-1998	194	1.12	34.9	I	56.3	45	139	81	485	302	6.17	3.98	7.45	450	131.3
154	13-Jul-1998	194	.	41.6	I	109.1	115	287	144	955	449	8.54	3.42	7.33	466	130.2
155	13-Jul-1998	194	.	35.0	I	18.4	16	37	45	277	164	3.50	5.66	6.78	135	70.7
156	13-Jul-1998	194	1.08	14.3	I	313.4	67	243	61	1133	24	11.83	4.76	6.22	73	53.0
157.5	13-Jul-1998	194	1.44	13.4	I	10.1	11	32	96	339	158	5.56	3.93	6.48	61	45.9
162.5	13-Jul-1998	194	2.08	51.0	I	35.7	45	144	111	872	54	9.57	1.93	7.03	321	133.5
163	13-Jul-1998	194	.	17.4	I	46.4	48	115	168	660	397	7.72	4.18	6.80	141	86.7
167	13-Jul-1998	194	.	25.1	I	6.5	58	89	120	497	1169	4.12	6.69	7.10	238	99.7
140.5	20-Jul-1998	201	0.00	3.0	S	49.2	46	116	71	692	13	9.88	3.82	6.98	370	82.2
147	20-Jul-1998	201	.	11.6	S	86.7	88	116	50	155	518	4.73	4.91	6.67	256	103.8
153	20-Jul-1998	201	0.08	47.3	I	17.5	20	39	32	298	160	5.45	4.35	7.48	475	136.9
154	20-Jul-1998	201	.	16.9	I	74.7	56	81	56	289	373	7.10	4.38	7.28	544	141.6
155	20-Jul-1998	201	.	30.2	I	10.3	20	51	43	194	116	7.00	5.65	6.78	152	70.2
156	20-Jul-1998	201	0.16	7.8	I	327.7	78	284	57	1369	47	18.62	4.26	6.57	152	50.9
157.5	20-Jul-1998	201	0.11	11.9	I	12.5	11	34	52	309	169	6.28	3.98	6.56	65	43.5
162.5	20-Jul-1998	201	0.00	23.4	I	8.3	24	75	73	523	63	5.76	2.02	7.03	322	147.3
163	20-Jul-1998	201	.	7.4	S	5.2	19	46	54	371	849	5.25	4.00	6.69	124	88.3
167	20-Jul-1998	201	.	17.7	I	9.1	67	147	57	316	1079	6.38	6.90	7.08	240	95.0
140.5	27-Jul-1998	208	0.00	2.5	S	102.3	59	159	81	1025	0	11.32	2.39	6.91	547	97.2
147	27-Jul-1998	208	.	8.8	I	7.8	190	290	107	351	299	13.79	5.11	6.68	222	101.2
153	27-Jul-1998	208	0.08	58.7	I	13.0	22	40	41	175	95	5.04	4.37	7.98	473	135.0
154	27-Jul-1998	208	.	13.1	I	53.2	60	78	44	207	313	7.30	4.55	7.43	567	143.8
155	27-Jul-1998	208	.	24.5	I	7.7	23	45	43	165	64	4.73	5.59	6.89	173	70.9
156	27-Jul-1998	208	0.02	4.8	I	204.6	43	133	57	694	17	13.17	4.09	6.87	190	50.7
157.5	27-Jul-1998	208	0.08	10.7	I	11.3	14	30	41	244	148	6.17	3.90	6.65	59	44.6
162.5	27-Jul-1998	208	0.00	22.5	I	8.8	49	123	77	466	58	9.05	2.29	7.22	379	164.6
163	27-Jul-1998	208	.	4.6	S	2.9	18	35	38	289	973	4.84	3.65	6.82	95	91.2
167	27-Jul-1998	208	.	13.6	I	7.7	79	100	87	369	875	8.57	6.61	7.19	253	96.5
140.5	4-Aug-1998	216	0.32	2.6	S	14.8	47	76	24	634	13	7.00	2.05	6.91	509	111.7
147	4-Aug-1998	216	.	6.7	S	116.5	189	197	84	241	226	3.19	5.57	6.40	186	100.7
153	4-Aug-1998	216	0.08	59.7	I	58.8	23	33	26	228	42	4.22	4.47	7.81	492	140.4
154	4-Aug-1998	216	.	13.1	I	11.0	74	78	31	319	307	4.12	4.59	7.33	586	152.5
155	4-Aug-1998	216	.	22.2	I	12.3	35	69	33	374	63	4.32	5.34	6.73	138	73.4
156	4-Aug-1998	216	0.40	3.6	I	175.7	47	139	28	963	43	11.83	3.96	6.75	150	49.0
157.5	4-Aug-1998	216	0.48	11.4	I	13.3	16	16	38	238	164	5.56	3.95	6.51	59	47.6
162.5	4-Aug-1998	216	0.16	24.2	I	7.9	29	59	39	484	36	6.28	2.18	7.03	382	180.0
163	4-Aug-1998	216	.	4.6	S	29.0	12	21	40	230	900	2.26	3.49	6.36	62	92.0
167	4-Aug-1998	216	.	11.8	I	24.0	89	89	49	325	626	5.04	6.49	7.03	249	95.0
140.5	10-Aug-1998	222	0.02	1.2	I	15.4	44	101	93	811	0	12.45	1.93	7.24	561	96.9
147	10-Aug-1998	222	.	0.5	S	3.2	125	141	64	198	277	2.57	5.24	6.80	227	90.4
153	10-Aug-1998	222	0.00	2.3	S	3.4	15	35	25	208	31	3.29	4.16	7.49	468	139.2
154	10-Aug-1998	222	.	9.9	I	12.5	56	72	52	249	551	4.12	4.49	7.55	627	146.2
155	10-Aug-1998	222	.	13.0	S	10.5	24	28	30	167	39	2.47	5.04	6.84	184	74.0
156	10-Aug-1998	222	0.38	1.5	S	6.9	12	40	46	368	51	4.01	4.01	6.88	167	48.7
157.5	10-Aug-1998	222	0.00	7.4	I	9.4	10	25	29	246	136	3.91	3.94	6.59	61	45.6
162.5	10-Aug-1998	222	0.00	18.2	I	27.1	38	130	54	903	43	6.58	2.33	7.15	401	165.3
163	10-Aug-1998	222	.	3.1	S	2.9	15	25	39	235	784	2.26	3.48	6.52	74	90.3
167	10-Aug-1998	222	.	6.6	I	4.8	77	99	47	262	562	3.40	6.35	7.09	304	90.6
140.5	17-Aug-1998	229	1.53	6.7	I	17.1	49	107	84	757	36	13.37	2.40	6.67	201	109.9
147	17-Aug-1998	229	.	88.3	I	302.0	359	717	75	1922	522	22.43	1.19	6.98	318	114.3
153	17-Aug-1998	229	1.48	20.8	I	17.7	55	83	70	386	179	7.51	4.11	7.38	585	139.4
154	17-Aug-1998	229	.	19.8	I	54.9	233	337	91	629	235	13.37	3.79	7.56	698	151.2
155	17-Aug-1998	229	.	20.4	I	10.1	34	53	43	246	50	4.01	4.74	6.93	192	74.8
156	17-Aug-1998	229	1.83	2.8	I	172.1	47	139	45	870	27	10.60	3.74	6.92	193	50.9
157.5	17-Aug-1998	229	1.25	10.2	I	6.5	13	27	37	273	66	4.94	3.85	6.58	63	44.1
162.5	17-Aug-1998	229	4.12	101.8	I	3.6	149	349	62	1167	49	14.71	5.74	6.97	316	122.5
163	17-Aug-1998	229	.	11.6	I	74.8	190	651	233	2957	193	45.06	1.73	6.60	86	96.0
167	17-Aug-1998	229	.	9.2	I	414.8	84	110	101	383	384	4.73	3.40	7.18	287	93.6

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	24-Aug-1998	236	0.00	6.6	I	31.2	43	135	51	722	5	11.83	2.23	.	.	.
147	24-Aug-1998	236	.	11.6	S	257.7	84	170	44	314	413	4.42	4.90	7.10	390	111.3
153	24-Aug-1998	236	0.01	16.5	I	22.3	36	59	35	238	64	6.07	3.93	.	.	.
154	24-Aug-1998	236	.	13.9	I	18.7	71	104	42	291	268	7.30	3.72	7.41	531	133.6
155	24-Aug-1998	236	.	17.0	I	9.1	27	54	27	189	45	5.56	4.71	.	.	.
156	24-Aug-1998	236	0.01	1.9	I	116.5	54	199	49	803	30	9.77	3.82	6.75	194	52.4
157.5	24-Aug-1998	236	0.47	9.4	I	20.3	17	60	30	322	128	7.00	3.99	6.60	66	49.1
162.5	24-Aug-1998	236	0.15	30.0	I	22.0	30	134	41	745	40	9.16	1.64	7.12	452	151.0
163	24-Aug-1998	236	.	3.5	S	10.1	20	82	49	300	800	5.14	3.53	6.53	86	90.4
167	24-Aug-1998	236	.	3.7	.	.	.	.	.	.	.	.	.	.	.	.
140.5	31-Aug-1998	243	0.06	5.2	.	.	.	.	.	.	.	.	.	.	.	.
147	31-Aug-1998	243	.	7.4	S	2.5	119	135	69	207	206	3.09	5.82	7.33	232	89.1
153	31-Aug-1998	243	0.26	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	31-Aug-1998	243	.	7.7	S	4.5	54	84	53	223	242	3.81	4.49	7.52	718	151.6
155	31-Aug-1998	243	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.
156	31-Aug-1998	243	0.45	1.4	S	7.7	8	58	57	324	3	4.87	3.90	6.81	209	51.8
157.5	31-Aug-1998	243	0.06	7.8	I	9.3	9	33	47	226	112	4.53	4.00	6.68	79	47.7
162.5	31-Aug-1998	243	1.12	23.0	I	16.2	30	103	53	743	54	9.26	2.09	7.06	440	164.6
163	31-Aug-1998	243	.	3.4	S	6.6	19	46	72	282	616	4.01	3.62	6.57	102	89.3
167	31-Aug-1998	243	.	2.3	.	.	.	.	.	.	.	.	.	.	.	.
140.5	8-Sep-1998	251	1.08	2.4	.	.	.	.	.	.	.	.	.	.	.	.
147	8-Sep-1998	251	.	3.1	S	3.3	142	197	80	306	350	8.23	6.04	7.24	193	86.8
153	8-Sep-1998	251	1.29	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	8-Sep-1998	251	.	9.5	S	10.5	127	189	83	409	335	9.98	5.48	7.60	978	178.1
155	8-Sep-1998	251	.	4.9	.	.	.	.	.	.	.	.	.	.	.	.
156	8-Sep-1998	251	1.12	0.8	S	8.9	14	68	73	336	27	6.28	3.83	6.65	207	52.0
157.5	8-Sep-1998	251	1.38	9.5	I	8.8	13	30	38	240	102	6.69	4.06	6.53	68	44.5
162.5	8-Sep-1998	251	0.91	24.0	I	23.6	27	115	73	688	66	9.98	2.15	7.08	352	149.1
163	8-Sep-1998	251	.	3.3	S	4.5	19	45	48	317	811	5.56	3.29	6.53	86	93.6
167	8-Sep-1998	251	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
140.5	14-Sep-1998	257	0.00	0.3	.	.	.	.	.	.	.	.	.	.	.	.
147	14-Sep-1998	257	.	0.3	.	.	.	.	.	.	.	.	.	.	.	.
153	14-Sep-1998	257	0.00	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	14-Sep-1998	257	.	5.3	S	4.2	44	51	37	179	226	7.20	4.01	7.48	532	137.4
155	14-Sep-1998	257	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	14-Sep-1998	257	0.00	0.4	.	.	.	.	.	.	.	.	.	.	.	.
157.5	14-Sep-1998	257	0.00	8.1	I	6.9	11	24	44	185	93	6.28	4.04	6.14	43	47.9
162.5	14-Sep-1998	257	0.00	18.7	I	15.2	17	94	60	748	75	11.93	2.09	7.05	395	179.4
163	14-Sep-1998	257	.	2.3	S	2.6	17	30	58	298	737	4.22	3.26	6.43	92	92.0
167	14-Sep-1998	257	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
140.5	21-Sep-1998	264	0.08	0.1	.	.	.	.	.	.	.	.	.	.	.	.
147	21-Sep-1998	264	.	0.1	S	3.1	114	134	35	216	19	18.52	6.45	6.52	185	89.4
153	21-Sep-1998	264	0.13	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	21-Sep-1998	264	.	5.4	S	4.0	48	80	32	238	25	16.15	4.45	7.48	688	153.9
155	21-Sep-1998	264	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	21-Sep-1998	264	0.12	0.0	.	.	.	.	.	.	.	.	.	.	.	.
157.5	21-Sep-1998	264	0.13	8.0	I	9.8	15	35	38	260	32	6.58	4.06	6.61	77	47.5
162.5	21-Sep-1998	264	0.00	17.6	I	5.3	25	66	33	463	49	11.52	2.17	7.07	417	180.5
163	21-Sep-1998	264	.	2.7	S	4.9	20	38	28	238	28	50.72	3.37	6.60	108	93.2
167	21-Sep-1998	264	.	3.3	.	.	.	.	.	.	.	.	.	.	.	.
140.5	28-Sep-1998	271	2.59	0.1	.	.	.	.	.	.	.	.	.	.	.	.
147	28-Sep-1998	271	.	3.8	.	.	.	.	.	.	.	.	.	.	.	.
153	28-Sep-1998	271	2.12	8.3	.	.	.	.	.	.	.	.	.	.	.	.
154	28-Sep-1998	271	.	14.4	I	7.0	92	117	86	341	237	5.04	4.07	7.42	594	137.9
155	28-Sep-1998	271	.	15.3	S	3.6	8	22	77	257	14	2.98	4.68	7.09	172	92.6
156	28-Sep-1998	271	2.14	8.4	I	80.3	38	113	69	627	2	6.79	3.46	.	.	.
157.5	28-Sep-1998	271	2.66	13.1	I	8.0	13	25	62	221	69	4.42	4.08	6.67	74	47.6
162.5	28-Sep-1998	271	0.78	22.2	I	7.3	21	64	64	561	120	4.94	1.98	7.24	403	191.1
163	28-Sep-1998	271	.	3.0	S	5.1	19	34	82	377	463	2.57	3.33	6.68	117	93.0
167	28-Sep-1998	271	.	6.6	I	2.6	84	119	120	433	253	4.94	5.39	.	.	.
140.5	5-Oct-1998	278	1.63	0.4	.	.	.	.	.	.	.	.	.	.	.	.
147	5-Oct-1998	278	.	17.0	I	12.4	66	80	70	475	311	6.79	3.19	7.37	303	104.8
153	5-Oct-1998	278	2.25	40.3	I	104.8	100	190	74	946	386	10.19	2.47	7.54	457	127.6
154	5-Oct-1998	278	.	20.0	S	5.0	40	60	19	398	290	3.40	3.85	7.33	531	134.5
155	5-Oct-1998	278	.	14.7	S	5.8	9	22	14	113	13	2.78	4.20	6.78	167	79.6
156	5-Oct-1998	278	0.92	3.3	I	172.9	70	204	43	986	2	10.49	3.45	6.80	180	48.7
157.5	5-Oct-1998	278	0.90	9.4	I	7.8	10	16	19	211	79	5.25	4.41	6.58	59	43.5
162.5	5-Oct-1998	278	2.76	43.4	I	42.1	78	187	53	937	135	9.26	1.75	7.10	383	164.5
163	5-Oct-1998	278	.	2.6	S	3.2	14	18	23	226	597	2.57	3.30	6.67	84	92.3
167	5-Oct-1998	278	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
140.5	13-Oct-1998	286	1.42	1.5	.	.	.	.	.	.	.	.	.	.	.	.
147	13-Oct-1998	286	.	13.3	S	2.0	59	74	63	276	370	4.42	4.86	7.21	319	104.9
153	13-Oct-1998	286	1.46	14.8	I	16.8	53	104	63	371	169	6.48	3.39	8.01	487	120.6
154	13-Oct-1998	286	.	27.5	S	5.1	28	66	58	199	265	2.88	4.08	7.35	519	133.2
155	13-Oct-1998	286	.	26.6	I	2.4	11	27	36	139	27	4.22	4.16	6.83	161	78.4
156	13-Oct-1998	286	1.56	8.2	I	42.0	37	108	67	592	4	9.77	3.53	6.62	208	46.9
157.5	13-Oct-1998	286	1.30	14.3	I	79.4	8	21	49	203	72	5.14	4.22	6.51	59	43.7
162.5	13-Oct-1998	286	1.07	25.7	I	6.7	27	60	96	471	175	6.38	1.70	7.01	350	156.5
163	13-Oct-1998	286	.	3.6	S	5.6	13	27	67	399	429	3.50	3.44	6.58	95	88.9
167	13-Oct-1998	286	.	12.0	S	5.5	64	70	58	254	279	5.86	5.55	7.03	317	101.1
140.5	19-Oct-1998	292	0.10	3.3	I	22.2	45	55	80	549	11	5.97	2.34	6.92	273	117.3
147	19-Oct-1998	292	.	7.4	S	0.9	45	46	19	160	372	1.23	6.30	6.96	243	98.6
153	19-Oct-1998	292	0.07	1.8	S	1.7	6	17	28	112	0	2.57	2.69	7.58	494	129.3
154	19-Oct-1998	292	.	10.3	S	3.3	36	48	27	258	201	2.37	4.99	7.49	622	147.4
155	19-Oct-1998	292	.	17.6	I	2.8	16	25	22	77	5	1.75	4.50	6.75	165	78.9
156	19-Oct-1998	292	0.08	5.0	I	60.0	32	66	43	322	0	4.53	3.96	6.76	223	49.5
157.5	19-Oct-1998	292	0.04	9.4	I	6.6	9	19	52	143	63	2.67	4.59	6.75	77	44.6
162.5	19-Oct-1998	292	0.00	13.5	I	2.9	19	44	72	376	277	2.88	1.99	7.15	348	168.1
163	19-Oct-1998	292	.	2.5	S	2.2	11	25	37	177	392	1.85	3.70	6.63	104	89.8
167	19-Oct-1998	292	.	8.8	I	1.8	55	66	44	161	232	3.09	6.11	7.01	338	101.9

SERC Charles County Watershed Study
Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	26-Oct-1998	299	0.00	3.2	.	.	.	.	.	.	.	.	.	.	.	.
147	26-Oct-1998	299	.	7.3	S	.	50	66	39	237	95	1.85	.	7.14	296	102.7
153	26-Oct-1998	299	0.00	0.1	.	.	.	.	.	.	.	.	.	.	.	.
154	26-Oct-1998	299	.	10.3	S	3.6	32	26	32	193	123	2.26	5.15	7.65	664	151.2
155	26-Oct-1998	299	.	24.9	I	2.7	16	20	27	254	0	2.67	4.64	6.63	175	80.8
156	26-Oct-1998	299	0.00	6.0	I	128.6	48	170	24	718	0	5.35	4.01	6.55	217	49.1
157.5	26-Oct-1998	299	0.05	17.8	I	4.8	6	17	32	149	14	3.29	4.60	6.50	73	44.2
162.5	26-Oct-1998	299	0.06	20.1	I	3.5	15	37	64	433	228	3.60	1.50	6.97	355	168.8
163	26-Oct-1998	299	.	3.0	S	1.5	10	20	37	304	331	2.47	3.74	6.52	105	89.8
167	26-Oct-1998	299	.	10.6	I	1.4	50	61	55	218	85	4.22	5.97	7.05	331	97.1
140.5	2-Nov-1998	306	0.00	2.5	.	.	.	.	.	.	.	.	.	.	.	.
147	2-Nov-1998	306	.	8.5	S	1.0	73	85	15	130	2	3.50	6.81	6.53	385	105.5
153	2-Nov-1998	306	0.00	0.5	S	2.4	27	59	20	368	2	5.35	3.56	7.52	546	146.5
154	2-Nov-1998	306	.	12.8	S	5.2	35	55	15	227	1	4.94	5.36	7.41	744	157.4
155	2-Nov-1998	306	.	31.9	I	3.0	14	37	8	140	1	3.29	4.60	6.59	195	79.7
156	2-Nov-1998	306	0.00	7.3	I	51.6	31	113	27	394	1	7.00	4.17	6.50	208	49.8
157.5	2-Nov-1998	306	0.00	21.5	I	5.8	7	26	8	158	1	5.76	4.75	6.44	80	45.8
162.5	2-Nov-1998	306	0.00	24.7	I	2.2	14	47	69	368	199	5.04	1.68	6.97	347	191.6
163	2-Nov-1998	306	.	3.4	S	3.0	9	36	23	193	54	3.91	4.06	6.59	145	93.7
167	2-Nov-1998	306	.	15.3	I	1.1	48	73	23	177	36	4.01	5.83	7.00	342	100.2
140.5	9-Nov-1998	313	0.76	4.1	I	11.0	34	79	54	589	9	7.61	2.00	7.25	224	122.1
147	9-Nov-1998	313	.	20.7	I	1.6	89	124	27	237	5	9.16	5.97	6.63	448	120.4
153	9-Nov-1998	313	0.69	7.5	S	1.0	15	36	30	239	1	6.89	4.03	7.44	606	158.3
154	9-Nov-1998	313	.	17.2	I	0.8	55	68	39	248	4	7.41	5.33	7.38	705	153.3
155	9-Nov-1998	313	.	34.5	I	1.8	16	32	19	175	8	6.89	4.65	6.74	180	83.7
156	9-Nov-1998	313	0.87	10.7	I	9.5	22	56	31	355	3	7.00	4.04	6.55	152	42.9
157.5	9-Nov-1998	313	1.08	30.5	I	2.8	1	22	31	159	4	8.95	4.80	6.50	73	45.4
162.5	9-Nov-1998	313	0.82	20.9	I	3.6	5	40	48	364	213	5.56	1.48	7.06	625	189.2
163	9-Nov-1998	313	.	4.7	S	1.0	8	24	33	210	8	6.28	4.64	6.57	147	100.2
167	9-Nov-1998	313	.	18.4	I	0.6	48	68	40	174	46	4.94	5.79	7.20	356	104.1
140.5	17-Nov-1998	321	0.73	9.6	I	8.2	33	68	45	504	1	6.48	1.54	7.03	233	121.5
147	17-Nov-1998	321	.	19.9	I	3.6	91	121	21	255	22	6.89	5.71	6.73	521	125.1
153	17-Nov-1998	321	0.68	17.4	I	4.5	33	46	28	269	5	6.58	4.42	7.38	713	165.8
154	17-Nov-1998	321	.	24.1	I	3.6	57	94	28	251	7	7.20	5.20	7.24	739	156.5
155	17-Nov-1998	321	.	34.5	I	3.5	20	32	17	140	6	5.45	4.80	6.69	178	83.5
156	17-Nov-1998	321	0.76	11.9	I	28.9	27	66	21	307	2	6.17	4.12	6.50	150	43.4
157.5	17-Nov-1998	321	0.62	42.2	I	4.8	6	11	14	195	5	5.14	4.71	6.45	66	46.2
162.5	17-Nov-1998	321	1.18	30.7	I	5.2	17	69	43	465	254	4.42	2.06	7.05	423	182.4
163	17-Nov-1998	321	.	7.2	S	4.2	14	32	35	237	4	4.73	4.66	6.50	130	105.0
167	17-Nov-1998	321	.	21.1	I	1.3	44	61	21	188	48	3.91	5.81	7.21	397	107.5
140.5	23-Nov-1998	327	0.30	10.0	I	9.3	41	60	52	544	4	5.86	1.35	6.47	215	118.0
147	23-Nov-1998	327	.	1.5	I	2.9	106	136	39	364	4	9.36	5.72	6.75	576	133.8
153	23-Nov-1998	327	0.37	9.5	S	1.6	30	43	33	346	0	5.66	4.60	7.30	690	166.0
154	23-Nov-1998	327	.	15.8	I	2.0	67	77	42	295	6	8.54	5.83	7.40	956	178.5
155	23-Nov-1998	327	.	24.7	I	5.8	24	38	36	172	4	4.94	5.03	6.65	171	82.5
156	23-Nov-1998	327	0.35	9.3	I	74.2	37	91	36	596	0	6.38	4.13	6.51	139	42.0
157.5	23-Nov-1998	327	0.33	37.1	I	6.0	6	14	22	228	0	4.42	4.72	6.41	67	46.6
162.5	23-Nov-1998	327	0.33	20.7	I	3.5	15	38	42	440	93	5.14	2.24	6.72	307	175.1
163	23-Nov-1998	327	.	5.7	I	23.9	21	34	47	255	4	5.45	4.73	6.54	119	105.5
167	23-Nov-1998	327	.	19.8	I	1.3	40	53	37	209	26	3.91	5.57	7.10	388	110.8
140.5	30-Nov-1998	334	1.33	14.2	I	5.1	32	74	48	556	3	6.89	1.41	6.50	209	116.5
147	30-Nov-1998	334	.	8.2	I	6.7	144	216	25	451	0	12.65	5.38	6.85	576	134.0
153	30-Nov-1998	334	0.98	15.8	I	4.4	33	52	38	276	9	8.64	4.67	7.46	710	166.0
154	30-Nov-1998	334	.	29.4	I	1.6	68	117	20	324	38	11.83	4.81	7.61	626	146.2
155	30-Nov-1998	334	.	30.9	I	2.2	19	33	18	154	11	6.48	4.73	6.80	147	81.7
156	30-Nov-1998	334	1.33	10.0	I	46.3	22	79	32	404	2	8.02	3.97	6.61	120	41.4
157.5	30-Nov-1998	334	1.13	48.9	I	3.6	2	13	48	237	12	5.97	4.67	6.49	62	45.3
162.5	30-Nov-1998	334	1.08	27.0	I	3.0	9	54	67	472	145	6.38	1.52	6.94	335	172.8
163	30-Nov-1998	334	.	7.7	I	3.8	12	31	57	251	35	6.07	4.65	6.54	193	148.4
167	30-Nov-1998	334	.	21.5	I	0.4	33	48	37	238	174	4.32	4.96	7.22	360	109.2
140.5	8-Dec-1998	342	1.60	19.8	I	7.4	35	64	24	515	3	6.48	1.25	6.68	242	107.6
147	8-Dec-1998	342	.	14.7	I	9.4	262	316	34	512	4	10.49	5.45	6.82	635	139.8
153	8-Dec-1998	342	1.52	10.0	S	9.5	48	106	164	680	361	9.26	3.80	7.35	880	225.0
154	8-Dec-1998	342	.	33.7	I	12.4	59	85	16	317	16	6.38	5.02	7.22	859	161.4
155	8-Dec-1998	342	.	29.5	I	2.7	18	24	11	121	3	3.91	4.83	6.71	154	78.7
156	8-Dec-1998	342	1.61	11.6	I	30.3	31	75	44	429	0	5.56	3.82	6.53	145	43.8
157.5	8-Dec-1998	342	1.44	43.1	I	6.0	6	20	15	184	18	4.42	4.61	6.51	76	46.3
162.5	8-Dec-1998	342	1.36	21.3	I	8.6	19	58	43	458	136	5.45	1.93	6.81	337	152.2
163	8-Dec-1998	342	.	9.2	S	1.4	18	37	39	381	108	6.07	5.19	6.54	134	129.9
167	8-Dec-1998	342	.	20.9	I	0.7	32	47	18	243	108	4.01	3.90	7.13	404	106.4
140.5	14-Dec-1998	348	3.88	26.1	I	6.4	18	75	77	471	2	8.64	2.20	6.49	98	141.1
147	14-Dec-1998	348	.	66.7	I	40.8	94	235	105	838	333	11.42	1.98	6.68	230	158.8
153	14-Dec-1998	348	3.92	67.2	I	19.8	28	89	48	345	93	7.61	3.16	7.27	368	141.3
154	14-Dec-1998	348	.	69.5	I	15.6	51	114	57	434	173	7.41	2.98	7.07	312	134.7
155	14-Dec-1998	348	.	36.0	I	4.8	9	30	37	247	9	4.63	4.21	6.81	123	82.4
156	14-Dec-1998	348	4.10	21.9	I	18.3	10	60	53	354	28	5.45	4.00	6.44	72	73.9
157.5	14-Dec-1998	348	4.00	45.3	I	6.5	0	24	61	275	15	8.74	4.35	5.97	26	54.4
162.5	14-Dec-1998	348	3.96	124.1	I	31.3	34	143	133	1039	225	11.21	1.54	6.82	264	131.5
163	14-Dec-1998	348	.	22.8	I	5.4	6	41	49	304	220	7.61	5.53	6.03	33	135.8
167	14-Dec-1998	348	.	25.6	I	1.9	28	55	44	231	154	5.76	4.75	7.10	262	124.8
140.5	21-Dec-1998	355	0.04	28.4	I	3.3	17	37	57	281	42	19.65	3.23	6.58	74	143.5
147	21-Dec-1998	355	.	9.5	S	2.9	60	81	66	251	402	10.08	5.33	6.80	281	146.8
153	21-Dec-1998	355	0.03	15.8	I	8.5	11	33	8	172	65	12.14	3.79	7.48	509	178.9
154	21-Dec-1998	355	.	18.7	I	5.0	29	46	29	196	204	10.60	3.97	7.33	451	148.2
155	21-Dec-1998	355	.	23.8	I	3.3	8	26	16	143	6	9.67	4.36	6.78	125	84.4
156	21-Dec-1998	355	0.08	13.0	I	60.3	34	131	67	602	19	15.23	4.25	6.59	90	67.0
157.5	21-Dec-1998	355	0.08	24.1	I	4.0	2	16	19	157	70	12.96	4.37	6.29	33	46.5
162.5	21-Dec-1998	355	0.10	25.7	I	14.0	7	60	125	400	321	15.43	2.23	6.92	293	136.5
163	21-Dec-1998	355	.	9.7	S	2.1	3	24	38	175	286	10.29	5.56	6.69	59	128.2
167	21-Dec-1998	355	.	17.6	I	1.1	20	39	33	189	511	9.88	4.97	7.37	293	111.8

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	28-Dec-1998	362	1.10	33.3	S	17.2	25	99	50	399	9	3.60	3.67	6.04	49	182.4
147	28-Dec-1998	362	.	9.2	S	3.3	36	47	2454	3722	462	1.95	4.90	6.57	278	125.7
153	28-Dec-1998	362	0.84	15.5	S	0.9	5	18	51	166	99	1.54	3.98	7.15	422	672.0
154	28-Dec-1998	362	.	20.1	S	2.2	18	33	3167	7747	153	1.65	4.77	7.12	600	843.0
155	28-Dec-1998	362	.	22.4	S	5.5	4	14	33	99	51	1.95	4.65	6.58	107	120.3
156	28-Dec-1998	362	1.28	12.8	S	3.6	5	17	50	148	1	2.16	4.55	6.37	83	67.2
157.5	28-Dec-1998	362	0.82	23.0	S	2.5	5	14	38	101	134	2.26	4.50	6.35	42	42.7
162.5	28-Dec-1998	362	0.87	23.5	S	5.1	12	37	172	329	333	3.40	2.41	6.71	263	227.0
163	28-Dec-1998	362	.	8.1	S	9.3	9	23	60	229	295	2.78	5.45	6.21	53	118.0
167	28-Dec-1998	362	.	17.1	S	1.6	18	32	40	166	964	2.37	5.31	7.05	235	109.0
140.5	4-Jan-1999	4	4.06	51.5	S	13.3	30	85	23	480	466	7.00	3.03	6.75	59	253.0
147	4-Jan-1999	4	.	104.8	I	138.5	177	396	403	1476	490	13.68	1.38	6.50	114	357.0
153	4-Jan-1999	4	3.71	66.6	I	235.0	119	414	552	2252	353	13.07	2.16	7.09	272	377.0
154	4-Jan-1999	4	.	87.1	I	325.1	184	604	1075	3412	426	19.24	2.07	6.88	244	667.0
155	4-Jan-1999	4	.	42.4	I	30.4	14	23	0	179	128	3.60	3.73	6.55	61	250.0
156	4-Jan-1999	4	3.71	35.9	I	149.2	38	122	45	711	94	6.69	2.79	6.22	50	111.9
157.5	4-Jan-1999	4	3.98	45.8	S	1.0	60	135	19	321	81	8.74	3.40	5.85	17	61.9
162.5	4-Jan-1999	4	3.76	156.3	I	54.9	7	18	136	881	407	8.13	1.33	6.57	176	370.0
163	4-Jan-1999	4	.	47.7	I	12.7	30	83	63	558	643	7.61	3.38	5.75	21	141.3
167	4-Jan-1999	4	.	26.9	I	21.5	45	73	43	416	930	4.32	4.04	6.82	161	138.5
140.5	11-Jan-1999	11	0.96	38.2	S	1.7	3	19	16	168	219	3.81	3.60	6.38	72	311.0
147	11-Jan-1999	11	.	18.4	S	4.0	20	40	254	477	530	3.60	4.59	6.61	230	660.0
153	11-Jan-1999	11	0.92	38.0	S	1.0	3	12	4295	14188	466	3.29	4.08	7.30	385	1447.0
154	11-Jan-1999	11	.	25.7	S	1.8	7	22	5965	14994	580	3.81	3.87	7.13	414	1436.0
155	11-Jan-1999	11	.	28.7	S	0.2	0	5	17	299	144	2.06	4.90	6.67	73	152.3
156	11-Jan-1999	11	0.92	15.8	S	1.0	0	10	20	153	143	2.06	4.77	6.65	68	76.6
157.5	11-Jan-1999	11	0.66	28.3	S	2.5	2	4	25	186	182	4.94	4.44	6.49	39	53.9
162.5	11-Jan-1999	11	0.80	36.4	S	5.7	6	27	118	458	443	4.42	2.52	6.76	199	509.0
163	11-Jan-1999	11	.	40.2	S	1.3	4	15	49	299	605	4.01	5.87	6.24	48	129.4
167	11-Jan-1999	11	.	21.1	S	0.2	11	17	28	200	1224	2.88	6.82	6.94	209	127.3
140.5	19-Jan-1999	19	.	68.6	S	19.3	9	57	34	299	241	4.32	3.19	6.42	72	296.0
147	19-Jan-1999	19	.	137.4	S	22.6	15	65	79	352	371	6.69	3.02	6.65	195	289.0
153	19-Jan-1999	19	3.34	53.4	S	13.3	8	52	328	645	451	4.84	3.89	7.13	264	317.0
154	19-Jan-1999	19	.	62.3	S	13.9	15	62	458	801	589	5.04	3.71	7.12	268	380.0
155	19-Jan-1999	19	.	49.2	S	8.8	0	23	57	195	211	4.32	4.37	6.42	68	201.0
156	19-Jan-1999	19	3.34	39.8	S	6.8	1	25	56	238	369	4.53	4.27	6.41	60	121.9
157.5	19-Jan-1999	19	3.52	51.1	S	6.0	0	25	72	295	56	7.82	3.34	6.00	29	72.7
162.5	19-Jan-1999	19	3.72	148.6	S	24.7	23	88	193	729	458	6.79	2.00	6.69	232	379.0
163	19-Jan-1999	19	.	81.0	S	18.3	19	97	157	723	3263	6.48	4.84	6.04	43	151.6
167	19-Jan-1999	19	.	30.0	S	3.7	13	35	35	246	746	4.63	6.29	6.93	165	133.8
140.5	25-Jan-1999	25	.	155.0	I	68.3	26	134	29	595	408	9.26	3.46	5.90	29	138.8
147	25-Jan-1999	25	.	522.2	I	280.5	105	386	50	1639	368	22.63	1.98	6.49	139	205.0
153	25-Jan-1999	25	5.96	198.2	I	383.0	91	390	127	1633	510	16.56	2.60	6.88	536	190.5
154	25-Jan-1999	25	.	272.7	I	310.4	135	462	199	1726	497	19.34	2.19	6.76	207	175.1
155	25-Jan-1999	25	.	172.4	I	166.5	43	197	25	1029	232	13.79	3.61	6.35	57	101.6
156	25-Jan-1999	25	5.27	150.8	I	671.9	153	721	63	2206	281	33.74	3.72	6.12	34	76.2
157.5	25-Jan-1999	25	5.32	127.3	I	41.8	8	88	43	613	71	13.17	2.85	5.51	13	66.9
162.5	25-Jan-1999	25	6.05	365.4	I	37.5	40	139	188	920	567	9.36	1.73	6.69	223	233.0
163	25-Jan-1999	25	.	136.4	I	126.6	69	276	122	1401	1563	16.67	3.90	6.25	45	116.9
167	25-Jan-1999	25	.	47.9	I	434.9	254	703	91	1966	615	25.62	4.94	6.74	145	134.7
140.5	1-Feb-1999	32	.	150.1	S	1.3	7	11	5	151	166	2.88	6.37	6.67	99	106.1
147	1-Feb-1999	32	.	37.0	S	5.8	22	33	33	239	451	4.32	4.36	6.53	146	219.0
153	1-Feb-1999	32	0.00	57.8	S	4.6	4	15	88	295	417	2.98	4.40	7.37	325	236.0
154	1-Feb-1999	32	.	63.1	S	3.4	11	22	155	411	647	2.88	4.20	7.04	250	232.0
155	1-Feb-1999	32	.	51.2	S	1.8	5	8	8	140	177	2.57	5.04	6.69	85	104.6
156	1-Feb-1999	32	0.00	41.7	S	2.9	4	13	28	143	229	2.78	4.52	6.63	59	76.3
157.5	1-Feb-1999	32	0.02	41.0	S	4.2	5	16	14	227	143	4.53	3.91	6.33	37	63.3
162.5	1-Feb-1999	32	0.02	64.2	S	6.5	17	45	159	537	564	4.94	2.82	6.93	255	245.0
163	1-Feb-1999	32	.	43.6	S	3.6	9	18	47	268	454	3.81	5.17	6.41	60	120.8
167	1-Feb-1999	32	.	25.4	S	2.4	9	25	23	172	1089	2.57	6.47	7.09	205	132.3
140.5	8-Feb-1999	39	1.42	44.0	S	2.5	9	20	22	189	131	2.78	3.97	6.58	3	169.8
147	8-Feb-1999	39	.	25.8	S	6.9	21	45	75	436	606	4.12	3.52	6.73	233	249.0
153	8-Feb-1999	39	1.59	51.9	S	0.1	8	14	35	196	400	2.26	4.62	7.17	313	221.0
154	8-Feb-1999	39	.	36.8	S	4.1	18	27	142	384	601	3.19	3.93	7.37	332	253.0
155	8-Feb-1999	39	.	39.4	S	1.6	7	12	14	151	199	1.95	5.06	6.98	92	102.6
156	8-Feb-1999	39	1.49	22.6	S	2.1	2	11	24	131	196	2.37	4.90	6.50	61	75.5
157.5	8-Feb-1999	39	1.42	29.9	S	4.0	0	16	24	149	135	4.42	3.58	6.35	38	60.9
162.5	8-Feb-1999	39	1.56	62.1	S	6.4	10	40	161	494	607	4.73	2.70	6.89	243	226.0
163	8-Feb-1999	39	.	34.9	S	3.6	7	24	43	246	435	3.09	5.61	6.33	59	117.5
167	8-Feb-1999	39	.	21.5	S	1.6	20	36	37	220	965	1.95	6.33	7.05	200	135.5
140.5	16-Feb-1999	47	1.57	45.6	I	18.4	6	18	25	246	78	2.37	4.09	6.49	120	165.8
147	16-Feb-1999	47	.	33.1	I	47.5	30	81	79	382	357	1.03	3.44	6.72	153	203.0
153	16-Feb-1999	47	1.38	51.9	I	62.5	29	87	63	415	353	0.82	3.51	7.22	335	210.0
154	16-Feb-1999	47	.	38.4	I	55.1	39	90	124	524	487	1.75	3.28	7.39	253	188.4
155	16-Feb-1999	47	.	42.5	I	6.6	5	14	14	167	154	3.09	5.05	6.75	97	102.6
156	16-Feb-1999	47	1.45	26.8	I	210.5	37	154	24	632	101	3.60	4.58	6.46	74	80.4
157.5	16-Feb-1999	47	1.56	37.4	I	.	3	11	33	225	110	1.65	4.04	6.21	42	68.7
162.5	16-Feb-1999	47	1.38	81.9	I	16.6	11	52	53	491	545	2.67	2.54	7.14	222	232.0
163	16-Feb-1999	47	.	40.6	I	19.1	23	36	38	381	731	2.16	5.08	6.26	60	111.7
167	16-Feb-1999	47	.	29.1	I	13.1	15	45	57	250	424	2.78	6.10	7.08	200	133.8
140.5	22-Feb-1999	53	2.38	82.8	I	15.9	16	40	24	316	293	4.01	4.15	6.35	69	147.3
147	22-Feb-1999	53	.	124.0	I	30.5	46	98	118	651	411	7.41	2.37	6.31	130	190.9
153	22-Feb-1999	53	2.19	87.5	I	29.8	22	61	66	425	375	5.66	3.48	7.07	295	188.9
154	22-Feb-1999	53	.	70.2	I	26.3	30	67	89	494	493	5.86	2.91	6.84	232	177.6
155	22-Feb-1999	53	.	62.6	I	7.8	0	25	26	186	205	3.29	5.01	6.53	91	97.0
156	22-Feb-1999	53	2.49	81.0	I	63.4	12	61	3	364	252	4.63	4.27	6.45	59	71.2
157.5	22-Feb-1999	53	2.52	64.5	I	5.6	0	27	42	248	91	4.63	3.79	6.07	35	69.2
162.5	22-Feb-1999	53	2.51	152.1	I	14.1	10	54	44	538	526	4.42	2.12	6.67	217	191.9
163	22-Feb-1999	53	.	69.9	I	12.1	16	32	52	479	587	4.22	5.27	6.13	54	114.1
167	22-Feb-1999	53	.	39.1	I	8.3	27	39	47	307	707	2.98	5.81	6.84	182	135.0

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	1-Mar-1999	60	2.12	45.1	I	26.6	11	94	25	279	124	4.22	3.66	6.44	92	125.9
147	1-Mar-1999	60	.	49.3	I	37.3	38	103	96	469	379	5.97	2.38	6.50	163	168.5
153	1-Mar-1999	60	1.97	59.3	I	43.5	11	80	68	309	400	3.70	3.30	6.99	259	158.7
154	1-Mar-1999	60	.	47.6	I	48.3	25	93	99	492	539	4.12	2.69	6.88	237	157.2
155	1-Mar-1999	60	.	48.5	I	2.4	0	14	13	110	225	2.26	4.69	6.56	91	99.5
156	1-Mar-1999	60	2.07	38.6	I	264.1	38	202	30	958	212	7.30	4.26	6.37	68	78.3
157.5	1-Mar-1999	60	2.02	41.8	S	4.6	0	33	40	285	61	5.35	3.66	5.77	20	68.6
162.5	1-Mar-1999	60	1.92	86.8	I	5.7	6	66	51	468	596	3.91	2.31	6.76	215	176.6
163	1-Mar-1999	60	.	49.8	S	3.0	3	38	49	319	510	3.91	4.80	6.04	44	103.5
167	1-Mar-1999	60	.	30.8	I	8.0	18	37	25	233	951	1.95	5.61	6.70	129	112.3
140.5	8-Mar-1999	67	3.17	104.4	I	13.8	19	45	7	331	187	4.63	4.11	6.40	75	130.1
147	8-Mar-1999	67	.	159.1	I	2.8	46	117	106	588	432	7.30	2.58	6.42	153	155.7
153	8-Mar-1999	67	2.23	106.7	I	12.1	20	43	22	325	336	4.32	3.37	7.07	273	164.2
154	8-Mar-1999	67	.	86.5	I	13.8	18	53	29	416	451	6.28	2.94	6.88	230	154.3
155	8-Mar-1999	67	.	90.6	I	5.4	11	23	13	219	188	3.19	4.30	6.68	80	90.9
156	8-Mar-1999	67	3.27	159.3	I	67.7	22	75	0	452	220	4.94	4.00	6.33	50	65.1
157.5	8-Mar-1999	67	2.72	80.8	I	4.7	10	15	0	245	73	3.91	3.78	5.97	29	68.4
162.5	8-Mar-1999	67	2.15	159.7	I	10.8	20	47	34	557	588	4.42	1.90	6.77	228	176.4
163	8-Mar-1999	67	.	66.7	I	7.6	9	36	34	388	469	4.01	4.78	6.18	53	107.4
167	8-Mar-1999	67	.	42.5	I	5.5	29	41	24	262	652	3.81	5.49	6.94	178	132.1
140.5	15-Mar-1999	74	6.00	127.7	I	140.7	36	136	41	625	216	8.23	3.28	5.90	36	119.3
147	15-Mar-1999	74	.	342.7	I	190.5	105	303	120	1170	332	15.02	1.53	6.54	170	174.9
153	15-Mar-1999	74	5.70	208.1	I	142.5	3	35	444	1227	344	3.40	2.90	6.56	105	311.0
154	15-Mar-1999	74	.	250.7	I	134.9	64	260	369	1749	469	11.63	2.08	6.55	144	525.0
155	15-Mar-1999	74	.	229.3	I	137.6	24	135	39	587	224	8.13	3.83	5.85	32	85.7
156	15-Mar-1999	74	6.20	178.4	I	259.6	34	197	39	1013	259	11.83	3.58	5.58	21	59.2
157.5	16-Mar-1999	75	6.20	307.3	I	52.9	3	43	50	364	85	8.54	3.35	5.10	4	74.8
162.5	16-Mar-1999	75	5.67	425.4	I	33.2	25	99	87	670	582	6.79	1.89	6.44	176	401.0
163	16-Mar-1999	75	.	194.8	I	171.0	61	272	78	1035	563	14.20	3.71	5.93	48	103.7
167	16-Mar-1999	75	.	101.2	I	166.9	142	313	47	729	686	9.77	5.08	6.46	106	125.7
140.5	22-Mar-1999	81	4.60	444.5	I	41.1	28	68	25	413	258	7.82	3.35	5.55	20	82.6
147	22-Mar-1999	81	.	339.6	I	42.7	53	123	118	658	383	9.16	2.21	6.41	145	179.6
153	22-Mar-1999	81	4.96	350.5	I	282.3	93	260	50	1147	345	13.99	2.71	6.44	104	109.2
154	22-Mar-1999	81	.	548.1	I	278.0	127	324	100	1328	352	14.30	2.17	6.35	105	100.6
155	22-Mar-1999	81	.	518.0	I	169.9	64	162	30	782	208	9.67	3.59	5.78	24	63.0
156	22-Mar-1999	81	4.53	444.8	I	179.1	52	128	35	823	211	10.91	3.33	5.51	16	51.0
157.5	22-Mar-1999	81	3.90	267.6	I	95.7	25	66	19	489	66	9.67	3.20	4.99	0	56.7
162.5	22-Mar-1999	81	3.06	190.5	I	23.2	36	71	53	688	616	6.89	2.11	6.67	200	280.0
163	22-Mar-1999	81	.	144.2	I	104.2	65	163	70	785	479	11.52	4.06	5.85	41	83.5
167	22-Mar-1999	81	.	88.7	I	134.0	320	442	50	900	730	7.61	6.43	6.36	89	101.2
140.5	29-Mar-1999	88	0.26	206.1	I	12.7	11	43	81	293	236	9.05	3.96	6.47	86	85.2
147	29-Mar-1999	88	.	63.9	I	13.0	16	37	70	333	320	5.66	3.38	6.34	127	228.0
153	29-Mar-1999	88	0.16	133.2	I	19.5	12	40	59	282	307	5.45	2.88	6.98	213	156.1
154	29-Mar-1999	88	.	109.1	I	11.6	30	68	62	388	297	6.48	2.50	6.70	184	150.2
155	29-Mar-1999	88	.	148.1	I	5.9	8	29	30	166	174	3.29	4.65	6.41	62	84.2
156	29-Mar-1999	88	0.00	110.2	I	14.9	6	22	24	203	205	3.60	4.17	6.32	53	62.0
157.5	29-Mar-1999	88	0.29	84.2	I	3.3	7	18	34	193	52	5.56	3.51	6.04	36	68.9
162.5	29-Mar-1999	88	0.29	116.8	I	5.0	16	66	59	485	646	4.84	1.95	6.93	206	247.0
163	29-Mar-1999	88	.	108.4	I	10.4	16	46	71	482	476	4.63	4.37	6.20	60	97.2
167	29-Mar-1999	88	.	60.8	I	7.2	32	50	46	582	924	3.29	6.28	6.77	153	119.4
140.5	5-Apr-1999	95	3.62	61.5	I	204.0	84	302	33	1156	109	14.71	3.78	6.32	89	102.1
147	5-Apr-1999	95	.	99.1	I	14.5	27	80	102	468	323	5.97	3.21	6.39	179	184.7
153	5-Apr-1999	95	4.64	139.2	I	370.2	120	562	138	1293	314	19.14	2.70	6.46	147	117.0
154	5-Apr-1999	95	.	143.0	I	282.8	138	565	200	1709	394	19.34	2.38	6.59	198	119.9
155	5-Apr-1999	95	.	144.1	I	21.8	12	89	38	344	158	6.38	4.46	6.11	56	72.9
156	5-Apr-1999	95	2.89	44.5	I	46.1	10	83	26	325	221	6.38	4.05	6.22	53	60.2
157.5	5-Apr-1999	95	3.95	103.4	I	23.0	8	74	43	393	70	8.13	3.38	5.40	14	55.1
162.5	5-Apr-1999	95	2.66	134.4	I	41.1	33	152	67	979	601	9.47	1.78	6.62	220	201.0
163	5-Apr-1999	95	.	65.8	I	10.7	12	55	69	343	408	4.84	4.29	6.16	66	91.9
167	5-Apr-1999	95	.	72.2	I	64.3	130	274	81	797	680	9.88	5.32	6.54	126	102.7
96	12-Apr-1999	102	.	163.7	.	.	.	.	.	.	.	.	.	.	.	.
140.5	12-Apr-1999	102	1.88	73.6	I	143.0	69	187	38	860	49	15.64	4.10	6.87	109	107.8
147	12-Apr-1999	102	.	52.5	I	6.8	25	41	37	368	241	9.57	3.09	6.43	169	204.0
153	12-Apr-1999	102	1.26	106.6	I	25.2	28	44	45	654	214	6.69	3.80	6.96	254	150.9
154	12-Apr-1999	102	.	75.4	I	15.3	29	51	63	337	296	8.64	3.65	6.71	250	138.3
155	12-Apr-1999	102	.	111.3	I	2.7	11	18	25	375	119	4.22	5.10	6.51	81	80.5
156	12-Apr-1999	102	2.18	56.1	I	41.9	14	52	26	779	137	5.97	4.33	6.52	66	61.9
157.5	12-Apr-1999	102	1.63	83.5	I	5.1	5	21	22	154	43	8.44	3.77	6.29	43	66.6
162.5	12-Apr-1999	102	1.18	100.5	I	21.0	26	94	44	650	466	9.67	1.36	6.92	264	200.0
163	12-Apr-1999	102	.	48.5	I	9.6	18	31	47	418	367	6.58	4.25	6.41	82	95.5
167	12-Apr-1999	102	.	52.6	I	8.2	57	62	38	234	766	4.22	6.33	6.93	171	114.6
96	19-Apr-1999	109	.	159.0	.	.	.	.	.	.	.	.	.	.	.	.
140.5	19-Apr-1999	109	0.27	36.8	I	135.3	66	183	48	905	29	14.71	3.54	6.79	120	119.5
147	19-Apr-1999	109	.	15.0	I	4.1	34	51	30	290	233	5.86	3.64	6.66	170	190.6
153	19-Apr-1999	109	0.26	51.8	I	18.1	13	37	28	240	138	4.32	3.41	7.27	304	158.4
154	19-Apr-1999	109	.	37.7	I	7.2	24	42	28	264	233	5.25	3.55	6.97	275	141.9
155	19-Apr-1999	109	.	66.0	I	3.5	7	15	21	173	91	2.47	5.22	6.75	101	80.6
156	19-Apr-1999	109	0.28	20.9	I	108.2	28	94	25	591	104	6.07	4.29	6.57	76	59.7
157.5	19-Apr-1999	109	0.12	34.6	I	3.9	8	19	21	185	59	1.95	3.53	6.42	68	66.6
162.5	19-Apr-1999	109	0.18	54.1	I	18.1	29	93	38	721	487	7.82	1.54	7.19	273	202.0
163	19-Apr-1999	109	.	27.3	I	6.3	14	36	42	307	394	5.14	4.27	6.57	85	90.3
167	19-Apr-1999	109	.	32.5	I	2.3	30	40	22	181	721	2.67	5.81	7.17	201	112.8
96	26-Apr-1999	116	.	225.3	.	.	.	.	.	.	.	.	.	.	.	.
140.5	26-Apr-1999	116	1.36	43.8	I	143.9	59	181	30	931	22	8.33	3.70	6.65	116	116.7
147	26-Apr-1999	116	.	48.6	I	17.7	35	94	64	547	231	6.07	3.19	6.78	178	183.5
153	26-Apr-1999	116	1.24	73.3	I	76.6	72	146	39	629	91	5.25	3.23	7.17	293	144.6
154	26-Apr-1999	116	.	92.2	I	178.2	102	308	110	1303	171	14.09	2.55	6.95	250	115.0
155	26-Apr-1999	116	.	60.3	I	4.1	5	13	14	177	65	2.16	5.11	7.14	110	83.9
156	26-Apr-1999	116	1.06	36.7	I	109.5	28	95	21	487	91	5.04	4.35	6.88	89	60.0
157.5	26-Apr-1999	116	1.43	26.7	I	5.3	6	21	19	257	51	3.40	3.78	6.46	64	63.5

SERC Charles County Watershed Study
Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
162.5	26-Apr-1999	116	2.23	116.3	I	60.0	42	194	58	1090	459	8.02	1.45	6.90	286	175.1
163	26-Apr-1999	116	.	57.6	I	49.6	49	141	55	740	324	8.13	3.91	6.47	93	92.0
167	26-Apr-1999	116	.	33.7	I	3.2	26	44	29	237	579	2.06	5.33	7.14	230	111.9
96	3-May-1999	123	.	155.3	.	.	.	.	.	.	.	.	.	.	.	.
140.5	3-May-1999	123	0.00	22.5	I	227.6	90	278	64	1217	6	13.58	3.26	6.79	161	118.1
147	3-May-1999	123	.	8.6	I	10.9	31	61	60	351	257	5.97	3.62	6.51	212	162.4
153	3-May-1999	123	0.00	30.0	I	28.7	65	108	81	624	38	8.13	3.41	7.30	350	159.4
154	3-May-1999	123	.	25.9	I	26.3	26	74	56	393	98	7.41	3.16	7.04	318	138.2
155	3-May-1999	123	.	44.7	I	2.3	0	18	40	129	74	2.98	5.24	6.93	122	81.7
156	3-May-1999	123	0.00	124.9	I	82.3	14	60	39	420	64	6.89	4.12	7.07	85	59.0
157.5	3-May-1999	123	0.00	14.5	I	4.0	0	18	44	179	52	4.22	3.46	6.56	68	57.1
162.5	3-May-1999	123	0.00	41.2	I	22.0	26	104	195	892	469	7.10	1.47	7.08	397	182.6
163	3-May-1999	123	.	22.8	I	10.5	14	47	61	417	326	6.17	3.91	6.62	104	90.5
167	3-May-1999	123	.	24.9	I	2.8	20	34	46	275	472	3.19	4.84	7.36	240	109.2
96	10-May-1999	130	.	169.5	.	.	.	.	.	.	.	.	.	.	.	.
140.5	10-May-1999	130	0.22	12.2	I	245.9	89	258	44	1180	30	12.45	3.36	6.88	205	118.5
147	10-May-1999	130	.	6.3	I	12.5	41	64	57	361	320	5.25	4.24	6.71	238	158.9
153	10-May-1999	130	0.08	19.2	I	16.8	54	107	78	419	29	5.04	3.28	7.28	364	163.9
154	10-May-1999	130	.	18.8	I	28.2	17	43	24	227	168	3.60	3.01	7.00	332	143.9
155	10-May-1999	130	.	36.8	I	3.0	6	16	14	105	74	2.57	4.95	6.89	147	80.8
156	10-May-1999	130	0.26	119.2	I	52.5	14	66	20	370	37	5.35	4.02	6.78	117	58.5
157.5	10-May-1999	130	0.52	10.9	I	7.9	6	21	16	196	58	4.22	3.51	6.57	71	53.8
162.5	10-May-1999	130	0.34	41.9	I	52.0	124	295	945	2062	190	13.58	2.12	6.88	564	240.0
163	10-May-1999	130	.	15.2	I	23.5	19	41	56	368	369	6.58	3.91	6.69	147	91.8
167	10-May-1999	130	.	25.6	I	3.4	25	44	34	216	455	4.22	4.49	7.41	302	109.2
96	17-May-1999	137	.	216.7	.	.	.	.	.	.	.	.	.	.	.	.
140.5	17-May-1999	137	0.00	10.9	I	179.6	78	237	63	1199	57	11.21	3.59	6.98	238	123.4
147	17-May-1999	137	.	32.6	I	18.1	52	84	105	446	451	3.91	4.87	6.61	258	151.2
153	17-May-1999	137	0.00	9.7	S	3.5	5	16	24	196	67	2.67	3.51	7.44	368	160.2
154	17-May-1999	137	.	13.0	I	20.9	14	31	30	269	231	3.29	3.25	7.19	326	147.9
155	17-May-1999	137	.	27.1	I	4.0	8	23	25	179	87	2.26	5.26	7.12	139	79.2
156	17-May-1999	137	0.00	104.9	I	67.9	17	61	39	525	8	6.48	4.06	6.94	129	54.3
157.5	17-May-1999	137	0.00	6.4	I	13.3	7	26	28	258	97	3.91	3.58	6.70	80	49.8
162.5	17-May-1999	137	0.00	31.0	I	54.5	737	825	1922	4513	73	10.91	2.94	7.02	918	251.0
163	17-May-1999	137	.	8.2	I	34.5	25	52	86	562	447	6.69	4.31	6.83	165	93.6
167	17-May-1999	137	.	15.7	I	3.0	38	61	75	322	519	3.70	5.43	7.33	294	105.8
96	24-May-1999	144	.	176.1	.	.	.	.	.	.	.	.	.	.	.	.
140.5	24-May-1999	144	2.14	8.1	I	113.4	78	331	103	1036	56	16.26	3.47	6.94	247	116.3
147	24-May-1999	144	.	59.4	I	29.9	83	118	122	531	479	8.85	4.91	6.77	390	167.1
153	24-May-1999	144	3.22	12.8	I	51.4	47	119	89	661	182	9.77	3.35	6.94	358	144.1
154	24-May-1999	144	.	27.3	I	94.4	72	204	131	1160	312	19.44	2.89	6.79	216	80.8
155	24-May-1999	144	.	25.6	I	5.3	13	24	44	240	89	5.56	5.04	6.85	159	77.0
156	24-May-1999	144	2.36	101.6	I	36.7	15	47	59	427	44	7.41	4.01	6.84	139	52.2
157.5	24-May-1999	144	1.65	5.6	I	18.6	5	24	54	283	91	6.79	3.57	6.54	71	46.9
162.5	24-May-1999	144	1.58	39.0	I	79.0	627	890	2233	4931	30	26.85	3.01	6.96	655	209.0
163	24-May-1999	144	.	8.7	I	12.6	29	61	134	590	421	13.37	4.35	6.56	156	88.1
167	24-May-1999	144	.	16.7	I	3.8	46	78	100	388	515	7.51	5.61	7.27	344	103.6
96	1-Jun-1999	152	.	172.1	.	.	.	.	.	.	.	.	.	.	.	.
140.5	1-Jun-1999	152	0.00	6.8	I	134.3	93	238	91	1320	42	15.95	3.01	6.74	317	135.4
147	1-Jun-1999	152	.	73.6	I	13.6	95	144	185	808	319	10.08	3.86	6.75	378	144.7
153	1-Jun-1999	152	0.00	11.7	I	166.9	112	340	74	1332	159	13.89	3.12	7.44	432	147.3
154	1-Jun-1999	152	.	15.9	I	19.3	33	78	94	514	224	9.57	3.01	7.18	373	137.6
155	1-Jun-1999	152	.	24.4	I	5.2	12	37	46	243	40	3.91	5.10	6.65	179	79.8
156	1-Jun-1999	152	0.00	104.5	I	33.1	21	88	57	535	26	7.51	4.09	6.66	190	47.4
157.5	1-Jun-1999	152	0.00	4.9	I	16.0	7	32	54	276	85	5.56	4.02	6.57	98	49.0
162.5	1-Jun-1999	152	0.80	42.4	I	135.9	711	1125	1695	3680	38	24.38	2.87	7.12	476	190.7
163	1-Jun-1999	152	.	5.1	I	18.4	39	89	122	621	393	10.91	4.53	6.73	198	97.9
167	1-Jun-1999	152	.	10.5	I	4.2	70	120	91	349	286	3.60	5.97	6.96	379	102.3
96	7-Jun-1999	158	.	123.4	.	.	.	.	.	.	.	.	.	.	.	.
140.5	7-Jun-1999	158	0.00	3.0	S	21.1	34	110	73	954	1	13.07	1.65	6.95	415	128.5
147	7-Jun-1999	158	.	26.6	I	11.7	157	192	242	544	214	5.56	5.34	7.33	339	128.9
153	7-Jun-1999	158	0.00	0.2	.	.	.	.	.	.	.	.	.	.	.	.
154	7-Jun-1999	158	.	6.6	I	22.3	45	100	97	539	171	6.17	3.89	7.15	378	142.0
155	7-Jun-1999	158	.	11.0	I	7.8	20	40	81	296	36	5.35	4.90	6.61	202	81.8
156	7-Jun-1999	158	0.00	62.7	S	8.1	16	38	72	441	19	5.97	3.42	6.56	205	49.1
157.5	7-Jun-1999	158	0.00	2.5	I	19.0	15	31	91	335	111	5.25	4.05	6.55	90	48.5
162.5	7-Jun-1999	158	0.00	16.6	I	65.9	277	482	732	1937	118	7.82	2.61	6.97	450	234.0
163	7-Jun-1999	158	.	2.1	I	13.9	47	70	174	571	585	6.69	4.23	6.54	129	93.7
167	7-Jun-1999	158	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.
96	14-Jun-1999	165	.	184.1	.	.	.	.	.	.	.	.	.	.	.	.
140.5	14-Jun-1999	165	0.56	1.5	.	.	.	.	.	.	.	.	.	.	.	.
147	14-Jun-1999	165	.	27.5	I	12.5	188	244	164	541	199	5.04	5.57	7.06	435	127.4
153	14-Jun-1999	165	0.56	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	14-Jun-1999	165	.	8.5	I	14.4	35	88	96	525	182	5.56	3.70	7.67	392	135.5
155	14-Jun-1999	165	.	6.7	I	7.1	12	45	66	453	28	4.01	4.73	6.80	202	80.5
156	14-Jun-1999	165	.	21.2	S	15.9	6	48	93	582	33	5.56	3.42	6.84	224	47.2
157.5	14-Jun-1999	165	1.10	3.7	I	20.1	7	47	80	531	122	4.94	4.00	6.36	65	39.4
162.5	14-Jun-1999	165	3.34	46.8	I	34.5	133	236	504	1268	192	8.33	2.62	6.80	348	184.8
163	14-Jun-1999	165	.	2.1	I	10.3	20	56	150	598	833	4.32	3.85	6.40	96	97.4
167	14-Jun-1999	165	.	2.2	S	4.8	73	117	99	440	294	6.69	5.68	7.09	281	94.8
96	21-Jun-1999	172	.	135.5	.	.	.	.	.	.	.	.	.	.	.	.
140.5	21-Jun-1999	172	2.64	0.5	.	.	.	.	.	.	.	.	.	.	.	.
147	21-Jun-1999	172	.	65.2	I	23.8	149	164	164	725	375	8.33	4.12	7.07	476	136.4
153	21-Jun-1999	172	2.43	6.3	S	7.3	21	37	57	277	260	6.89	3.05	7.33	401	149.6
154	21-Jun-1999	172	.	17.8	I	27.5	50	85	78	498	136	6.79	2.75	7.13	345	104.0
155	21-Jun-1999	172	.	15.9	I	8.4	25	36	63	281	160	4.63	4.56	6.78	143	75.4
156	21-Jun-1999	172	.	41.3	S	26.4	18	50	90	419	40	6.48	3.09	6.73	158	40.9
157.5	21-Jun-1999	172	2.82	5.1	I	18.9	13	34	61	234	81	5.56	3.88	6.32	52	40.3
162.5	21-Jun-1999	172	2.64	68.8	I	44.2	120	213	220	1091	146	10.49	1.79	6.90	372	154.6
163	21-Jun-1999	172	.	3.3	I	9.1	30	58	112	364	582	5.14	3.88	6.85	246	100.2

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
167	21-Jun-1999	172	.	7.1	I	4.3	98	110	94	294	301	7.20	5.30	7.15	283	95.2
96	28-Jun-1999	179	.	124.2	.	.	.	.	.	.	.	.	.	.	.	.
140.5	28-Jun-1999	179	0.00	0.2	.	.	.	.	.	.	.	.	.	.	.	.
147	28-Jun-1999	179	.	39.0	I	13.6	119	172	123	547	307	7.72	3.70	7.28	556	142.2
153	28-Jun-1999	179	0.00	2.0	.	.	.	.	.	.	.	.	.	.	.	.
154	28-Jun-1999	179	.	7.7	I	17.4	34	80	85	360	224	5.76	3.06	7.35	389	126.8
155	28-Jun-1999	179	.	13.3	I	14.7	18	46	57	225	75	3.81	4.23	.	.	.
156	28-Jun-1999	179	.	69.6	I	50.6	27	72	72	489	25	5.86	3.27	.	.	.
157.5	28-Jun-1999	179	0.00	3.4	I	13.8	11	41	70	245	108	4.53	4.09	6.61	85	48.3
162.5	28-Jun-1999	179	0.00	29.2	I	39.6	99	187	176	903	224	8.23	1.65	7.23	418	179.3
163	28-Jun-1999	179	.	3.2	I	24.9	48	86	210	696	456	7.72	4.02	6.56	131	92.7
167	28-Jun-1999	179	.	5.4	I	3.7	82	122	61	260	323	4.22	6.04	.	.	.
96	7-Jul-1999	188	.	352.8	.	.	.	.	.	.	.	.	.	.	.	.
140.5	7-Jul-1999	188	3.58	4.3	S	11.3	35	75	81	749	11	8.33	2.03	7.14	400	139.3
147	7-Jul-1999	188	.	127.2	I	17.1	85	154	166	549	322	7.82	2.82	7.28	437	134.2
153	7-Jul-1999	188	4.44	24.2	I	492.3	308	952	210	2391	296	12.96	1.87	.	.	.
154	7-Jul-1999	188	.	35.4	I	1106.7	259	1830	241	3253	198	20.78	2.12	7.08	398	125.2
155	7-Jul-1999	188	.	24.5	I	23.3	30	61	102	365	76	4.84	3.94	.	.	.
156	7-Jul-1999	188	.	89.4	I	38.8	35	63	122	521	33	5.97	2.92	.	.	.
157.5	7-Jul-1999	188	1.84	4.1	I	16.1	23	41	110	348	89	5.04	4.11	6.57	104	52.3
162.5	7-Jul-1999	188	6.08	179.8	I	76.1	101	262	150	1176	142	10.49	1.57	7.08	382	138.8
163	7-Jul-1999	188	.	11.2	I	59.4	94	171	169	913	322	11.01	3.97	6.66	188	93.9
167	7-Jul-1999	188	.	6.5	I	5.6	123	134	92	318	239	4.22	6.15	.	.	.
96	12-Jul-1999	193	.	126.3	.	.	.	.	.	.	.	.	.	.	.	.
140.5	12-Jul-1999	193	0.28	0.4	.	.	.	.	.	.	.	.	.	.	.	.
147	12-Jul-1999	193	.	8.3	.	.	.	.	.	.	.	.	.	.	.	.
153	12-Jul-1999	193	0.00	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	12-Jul-1999	193	.	1.0	.	.	.	.	.	.	.	.	.	.	.	.
155	12-Jul-1999	193	.	0.6	.	.	.	.	.	.	.	.	.	.	.	.
156	12-Jul-1999	193	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
157.5	12-Jul-1999	193	0.06	1.1	I	12.5	16	54	73	312	97	4.94	4.03	6.66	115	58.1
162.5	12-Jul-1999	193	0.00	13.2	I	6.8	33	162	145	897	378	5.66	2.42	7.05	246	172.9
163	12-Jul-1999	193	.	1.0	S	20.3	28	69	86	352	704	2.67	3.81	6.69	141	101.3
167	12-Jul-1999	193	.	0.1	.	.	.	.	.	.	.	.	.	.	.	.
96	19-Jul-1999	200	.	176.9	.	.	.	.	.	.	.	.	.	.	.	.
140.5	19-Jul-1999	200	1.22	0.1	.	.	.	.	.	.	.	.	.	.	.	.
147	19-Jul-1999	200	.	36.0	I	35.0	184	224	114	446	301	7.00	3.71	.	.	.
153	19-Jul-1999	200	1.38	1.8	.	.	.	.	.	.	.	.	.	.	.	.
154	19-Jul-1999	200	.	11.4	.	.	.	.	.	.	.	.	.	.	.	.
155	19-Jul-1999	200	.	4.9	.	.	.	.	.	.	.	.	.	.	.	.
156	19-Jul-1999	200	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
157.5	19-Jul-1999	200	1.60	2.6	I	9.4	18	35	64	293	97	4.01	3.98	6.64	98	53.9
162.5	19-Jul-1999	200	1.42	31.8	I	47.8	97	213	106	917	328	8.33	2.03	7.23	443	164.1
163	19-Jul-1999	200	.	1.6	I	11.9	41	52	99	314	618	4.42	3.76	6.84	167	95.0
167	19-Jul-1999	200	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
96	26-Jul-1999	207	.	182.7	.	.	.	.	.	.	.	.	.	.	.	.
140.5	26-Jul-1999	207	3.74	0.0	.	.	.	.	.	.	.	.	.	.	.	.
147	26-Jul-1999	207	.	22.5	I	27.4	199	327	161	702	373	9.47	4.71	6.98	375	103.9
153	26-Jul-1999	207	2.46	0.1	.	.	.	.	.	.	.	.	.	.	.	.
154	26-Jul-1999	207	.	3.6	S	152.6	48	296	78	735	283	8.74	3.04	7.12	366	118.7
155	26-Jul-1999	207	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	26-Jul-1999	207	.	11.5	S	104.6	19	103	95	588	252	8.54	2.44	6.31	101	45.2
157.5	26-Jul-1999	207	2.17	2.4	I	11.3	16	58	79	264	92	4.73	3.96	6.56	85	46.1
162.5	26-Jul-1999	207	1.24	29.2	I	34.3	99	226	92	815	341	8.33	2.19	6.88	360	134.8
163	26-Jul-1999	207	.	1.4	I	14.8	51	103	126	442	596	5.04	3.57	6.38	89	89.6
167	26-Jul-1999	207	.	8.4	S	30.2	104	314	138	1157	529	13.07	3.51	6.59	102	83.6
96	2-Aug-1999	214	.	163.2	.	.	.	.	.	.	.	.	.	.	.	.
140.5	2-Aug-1999	214	1.40	0.0	.	.	.	.	.	.	.	.	.	.	.	.
147	2-Aug-1999	214	.	24.2	I	8.9	166	214	81	764	299	6.58	3.53	7.50	333	90.1
153	2-Aug-1999	214	0.54	3.3	.	.	.	.	.	.	.	.	.	.	.	.
154	2-Aug-1999	214	.	15.4	I	46.3	100	151	177	1018	389	8.23	2.22	7.16	399	120.3
155	2-Aug-1999	214	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	2-Aug-1999	214	.	62.4	I	15.0	27	58	87	679	115	6.07	2.82	.	.	.
157.5	2-Aug-1999	214	0.70	1.7	I	10.0	17	26	57	386	50	4.12	3.85	6.75	107	51.7
162.5	2-Aug-1999	214	0.82	23.6	I	50.4	131	252	150	939	215	10.60	2.12	7.34	499	162.9
163	2-Aug-1999	214	.	1.3	S	11.6	41	75	86	531	451	4.12	3.61	6.95	153	92.2
167	2-Aug-1999	214	.	1.7	.	.	.	.	.	.	.	.	.	.	.	.
96	9-Aug-1999	221	.	143.7	.	.	.	.	.	.	.	.	.	.	.	.
140.5	9-Aug-1999	221	1.46	0.0	.	.	.	.	.	.	.	.	.	.	.	.
147	9-Aug-1999	221	.	8.1	I	9.5	116	132	53	371	342	6.28	2.92	7.04	394	115.2
153	9-Aug-1999	221	1.72	0.0	.	.	.	.	.	.	.	.	.	.	.	.
154	9-Aug-1999	221	.	8.5	S	6.5	30	62	58	509	339	5.04	2.92	7.24	399	132.7
155	9-Aug-1999	221	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	9-Aug-1999	221	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
157.5	9-Aug-1999	221	2.74	1.8	I	14.7	16	37	62	333	90	4.42	4.03	6.70	92	45.9
162.5	9-Aug-1999	221	0.70	18.3	I	30.7	114	176	99	1045	300	8.02	2.14	7.39	464	163.1
163	9-Aug-1999	221	.	0.9	I	30.9	48	68	64	467	480	4.42	3.27	6.84	154	101.0
167	9-Aug-1999	221	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
96	16-Aug-1999	228	.	184.8	S	11.1	21	49	112	440	1023	2.88	5.40	7.03	290	132.1
140.5	16-Aug-1999	228	0.46	0.0	.	.	.	.	.	.	.	.	.	.	.	.
147	16-Aug-1999	228	.	68.8	I	15.6	100	156	112	695	543	9.57	2.90	7.42	374	108.4
153	16-Aug-1999	228	0.90	0.2	.	.	.	.	.	.	.	.	.	.	.	.
154	16-Aug-1999	228	.	13.3	S	3.8	25	47	36	463	276	5.66	2.55	7.10	775	105.2
155	16-Aug-1999	228	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	16-Aug-1999	228	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
157.5	16-Aug-1999	228	1.16	1.7	I	9.3	22	41	49	449	84	4.73	4.17	6.76	112	51.2
162.5	16-Aug-1999	228	2.97	81.8	I	93.3	172	356	90	1455	182	14.81	1.59	7.48	349	116.0
163	16-Aug-1999	228	.	1.0	S	7.1	30	58	46	404	370	5.25	3.32	6.93	124	88.1
167	16-Aug-1999	228	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
96	23-Aug-1999	235	.	150.9	I	122.3	126	279	383	1480	875	9.16	0.48	6.88	280	125.9

SERC Charles County Watershed Study
Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
140.5	23-Aug-1999	235	1.60	0.0	.	.	.	.	.	.	.	.	.	.	.	.
147	23-Aug-1999	235	.	30.1	I	7.3	96	124	63	521	262	7.20	2.96	7.34	382	97.7
153	23-Aug-1999	235	2.62	0.9	.	.	.	.	.	.	.	.	.	.	.	.
154	23-Aug-1999	235	.	10.9	S	4.6	25	40	61	272	266	3.81	2.81	7.19	391	111.7
155	23-Aug-1999	235	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
156	23-Aug-1999	235	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
157.5	23-Aug-1999	235	3.06	2.5	I	14.3	10	36	60	316	109	4.01	3.75	6.68	91	49.5
162.5	23-Aug-1999	235	1.78	54.2	I	28.7	57	113	83	683	199	6.79	1.60	7.32	386	126.4
163	23-Aug-1999	235	.	0.9	I	20.6	35	61	85	291	416	3.50	3.23	7.08	126	96.6
167	23-Aug-1999	235	.	0.0	.	.	.	.	.	.	.	.	.	.	.	.
96	30-Aug-1999	242	.	1010.1	I	112.0	182	349	132	1353	475	14.20	0.63	6.62	368	158.7
140.5	30-Aug-1999	242	9.32	246.7	I	21.8	38	98	37	1047	70	14.20	2.95	6.06	70	110.3
147	30-Aug-1999	242	.	1008.8	I	129.1	99	284	98	1053	338	12.93	1.51	6.59	248	130.6
153	30-Aug-1999	242	8.12	98.7	I	463.3	185	630	124	1945	344	21.40	1.72	7.19	395	133.3
154	30-Aug-1999	242	.	169.6	I	304.3	172	517	126	1582	369	17.49	1.73	7.18	401	151.4
155	30-Aug-1999	242	.	29.8	I	119.6	59	172	64	864	131	10.91	3.15	6.52	163	92.4
156	30-Aug-1999	242	.	131.4	I	88.9	22	147	57	737	87	8.54	3.07	6.41	120	68.1
157.5	30-Aug-1999	242	4.20	8.6	I	10.6	9	31	35	312	58	6.69	4.23	6.52	73	51.1
162.5	30-Aug-1999	242	16.34	968.6	I	88.3	80	189	73	949	210	10.70	1.16	6.78	287	118.4
163	30-Aug-1999	242	.	84.1	I	181.5	195	492	106	2087	2192	20.68	2.65	6.40	79	145.4
167	30-Aug-1999	242	.	11.9	I	165.8	245	406	148	1361	354	17.08	4.07	.	.	.
96	7-Sep-1999	250	.	159.4	I	74.8	116	175	165	1243	457	11.21	1.78	6.90	745	189.2
140.5	7-Sep-1999	250	7.62	17.4	I	81.0	38	90	69	747	1	12.76	3.68	6.38	381	112.8
147	7-Sep-1999	250	.	113.9	I	63.0	87	138	88	779	428	8.95	3.44	6.80	336	123.3
153	7-Sep-1999	250	6.00	51.1	I	156.7	87	264	55	995	205	11.93	2.41	6.97	327	116.7
154	7-Sep-1999	250	.	97.9	I	83.2	86	213	61	830	233	9.67	2.21	7.22	358	126.7
155	7-Sep-1999	250	.	18.0	I	39.5	25	80	37	483	65	7.92	3.57	6.78	158	77.9
156	7-Sep-1999	250	.	112.6	I	75.8	23	109	38	550	51	8.64	3.37	6.38	106	75.6
157.5	7-Sep-1999	250	6.54	11.6	I	16.5	12	46	35	348	64	6.28	4.19	5.52	16	52.4
162.5	7-Sep-1999	250	4.18	118.3	I	72.2	79	208	69	969	171	9.67	1.96	6.86	297	106.6
163	7-Sep-1999	250	.	16.2	I	37.3	43	93	79	770	862	8.02	4.51	6.06	69	128.9
167	7-Sep-1999	250	.	4.3	I	44.9	111	145	43	368	151	6.89	5.65	7.01	324	93.2
96	13-Sep-1999	256	.	57.4	S	1.0	1	14	62	206	1269	1.03	5.33	6.65	338	126.3
140.5	13-Sep-1999	256	0.33	14.4	I	25.4	34	73	66	569	1	10.70	3.70	6.95	214	117.8
147	13-Sep-1999	256	.	33.4	I	14.9	94	121	89	536	348	9.47	4.01	7.16	348	130.0
153	13-Sep-1999	256	0.19	9.6	I	36.2	33	58	52	320	172	5.56	3.27	7.48	458	151.2
154	13-Sep-1999	256	.	19.3	I	12.0	31	56	45	370	288	4.66	3.76	7.17	446	148.5
155	13-Sep-1999	256	.	8.1	I	7.5	18	46	39	226	35	4.32	3.89	6.69	205	91.4
156	13-Sep-1999	256	.	73.7	S	4.0	6	30	38	210	9	3.70	3.73	6.57	144	67.4
157.5	13-Sep-1999	256	0.29	2.7	I	7.3	8	37	46	289	0	5.66	4.50	6.54	74	48.1
162.5	13-Sep-1999	256	0.58	35.4	I	32.3	60	132	67	648	174	7.61	1.98	6.91	346	134.2
163	13-Sep-1999	256	.	4.6	I	50.6	39	106	93	818	936	7.72	4.90	6.92	147	111.9
167	13-Sep-1999	256	.	2.1	I	43.8	97	128	57	356	39	5.86	5.93	.	.	.
96	20-Sep-1999	263	.	1560.8	I	80.4	173	248	76	980	434	10.08	1.11	6.45	250	123.6
140.5	20-Sep-1999	263	15.14	681.9	I	93.0	77	222	46	1033	105	15.33	2.22	6.40	105	81.9
147	20-Sep-1999	263	.	1570.2	I	47.3	118	225	79	799	310	13.07	2.24	6.46	221	129.1
153	20-Sep-1999	263	13.90	277.9	I	491.6	120	482	70	1597	280	17.39	2.48	7.16	385	156.5
154	20-Sep-1999	263	.	820.7	I	248.1	142	371	67	1185	332	18.52	1.79	6.95	305	133.1
155	20-Sep-1999	263	.	496.0	I	373.2	145	354	67	1405	101	19.51	2.82	6.65	108	81.8
156	20-Sep-1999	263	.	688.6	I	863.5	163	595	75	2305	207	34.88	2.91	6.19	52	63.8
157.5	20-Sep-1999	263	16.72	605.9	I	140.3	33	155	67	1286	31	20.27	2.54	5.84	26	47.7
162.5	20-Sep-1999	263	15.34	1565.6	I	77.3	114	170	69	771	225	9.57	1.33	6.78	262	116.9
163	20-Sep-1999	263	.	412.8	I	511.4	161	562	80	1710	508	21.71	2.22	6.32	73	97.0
167	20-Sep-1999	263	.	152.2	I	405.4	459	823	89	1246	469	17.39	3.21	6.97	22	123.5
96	27-Sep-1999	270	.	130.4	I	1.2	2	24	58	216	1695	2.98	4.86	6.38	259	137.1
140.5	27-Sep-1999	270	1.84	58.9	S	6.8	19	51	41	356	67	7.61	4.07	6.61	168	104.7
147	27-Sep-1999	270	.	55.9	I	29.9	41	87	67	480	428	8.85	4.41	6.47	304	135.4
153	27-Sep-1999	270	1.60	25.1	I	27.3	36	94	51	434	261	6.07	3.90	7.14	496	181.2
154	27-Sep-1999	270	.	31.3	I	69.5	25	68	56	369	351	6.07	3.63	6.99	398	153.6
155	27-Sep-1999	270	.	18.4	I	46.0	67	119	89	653	0	14.40	4.10	6.61	147	88.2
156	27-Sep-1999	270	.	76.9	I	183.1	119	271	42	715	58	10.01	4.99	6.49	100	64.6
157.5	27-Sep-1999	270	1.34	12.3	I	57.6	3	30	29	297	68	6.48	4.21	6.30	53	50.4
162.5	27-Sep-1999	270	1.54	147.4	I	29.9	36	113	65	606	322	8.02	2.51	6.85	272	142.0
163	27-Sep-1999	270	.	75.2	I	87.5	21	56	52	465	612	6.38	4.71	6.50	102	100.6
167	27-Sep-1999	270	.	21.0	I	22.7	80	125	52	405	710	5.66	7.11	7.18	296	124.2
96	4-Oct-1999	277	.	288.8	I	95.5	169	311	125	1385	401	14.71	0.68	6.46	222	68.8
140.5	4-Oct-1999	277	5.52	122.5	I	27.0	57	112	43	616	106	9.67	4.00	6.75	160	91.3
147	4-Oct-1999	277	.	147.9	I	26.3	55	112	67	521	428	8.85	3.79	6.89	268	121.1
153	4-Oct-1999	277	5.42	97.3	I	359.4	195	565	49	1337	226	17.39	2.82	7.24	569	186.9
154	4-Oct-1999	277	.	158.0	I	299.3	188	497	68	1511	282	15.64	2.55	6.93	369	137.1
155	4-Oct-1999	277	.	56.3	I	85.4	41	120	34	461	96	7.10	4.24	6.73	135	78.7
156	4-Oct-1999	277	.	189.8	I	285.1	237	513	54	1110	111	14.92	3.73	6.44	92	57.7
157.5	4-Oct-1999	277	5.68	61.5	I	28.4	6	68	31	476	47	8.98	3.65	6.24	53	54.5
162.5	4-Oct-1999	277	4.22	210.2	I	35.2	38	114	54	953	272	6.89	2.02	6.93	312	121.4
163	4-Oct-1999	277	.	95.2	I	82.4	117	270	59	972	547	11.21	4.08	6.46	112	93.9
167	4-Oct-1999	277	.	25.3	I	32.0	91	122	27	498	653	5.04	6.89	6.96	301	115.6
96	12-Oct-1999	285	.	172.9	I	13.5	92	128	180	877	765	7.20	2.65	6.51	310	126.8
140.5	12-Oct-1999	285	2.30	44.8	I	18.0	40	75	32	430	55	7.61	4.25	6.77	172	94.7
147	12-Oct-1999	285	.	96.0	I	17.4	53	125	60	591	306	9.47	3.76	6.71	268	112.0
153	12-Oct-1999	285	2.48	39.2	I	16.3	22	71	30	339	172	5.04	4.17	7.15	494	166.7
154	12-Oct-1999	285	.	48.0	I	30.4	30	57	45	433	321	4.94	3.86	7.32	444	145.9
155	12-Oct-1999	285	.	22.6	I	8.6	13	28	24	207	76	3.81	5.14	6.86	175	87.5
156	12-Oct-1999	285	.	104.5	I	18.8	19	55	26	290	106	4.53	4.99	6.63	119	68.9
157.5	12-Oct-1999	285	2.82	22.5	I	8.7	6	27	26	293	48	5.25	4.35	6.25	60	55.0
162.5	12-Oct-1999	285	2.90	164.2	I	42.1	45	118	56	767	235	7.92	1.88	6.81	293	123.4
163	12-Oct-1999	285	.	97.0	I	26.8	85	153	83	758	557	7.37	4.72	6.47	112	96.9
167	12-Oct-1999	285	.	24.5	I	4.9	58	70	42	442	667	3.70	7.24	7.07	297	119.8
96	18-Oct-1999	291	.	118.2	I	2.0	0	14	55	211	1513	2.67	4.80	6.36	293	128.8
140.5	18-Oct-1999	291	0.62	21.4	I	15.7	34	59	48	356	38	8.13	4.19	6.68	209	106.5
147	18-Oct-1999	291	.	24.1	I	10.1	49	100	72	669	408	8.23	4.33	6.66	358	117.9

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
153	18-Oct-1999	291	0.52	12.8	I	3.9	14	33	30	204	106	3.40	4.31	7.08	490	181.0
154	18-Oct-1999	291	.	18.0	I	9.4	18	29	38	260	309	3.60	4.58	6.90	394	156.1
155	18-Oct-1999	291	.	10.3	I	4.0	10	21	36	124	36	3.70	5.32	6.70	165	87.7
156	18-Oct-1999	291	.	74.0	I	19.2	21	56	36	271	98	4.22	4.93	6.52	128	68.0
157.5	18-Oct-1999	291	0.62	9.0	I	5.6	3	18	32	103	55	3.91	4.30	6.26	72	50.9
162.5	18-Oct-1999	291	0.87	75.7	I	23.3	32	80	82	481	279	5.25	1.81	6.67	286	136.5
163	18-Oct-1999	291	.	55.8	I	7.8	25	38	64	423	636	5.04	4.97	6.42	119	93.3
167	18-Oct-1999	291	.	17.4	I	3.5	56	58	51	247	570	3.57	7.33	6.86	265	114.1
96	25-Oct-1999	298	.	192.9	S	35.1	110	247	233	1319	600	7.92	1.46	6.45	278	126.0
140.5	25-Oct-1999	298	3.14	68.4	I	15.1	34	81	32	430	39	5.86	4.23	6.76	180	100.2
147	25-Oct-1999	298	.	112.5	I	15.9	42	100	53	453	292	7.82	3.38	6.74	270	123.5
153	25-Oct-1999	298	2.50	41.0	I	35.7	34	105	34	405	158	5.14	3.74	7.39	528	184.6
154	25-Oct-1999	298	.	48.4	I	28.3	39	90	39	385	326	4.12	3.33	7.16	410	138.5
155	25-Oct-1999	298	.	18.6	I	8.9	6	26	15	199	26	3.09	5.23	6.72	175	86.3
156	25-Oct-1999	298	.	104.9	I	131.8	168	389	48	842	9	8.74	4.88	6.55	127	69.1
157.5	25-Oct-1999	298	2.98	32.1	I	9.8	2	25	22	205	16	4.94	4.11	6.24	68	59.3
162.5	25-Oct-1999	298	3.14	156.6	I	53.0	45	142	54	701	268	7.10	1.50	6.73	282	130.1
163	25-Oct-1999	298	.	108.4	I	33.8	37	93	45	463	501	7.10	4.54	6.39	104	94.0
167	25-Oct-1999	298	.	32.9	I	6.2	45	91	32	356	528	5.14	6.95	7.15	272	133.6
96	1-Nov-1999	305	.	105.4	S	3.0	1	5	63	161	1393	2.16	4.87	7.08	270	119.6
140.5	1-Nov-1999	305	0.00	27.4	I	15.0	18	35	61	218	0	6.48	4.21	6.65	196	97.9
147	1-Nov-1999	305	.	22.7	I	7.6	43	56	63	345	368	6.07	4.84	6.71	281	143.7
153	1-Nov-1999	305	0.00	11.4	I	11.3	9	20	35	109	87	3.81	4.69	7.13	544	183.7
154	1-Nov-1999	305	.	16.9	I	7.0	12	27	31	211	257	5.86	4.61	6.88	437	149.0
155	1-Nov-1999	305	.	9.4	I	4.1	5	16	23	74	1	3.50	5.40	6.99	184	88.2
156	1-Nov-1999	305	.	83.0	I	16.0	30	46	45	315	103	4.42	5.11	6.43	140	67.0
157.5	1-Nov-1999	305	0.00	14.6	I	5.7	1	16	27	128	24	4.22	4.40	6.44	100	59.3
162.5	1-Nov-1999	305	0.00	77.4	I	19.5	14	61	74	435	314	5.14	1.75	6.67	277	144.9
163	1-Nov-1999	305	.	67.1	I	7.1	13	25	58	315	558	4.84	5.04	6.57	134	95.5
167	1-Nov-1999	305	.	22.8	I	2.6	30	33	39	329	773	2.98	7.68	7.05	307	129.0
96	8-Nov-1999	312	.	133.5	I	99.4	136	197	155	1250	370	13.07	1.81	6.73	270	126.8
140.5	8-Nov-1999	312	1.18	21.7	I	14.4	34	43	33	399	0	7.92	4.74	6.74	230	109.7
147	8-Nov-1999	312	.	42.2	I	14.1	52	56	44	507	185	8.74	4.48	6.43	294	136.2
153	8-Nov-1999	312	0.80	19.6	I	17.6	19	52	28	408	0	6.58	4.61	7.28	608	185.0
154	8-Nov-1999	312	.	28.0	I	29.9	54	78	34	490	22	8.74	4.22	6.94	526	154.7
155	8-Nov-1999	312	.	11.5	I	5.1	14	22	25	203	0	6.48	5.54	6.69	215	93.6
156	8-Nov-1999	312	.	86.9	I	15.1	7	22	28	401	37	5.25	5.32	6.50	159	70.2
157.5	8-Nov-1999	312	1.06	43.5	I	12.5	3	8	28	211	0	8.33	4.71	6.33	107	61.7
162.5	8-Nov-1999	312	1.88	94.6	I	27.7	21	62	51	570	161	6.69	2.05	6.58	294	144.3
163	8-Nov-1999	312	.	87.9	I	17.4	25	44	38	513	291	8.85	5.20	6.51	161	97.4
167	8-Nov-1999	312	.	24.3	I	3.3	42	47	30	320	343	4.42	7.90	7.12	378	134.3
96	15-Nov-1999	319	.	149.9	I	3.2	16	43	96	411	1005	2.88	5.00	6.64	252	126.4
140.5	15-Nov-1999	319	0.00	13.1	I	13.3	35	53	46	296	3	6.89	5.40	6.72	252	114.5
147	15-Nov-1999	319	.	25.7	I	7.1	71	104	54	401	147	8.64	5.54	6.50	334	148.3
153	15-Nov-1999	319	0.00	10.2	I	6.7	15	33	36	229	0	5.14	4.97	7.38	648	197.4
154	15-Nov-1999	319	.	18.5	I	7.9	35	65	36	212	0	6.69	4.81	6.86	544	162.3
155	15-Nov-1999	319	.	8.9	I	4.2	11	28	30	148	0	5.45	5.74	6.81	210	89.4
156	15-Nov-1999	319	.	93.4	I	8.2	3	31	31	290	44	3.70	5.32	6.52	147	66.6
157.5	15-Nov-1999	319	0.00	52.9	I	7.6	2	5	18	166	0	5.25	4.53	6.32	98	60.0
162.5	15-Nov-1999	319	0.00	69.4	I	16.6	20	56	64	523	198	5.76	2.22	6.46	292	145.7
163	15-Nov-1999	319	.	66.0	I	14.1	16	37	46	328	363	6.17	5.49	6.44	166	95.0
167	15-Nov-1999	319	.	23.4	I	1.7	25	33	33	308	310	3.09	7.83	7.04	380	132.5
96	22-Nov-1999	326	.	197.2	I	2.5	1	23	54	158	1115	1.75	5.01	6.65	248	124.8
140.5	22-Nov-1999	326	0.00	10.5	I	31.2	37	64	34	237	0	6.58	5.36	6.80	218	104.8
147	22-Nov-1999	326	.	27.0	I	9.7	90	139	30	400	104	10.63	5.67	6.38	344	152.8
153	22-Nov-1999	326	0.00	11.0	I	4.1	10	35	24	147	0	4.84	5.01	7.14	606	188.2
154	22-Nov-1999	326	.	23.2	I	3.9	19	47	23	203	0	5.56	4.88	6.91	474	149.7
155	22-Nov-1999	326	.	8.3	I	6.4	8	35	27	97	0	4.01	5.70	6.88	180	88.4
156	22-Nov-1999	326	.	85.5	I	7.1	4	30	22	186	48	3.60	5.28	7.02	142	65.4
157.5	22-Nov-1999	326	0.00	65.2	I	5.5	0	22	21	87	0	4.32	4.66	6.85	90	55.5
162.5	22-Nov-1999	326	0.00	68.2	I	17.9	19	54	50	400	180	5.76	2.14	6.48	272	152.4
163	22-Nov-1999	326	.	69.7	I	9.0	15	43	38	324	357	5.76	5.45	6.49	146	92.6
167	22-Nov-1999	326	.	24.2	I	0.7	16	34	28	136	373	2.98	7.54	7.11	348	125.6
96	29-Nov-1999	333	.	244.5	I	181.5	167	433	169	1807	357	34.98	1.02	6.49	304	133.9
140.5	29-Nov-1999	333	4.44	102.8	I	26.4	73	153	39	550	8	12.65	4.52	6.57	162	100.7
147	29-Nov-1999	333	.	119.4	I	21.1	100	186	44	529	108	12.24	4.18	6.37	200	118.8
153	29-Nov-1999	333	4.24	85.9	I	166.4	116	346	46	969	135	16.05	3.14	6.99	454	166.3
154	29-Nov-1999	333	.	107.1	I	111.5	162	348	49	858	146	15.12	3.10	6.68	364	146.0
155	29-Nov-1999	333	.	44.3	I	11.4	16	51	21	173	1	6.72	4.96	6.67	154	84.9
156	29-Nov-1999	333	.	120.3	I	102.7	75	238	38	678	60	10.39	4.52	6.41	108	66.8
157.5	29-Nov-1999	333	4.16	95.4	I	12.5	2	37	31	204	0	7.41	4.06	6.17	66	65.6
162.5	29-Nov-1999	333	4.66	151.2	I	76.4	60	220	65	1046	117	11.11	2.15	6.62	300	133.6
163	29-Nov-1999	333	.	152.8	I	123.6	86	310	47	958	248	17.18	4.18	6.39	112	88.1
167	29-Nov-1999	333	.	27.1	I	1.6	31	55	26	204	197	4.32	7.17	7.08	344	130.5
96	6-Dec-1999	340	.	86.1	S	6.7	46	74	83	401	600	7.20	2.42	6.29	275	83.9
140.5	6-Dec-1999	340	1.02	33.7	I	17.4	48	67	32	423	13	8.02	4.51	6.58	167	97.4
147	6-Dec-1999	340	.	29.1	I	12.4	83	103	59	445	177	8.23	4.74	6.43	250	130.7
153	6-Dec-1999	340	0.82	24.8	I	12.9	18	30	29	194	59	4.49	4.97	7.04	528	180.5
154	6-Dec-1999	340	.	27.1	I	27.9	43	61	35	262	184	4.73	4.76	6.93	384	144.2
155	6-Dec-1999	340	.	18.5	I	15.2	14	32	17	177	7	4.63	5.73	6.66	163	89.1
156	6-Dec-1999	340	.	91.6	I	8.8	11	22	27	131	134	3.29	5.16	6.62	119	64.8
157.5	6-Dec-1999	340	0.90	42.6	I	39.9	7	23	46	201	9	5.86	3.79	6.21	94	63.3
162.5	6-Dec-1999	340	0.64	56.5	I	22.1	34	74	56	457	188	5.97	2.46	6.58	290	141.2
163	6-Dec-1999	340	.	73.0	I	28.1	25	46	66	319	345	5.76	5.50	6.26	109	88.3
167	6-Dec-1999	340	.	22.5	I	0.8	24	27	29	213	515	2.98	7.52	7.00	308	128.7
96	13-Dec-1999	347	.	129.8	I	16.9	84	162	169	679	392	9.36	1.52	6.59	290	128.5
140.5	13-Dec-1999	347	1.66	49.3	S	7.1	26	52	46	232	59	6.07	4.40	6.68	150	97.7
147	13-Dec-1999	347	.	77.3	I	12.8	70	113	110	446	198	8.64	3.87	6.31	204	118.8
153	13-Dec-1999	347	1.38	48.4	I	33.2	37	86	57	306	132	6.48	4.23	7.09	452	169.7
154	13-Dec-1999	347	.	49.1	I	22.0	54	122	106	467	210	6.21	3.43	6.79	359	144.9

SERC Charles County Watershed Study
Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
155	13-Dec-1999	347	.	23.8	I	6.4	6	31	30	148	24	4.94	5.63	6.61	160	91.2
156	13-Dec-1999	347	.	104.9	I	9.6	4	29	83	123	108	3.81	5.02	6.48	108	67.1
157.5	13-Dec-1999	347	2.12	75.9	I	8.7	2	21	37	205	36	5.76	4.01	6.23	63	67.0
162.5	13-Dec-1999	347	2.18	114.7	I	38.0	34	105	97	667	290	6.69	2.14	6.72	256	129.1
163	13-Dec-1999	347	.	85.8	I	27.0	28	54	77	432	392	6.07	5.25	6.21	94	90.9
167	13-Dec-1999	347	.	25.1	I	2.6	21	32	59	259	604	3.60	7.12	7.41	278	131.8
96	20-Dec-1999	354	.	231.0	I	56.7	155	352	173	1404	250	11.63	1.01	6.21	274	84.1
140.5	20-Dec-1999	354	3.10	207.2	I	22.5	51	114	62	460	92	8.95	4.06	6.50	124	90.0
147	20-Dec-1999	354	.	198.4	I	18.5	61	119	89	416	214	8.54	3.34	6.42	222	134.7
153	20-Dec-1999	354	3.04	134.8	I	91.0	66	170	91	623	205	9.36	3.24	6.96	393	161.9
154	20-Dec-1999	354	.	167.1	I	41.6	168	258	94	701	257	10.19	3.00	6.75	312	134.3
155	20-Dec-1999	354	.	114.7	I	27.3	18	57	50	233	64	7.20	4.60	6.59	123	83.6
156	20-Dec-1999	354	.	217.4	I	118.4	134	273	64	781	110	11.69	4.10	6.39	83	61.4
157.5	20-Dec-1999	354	2.98	147.0	I	12.3	6	36	49	291	28	7.92	3.80	6.19	63	65.4
162.5	20-Dec-1999	354	3.30	201.5	I	45.5	54	137	104	631	303	7.92	1.97	6.65	253	131.0
163	20-Dec-1999	354	.	128.6	I	32.0	47	125	87	548	394	9.36	4.54	6.25	94	89.6
167	20-Dec-1999	354	.	38.6	I	12.1	48	64	61	411	612	5.25	6.98	6.88	242	134.0
96	27-Dec-1999	361	.	89.4	S	2.1	0	0	67	148	1095	1.44	4.78	6.43	255	124.3
140.5	27-Dec-1999	361	0.78	50.9	I	32.0	34	49	62	272	133	6.17	6.31	6.58	136	96.7
147	27-Dec-1999	361	.	66.4	I	83.7	101	143	163	888	582	13.99	7.88	6.39	216	136.1
153	27-Dec-1999	361	0.52	35.7	I	33.9	15	31	54	239	229	4.53	5.77	7.03	408	166.2
154	27-Dec-1999	361	.	39.5	S	8.3	24	31	82	307	353	4.63	4.76	6.79	336	142.5
155	27-Dec-1999	361	.	34.0	S	4.0	3	8	22	122	151	1.85	6.04	6.59	123	87.8
156	27-Dec-1999	361	.	99.2	S	1.5	1	7	42	120	236	2.06	5.44	6.42	95	66.3
157.5	27-Dec-1999	361	0.56	49.9	S	2.6	5	11	74	154	94	3.33	4.68	6.23	62	63.7
162.5	27-Dec-1999	361	0.62	82.3	I	11.9	23	69	108	539	474	5.35	2.75	6.63	240	134.4
163	27-Dec-1999	361	.	78.5	I	41.4	26	54	107	505	600	5.35	7.23	6.32	89	91.0
167	27-Dec-1999	361	.	26.8	I	3.2	23	30	52	224	371	2.88	9.03	6.98	225	132.1
96	3-Jan-2000	3	.	74.8	S	1.3	0	7	85	96	1389	1.13	5.00	6.32	271	135.6
140.5	3-Jan-2000	3	0.00	23.4	I	12.6	22	41	51	195	126	4.12	4.39	6.60	137	97.3
147	3-Jan-2000	3	.	39.5	I	6.1	50	65	89	232	321	4.22	5.04	6.42	207	140.6
153	3-Jan-2000	3	0.00	21.8	I	6.1	14	26	43	130	148	2.37	4.72	7.04	424	174.3
154	3-Jan-2000	3	.	23.4	I	6.9	17	32	69	212	338	3.50	4.68	6.83	346	146.4
155	3-Jan-2000	3	.	25.7	I	1.8	2	15	30	72	136	1.75	6.34	6.70	136	86.1
156	3-Jan-2000	3	.	80.3	I	2.5	3	14	32	85	232	0.93	5.43	6.46	99	66.4
157.5	3-Jan-2000	3	0.00	33.5	I	3.9	3	16	46	98	83	2.78	4.86	6.28	70	63.6
162.5	3-Jan-2000	3	0.00	57.9	I	9.2	15	43	92	396	504	4.53	3.08	6.71	243	147.9
163	3-Jan-2000	3	.	61.4	I	14.6	14	39	81	307	517	3.50	5.41	6.27	80	89.4
167	3-Jan-2000	3	.	23.5	I	1.9	18	32	30	174	1027	2.57	7.88	7.03	231	129.3
96	10-Jan-2000	10	.	139.4	I	35.2	84	151	133	1722	516	11.01	2.14	6.83	405	97.5
140.5	10-Jan-2000	10	2.98	60.4	I	10.9	34	55	35	333	102	4.73	4.89	6.80	136	89.7
147	10-Jan-2000	10	.	93.1	I	11.5	52	102	66	355	265	6.69	4.13	6.54	229	135.8
153	10-Jan-2000	10	2.64	51.5	I	72.1	49	124	48	530	198	7.92	4.08	7.20	379	150.8
154	10-Jan-2000	10	.	54.2	I	56.6	59	140	62	482	272	9.26	3.62	7.02	318	134.3
155	10-Jan-2000	10	.	39.0	I	4.2	6	13	12	107	104	2.88	5.80	6.89	122	79.6
156	10-Jan-2000	10	.	91.9	I	9.4	8	23	16	143	170	3.09	5.13	6.44	100	62.9
157.5	10-Jan-2000	10	2.34	45.0	I	6.0	0	14	17	127	60	3.81	4.64	6.26	87	68.4
162.5	10-Jan-2000	10	3.04	107.5	I	31.6	25	96	53	570	394	7.17	2.66	6.63	231	115.4
163	10-Jan-2000	10	.	109.5	I	53.1	46	132	66	562	413	8.33	4.82	6.47	82	79.4
167	10-Jan-2000	10	.	34.6	I	10.3	37	64	43	326	734	4.84	7.34	6.79	180	114.4
96	18-Jan-2000	18	.	95.5	S	0.9	0	0	43	97	1505	1.23	5.13	6.45	242	122.9
140.5	18-Jan-2000	18	0.00	67.5	S	3.2	20	33	25	167	143	4.42	4.70	6.55	125	99.4
147	18-Jan-2000	18	.	88.9	S	5.5	42	53	63	171	339	3.60	5.23	6.44	229	144.5
153	18-Jan-2000	18	0.66	73.3	S	3.8	8	14	41	122	180	3.19	5.21	7.00	392	164.8
154	18-Jan-2000	18	.	80.4	S	7.3	19	28	45	149	326	4.53	5.02	6.66	320	143.4
155	18-Jan-2000	18	.	62.3	S	1.5	1	10	17	48	157	2.37	6.49	6.57	124	86.1
156	18-Jan-2000	18	.	123.5	S	1.6	0	1	28	40	205	1.75	5.53	6.45	93	64.4
157.5	18-Jan-2000	18	0.00	74.7	S	5.4	1	14	32	47	82	2.47	4.98	5.95	62	65.5
162.5	18-Jan-2000	18	0.00	89.2	S	.	12	36	70	261	484	4.84	.	6.68	256	147.8
163	18-Jan-2000	18	.	87.6	S	4.5	12	17	60	187	604	2.98	5.84	6.34	89	92.3
167	18-Jan-2000	18	.	33.9	S	1.5	14	18	48	135	1214	2.26	8.34	6.87	228	136.7
96	24-Jan-2000	24	.	91.5	S	1.2	0	0	47	89	1499	1.34	5.04	6.29	226	173.6
140.5	24-Jan-2000	24	0.40	40.7	S	4.6	15	33	40	119	197	3.29	4.79	6.52	144	145.7
147	24-Jan-2000	24	.	29.1	S	4.2	29	35	70	188	440	2.98	5.06	6.28	184	374.0
153	24-Jan-2000	24	0.52	29.6	S	2.2	1	9	739	2079	239	2.16	4.98	6.94	348	706.0
154	24-Jan-2000	24	.	21.1	S	5.0	4	11	2050	2757	449	2.37	4.58	6.70	240	1265.0
155	24-Jan-2000	24	.	28.0	S	1.3	0	8	20	220	199	1.54	6.20	6.50	108	103.4
156	24-Jan-2000	24	.	54.3	S	1.6	0	6	25	57	244	1.34	5.41	6.44	96	70.4
157.5	24-Jan-2000	24	0.66	30.2	S	2.5	0	5	23	58	102	2.37	5.03	6.22	62	63.9
162.5	24-Jan-2000	24	0.60	51.3	S	4.8	2	20	72	248	524	3.29	2.97	6.53	189	426.0
163	24-Jan-2000	24	.	58.4	S	11.1	7	25	60	223	657	2.67	5.70	6.49	85	87.4
167	24-Jan-2000	24	.	25.9	S	1.6	8	15	39	90	1236	1.58	7.55	6.88	190	122.8
96	1-Feb-2000	32	.	212.2	I	27.6	75	219	1648	2195	539	15.23	2.02	6.40	400	18430.0
140.5	1-Feb-2000	32	2.86	165.8	S	7.9	15	22	75	552	192	5.66	4.35	5.61	48	661.0
147	1-Feb-2000	32	.	93.9	S	10.7	21	37	2076	4006	281	4.53	2.76	6.40	212	1798.0
153	1-Feb-2000	32	2.64	66.3	S	6.0	10	21	6080	16148	276	3.50	3.49	6.64	291	2390.0
154	1-Feb-2000	32	.	54.3	S	9.8	14	28	4940	10544	372	4.12	3.31	6.54	355	2240.0
155	1-Feb-2000	32	.	66.4	S	1.7	2	3	16	825	187	2.47	5.21	6.08	72	701.0
156	1-Feb-2000	32	.	157.7	S	2.8	5	6	36	173	236	1.95	4.75	6.18	86	257.0
157.5	1-Feb-2000	32	2.54	124.1	S	4.3	6	7	40	130	64	3.29	4.49	5.91	43	132.6
162.5	1-Feb-2000	32	2.38	130.0	S	8.6	15	38	538	1028	448	4.22	2.43	6.45	233	1927.0
163	1-Feb-2000	32	.	140.2	S	10.4	11	34	72	367	596	3.50	4.87	6.10	81	129.9
167	1-Feb-2000	32	.	49.6	S	7.3	17	31	47	274	694	3.60	6.63	6.36	137	154.9
96	7-Feb-2000	38	.	110.2	S	7.3	12	21	108	348	1383	2.98	3.95	6.31	430	404.0
140.5	7-Feb-2000	38	0.00	82.9	S	4.1	8	17	84	298	190	2.57	3.91	6.15	64	415.0
147	7-Feb-2000	38	.	92.1	S	8.5	24	37	2064	2087	393	3.60	3.80	6.45	266	828.0
153	7-Feb-2000	38	0.00	50.2	S	4.1	6	18	915	1016	311	3.19	4.13	6.58	255	673.0
154	7-Feb-2000	38	.	46.7	S	9.0	13	31	1090	1573	433	4.42	3.89	6.94	335	723.0
155	7-Feb-2000	38	.	44.9	S	2.4	0	4	9	97	172	1.75	5.15	6.30	77	250.0
156	7-Feb-2000	38	.	89.2	S	2.1	0	6	11	119	219	2.06	4.61	6.36	84	121.7

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
157.5	7-Feb-2000	38	0.00	61.9	S	3.4	0	11	14	68	69	2.78	4.30	6.06	52	116.5
162.5	7-Feb-2000	38	0.04	85.3	I	11.8	13	53	360	784	595	4.12	2.58	6.54	253	1691.0
163	7-Feb-2000	38	.	82.1	S	3.8	7	16	44	241	665	2.47	4.99	6.21	64	107.0
167	7-Feb-2000	38	.	32.9	S	2.4	13	24	24	145	1314	1.95	6.65	6.74	157	153.2
96	14-Feb-2000	45	.	179.2	I	21.0	78	137	351	943	820	10.08	2.78	6.68	523	305.0
140.5	14-Feb-2000	45	0.54	137.0	I	13.3	11	35	58	238	204	4.01	4.23	6.34	75	182.7
147	14-Feb-2000	45	.	156.9	I	5.6	22	44	1355	1440	361	4.84	3.38	6.59	368	705.0
153	14-Feb-2000	45	0.38	114.2	I	9.9	11	32	570	874	314	4.42	3.85	6.95	259	314.0
154	14-Feb-2000	45	.	108.7	I	10.3	16	44	788	1266	405	5.56	3.59	6.64	237	412.0
155	14-Feb-2000	45	.	92.5	I	3.6	1	14	24	119	176	2.47	4.82	6.43	70	123.6
156	14-Feb-2000	45	.	161.0	I	9.7	2	16	27	174	205	3.40	4.16	6.39	64	104.7
157.5	14-Feb-2000	45	0.72	117.5	I	5.1	1	12	30	156	52	3.40	4.19	6.06	36	118.3
162.5	14-Feb-2000	45	0.68	131.7	I	22.9	28	71	219	697	582	5.45	2.69	6.54	258	811.0
163	14-Feb-2000	45	.	127.3	I	19.1	6	41	55	285	689	3.19	4.55	6.20	75	96.3
167	14-Feb-2000	45	.	58.6	I	14.1	24	51	43	371	2193	3.50	6.37	6.40	109	113.1
96	22-Feb-2000	53	.	159.8	I	25.9	60	117	64	721	1029	8.74	3.09	6.28	248	183.1
140.5	22-Feb-2000	53	1.62	148.6	I	17.2	16	44	32	336	166	4.42	3.91	6.37	79	218.0
147	22-Feb-2000	53	.	154.0	I	11.6	32	58	1063	1376	392	6.17	3.21	6.38	195	377.0
153	22-Feb-2000	53	1.44	105.1	I	14.2	18	56	225	624	326	5.25	3.71	6.99	281	243.0
154	22-Feb-2000	53	.	110.0	I	16.3	26	56	391	901	388	7.30	3.27	6.58	232	222.0
155	22-Feb-2000	53	.	84.6	I	2.4	0	9	15	157	156	2.98	4.93	6.66	89	118.5
156	22-Feb-2000	53	.	160.1	I	29.2	24	56	25	209	173	3.60	4.25	6.28	60	73.6
157.5	22-Feb-2000	53	1.56	123.6	I	3.6	0	8	14	111	59	3.19	4.24	5.97	40	106.9
162.5	22-Feb-2000	53	1.64	163.6	I	28.9	27	82	233	753	556	6.17	2.36	6.50	216	809.0
163	22-Feb-2000	53	.	139.0	I	18.8	17	35	47	310	652	4.53	4.47	6.16	75	96.3
167	22-Feb-2000	53	.	61.4	I	9.1	18	34	33	340	1510	3.91	6.21	5.94	143	128.1
96	28-Feb-2000	59	.	110.4	I	30.5	99	245	197	1112	708	14.09	3.10	6.35	405	187.2
140.5	28-Feb-2000	59	1.62	43.1	I	43.1	27	95	28	472	110	5.35	3.47	6.27	110	148.2
147	28-Feb-2000	59	.	67.6	I	6.9	24	46	449	563	415	5.45	3.57	6.49	341	379.0
153	28-Feb-2000	59	1.88	61.7	I	84.3	46	143	68	477	240	7.72	3.40	6.71	240	202.0
154	28-Feb-2000	59	.	66.7	I	83.6	49	165	118	665	324	8.44	3.06	6.62	280	229.0
155	28-Feb-2000	59	.	47.1	I	7.5	0	24	18	233	120	3.09	5.11	6.21	87	116.4
156	28-Feb-2000	59	.	95.1	I	68.8	46	98	30	287	166	4.01	4.55	6.40	109	88.7
157.5	28-Feb-2000	59	1.52	61.3	I	5.0	0	16	26	98	51	2.78	4.26	5.93	41	102.9
162.5	28-Feb-2000	59	1.66	99.9	I	31.9	32	109	172	676	541	5.14	2.61	6.53	236	592.0
163	28-Feb-2000	59	.	78.3	I	22.1	14	55	61	365	586	4.01	4.69	6.11	72	93.7
167	28-Feb-2000	59	.	33.2	I	4.3	14	32	32	165	1118	2.06	6.77	6.36	144	111.6
96	6-Mar-2000	66	.	96.0	S	0.9	0	0	73	112	1569	1.23	4.40	6.08	213	155.4
140.5	6-Mar-2000	66	0.00	71.8	I	26.9	28	72	34	299	95	5.25	3.41	6.48	108	172.0
147	6-Mar-2000	66	.	72.1	I	6.0	29	42	330	516	295	4.73	3.36	6.25	167	294.0
153	6-Mar-2000	66	0.00	63.4	I	10.3	14	48	47	309	189	3.91	3.77	6.86	339	213.0
154	6-Mar-2000	66	.	59.9	I	8.2	20	57	56	295	290	4.63	3.56	6.54	269	204.0
155	6-Mar-2000	66	.	54.7	I	4.2	3	21	20	93	108	2.37	5.16	6.58	106	94.9
156	6-Mar-2000	66	.	110.4	I	8.5	3	131	45	264	117	3.50	4.42	6.22	93	72.6
157.5	6-Mar-2000	66	0.00	73.0	I	3.1	1	16	28	107	36	2.78	4.23	6.15	58	85.1
162.5	6-Mar-2000	66	0.00	88.5	I	22.2	31	89	131	696	509	5.04	2.27	6.52	206	471.0
163	6-Mar-2000	66	.	78.5	I	8.3	16	44	69	268	588	3.29	4.82	6.19	75	91.2
167	6-Mar-2000	66	.	35.6	I	2.4	16	32	40	185	1538	2.88	6.84	6.84	182	124.3
96	13-Mar-2000	73	.	139.2	I	35.8	61	232	216	1522	1002	13.17	3.95	6.23	230	164.4
140.5	13-Mar-2000	73	1.04	25.1	I	76.9	47	128	35	531	73	6.89	3.03	6.46	146	161.3
147	13-Mar-2000	73	.	60.1	I	5.3	23	44	95	304	340	4.73	3.40	5.64	163	362.0
153	13-Mar-2000	73	0.62	35.6	I	11.0	6	28	27	164	135	5.04	3.80	6.57	380	224.0
154	13-Mar-2000	73	.	35.3	I	9.7	12	45	36	248	257	4.94	3.49	6.70	337	208.0
155	13-Mar-2000	73	.	35.5	I	3.9	0	15	22	109	89	3.19	5.37	6.66	121	94.8
156	13-Mar-2000	73	.	89.1	I	9.3	4	25	24	114	143	3.40	4.46	6.52	109	72.0
157.5	13-Mar-2000	73	1.10	46.7	S	3.8	0	14	15	120	27	3.40	4.22	6.31	61	86.3
162.5	13-Mar-2000	73	1.12	92.4	I	24.5	21	92	77	713	371	6.69	2.02	6.74	203	436.0
163	13-Mar-2000	73	.	73.9	I	16.7	16	52	62	326	535	5.14	4.66	6.41	83	91.9
167	13-Mar-2000	73	.	33.4	I	3.7	15	38	35	198	1083	2.98	6.77	6.98	196	122.5
96	20-Mar-2000	80	.	114.4	I	56.9	88	203	430	1443	720	15.12	3.36	6.26	226	161.6
140.5	20-Mar-2000	80	2.08	51.1	I	41.9	29	85	39	401	66	7.92	3.15	6.64	138	177.2
147	20-Mar-2000	80	.	92.7	I	7.0	19	60	142	428	291	7.61	2.72	6.42	184	254.0
153	20-Mar-2000	80	1.46	45.8	I	11.7	2	35	42	232	173	5.86	3.57	7.08	382	212.0
154	20-Mar-2000	80	.	41.1	I	11.0	8	46	48	308	264	6.48	2.94	6.83	318	198.7
155	20-Mar-2000	80	.	39.8	I	4.3	0	12	19	122	95	3.40	5.10	6.56	118	100.7
156	20-Mar-2000	80	.	101.6	I	12.6	0	19	27	154	140	3.70	4.25	6.53	96	66.8
157.5	20-Mar-2000	80	1.76	71.5	I	7.5	0	13	21	125	46	4.12	4.21	6.23	60	87.9
162.5	20-Mar-2000	80	1.76	108.2	I	46.2	28	120	158	938	248	10.60	1.84	6.73	219	347.0
163	20-Mar-2000	80	.	79.4	I	18.9	7	39	48	288	456	5.66	4.72	6.40	90	91.6
167	20-Mar-2000	80	.	38.0	I	7.3	11	39	37	200	955	4.12	6.81	6.92	188	121.3
96	27-Mar-2000	87	.	459.1	I	129.6	183	332	348	1870	137	20.47	1.20	6.29	268	171.4
140.5	27-Mar-2000	87	7.04	517.9	I	50.0	47	97	48	477	95	10.29	3.61	6.22	95	115.9
147	27-Mar-2000	87	.	504.0	I	64.5	88	131	123	669	233	12.65	2.20	6.37	206	179.7
153	27-Mar-2000	87	6.52	322.8	I	318.5	103	259	88	800	209	14.51	3.10	6.83	247	147.7
154	27-Mar-2000	87	.	391.2	I	131.2	96	197	97	739	204	12.76	2.50	6.43	210	132.4
155	27-Mar-2000	87	.	339.9	I	142.5	48	134	50	475	122	10.49	3.89	6.32	80	79.7
156	27-Mar-2000	87	.	461.1	I	361.6	171	395	93	1300	67	21.60	3.12	6.36	77	61.5
157.5	27-Mar-2000	87	5.08	404.8	I	333.9	48	163	43	535	12	13.07	3.29	6.12	58	71.1
162.5	27-Mar-2000	87	6.78	430.5	I	149.6	117	235	142	1118	250	14.09	1.69	6.78	242	204.0
163	27-Mar-2000	87	.	275.8	I	261.5	102	245	80	788	442	15.12	3.42	6.27	82	85.7
167	27-Mar-2000	87	.	110.7	I	203.0	134	220	74	679	725	10.80	5.55	6.76	159	114.4
96	3-Apr-2000	94	.	93.4	I	112.2	238	405	1145	3788	191	20.78	2.16	6.20	217	154.0
140.5	3-Apr-2000	94	2.52	296.7	I	15.3	24	82	42	410	74	8.23	3.29	6.62	135	105.1
147	3-Apr-2000	94	.	188.4	I	11.9	50	82	85	578	245	10.19	2.59	6.46	199	189.2
153	3-Apr-2000	94	2.58	196.1	I	78.0	39	113	62	496	150	9.88	3.44	6.96	278	155.5
154	3-Apr-2000	94	.	211.2	I	49.6	58	126	72	483	191	10.29	3.03	6.60	249	142.8
155	3-Apr-2000	94	.	145.0	I	25.3	13	41	30	284	101	5.45	5.00	6.60	107	79.4
156	3-Apr-2000	94	.	169.3	I	51.7	39	82	40	326	94	5.86	4.23	6.49	93	69.5
157.5	3-Apr-2000	94	2.50	141.0	I	54.9	11	39	28	224	32	5.86	4.02	6.30	68	72.0
162.5	3-Apr-2000	94	2.65	198.1	I	98.8	77	199	85	1037	295	13.07	1.84	6.73	273	216.0

SERC Charles County Watershed Study

Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
163	3-Apr-2000	94	.	167.0	I	65.1	39	110	56	593	392	8.54	3.69	6.32	82	84.8
167	3-Apr-2000	94	.	63.3	I	34.9	47	72	54	426	817	6.07	5.45	6.85	164	113.3
96	10-Apr-2000	101	.	168.1	I	88.6	443	664	5005	6747	201	19.65	3.32	6.20	244	152.9
140.5	10-Apr-2000	101	4.14	132.5	I	54.1	40	102	66	585	77	7.85	3.57	6.33	114	114.6
147	10-Apr-2000	101	.	156.8	I	22.0	58	129	137	753	267	11.32	2.52	6.42	198	146.8
153	10-Apr-2000	101	3.54	128.0	I	63.2	37	110	83	675	134	8.13	3.37	6.89	271	134.4
154	10-Apr-2000	101	.	130.5	I	45.3	54	121	102	735	201	10.08	2.96	6.56	236	120.6
155	10-Apr-2000	101	.	74.5	I	14.5	15	42	31	282	121	4.73	5.10	6.31	85	71.8
156	10-Apr-2000	101	.	135.2	I	41.8	24	82	44	467	90	7.20	4.19	6.26	60	51.8
157.5	10-Apr-2000	101	3.92	120.6	I	39.2	13	33	25	252	32	5.86	3.94	6.12	47	61.6
162.5	10-Apr-2000	101	3.72	185.1	I	67.9	76	193	76	1031	277	11.73	1.70	6.86	243	178.5
163	10-Apr-2000	101	.	122.3	I	34.6	31	64	61	560	385	7.30	4.13	6.40	87	85.1
167	10-Apr-2000	101	.	50.4	I	16.2	40	63	65	431	862	5.45	5.92	6.90	168	107.4
96	17-Apr-2000	108	.	99.1	I	77.2	713	904	7216	9170	190	30.66	3.99	6.11	288	147.4
140.5	17-Apr-2000	108	2.44	89.8	I	34.1	25	61	43	471	73	6.58	3.90	6.55	171	106.0
147	17-Apr-2000	108	.	66.9	I	.	48	105	71	708	254	12.69	.	6.44	256	132.5
153	17-Apr-2000	108	2.22	76.8	I	37.6	15	59	40	417	100	6.69	3.77	6.75	287	130.9
154	17-Apr-2000	108	.	74.3	I	46.4	36	104	57	812	193	9.98	3.63	6.45	231	116.9
155	17-Apr-2000	108	.	48.9	I	15.1	0	11	18	277	72	3.50	5.30	6.41	114	67.3
156	17-Apr-2000	108	.	99.6	I	20.0	1	26	17	382	59	4.94	4.63	6.43	144	63.5
157.5	17-Apr-2000	108	2.58	72.4	I	6.0	0	8	22	270	25	4.53	4.28	6.29	129	91.3
162.5	17-Apr-2000	108	1.28	106.3	I	42.5	33	105	56	832	250	8.85	1.59	6.66	292	179.1
163	17-Apr-2000	108	.	89.7	I	10.6	12	30	45	419	410	4.84	4.42	6.41	110	83.2
167	17-Apr-2000	108	.	42.1	I	3.6	23	37	29	338	847	3.81	7.07	6.91	203	110.2
96	24-Apr-2000	115	.	187.7	I	74.1	413	726	3453	6070	246	18.93	2.77	6.04	263	159.5
140.5	24-Apr-2000	115	2.88	370.7	I	26.0	41	76	46	512	74	8.23	3.91	6.51	147	91.4
147	24-Apr-2000	115	.	367.2	I	23.7	64	104	110	791	278	11.63	2.52	6.37	239	152.4
153	24-Apr-2000	115	5.00	290.7	I	127.8	67	230	84	1104	176	14.03	3.44	6.87	284	138.4
154	24-Apr-2000	115	.	314.3	I	88.4	77	197	87	1034	219	13.89	3.02	6.51	249	123.6
155	24-Apr-2000	115	.	193.5	I	30.3	15	58	37	458	88	7.30	4.55	6.61	126	73.6
156	24-Apr-2000	115	.	225.3	I	30.3	12	53	28	395	71	6.48	3.97	6.44	89	59.3
157.5	24-Apr-2000	115	2.66	136.8	I	7.1	1	21	30	240	31	5.66	4.29	6.33	76	69.6
162.5	24-Apr-2000	115	3.62	206.7	I	112.1	77	235	93	1314	219	14.92	1.91	6.76	305	180.3
163	24-Apr-2000	115	.	124.3	I	36.4	38	87	62	525	311	8.33	4.24	6.40	101	83.6
167	24-Apr-2000	115	.	50.1	I	8.4	48	67	47	443	767	5.86	6.50	6.92	190	114.8
96	1-May-2000	122	.	161.3	I	225.3	1345	1710	7280	9387	188	38.27	3.34	6.18	227	153.8
140.5	1-May-2000	122	3.70	294.1	I	13.7	34	90	74	580	77	9.36	3.89	6.60	159	97.4
147	1-May-2000	122	.	198.4	I	18.1	51	100	125	645	255	10.91	3.14	6.60	219	157.5
153	1-May-2000	122	3.50	231.8	I	67.5	41	126	93	673	163	10.29	3.38	7.05	288	142.1
154	1-May-2000	122	.	262.3	I	46.7	59	135	104	784	210	11.73	3.15	6.50	259	125.9
155	1-May-2000	122	.	177.6	I	53.0	15	64	42	509	96	6.79	4.78	6.59	112	73.8
156	1-May-2000	122	.	258.9	I	71.8	27	99	47	645	77	8.85	4.07	6.47	93	58.2
157.5	1-May-2000	122	4.10	240.6	I	14.9	6	24	44	347	26	7.82	3.85	6.33	76	66.7
162.5	1-May-2000	122	2.50	177.5	I	172.5	115	307	117	1498	327	14.61	2.08	6.79	303	176.6
163	1-May-2000	122	.	136.5	I	24.6	31	65	94	512	371	7.20	4.00	6.41	95	79.5
167	1-May-2000	122	.	63.7	I	20.1	54	73	71	660	900	5.76	6.54	6.93	182	112.2
96	8-May-2000	129	.	111.3	I	101.5	112	214	700	1454	1158	7.30	4.52	6.09	212	153.8
140.5	8-May-2000	129	0.04	29.4	I	258.0	56	87	127	622	109	7.20	4.38	4.70	0	112.6
147	8-May-2000	129	.	27.6	I	15.0	70	96	113	577	425	10.29	4.28	6.39	244	174.8
153	8-May-2000	129	0.04	47.8	I	174.8	21	42	80	345	173	4.94	4.75	7.06	382	163.8
154	8-May-2000	129	.	36.9	I	68.0	42	78	93	443	300	6.69	4.86	6.69	338	142.3
155	8-May-2000	129	.	29.0	I	50.2	19	54	40	295	127	4.36	6.05	6.75	150	80.1
156	8-May-2000	129	.	71.5	I	214.7	41	134	33	680	56	10.19	4.99	6.68	121	57.3
157.5	8-May-2000	129	0.04	32.3	I	17.8	10	20	33	224	51	4.53	4.33	6.55	109	65.2
162.5	8-May-2000	129	0.00	71.8	I	58.1	53	152	146	1121	211	9.77	1.86	6.78	296	200.0
163	8-May-2000	129	.	62.9	I	25.7	28	60	86	456	472	6.07	4.85	6.54	133	85.5
167	8-May-2000	129	.	35.2	S	4.5	44	70	64	316	1290	3.29	7.38	7.07	220	113.7
96	15-May-2000	136	.	177.7	I	283.1	284	729	750	4062	407	44.14	0.93	6.17	216	146.7
140.5	15-May-2000	136	4.08	26.6	I	61.7	77	178	90	828	105	11.32	4.19	6.92	275	122.5
147	15-May-2000	136	.	56.3	I	30.0	255	302	185	915	316	14.51	4.10	6.48	326	162.9
153	15-May-2000	136	3.48	49.6	I	62.5	59	148	81	892	173	9.67	4.14	7.06	420	152.1
154	15-May-2000	136	.	55.4	I	167.2	132	361	137	1366	167	16.15	3.72	6.71	369	126.3
155	15-May-2000	136	.	25.0	I	92.0	32	121	37	568	64	8.74	5.87	6.83	184	82.9
156	15-May-2000	136	.	50.9	S	8.3	5	30	38	248	89	4.18	4.86	6.64	145	59.2
157.5	15-May-2000	136	2.96	22.6	I	19.5	5	41	25	312	53	6.48	4.06	6.42	99	57.7
162.5	15-May-2000	136	2.98	116.0	I	151.5	112	377	127	1606	128	17.39	1.73	6.79	334	178.1
163	15-May-2000	136	.	45.8	I	48.2	29	100	80	604	388	8.95	5.11	6.62	156	84.3
167	15-May-2000	136	.	31.5	I	8.3	48	82	54	450	960	4.73	7.28	7.15	273	110.0
96	22-May-2000	143	.	212.4	I	41.1	192	497	1065	2350	251	16.77	1.01	6.35	462	143.4
140.5	22-May-2000	143	3.52	10.8	I	45.1	66	115	125	524	150	9.88	4.38	6.58	237	101.5
147	22-May-2000	143	.	16.2	I	11.7	89	160	180	588	514	9.16	4.46	6.49	334	117.5
153	22-May-2000	143	3.44	25.1	I	53.6	35	112	80	475	84	8.02	4.09	6.51	218	96.3
154	22-May-2000	143	.	36.2	I	247.2	128	408	135	1239	287	16.77	3.63	6.26	236	102.8
155	22-May-2000	143	.	15.1	I	31.1	14	45	44	370	100	5.14	5.90	6.45	125	61.8
156	22-May-2000	143	.	30.3	I	149.2	36	163	73	905	88	16.67	4.71	6.28	142	55.0
157.5	22-May-2000	143	3.88	19.3	I	22.7	6	41	43	325	74	6.69	4.05	6.08	69	53.1
162.5	22-May-2000	143	4.36	101.5	I	54.3	62	187	178	1107	267	11.73	1.66	6.48	238	108.8
163	22-May-2000	143	.	68.1	I	338.1	172	517	161	2248	378	28.91	3.52	5.95	76	59.9
167	22-May-2000	143	.	30.3	I	20.2	71	110	103	543	1374	5.45	7.19	6.65	185	83.5
96	30-May-2000	151	.	84.6	S	10.8	4	6	70	162	1438	1.34	4.67	6.28	215	153.8
140.5	30-May-2000	151	1.20	64.0	I	36.7	78	110	107	612	126	8.64	4.02	6.80	236	113.0
147	30-May-2000	151	.	98.0	I	60.9	117	196	170	932	342	12.35	2.93	6.65	305	153.8
153	30-May-2000	151	1.30	71.6	I	246.9	132	271	109	1235	126	14.81	3.25	7.03	412	174.4
154	30-May-2000	151	.	78.3	I	57.9	77	157	108	742	248	9.57	3.18	6.75	380	149.7
155	30-May-2000	151	.	37.8	I	40.1	23	66	54	406	247	6.17	5.46	6.68	144	80.9
156	30-May-2000	151	.	63.9	I	133.8	57	137	59	797	88	13.79	4.40	6.53	136	60.8
157.5	30-May-2000	151	1.60	42.7	I	10.7	14	32	62	385	64	7.41	3.94	6.36	81	58.4
162.5	30-May-2000	151	1.44	108.5	I	61.8	77	174	140	917	270	9.60	1.97	6.74	302	153.6
163	30-May-2000	151	.	87.0	I	66.5	53	129	105	734	356	9.88	4.15	6.56	141	82.5
167	30-May-2000	151	.	38.3	I	8.7	60	72	84	375	1030	4.22	7.93	7.03	262	109.4

SERC Charles County Watershed Study
Automated stream samples

Station	Date	Julian day	Rainfall cm	Flow m3/ha	Spot or integrated sample	Sediment mg/l	Total phosphate ug P/l	Total phosphorus ug P/l	Total ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Total organic carbon mg C/l	Silicate mg Si/l	pH	Bicarbonate alkalinity mg CaCO3/l	Conductivity umhos/cm
96	5-Jun-2000	157	.	141.0	I	127.4	204	384	358	1681	431	14.61	0.56	6.34	225	149.0
140.5	5-Jun-2000	157	3.00	14.0	I	69.5	117	171	76	735	175	9.47	4.23	6.77	249	111.3
147	5-Jun-2000	157	.	21.3	I	14.1	92	117	155	670	426	9.16	3.55	6.57	286	148.4
153	5-Jun-2000	157	2.08	27.8	I	32.5	48	117	103	654	241	6.79	4.07	7.10	462	165.8
154	5-Jun-2000	157	.	25.4	I	43.8	79	142	108	694	353	7.00	4.43	6.78	398	135.0
155	5-Jun-2000	157	.	20.0	I	22.1	24	48	56	314	149	3.29	5.81	6.87	177	79.2
156	5-Jun-2000	157	.	29.7	S	5.5	9	22	60	244	118	2.78	5.00	6.63	157	61.2
157.5	5-Jun-2000	157	1.50	14.3	I	11.0	12	39	60	332	52	5.14	3.99	6.45	93	54.4
162.5	5-Jun-2000	157	1.82	84.7	I	71.3	74	166	110	826	275	8.33	2.08	6.70	295	138.6
163	5-Jun-2000	157	.	40.3	I	19.5	50	91	112	639	460	7.48	4.85	6.63	173	89.1
167	5-Jun-2000	157	.	26.8	I	6.7	66	84	65	466	1052	3.70	7.85	7.07	297	111.4
96	12-Jun-2000	164	.	69.2	S	.	1	23	99	204	1507	2.26	4.24	6.30	229	152.8
140.5	12-Jun-2000	164	0.92	8.2	I	33.7	72	155	67	600	148	11.52	4.03	6.73	260	116.9
147	12-Jun-2000	164	.	15.0	I	9.0	117	189	109	629	506	7.72	4.49	6.91	769	184.7
153	12-Jun-2000	164	1.10	19.4	I	39.4	35	85	67	436	164	5.66	4.06	7.13	467	170.0
154	12-Jun-2000	164	.	20.8	I	16.9	46	91	77	450	330	5.66	2.92	6.80	398	139.1
155	12-Jun-2000	164	.	15.3	I	14.4	19	56	50	275	170	3.40	8.80	6.69	189	82.1
156	12-Jun-2000	164	.	14.3	S	7.5	11	48	54	334	92	5.66	4.09	6.61	243	57.5
157.5	12-Jun-2000	164	1.30	12.3	I	10.3	12	44	61	317	102	5.25	2.21	6.40	94	56.4
162.5	12-Jun-2000	164	0.96	60.3	I	46.1	58	211	87	904	247	8.64	5.18	6.82	340	163.1
163	12-Jun-2000	164	.	38.6	I	36.7	39	88	98	574	541	7.10	4.16	6.65	180	93.7
167	12-Jun-2000	164	.	28.8	I	10.0	64	105	54	375	1060	4.53	7.99	7.05	330	113.8
96	19-Jun-2000	171	.	129.9	I	96.1	141	260	305	1632	691	17.18	1.32	6.31	332	163.7
140.5	19-Jun-2000	171	4.90	51.9	I	48.3	72	145	112	684	184	9.88	3.27	6.58	229	116.1
147	19-Jun-2000	171	.	121.6	I	35.3	130	213	203	1040	364	14.20	2.78	6.42	274	108.9
153	19-Jun-2000	171	4.88	57.2	I	107.8	106	198	181	1053	230	11.42	3.45	6.75	380	126.1
154	19-Jun-2000	171	.	73.8	I	122.1	133	277	184	1174	309	15.02	2.94	6.74	355	108.2
155	19-Jun-2000	171	.	24.7	I	26.5	28	62	73	371	147	3.09	5.27	6.79	187	71.9
156	19-Jun-2000	171	.	24.9	I	165.7	65	217	101	1089	0	20.16	4.59	6.60	179	63.5
157.5	19-Jun-2000	171	7.42	45.2	I	39.5	18	89	89	678	96	11.32	3.72	6.18	78	60.2
162.5	19-Jun-2000	171	4.70	114.2	I	147.0	141	403	142	1637	126	20.27	1.91	6.71	344	127.7
163	19-Jun-2000	171	.	39.1	I	48.9	50	95	140	649	435	9.98	5.24	6.62	199	82.0
167	19-Jun-2000	171	.	75.1	I	125.8	192	418	157	1122	1082	12.86	6.44	6.62	221	105.9
96	26-Jun-2000	178	.	99.7	I	199.3	244	499	296	1857	644	32.20	0.89	6.34	239	75.1
140.5	26-Jun-2000	178	1.58	41.0	I	34.1	84	146	68	596	114	9.16	3.58	6.88	316	113.6
147	26-Jun-2000	178	.	74.4	I	32.0	128	200	143	896	312	13.27	2.87	6.70	323	137.6
153	26-Jun-2000	178	1.88	43.0	I	218.6	160	352	117	1226	237	11.73	3.23	7.07	490	154.7
154	26-Jun-2000	178	.	51.7	I	134.3	137	292	126	953	340	11.21	2.93	6.86	411	133.5
155	26-Jun-2000	178	.	23.5	I	31.5	36	110	59	451	125	5.35	5.21	6.89	229	78.8
156	26-Jun-2000	178	.	21.4	S	9.6	8	47	57	333	40	4.12	4.29	6.73	209	57.1
157.5	26-Jun-2000	178	1.54	22.0	I	14.3	10	43	68	362	90	6.28	4.00	6.50	105	62.9
162.5	26-Jun-2000	178	1.90	80.2	I	106.8	122	292	128	1285	147	11.32	1.95	6.92	341	142.7
163	26-Jun-2000	178	.	35.6	I	39.4	59	98	108	613	423	8.33	5.32	6.74	215	92.4
167	26-Jun-2000	178	.	39.9	I	19.8	80	114	87	1138	1380	5.04	7.95	7.01	310	113.2
96	3-Jul-2000	185	.	153.1	I	96.0	156	249	182	1222	384	17.39	0.67	6.47	248	152.1
140.5	3-Jul-2000	185	3.58	29.7	I	19.3	72	104	69	574	142	8.74	3.43	6.94	313	120.6
147	3-Jul-2000	185	.	73.8	I	13.8	98	138	103	707	387	10.91	3.19	7.19	856	187.8
153	3-Jul-2000	185	4.38	65.4	I	163.9	117	270	89	1004	222	11.63	3.22	7.23	520	175.1
154	3-Jul-2000	185	.	81.5	I	65.7	106	219	129	898	334	9.47	3.00	6.91	429	150.0
155	3-Jul-2000	185	.	23.0	I	49.0	47	83	52	456	140	6.69	5.38	6.89	231	85.7
156	3-Jul-2000	185	.	37.5	S	6.8	21	28	60	239	71	4.94	4.26	6.69	203	65.6
157.5	3-Jul-2000	185	1.50	18.6	I	12.0	20	42	56	372	117	6.79	4.22	6.48	93	59.1
162.5	3-Jul-2000	185	4.14	123.5	I	79.7	87	208	83	1033	171	11.63	1.62	6.71	260	145.8
163	3-Jul-2000	185	.	38.0	I	30.5	69	110	99	730	408	10.70	5.03	6.83	190	92.3
167	3-Jul-2000	185	.	30.9	I	7.9	67	73	55	456	1498	4.42	8.09	7.17	316	119.6
96	12-Jul-2000	194	.	117.9	.	.	.	.	.	.	.	.	.	6.40	256	144.4
147	12-Jul-2000	194	.	60.3	.	.	.	.	.	.	.	.	.	.	.	.
162.5	12-Jul-2000	194	2.00	76.0	.	.	.	.	.	.	.	.	.	6.93	350	132.9
96	17-Jul-2000	199	.	425.6	.	.	.	.	.	.	.	.	.	6.58	438	161.3
147	17-Jul-2000	199	.	177.7	.	.	.	.	.	.	.	.	.	.	.	.
162.5	17-Jul-2000	199	5.78	186.5	.	.	.	.	.	.	.	.	.	6.72	274	113.8
96	24-Jul-2000	206	.	348.7	.	.	.	.	.	.	.	.	.	6.52	284	96.4
147	24-Jul-2000	206	.	211.3	.	.	.	.	.	.	.	.	.	.	.	.
162.5	24-Jul-2000	206	4.76	218.1	.	.	.	.	.	.	.	.	.	6.78	332	135.4
96	31-Jul-2000	213	.	432.7	.	.	.	.	.	.	.	.	.	6.29	277	153.0
147	31-Jul-2000	213	.	294.0	.	.	.	.	.	.	.	.	.	.	.	.
162.5	31-Jul-2000	213	1.94	295.9	.	.	.	.	.	.	.	.	.	6.80	295	123.2
96	7-Aug-2000	220	.	298.4	.	.	.	.	.	.	.	.	.	6.48	436	151.2
147	7-Aug-2000	220	.	187.0	.	.	.	.	.	.	.	.	.	.	.	.
162.5	7-Aug-2000	220	5.98	195.2	.	.	.	.	.	.	.	.	.	6.75	292	99.7
96	14-Aug-2000	227	.	115.9	.	.	.	.	.	.	.	.	.	6.21	226	153.6
147	14-Aug-2000	227	.	83.6	.	.	.	.	.	.	.	.	.	.	.	.
162.5	14-Aug-2000	227	2.34	97.9	.	.	.	.	.	.	.	.	.	6.87	312	114.9

SERC Charles County Watershed Study

Particulate/dissolved grab samples

Station	Date	Julian day	Depth cm	Flow l/sec	Sediment mg/l	Total phosphate ug P/l	Dissolved phosphate ug P/l	Total total phosphorus ug P/l	Dissolved total phosphorus ug P/l	Total ammonium ug N/l	Dissolved ammonium ug N/l	Total total Kjeldahl nitrogen ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Total organic carbon mg C/l	Bicarbonate alkalinity mg CaCO3/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Chloride mg/l	Sulfate mg S/l
96	8-Jan-1999	8	7.8	7.8	17.52	53	46	92	52	515	322	903	755	865	5.04	10.80	232	0.82	7.05	2190.0	636.52	3.90
96	8-Jan-1999	8	7.6	6.4	20.24	57	46	78	49	442	268	953	691	760	4.42	12.76	212	0.70	6.87	1559.0	442.32	3.19
147	22-Jan-1999	22	30.5	98.0	16.47	13	8	53	14	83	69	475	353	654	13.58	12.96	151	2.66	6.85	255.0	50.70	7.22
156	22-Jan-1999	22	12.8	41.6	5.88	3	3	16	3	30	22	207	167	361	4.53	5.56	64	4.49	6.68	117.9	19.07	4.74
167	22-Jan-1999	22	16.2	16.9	10	16	11	25	13	15	14	256	223	736	5.04	4.12	206	5.94	7.19	133.3	11.50	7.79
140.5	2-Feb-1999	33	67.4	1262.5	4.37	11	0	20	6	48	12	194	165	180	6.07	6.79	65	4.14	6.77	166.7	28.15	7.86
153	2-Feb-1999	33	27.7	107.0	9	17	0	35	4	131	117	347	297	495	7.72	7.82	259	4.16	7.18	235.0	45.87	6.38
154	2-Feb-1999	33	14.3	44.6	16.27	15	0	63	8	223	204	541	515	424	7.72	8.74	311	2.48	7.09	172.3	30.21	4.03
155	2-Feb-1999	33	24.7	53.3	2.94	11	0	13	5	15	8	145	135	240	4.53	4.53	73	5.00	6.71	98.4	15.70	3.99
157.5	9-Feb-1999	40	21.3	20.8	17.56	5	1	30	1	32	23	225	171	124	3.50	5.35	41	4.14	6.35	63.6	9.86	2.32
162.5	9-Feb-1999	40	43.9	38.5	7.12	10	2	22	6	68	44	420	291	602	7.61	8.74	231	2.80	6.91	241.0	50.06	5.81
163	9-Feb-1999	40	33.2	47.2	3.84	9	2	17	6	64	27	281	248	415	3.70	4.22	65	5.56	6.54	112.2	9.94	8.77
140.5	15-Mar-1999	74	159.7	17541.4	83.6	24	24	117	37	46	50	569	395	402	7.51	9.47	36	3.03	5.9	119.3	21.40	3.38
147	15-Mar-1999	74	57.3	795.3	34.3	19	16	86	30	233	79	456	402	381	6.89	9.67	170	1.88	6.54	174.9	34.27	3.72
153	15-Mar-1999	74	99.1	1400.2	224.4	16	3	125	16	86	67	900	368	412	7.10	11.63	105	2.62	6.56	311.0	73.94	3.86
154	15-Mar-1999	74	50.6	779.8	89.4	30	12	113	12	167	161	1839	1404	461	6.79	12.14	144	1.89	6.55	525.0	139.12	3.37
155	15-Mar-1999	74	64.3	1140.3	48.8	3	0	38	13	66	37	401	237	224	7.00	7.82	32	2.91	5.85	85.7	13.24	3.41
156	15-Mar-1999	74	29.6	1297.0	41.2	3	0	59	5	55	49	325	231	220	7.51	8.95	21	3.02	5.58	59.2	6.34	3.06
162.5	2-Aug-1999	214	39.6	16.4	3.52	67	29	94	29	79	77	636	482	571	7.61	9.26	499	2.35	7.34	162.9	23.99	2.78
96	2-Aug-1999	214	6.1	5.4	1.16	11	3	17	3	61	47	676	204	1207	3.60	3.91	260	5.00	6.63	123.9	17.52	2.67
96	25-Aug-1999	237	22.3	195.4	35.6	125	118	175	125	84	78	888	534	221	7.92	11.11	161	0.85	6.92	34.6	1.57	0.80
96	25-Aug-1999	237	46.6	954.7	40.4	179	165	202	184	75	72	1057	509	448	7.30	11.83	151	0.72	6.87	33.6	1.30	0.61
140.5	26-Aug-1999	238	91.1	4805.6	55.7	53	18	176	33	32	17	935	549	311	11.52	14.71	55	2.03	5.99	93.5	11.22	4.37
162.5	26-Aug-1999	238	53.3	394.2	33.5	36	16	120	22	154	78	561	365	230	5.66	7.00	157	1.27	6.51	75.2	8.67	2.38
163	26-Aug-1999	238	33.5	90.9	24.6	40	2	81	16	68	72	917	699	3417	9.05	10.60	31	3.64	5.81	157.8	8.85	11.14
147	16-Sep-1999	259	137.2	7066.3	51.87	83	67	151	78	53	34	755	458	291	7.92	11.73	220	1.17	6.77	52.0	2.70	1.40
154	16-Sep-1999	259	88.7	3129.1	264.4	128	50	412	58	68	63	1048	417	379	8.44	19.24	131	1.46	6.47	47.1	2.66	1.72
163	16-Sep-1999	259	172.2	7878.2	185	97	34	355	43	73	74	1069	522	733	10.70	17.08	50	1.65	5.82	51.3	2.49	2.73
167	16-Sep-1999	259	93.3	1615.7	1220.4	366	52	1356	67	92	82	2697	571	427	10.70	45.06	70	1.81	6.22	45.0	2.35	2.13
140.5	17-Sep-1999	260	232.3	89205.2	29.87	50	30	163	44	66	65	720	429	123	12.14	17.70	21	2.27	5.45	51.7	4.83	2.45
140.5	15-Dec-1999	349	133.5	10047.7	19.6	32	15	107	30	28	28	421	323	122	8.95	11.63	77	3.77	6.12	79.5	9.61	3.14
147	14-Feb-2000	45	23.5	123.2	20.4	30	9	85	15	742	687	1558	1139	649	5.56	9.05	368	2.82	6.59	705.0	180.02	5.47
153	14-Feb-2000	45	27.4	134.8	7.2	6	1	19	7	282	169	494	448	378	3.60	4.12	259	4.18	6.95	314.0	71.03	5.18
154	14-Feb-2000	45	16.2	44.7	9.9	14	1	37	17	399	272	668	613	489	5.76	7.20	237	3.61	6.64	412.0	100.48	4.50
155	14-Feb-2000	45	28.7	139.3	3.33	3	0	8	5	46	4	149	136	222	2.78	3.60	70	4.94	6.43	123.6	22.58	4.05
156	14-Feb-2000	45	12.8	215.2	5.47	4	0	10	4	49	8	169	142	248	2.47	3.19	64	4.21	6.39	104.7	17.60	3.54
162.5	15-Feb-2000	46	41.8	131.1	9.95	9	2	33	4	166	190	562	417	645	3.29	4.42	248	2.55	6.68	800.0	216.99	4.79
163	15-Feb-2000	46	36.9	273.3	8.25	6	3	31	4	42	31	339	256	743	3.09	3.70	73	4.31	6.12	99.8	11.34	5.04
167	15-Feb-2000	46	23.5	43.6	5.75	7	6	27	11	49	27	270	250	1815	2.98	3.29	162	6.50	6.02	143.4	14.42	7.13
96	15-Feb-2000	46	4.9	3.1	5.64	2	1	20	3	64	49	187	164	1631	1.54	2.06	338	4.17	6.41	214.0	37.36	4.13
157.5	17-Feb-2000	48	24.7	49.8	2.56	2	2	8	7	30	8	152	73	66	4.12	4.53	40	4.31	6.27	103.4	19.46	3.27
147	25-Feb-2000	56	16.5	29.2	4.76	20	2	35	7	465	451	694	486	466	3.60	4.94	160	3.78	6.4	352.0	84.65	4.65
156	25-Feb-2000	56	7.2	56.4	2.08	4	1	9	5	20	16	148	100	210	1.85	2.78	82	4.73	6.38	69.7	7.40	3.43
157.5	25-Feb-2000	56	23.2	45.3	2.68	5	1	10	1	31	12	113	96	61	2.37	2.88	56	4.41	6.15	100.5	18.27	3.09
162.5	25-Feb-2000	56	40.2	84.4	5.16	12	1	25	8	200	171	482	387	739	3.60	11.83	201	2.57	6.71	699.0	187.91	5.06
163	25-Feb-2000	56	31.1	190.6	5.16	11	2	22	9	63	45	297	278	711	2.88	3.50	71	4.82	6.47	91.0	10.15	5.00
147	29-Feb-2000	60	27.1	145.0	19.27	32	6	97	16	397	357	735	565	395	8.54	11.93	341	2.35	6.49	379.0	89.74	3.99
156	29-Feb-2000	60	12.2	175.3	12.6	7	2	26	6	32	31	289	233	220	5.14	7.00	109	4.15	6.4	88.7	12.36	3.34
163	29-Feb-2000	60	40.2	334.5	19.28	15	2	51	9	50	48	340	221	550	4.84	7.92	72	4.38	6.11	93.7	10.84	4.96
147	21-Mar-2000	81	74.1	1815.3	392.4	231	22	917	31	195	138	1747	509	266	8.23	37.65	215	1.10	6.59	105.2	17.16	2.06
162.5	21-Mar-2000	81	79.9	1856.9	110	67	6	233	15	267	169	974	529	271	7.41	23.77	225	1.37	6.63	191.8	42.74	2.31
162.5	21-Mar-2000	81	107.6	4219.4	250.6	137	10	615	20	278	172	1691	519	258	7.82	22.12	202	1.22	6.59	191.8	43.27	2.14
163	21-Mar-2000	81	91.4	1890.9	529.4	191	3	795	18	150	73	1926	303	354	4.84	32.41	74	3.49	6.13	67.1	6.09	3.36
96	21-Mar-2000	81	27.1	258.0	223	256	121	679	142	267	202	2037	699	120	5.86	60.49	208	0.48	6.9	51.9	5.26	0.72
156	18-May-2000	139	0.9	26.3	6.8	5	0	19	4	53	37	262	190	159	2.98	4.12	125	4.75	6.74	56.5	4.87	2.50
157.5	18-May-2000	139	19.2	12.5	8.13	6	0	28	3	54	18	265	135	102	3.81	5.56	91	3.96	6.51	54.9	8.37	1.12

SERC Charles County Watershed Study

Particulate/dissolved grab samples

Station	Date	Julian day	Depth cm	Flow l/sec	Sediment mg/l	Total phosphate ug P/l	Dissolved phosphate ug P/l	Total total phosphorus ug P/l	Dissolved total phosphorus ug P/l	Total ammonium ug N/l	Dissolved ammonium ug N/l	Total total Kjeldahl nitrogen ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Total organic carbon mg C/l	Bicarbonate alkalinity mg CaCO3/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Chloride mg/l	Sulfate mg S/l
167	18-May-2000	139	18.3	21.8	3.47	34	25	66	25	71	52	352	320	1397	3.81	4.73	263	7.85	7.1	110.2	9.34	4.17
156	22-May-2000	143	19.8	616.5	125	21	4	126	17	161	65	942	409	207	5.66	11.73	126	3.81	6.36	51.2	4.59	2.15
157.5	22-May-2000	143	39.3	382.0	73	10	2	195	16	178	78	926	422	74	9.26	14.71	68	2.85	6.21	53.8	6.00	2.01

SERC Charles County Watershed Study

Storm fraction samples

Station	Date	Julian day	Storm fraction	Storm stage	Time	Depth cm	Flow l/(sec-ha	Sediment mg/l	Total phosphate ug P/l	Dissolved phosphate ug P/l	Total total phosphorus ug P/l	Dissolved total phosphorus ug P/l	Total ammonium ug N/l	Dissolved ammonium ug N/l	Total total Kjeldahl nitrogen ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Total organic carbon mg C/l	Bicarbonate alkalinity mg CaCO3/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Chloride mg/l	Sulfate mg S/l
96	##########	226	1	R	2:47	6.61	0.286	13.80	23	0	24	16	36	12	497	253	999	5.97	15.23	298	5.25	7.32	125.7	19.49	2.28
96	[illegible]	226	2	D	4:02	6.07	0.228	10.4	27	1	82	16	185	163	609	484	1009	7.00	8.95	305	5.03	6.49	129.1	18.34	2.58
96	[illegible]	226	3	R	####	26.16	10.21	238.0	110	40	480	76	403	343	2782	706	643	6.38	27.88	42	0.52	6.12	47.3	1.95	2.91
96	[illegible]	226	4	R	####	47.79	48.85	156.5	106	56	493	81	268	206	2291	495	422	5.04	51.34	56	0.34	6.37	30.2	1.33	1.49
96	[illegible]	226	5	D	####	29.23	13.607	87.4	96	79	249	108	179	154	1258	441	343	5.04	13.7	73	0.31	6.21	28.5	1.50	1.05
96	[illegible]	226	6	D	####	5.91	0.213	30.6	70	46	164	66	234	201	1021	672	1080	8.02	11.7	209	1.85	6.46	87.6	6.95	2.45
96	[illegible]	231	1	R	####	8.41	0.534	66.4	77	11	326	17	255	176	1434	488	1170	7.41	31.2	235	3.95	7.44	113.5	15.90	2.50
96	[illegible]	231	2	R	####	41.88	34.65	168.4	107	17	349	26	333	261	2252	614	982	5.56	30.04	115	1.57	6.82	58.7	5.75	1.94
96	[illegible]	231	3	D	####	24.81	8.885	75.8	96	69	254	75	257	208	1072	584	585	4.42	14.81	55	0.37	6.20	29.2	1.61	1.19
96	[illegible]	232	4	D	2:22	6.04	0.225	33.0	93	75	175	84	201	174	1071	687	996	10.6	12.96	267	1.76	6.75	89.9	9.33	1.77
96	[illegible]	238	1	R	####	7.01	0.332	8.90	15	1	49	8	119	68	1452	1294	1767	4.84	6.79	508	5.58	7.42	180.7	23.34	3.79
96	[illegible]	238	2	R	####	37.80	26.54	236.8	82	15	277	23	201	180	1404	535	606	4.32	18.8	110	0.77	6.91	46.5	2.55	2.21
96	[illegible]	238	3	R	####	49.38	53.18	137.5	46	20	169	30	218	173	1152	385	442	3.19	17.1	73	0.42	6.60	33.1	1.40	1.68
96	[illegible]	238	4	D	####	36.58	24.37	116.9	60	36	177	46	201	155	1240	510	353	4.22	10.7	57	0.33	6.32	29.4	1.25	1.34
96	[illegible]	238	5	D	####	22.86	7.181	78.0	102	81	235	103	213	139	1227	655	425	7.20	14.2	110	0.77	6.50	40.6	1.94	1.52
96	[illegible]	239	6	D	1:05	6.10	0.231	26.3	205	181	354	186	208	174	2287	1839	1328	17.8	23.25	676	4.24	7.21	160.6	11.02	3.75
96	4-Sep-1999	247	1	R	####	11.19	1.120	87.10	133	36	262	42	214	188	1569	1016	716	5.45	16.05	248	2.48	6.66	92.9	11.77	1.83
96	4-Sep-1999	247	2	R	####	25.36	9.405	129.40	139	85	371	90	251	198	1808	673	295	6.07	24.49	126	0.49	6.93	38.0	2.64	1.26
96	4-Sep-1999	247	3	D	####	24.08	8.220	114.60	142	94	326	108	240	192	1558	511	213	4.53	20.27	118	0.37	6.43	32.5	2.00	0.83
96	4-Sep-1999	247	4	D	####	6.07	0.228	23.60	103	85	164	94	232	200	857	780	402	6.28	7.82	175	0.93	6.36	56.8	5.72	1.15
96	4-Sep-1999	247	5	R	####	12.07	1.365	65.10	83	56	201	62	175	148	1572	1173	698	5.25	12.65	203	1.80	7.10	80.5	10.72	1.36
96	4-Sep-1999	247	6	R	####	34.41	20.799	159.10	87	38	311	50	145	111	1887	670	210	5.97	24.18	122	0.63	6.89	30.6	2.29	1.05
96	4-Sep-1999	247	7	D	####	23.26	7.509	66.20	93	68	227	87	176	169	863	453	151	4.63	10.39	96	0.35	6.47	24.8	1.73	0.52
96	4-Sep-1999	247	8	D	####	5.94	0.216	36.2	196	172	393	241	388	331	1929	1479	586	14.2	22.94	362	2.08	7.46	98.4	11.08	2.30
96	[illegible]	258	1	R	9:15	6.43	0.266	11.2	42	0	43	4	83	60	699	189	1276	4.01	5.56	358	5.48	7.13	132.6	17.57	2.91
96	[illegible]	259	1	R	1:12	24.51	8.604	56.9	159	132	180	134	146	142	1049	666	233	8.44	12.1	289	1.67	7.32	46.5	1.73	0.84
96	[illegible]	259	2	R	3:52	44.35	40.22	68.3	219	156	285	181	127	125	970	547	323	6.89	10.1	241	0.85	7.20	40.9	1.20	0.83
96	[illegible]	259	3	D	5:15	41.12	33.04	108.0	196	139	257	139	114	102	1339	510	318	7.20	13.79	237	1.01	6.82	43.6	5.64	0.98
96	[illegible]	259	5	D	6:02	42.61	36.25	36.6	208	165	285	170	117	100	851	482	370	7.92	9.16	232	0.94	6.82	43.0	1.29	0.88
96	[illegible]	259	8	D	8:02	24.20	8.329	42.6	182	165	256	173	130	117	1094	701	522	9.57	12.35	306	1.53	6.83	61.8	2.06	1.48
96	[illegible]	259	9	R	8:07	25.91	9.943	65.0	184	118	268	191	119	119	1052	744	498	10.3	11.73	300	1.48	7.17	60.0	2.06	1.49
96	[illegible]	259	10	R	8:17	46.12	44.52	67.4	139	102	237	112	94	90	858	565	296	6.38	9.57	196	0.82	7.11	37.2	1.16	0.98
96	[illegible]	259	11	D	8:47	42.61	36.25	38.1	171	146	211	191	99	96	851	506	322	7.82	9.88	228	0.97	6.86	43.4	1.39	1.11
96	[illegible]	272	1	R	####	10.58	0.968	68.4	66	8	201	19	103	90	888	568	883	6.07	12.2	232	2.36	6.57	78.1	8.70	2.03
96	[illegible]	273	3	R	0:30	21.09	5.825	572.6	171	8	732	21	108	97	2829	418	379	6.17	52.7	175	0.85	6.70	44.4	2.95	1.37
96	[illegible]	273	4	R	0:32	47.27	47.49	404.8	126	21	622	36	144	109	2429	310	215	5.45	65.2	104	0.36	6.59	24.8	1.31	0.87
96	[illegible]	273	5	R	0:35	56.57	75.74	312.0	289	214	852	291	210	199	3541	1295	1146	13.7	77.98	474	2.15	6.90	97.4	4.41	2.10
96	[illegible]	273	6	D	0:42	50.96	57.73	157.5	101	61	301	93	161	134	1357	457	184	3.60	16.4	86	0.36	6.60	20.7	0.99	0.65
96	[illegible]	273	7	D	0:57	38.59	28.01	90.5	176	147	392	176	210	180	1419	651	373	6.28	13.79	139	2.57	6.73	34.0	1.52	0.83
96	[illegible]	273	10	D	2:42	24.20	8.329	51.9	240	238	452	265	201	201	1681	1142	917	11.6	24.49	356	1.49	6.87	75.5	2.92	1.60
96	[illegible]	273	11	D	5:00	9.14	0.663	26.3	273	234	497	291	195	195	2016	1413	1259	16.1	21.09	508	2.43	7.03	109.0	5.07	2.36
96	2-Nov-1999	306	1	R	####	9.94	0.823	129.00	220	3	314	4	385	318	2048	961	1380	10.70	25.82	275	3.34	6.63	139.3	18.44	4.16
96	2-Nov-1999	306	2	R	####	26.85	10.914	155.20	139	28	298	32	66	63	1505	309	94	5.14	28.19	170	0.53	6.77	38.1	2.14	0.64
96	2-Nov-1999	306	3	D	####	22.89	7.206	57.60	83	67	167	69	56	36	786	281	116	4.32	9.77	122	0.41	6.42	27.4	1.40	0.52
96	2-Nov-1999	306	4	D	####	9.14	0.663	33.00	99	96	162	100	117	60	1035	621	260	8.64	12.35	197	0.90	6.53	51.7	3.49	0.98
96	##########	329	1	R	5:47	20.18	5.191	181.07	170	6	609	23	92	90	1854	363	89	8.74	40.84	265	1.71	6.33	93.3	10.65	2.40

SERC Charles County Watershed Study

Storm fraction samples

Station	Date	Julian day	Storm fraction	Storm stage	Time	Depth cm	Flow l/(sec-ha	Sediment mg/l	Total phosphate ug P/l	Dissolved phosphate ug P/l	Total total phosphorus ug P/l	Dissolved total phosphorus ug P/l	Total ammonium ug N/l	Dissolved ammonium ug N/l	Total total Kjeldahl nitrogen ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Total organic carbon mg C/l	Bicarbonate alkalinity mg CaCO3/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Chloride mg/l	Sulfate mg S/l
96	##########	329	2	R	5:50	26.40	10.437	147.30	109	22	510	35	54	28	1815	297	0	11.32	27.37	246	1.20	6.52	83.2	9.11	1.99
96	[illegible]	329	3	D	5:57	22.22	6.670	136.8	98	1	466	19	68	53	2062	381	0	10.3	29.22	223	0.92	6.34	70.8	5.98	2.18
96	[illegible]	329	4	D	7:45	9.08	0.652	30.3	6	5	218	31	70	49	1027	366	0	9.88	13.6	212	0.82	6.28	56.6	4.66	1.38
96	[illegible]	330	5	R	5:02	11.00	1.073	30.8	12	1	92	8	32	12	484	166	954	5.35	9.26	308	4.23	6.68	129.4	19.13	2.45
96	[illegible]	330	6	R	####	29.41	13.83	220.8	69	23	461	38	53	45	2033	241	143	7.61	32.1	282	1.60	6.35	89.1	11.50	1.38
96	[illegible]	330	7	P	####	52.18	61.39	404.4	89	7	695	21	38	22	2783	211	199	5.25	45.0	172	0.72	6.44	42.3	2.90	1.26
96	[illegible]	330	8	D	####	33.31	19.11	258.7	103	38	590	58	40	17	1927	206	117	5.56	32.1	112	0.38	6.34	29.8	2.15	0.72
96	[illegible]	330	9	D	####	22.80	7.132	76.9	128	102	343	137	44	32	1225	401	217	8.13	16.5	123	0.56	6.43	36.7	2.55	0.86
96	[illegible]	330	10	D	####	9.14	0.663	58.6	212	198	459	266	77	47	1777	928	453	16.0	22.8	268	1.23	6.45	74.6	4.93	1.75
96	[illegible]	348	1	R	0:37	9.91	0.816	25.6	17	5	85	12	104	101	543	351	818	7.61	9.05	318	1.96	6.52	93.9	6.69	2.84
96	[illegible]	348	2	D	1:35	9.14	0.663	40.27	76	61	193	78	132	117	856	475	322	8.85	10.8	232	1.02	6.78	62.1	3.46	2.05
96	[illegible]	348	3	R	5:32	10.70	0.997	24.6	53	49	114	55	149	146	783	691	577	10.0	12.4	446	1.72	6.78	95.2	5.32	2.85
96	[illegible]	348	4	R	6:47	24.44	8.549	81.8	121	96	298	117	108	98	1130	478	168	7.30	16.87	215	0.78	6.89	46.5	2.09	1.27
96	[illegible]	348	5	D	7:07	24.17	8.301	81.4	179	137	282	137	113	109	1007	572	212	8.23	14.81	229	0.83	6.88	50.3	2.39	1.33
96	[illegible]	348	6	R	8:40	26.67	10.72	88.8	122	107	295	115	92	92	1023	516	200	7.51	15.9	224	0.73	6.95	45.9	1.98	1.18
96	[illegible]	348	7	D	8:57	23.44	7.664	84.4	138	133	330	142	108	94	1014	523	188	7.92	13.4	226	0.74	6.85	46.4	1.99	1.14
96	[illegible]	348	8	R	####	24.87	8.942	38.8	147	130	257	138	99	85	925	458	225	7.30	15.0	235	0.84	6.85	48.9	2.11	1.17
96	[illegible]	348	9	D	####	23.47	7.690	57.2	155	136	311	139	93	89	893	546	209	7.72	10.8	231	0.81	6.92	47.3	1.97	1.08
96	[illegible]	348	10	R	####	26.30	10.34	60.27	126	122	260	128	94	80	966	418	240	8.13	13.4	230	0.85	6.87	48.3	2.04	1.22
96	[illegible]	348	11	D	####	23.26	7.509	56.8	136	102	235	119	95	82	888	422	194	6.89	12.9	215	0.74	6.89	44.0	1.86	1.02
96	[illegible]	348	12	D	####	9.08	0.652	51.8	178	149	301	156	118	108	1196	763	482	12.45	16.98	383	1.88	6.64	108.3	9.75	2.78
96	22-Mar-200	82	8	D	8:37	9.11	0.657	57.3	127	88	296	114	165	132	1021	704	495	10.7	15.9	422	2.08	6.76	124.2	13.23	3.08
96	25-Mar-200	85	1	R	####	11.25	1.136	114.80	70	0	249	3	321	265	1519	442	1689	8.54	21.50	290	3.52	6.32	242.0	46.23	4.40
96	25-Mar-200	85	3	R	####	22.56	6.935	809.00	208	2	1092	19	349	316	3928	684	654	9.05	78.60	315	0.99	6.60	116.5	16.99	2.21
96	25-Mar-200	85	4	P	####	31.39	16.384	1060.60	256	3	1703	15	408	344	5261	663	537	7.30	98.87	319	0.92	6.68	94.0	10.40	1.98
96	25-Mar-200	85	5	D	####	24.32	8.438	253.87	106	40	551	59	370	329	2110	898	514	8.13	27.67	198	0.65	6.57	63.1	5.41	1.86
96	25-Mar-200	85	6	D	####	9.14	0.663	91.87	171	124	436	173	410	377	2704	1920	465	15.12	23.56	446	1.50	6.72	120.4	12.61	3.17
96	18-Apr-200	109	7	R	5:52	9.27	0.686	42.70	33	0	112	5	273	239	1018	442	1042	7.00	14.20	401	3.35	6.47	186.9	30.93	2.93
96	18-Apr-200	109	8	R	6:10	18.35	4.055	133.87	58	4	284	18	162	150	1376	432	419	5.66	21.91	247	0.90	6.70	65.1	6.03	1.30
96	18-Apr-200	109	9	D	6:37	17.86	3.781	68.93	53	28	207	39	257	213	1276	620	316	9.05	17.08	245	0.71	6.80	56.2	3.72	1.11
96	18-Apr-200	109	10	D	9:42	9.14	0.663	52.67	112	82	267	97	246	207	1436	1054	298	17.28	23.77	485	1.56	6.93	100.2	7.57	1.78
96	21-Apr-200	112	1	R	####	13.72	1.903	288.00	124	0	684	3	916	688	4466	1587	17	7.61	47.53	395	2.78	6.47	208.0	39.06	3.25
96	21-Apr-200	112	2	R	####	20.06	5.110	522.00	135	5	1004	18	526	378	5417	1156	13	8.13	66.15	302	0.87	6.25	105.9	14.17	2.12
96	21-Apr-200	112	3	R	####	29.99	14.549	656.80	254	1	1260	15	604	389	6212	997	13	5.66	96.30	363	1.03	6.43	85.1	10.04	1.39
96	21-Apr-200	112	4	D	####	27.43	11.536	273.00	105	1	579	15	361	212	3738	783	19	4.94	35.60	261	0.72	6.34	66.5	5.98	3.48
96	21-Apr-200	112	5	D	####	17.98	3.848	143.4	82	33	466	53	398	307	2878	1066	220	7.41	21.30	252	0.69	6.40	64.5	5.19	1.43
96	21-Apr-200	112	6	D	####	9.14	0.663	103.2	102	85	403	111	561	484	3261	1858	344	15.12	23.46	395	1.16	6.63	106.2	11.29	1.99
96	[illegible]	131	4	R	9:57	9.02	0.640	214.4	274	97	1055	183	970	780	6870	3932	20	28.81	62.04	475	1.10	6.38	180.9	20.90	5.00
96	[illegible]	131	5	R	####	17.16	3.407	310.61	151	19	717	50	809	754	4940	1844	38	17.49	53.91	343	1.97	6.26	181.7	30.31	3.43
96	[illegible]	131	6	R	####	36.64	24.47	434.8	199	14	1076	44	514	497	5030	1502	296	13.37	79.01	248	0.70	6.23	105.5	13.68	2.22
96	[illegible]	131	7	R	####	48.01	49.42	281.2	163	34	635	54	242	187	3514	676	348	6.89	39.51	133	0.37	6.27	45.3	3.34	1.28
96	[illegible]	131	8	D	####	40.63	32.03	178.1	144	86	458	125	204	166	1953	715	348	7.00	17.59	119	0.34	6.22	42.8	3.22	1.23
96	[illegible]	131	9	D	####	34.14	20.37	308.4	198	25	756	52	304	214	3719	800	324	5.86	37.76	156	0.48	6.29	49.6	4.12	1.12
96	[illegible]	131	10	D	####	24.99	9.056	117.07	155	133	527	157	288	226	2121	994	409	7.61	21.40	147	0.48	6.23	50.8	3.64	1.30
96	[illegible]	131	11	D	####	17.40	3.534	92.13	198	161	503	179	311	273	2209	970	486	8.13	18.72	181	0.59	6.28	61.3	4.54	1.51
96	##########	131	12	D	####	8.96	0.629	72.67	217	185	511	239	347	322	2622	1474	694	14.20	20.68	278	1.01	6.45	94.0	8.75	1.97

SERC Charles County Watershed Study

Storm fraction samples

Station	Date	Julian day	Storm fraction	Storm stage	Time	Depth cm	Flow l/(sec-ha	Sediment mg/l	Total phosphate ug P/l	Dissolved phosphate ug P/l	Total total phosphorus ug P/l	Dissolved total phosphorus ug P/l	Total ammonium ug N/l	Dissolved ammonium ug N/l	Total total Kjeldahl nitrogen ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Total organic carbon mg C/l	Bicarbonate alkalinity mg CaCO3/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Chloride mg/l	Sulfate mg S/l
96	15-Jun-2000	167	1	R	####	9.54	0.740	49.40	75	24	205	44	1002	874	2315	1418	1692	11.63	19.34	239	2.61	6.34	166.6	26.02	4.40
96	15-Jun-2000	167	2	R	####	19.93	5.030	166.47	80	20	350	33	812	745	2565	1438	1117	10.49	26.65	207	1.31	6.37	111.5	13.32	3.25
96	15-Jun-2000	167	3	R	####	30.33	14.975	171.67	94	18	330	26	437	329	2126	745	523	5.76	22.94	150	0.59	6.50	47.9	3.26	1.63
96	15-Jun-2000	167	4	D	####	26.73	10.785	81.00	57	37	230	46	282	164	1113	454	232	3.40	11.42	105	0.37	6.46	25.9	1.70	0.63
96	15-Jun-2000	167	5	D	####	18.14	3.934	61.47	52	32	210	38	164	102	1011	427	233	3.70	9.67	101	0.40	6.48	27.5	1.90	0.64
96	15-Jun-2000	167	6	D	####	8.72	0.586	45.73	48	43	158	56	353	173	963	560	346	6.17	10.70	135	0.57	6.57	40.8	3.63	0.84
96	21-Jun-2000	173	1	R	####	9.39	0.710	58.47	111	35	292	51	599	545	2126	1185	1283	9.57	21.09	236	2.23	6.14	147.2	21.63	3.52
96	22-Jun-2000	174	2	R	0:12	30.08	14.664	352.80	133	33	418	50	572	531	2632	910	564	8.02	30.45	138	0.50	6.33	62.0	5.05	1.97
96	22-Jun-2000	174	3	R	0:15	39.50	29.772	461.10	205	14	760	23	400	385	2982	715	480	5.56	49.38	134	0.50	6.28	48.9	2.86	1.93
96	22-Jun-2000	174	4	D	0:20	31.49	16.508	184.87	124	26	355	32	382	343	1629	593	459	4.84	19.14	111	0.40	6.22	41.1	2.23	1.58
96	22-Jun-2000	174	5	D	0:22	25.76	9.792	140.53	118	35	340	54	400	343	1508	636	448	4.01	17.59	100	0.42	6.28	39.0	2.19	1.48
96	22-Jun-2000	174	8	D	1:15	17.40	3.534	39.87	177	151	378	183	415	342	1472	962	393	9.05	13.07	234	0.90	6.47	58.5	3.17	1.32
96	22-Jun-2000	174	9	D	1:57	9.05	0.646	48.10	219	181	424	229	457	389	1765	1355	568	15.53	18.72	366	1.42	6.70	95.3	7.03	1.78
96	14-Jul-2000	196	1	R	####	23.53	7.742	239.10	91	11	506	22	302	243	2241	717	776	6.17	30.25	132	0.90	6.61	61.8	5.82	2.44
96	14-Jul-2000	196	2	R	####	42.52	36.052	220.20	95	16	409	26	288	223	2110	625	566	4.73	24.90	94	0.61	6.33	43.5	2.55	1.85
96	14-Jul-2000	196	4	R	####	56.60	75.849	201.10	105	33	421	48	245	220	1645	540	376	3.19	19.34	66	0.36	6.23	28.2	1.35	1.32
96	14-Jul-2000	196	5	D	####	42.61	36.254	83.40	88	62	248	75	226	168	1344	505	364	4.12	10.29	72	0.41	6.29	29.4	1.52	1.05
96	14-Jul-2000	196	6	D	####	35.66	22.820	65.30	113	87	288	121	243	193	1036	668	427	4.32	9.26	98	0.52	6.42	35.0	1.73	1.11
96	14-Jul-2000	196	7	D	####	25.63	9.672	49.60	140	115	382	143	276	220	1101	702	474	6.28	9.16	131	0.61	6.65	43.1	2.18	1.24
96	14-Jul-2000	196	8	D	####	18.04	3.882	33.30	184	148	285	188	336	279	1574	960	597	8.23	12.24	179	0.87	6.66	54.3	2.82	1.51
96	4-Aug-2000	217	7	R	####	10.94	1.058	109.10	15	5	101	7	168	118	.	.	1505	5.25	10.70	260	.	6.54	153.2	24.58	2.86
96	4-Aug-2000	217	8	R	####	33.68	19.669	153.30	76	18	221	19	306	230	.	.	813	5.04	20.37	146	.	6.42	60.6	4.39	2.02
96	4-Aug-2000	217	10	R	####	47.76	48.778	118.10	59	38	186	45	278	196	.	.	416	4.32	14.40	93	.	6.36	31.2	1.50	1.42
96	4-Aug-2000	217	11	D	####	45.05	41.898	89.20	87	71	208	79	240	190	.	.	339	5.66	11.52	86	.	6.32	30.3	1.51	1.11
96	4-Aug-2000	217	12	D	####	33.77	19.80	67.4	138	117	248	158	196	165	.	.	361	7.41	14.71	0	.	4.34	61.5	1.76	4.09
162.5	[illegible]	273	1	R	0:47	62.58	1.045	375.3	200	4	732	14	69	24	2316	274	430	7.10	37.0	264	2.25	6.80	120.0	17.49	3.03
162.5	[illegible]	273	2	R	1:27	87.17	3.140	435.2	186	18	763	32	78	49	3667	438	298	6.58	36.01	196	1.29	6.72	73.6	8.68	1.93
162.5	[illegible]	273	3	D	5:27	85.22	2.912	126.27	61	13	220	31	59	49	1013	302	263	7.00	15.43	204	1.66	6.67	83.9	10.11	2.54
162.5	[illegible]	273	4	D	9:27	60.96	0.958	56.5	28	4	140	23	65	37	779	298	261	7.41	11.11	222	1.53	6.89	93.0	11.43	2.68
162.5	[illegible]	330	3	R	####	45.78	0.104	86.0	43	5	199	9	53	30	843	235	168	7.82	11.73	264	2.38	6.80	149.0	25.54	3.40
162.5	[illegible]	330	4	R	####	61.05	0.963	213.07	84	4	498	16	87	39	1725	270	111	8.85	23.6	260	1.68	6.69	120.3	18.23	2.72
162.5	[illegible]	330	6	R	####	61.36	0.979	48.7	20	6	173	22	52	38	836	315	159	9.36	13.7	280	1.61	6.82	125.6	18.48	3.05
162.5	[illegible]	331	7	D	5:02	60.93	0.957	40.5	13	6	138	19	57	32	635	330	148	8.74	11.5	254	1.51	6.89	116.4	16.72	3.20
162.5	[illegible]	331	8	D	####	45.69	0.101	22.5	7	4	96	20	48	24	483	245	164	8.33	8.85	262	1.79	7.00	120.5	17.11	3.24
162.5	[illegible]	348	1	R	1:52	46.27	0.116	45.47	19	2	100	4	77	67	563	247	463	6.69	9.47	254	2.26	6.75	130.9	18.30	3.77
162.5	[illegible]	348	2	R	7:22	61.87	1.007	96.53	52	7	207	12	105	105	918	295	339	6.38	13.5	256	1.61	6.69	103.9	12.75	2.77
162.5	[illegible]	348	3	R	9:27	76.75	2.058	109.87	55	13	292	17	80	76	965	307	295	6.58	15.43	230	1.49	6.57	92.9	11.02	2.65
162.5	[illegible]	348	4	D	####	76.20	2.009	48.4	23	14	111	16	61	59	550	327	289	7.20	13.07	212	1.39	6.64	84.8	9.20	2.45
162.5	[illegible]	348	5	D	####	60.69	0.944	28.67	22	15	88	18	64	51	462	329	277	6.79	9.16	219	1.45	6.67	83.9	8.53	2.78
162.5	[illegible]	349	6	D	9:27	45.69	0.101	23.5	7	9	80	9	61	51	462	267	286	6.17	7.72	232	1.83	6.62	96.0	10.49	3.01
162.5	4-Jan-2001	4	1	R	####	45.90	0.106	90.4	53	3	141	7	82	61	1210	371	580	6.07	16.5	253	2.85	6.75	149.8	23.08	4.13
162.5	4-Jan-2001	4	2	R	####	61.14	0.968	94.4	61	3	221	11	66	63	968	375	448	5.97	13.37	213	1.97	6.79	102.9	13.28	3.23
162.5	4-Jan-2001	4	3	D	####	60.93	0.957	43.47	28	4	91	9	58	50	740	337	476	6.17	9.88	237	2.41	6.84	120.8	16.91	3.61
162.5	4-Jan-2001	4	4	D	8:07	45.69	0.101	20.90	18	5	58	9	59	55	500	385	438	5.35	8.02	263	2.38	7.04	122.7	16.68	3.67
162.5	21-Mar-2001	81	1	R	9:52	61.72	0.999	139.20	66	1	316	12	200	161	1200	552	290	8.13	17.39	236	1.32	6.57	204.0	50.05	2.33
162.5	21-Mar-2001	81	2	R	####	77.57	2.132	255.20	118	3	602	14	233	164	1866	459	321	7.82	27.06	220	1.22	6.60	198.3	40.68	2.50

SERC Charles County Watershed Study

Storm fraction samples

Station	Date	Julian day	Storm fraction	Storm stage	Time	Depth cm	Flow l/(sec-ha	Sediment mg/l	Total phosphate ug P/l	Dissolved phosphate ug P/l	Total total phosphorus ug P/l	Dissolved total phosphorus ug P/l	Total ammonium ug N/l	Dissolved ammonium ug N/l	Total Kjeldahl nitrogen ug N/l	Dissolved total Kjeldahl nitrogen ug N/l	Nitrate ug N/l	Dissolved organic carbon mg C/l	Total organic carbon mg C/l	Bicarbonate alkalinity mg CaCO3/l	Silicate mg Si/l	pH	Conductivity umhos/cm	Chloride mg/l	Sulfate mg S/l
162.5	21-Mar-2000	81	3	R	####	92.78	3.861	387.80	125	2	756	14	211	151	2168	382	1049	7.92	35.91	214	1.26	6.55	210.0	13.87	4.30
162.5	21-Mar-2000	81	4	P	####	#####	6.165	230.40	88	3	522	12	202	156	1757	372	614	8.74	27.06	238	1.30	6.62	227.0	14.24	8.81
162.5	21-Mar-2000	81	5	D	####	#####	6.072	156.93	60	0	304	12	185	143	989	350	233	10.91	23.56	242	1.47	6.78	257.0	3.30	3.39
162.5	21-Mar-2000	81	6	D	####	91.35	3.667	115.33	44	0	246	9	163	131	766	472	113	8.85	17.90	252	1.40	6.78	243.0	8.23	3.46
162.5	21-Mar-2000	81	9	D	####	75.90	1.983	80.67	38	2	159	10	146	117	755	360	289	8.44	16.77	242	1.31	6.71	219.0	46.14	2.27
162.5	21-Mar-2000	81	12	D	####	60.96	0.958	51.73	36	4	142	9	142	115	686	387	282	9.47	14.40	270	1.59	6.63	193.8	44.56	2.09
162.5	25-Mar-2000	85	1	R	####	45.90	0.106	88.53	68	0	265	5	142	111	1019	444	827	9.36	18.21	326	2.31	6.74	226.0	44.03	4.41
162.5	25-Mar-2000	85	2	P	####	61.23	0.973	131.07	68	0	328	11	201	169	1111	421	565	8.54	20.16	296	1.92	6.84	174.7	33.08	2.95
162.5	25-Mar-2000	85	3	D	####	60.72	0.946	50.00	39	1	151	9	156	118	766	380	488	9.05	14.40	306	2.26	6.87	201.0	40.13	3.53
162.5	26-Mar-2000	86	4	D	####	45.69	0.101	62.90	36	0	156	8	104	71	761	273	459	9.36	15.95	306	2.28	6.88	206.0	42.91	3.39
162.5	18-Apr-2000	109	3	R	6:22	45.81	0.104	35.70	18	0	85	5	124	100	673	323	365	8.33	12.45	310	1.77	7.01	185.6	34.04	3.34
162.5	18-Apr-2000	109	4	R	9:02	61.33	0.977	131.33	40	2	224	11	161	124	1520	434	310	9.77	19.24	314	1.44	7.04	150.9	25.48	2.83
162.5	18-Apr-2000	109	5	D	####	60.84	0.952	65.07	26	3	138	11	150	111	1031	429	313	10.29	14.20	318	1.51	7.12	168.0	29.20	2.93
162.5	19-Apr-2000	110	6	D	6:42	45.66	0.101	33.47	20	0	89	7	169	122	894	376	324	9.16	12.65	365	1.85	7.08	177.1	30.20	2.97
162.5	[illegible]	131	1	R	####	47.67	0.158	238.53	104	4	466	18	70	34	2094	458	353	9.16	25.0	276	1.25	6.44	176.3	33.86	3.45
162.5	[illegible]	131	2	R	####	63.70	1.109	403.73	218	6	840	18	113	89	3106	400	481	8.02	36.01	246	0.83	6.49	115.6	17.14	2.43
162.5	[illegible]	131	3	D	####	60.90	0.955	81.6	35	5	296	16	122	116	1494	577	230	9.77	16.3	457	1.64	6.68	197.7	34.08	3.08
162.5	[illegible]	132	4	D	7:17	45.60	0.099	35.5	20	5	150	17	115	100	917	548	284	8.64	13.07	330	1.64	6.79	163.0	26.80	3.12
162.5	22-Jun-2000	174	1	R	0:32	46.70	0.127	174.7	112	3	378	16	139	101	1355	405	507	6.58	17.3	300	2.10	6.83	146.4	24.50	2.59
162.5	22-Jun-2000	174	2	R	1:57	60.99	0.960	160.2	132	12	556	26	270	212	1534	576	495	6.17	18.11	209	1.10	6.53	81.2	9.47	2.04
162.5	22-Jun-2000	174	3	D	3:37	60.78	0.949	63.50	66	12	221	23	329	115	1389	566	167	7.20	13.68	333	1.52	6.81	124.8	18.28	2.30
162.5	22-Jun-2000	174	4	D	####	45.63	0.100	37.80	47	7	228	20	374	336	1442	579	74	8.54	13.79	549	1.82	6.83	152.5	21.83	2.40
162.5	14-Jul-2000	196	1	R	####	48.25	0.179	158.80	106	6	348	10	62	45	1489	447	466	6.89	19.24	268	1.49	6.96	138.7	23.52	2.52
162.5	14-Jul-2000	196	2	R	####	63.89	1.120	547.60	387	24	984	31	119	105	3336	387	540	5.04	42.08	175	0.72	6.68	63.5	5.86	1.88
162.5	15-Jul-2000	197	3	R	0:02	77.18	2.096	271.20	176	20	530	24	248	209	2125	558	496	4.53	18.62	163	0.91	6.67	73.4	8.24	1.87
162.5	15-Jul-2000	197	4	R	0:52	92.75	3.857	228.40	168	19	560	28	547	491	2678	873	136	5.45	23.66	345	1.29	6.92	114.8	14.59	2.17
162.5	15-Jul-2000	197	5	D	3:17	91.41	3.675	244.27	179	8	627	12	755	639	2969	1003	33	6.89	26.44	700	1.78	7.37	164.5	20.59	2.12
162.5	15-Jul-2000	197	6	D	5:32	75.93	1.985	168.53	128	5	509	7	744	642	2863	1043	16	7.20	20.58	841	2.07	7.24	181.0	21.61	1.77
162.5	15-Jul-2000	197	7	D	8:32	60.72	0.946	94.40	74	8	1208	25	493	442	2373	1059	159	8.95	29.22	326	1.63	7.65	177.0	19.74	1.81
162.5	15-Jul-2000	197	8	D	####	45.66	0.101	166.27	98	3	539	15	744	633	2978	1209	0	11.11	23.35	1429	2.13	7.20	219.0	21.81	1.30
162.5	26-Jul-2000	208	1	R	4:27	45.84	0.105	71.80	52	3	141	16	100	31	769	355	501	7.20	12.24	350	.	7.06	142.5	22.13	2.42
162.5	26-Jul-2000	208	2	R	6:37	63.49	1.097	181.80	81	9	342	19	91	44	1259	374	214	5.35	19.86	235	.	6.88	76.0	9.56	1.45
162.5	26-Jul-2000	208	3	R	7:02	79.10	2.274	265.70	121	13	502	25	88	48	1632	384	168	5.86	26.13	224	.	6.85	71.1	8.58	1.30
162.5	26-Jul-2000	208	4	R	7:22	93.63	3.980	228.70	91	21	395	31	124	65	1624	475	161	6.48	22.02	214	.	6.77	66.2	7.70	1.21
162.5	26-Jul-2000	208	5	R	7:57	[illegible]	6.516	170.2	93	29	363	38	115	71	1266	453	155	6.28	20.0	200	.	6.97	63.0	6.99	1.35
162.5	26-Jul-2000	208	6	D	####	[illegible]	6.026	80.1	49	12	155	22	107	74	1018	512	132	7.00	12.24	209	.	7.02	71.6	8.36	1.56
162.5	26-Jul-2000	208	7	D	####	91.35	3.667	57.9	41	13	136	25	99	61	823	383	132	6.38	11.21	211	.	6.89	69.2	7.51	1.52
162.5	26-Jul-2000	208	8	D	####	75.93	1.985	50.20	25	10	111	19	78	52	730	428	128	7.20	10.19	226	.	6.85	71.5	7.60	1.64
162.5	26-Jul-2000	208	9	D	####	60.90	0.955	37.10	22	4	101	11	71	27	718	362	119	8.44	10.49	237	.	6.77	79.1	8.96	1.80
162.5	27-Jul-2000	209	10	D	4:37	45.69	0.101	25.00	22	6	75	14	93	65	618	429	174	6.58	9.57	257	.	6.86	90.3	10.88	1.94
162.5	4-Aug-2000	217	3	R	####	45.84	0.105	66.00	47	9	131	8	132	94	.	.	340	7.00	12.04	301	.	7.11	125.3	19.05	2.38
162.5	4-Aug-2000	217	4	R	####	60.99	0.960	237.30	128	18	556	26	137	87	.	.	426	6.38	17.39	205	.	6.87	82.0	10.17	1.98
162.5	4-Aug-2000	217	5	D	####	60.84	0.952	50.20	42	12	134	20	187	138	.	.	244	6.79	12.04	248	.	7.04	97.5	13.05	2.63
162.5	5-Aug-2000	218	6	D	2:42	45.72	0.102	32.90	27	9	96	17	143	102	.	.	243	6.79	10.19	285	.	6.96	109.0	14.99	2.38

Rating curve constants for different time periods and depth (ft.) ranges for:
Flow cfs = (Correction Factor) $e^{(Slope(ln(Depth\ ft.) + Intercept)}$

Watershed	Time Period	Depth Range	Correction Factor	Intercept	Slope
96	All	All	1.037	2.488	2.600
140.5	All	>2.68	1.022	1.612	3.047
	All	<2.68	1.002	0.355	4.320
147	All	>1.35	1.006	1.994	2.340
	<13May99	<1.35	1.057	0.845	6.166
	>13May99	<1.35	1.007	2.605	4.118
153	All	>1.97	1.001	2.002	1.603
	All	<1.97	1.008	1.704	2.043
154	All	All	1.008	2.100	2.482
155	All	All	1.026	1.534	3.018
156	All	>0.667	1.003	3.951	2.250
	17Sep99-25Apr00	<0.667	1.003	3.951	2.250
	<17Sep99	<0.667	1.018	5.277	5.527
	>25Apr00	<0.402	1.004	2.607	0.775
157.5	All	>0.790	1.061	1.666	3.295
	All	<0.790	1.077	2.736	7.835
162.5	All	>1.80	1.007	0.875	3.318
	<27Aug99	<1.80	1.008	-3.286	10.410
	>27Aug99	<1.51	1.003	-1.096	8.065
163	<17Sep99	>1.92	1.025	1.742	2.230
	<17Sep99	<1.92	1.037	0.352	4.368
	>17Sep99	All	1.025	1.742	2.230
167	<16Sep99	>0.807	1.004	1.710	2.093
	<16Sep99	<0.807	1.007	2.153	4.159
	>16Sep99	All	1.001	1.114	2.618